FOREWIND
DELIVERING YOUR ENERGY FUTURE

Dogger Bank Project One
Environmental Impact Assessment Scoping Report

This report was prepared for Forewind by:

Royal Haskoning is an international, multidisciplinary engineering and environmental consultancy with over 125 years of experience. We provide engineering, environmental, planning, project management and consultancy services worldwide. Royal Haskoning offers market-leading knowledge and experience of the engineering and environmental issues associated with coastal and marine development for the full spectrum of works including major infrastructure projects, renewable energy deployment, water resource developments, flood defences, ports, harbours, marinas and pipelines. The group as a whole employs over 4,000 staff, with 700 based in the UK. Our key UK offices are in Peterborough, London, Exeter, Edinburgh, Glasgow, Newcastle, Rochdale and Haywards Heath.

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EXECUTIVE SUMMARY

As part of the staged development of the Dogger Bank Zone, Forewind intends to apply to the Infrastructure Planning Commission (IPC) for a Development Consent Order (DCO), under the auspices of the Planning Act (2008), for Dogger Bank Project One, an offshore wind farm project with a generating capacity of up to 1.4W. In accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (EIA Regulations), an Environmental Impact Assessment (EIA) will be undertaken and an Environmental Statement (ES) submitted to support the application (see **Section 3**). Forewind anticipate submitting its consent application for Dogger Bank Project One in December 2012.

This document comprises the EIA Scoping Report which has been produced in accordance with Regulation 8(3) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the EIA Regulations) in order to facilitate the IPC and the relevant stakeholders to provide a formal scoping opinion (in accordance with Regulation 8(1) of the EIA Regulations) for the first project in Tranche A (the first tranche identified for development).

An indicative outline programme for the delivery of that project is included below:

- Q3 2010 - Request for Scoping Opinion
- 2010/11 – Environmental surveys and reporting (to inform an Environmental Impact Assessment)
- 2011/12 - EIA and reporting
- Q4 2012 – Planning Application
- Q4 2013 – Determination
- 2013/14 – Pre-construction phase
- 2015 to 2017 – Start of construction
- 2016 to 2018 – Start of operation

This document also provides an overview of the Zone Appraisal and Planning Phase of Forewind's development activities and refers to the Zonal Characterisation document (ZoC) which comprises the information that has been collected to date. The ZoC has informed the production of this Scoping Report and as it continues to be updated throughout the ZAP process will be used to inform the EIA and consultation process associated with the development of Dogger Bank Project One.

For each environmental parameter, this report sets out the proposed approach to the Environmental Impact Assessment (EIA). Where it is evidenced through past industry experience that a potential impact is unlikely to occur or to be significant, it is recommended that these matters be 'scoped out' of the EIA process for each parameter.

GLOSSARY OF ABBREVIATIONS

AADT - Annual Average Daily Traffic

AAWT - Annual Average Weekday Traffic

AC - Alternating Current

ADBA - Archaeological Desk-Based Assessment

ADCP - Acoustic Doppler Current Profiler

AGDS - Acoustic Ground Discrimination System

AIS - Automatic Identification Systems

AONB - Areas of Outstanding Natural Beauty

AQAP - Air Quality Action Plan

AQMA - Air Quality Management Area

AQS - Air Quality Strategy

ATC - Air Traffic Control

AWAC - Acoustic waves and currents

BAP - Biodiversity Action Plan

BGS - British Geological Survey

BS - British Standard

BSBI - Botanical Society for the British Isles

BTO - British Trust for Ornithology

BWEA - British Wind Energy Association

CA - Cruising Association

CCS - Carbon Capture and Storage

Cefas - Centre for Environment, Fisheries & Aquaculture Science

CIA - Cumulative Impact Assessment

CITES - Convention on International Trade in Endangered Species

CNS - Communications, Navigation and Surveillance

COWRIE - Collaborative Offshore Wind Research Into The Environment

CPA - Coast Protection Act

CPT - Cone Penetration Test

CPUE - Catch per Unit Effort

CRA - Collision Risk Assessment

CRTN - Calculation of road traffic noise

CSA - Coastal Study Area

CSM - Conceptual Site Model

dB - Decibel

DBA - Desk-based assessment

DC - Direct Current

DCO - Development Consent Order

DECC - Department of Energy and Climate Change

Defra - Department for Environment, Food and Rural Affairs

DETR - Department of the Environment, Transport and the Regions

DfT - Department for Transport

DMRB - Design Manual for Roads and Bridges

dSAC - draft Special Area of Conservation

DTI - Department of Trade and Industry

EA - Environment Agency

EAC - Environmental Assessment Criteria

EC - European Council

EC - European Commission

ECC - Earth Continuity Cable

ECMWF - European Centre for Medium-Range Weather Forecasts

EIA - Environmental Impact Assessment

EMF - Electromagnetic fields

EMP - Environmental Management Plan

EPUK - Environmental Protection UK

ES - Environmental Statement

EU - European Union

FEPA - Food and Environmental Protection Act

FLC - Fisheries Liaison Coordinator

FLR - Fisheries Liaison Representative

FPO - Fishery Producers Organisations

FRA - Flood Risk Assessment

GBS - Gravity Base Structure

GIS - Gas Insulated Switchgear

GW - Gigawatts

HDD - Horizontal Directional Drilling

HDPE - High Density Polyethylene

HGV - Heavy Goods Vehicle

HMR - Helicopter Main Routes

HRA - Habitats Regulations Assessment

HVAC - High Voltage Alternating Current

HVDC - High Voltage Direct Current

Hz - Hertz

ICES - International Council for the Exploration of the Seas

IEEM - Institute of Ecology and Environmental Management

IEMA - Institution for Environmental Management and Assessment

IMO - International Maritime Organization

IPC - Infrastructure Planning Commission

IUCN - International Union for the Conservation of Nature

JNCC - Joint Nature Conservation Committee

Km - Kilometre

kV - Kilovolts

LAQM - Local Air Quality Management

LFA - Low Flying Area

LNR - Local Nature Reserves

LSVC - Landscape, Seascape and Visual Character

LVIA - Landscape and Visual Impact Assessment

MAGIC - Multi-Agency-Geographic-Information for the Countryside

MCA - Maritime and Coastguard Agency

MCZ - Marine Conservation Zone

MFA - Marine and Fisheries Agency

MITS - Main Interconnected Transmission Network

Mm - Millimetre

MMO - Marine Management Organisation

MMO - Marine Mammal Observers

MoD - Ministry of Defence

MSA - Marine Study Area

MW - Mega Watts

NA - Navigation Assessment

NATO - North Atlantic Treaty Organisation

NATS - National Air Traffic Services

NESFC - North Eastern Sea Fisheries Committee

NETS - National Electrical Transmission System

NMR - National Monument Record

NPS - National Policy Statement

NRA - Navigation Risk Assessment

NRMM - Non-road Mobile Machinery

NSIP - Nationally Significant Infrastructure Project

NSRAC - North Sea Regional Advisory Council

O&M - Operation and Maintenance

OCP - Organochlorine Pesticides

ODIS - Offshore Development Information Statements

ODPM - Office of the Deputy Prime Minister

OFTO - Offshore Transmission Network Owner

OGED - Gas Exploration and Development

OREI - Offshore renewable energy installation

OSPAR - Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic

PAH - Polycyclic Aromatic Hydrocarbon

PCB - Polychlorinated Biphenyls

PEI - Preliminary Environmental Information

PEXA - Practice and Exercise Areas

PMSL - Precision Marine Survey Limited

PPD - Public Participation Directive

PPG - Planning Policy Guidance

PPGs - Pollution Prevention Guidelines

PPS - Planning Policy Statement

Project 1 – The first project to be developed in Tranche A

PSA - Particle Size Analysis

pSAC - possible Special Area of Conservation

PRoW - Public Rights of Way

RAF - Royal Air Force

RAMSAR - The Convention on Wetlands (Ramsar, Iran, 1971)

RO - Renewables Obligation

RSPB - Royal Society for the Protection of Birds

RSU - Regional Seascape Unit

RYA - Royal Yachting Association

RWE - RWE npower renewables (an RWE Innogy company)

SAC - Special Area of Conservation

SAM - Scheduled Ancient Monument

SAR - Search and Rescue

SCANS II - The Small Cetacean Abundance in the North Sea and Adjacent waters II

SCOS - Special Committee on Seals

SEA - Strategic Environmental Assessment

SEAL - Shearwater Elgin Area Line

SPA - Special Protected Area

SPZ - Source Protection Zone

SSE - Scottish and Southern Energy

SSSI - Site of Special Scientific Interest

StEP - Stakeholder Engagement Plan

SVIA - Seascape and Visual Impact Assessment

TAG - Transport Analysis Guidance

TCE - The Crown Estate

THLS - Trinity House Lighthouse Services

TMP - Traffic Management Plan

UCG - Underground Coal Gasification

VMS - Vessel Monitoring System

VSC HVDC - Voltage Source Conversion High Voltage Direct Current

WAM - Wave Model

WHO - World Health Organisation

WTG - Wind Turbine Generator

XLPE - Cross linked polyethylene

ZAP - Zone Appraisal and Planning

ZDE - Zone Development Envelope

ZoC - Zone Characterisation

ZTV - Zone of Theoretical Visibility

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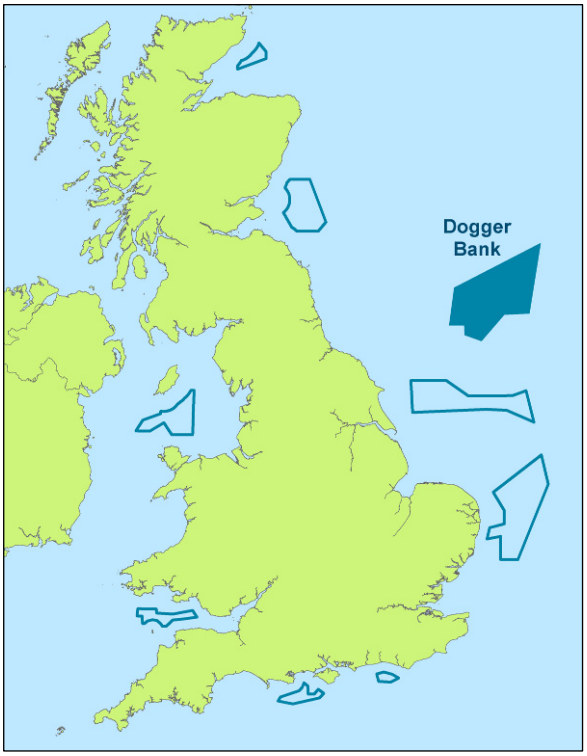
1. Introduction

1.1 Background

In June 2008 The Crown Estate announced proposals for the third round (Round 3) of offshore wind farm leasing, following on from the 8 gigawatts (GW) planned from earlier United Kingdom (UK) offshore wind leasing programmes (namely, Rounds 1 and 2). Subsequent to this announcement, a Strategic Environmental Assessment (SEA) to examine the potential for 25GW of additional UK offshore wind was carried out[1].



Under the Round 3 process, nine development 'zones' were identified by The Crown Estate, with a combined target energy generation capacity of 25GW. On the 8th January 2010, following a competitive tender process, The Crown Estate announced the successful bidders for each of the Zones. Forewind Limited (Forewind) was awarded the development rights for the largest Zone; Dogger Bank. Forewind's commitment is to secure all the necessary consents for the construction and development of the Dogger Bank Zone, up to the point of an investment decision.

Forewind has agreed with The Crown Estate a target installed capacity of 9GW by 2020, and has a further objective to deliver 13GW by 2023, which would equate to around 10% of total projected UK electricity requirements and would comprise the world's largest offshore wind farm.

[1] http://www.offshore-sea.org.uk

1.2 The Dogger Bank Zone

The Dogger Bank Zone is located in the North Sea off the east coast of Yorkshire. The key Zone characteristics are described in **Table 1.1**.

Table 1.1 Key project characteristics

Project Information	Detail
Zone Size	8,660km^2 / 3,343 sq.miles
Distance from shore	125 to 290km
Water Depth	18 to 63m below chart datum
Estimated Capacity	Agreed target of 9GW, with the potential for approximately 13GW

The Dogger Bank Zone has many favourable attributes which make it an attractive site for offshore wind farm development. It has a good wind resource, with higher annual mean wind speeds than the other Round 3 offshore wind farm zones (>10 m/s). It also has relatively shallow water depths and good ground conditions which make it appropriate for implementation of a broad range of foundation options. Initial estimates concluded that around 4GW could be located in a water depth less than 30m and 8GW in less than 35m water depth although this is dependent on the outcome of the necessary studies to inform the Environmental Impact Assessment (EIA).

It also presents a number of different challenges to the development and delivery of projects, not least because of its considerable distance from shore and its wave climate.

1.3 Introduction to Forewind Limited

Forewind Limited (Forewind) is a consortium comprising four leading international energy companies; Scottish and Southern Energy plc (SSE), RWE npower renewables (an RWE Innogy company), Statoil and Statkraft.

Together these companies combine extensive experience of international offshore project delivery and renewables development, construction, asset management and operations. Through the combined forces of its owner companies, Forewind has the ability to both make a significant contribution to the future of wind energy in the UK and demonstrate commitment to the continuing development of offshore wind.

A brief summary of each of the partner companies is provided below.

RWE npower renewables: RWE npower renewables is the UK subsidiary of RWE Innogy and is one of the UK's leading renewable energy developers and operators, committed to developing and operating wind farms and hydro plant to produce sustainable electricity. RWE Innogy is the renewable arm of European energy group RWE AG.

RWE Innogy plans, builds and operates renewable power generation facilities across Europe and is committed to investing €1.4 billion per year in renewables. The expansion of onshore and offshore wind power is a key driver behind RWE Innogy's goal to have 4,500MW in operation or construction by 2012.

SSE: SSE is one of the largest energy companies in the UK and is involved in the generation, transmission, distribution and supply of electricity; the storage, distribution and supply of gas; telecommunications; contracting; and other energy services. As well as being the second largest supplier of energy in the UK with 9 million customers, SSE is also the leading renewable energy company in the UK, with a total operating portfolio of renewable energy of 2,000MW. SSE's portfolio shows its commitment, past, present and future, to tackling climate change and delivering secure energy supplies.

Statoil: Statoil is an integrated technology-based international energy company primarily focused on upstream oil and gas operations. Headquartered in Norway, it has more than 30 years of experience from the Norwegian continental shelf, pioneering complex offshore projects under the toughest conditions. Statoil aims to deliver long-term growth and continue to develop technologies and manage projects that will meet the world's energy and climate challenges in a sustainable way. Renewable energy is one of Statoil's major focus areas. The UK offshore wind market is key to the company's ambition to utilise its extensive experience from complex offshore oil and gas projects to generate value from offshore wind. Statoil are partners with Statkraft for the delivery of the Sheringham Shoal Round 2 offshore wind farm project.

Statkraft: Statkraft is Europe's largest generator of renewable energy, with a total installed capacity of more than 14,800MW. The Norwegian company develops and generates hydropower, wind power, gas power and district heating, and is a major player on the European energy exchanges. Statkraft opened its first wind farm in 2002 and now owns and operates three onshore wind farms in Norway with a total installed capacity of 244MW. In the UK, Statkraft has one hydropower plant and one wind farm in operation in Wales and planning consent for another four in Scotland with a combined capacity of around 200MW. Statkraft are partners with Statoil for the delivery of the Sheringham Shoal Round 2 offshore wind farm project.

1.4 Delivery Strategy

Forewind's delivery strategy has been structured around the objective of delivering 13GW of offshore wind farm projects at the Dogger Bank Zone by 2023.

In order to ensure that the works associated with achieving this objective are managed effectively, and to more evenly distribute the demand on our stakeholders and the supply chain, Forewind proposes to develop the Zone in phases.

The ongoing Zone Appraisal and Planning (ZAP) phase (described in further detail in **Section 1.6**) will use available information and the outcome of stakeholder consultations to identify the optimum location of "tranches" or areas for development within the Zone.

At this stage it is anticipated that ZAP will identify four tranches for development in accordance with the programme outlined below:

- Tranche A – identified in Summer 2010;
- Tranche B – Area to be defined in 2011;
- Tranche C – Area to be defined in 2012; and
- Tranche D – Area also to be defined in 2012.

Within each tranche, a number of separate projects will be identified and will be the subject of independent applications for Development Consent under the Planning Act 2008 ("the 2008 Act").

The projects will be optimised in accordance with the location, capacity and timing of grid connections, secured through the application process with National Grid.

For Tranche A it is likely that three projects of a similar size will be identified and taken through the planning process. An indicative outline programme for the delivery of the first project in Tranche A (referred to as Dogger Bank Project One) is included below:

- Q3 2010 – Request for Scoping Opinion
- 2010/11 – Environmental surveys and reporting (to inform an Environmental Impact Assessment)
- 2011/12 - EIA and reporting
- Q4 2012 – Planning Application
- Q4 2013 – Determination
- 2013/14 – Pre-construction phase
- 2015 – 2017 - Construction
- 2016 onwards - Operation

1.5 The Scoping Report

This Scoping Report is submitted under Regulation 8 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (SI 2263) (the EIA Regulations) to support Forewind's request for a scoping opinion for Dogger Bank Project One. Forewind would like to secure a scoping opinion before the end of 2010 because of the need:

- To commence extensive survey work for the purposes of collecting baseline and characterisation data to inform the EIA; and
- To give confidence to Forewind of completing the first deliverable in its stakeholder consultation strategy on the development of Dogger Bank Project One.

Given the uncertainties around the point of grid connection and in order to maintain the ability to further define project details during the EIA stage, this report focuses on a broad study area, referred to as the 'scoping envelope' (see **Figure 1.1**). The scoping envelope will be further refined during the course of the EIA, engineering and technical studies to establish the red line boundary that will be the subject of the Development Consent Order (DCO) application. The scoping envelope incorporates all of the permanent and temporary development associated with Dogger Bank Project One which is likely to be in the order of 1.4GW. The Project includes both the offshore and onshore aspects, with the onshore electrical grid connection works comprising 'associated development' under the Planning Act 2008.

This Scoping Report covers the first of the three anticipated projects within Tranche A, and aims to provide information describing:

- The specific characteristics of the particular development;
- The specific characteristics of the development of the type concerned; and
- The environmental features likely to be affected by the development.

In **Figure 1.1** the 'scoping envelope' has been sectioned into three components A, B and C as described below:

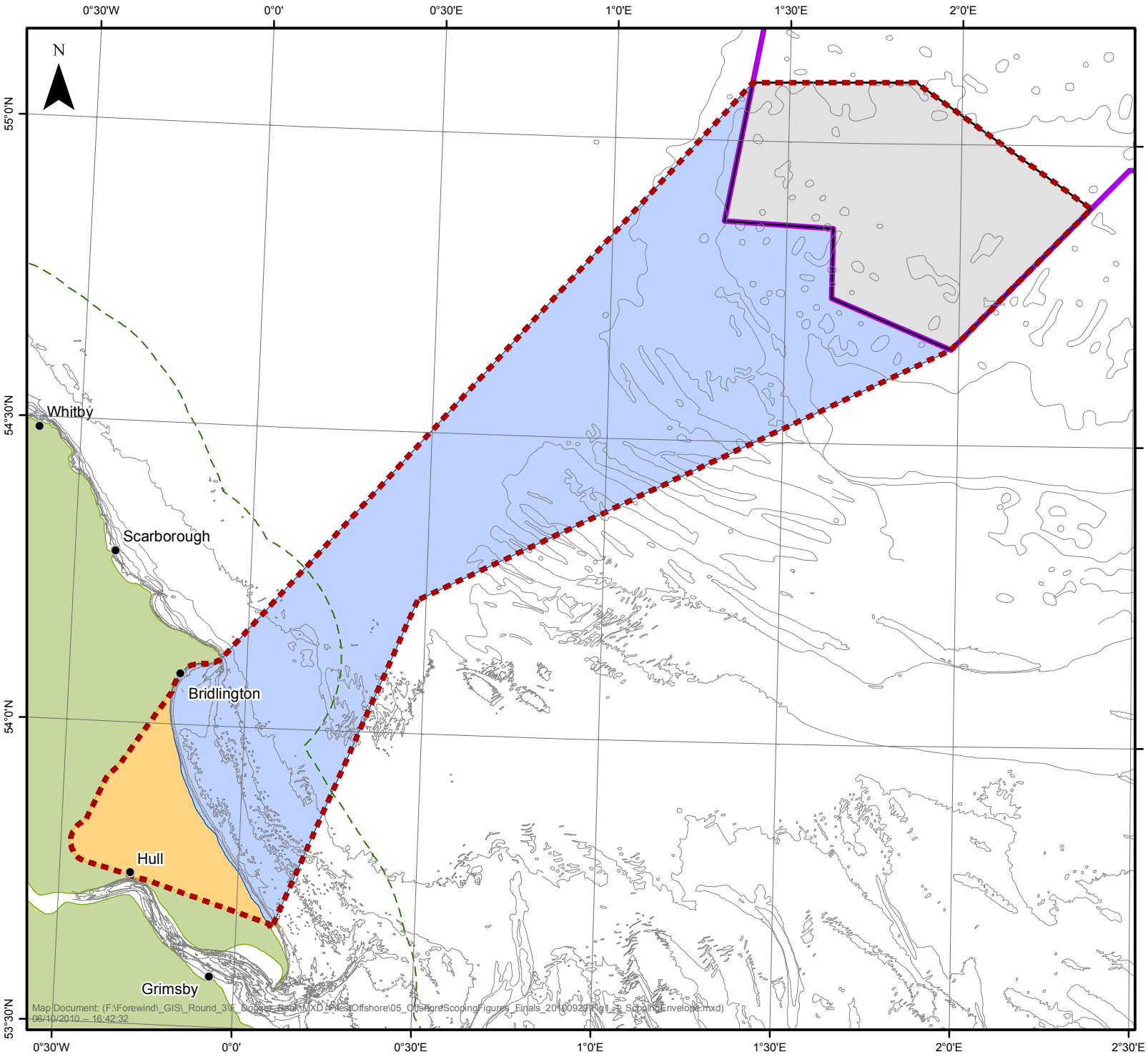
Section A: represents the indicative location of Tranche A, within which Forewind will ultimately seek to develop approximately three similar sized offshore wind farm projects. Given that the location of projects within Tranche A will not be defined until a later stage, the whole tranche area is included within the scoping envelope for Dogger Bank Project One.

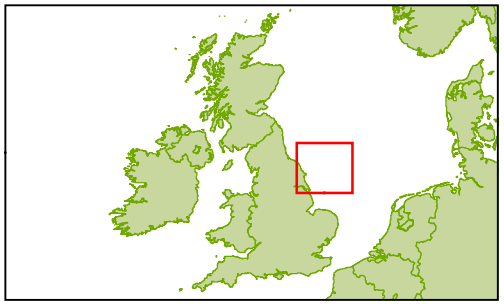
Section B: represents the export cable corridor, which will accommodate the subsea cables necessary to connect the offshore wind farm project to the onshore point of connection.

Section C: represents the onshore study area, which will accommodate the onshore electrical infrastructure including; up to two converter substations and the onshore electricity cables required to connect the electricity generated by the offshore wind farm project to the national electricity network.

This report provides a summary of the available desk based information and original data collection carried out to date to inform the existing environment of the offshore and onshore sections of the scoping envelope. For each environmental parameter, this report sets out the proposed approach to the Environmental Impact Assessment (EIA), including establishing the existing environment via desk studies, consultation and original data collection; and the subsequent assessment of impacts via recognised analysis criteria. Where it is evidenced through past industry experience that a potential impact is unlikely to occur or to be significant, it is recommended that these matters be 'scoped out' of the EIA process for each parameter. Matters will only be scoped out of the EIA process where properly addressed and justified and confirmed as being scoped out by the IPC. A summary of those matters recommended as being scoped out is provided in **Section 11** of this report.

Further projects which are to be accommodated within Tranche A and future tranches will be the subject of further scoping requests and will be scoped in a similar way, once the location and available grid capacity for a point of connection has been defined by National Grid.





Legend:

- Dogger Bank Round 3 Zone
- Scoping Envelope
- Tranche A
- Onshore Study Area
- Offshore Export Cable Corridor
- 12nm Territorial Boundary

Sources: Bathymetry © SeaZone, 2009.
R3 Zone © TCE, 2010.

0 10 20 40 Kilometres
0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Scoping Envelope		
Figure No: Fig 1.1	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:1,000,000	
Drawn On: 29/09/10	Projection: UTM31N	
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1.6 Zone Appraisal and Planning (ZAP)

1.6.1 ZAP process

ZAP is a non-statutory strategic planning process, which is being advocated by The Crown Estate as part of the development process for the larger Round 3 zones. One of the objectives of this zonal approach is to assist developers in making informed decisions on the location of their projects be providing a mechanism for the early consideration of environmental, planning and engineering constraints associated with the delivery of their projects.

The ZAP phase involves the characterisation of the Zone from data and information provided by:

- The developer and/or development partner;
- Consultants;
- Stakeholders, and
- The Crown Estate Marine Resource System (MaRS) database.

It also involves consideration of the technical and commercial challenges of delivering offshore wind farms and their associated infrastructure and will ultimately inform the identification of tranches for ongoing development.

The Crown Estate ZAP Framework document explains this process in detail and is available to review at - www.thecrownestate.co.uk/r3_zone_appraisal_and_planning.pdf.

The ongoing ZAP studies have the objective to provide recommendations for project development areas. ZAP is being undertaken across the full Zone Development Envelope (ZDE), comprising the offshore zone, potential offshore and onshore export cable routes, substations and converter stations. The ZDE is presented in **Figure 1.2**.

The first stage of ZAP was to undertake a gap analysis of the information collected and interpreted by Forewind during the Round 3 bidding phase. The output of the gap analysis was a set of targeted recommendations for the acquisition of further information and/or data in order to inform the identification of Tranche A and the ongoing ZAP process.

A similar exercise will continue throughout the ZAP process in order to ensure that the zonal development strategy is informed by the best and most appropriate information and data sets.

A key constituent of the ZAP is the Zone Characterisation (ZoC) document, which is intended to provide an overview of the physical and environmental conditions within the Zone and the constraints they may pose to the consenting and development of projects.

The ZoC comprises onshore and offshore volumes. Together, these will inform the location of each tranche within in the Zone, the associated export cable corridor and the area of search for the development of the onshore infrastructure for a given point of grid connection.

The ZoC is a live document that will evolve throughout the ZAP process, as new information becomes available, providing a common framework for the assessment of cumulative effects associated with Forewind's development strategy.

Onshore ZoC volume

The current version of the onshore volume provides a high level environmental and planning characterisation of the Zone Development Envelope (ZDE) and the onshore study area around the National Grid Creyke Beck substation. Creyke Beck substation, north of Hull, is the location of the first grid connection point which Forewind has accepted from National Grid. As Forewind accept future offers from National Grid for grid connections, additional study areas for more detailed review will be identified and reported.

The onshore volume is available on the Forewind website at http://www.forewind.co.uk.

Offshore ZoC volume

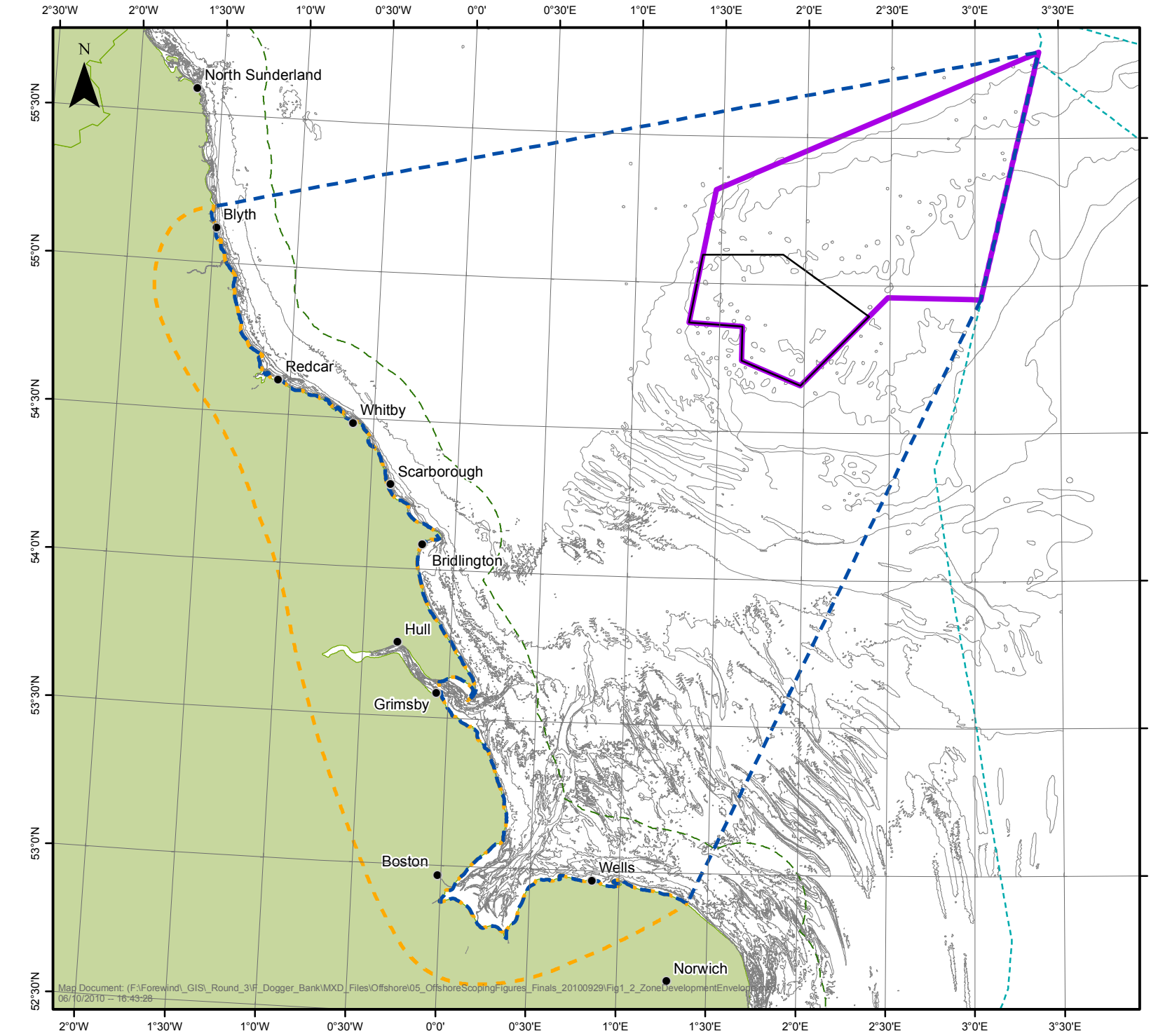
The current version of the offshore volume provides a high level characterisation of the offshore aspects of the ZDE.

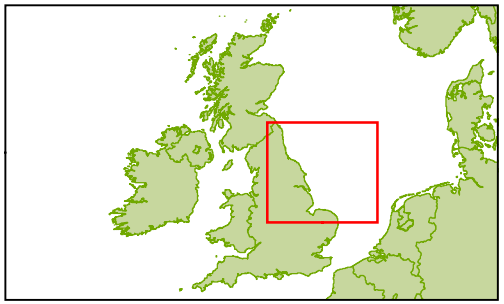
The document reports on a range of topics pertaining to the physical, biological and human environment of the wind farm Zone and the offshore cable corridor. These include geology, benthic ecology, fish resource, birds, marine mammals, navigation and shipping and military, aviation and radar.

The offshore volume is available on the Forewind website at http://www.forewind.co.uk.

The zonal characterisation studies undertaken to date have involved the collection and interpretation of a wide range of data. This data has been stored and mapped within a GIS database which assists interrogation and enables the visual assessment of constraints. The information collected as part of the ZAP and reported in the onshore and offshore ZoC volumes has been used to inform the existing environment elements of the technical sections of this scoping report. It is upon this existing environment that the identification of potentially significant impacts (both adverse and beneficial) is made for each parameter.

It should be noted that the current version of the ZoC provides an assessment of the information collected to date and that this assessment will be informed and supplemented by the ongoing zonal and project level data collection and consultation activities that will be undertaken by Forewind during the course of their development activities.





Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Onshore Zone Development Envelope
- Offshore Zone Development Envelope
- 12nm Territorial Boundary
- International Boundary

Sources: Bathymetry © SeaZone & TCarta, 2009.
R3 Zone © TCE, 2010.

0 20 40 80 Kilometres
0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
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Zone Development Envelope		
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Drawn By: DJM	Scale: 1:2,000,000	
Drawn On: 29/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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1.6.2 Stakeholder Engagement

Stakeholder engagement is an important part of both the zonal and project level development processes. Consultation with the stakeholders will be undertaken throughout the development process and the strategy to achieve this is outlined in the consultation section (**Section 4**) of this Scoping Report.

Forewind has already collected a large amount of information through informal consultation and through the stakeholder workshops held in April 2010. This information has been fed into the ZAP process and is referenced in the ZoC documents.

1.6.3 Ongoing ZAP Phase

The ZAP phase will continue throughout the entire development phase for Dogger Bank Zone. The outcome of the initial ZAP phase and of the initial project development processes will inform subsequent ZAP and project development phases. In this way the development of each project will be set within the context of the relevant stage of development of the Zone. This will inform and support the "building block" approach to the assessment of cumulative impacts (see **Section 3**) and provide a common framework for those assessments at a project level. Importantly, this approach is also intended to provide stakeholders with the assurance that, while being asked to comment on individual projects, Forewind is fully cognisant of the need to maintain a strategic overview of the whole Zone development strategy.

1.7 Identification of the Scoping Envelope

1.7.1 Identification of the offshore wind farm scoping envelope – Tranche A

In order to make recommendations for the boundary of Tranche A (see **Figure 1.1**) the work undertaken to characterise the Zone ("Consents Workstream") was combined with an assessment of technical and commercial considerations ("Engineering Workstream") in order to obtain a holistic view of the optimum areas within the Zone for initial project development.

This process is summarised below and is described in further detail in the Tranche A Identification Report document which has now been published on the Forewind website at http://www.forewind.co.uk.

For the Consents Workstream, the spatial and geographic constraints identified through ZAP (i.e. fishing effort, cables and pipelines, archaeology, ecology etc) were characterised as either hard or soft constraints. Hard constraints were considered to be incompatible with development at this stage. Soft constraints were assigned a weighting in accordance with their perceived "consentability" (the higher the weighting the more significant the issue and the less likely that a project in that area would be able achieve development consent).

The Engineering Workstream included consideration of safety concerns, costs (including the influence of water depth, distance from shore, wind resource, operational and maintenance costs, grid

connection and foundation costs) and strategic considerations with regards to future tranche requirements in order to establish a relative cost of energy across the Zone.

Where relevant the information for the engineering and consenting workstreams were produced at a 1km square resolution and were combined together to produce a holistic development heat map which was used to provide a visual representation of the optimum areas for development.

The area of Tranche A is approximately 2,000km^2 and is larger than the area required for the first three projects. This is to ensure that the ultimate location of those projects remains flexible enough to be informed by the data collected and stakeholder consultation undertaken throughout the development phase.

1.7.2 Identification of the export cable route scoping envelope

The export cable route scoping envelope connects Tranche A to the Onshore Scoping Envelope. A cable routing assessment will be undertaken that will include consideration of the technical, commercial and environmental factors associated with the installation and maintenance of the export cables. This assessment will determine the preferred route and landfall location within the scoping envelope and will be further described in the ES.

1.7.3 Identification of the onshore scoping envelope

The onshore scoping envelope is shown in detail in **Figure 1.3** and is a broad area of land identified at an early stage in the consents process, within which the onshore works associated with Dogger Bank Project One are likely to be located. The study area is roughly cone shaped with the apex including a 4km radius encompassing Creyke Beck substation. The cone extends out to the coast to points approximately equidistant north and south and includes the towns of Skipsea and Easington. The study area excludes the international ecological designations associated with the Humber estuary to the south, and Flamborough Head to the north.

The onshore scoping study area has been sub-divided into Project Areas A-D, for the purposes of describing the character in each of the technical onshore scoping sections. Each project area contains an indicative cable route corridor, provided to illustrate the likely area of landtake required for the cable, which are described in further detail below. Forewind is not seeking comments focused on these routes, as they are indicative only, and are likely to change as the result of a combination of EIA studies, engineering and commercial assessments and, importantly, the output of the consultation process.

Project Area A: comprises a 4km radius area centred on Creyke Beck substation within which it is likely that up to two new converter substations will be constructed. Cabling between the converter substations and the NGET substation will pass through this project area, as will cabling between the converter stations and the landfall location.

Project Area B: comprises the most northerly area within which the cable route could be located, connecting area A with the landfall. It is also the most northerly Project Area within which the landfall could be located. **Figure 1.3** shows an indicative cable route corridor passing north of Skipsea.

Project Area C: is located at the centre of the Project Areas within which the cable route could be located. A cable route within this area would be the shortest of the options presented, which has environmental advantages, as discussed below. **Figure 1.3** shows an indicative cable route corridor (with several spurs), heading east towards Hornsea and Mappleton from Project Area A.

Project Area D: comprises the most southerly area. **Figure 1.3** shows a south easterly indicative cable route corridor heading in the direction of Easington.

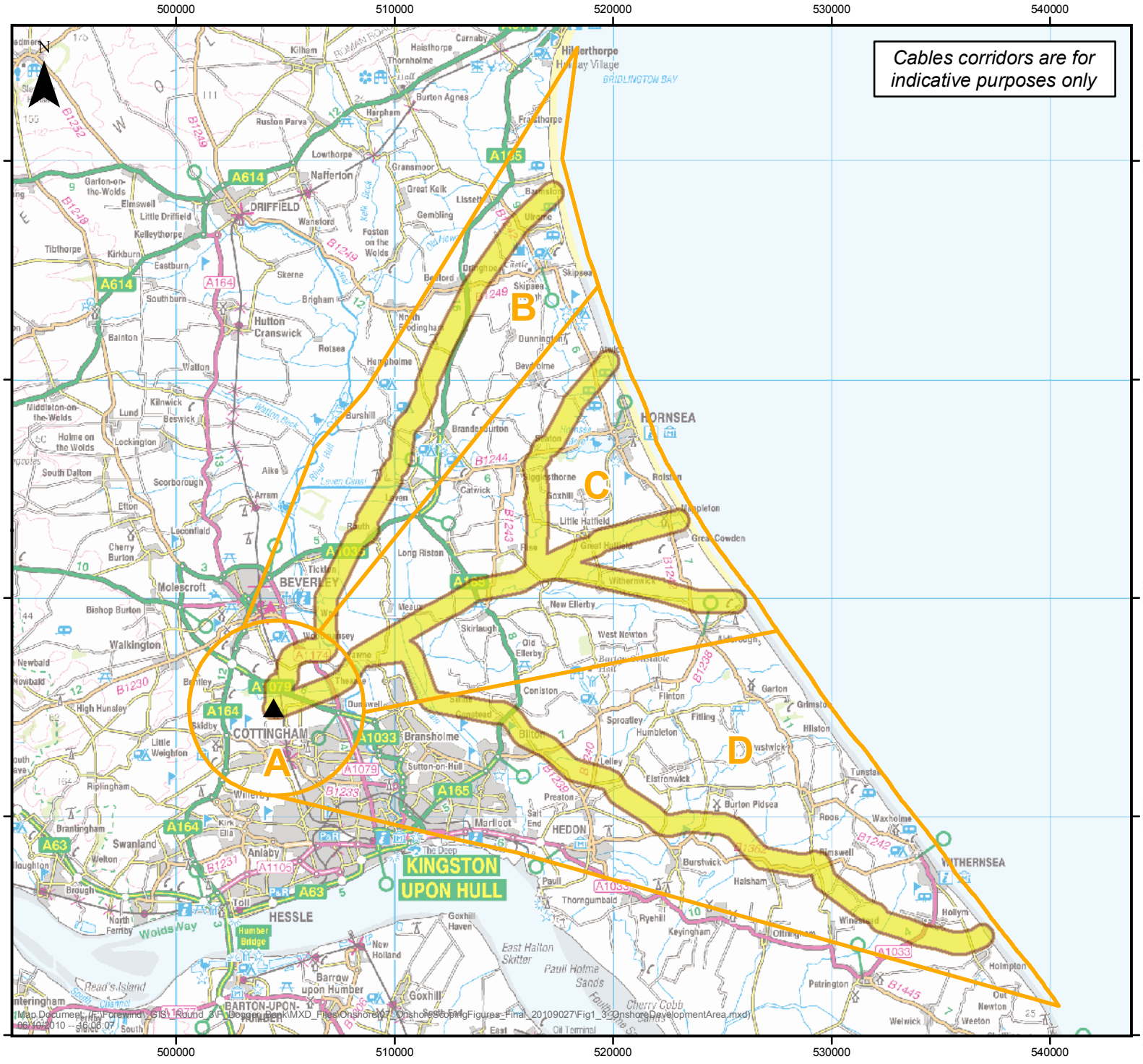
Indicative Cable Route Corridor options: These indicative cable route corridors are approximately 1km in width. The routes are based on desk top data identified during the ZAP process, including planning, environmental and high level engineering considerations, as outlined in the onshore volume of the ZoC.

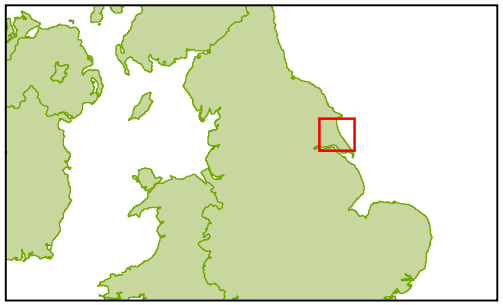
The indicative route options also take into account the feedback from pre-scoping discussions with statutory consultees in summer 2010, who have provided their initial views on the key considerations for cable corridors and landfall locations within the study area.

The indicative routes are shown in **Figure 1.3** and are intended to indicate that feasible corridor options do exist within each of the three broader areas.

In determining the preferred onshore cable corridor, which will be the subject of the consent application, consideration will be given to route length, technical, commercial (e.g. land owner agreements) and environmental constraints. A shorter route may assist in minimising the environmental and social impacts of construction (e.g. by limiting watercourse and hedgerow crossings and minimising land disturbance), whilst potentially reducing the cost of the project.

The justification for the preferred route, along with details of the alternatives considered, will be provided in the ES.





Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Source: Ordnance Survey 250k Raster © Crown copyright and database right, 2010.

0 2 4 8 Kilometres

0 1 2 4 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Onshore Scoping Envelope Detail		
Figure No: Fig 1.3	Paper Size: A4	Rev: 9
Drawn By: DJM	Scale: 1:250,000	
Drawn On: 27/09/10	Projection: BNG	
Checked By: RH	Datum: OSGB36	

FOREWIND

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2. Project Description

2.1 Project Infrastructure

In order to maintain flexibility for the purpose of optimising the final design, construction methodology and operations and maintenance requirements the consent application will provide details of a "Rochdale Envelope" within which the likely impacts of the final design can be assessed. The parameters of this envelope will be established over the coming months in order to inform the EIA assessment which will take account of the full feasible range of dimensions and specifications from multiple suppliers, to ensure that the EIA assesses a realistic worst case scenario (see **Section 3**). The ES will report clearly upon the assumptions on which the assessments are based.

The details provided in the following sections provide an indication of some of the likely parameters that may be used to describe the Rochdale Envelope and are based on the technical information that is currently available.

2.1.1 Main offshore project components

Dogger Bank Project One is likely to comprise the following main offshore components:

- Offshore wind farm array allowing for the production of up to 1.4GW (Wind Turbine Generators (WTG), foundations and scour protection measures);
- Offshore collector and converter substations, foundations and scour protection measures;
- Offshore operations and maintenance infrastructure, such as accommodation platforms, permanent moorings, and navigational buoys and scour protection measures;
- Subsea inter-array cables:
  - Between the turbines;
  - Between turbines and substations; and
  - Between substations.
- Subsea export cables, carrying power from the wind farm to the shore, or possibly adjacent projects.
- Crossing structures at the points where project cables cross existing subsea cables and pipelines.
- Offshore meteorological masts and metocean equipment; and

There follows a brief description of the potential technologies that may be employed, but these are for indicative purposes only and more detail will be given at the ES stage.

Wind Turbine Generators (WTGs)

Offshore wind turbine technology is evolving rapidly and it is anticipated that machines of between approximately 3.6MW and 12MW may be available within the timescales of this project. This results in a range of possible dimensions: current 3.6MW turbines have rotor diameters of around 120m, and tip heights of around 160m; and future turbines in the region of 12MW might potentially have rotor diameters of around 180m and tip heights of around 220m. Based on these estimates this means that a wind farm array of 1.4GW may range from 389 x 3.6MW WTGs to 117 x 12MW WTGs, or variations in between.

Foundations

A wide range of foundation options are potentially available for use on the project, contingent on the outcome of ground investigations, detailed design studies and environmental assessment. This range changes continually as new sub-types are developed, but can be considered as grouped within the following categories:

Monopile: usually constructed from welded steel tubular sections (tapered or cylindrical) driven vertically into the seabed using piling hammers, and sometimes drilling rigs. Investigations are currently underway into large steel monopiles of 8.5m in diameter. An alternative monopile solution (currently under development) uses a steel reinforced concrete design with indicative diameter of 9m to 11m for larger turbines.

Multipile (or Jacket): this describes a family of foundation options, typically consisting of three or four main legs which are linked by a supporting matrix of cross-braces. Indicative dimensions for large multipile foundations include main tubular diameters of 1.4m, and a width of base at seabed of 20 to 30m. Each leg is usually secured by a pin pile, driven into the seabed and grouted or swaged into a sleeve, but this can also be achieved using other techniques, such as suction caissons as described below.

Tripod: similarly to the multipile foundation options, this includes a family of foundation types. All include multiple legs (usually three) supporting a single tubular support for the turbine, and they may be asymmetrical in some cases. Indicative dimensions for large tripods are a central tubular section diameter of around 7 to 8m, supporting braces of 4 to 5.5m, and piles of around 3m diameter. The tripod is driven into the sea bed in a similar manner to the multipile concepts above.

Gravity base structure (GBS): a heavy steel, concrete, or steel and concrete combination base, sometimes including additional ballast substances, which sits on the seabed to support the turbine tower. Gravity bases vary in shape and include conical, as well as cylindrical or hexagonal sections, with indicative base diameters up to 35 to 45m. In all cases, the gravity base structure is placed on a pre-prepared area of seabed. Seabed preparation consists of removal of soft, mobile sediments and the levelling of an area. Gravity base foundations may be designed with steel skirts around the perimeter of the base, which penetrate into the soil and allow under-base grouting.

Suction caisson: based on a structure comparable to an upturned bucket that is lowered to penetrate into a pre-prepared (levelled) seabed. Other than seabed surface preparation, the installation process does not result in the generation of spoil, nor does it require piling. For smaller turbine classes,

caissons may be used individually with an indicative diameter of around 25m, penetrating to around 15m into the seabed. For larger turbine classes, the use of suction caisson foundations are likely to be as part of a multipile or tripod structure and thus should be considered in conjunction with the applicable dimensions above.

Spoil

Spoil may be produced during the installation of the foundations, either through drilling or suction dredging. Where seabed preparation is anticipated (i.e. for gravity base and suction caissons) base locations may be levelled by suction dredging (or similar) to an estimated average depth of 3m below current seabed levels. Spoil could be disposed of on site, or off-site at a licensed spoil disposal area. Any disposal on site will be subject to assessment and licensing, as appropriate.

Scour protection

Scour protection may be required around any offshore structures installed by the project. Should scour protection be required there are a number of options available, selection of which will depend on the final foundation or structural design, ground conditions, scour assessments and environmental assessment. Typical options include:

- Protective aprons;
- Mattresses;
- Flow energy dissipation (frond) devices; and
- Rock and gravel dumping.

Inter-array cabling and installation

Inter-array cabling will transmit power from the individual turbines to an offshore collector platform. The exact number of turbines in each string will depend on the power transmission capacity of the selected cable. The inter-array cable is typically a single cable containing three cores and a fibre-optic cable to transmit data. The three cores are bundled together and protected by armouring to prevent damage to the cable. The cabling will likely have a diameter of around 90-150mm for 33kV (industry standard), but may be larger for higher voltages.

Inter-array cabling is typically installed below the seabed utilising either ploughing or trenching/jetting techniques as appropriate to the location. A detailed cable burial assessment will be carried out to identify the most suitable burial depth in each area, including consideration of operating characteristics, sediment type and risk. In some cases additional protection, similar to that used for scour protection, may be required after the installation of a cable, for instance if ground conditions result in a cable being laid too close to the seabed surface.

Collector substations

Each inter-array cable from a string of turbines will be brought to an offshore collector substation platform, located appropriately to optimise the inter-array cable lengths required. At this platform, the generated power will be transformed to a higher AC voltage, to allow transmission to a converter substation. The higher voltage will be determined by detailed studies, but is likely to be in the range of 132kV to 245kV. The number of collector substations for the project will be determined based on detailed studies, but it is likely that, for a single project, there will be up to four collector substations for

around 1.4GW of generation capacity. The foundation type for the collector substations is likely to comprise a multipile-type foundation, but this will be confirmed following detailed design work.

Converter substations

Given the distance offshore, the likely technical solution for the project's grid connection will be Voltage Source Conversion High Voltage Direct Current (VSC HVDC) technology. This technology provides for significantly lower power losses over long distances than High Voltage Alternating Current (HVAC) technology. HVDC technology requires a converter substation at each end of the export cable, to transform the power from AC to DC. The number of converter substations for the project will be determined based on detailed studies, but it is likely that, for a single project, there will be up to three converter substations for around 1.4GW of generation capacity, and these may be either standalone or associated with collector substations. The foundation requirement will be similar to that required for the collector substations.

Export cabling

Export cabling will vary for different components of the project as detailed below:

- **Collector to converter export cabling**: Depending on the transmission voltage and the capacity of the collector substation, there are likely to be two to four AC export cables from each of the collector substations to the converter substation. The voltage will be determined by detailed studies, but is likely to be in the range of 132kV to 245kV.
- **Inter-project export cabling**: There may be a need for connections linking the Dogger Bank Project One with further development within Tranche A, to be confirmed during detailed design. If required, the cable types will be similar to those described above.
- **HVDC Export cabling to shore**: The design of the HVDC connection to shore will determine the type of export cabling required. The base case design will be a Bipolar converter system, consisting of a pair of high voltage DC cables for each converter substation, one with a high positive voltage, and one with a high negative voltage relative to earth. A typical voltage for this design would be +/- 300kV, depending on the power to be transmitted. Such a system could transmit up to around 1.1GW per pair of cables.

The different export cabling types will be installed utilising the most appropriate installation technique for the location, with the likely options as described for the inter-array cabling.

Cable and pipeline crossings

Both inter-array and export cables may be required to cross existing pipelines or cables (see **Section 7.6**). Detailed methodology for the crossing of cables and pipelines by the export cables will be determined in collaboration with the owners of the infrastructure to be crossed. A number of techniques can be utilised, including:

- Pre-lay and post lay concrete mattresses;
- Pre-lay and post lay rock dumping;
- Pre-lay steel structures; or
- Pre-constructed HDPE castings or other innovative approaches.

Meteorological masts and metocean equipment

The Zone will include the installation of a number of meteorological monitoring stations (masts). These consist primarily of a tall tower fitted with anemometers for measuring wind data, mounted on a foundation similar to that of a smaller wind turbine. This mast may also include a wide variety of other instrumentation both mounted on the mast and deployed around it. Meteorological masts are essential to provide meteorological and oceanographic (metocean) data. The metocean data are used for designing and optimising the wind farm design prior to installation and subsequently for monitoring wind farm performance. The final locations and foundation option for the proposed meteorological masts will be determined during the detailed project design process.

It is possible that some metocean monitoring equipment will also be installed separately to the main meteorological masts. This could include technologies such as waverider buoys (floating buoys designed to measure wave data) and AWAC units (seabed mounted equipment designed to measure wave, current, and water level data).

Offshore operation and maintenance

Once operational, the project will require regular inspections, service and maintenance throughout its lifetime. This will require a full time dedicated team of technicians and associated support staff. There are a number of approaches to the operation and maintenance (O&M) of the wind farm and the final solution will be determined following consideration of health and safety issues, transit duration, port location and facilities, weather downtime, turbine selection and the cost-benefit analysis of each option. Given the distance of the project from shore, it is assumed that in addition to an onshore base at a suitable port, one or more offshore operations hubs will also be required. The offshore hub could be either a fixed platform at the site (standalone, or associated with one of the substation platforms), or a medium to large vessel which is able to travel between port and the project area. Transport to the offshore project elements could be by various means, including some combination of small, medium or large vessels, jack up vessels and helicopters.

It is expected that as part of the O&M of the wind farm, large vessels may be used continually to support offshore activities – as offshore operations hubs, or otherwise. Therefore, it may be necessary to have a number of pre-installed permanent moorings at intervals around the project area to allow vessels to moor at the project site while work is ongoing.

It is estimated that around 10 of these moorings may be required, and that they will be likely to consist of a floating buoy with appropriate mooring systems (loops, pre-fixed cables, etc), secured via chains or cables to a system of anchors on the seabed.

Given the range of O&M options available to Forewind, it will be ensured that these matters will be dealt with explicitly in the relevant topic sections of the EIA.

Landfall works

The landfall point is expected to be chosen to minimise the offshore and onshore cable route lengths for the HVDC export cables, while ensuring that a technically suitable and environmentally appropriate location is chosen. The landfall location is anticipated to be along the coastline between Hilderthorpe (south of Bridlington) and Holmpton (south of Withernsea).

The technique employed may depend on the characteristics of the landfall location chosen. If the landfall is suitable, the cables may be buried in a trench up the beach to the transition pit. If this is not appropriate then other techniques, such as HDD (which will still require some trenching), may be utilised to take the cables across the immediate coastline to the transition pit.

Offshore Installation Issues

The offshore construction and installation process could take place over a period of several years for this initial project, and although it is often limited to favourable weather conditions, some activities could take place throughout the year.

Foundations will be installed prior to the installation of the turbines. Methods of installation vary depending upon the foundation type selected and may therefore require a range of installation vessel types.

Techniques typically employed include:

- Pile driving;
- Seabed levelling (for gravity bases and suction caissons);
- Drilling;
- Connections such as grouting, swaging or bolting; and
- Pile connection activities (for multipiles and tripods).

Wind turbines, transition pieces (if required), met masts, substations, and accommodation platforms are commonly installed onto their foundation structures using one or more crane lifts from offshore barges, crane ships, or jack-up vessels. Turbines for example, have been installed pre-assembled in a single crane lift, and also erected using a series of lifts to assemble multiple tower sections, the nacelle, and blades. These large construction vessels are often supported by support craft such as tugs, crew transfer vessels, and feeder barges and may be required either to stay on site, anchoring as required, or to transit to and from base ports.

Subsea cables are generally installed using specialist cable installation vessels. These vessels are equipped to transport the cables, and then to install them using a variety of methods. Typically this includes some combination of jetting and ploughing techniques.

Offshore decommissioning and replanting issues

The design life of most offshore wind turbine structures is around 20 years, whereas The Crown Estate lease for the site would be expected to be for 50 years. Therefore, it is possible that the project would be replanted during the lease period. Replanting consists of replacing some or all components with new parts, to a partly or wholly new project design. If this were to take place, then the necessary consents and licenses would need to be applied for at that time.

At the end of the project life, it will be required to be decommissioned. At the end of The Crown Estate lease period it is a condition of the lease, as well as a statutory requirement through the provisions of the Energy Act 2004, that the project is decommissioned. Under the statutory process, a decommissioning plan is required at the request of the Secretary of State.

For the purposes of the EIA the decommissioning of the wind farm would likely be the reverse of the construction process with some exceptions. Piled foundations would likely be removed to just below seabed with due consideration made of likely changes in seabed level. Currently there is no statutory requirement for decommissioned cables to be removed. However, the necessity to remove cables will be reviewed at the time, in terms of environmental impact of the removal versus the impacts of cables left in situ. It is expected that decommissioning will require similar vessels to construction and will take a similar period of time. Further information on the impacts associated with decommissioning is provided in the technical sections of this Scoping Report.

2.1.2 Main onshore project components

This section provides a high level description of the key onshore components of the project and an outline of the construction, operational and decommissioning phases. The onshore works are described as all infrastructure required landward of the onshore transition pit to connect the electricity generated by the offshore wind turbines to the electricity transmission system. The main onshore components include:

- Onshore transition pit;
- Cable system* - from onshore transition pit to onshore converter substation;
- Ancillary cable ducts* – these are buried ducts running adjacent to the cable system;
- Cable system - from onshore converter substation to National Grid Electricity Transmission (NGET) substation; and
- Up to two converter substations*.

***Note:**

Cable system is a collective term to describe the components parts that may be installed in the cable trench to facilitate connection – e.g. HVDC cables, communication cable(s), proprietary back fill material (to assist heat dissipation) and marker tape.

Ancillary cable ducts refers to conduit or pipe ducting, likely made from High Density Polyethylene (HDPE) or similar suitable material, which will facilitate retrospective installation of cables for further electrical capacity.

Converter substations change the direct current (DC) power exported from the wind farm to 400kV alternating current (AC) prior to connection to the existing Creyke Beck National Grid substation.

It should be noted that the present regulatory system for the connection of offshore wind farms to the UK transmission network requires an Offshore Transmission Owner (OFTO) appointed through competitive tendering processes to design, build, own and operate the transmission assets between the offshore wind farm and National Grid's asset boundary.

Onshore transition pit

The transition pit is typically located close to the shoreline, to allow each offshore export cable to be jointed to an onshore cable which is then connected to the onshore converter substation (the onshore cable route). The transition pit size and design will be determined through detailed design. The pit will

be located below ground level and will need to be accessible throughout the lifetime of the project and as such the immediate area around it will likely have restricted use.

Cable system from onshore transition pit to onshore converter substation

Given the distance offshore, the likely technical solution for the project's grid connection will be VSC HVDC technology. This technology results in significantly lower power losses over long distances than High Voltage Alternating Current (HVAC) technology. HVDC technology requires a converter substation at each end of the export cables, to transform the power from alternating current (AC) to DC. The number of converter substations for the project will be determined following detailed studies, but there may be up to two converter substations at the onshore end of the export cables for around 1.4GW of generation capacity.

The design of the HVDC connection from the transition pit to the onshore converter substation(s) will determine the type of cabling required.

The onshore portion of the HVDC transmission will require cables between the transition pit and the onshore converter substation. This will comprise a new underground (buried) cable system rather than any new overhead lines. Detailed feasibility and route selection studies are ongoing in order to identify the optimum route for the buried cable system.

The chosen cable corridor is likely to be 20 to 35km long. The exact length will be dependent on the route chosen and the constraints identified during detailed assessments. There are likely to be up to four main cables and up to two associated fibre optic cables for communication purposes. Cables would likely be buried in one trench which is likely to be around 1.5m wide and approximately 1.5m deep, with an indicative (but still to be confirmed) working corridor during construction of up to 30m wide, including temporary haul road and spoil heaps.

Cable jointing bays may be required approximately every 700m - 1km to join lengths of cable. Following construction, the ground above the cable joint bay will be reinstated; however occasional access for maintenance purposes may be required.

There is a possibility that future offshore wind farm projects proposed for the Dogger Bank Zone may be awarded grid connection offers at the Creyke Beck substation. In order to prepare for this Forewind propose to allow for the option of the installation of ancillary underground ducting which could be installed adjacent to, and at the same time as, the cable system (increasing the working corridor width to accommodate the additional works). The ducting would facilitate retrospective pull-through of cables at a later date and minimise necessary cable installation works and disruption. The depth of burial of ducts will be similar to that of the cable system but separation distances and overall working corridor would be determined by detailed engineering study and agreed through discussions with the landowner.

Cable system from onshore converter substation to the National Grid (NGET) substation

Once the transmitted power has been converted back into HVAC (400kV as stipulated by National Grid) by the onshore converter substation, the power will be transmitted by cable from the onshore converter substation to the existing NGET substation at Creyke Beck. The connection could be by

buried cable or by a short length of overhead line, depending on detailed technical feasibility, environmental impact and route selection studies.

Cable installation techniques

A range of cable installation techniques are available for use, including cable ploughing (lower shore area), open cut trenching, coffer dam and tunnelling techniques (such as directional drilling technology). The two main techniques are described in brief below. The techniques will be discussed with consultees, together with the results of studies and assessments on a case by case basis, to determine their appropriateness for use in specific circumstances along the proposed cable routes.

Open cut trenching

This technique is the default installation methodology for underground cabling in relatively unconstrained areas. For more numerous and minor physical constraints such as tracks, roads and drains, open trenching cut by an excavator can be used along with additional measures to minimise impact.

Horizontal Directional Drilling technology

Horizontal Directional Drilling (HDD) is a mature tunnelling technique used for underground cable installation across significant environmental or physical features such as sea defences, rivers, roads, railways etc. A typical installation of ducts by directional drilling comprises drilling pilot holes; reaming (to make the holes bigger) and pulling the conduits through the reamed holes.

Onshore converter stations

Forewind has accepted a grid connection offer made by National Grid to connect the first approximately 1.4GW of the Dogger Bank project into the existing Creyke Beck substation, near Cottingham, at 400kV HVAC.

The converter substations will convert the DC export power to 400kV AC prior to connection to the existing National Grid substation. Up to two new converter substations will be constructed which represent the main permanent, visible, aspect of the onshore project works. It is envisaged that they will be proximate to the existing Creyke Beck substation, and will be co-located together where possible.

The design and layout of the new converter substations will be developed in parallel with the development process. The final locations will be finalised during feasibility studies taking into consideration land availability, environmental and technical constraints; and landowner negotiations.

Initial estimates suggest that a land footprint of approximately 200m x 150m could accommodate the two converter substations of approximately 500MW capacity each. In addition, a similar land area would be necessary, on a temporary basis, for construction purposes. The exact footprint will be determined through detailed design studies. The overall volume is important so a reduction in height would result in an increase in ground area, and vice versa. Typically substation buildings /apparatus may be around 15 - 35m elevation depending on land available, and will be serviced by an access road of width up to 6m. Detailed design studies will be undertaken involving a number of major

suppliers, and hence these parameters could be subject to change once further information is known. A typical HVDC substation at Murraylink, Victoria, South Australia is shown in **Figure 2.1**.

Figure 2.1 Murraylink HVDC Light, Berri Station (220MW)

NGET Creyke Beck substation

The requirement for any NGET substation consents necessary to undertake works associated with Dogger Bank Project One at Creyke Beck is the responsibility of National Grid. The cumulative impacts will be considered where appropriate, as discussed in **Section 3**.

Onshore construction phase

The onshore construction period is estimated to have a duration of up to 24 months.

During construction there will be a requirement for temporary construction compounds, laydown areas, spoil heaps and access tracks. Following the completion of construction, these working areas will be reinstated to their previous condition, which in many cases is likely to be agricultural farmland.

It may also be necessary during construction for there to be temporary closures or diversions of roads or public rights of way (PRoW). These will be kept to a minimum, and where necessary will be undertaken in consultation with the relevant local authority officers.

Onshore operation and maintenance

During the operational phase of the wind farm, the impacts arising from the onshore components are limited. Access will be required to the converter substation, throughout the lifetime of the project for monitoring and maintenance purposes and occasional access may be needed to the landfall transition pit and cable joint pits.

Onshore replanting and decommissioning

There is currently no statutory requirement for decommissioned cables to be removed and it is likely that removal of the cables would bring about further environmental impacts. At present it is proposed that the cables will be left in-situ and this will be reviewed over the design life of the project. The onshore site will be restored in accordance with the Decommissioning Programme, which is also a requirement of the lease.

3. The Consents Framework and EIA Methodology

3.1 The Consents Framework

The information provided below outlines the key legislation that will be considered in accordance with the development of the Dogger Bank Zone – The Planning Act 2008, The EIA Regulations and the Marine and Coastal Access Act 2009.

A full list of the relevant legislation, authorisations and permits associated with the delivery of the offshore wind farm project will be provided in the ES produced to support the planning application.

3.1.1 The Planning Act 2008

Its is Forewind's intention to submit a consent application for Dogger Bank Project One to the Infrastructure Planning Commission (IPC) under Section 5 of the Planning Act 2008, which provides the system of development consent for nationally significant infrastructure projects (NSIPs), including large offshore wind farms, in the UK.

The IPC is responsible for examining applications for development consent for NSIPs and deciding any such application, when there is in force a National Policy Statement (NPS).

Detailed consultation will be undertaken on the proposals, in accordance with the Planning Act, before a formal application for consent is submitted to the IPC. The consultation requirements for the promotion of a DCO are set out in Sections 42 to 50 of Chapter 2 to the 2008 Act and require the promoter to –

- Consult with the local authority on what information should be included in the Statement of Community Consultation (SOCC) which will set out how the promoter proposes to consult with the local community, as prescribed in Section 47;
- Publish the SOCC and carry out consultation in accordance with it;
- Consult the statutory consultees prescribed in section 42 and Schedule 1 of the Infrastructure Planning (Applications: Prescribed forms and Procedure) Regulations 2009;
- Notify the IPC in accordance with Section 46;

- Publicise the application;
- Have regard to relevant responses to publicity and consultation as required by section 49; and
- Prepare a consultation report and submit to the IPC (required by section 33(3)(c).

Forewind's consultation objectives are further described in **Section 4**.

NPS's have not yet been finalised and are currently being reviewed following the outcome of a public consultation which concluded in February 2010. The IPC will have regard to the draft NPS's when making recommendations for development consent to the Secretary of State (SoS) until the final versions of the NPS have been published.

The draft Overarching Energy NPS (EN-1) sets out the Government's energy policy, the need for new energy infrastructure and instructs the IPC on how to assess the impacts of energy infrastructure development in general. The other draft energy NPS's contain supplementary information for specific types of infrastructure including the NPS for Renewable Energy Infrastructure (EN-3). These draft "technology specific" energy NPS's (EN 2-6) must be read in conjunction with EN1.

Following the 2010 UK general election the new Coalition Government announced their plans to abolish the IPC. It has been proposed that a new unit called the 'Major Infrastructure Planning Unit' will be established to consider all NSIP applications, with the final decision on any developments made by the relevant Secretary of State.

Primary legislation to amend the Planning Act and abolish the IPC is expected to be brought forward in 2011. Until then the IPC will continue to fulfil its role in accordance with the current version of the Planning Act.

3.1.2 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009

Planning applications for NSIPs submitted under the Planning Act 2008 are likely to be supported by an Environmental Statement produced in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. These regulations have been produced in accordance with the European Council Directive Council Directive 85/337/EEC of 27 June 1985 which requires the assessment of the effects of certain public and private projects on the environment.

3.1.3 The Marine and Coastal Access Act 2009

The Marine and Coastal Access Act 2009 (MACA 2009) has been implemented in response to the European Marine Strategy Framework Directive. The Act establishes an authority (the Marine Management Organisation) and a legislative regime through which the UK will fulfil its obligation to establish a strategy to achieve good environmental status within its marine environment.

The Act allows for the designation of a network of Marine Conservation Zones (MCZ), which are a form of Marine Protection Area, established to preserve the integrity of national, regional or local areas of significant environmental status.

It also creates a strategic marine planning system that clarifies the UK's marine objectives and priorities for the future and directs decision makers and users towards more efficient, sustainable use and protection of our marine resources. The first stage of this marine planning system will be the creation of a marine policy statement to create a more integrated approach to marine management. The second stage will be the creation of a series of marine plans, which will implement the policy statement in specific areas, using information about spatial uses and needs in those areas.

The Act also makes changes to the marine licensing system, replacing the requirement for a licence under the Food and Environment Protection Act 1985 (FEPA) and the Coast Protection Act 1949 (CPA) for all works and deposits above, on or under the sea bed that occur below mean high water springs (MHWS).

The MACA 2009 adds a new section to the Planning Act 2008 (Part 4 - 149A "Deemed Consent under a marine licence") enabling the applicant for a DCO to apply for a deemed marine licence as part of the DCO process.

3.1.4 Habitats Regulations Assessment

The need for a Habitats Regulations Assessment (HRA) and, importantly Appropriate Assessment, arises through EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (known as the Habitats Directive); where a plan or project is considered to have a likely significant effect on a European site (SPA, SAC and Ramsar), either alone or in-combination with other plans or projects. In the UK this is implemented under the Conservation of Habitats and Species Regulations 2010 and The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010. The regulations state that it is the developer's responsibility to provide sufficient information to the regulatory authority to enable them to assess the significance and carry out the HRA where necessary. In the case of Dogger Bank Project One, the IPC (or Planning Inspectorate) will be the competent authority for the HRA, and for the Appropriate Assessment, should screening conclude that one is required.

In accordance with the requirements of The Habitats Regulations and Offshore Habitats Regulations, an Appropriate Assessment of the Round 3 plan was undertaken by The Crown Estate (Entec, 2009). The report assessed the likely impacts of development at each of the Round 3 zones and concluded that, while the plan itself was not considered to have an adverse effect, the possibility of individual projects having a likely significant effect on the European designated sites could not be ruled out. As such, a HRA are likely to be required at the project level.

At a high level, the Plan-Level Appropriate Assessment is based on the application of a range of "general environmental measures" (i.e. industry standard mitigation) and "Directive measures" (i.e. high level avoidance measures required to avoid significant effects on designated features). Together, the application of these measures is referred to as "avoidance and mitigation measures". With these measures in mind, the Appropriate Assessment provides a range of findings for the Dogger Bank Zone that are relevant to this Scoping Report and to subsequent project development. The reader is

referred to the Plan-Level Appropriate Assessment for further detail. A summary of potential key issues for Dogger Bank is provided in Section 6 of this Scoping Report. Forewind will review the findings of the Plan-Level Appropriate Assessment, in conjunction with its stakeholders, as the EIA process progresses in order to determine the information necessary to inform the HRA

3.2 EIA Methodology

A formal Environmental Impact Assessment (EIA) will be required as part of the DCO application. The Environmental Statement (ES), the report documenting the EIA process, will be prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the EIA Regulations) and will take into account key guidance including the following:

- Draft Overarching National Policy Statements for Energy EN-1, Renewable Energy Infrastructure EN-3, and Electricity Networks Infrastructure EN-5.
- DECC (formerly the Department of Trade and Industry (DTI)) Guidance Note 'Offshore Wind Farm Consents Process' (DTI, 2004);
- Cefas guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements (2004);
- Nature conservation guidance on offshore wind farm development (Defra, 2005);
- The Conservation of Habitats and Species Regulations 2010;
- The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010;
- Institute of Ecology and Environmental Management (2006) *Guidelines for Ecological Impact Assessment in the United Kingdom* (version 7 July 2006). http://www.ieem.org.uk/ecia/index.html;
- Institute of Ecology and Environmental Management (unpublished) Draft guidelines for marine Ecological Impact Assessment – anticipated in late 2010; and
- Institute of Environmental Management & Assessment, 2004. Guidelines for Environmental Impact Assessment. IEMA, Lincoln (www.iema.net).

In order to provide a consistent framework for considering and evaluating impacts (both adverse and beneficial), significance levels will be assigned to each impact. **Table 3.1** sets out the assigned definitions that are proposed to be used in the assessment process for the majority of parameters. Each parameter of the EIA will include a description of the approach to impact assessment so that it is clear to the reader exactly how impacts have been defined. This will be particularly important for those parameters which necessitate a different approach.

Table 3.1 Terminology for Classifying Environmental Impacts

Impact Significance	Definition
No impact	There is an absence of one or more of the following: impact source, pathway or receptor.
Negligible	The impact is not of concern.
Minor adverse	The impact is undesirable but of limited concern.
Moderate adverse	The impact gives rise to some concern but is likely to be tolerable (depending on the scale and duration).
Major adverse	The impact gives rise to serious concern; it should be considered as unacceptable.
Minor beneficial	The impact is of minor significance but has some environmental benefit.
Moderate beneficial	The impact provides some gain to the environment.
Major beneficial	The impact provides a significant positive gain.

The significance of an impact is predominantly determined by its magnitude and probability of occurring. A number of different factors combine in the consideration of magnitude:

- Spatial extent of the impact (small scale/large scale);
- Duration of the impact (short term/long term);
- Reversibility of the impact (including species or habitat recoverability);
- Sensitivity and level of tolerance of the receptor or species;
- Conservation or protected status;
- Confidence in the impact prediction; and
- The margins by which set values are exceeded (e.g. noise standards).

The first step in the EIA process is the establishment of the existing environment, either through development of a scientifically robust baseline or via a characterisation study. The existing environment is collated from a number of sources including desk-based literature/data collection, consultation and consultation. Identification and evaluation of impacts is carried out using a range of evaluation and assessment techniques including desk-based assessment, numeric and computer modelling, reference to standards, guidelines and best practice and experience of other similar schemes and projects.

During the impact assessment for each parameter, cumulative impacts will be considered along with transboundary impacts where appropriate. The approach to the cumulative impacts assessment (CIA) is considered in **Section 3.6**.

Transboundary impacts cover any impacts of the development which may affect another European Member State in accordance with Regulation 24 of the Infrastructure Planning (Environmental Impact Assessment) Regulations (2009) (the EIA Regulations) and the Espoo Convention (1991). The IPC is required to consult with Member States regarding highlighted issues and agree on appropriate mitigation measures to eliminate or alleviate the impacts.

3.3 The Rochdale Envelope

The design of the project will be refined throughout the development and EIA process. The EIA will assess a number of different development options including various turbine layouts, foundation type, cabling array, turbine model, export cable route, installation methodology, onshore cable route, and substation design/location.

The final definitive development plan, incorporating all elements of the project, is likely to be defined post consent. In order to accommodate this flexibility, and ensure that the ultimate project has been properly assessed, it has become routine practice to employ a 'Rochdale envelope[2]' approach to EIA where the 'worst case scenario or option' (or more realistically a 'worst-likely case scenario or option') is assessed so that it can be safely assumed that all lesser options will have less impact. Therefore, the EIA looks at the maximum potential impact that could realistically arise from the wind farm development. This approach is recognised as necessary within NPS EN-3. It should be noted that, as required via Paragraph 27 of Schedule 4 Part 2 of the EIA Regulations, Forewind will ensure that the ES provides an outline of the main alternatives studied during the EIA and the reasons for the choice of option(s) carried forward, taking into account environmental effects.

In accordance paragraph 24 of Schedule 4 Part 2 of the EIA Regulations, as far as is practicable at the time of application, Forewind will provide details of the design envelope options that are known, such as the site location, design and size.

3.4 Mitigation and Monitoring

The requirement to implement mitigation stems from Schedule 4 of the EIA Regulations where it is stated that mitigation measures are required to prevent, reduce and where possible offset the impact of significant adverse impacts. Accordingly, such measures will be categorised as to whether they avoid, reduce, compensate or enhance (Schedule 4 part 1 paragraph 21). Appropriate mitigation

[2] Case law (i.e. *R.V. Rochdale MBC Ex Part C Tew* 1999 – "the Rochdale case") set a precedent that "indicative" sketches and layouts, etc, cannot provide a sufficient basis for the determination of applications for outline planning permission for EIA development. In respect of DCO consent, the final scheme constructed must have been covered by the scope of the EIA.

measures will be established in conjunction with the Regulatory Authorities and relevant stakeholders where the EIA process has identified an adverse impact on a receptor. It is recognised that this 'mitigation by design' approach is an important factor ensuring resultant environmental impacts are minimised.

Except for the onshore aspects of the development, where standard methodologies provide for the mitigation of anticipated effects, the types of mitigation that may be required for each parameter are not detailed within this Scoping Report, as Forewind does not consider it valid to pre-empt the outcome of the EIA process at this stage. However, Forewind fully commits to working closely with the relevant authorities and following best practice and relevant guidance to ensure that the measures put forward in the EIA are practical both in terms of implementation and reducing the potential impact.

Examples of industry standard mitigation for onshore development activities are summarised in this scoping report, as Forewind expects to undertake a number of these as a matter of course.

The site specific studies identified within this Scoping Report are focused on ensuring that the existing environment can be adequately characterised to enable the assessment of impacts and, therefore, a robust EIA process. It is recognised that further detailed and targeted (and possibly quantitative) monitoring studies may be required following award of the DCO and prior to, during and following construction. Furthermore, Forewind fully anticipates that the need for and nature of mitigation and monitoring for the project will be included in conditions attached to the DCO. Forewind is committed to working closely with the relevant authorities to establish practical and robust monitoring programmes based on the actual impacts assessed. The extent and detail of these monitoring programmes will be largely informed through the findings of the EIA process and therefore, no detailed monitoring specifications are provided within this Scoping Report.

3.5 Cumulative Impact Assessment

Cumulative impacts of the wind farm will also be assessed within the EIA. Cumulative Impact Assessment (CIA) will include assessment of offshore wind farm projects in the Dogger Bank Zone (as described below), other offshore wind farm projects for which available data allows assessment (the identity of which is to be agreed with the relevant authorities) and other plans and projects that have the potential to impact on the same receptors (e.g. oil and gas activity, fishing, dredging etc.)

As discussed in **Section 1**, the phased approach to development of the Dogger Bank Zone means that cumulative impacts must be assessed on the basis of the 'Building Block' approach, using the ongoing ZAP process to inform wider strategic decision making on the location of subsequent tranches and projects. Under this approach, those projects which reach the application stage at a similar time, or which are at more advanced stages of development than those reaching the application stage, will be considered in terms of cumulative impact. This means that Dogger Bank Project One is most likely to be considered in conjunction with the two other projects planned for Tranche A, provided that grid connection locations are identified in sufficient timescales to allow these projects to be developed in parallel. Under the Building Block approach, subsequent projects in the

Zone will consider the cumulative impact of all preceding projects as well as those projects in the development phase together.

Onshore cumulative impacts include other infrastructure and construction projects, and may include any works required by National Grid to facilitate the Dogger Bank Project One connection at Creyke Beck (depending on the timing of those works). Effects will be described as those both within the project, and between other plans and projects.

Given its location, the project will also take into consideration international projects in accordance with the Espoo (EIA) Convention (1991). The full list of projects and activities to be included in the assessment will be agreed with the relevant authorities.

3.6 Structure of the Environmental Statement

Forewind seeks the advice of the IPC on the following proposed contents list of the ES.

Glossary	
Non-Technical Summary	
Section 1	Introduction
Section 2	Need for the Project
Section 3	Project Details (including assessment of alternatives)
Section 4	Legislative Requirements and the EIA Process
Section 5	Policy Framework and Guidance
Section 6	Nature Conservation Designations
Section 7	Physical Processes
Section 8	Marine and Coastal Water Quality
Section 9	Marine Ecology
Section 10	Fish and Shellfish Resource
Section 11	Ornithology
Section 12	Marine Mammals
Section 13	Commercial Fisheries
Section 14	Shipping and Navigation
Section 15	Military and Civil Aviation
Section 16	Other Uses and Users of the Sea
Section 17	Archaeology and Cultural Heritage
Section 18	Landscape, Seascape and Visual Character
Section 19	Socio-economic Assessment
Section 20	Geology, Hydrogeology and Land Quality
Section 21	Terrestrial Ecology
Section 22	Traffic and Access
Section 23	Noise and Vibration
Section 24	Air Quality
Section 25	Local Community, Land Use, Tourism and Recreation
Section 26	Information for Appropriate Assessment
Section 27	Summary
References	

4. Consultation

4.1 Approach to Stakeholder Engagement

Forewind recognises that effective and meaningful consultation is an integral part of its development activities and is committed to ensuring that it maintains a transparent approach to its consultation and engagement activities.

Forewind's stakeholder engagement objectives are as follows:

- To identify and pro-actively engage with those statutory, non-governmental, international, community and landowner organisations that have the potential to be affected by our activities;
- To develop a transparent consultation and engagement strategy which fulfils the pre-application consultation requirements of the Planning Act 2008 ("the Act")_;
- To prioritise consultation with stakeholders who are most affected or who have a greater cause for concern as a result of our development proposals;
- To be open and honest in all communications with our stakeholders;
- To recognize the interests and points of view of our stakeholders and wherever appropriate to use these to inform our development activities;
- To undertake a comprehensive ZAP process with appropriate consultation with stakeholders to enable robust site selection and identification of individual projects for development; and
- To develop a Statement of Community Consultation which clarifies our approach to community engagement – to publish this at an early stage of development and to update it as informed by those engagement activities throughout the development process.

Following on from the production of the Scoping Report and using the information received at the stakeholder workshops and stakeholders meetings held during the initial stages of ZAP, Forewind is developing a Stakeholder Engagement Plan (StEP) to communicate their proposed approach to consultation.

The StEP will help maintain a transparent and structured approach to its engagement activities and will clarify how consultation with stakeholders on both zonal and project development matters might be undertaken.

The StEP will be developed in consideration of what is necessary to achieve compliance with the Planning Act and what information is needed through consultation to inform the development process.

In view of this, it will also set out the requirements and a proposed approach to the implementation of processes in accordance with Section 42, 47 and 48 of the Act, as described in Section 3.1.1.

4.2 Consultation to Date

Forewind has sought to ensure that relationships with stakeholders are established from an early stage of development. Therefore, contact was made with a large number of stakeholders to inform them of our initial development proposals.

A summary of the consultation undertaken to date is included below:

- January 2010 – letters of introduction to over 270 individuals upon award of the exclusivity agreement by The Crown Estate;
- Feb – Mar 2010 – meetings with several of key stakeholders to provide further information on the proposals including; the Marine Management Organisation (MMO), The Wildlife Trusts, English Heritage, Natural England, the Royal Society for the Protection of Birds (RSPB), the Joint Nature Conservation Committee (JNCC), Centre for Environment, Food and Agricultural Services (Cefas), the Infrastructure Planning Committee (IPC), the Environment Agency, East Riding of Yorkshire Council and the North Sea Regional Advisory Council (NSRAC);
- April 2010 – Stakeholder workshops in Hull, Newcastle and London attended by a wide range of consultees across a broad spectrum of disciplines as described in further detail below; and
- May – September 2010 – Pre- Scoping meetings with stakeholders including Maritime Coastguard Agency (MCA), Trinity House Lighthouse Services (THLS), Chamber of Shipping, National Air Traffic Services (NATS), Department of Energy and Climate Change (DECC), Volantis, PA Resources, Natural England, the Environment Agency and East Riding of Yorkshire Council.

As referred to above, Forewind held a series of stakeholder workshops in Hull, Newcastle and London in April 2010. These workshops provided an opportunity for Forewind to engage and to start to build relationships with as many stakeholders as possible at an early stage in the development process.

The objectives for the stakeholder workshops were to:

- Provide an opportunity for early stakeholder engagement and to ascertain their interests or concerns;
- Communicate Forewind's development objectives;
- Build on Forewind's understanding of the Zone wide development issues;
- Identify stakeholder concerns so that they can be considered in the selection of wind farm sites;
- Establish a relationship with stakeholders and inform the production of a StEP; and
- Feed information into tranche and project selection.

The workshops provided an important contribution to the ZAP process and will inform the production of a StEP. The information gathered has been very useful in helping identify stakeholder interests and concerns and has been an important source of information for the identification of the first tranche of projects for development.

Over 400 individual consultees, representing stakeholders from both private and public sectors, were invited to the workshops. The sectors invited and represented at the workshops are set out below:

Table 4.1 Workshop consultee groups

Consultees	
Energy and infrastructure companies and representative organisations.	Heritage and archaeological representative organisations.
Fishing industry representatives (domestic and European).	Highways and Planning representatives.
Ports and logistics companies and organisations.	Government departments.
Shipping companies and representative organisations.	Local authorities.
Maritime safety organisations.	The Ministry of Defence (MOD).
Environmental, wildlife and marine conservation groups.	Regulatory authorities.

Forewind considered the stakeholder workshops to be successful in terms of the participation and commitment from a broad range of stakeholders at such an early stage of development. The output from these workshops has been a very important information source in the selection of Tranche A.

A full suite of presentations and reports from the zone level stakeholder workshops are available on the Forewind website at http://www.forewind.co.uk/stakeholders/.

5. Physical Environment - Offshore

5.1 Tranche A Existing Environment

5.1.1 Geology

Pleistocene

The sub-surface geology of Tranche A comprises Pleistocene sediments resting on a Tertiary base. Lower and Middle Pleistocene units at depth (below approximately 100m sub-seabed) include (from oldest to youngest) Ijmuiden Ground, Winterton Shoal, Markham's Hole, Outer Silver Pit, Aurora and Yarmouth Roads Formations. These formations comprise a complex of deltaic muds and sands (Cameron *et al.*, 1992). The Yarmouth Roads Formation is channelised and filled by the sands and muds of the Swarte Bank Formation, providing the first record of ice in the North Sea. Above 100m the Pleistocene succession is dominated by sedimentation mainly controlled by invasion and retreat of ice sheets across the area. The Egmond Ground and Cleaver Bank Formations comprise up to 10m of marine sands and marine clays, respectively, at a time when the ice had retreated and the North Sea became a sea (Cameron *et al*., 1992).

The final phase of Pleistocene deposition across Tranche A is represented by the laterally equivalent Bolders Bank and Dogger Bank Formations, which are near surface in the area. Both are associated with a glacial advance into the North Sea; the Bolders Bank Formation comprises till deposited beneath the ice sheet whereas the till of the Dogger Bank Formation was deposited proglacially.

Holocene (post-glacial)

Three Holocene sediment units are recognised across Tranche A. The Elbow Formation comprises muddy sands and occurs as isolated patches across Dogger Bank. The Terschellingerbank Member of the Nieuw Zeeland Gronden Formation is composed of one to 10m of sand and distributed extensively across Tranche A. The Indefatigable Grounds Formation is a gravel and sand deposit which forms a thin veneer over Pleistocene till and occupies isolated areas of Dogger Bank (Cameron *et al*., 1992).

Mapped Quaternary channels

BGS Data regarding the presence of quaternary channels across Tranche A has been re-interpreted by Emu (2010a). It was noted that, in the original interpretation, a limited number of channel features were identified across the Zone.

These were divided into three main formations:

- Botney Cut;
- Volans Member (Dogger Bank); and
- Swarte Bank.

The revised interpretation has confirmed the units identified in the original sequence, however a major departure from this is noted within the upper 30-40m of the soil profile. As such, a more complex system of channels with varying width, depth and acoustic character of the infill material across the Zone is recognised.

In particular, a trend of deeper, larger channels has been identified along the northern and western margin of Tranche A. Shallower channels are present across the Zone and in the central-south area these sequences can be complex with multiple phases of channelling. Finally, to the east of the site, features are identified with a highly variable undulating base and are interpreted to be a buried paleo-landscape. This unit is noted as not being consistent with any of the formations previously outlined (Emu, 2010a).

5.1.2 Hydrodynamic and meteorological regimes

Tidal currents

Tidal current velocity information for Dogger Bank is limited. Metoc (2004) examined the tidal currents immediately south of Tranche A as part of the development of the Cavendish gas field, where in water depths of 17.6m a mean-spring depth-averaged velocity of 0.44ms^{-1}, and a velocity of 0.37ms^{-1} approximately 1m above the seabed were recorded. The predominant directions of tidal currents were south east and north west. Cameron *et al*. (1992) described tidal currents across Tranche A of less than 0.5ms^{-1}.

Wind climate

The wind regime of the North Sea is characterised by frontal depressions and anti-cyclones (high pressure). Wind roses for the area directly south of Tranche A, show south-westerly prevailing winds between October and January (Metoc, 2004). These winds are typically classified on the Beaufort Scale as force 4-6 (moderate-strong breeze). However, a proportion of values exceed this, reaching force 9-12 (gale-hurricane). In April, there is a greater proportion of winds from the north east, with generally calmer winds.

Waves

Waves are generated through wind action on the surface of the sea. Studies immediately south of Tranche A have identified maximum one year wave heights of 13.4m with a corresponding period of 11.7s (Metoc, 2004). Annual mean significant wave heights for the western side of Dogger Bank are in the region of 1.80m (Garrad Hassan and Partners Ltd, 2008). These wave data are based on the Atlas of Marine Renewable Energy Resources (BERR, 2008). While not considered suitable for design purposes, the data provides a useful indication of conditions likely to be encountered.

Considering the potential for an extreme event, significant wave heights for a range of return periods were also deduced from this study. This has identified significant wave heights of 9.7m and 11.5m for 1:5yr and 1:50yr events respectively (Garrad Hassan and Partners Ltd, 2008 – utilising information from the Health and Safety Executive (2001) Offshore Technology Report 2000/010 – Environmental Considerations) and is supported by data from the European Centre for Medium-Range Weather Forecasts (ECMWF) Wave Model (WAM). Forewind recognises, however, that this information is indicative on a site specific basis and further investigation is likely to be required.

5.1.3 Geomorphology

The bathymetry of Tranche A is outlined in **Figure 5.1**, and demonstrates the shallow nature of the area. Water depths are predominantly less than 30m, being generally shallower to the south. It is noted that the majority of the Dogger Bank Zone is approximately between 25m and 30m below sea level (Emu, 2010b). The morphology of the Tranche A seabed is largely the result of bathymetry sculpted by processes during the glacial and interglacial cycles of the Pleistocene (RPS, 2008). The morphology of Dogger Bank is largely controlled by the Dogger Bank Formation which forms a high-standing core. Sedimentary units deposited during post-glacial sea-level rise effectively complete the morphological development of the Tranche A area.

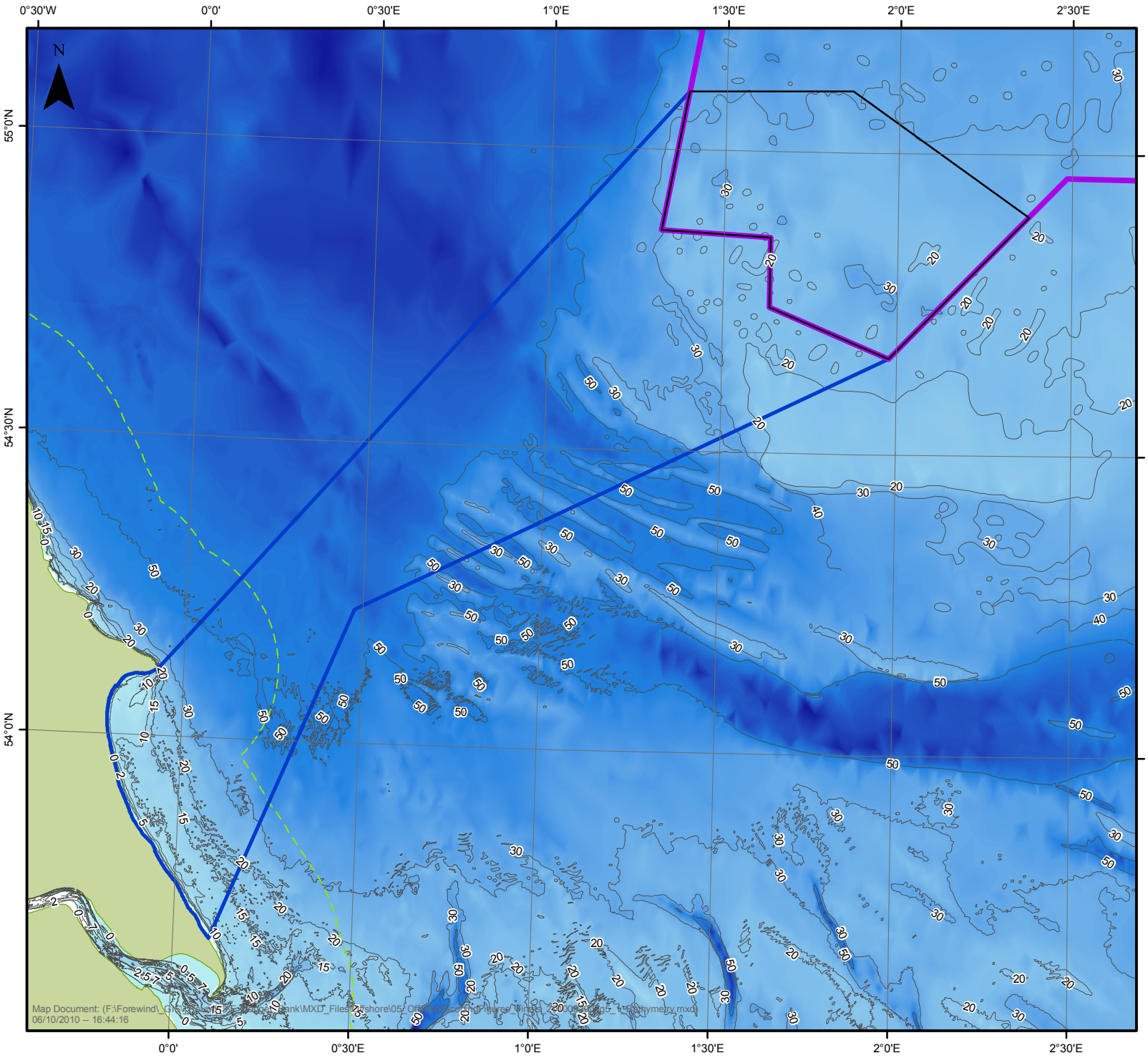
5.1.4 Seabed sediments

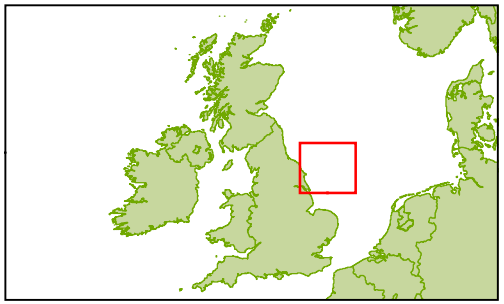
Seabed sediments across Tranche A are dominated by a thin surface veneer of sand and gravelly sand without any distinctive bedforms (Cameron *et al.*, 1992). Coarser gravel and sandy gravel occurs in the west-central part of Tranche A. Apart from small ripples, recognisable bedforms are either rare or absent (Lott, 1987). Mobile sand waves and sand banks are largely absent because tidal current velocities are low and sediment supply is limited. **Figure 5.2** provides an overview of the seabed sediments within this area.

5.1.5 Water & sediment quality

In the central North Sea, concentrations of heavy metals are typically low. However, elevated concentrations of heavy metals associated with particular matter have been reported in the vicinity of Dogger Bank (RPS, 2008). Furthermore, concentrations of several organochlorine pesticides and polycyclic aromatic hydrocarbons in the sediments are reported to be comparable to those of coastal areas (RPS, 2008).

There are conflicting arguments surrounding the nature and origins of metal enrichment in sediments from the Dogger Bank and much speculation as to its biological significance. Across Tranche A, an increase of 100-150% in lead concentrations was recorded within the top 10m of sediment compared to coastal sediments (RPS, 2008). Such levels of heavy metals suggest the Dogger Bank is a potential “sink” for these elements (RPS, 2008).





Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary

Bathymetry (m below MSL)

0
50
100
150
209

Source: Bathymetry © SeaZone, 2009.
R3 Zone © TCE, 2010.

0 10 20 40 Kilometres
0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT

Dogger Bank Project 1

Figure Title:

Bathymetry

Figure No: Fig. 5.1	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:1,000,000	
Drawn On: 29/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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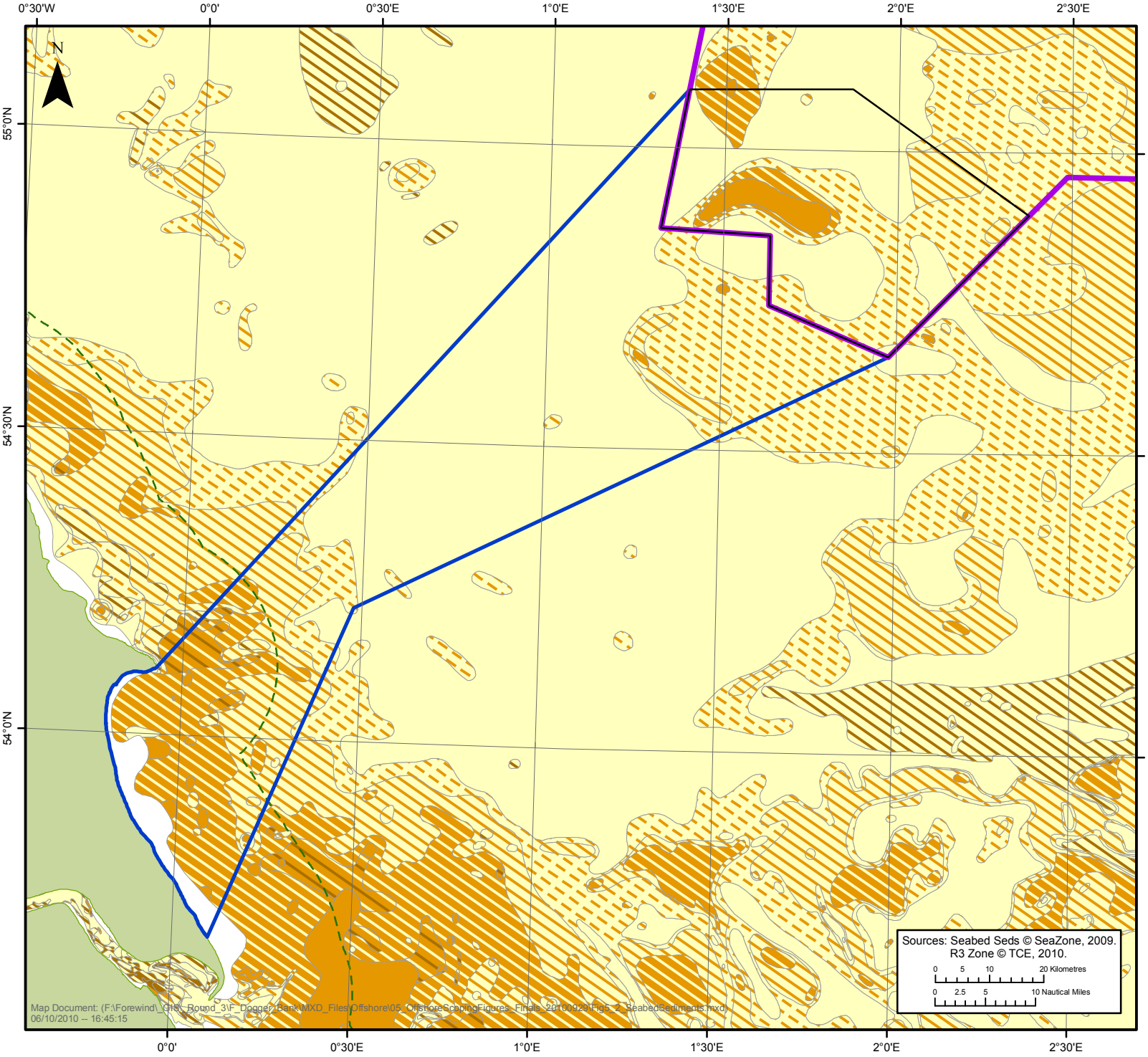

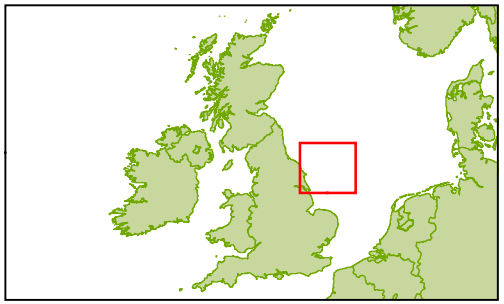

Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary

Seabed Sediments (Folk Classification)

- SAND
- (slightly gravelly) SAND
- gravelly SAND
- muddy SAND
- (slightly gravelly) muddy SAND
- gravelly muddy SAND
- GRAVEL
- sandy GRAVEL
- muddy GRAVEL
- muddy sandy GRAVEL
- MUD
- (slightly gravelly) MUD
- sandy MUD
- (slightly gravelly) sandy MUD
- gravelly MUD

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Seabed Sediments		
Figure No: Fig. 5.2	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:1,000,000	
Drawn On: 29/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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5.2 Cable Corridor Existing Environment

5.2.1 Geology

Jurassic and Cretaceous

The regional geology of the cable corridor consists of Jurassic and Cretaceous bedrock. Cretaceous Chalk occurs landward and seaward of a band of Jurassic mudstones, sandstones and limestones (Humber Group) oriented northwest-southeast midway along the cable corridor (Cameron *et al*., 1992).

Pleistocene

The thick Pleistocene sequence beneath Tranche A thins towards the coast along the cable corridor, bringing the underlying bedrock closer to the seabed. The deeper Pleistocene formations gradually thin and disappear to leave Swarte Bank, Egmond Ground and Bolders Bank Formations resting on bedrock. The cable corridor also crosses at the channel infills of the Botney Cut Formation (variable mix of muds and tills), which is not present across Tranche A (Cameron *et al*., 1992).

Holocene (post-glacial)

Along the cable corridor, Holocene sediments generally form a thin veneer over Pleistocene or older formations.

5.2.2 Hydrodynamic and meteorological regimes

Tidal currents

Admiralty Chart 1190, offshore of Spurn Point to Flamborough Head, shows that tidal streams run parallel to the coast and are generally north to south during the flood tide and south to north during the ebb. Tidal Diamond C, situated within the cable corridor, describes moderate currents, with peak flows on a spring tide of approximately 0.7ms^{-1}. Approximately 10km offshore from Holderness, Dong Energy (2009) reported peak current velocities of 1.2ms^{-1} on the flood tide and 1.1ms^{-1} on the ebb.

Wind climate

Wind roses taken from data along the export cable corridor confirm a similar pattern to Tranche A. In January, the prevailing wind is south-westerly, typically in the range of 5 to 15ms^{-1} close to the shoreline, increasing further offshore. In July, the winds are generally lower, with directions primarily westerly and north-westerly because of the effects of the high pressure systems over the UK.

Waves

Approximately 10km offshore from Holderness, Dong Energy (2009) reported prevailing waves from the north-northeast with significant wave heights of 4.5m. Extreme waves approach from the north with 50 year significant wave height of 5.7m. Approximately 17km east of Easington, Statoil ASA (2004) reported a 1 year maximum wave height of 11.3m in 16m of water.

5.2.3 Geomorphology

The bathymetry of the cable export corridor is outlined in **Figure 5.1**. Water depths in this region reach a maximum depth of up to 98m in the northwest sector of the corridor. Topographic highs are found on the flanks of the Dogger Bank in the northeast sector, and to the southwest of Dogger Bank and along the eastern margin of the cable corridor where tidal sand ridges such as The Sand Hills are present. These features extend up to 35m above the sea floor (Emu, 2010a). Between 10km to 20km from the coastline, the bathymetry begins to shallow from approximately 50m deep to the foreshore (Emu, 2010a).

The morphology of the seabed closer to shore is relatively flat dominated by exposed Bolders Bank Formation (RPS, 2008). Between this Zone and Tranche A the morphology is characterised by sand banks and mobile sand waves (Sand Hills) sculpted by tidal currents. The long axes of the banks are oriented west-northwest and are up to 60km long with amplitudes of up to 40m.

5.2.4 Seabed sediments

The seabed sediments along the majority of the cable corridor southwest of Tranche A are sand (location of Sand Hills). Closer to the coastline a mix of sandy gravel and gravelly sand occurs as a lag on top of the Bolders Bank Formation. **Figure 5.2** provides an overview of the seabed sediments within this area.

5.2.5 Water & sediment quality

Studies of sediment quality undertaken by Dong Energy (2009) showed that trace metal levels 10km offshore from Holderness along the cable route corridor were low with none above naturally occurring levels. The concentration of arsenic (As) was, however, higher than the OSPAR sediment EAC level. Organotins, PAHs, OCPs and PCBs were generally below the limits of detection (Dong Energy, 2009).

5.3 Potential Effects

Potential effects during construction

Effects on geology: The construction of the wind farm and the associated trenching for the cable corridor will not materially change the underlying geology of this area of the North Sea. It is proposed that this issue is scoped out of the EIA.

Effects on physical processes: The presence of construction infrastructure (such as jack-up barges, vessels and cable installation works) has the potential to result in temporary localised influences on the hydrodynamic regime. These influences will not be expected to result in a significant impact on any related environmental parameter.

Effects on sediment transport processes: Installation of foundations, inter-array and export cables will cause disturbance to the seabed and generate additional suspended sediment into the water column. The scale of this disturbance will vary depending on the substrate, foundation type and installation techniques (ABPmer *et al.*, 2010). However, relative changes in suspended sediments

from offshore wind farm construction work have been shown to be typically within the natural range of suspended sediment concentration due to the effects of waves and tidal currents (ABPmer *et al.*, 2010) and, as such, will not be expected to result in significant impacts.

Effects on water and sediment quality: The construction process has the potential to result in the re-suspension into the water column of contaminated sediments or the release of chemicals used during the construction process.

Potential effects during operation

Effects on physical processes: Foundations have the potential to change both wave climate and tidal current velocities and directions locally. Effects are most likely to manifest themselves in localised scour around the base of the WTG foundations, the scale of which will be dependent upon the foundation option deployed and the localised hydrodynamic conditions. Far field impacts on wave and tidal regime is considered unlikely.

Effects on sediment transport processes: Tidal current velocities across Tranche A are low and not a driver of sediment transport in this area. However, it is possible that around each WTG foundation, velocities could accelerate, resulting in scour.

Potential effects during decommissioning

The effects during decommissioning will be similar to those described during the construction phase.

Cumulative effects

The proposed 'building block' approach to cumulative effects is set out in **Section 3**, should further projects with Tranche A or within the wider Zone be taken forward on a timescale that overlaps with Dogger Bank Project One, then due consideration will be given to them with regard to cumulative impact. The Tranche A site is not in close proximity to other wind farms in the North Sea and so cumulative effects between wind farms on the physical environment are not anticipated. No current ongoing activity from other developments that influence the physical environment occurs within Tranche A (e.g. aggregate extraction, oil and gas etc) although, such activities may occur in the near future and will need to be taken into account if they appear likely in the timescale of the DCO application.

It is noted that the NW Roughs aggregate extraction licence is approximately 600m to the west of the Tranche A boundary. While it is not anticipated that the two activities would have a significant cumulative effect on physical processes, the potential for an effect to arise will be studied as part of the EIA.

Along the export cable corridor, a number of existing infrastructure features exist (such as pipelines) and a number of future developments will have export cabling (e.g. the Hornsea Zone and Westermost Rough offshore wind farm). Therefore, whilst impacts are likely to be localised, consideration will be given to potential for cumulative effects.

5.4 Approach to EIA

5.4.1 Guidance

The approach to investigations carried out to inform the EIA will follow the guidance on the generic requirements of a physical process study as provided in 'Offshore wind farms: guidance note for Environmental Impact Assessment in respect of the Food and Environment Protection Act (FEPA) and Coast Protection Act (CPA) requirements: Version 2' (Defra, 2004). This is also in line with guidance provided for the dredging industry 'Guidance on Environmental Impact Assessment in Relation to Dredging Applications' (ODPM, 2001) and 'Nature Conservation Guidance on Offshore Wind Farm Development' (Defra, 2005). Best practice guidance on the application of numerical models to predict the potential impact from offshore wind farms on coastal processes has also recently been updated in line with the much larger Round 3 sites (Lambkin *et al*., 2009).

5.4.2 Baseline characterisation

Geophysical survey

A regional geophysical survey has been completed over the Dogger Bank Zone with 2.5km grid line spacing in both northwest-southeast and northeast-southwest directions. This survey included 110 survey lines totalling around 6,900 line km.

To characterise the bathymetry, substrate type, morphology, shallow geology and magnetic anomalies of Tranche A and cable corridor, and to provide the necessary baseline information for the EIA, a geophysical survey began in June 2010. The scope of the survey is to collect full coverage of the Tranche A seabed using a combination of multibeam echosounder, side scan sonar and acoustic ground discrimination. High resolution seismic profile will characterise the shallow geology to a minimum of 50m below the seabed. A magnetometer will be deployed to collect magnetic anomaly data for detecting significant ferrous objects on or beneath the seabed.

Benthic survey

The benthic survey (detailed in **Section 6.3**) will include the collection of seabed sediment samples for the purposes of particle size analysis (PSA) and chemical contamination. The PSA information will be used to inform the characterisation of grain size distribution within the seabed sediments, which will also provide helpful information concerning the hydrodynamic conditions at the seabed.

Geotechnical survey

A geotechnical survey is expected to commence in autumn 2010 to provide further information on sub-surface geology and foundation conditions, as well as informing the archaeological assessment. Approximately 40 boreholes to a depth of 40m below seabed and up to 100 cone penetration tests (CPTs) are planned. Seabed sediment sampling will take place as part of the benthic survey.

Metocean survey

Given the limited amount of wind and wave data and the need to more closely define the baseline physical environment across Tranche A, collection of physical process data is required. To record

wind data, a meteorological data mast will be installed in Tranche A in 2011. An existing Cefas waverider buoy is being removed and replaced by a new waverider in the south west of the Zone, and a triaxys directional wave buoy in the north of the Zone to collect wave height and period information. This device includes a downward facing Acoustic Doppler Current Profiler (ADCP) for the collection of current data and the verification of wave height data.

5.4.3 Approach to assessment of effects

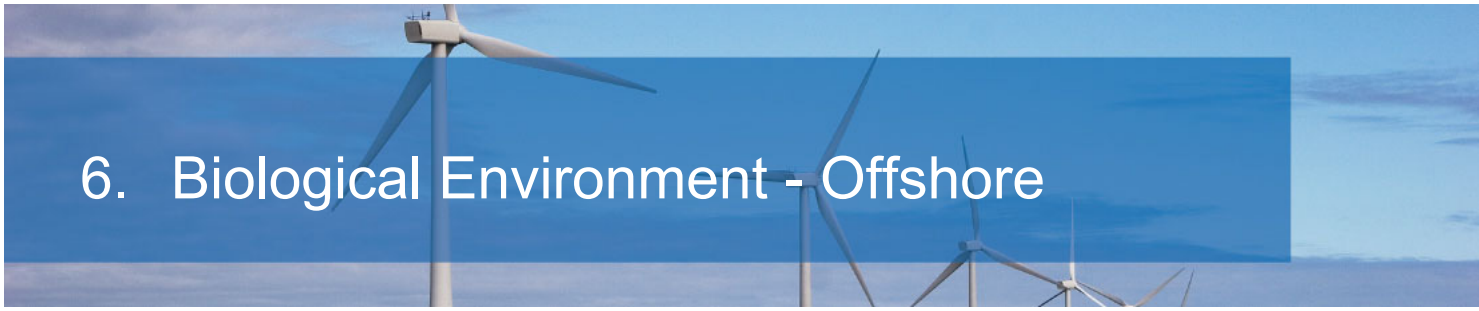
The site specific data collected from the geophysical, benthic and metocean survey will provide input to a series of models to investigate wave, tides and sediment transport regimes across the area, where required, and to inform the EIA of potential physical process changes and their likely significance on other parameters, such as benthic ecology.

Whilst significant impacts as a result of contaminated sediments are considered unlikely within the study area, the potential for impact will be determined through analysis of seabed sediment samples and the output of the hydrodynamic sediment transport modelling.

The need for and scope of any future modelling work will give due consideration to relevant guidance (namely Cefas, 2004) and be established in consultation with the relevant stakeholders.

Key data collection/study required

Activity	Purpose
Geophysical survey.	To characterise the bathymetry, seabed sediment, geomorphological environment as well as identifying seabed features for planning of environmental survey.
Benthic survey.	To characterise the seabed sediment composition (for Particle Size Analysis (PSA) and assessment of contamination levels). This work will be carried out in conjunction with the ecological benthic survey work as detailed in **Section 6.3**.
Metocean survey.	To characterise the wind, wave and tide conditions of the study area.
Geotechnical survey.	To characterise the shallow geological profile of the Tranche A area.
Numerical modelling (where required).	To establish the extent of effects on physical environment (namely; waves, tides, geomorphology and suspended sediment dispersion).



6. Biological Environment - Offshore

6.1 Nature Conservation Designations

6.1.1 Existing environment

There are a number of international, national and local designations (statutory and non-statutory) of relevance to the development of a project within Tranche A. At present no formal nature conservation designations cover the site of Tranche A. However, there are a number of relevant sites in the context of the export cable corridor. In addition, the areas of Dogger Bank designated by other European Member States (i.e. The Netherlands and Germany) will be of relevance to the EIA. Sites discussed in this section are those for which development of within Tranche A could directly affect (i.e. the wind farm or export cable corridor could coincide with site boundaries) or those which are designated for mobile species (i.e. birds and marine mammals) which could be affected by development.

This section of the Scoping Report describes the baseline and policy conditions with regard to these sites and the potential for impact upon them from the development. Reference should also be made to the following sections for further detail on potential impacts: **5 Physical processes**, **6.2 Intertidal ecology, 6.3 Marine ecology**, **6.5 Ornithology and 6.6 Marine mammals**.

6.1.2 Statutory international designations

Special Protection Areas

Special Protection Areas (SPA) are statutory designated sites that are classified under European Union (EU) law in accordance with Article 4 of the EC Directive on the conservation of wild birds (79/409/EEC) (known as the Birds Directive). They are classified for rare and vulnerable birds, listed in Annex I to the Birds Directive, and for regularly occurring migratory species. The SPAs initially considered to be of potential relevance to Tranche A are listed in **Table 6.1**. Site specific investigation of the birds present within Tranche A will enable this list to be refined and expanded dependent upon the findings, it is likely that the final list will include SPAs from other Member States.

Ramsar sites

Ramsar sites are wetlands of international importance designated under the Ramsar Convention. The initial emphasis was on selecting sites of importance to waterbirds within the UK, and consequently many Ramsar sites are also Special Protection Areas (SPAs) classified under the Birds Directive. Ramsar sites of relevance to Tranche A are listed in **Table 6.1**.

Special Areas of Conservation

Special Areas of Conservation (SAC) are sites designated under EC Directive 92/43/EEC on the conservation of habitats and wild flora and fauna (known as the Habitats Directive), because they make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive. SACs of relevance to Tranche A are listed in **Table 6.1**.

Tranche A and the export cable corridor have the potential to support Annex 1 features such as Reefs, Estuaries, Sandbanks which are slightly covered by sea water all the time and Mudflats and sandflats not covered by seawater at low tide and the Annex 2 species common seal *Phoca vitulina* and grey seal *Halichoreus grypsus.* The Dogger Bank possible SAC ((pSAC), proposed for designation of Sandbanks) encompasses the whole of the Tranche A area, whilst the neighbouring Dutch Dogger Bank proposed SCI (Site of Community Importance), Klaverbank SCI and German Dogger Bank SAC may also be of relevance due to their designation for harbour porpoise *Phocoena phocoena,* common and grey seal. On the 20 August 2010, the Marine Environment Minister, Richard Benyon announced that the Dogger Bank along with fourteen other marine areas in the UK EEZ were to be considered for SAC designation. In addition, sites further afield in France, Germany and the Netherlands, designated for bottlenose dolphin *Tursiops truncatus*, may be relevant to Tranche A due to the wide migratory range of this species. Forewind recognises that assessment of impacts on such distant sites will be extremely difficult and seeks to work closely with the statutory nature conservation bodies, the IPC and the MMO in order to determine the most appropriate way forward.

Table 6.1 International sites of relevance to Tranche A

Name	Type of designation
Broadland	SPA
North Norfolk Coast	Ramsar / SPA
The Wash	Ramsar / SPA
Gibraltar Point	Ramsar / SPA
Humber Estuary	Ramsar / SPA
Coquet Island	SPA
Northumbria Coast	SPA
Teesmouth and Cleveland Coast	Ramsar / SPA
Lindisfarne	Ramsar / SPA
Firth of Forth	Ramsar / SPA

Name	Type of designation
Forth Islands	SPA
Hornsea Mere	SPA
St Abb's Head to Fast Castle	SPA
Moray Firth*	SAC
Berwickshire and North Northumberland Coast*	SAC
Humber Estuary**	SAC
Flamborough Head	SAC
The Wash and North Norfolk Coast*	SAC
Dogger Bank	pSAC
Dogger Bank (Netherlands)*	pSCI (pSAC)
Klaver Bank (Netherlands)*	SCI (SAC)
Waddenzee (Netherlands)*	SCI (SAC)
NoordzeekustZone (Netherlands)*	SCI (SAC)
Voordelta (Netherlands)*	SCI (SAC)
Dogger Bank (Germany)*	SCI (SAC)
Wattenmeer und angrenzende Kustengebiete (Germany)*	SCI (SAC)
Baie du Mont Saint Michel (France)*	SAC
Les Illes Chausey (France)*	SAC
Cap d'Erquy, Cap Frehel (France)*	SAC
Baie de Lancieux (France)*	SAC

*Potential impact to mobile species not habitats, ** potential impact to habitats or mobile species.

It should be noted that the sites listed in **Table 6.1** are taken from the Plan-Level Appropriate Assessment undertaken for the entire Round 3 plan by The Crown Estate (Entec. 2009). The list is considered to be overly precautionary and it is anticipated that the number of sites will reduce as data

is collected and consultation progresses. **Figure 6.1** provides a geographic overview of the European designated sites within the project vicinity.

Forewind is aware of the implications of the Espoo Convention and that it will work closely with UK Regulatory Authorities to ensure that any transboundary issues are identified and addressed.

6.1.3 Statutory national designations

Sites of Special Scientific Interest

Sites of Special Scientific Interest (SSSI) are designated for a variety of wildlife and geological features in England and are designated under the Wildlife and Countryside Act 1981 (as amended). Several SSSIs are in the potential landfall area, given the size of the cable corridor at present. Many of these sites (such as Flamborough Head and the Humber Estuary) underpin the European designated sites and any impacts are likely to be assessed under the more stringent Habitats Regulations.

National Nature Reserves

National Nature Reserves (NNR) are a selection of the parts of SSSIs considered to be of the best quality in terms of conservation of their features. The underlying SSSI designation gives NNRs their strong legal protection. The majority of NNRs also share boundaries with, or are part of European sites, for instance the Spurn Point NNR is within both the Humber Estuary SAC and SPA.

Local Nature Reserves

All district and county councils have powers to acquire, declare and manage Local Nature Reserves (LNR). To qualify for LNR status, a site must be of importance for wildlife, geology, education or public enjoyment. Some are also nationally important SSSIs. LNRs must be controlled by the local authority through ownership, lease or agreement with the owner (Natural England 2010a).

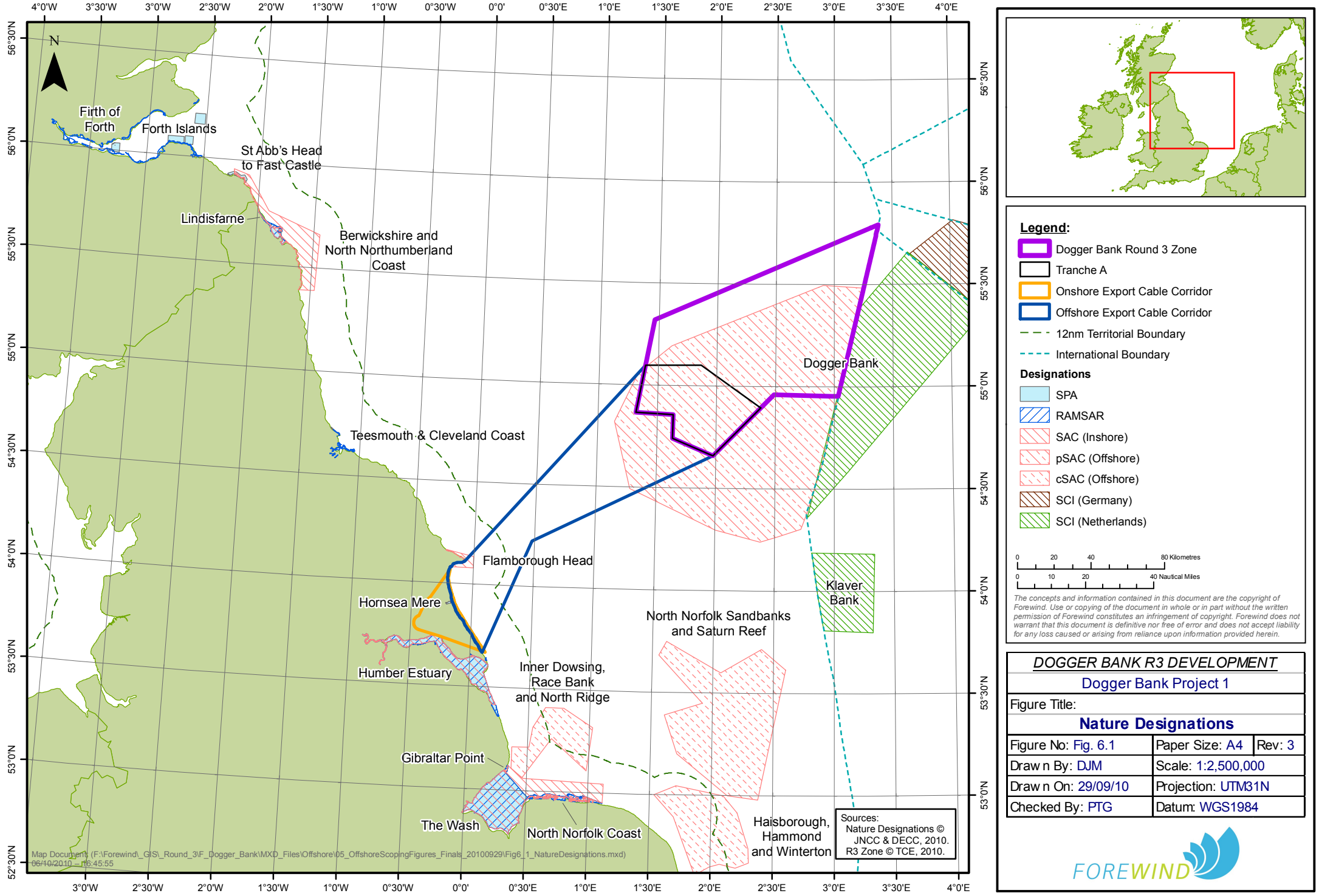
Marine Conservation Zones

In addition, new marine protected areas will be put forward under the provisions of the Marine and Coastal Access Act (2009), with Marine Conservation Zones (MCZ) being designated by 2012. These MCZs will augment the Natura 2000 network for species and habitats that are either not covered by the Habitats Directive or for which the Directive is felt not to cover adequately. The process of putting forward sites has been devolved to four regional projects which are stakeholder led. The project of most relevance to Tranche A is the NetGain project[3]. At this early stage in the process it is not possible to say whether there will be new sites of relevance to Tranche A or its associated export cable corridor.

6.1.4 Non-statutory national designations

A variety of other conservation designations exist at the local level. Local Sites are non-statutory areas of local importance for nature conservation that complement nationally and internationally designated geological and wildlife sites. A full appraisal of relevant sites will be made within the EIA.

[3] http://www.netgainmcz.org/



Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Onshore Export Cable Corridor
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

Designations

- SPA
- RAMSAR
- SAC (Inshore)
- pSAC (Offshore)
- cSAC (Offshore)
- SCI (Germany)
- SCI (Netherlands)

0 20 40 80 Kilometres
0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT	
Dogger Bank Project 1	
Figure Title:	
Nature Designations	
Figure No: Fig. 6.1	Paper Size: A4 Rev: 3
Drawn By: DJM	Scale: 1:2,500,000
Drawn On: 29/09/10	Projection: UTM31N
Checked By: PTG	Datum: WGS1984

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6.1.5 Potential impacts

The potential impacts to designated nature conservation sites are discussed in the Potential Impacts sections of the following sections of this Scoping Report: **5 Physical processes**, **6.2 Intertidal ecology**, **6.3 Marine ecology**, **6.5 Ornithology**, and **6.6 Marine mammals**.

6.1.6 Approach to EIA

The Plan-Level Appropriate Assessment carried out for Round 3 (Entec, 2009) has concluded that a Habitats Regulations Assessment (HRA) will be required at a project specific level for all Round 3 developments. While it does not necessarily follow that the initial screening stage of the HRA will conclude that an Appropriate Assessment will be required, the guidance in the Plan-Level Appropriate Assessment suggests that this requirement is likely.

At this scoping stage, following the Zone-specific guidance in the Plan-Level Appropriate Assessment, Forewind expects to include assessment of impacts on the following features within the EIA, aimed at informing the HRA:

- Diadromous fish interest features (river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*);
- Marine mammal interest features (grey seal *Halichoerus grypus*, common seal *Phoca vitulina,* harbour porpoise *Phocoena phocoena* and bottlenose dolphin *Tursiops truncatus*);
- Habitat interest features (sandbanks which are slightly covered by seawater all the time, reefs, estuaries, mudflats and sandflats not covered by seawater at low tide and submerged or partially submerged sea caves);
- Birds – effects of cabling; and
- Birds – effects of wind turbines.

The reader is referred to the Plan-Level Appropriate Assessment for further information.

All designated sites at European, national and local level will be identified in relation to the Tranche A boundary within the EIA. This will encompass both existing and proposed designated sites.

The investigations required to inform the potential for impacts on designated features will be covered by the investigations detailed in relevant sections of the ES (e.g. physical processes, marine ecology and ornithology). Forewind intends to finalise the scope of these investigations in conjunction with ongoing stakeholder liaison and consultation with the relevant regulatory authorities and their advisors.

6.2 Intertidal Ecology

6.2.1 Existing environment

The majority of the Holderness coastline within the study area (Easington to Bridlington) is dominated by an almost continuous line of cliffs, broken by low ground in places such as Barmston and Tunstall, where saline incursion is prevented by tidal defence embankments protecting small areas of agricultural land (Natural England, 1999). The cliffs are fronted by a thin veneer of sand forming a beach (HECAG, 2009). Cliff erosion rates are high in undefended areas and the speed of erosion prohibits colonisation by anything but ruderal vegetation such as Coltsfoot *Tussilago farfara* (Natural England, 1999).

The infauna of the beaches of southern Holderness is typically species poor and related to sediment type (Natural England, 1999). An intertidal invertebrate survey carried out on the EC designated bathing beaches of the Holderness Coast found that fauna consisted of amphipods and polychaete worms, with the distribution dependent on sediment particle size (Natural England, 1999). The intertidal survey carried out for Westermost Rough Environmental Statement (Dong Energy, 2009) reported similar faunal communities.

The cliffs at Bridlington are 'regionally important cliff locations' in the JNCC's Invertebrate Site Register (Barne *et al.*, 1995) with Coleoptera (beetles), Diptera (flies) and Isopoda (woodlice) being particularly significant. Other cliff faces that are relatively dry or flushed by seepages are equally important along this coastline (Natural England, 1999).

Around Easington and Kilnsea to the south of the indicative export cable corridor, there is a nationally important coastal lagoon system called Easington Lagoons and Kilnsea Beacon Ponds which is known to support rare flora and fauna including nesting sites for little tern *Sterna albifrons* and ringed plover *Charadrius hiaticula* (Barne *et al.*¸1995). The area comprises a variety of coastal habitats including saltmarsh, shingle, sand dune, swamp and saline lagoons and pools which are fronted by a beach of very sandy shingle but with little typical shingle vegetation (Natural England, 1999).

There are further important intertidal habitats immediately to the north and south of the study area (around Flamborough Head and Spurn Head respectively).

6.2.2 Potential impacts

Potential impacts during construction

Temporary loss of habitats: Dependant on the method of intertidal cable installation (see **Section 2**) there may be some temporary loss of habitats within the installation footprint. However, it is unlikely that any significant long term impact to habitats will occur, as construction works will be localised and short-term in nature.

Physical disturbance to intertidal features: There is potential for localised physical disturbance to intertidal habitats from the cable installation, impacts are likely to be temporary in nature.

Potential impacts during operation

There are not anticipated to be any impacts during operation, as the cables across the intertidal area will be buried. There is the possibility of maintenance activities occurring however, this will be very short-term and any disturbance will be localised.

Potential impacts during decommissioning

There are not anticipated to be any potential impacts during decommissioning as the export cables are likely to be disconnected and left in situ. Should any substantial coastal retreat occur, beyond the predicted design envelope, then remedial action to remove the cables may be necessary.

Cumulative effects

Cumulative impacts on the intertidal ecology are considered to be unlikely as any impacts will be highly localised. However, during the EIA phase consideration will be given to potential sources of cumulative impact from other wind farm developments (such as from the Hornsea Zone or Westermost Rough) and other industries in the region, such as oil and gas.

6.2.3 Approach to EIA

Currently, the area identified for potential landfall sites for Dogger Bank Project One includes a wide area. As this area is narrowed down, it will be possible to obtain more detailed information on the intertidal ecology specific to that area. A desk-based study will be undertaken to examine records of habitats and flora and fauna present, and a Phase I terrestrial and intertidal survey will also be undertaken, in and around the transition pit location.

Consultation will be undertaken with Natural England and the JNCC on the outcome of the survey findings and interpretation, necessary mitigation, if required, will be established at this juncture.

6.3 Marine Ecology

6.3.1 Existing environment

Benthos

Several large scale studies have been undertaken in the area to date to characterise the benthic communities found on the Dogger Bank and surrounding area:

- 1986 - Benthos Ecology Working Group of ICES;
- 1999 - 2001 - North Sea Benthos Project 2000; and
- 2008 - Cefas survey for JNCC.

Tranche A area

The Dogger Bank is a sandy mound, formed by glacial processes and submergence through sea level rise and is composed of moderately mobile, clean sandy sediments (JNCC, 2010a). Seabed sediments across Tranche A are dominated by a thin surface veneer of sand and gravelly sand,

without any distinctive bedforms (Cameron *et al*., 1992). In general, the biological communities on the Dogger Bank are typical of fine sand and muddy sand sublittoral sediments (JNCC, 2010a).

The transition of benthic communities across the bank seems most related to depth and temperature (JNCC, 2010a) with communities changing from low diversity in the shallowest areas to more diverse communities at greater depths. Tranche A covers at least two of the broad infaunal community types identified by Wieking & Kröncke (2003):

- Bank Community - In waters <25m this community is dominated by the amphipods *Bathyporeia elegans* and *B. guilliamsoniana*, while in areas >25m the community is dominated by the tellinid bivalve *Fabulina fibula*, the brittlestar *Amphiura brachiata* and the polychaetes *Spiophanes bombyx*, *Magelona johnstoni*, *M. filiformis*, *Spio* cf. *decorata* and *Owenia fusiformis*; and
- The South-west Patch Community - A subgroup of the Bank Community, this is characterised by an impoverished fauna with low numbers of individuals and species, dominated by the amphipods *B. elegans* and *B. guilliamsoniana*.

Epinfaunal communities are not as well delineated by current work and are largely separated on the basis of particle size of the substrate (JNCC, 2010a). Sandy areas are characterised by burrowing species, such as the urchin *Echinocardium* sp., along with the razor shell *Ensis* sp., the sandmason worm *Lanice conchilega*, the masked crab *Corystes cassivelaunus* and sandeels *Ammodytes* sp. Where there are more gravelly sediments, communities are characterised by the brittlestar *Ophiothrix fragilis* and the hermit crab *Pagurus bernhardus* with larger pebbles and cobbles providing the opportunity for colonisation by species such as the soft coral *Alcyonium digitatum*, the bryozoan *Alcyonidium diaphanum* and Serpulid worms (Diesing *et al*., 2009). Based on sediment analysis and faunal analysis, Diesing *et al*. (2009) identified four level 4 EUNIS habitats within the Tranche A area which are components of the broadscale communities identified by Wieking & Kröncke (2003):

- Infralittoral coarse sediment (EUNIS A5.13). Moderately exposed habitats with coarse sand, gravelly sand, shingle and gravel in the infralittoral (JNCC, 2010b);
- Circalittoral coarse sediment (EUNIS A5.14). Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20m, which may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves (JNCC, 2010c);
- Infralittoral fine sand (EUNIS A5.23). The habitat typically lacks a significant seaweed component and is characterised by robust fauna, particularly amphipods (*Bathyporeia*) and robust polychaetes including *Nephtys cirrosa* and *Lanice conchilega*.(JNCC, 2010d); and
- Circalittoral fine sand (EUNIS A5.25). Clean fine sands with less than 5% silt/clay in deeper water, and is characterised by a wide range of echinoderms, polychaetes and bivalves. This habitat is generally more stable than shallower, infralittoral sands and consequently supports a more diverse community. (JNCC, 2010e).

Cable corridor

The cable corridor area immediately to the west of Tranche A is covered by one of the communities described by Wieking & Kröncke (2003):

- Western *Amphiura* Community: This community is in deeper waters than the main bank communities and is dominated by *Amphiura filiformis*.

The area to the immediate south west of Tranche A is largely covered by linear sandbanks (JNCC, 2010a). The areas inshore of Dogger Bank itself are less well surveyed and broadscale habitats (EUNIS level 3, JNCC, 2010f) have been modelled by the UKSeaMap2010 project (JNCC, 2010g). Moving south-westward towards the Yorkshire coast, the broadscale habitats are mostly:

- Sublittoral sand (EUNIS A5.2). Clean medium to fine sands or non-cohesive slightly muddy sands, these habitats are often subject to a degree of wave action or tidal currents which restrict the silt and clay content to less than 15%. This habitat is characterised by a range of taxa including polychaetes, bivalve molluscs and amphipod crustacea (JNCC, 2010h); and
- Sublittoral coarse sediment (EUNIS A5.1). Coarse sediments including coarse sand, gravel, pebbles, shingle and cobbles which are often unstable due to tidal currents and/or wave action. These habitats are generally found on the open coast or in tide-swept channels of marine inlets, typically have a low silt content and lack a significant algal component. They are characterised by a robust fauna including venerid bivalves (JNCC, 2010i).

In the more inshore waters there are patches of the following habitats:

- Moderate energy circalittoral[4] rock (EUNIS A4.2). This habitat is covered by several types of reef. This habitat complex mainly occurs on exposed to moderately wave-exposed circalittoral bedrock and boulders, subject to moderately strong and weak tidal streams and contains a wide range of habitats, from mixed faunal turf to *Sabellaria* reefs and circalittoral mussel beds. This habitat can also occur on more mixed substrata featuring cobble and sand (JNCC, 2010j); and
- Sublittoral mixed sediments (EUNIS A5.4). These habitats incorporate a range of sediments including heterogeneous muddy gravelly sands and also mosaics of cobbles and pebbles embedded in or lying upon sand, gravel or mud. These habitats may support a wide range of infauna and epibiota including polychaetes, bivalves, echinoderms, anemones, hydroids and bryozoa (JNCC, 2010k).

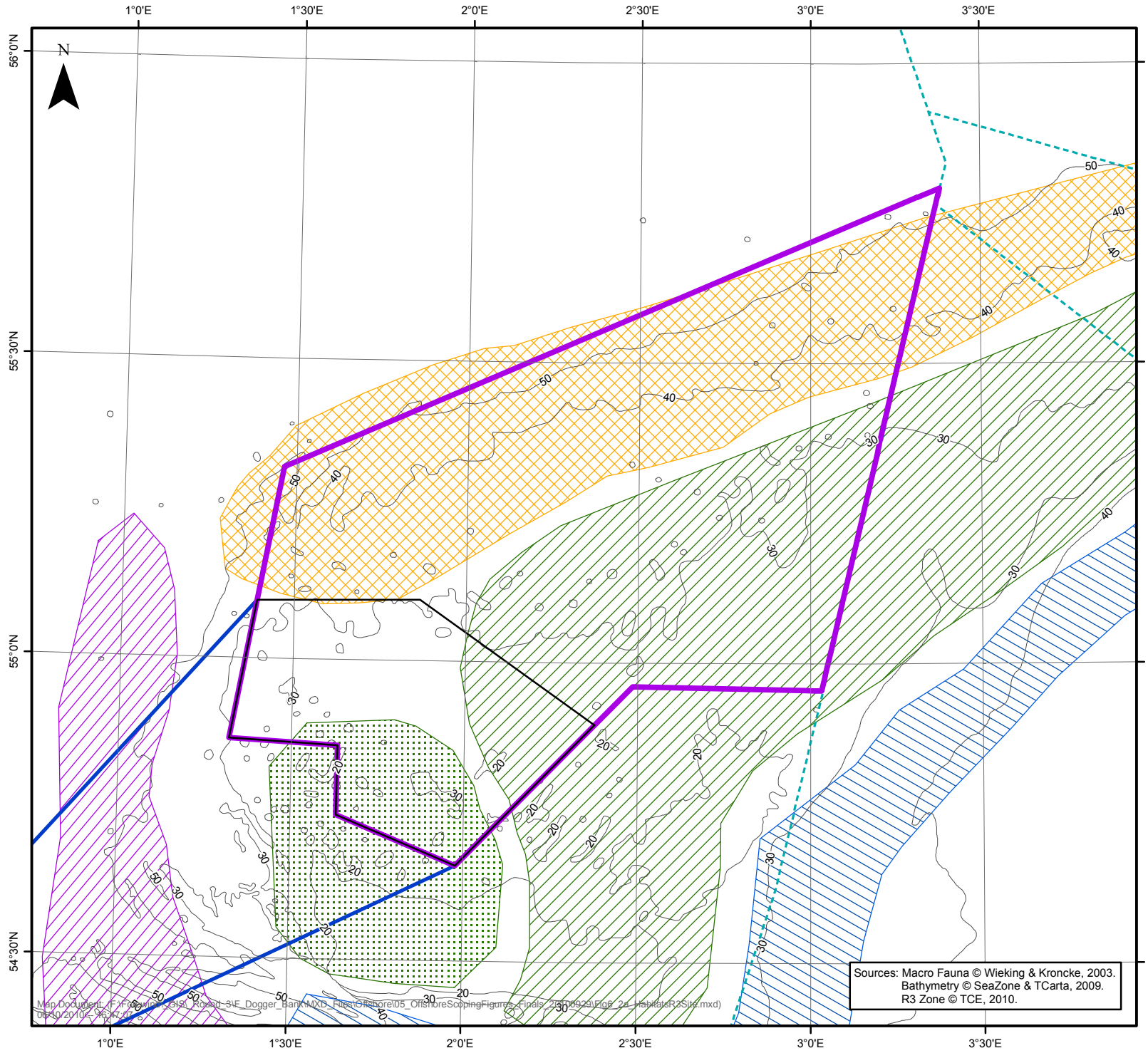
The majority of the seabed within the export cable corridor is composed of soft substrates. However, the potential for reef habitats in this poorly surveyed and large area means that where possible surveys of the likely cable routes will be undertaken to ensure that areas of hard substrate or biogenic reef of potential conservation importance are avoided.

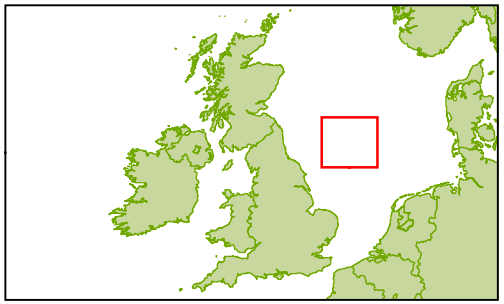
Plankton

Phytoplankton production on the Dogger Bank occurs throughout the year supporting a high biomass of species at higher trophic levels year-round, creating a region that is biologically unique in the North Sea (Kröncke & Knust, 1995). Studies carried out during the winter 1987-88 (Richardson *et al.*, unpublished data, cited in Nielsen *et al.*, 1993) concluded that because of the shallow depth of Dogger Bank, primary production is high throughout the winter. Richardson *et al.* (unpublished data, cited in

[4] Circalittoral rock is either nearshore deep water or offshore subtidal

Nielsen *et al.*, 1993) have shown that primary production during the winter in the Dogger Bank region is higher than for all other regions of the North Sea. The shallowness of the area also causes the spring phytoplankton bloom to be initiated months before thermal stratification triggers the spring bloom in the northern North Sea (Nielsen *et al.*, 1993).





Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- International Boundary

Dogger Bank Macro Fauna

- Bank Community
- North-Eastern Community
- South-West Patch Community
- Southern Amphiura Community
- Western Amphiura Community

0 10 20 40 Kilometres

0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT

Dogger Bank Project 1

Figure Title:

Dogger R3 Site Habitats

Figure No: Fig. 6.2a	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:1,000,000	
Drawn On: 10/09/10	Projection: UTM31N	
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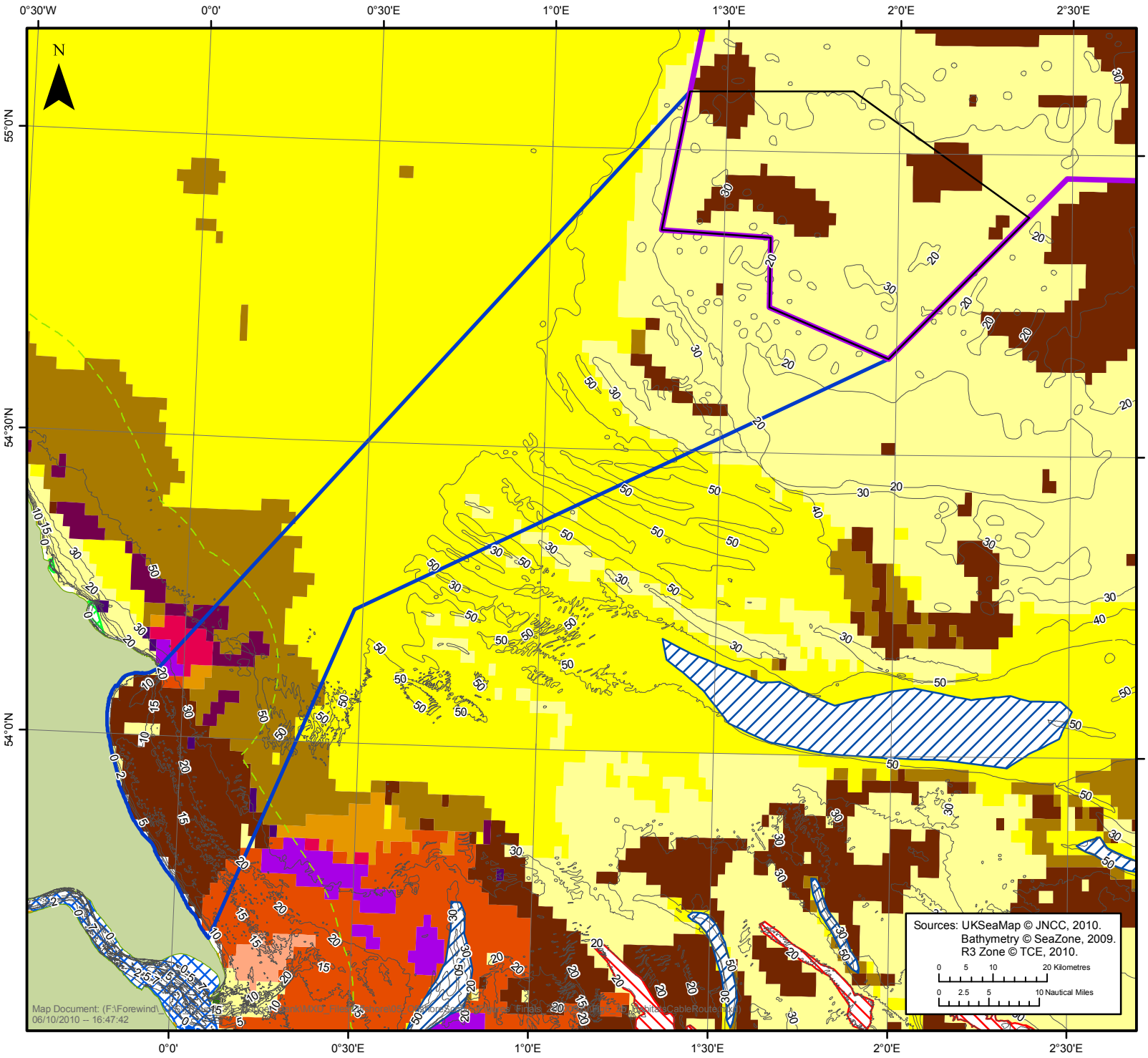

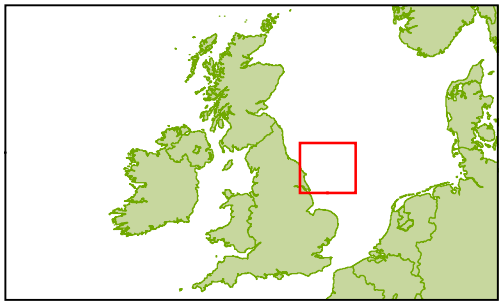

Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary

UK Seabed Map

- Bay
- Estuary
- Lagoon
- Shelf Trough
- Subtidal Sediment Bank
- Shallow Coarse Sediment Plain (strong tide)
- Shallow Coarse Sediment Plain (moderate tide)
- Shallow Coarse Sediment Plain (weak tide)
- Shallow Mixed Sediment Plain (moderate tide)
- Shallow Mixed Sediment Plain (weak tide)
- Shelf Coarse Sediment Plain (moderate tide)
- Shelf Coarse Sediment Plain (weak tide)
- Shelf Mixed Sediment Plain (moderate tide)
- Shelf Mixed Sediment Plain (weak tide)
- Shallow Mud Plain
- Shallow Sand Plain
- Shelf Sand Plain
- Photic Rock

DOGGER BANK R3 DEVELOPMENT

Dogger Bank Project 1

Figure Title:

Cable Route Habitats

Figure No: Fig. 6.2b	Paper Size: A4	Rev: 4
Drawn By: DJM	Scale: 1:1,000,000	
Drawn On: 29/09/10	Projection: UTM31N	
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6.3.2 Potential impacts

Potential impacts during construction

Loss of habitat: Construction activities, such as the installation of foundations, cables and ancillary structures and the placement of jack-up vessel legs will cause direct physical disturbance of the seabed. These impacts, although highly abrasive in nature, will be temporary and localised and the significance of this impact will be dependant upon the habitat(s) and community(ies) present within the impact footprint. Given the seabed sediments considered to be present at the site, it is anticipated that species richness and diversity will be low and that direct impacts will not be significant. This assumption, however, needs to be confirmed by site specific data collection and analysis at the EIA stage.

Changes in water quality: There is potential for contaminated sediments to be re-suspended during installation of foundations and cables. There is evidence of some elevated levels of heavy metal at the Tranche A site, while contaminant levels are at background levels or below the level of detection for the cable corridor (see **Section 5**). Site specific data collection and analysis at the EIA stage will determine the significance of this possible impact.

Changes in suspended sediment concentrations: An increase in suspended sediments is anticipated during construction. Any sediment plumes are likely to settle out within a short distance of the activity and limit the overall footprint of the affected area. The significance of impacts associated with temporary increases in suspended sediment will be dependant upon the habitats and communities present within the wind farm and export cable corridor area.

Noise and vibration: Installation of the foundations will cause temporary increases in noise and vibration, particularly if percussive pile driving methods are employed too. Noise could impact upon both planktonic and adult life stages of the benthos.

Potential impacts during operation

Changes in physical processes: The presence of foundation structures may cause impacts on wave climate, currents, sediment transport and scour. Changes in these processes could in turn affect the benthic communities. Given the separation between Wind Turbine Generators (WTG), it is not anticipated that there will be additive impacts between turbines in the array and impacts are likely to be minor and restricted to a small footprint around each separate structure. It is accepted, however, that further work to confirm this assumption may be required through the EIA for certain foundation types that are less well understood (i.e. large gravity bases and/or multiple jacket structures).

Operation and maintenance activities: Operation and maintenance activities are likely to require reasonably frequent traffic of vessels to and from the wind farm. No pathway has been determined by which these activities could impact upon the benthos, aside from minor pollution events. The Environmental Management Plan (EMP) developed for the operational phase of the wind farm will ensure that pollution events are limited and impacts controlled.

Noise: Operation of the turbines will increase the level of background noise across the site. Evidence to date does not suggest that this has any adverse impact upon benthic species. Studies at several

offshore wind farms have shown that the presence of hard substrata (i.e. foundations) encourages the settlement of new species into the area as a fouling community (Vattenfall, 2009).

Electromagnetic Fields (EMF): The main concern with regard to the impact of EMF is in relation to electrosensitive fish species (particularly elasmobranchs, see **Section 6.4**), to date there is no evidence available of any impacts upon the benthos from EMF as a result of wind farm monitoring programmes (Vattenfall, 2009). However, it is expected that this issue will need to be further investigated through the EIA, in the context of the effects of HVDC cables.

Colonisation of foundations: Colonisation of foundations and any scour protection, initially by fouling communities which then attract mobile species, will lead to localised increases in diversity and changes in community structure from soft to hard substrate communities on and around the foundations. Given the distance between turbines, there is unlikely to be an additive effect of such changes that could be considered to be creation of a reef habitat.

Potential impacts during decommissioning

The potential impacts during the decommissioning of the project are expected to be similar in nature, extent and duration to those arising during construction.

Cumulative effects

Impacts on the benthos during the construction and operational phases of the development will be limited both spatially and temporally. The significance of these impacts will be dependant upon the community present within the impacted area.

While there will be an aggregated loss/disturbance of habitat throughout the development area of the Dogger Bank Zone, it is considered that the habitats and community types present are widespread, both within the Zone and in the wider North Sea context. While this remains to be confirmed through the EIA process, it is not considered likely that development of Tranche A will have cumulative impacts with other planned offshore wind farm developments.

Other human activities, such as aggregate extraction, oil and gas operations and commercial fishing have the potential to affect similar habitat and community types to those encountered within the Tranche A study area. As all industries, with the exception of fishing, are regulated under the EIA process, impacts on the benthos will be assessed and understood prior to the granting of licences. With controls in place and, given the widespread nature of similar sedimentary habitats within the North Sea, it is not anticipated that significant impacts will arise.

6.3.3 Approach to EIA

Key data collection/study required

The following surveys will be carried out in order to refine the site specific characterisation for Tranche A and the export cable corridor, upon which the impacts can then be assessed. The geophysical survey will be conducted first and the data interpreted and analysed to determine the survey design for the benthic characterisation work to follow.

Activity	Purpose
Geophysical survey of Tranche A area (June 2010 – ongoing) and export cable corridor.	Full coverage of the area in order to define habitat type and sampling strategy and to provide information for habitat mapping.
Benthic survey of Tranche A and export cable corridor (expected spring / summer 2011).	Grab sampling (infauna, contaminant and particle size analysis) and drop-down video / digital stills as required. Note: epibenthic information will be obtained through standard (2m beam) trawls undertaken as part of the planned fish resource surveys.

The scope of the benthic survey will be in accordance with relevant guidance (e.g. Cefas, 2004) and established in conjunction with the JNCC, Cefas, Natural England and the MMO. Drop down video/camera survey will be employed chiefly over hard substrate and where the geophysical survey results suggest that there may be reef habitat that could qualify as Annex 1 Reef under the Habitats Directive. Latest guidance (e.g. Limpenny *et al*, 2010 and Gubbay, 2007) will be adopted with regard to assessing for habitats and or species (such as *Sabellaria spinulosa*).

The results of the benthic survey will enable the layout of the turbines, inter-array and export cables to be determined taking account of any sensitive habitats and species present and reduce or prevent the potential impacts of the development.

Hydrodynamic modelling (see **Section 5**) will establish the extent of any suspended sediments and potential impacts on the hydrodynamic regime, which will inform the assessment of impacts on the benthic and epibenthic communities.

6.4 Fish and Shellfish Resource

6.4.1 Existing environment

As evidenced by its long history as a fishing ground, the wider environs of the Dogger Bank and the North Sea within which the export cable corridor is located, support a range of fish and shellfish species at all stages of their lifecycle. Spawning grounds and nursery areas for various species (some of which are UK Biodiversity Action Plan protected) are found within Tranche A and the export cable corridor (**Figures 6.4a-c**). Of key note are the potential herring *Clupea harengus* spawning grounds to the south and southeast of the Dogger Bank Zone and the sandeel *Ammodytes sp.* spawning grounds that are known to occur throughout the Dogger Bank. Sandeel, which are abundant in the Dogger Bank region in water depths of 20-30m, are of particular importance on account of the ecosystem function they provide as a significant prey resource for various predators including other commercial fish species (Cefas, 2007).

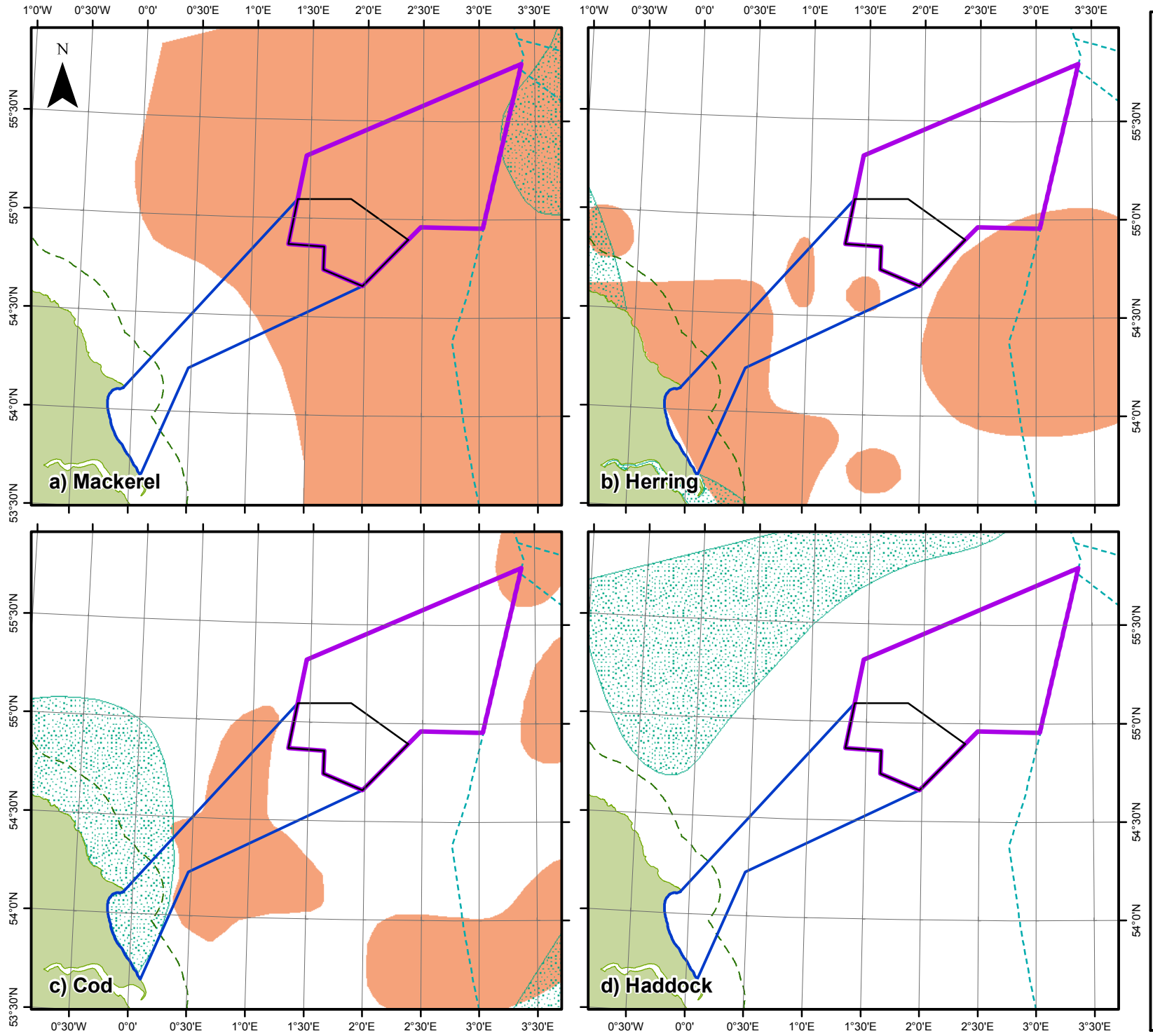
The inshore waters for much of the export cable corridor width, where exposed clay (from the Boulders Bank Formation) and coarse mixed sediments exist, are known to support significant shellfish populations. Species that are of particular importance for their commercial value include European lobster *Homarus gammarus*, velvet crab *Necora puber* and edible crab *Cancer pagurus*.

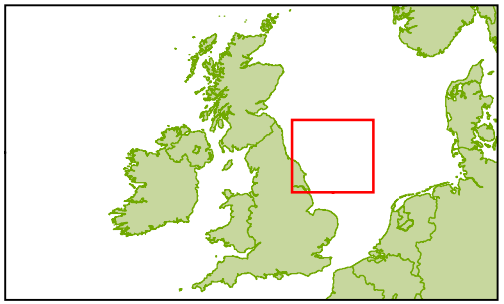
Elasmobranchs

The most abundant elasmobranchs found in UK waters are lesser and greater spotted dogfish *Scyliorhinus canicula* and *Scyliorhinus stellaris*, spurdog *Squalus acanthias* and tope *Galeorhinus galeus* (DECC, 2009). All are widespread in distribution and are expected to be present in the wider study area. A number of skates and rays are also present in UK waters, with the most abundant being thornback ray *Raja clavata* and cuckoo ray *Raja naevus* (DECC, 2009). Common skate *Leucoraja batis*, listed as endangered on the International Union for the Conservation of Nature (IUCN) Red List, may also be present in limited number.

Protected and Migratory Species

Numerous conservation frameworks act to protect certain species that may be found in the Project area. For example, an Appropriate Assessment conducted by The Crown Estate of the implications of Round 3 development for protected European Sites, identifies five diadromous species listed in Annex II of the Habitats Directive that must be taken into account as part of a project-level Habitats Regulations Assessment (HRA) (Entec, 2009). In addition, a number of species are listed under Annex V of the OSPAR list of threatened and/or declining species and habitats, by CITES (Convention on International Trade in Endangered Species), the IUCN Red List of Threatened Species, as well as being the subject of UK Biodiversity Action Plans (BAP) as priority species (DECC, 2009). Site specific survey data is necessary to confirm the use of the Project area by protected species, as well as migratory species such as Atlantic salmon *Salmo salar*.





Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

Fish Areas

- Spawning Ground
- Nursery Ground

Sources: Fish Areas © Coull *et al*, 1998.
R3 Zone © TCE, 2010.

0 20 40 80 Kilometres
0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT	
Dogger Bank Project 1	
Figure Title:	
Fish Spawning and Nursery Grounds	
Figure No: Fig. 6.3a	Paper Size: A4 Rev: 4
Drawn By: DJM	Scale: 1:3,000,000
Drawn On: 29/09/10	Projection: UTM31N
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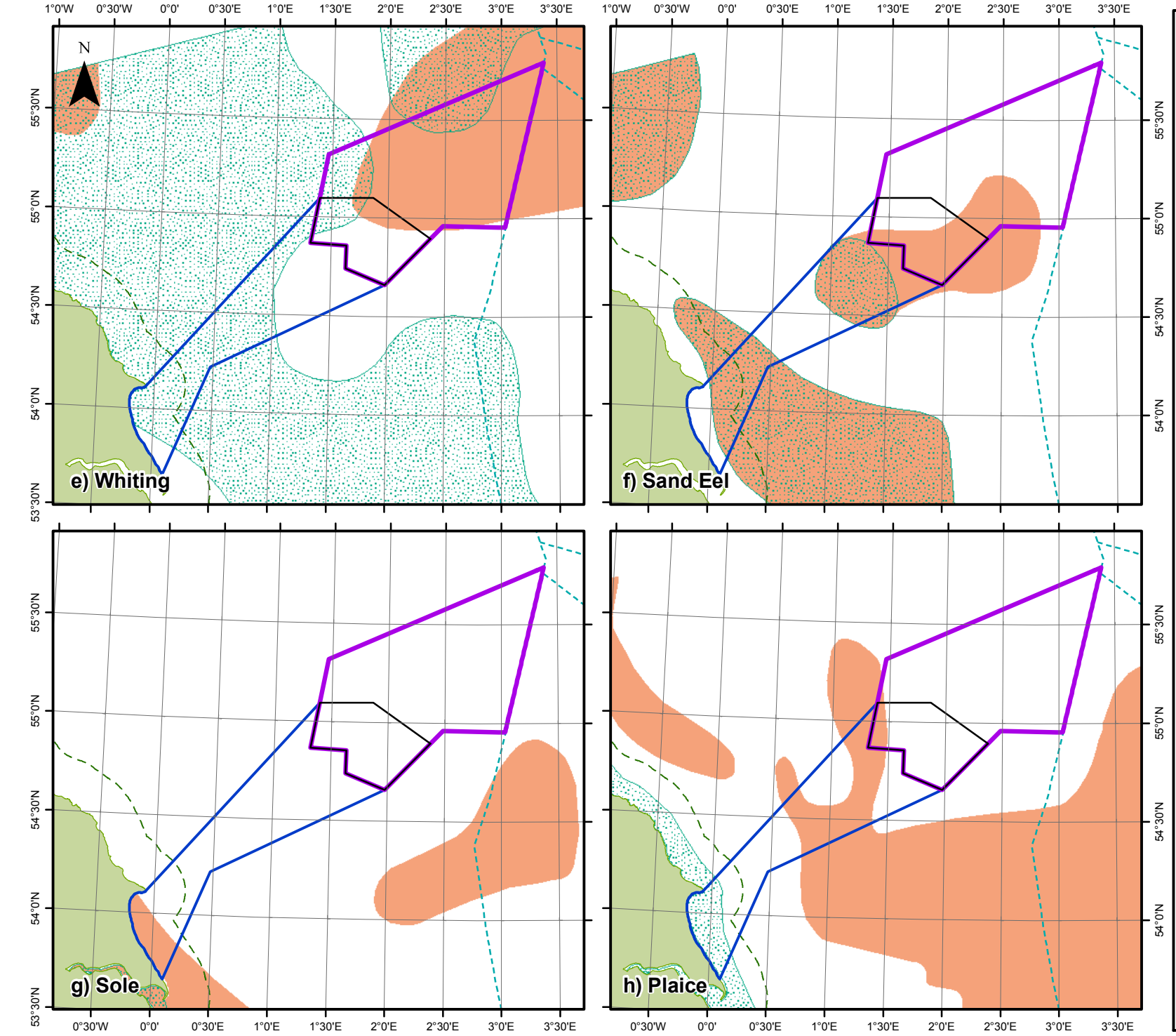

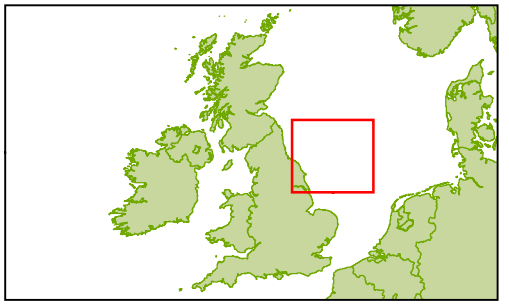

Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

Fish Areas

- Spawning Ground
- Nursery Ground

Sources: Fish Areas © Coull *et al*, 1998.
R3 Zone © TCE, 2010.

0 20 40 80 Kilometres
0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT	
Dogger Bank Project 1	
Figure Title:	
Fish Spawning and Nursery Grounds	
Figure No: Fig. 6.3b	Paper Size: A4 Rev: 4
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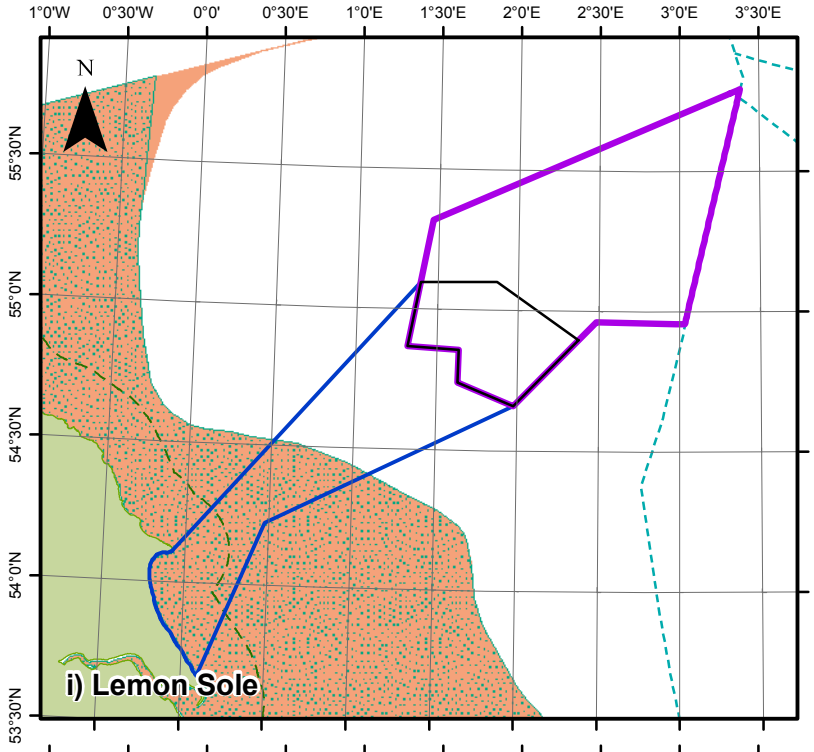

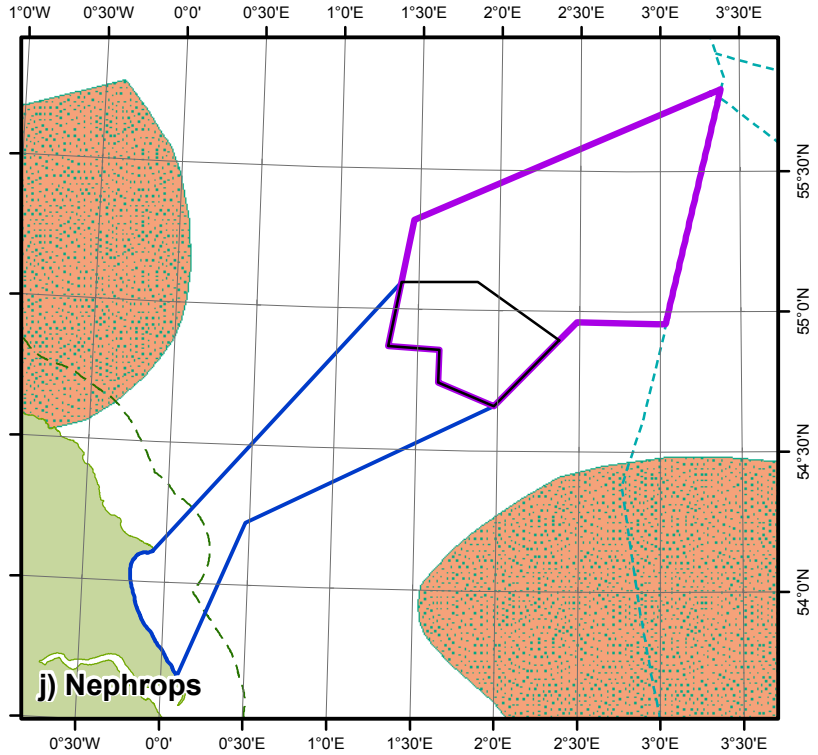

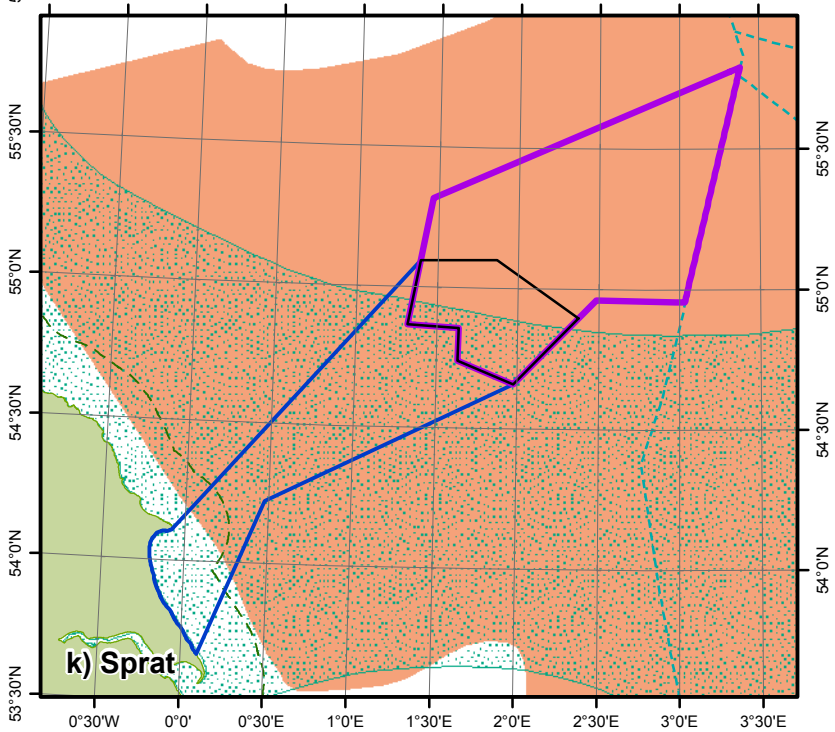

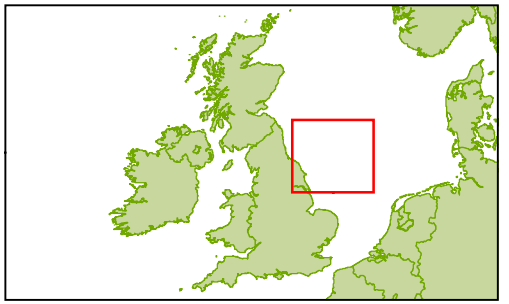

Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

Fish Areas

- Spawning Ground
- Nursery Ground

Sources: Fish Areas © Coull *et al*, 1998.
R3 Zone © TCE, 2010.

0 20 40 80 Kilometres
0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Fish Spawning and Nursery Grounds		
Figure No: Fig. 6.3c	Paper Size: A4	Rev: 4
Drawn By: DJM	Scale: 1:3,000,000	
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6.4.2 Potential impacts

Potential impacts during construction

Physical disturbance: Demersal fish and crustacean species (such as crabs and lobsters) could be prone to direct physical disturbance during the construction phase, especially where disturbance coincides with key spawning periods. Site surveys will reveal the potential for this and, where necessary, mitigation measures will be investigated in order to reduce or avoid significant impacts.

Noise and vibration disturbance: The construction process will result in the propagation of underwater noise that has the potential to result in a range of impacts on sensitive fish and shellfish species, from mortality (at extreme close range) to disturbance and behavioural effects. The significance of impacts will be dependent on the sensitivity of the species affected and the level of noise involved. It is anticipated that the most likely source of potential impact will be during the installation of foundations.

Suspended sediments (including previously contaminated sediments): Suspended sediments have the potential to impair respiratory or reproductive functions (including the disruption of migration/spawning activity) (ABP Research, 1997). However, it is not anticipated that suspended sediment levels as a result of construction, will be significant against natural background levels.

Existing contamination of sediments (whilst unlikely to be a major issue in this area) will be addressed within the EIA following analysis of sediment samples from the site.

Potential impacts during operation

Loss of habitat: The physical presence of foundation pieces represents a permanent loss of habitat within a small footprint. The significance of this effect will be dependant upon the presence of a species of fish and/or shellfish that is reliant upon the habitat in question and that have a limited distribution of such habitat within the wider study area. There is no indication that the study area supports such unique conditions. However, Forewind believes that Tranche A and the initial indicative export cable corridor are extensive enough to allow identified sensitive areas to be avoided.

Electromagnetic fields (EMF): Elasmobranchs are considered to be sensitive to the effects of EMF and it has been postulated that marine mammals could be affected by the magnetic field generated by buried export cables. Monitoring of existing projects and ongoing research will be taken into account in the EIA process for this issue. The high voltage direct current (HVDC) system proposed to be deployed by Forewind (**Section 2.1**) is considered to have significantly lower EMF emissions than alternating current (AC) systems that have been used to date (OSPAR, 2009). While further assessment is required, it is not expected that significant impacts would arise.

Provision of artificial habitat: Concrete and steel structures on the seabed will become colonised by a range of benthic invertebrate species, increasing ecological diversity (e.g. Linley *et al*., 2007) and acting as fish aggregating devices.

Physical disturbance: Operational noise impacts are considered highly unlikely to cause physical damage to fish species (Thomsen *et al.,* 2006; Nedwell *et al*., 2007). This is supported by Nedwell *et*

al., (2007) report that operational noise from North Hoyle, Barrow, Kentish Flats, and Scroby Sands was very low and only very slightly above background levels, even in close proximity to the WTGs

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

Cumulative effects

The most likely source of cumulative impact on the fish and shellfish resource is considered to be from overlapping noise disturbance where piling is conducted simultaneously by two or more projects or, in consecutive sensitive periods such as spawning seasons. The effects of EMF (multiple cables increase the range and spread of EMF) is also a potential source of cumulative impact that will require due consideration.

6.4.3 Approach to EIA

Studies will be conducted in line with the latest guidance, including:

- Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements (Cefas 2004) – incorporating latest guidance on nature conservation as updated in 2009;
- COWRIE report: On Establishing best practice for the documentation and dissemination of the marine biological data (Seeley *et al*., 2008); and
- The Potential Impact of Electromagnetic Fields generated by offshore wind farm cables (COWRIE September 2005).

Fish and shellfish resource surveys will be conducted to characterise the fish assemblage of Tranche A. These surveys will be carried out in accordance with accepted guidance (Cefas, 2004) and be representative of the gear types used by fishermen within the area. The detailed scope of the surveys will be informed by consultation between Forewind, the Fisheries Liaison Coordinators (FLC) and relevant authorities (Cefas, MMO, JNCC and Natural England).

To help inform the potential impacts on fish ecology it is envisaged that detailed noise modelling on percussive piling activity will be undertaken based on a worst case development scenario within the Project area (once established) in accordance with the Rochdale Envelope principal. The detail and scope of any such modelling work will be established through consultation with the relevant authorities.

Investigation into EMF impacts will draw on existing studies such as Gill *et al*., 2005, and follow the guidance for monitoring outlined in this review. This will include consultation with Cefas to obtain the latest thinking on EMF, particularly with respect to the HVDC system.

Key data collection/study required

Activity	Purpose
Autumn & Spring fish surveys comprising representative gear types for the relevant area and epibenthic beam trawls to characterise the epibenthic communities.	To characterise the fish and shellfish resource of the study area.
Subsea noise modelling of piling activity.	To ascertain the likely level of impact on key spawning species in the vicinity of the project, and help inform appropriate mitigation and monitoring measures.
Physical processes study – seabed sediment types and sediment dispersion modelling.	This information will be used to establish the potential for impacts on demersal fish species and the identification of spawning grounds.

6.5 Ornithology

6.5.1 Existing environment

Inshore waters

The Holderness coastline supports a wide range of bird species and a number of important sites. A total of ten internationally designated sites (Special Protected Areas (SPA) and Ramsar) are located along the stretch of coastline where the proposed cable route may cross, as illustrated in **Figure 6.1**. All ten support internationally important populations of waterbird or seabird during the breeding, passage and/or overwintering season (details of the SPA populations are provided in Table A1 at the end of this Scoping Report). The baseline environment immediately around the coast, and within inshore waters, is therefore likely to be influenced by the large populations of breeding and overwintering waterfowl and seabird species within these adjacent SPAs.

Boat-based and aerial surveys undertaken by Dong Energy around the Humber Estuary between August 2004 and July 2006, recorded 11 key species (Dong Energy, 2009). The most abundant species recorded within the survey area were guillemot *Uria aalge,* kittiwake *Rissa tridactyla*, razorbill *Alca torda*, gannet *Morus bassanus*, common gull *Larus canus*, great black-backed gull *Larus marinus*, common tern *Sterna hirundo* and puffin *Fratercula arctica*. Overall in the aerial surveys, kittiwake were recorded in the highest numbers, with a peak count in September 2004-2006 (3,647), although unidentified species of auk and guillemot were also recorded in relatively high numbers with a peak also in September 2004-2006 (3,132 and 1,493 respectively). Only very small numbers (<20 individuals) of little gull *Hydrocoloeus minutus* were recorded within the proposed development site further offshore.

Offshore waters

Due to its offshore location, Tranche A is well outside the foraging range of many species of relevance to coastal SPA populations. However, it is within the range of a number of key pelagic species and may be on the route of migration for coastal and terrestrial SPA species.

Adult gannet flying at the Dogger Bank 8th February 2010 (Gardline, 2010b)

Recent surveys by the JNCC aimed at identifying areas that qualify as possible marine SPAs recorded important populations of seabirds at the Dogger Bank, particularly during the winter months (Kober *et al.,* 2010). The area holds qualifying numbers of little gull (autumn passage season), guillemot (winter), little auk *Alle alle* (winter), and seabird assemblages (breeding, winter and summer). However, variability in these numbers would mean that the area would not qualify as an SPA in most years (Kober *et al.,* 2010). This is supported by preliminary data from Forewind's own surveys, which are recording generally low abundance and density of these key species compared to pre-survey estimates.

Current studies

Adult kittiwake flying at the Dogger Bank 10th February (Gardline, 2010b)

The Crown Estate Studies

Recent Forewind aerial and boat-based surveys of the Dogger Bank Zone have aimed to characterise the site. Boat-based surveys undertaken by DECC between March and September 2008 recorded a range of common pelagic seabird species within the Zone (DECC, 2009). Guillemot and razorbill were recorded within the study areas at significant densities of up to approximately 50 and 20 birds per square kilometre respectively during the March surveys. Five further species were considered to occur at moderate densities within the Zone over the course of the surveys, these were northern fulmar *Fulmarus glacialis*, gannet, herring gull *Larus argentatus*, great black-backed gull and kittiwake.

Aerial surveys for The Crown Estate by visual transect and HiDef between May 2009 and April 2010 recorded similar species, although in somewhat lower numbers (The Crown Estate, 2010a). The relative abundance of species of auk (guillemot and razorbill) was found to be highest in the winter months (>15/km^2), with auks recorded as being widespread across the study area.

Forewind studies

Monthly counts have been undertaken within the Zone during boat-based transect surveys which were initiated in January 2010 (see **Figure 6.4a**) and Forewind have also extended the hi-definition aerial survey initiated by the Crown Estate (see **Figure 6.4b**). The results of these surveys will inform the Zone Appraisal and Planning (ZAP) works, as well as the initial project EIAs. At the time of writing, the

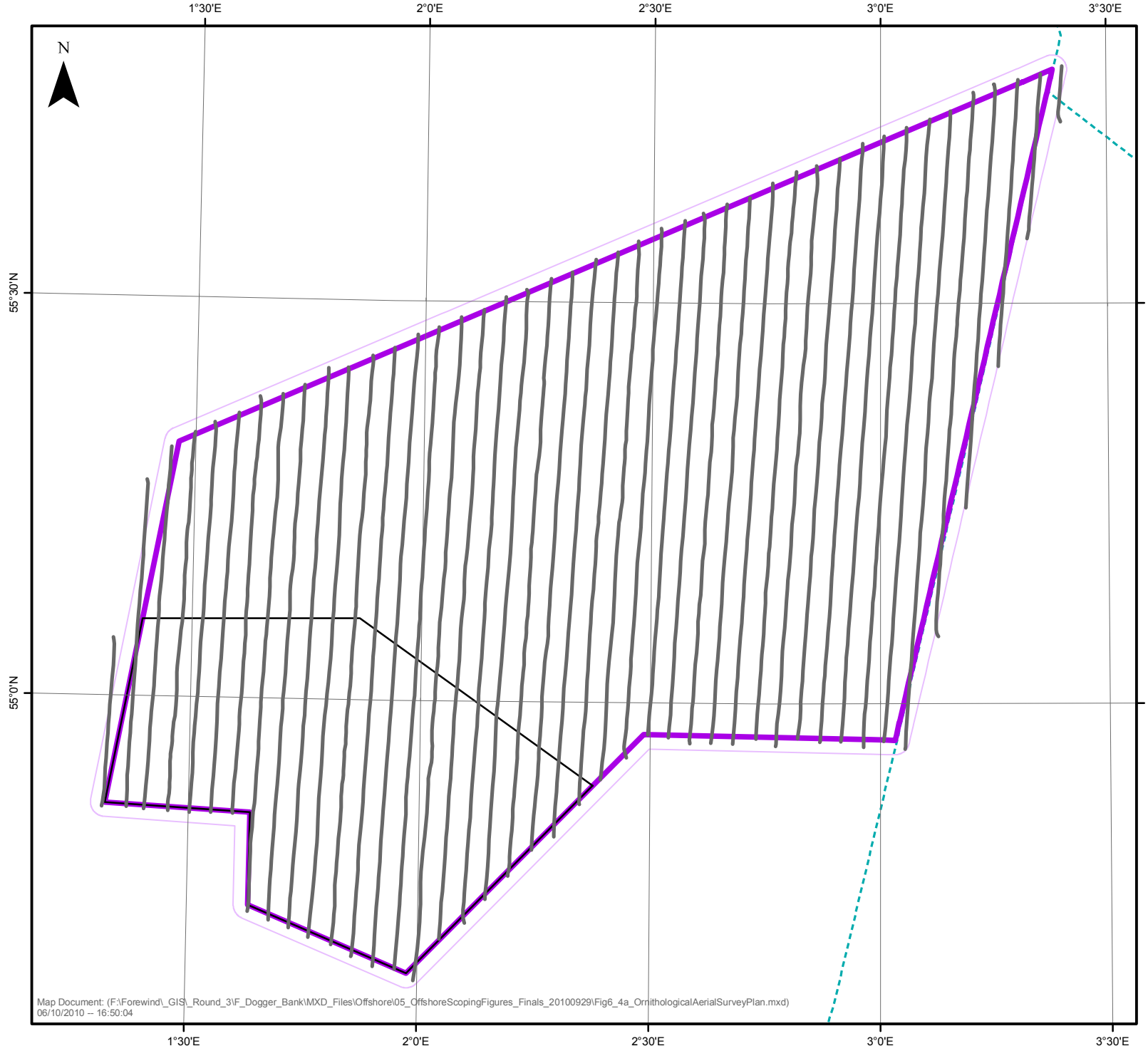
boat based surveys have reported six months of data. 12 species have been recorded regularly at the site. **Tables 6.2** and **6.3** summarise the peak count and density data collected for these species.

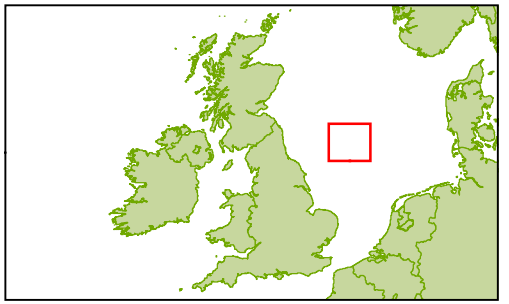
Table 6.2 **Monthly totals of common species recorded within the Dogger Bank Zone between January and June 2010 (Gardline, 2010-a-f)**

Species	January	February	March	April	May	June
Fulmar	11	640	800	508	2,608	1,638
Gannet	26	518	2,261	2,063	174	343
Great Skua	0	1	0	8	1	6
Lesser Black-backed Gull	0	3	17	606	215	386
Herring Gull	48	225	49	32	54	18
Great Black-backed Gull	26	416	249	136	64	26
Kittiwake	100	2,164	3,180	3,099	854	1,879
Guillemot	145	2,134	4,389	1,045	468	236
Razorbill	234	750	1,317	465	58	39
Guillemot/Razorbill	-	517	375	122	0	7
Little Auk	0	157	3	0	0	0
Puffin	4	153	106	112	40	113
Total number of species	**10**	**15**	**20**	**23**	**19**	**16**
Total km travelled	**157.65**	**1,164.78**	**1,734.23**	**2,252.79**	**1,368.22**	**1097.9**

Table 6.3 **Relative abundance (birds/km^2) of common species recorded within the Dogger Bank Zone between January and June 2010 (Gardline, 2010 a-f)**

Species	January	February	March	April	May	June
Fulmar	< 0.1	0.6	0.5	0.2	1.9	1.5
Gannet	0.2	0.4	1.3	0.9	0.1	0.3
Great Skua	0	< 0.1	0	< 0.1	< 0.1	< 0.1
Lesser Black-backed Gull	0	< 0.1	< 0.1	0.3	0.2	0.4
Herring Gull	0.3	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Great Black-backed Gull	0.2	0.4	0.1	< 0.1	< 0.1	< 0.1
Kittiwake	0.6	1.9	1.8	1.4	0.6	1.7
Guillemot	0.9	1.8	2.5	0.5	0.3	0.2
Razorbill	1.5	0.6	0.8	0.2	< 0.1	< 0.1
Guillemot/Razorbill	-	0.4	0.2	< 0.1	-	< 0.1
Little Auk	0	0.1	< 0.1	0	-	-
Puffin	< 0.1	0.1	< 0.1	< 0.1	< 0.1	0.1





Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- International Boundary

Ornithological Aerial Survey

- Indicative Survey Line
- 2km Buffer

Source: R3 Zone © TCE, 2010.

0 5 10 20 Kilometres

0 2.5 5 10 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Ornithological Aerial Survey Plan		
Figure No: Fig. 6.4a	Paper Size: A4	Rev: 2
Drawn By: DJM	Scale: 1:750,000	
Drawn On: 29/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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Map Document: (F:\Forewind_GIS_Round_3\F_Dogger_Bank\MXD_Files\Offshore\05_OffshoreScopingFigures_Finals_20100929\Fig6_4a_OrnithologicalAerialSurveyPlan.mxd)
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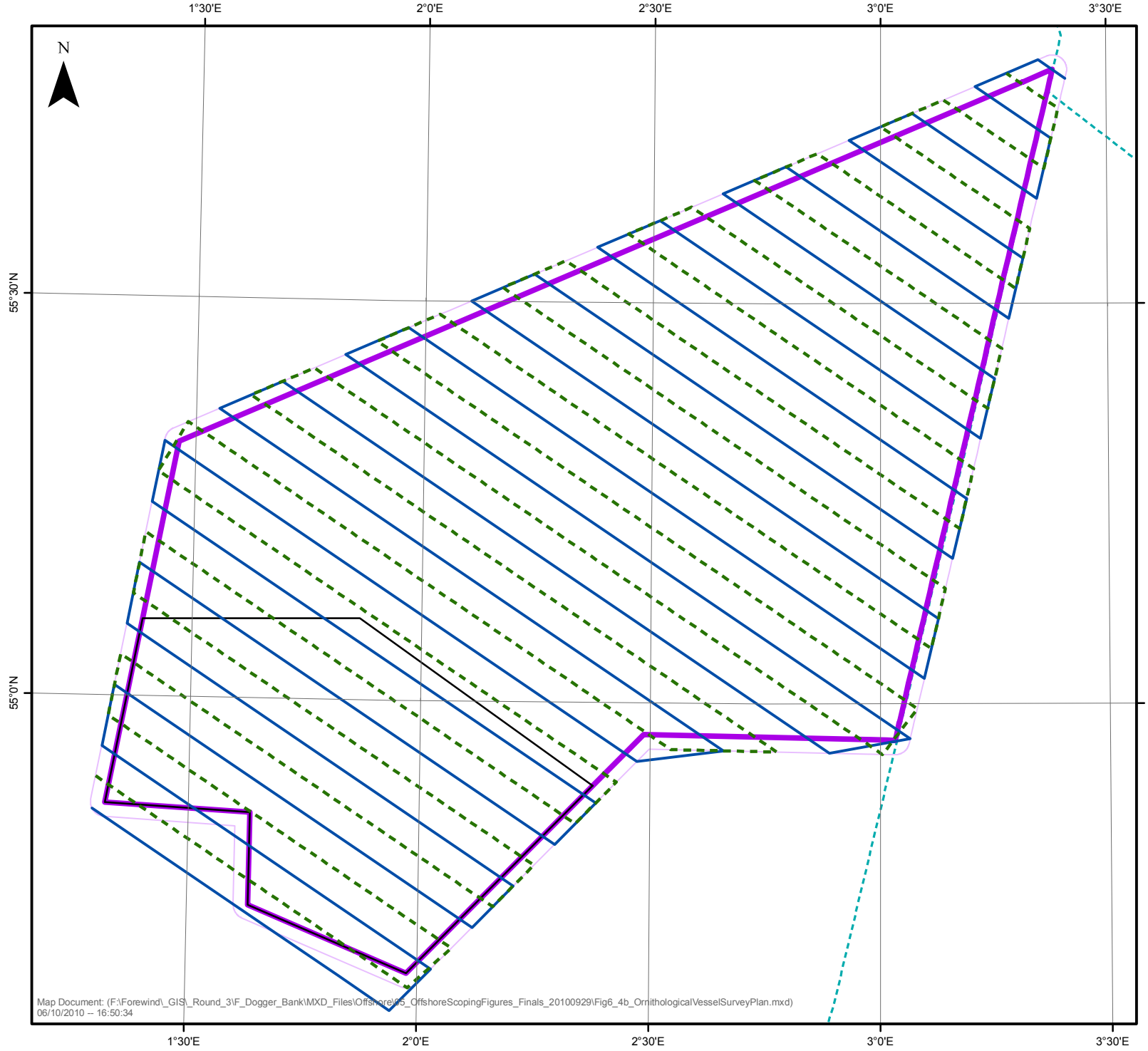

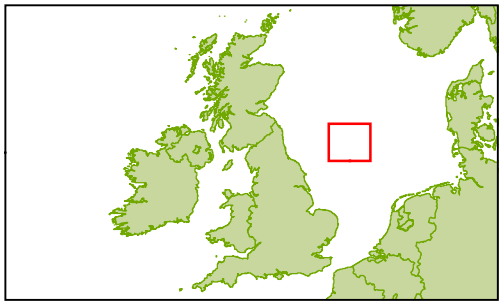

Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- International Boundary

Ornithological Vessel Survey

- Primary Survey Line
- Secondary Survey Line
- 2km Buffer

Source: R3 Zone © TCE, 2010.

0 5 10 20 Kilometres

0 2.5 5 10 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Ornithological Vessel Survey Plan		
Figure No: Fig. 6.4b	Paper Size: A4	Rev: 2
Drawn By: DJM	Scale: 1:750,000	
Drawn On: 29/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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Northern fulmar flying at the Dogger Bank 31st May (Gardline, 2010e)

Guillemot were recorded in the greatest densities (up to 2.5/km^2 during March), with feeding being the most common behaviour (Gardline, 2010c). Counts of kittiwake, northern fulmar, gannet and razorbill were also higher (i.e. more than 1/km^2), relative to other species such as great skua, the gulls, little auk and puffin (**Table 6.4**).

A range of migrant species were also recorded transiting through the site over the course of the surveys in relatively low numbers. The greatest number and diversity were recorded in April and May, with a total of 23 and 22 migrant species sighted respectively. Species recorded included waterfowl, waders, passerines, gamebirds and birds of prey.

6.5.2 Potential impacts

Potential impacts during construction

Disturbance and displacement: Construction activities associated with the export cable corridor will be short term in duration and transitory in nature. Significant impacts on coastal species are not anticipated to arise. The export cable landfall itself will not be located in an area where significant adverse impacts on birds are possible.

Offshore, construction activity has the potential to disturb and displace both bird species and their prey, as a result of increased noise and human activity. The significance of this impact will be dependant upon the sensitivity of the species affected and the importance of the Tranche A area to that species as an ecological resource. Conversely, it is possible that certain opportunistic species (such as species of gull) will be attracted to the construction activity as a potential foraging opportunity.

Potential impacts during operation

Disturbance and displacement: A range of activities during the operation of the wind farm may disturb and/or displace birds and their prey. This may include the generation of low level noise from the operation of the wind turbine generators (WTG), maintenance activities and the movement of maintenance vessels within the site and between service ports. The significance of impact will depend on the species affected and the availability of suitable alternative habitat or prey nearby. For example, a wide ranging habitat generalist, such as gannet, is not expected to be as sensitive as a seasonal, habitat dependent species, such as red throated diver.

Barrier effects: The wind farm may pose a physical obstacle to birds which may be transiting or feeding within the area, particularly during periods of reduced visibility or high winds. Therefore, less manoeuvrable species may choose to avoid the wind farm site entirely, changing their direction of flight and incurring additional energetic cost.

Collision risk: There is the potential for bird species to collide with WTG blades or other structures within the wind farm, particularly during periods of reduced visibility and high winds. Different species vary in their susceptibility to collision; with large bulky species with high wing loadings (high body weight to wing area ratio) at greatest risk. The greatest collision risk would be if high risk species were regularly forced to pass through a wind farm.

Potential impacts during decommissioning

The impacts on birds during decommissioning will be similar to those of construction, with the exception of any need for pile driving.

Cumulative effects

Interactions between other wind farms: An individual project within Tranche A is not, in isolation, expected to be of significant risk to birds. However, given the offshore position of the project and the wide ranging, pelagic and migratory nature of many of the key species identified, cumulative impacts could arise in conjunction with any other offshore wind farm development located within the range of the species of concern. Forewind will continue to work with the JNCC, Natural England and the RSPB throughout the EIA process, to determine the species/populations of concern and the cumulative envelope for assessment.

Interactions between other activities: There is the potential for noise and disturbance associated with other activities within the North Sea to combine with that of the construction and operation of Tranche A, should they occur in close proximity to the site or for extended periods. Examples of other activity that may result in cumulative effects include shipping, aggregate dredging, fishing, oil and gas extraction and MoD exercises.

6.5.3 Approach to EIA

The Dogger Bank Zone, the wider area of the central and southern North Sea and waters further inshore, have been the focus of a range of recent studies, including by Government Agencies and a variety of developers. The characterisation of the baseline environment will, therefore, be informed by the data collected during these investigations. This includes aerial and boat-based surveys undertaken by DECC (2009), Dong Energy (2009), Kober *et al.*, (2010) and The Crown Estate (2010a).

In addition to the existing available datasets, Forewind is in the process of collecting primary data from the Dogger Bank Zone to inform the EIA. The initial survey protocol was presented to the JNCC and the RSPB prior to the initiation of the surveys in 2009. To date nine months of boat-based surveys have been undertaken, to record bird and marine mammal use of the study area.

Forewind is also continuing the aerial survey programme commenced by The Crown Estate. The aerial survey is being undertaken by HiDef Limited, utilising two planes that provide the required 10% coverage of the Dogger Bank Zone each month, following the original transects. Aerial and boat based surveys are designed to work together to characterise bird abundance, density and seasonality across the Zone.

Forewind is currently in consultation with the JNCC, Natural England and the RSPB with regards to the aerial and boat-based survey protocols for Dogger Bank. This consultation will include a review and interpretation of the initial dataset in order to ensure the survey protocol is fit for purpose. Forewind does not wish to prejudge the outcome of this consultation in this Scoping Report. This report, therefore, provides an outline of the approach that Forewind have undertaken to date. Detailed information on the agreed approach to data collection and interpretation will be submitted to the IPC once the review is complete.

Following the analysis and interpretation of primary data, a Collision Risk Assessment (CRA) and Cumulative Impact Assessment (CIA) will be undertaken. The CRA and CIA will be carried out using the most-up to date guidance on the assessment of collision risk and cumulative impact at the time, and will be based on consultation with the JNCC, Natural England, RSPB and The Crown Estate.

The assessment within the EIA will be based upon the outputs of the CRA, CIA and any additional assessment tool used, taking account of relevant guidance e.g. COWRIE (Norman *et al.,* 2007, Maclean *et al.*, 2009 and King *et al.*, 2009), as well as consultation undertaken during the EIA process.

There are a number of sources of information that will be drawn upon to inform the impact assessment, in addition to the data sources identified above. These are outlined briefly below:

- COWRIE guidance on assessment methodologies (Maclean *et al.,* 2009 and King *et al.,* 2009);
- Published guidance on collision risk assessment, including avoidance rates (such as the models used by Scottish National Heritage5 (SNH) and SNH, 2000);
- Published monitoring data from other developments, including during construction and operation data collected from Round 1 and Round 2 offshore wind farms; and
- Published information from other relevant activities or developments which may have a cumulative impact on marine mammals.

Consultation with the other EU nations may also be required under the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) (see **Section 5.1**, Nature Conservation Designations). However, it is anticipated that such consultation will be initiated by the IPC.

[5] http://www.snh.org.uk/strategy/renewable/sr-we00a2.asp

Key data collection/study required

Activity	Purpose
Boat-based survey.	To characterise the ornithological assemblage within the study area and help inform Collision Risk Assessment and EIA.
Aerial survey.	To characterise the ornithological assemblage within the study area.
Collision Risk Assessment.	To establish the collision risk on key species (determined from analysis of boat-based and aerial surveys) from the operation of the wind farm.

6.6 Marine Mammals

6.6.1 Existing environment

Marine mammals are frequently encountered within the Dogger Bank Zone and in the coastal waters off Holderness and The Wash. Several coastal sites in the study area have been designated as being of importance to nature conservation, either directly for marine mammals, or for the habitats they utilise (**Section 6.1**).

The area has been the focus of a range of recent studies which have aimed to record marine mammal presence and abundance, including Government Agency and a variety of developers. This includes studies as part of Small Cetacean Abundance in the North Sea II (SCANS II) (Macleod *et al*, 2008), DECC (2009), Dong Energy (2009) and The Crown Estate (2010a).

Forewind has continued to record sightings and abundance of marine mammals, within the Dogger Bank Zone as part of multiple platform aerial and boat-based ornithological surveys. The data obtained from these surveys to date, combined with the existing literature and data sets allows Forewind to predict the marine mammal species likely to be of importance in the context of the Environmental Impact Assessment (EIA).

Minke Whale

Minke whale, *Balaenoptera acutorostrata,* a small baleen whale species, is largely present in continental shelf water in depths of 200m or less. The species is widely distributed within the North Sea and can often be found feeding in areas of strong upwelling and high currents during the summer months (Reid *et al.,* 2003). They feed on a variety of species such as herring, cod, capelin, haddock, sandeel and small crustaceans (Reid *et al.*, 2003).

Surveys of the central and southern North Sea and the Dogger Bank Zone have regularly recorded the species in the area. Most sightings were of single individuals, pairs or small groups between May and September with a peak in June (Reid *et al.* 2003, Cork Ecology 2009, Gardline 2010a-e). Individuals have been observed feeding around the Dogger Bank Zone on a number of occasions and their presence may be associated with the sandeel grounds to the west of the Zone.

Source: www.seawatchfoundation.org.uk

Status: Regular, common or fairly common (dark shading); Occasional (intermediate shading); and Casual / absent (light shading).

White-beaked Dolphin

White-beaked dolphin, *Lagenorhynchus albirostris,* are also considered a continental shelf species, usually recorded in waters of 50-100m depth. They are observed more frequently in the western sector of the central and northern North Sea, compared to further south around the Dogger Bank (Reid *et al.*, 2003). White-beaked dolphin feed on a wide range of fish and invertebrates, including mackerel, herring, cod, capelin, whiting, haddock, sandeel, crab, squid and octopus (Reid *et al.*, 2003).

Source: www.seawatchfoundation.org.uk

White-beaked dolphin on 15th May (Gardline 2010e)

White-beaked dolphin are present in the waters around the UK year round and are recorded most frequently between June and October (Reid *et al.*, 2003). The species has been regularly recorded feeding in small groups in the central North Sea and around the Dogger Bank Zone (including Tranche A), with a peak in sightings in May (Hammond, 2008; Cork Ecology, 2009; Gardline, 2010a-e).

Harbour Porpoise

Source: www.seawatchfoundation.org.uk

Harbour porpoise, *Phocoena phocoena* are the most commonly recorded cetacean species of UK inshore waters and typically occur in small groups (1-3). The species feeds on a variety of small fish species, such as whiting, poor cod, herring, sandeel and gobies (Reid *et al.,* 2003). Surveys of the southern North Sea and the Dogger Bank Zone, have regularly recorded harbour porpoise (SCANS II, 2008, Cork Ecology 2009, Gardline 2010a-e). Most sightings were of small groups, with a number observed feeding in the area (Gardline 2010a-e). The species was recorded in the greatest numbers between May and September, with a peak in May (Gardline 2010a-e).

The sea area surrounding the Dogger Bank, and the Dogger Bank Zone, is considered to be of reasonable importance to harbour porpoise. Harbour porpoise are listed in the citation for the Dogger Bank possible Special Area of Conservation (pSAC), but as a non-qualifying feature, since there is no evidence to suggest that the Dogger Bank is more important to the species than the wider North Sea area (JNCC, 2010a). Although the species is a non-qualifying feature, standard disturbance guidelines will still be applied. It is also worth noting that harbour porpoise are a feature of the German and Dutch designated sites, adjacent to the Dogger Bank Zone (see **Section 6.1**).

Grey Seal

Grey seal*, Halichoerus grypus,* is the larger of the two species that breed around the UK coast. The species hauls-out on land to rest between foraging trips, to moult in spring and give birth to their pups in autumn, but can travel up to several hundred kilometres offshore on foraging trips which can last several days (SCOS, 2009). Grey seal feed on a variety of fish species including sandeel, cod, haddock, whiting, ling and species of flatfish.

Grey seal feeding on a flatfish (Gardline 2010d)

As discussed in **Section 6.1**, two internationally important breeding sites for grey seal are located along the Holderness Coast around the proposed cable route and low numbers of the species will be expected within Tranche A, which is easily within foraging range of the species. Surveys in 2009 and 2010 have regularly recorded low numbers of the species within the Dogger Bank Zone throughout the year, with a peak in March and May (Cork Ecology, 2009; Gardline, 2010a-e). Grey seal are listed on the Dogger Bank pSAC citation but are a non-qualifying feature of the site.

Common Seal

Common seal, *Phoca vitulina* are widespread around the UK coast. The species regularly hauls out and generally feeds within around 45-50km of their haul-out sites (SCOS, 2009). Common seal feed on a wide range of prey including herring, whiting, sandeel, flatfish, octopus and squid.

As discussed in **Section 6.1** The Wash and north Norfolk Coast is considered internationally important for its population of breeding common seal. Large numbers are therefore likely to be within the coastal areas of the proposed cable route; due to their limited foraging ranges, numbers further offshore are likely to be reduced. Surveys of the Dogger Bank Zone (including Tranche A), have recorded occasional sightings of the species to date (Cork Ecology, 2009; Gardline, 2010a-e). Again, common seal are listed on the Dogger Bank pSAC citation but are a non-qualifying feature of the site.

6.6.2 Potential impacts

Potential impacts during construction

Disturbance: Construction activities will result in noise and vibration through the water column, which has the potential to affect marine mammals. Marine mammals, cetaceans in particular, are sensitive to underwater noise. Potential sources of noise include pile driving, trenching, the installation of Wind Turbine Generators (WTG) and increased vessel movements associated with the works. Impacts may range from temporary behavioural changes up to mortality via lethal noise levels. While a cause for concern, Forewind believes that such impacts on marine mammals can be effectively minimised by following a marine mammal mitigation protocol, to be agreed with the JNCC and based on best practice and industry guidance at the time.

Collision risk: As discussed above, construction activities will result in increased vessel movements, both within the Tranche A area and via transiting between the site, export cable corridor and service ports. Ship strikes are a known cause of mortality to marine mammals. However, most reported cases involve large, slow swimming species of whale. Due to the agility and speed of the common species to the area (seal, porpoise and dolphin) and the slow speeds of vessels involved in construction within the site, this is not considered a significant issue.

Potential impacts during operation

Disturbance: The operation of the wind farm will also produce noise and vibration. However, this would not be expected to cause disturbance to marine mammals (Nedwell *et al*., 2007). Sources include low level noise from the operation of the WTGs, maintenance activities and the movement of maintenance vessels within the site and between service ports. This issue will be given further consideration within the EIA, but is not considered significant.

Barrier effects: As discussed above operational wind farms will produce low level noise which may disturb more sensitive species of marine mammals causing them to avoid the area. Studies of operational wind farms, such as Nysted and Horns Rev suggested a reduction in the abundance and foraging activity of marine mammals within the wind farm, when compared to reference sites, in the first two years of operation (Tougaard *et al*., 2005). However, this reduction could not be attributed to the effect of the wind farm, as not all variables were considered. It is of note that later studies found that there was no significant effect on harbour porpoise beyond the first two years (Diedrichs *et al*., 2008).

WTG structures also pose a physical obstacle to animals which may be transiting or feeding within the area, particularly during stormy periods. Due to the agility and speed of the common species to the

area (seal, porpoise and dolphin) this is not considered a significant issue. However, it will be considered in more detail in the EIA.

Potential impacts during decommissioning

The impacts on marine mammals during decommissioning will be similar to those of construction, with the exception of any need for pile driving. The need for extensive mitigation measures during decommissioning is, therefore, likely to be reduced.

Cumulative effects

Interactions between other wind farms: The most significant cumulative impact for marine mammals will relate to construction noise. If the programme for construction at Tranche A was to overlap with that of other wind farms within the Dogger Bank Zone, it is possible that cumulative effects may arise. However, Tranche A is a significant distance away from other development activity that is expected to occur over the same timescale (the closest being wind farm sites in the Hornsea Zone). As such, the potential for overlapping noise impacts during construction is limited.

Interactions between other activities: There is the potential for noise and disturbance associated with other activities within the southern North Sea to combine with that of the construction and operation of Tranche A. These include shipping, aggregate dredging, fishing, oil and gas exploration and development and MoD exercises. There is the potential for a significant effect should any of the operations occur in close proximity to the site or for extended periods. However, it is expected that all activities capable of having a significant effect on marine mammals will be controlled under licence, and therefore a significant cumulative effect is unlikely. It should be noted that Forewind has undertaken a risk assessment (submitted to the MMO and JNCC) that has concluded that the seismic surveys being undertaken this year will not have significant effect and do not require an European Protected Species (EPS) licence.

6.6.3 Approach to EIA

The Dogger Bank Zone and the wider area of the central and southern North Sea and waters further inshore, have been the focus of a range of recent studies, including public and private sectors and a variety of developers. The baseline environment for marine mammals will therefore take account of the data collected during these investigations. This includes studies by SCANS II (Hammond, 2008), DECC (2009), Dong Energy (2009) and The Crown Estate (2010a).

In addition to the existing available datasets, Forewind are in the process of collecting primary data from the Dogger Bank Zone to inform the EIA. An original survey protocol was agreed in consultation with JNCC, prior to the initiation of the surveys in 2009. To date nine months of aerial and boat-based transect surveys have been undertaken, to record bird and marine mammal use of the study area.

The baseline surveys will continue for a total of two years (24 months). To ensure that they remain as efficient and targeted as possible, whilst meeting their aims, Forewind will continue to work with the stakeholders and regulatory authorities to develop a revised protocol and adapt the surveys to ensure that they provide a robust baseline for inclusion within the ES.

The assessment within the EIA will be based upon the data as described above, taking account of the relevant guidance from Cefas (2004), Defra (2005) and the JNCC (2010a), as well as consultation undertaken during the EIA process. There are a number of sources of information that will be drawn upon to inform the impact assessment. These are outlined briefly below:

- Noise assessments associated with the proposed development, as outlined within Section 6.11 (Noise and Vibration);
- Published literature on the responses of marine mammals to underwater noise and disturbance associated with offshore wind farm construction, operation and decommissioning (e.g. Bailey *et al*., 2010);
- Published monitoring data from other developments, including during construction and operation data collected from Round 1 and Round 2 offshore wind farms; and
- Published information from other relevant activities or developments which may have a cumulative impact on marine mammals.

Forewind believes that development of the Dogger Bank Zone must progress on the basis of the 'building block approach', as detailed in **Section 3**. Forewind will liaise with the Regulatory Authorities and statutory advisors (e.g. the JNCC) in order to identify those projects and activities that must be taken into account.

Following any potential impact, suitable mitigation and monitoring will be developed in consultation with the JNCC and Natural England. Consultation with the German and Dutch authorities will also be undertaken as a requirement of the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) (**Section 6.1**).

Key data collection/study required

Activity	Purpose
Boat-based survey.	To characterise the marine mammal populations within the study area.
Aerial survey.	To characterise the marine mammal populations within the study area.

7. Human Environment - Offshore

7.1 Commercial Fisheries

7.1.1 Existing environment

Western Europe, including the North Sea, falls into the International Council for the Exploration of the Seas (ICES) Sea Area IV. For the purpose of catch recording and reporting the area is further sub-divided by statistical rectangles. The ICES rectangles within the Project area are shown in **Figure 7.1**.

The fishing effort on and around the Dogger Bank is dominated by beam trawlers, which, target plaice, lemon sole, turbot & skates and rays, with Dover sole caught on a seasonal basis. Other types of activity include twin rigging for prawns, Danish seine netting for plaice, lemon sole, turbot & skates and rays,, gill netting for turbot and other flatfish, pelagic fishing, targeting herring or mackerel, or industrial fishing for sandeels. Demersal activity such as otter trawling occurs on the outer edges of the Dogger Bank into deeper water for species such as cod, haddock and whiting (Precision Marine Survey Limited (PMSL), 2010).

Without an appropriate field assessment, it is not possible to fully determine the extent and nature of the UK and European fleets that currently operate in and around the Dogger Bank, nor which fleet segment represents the majority effort component as there is always variability within the official dataset, particularly the overflight data. It is likely that a few vessels from some of the major fishing ports within the region (Fraserburgh, Peterhead, Grimsby, Scarborough and Whitby), as well as vessels from a number of European ports, are at some time during the year, fishing in and around the boundaries of the Dogger Bank. Other nations that are known to fish regularly within the Dogger Bank area include The Netherlands, Denmark, Sweden and Norway (Lee *et al*., 2009).

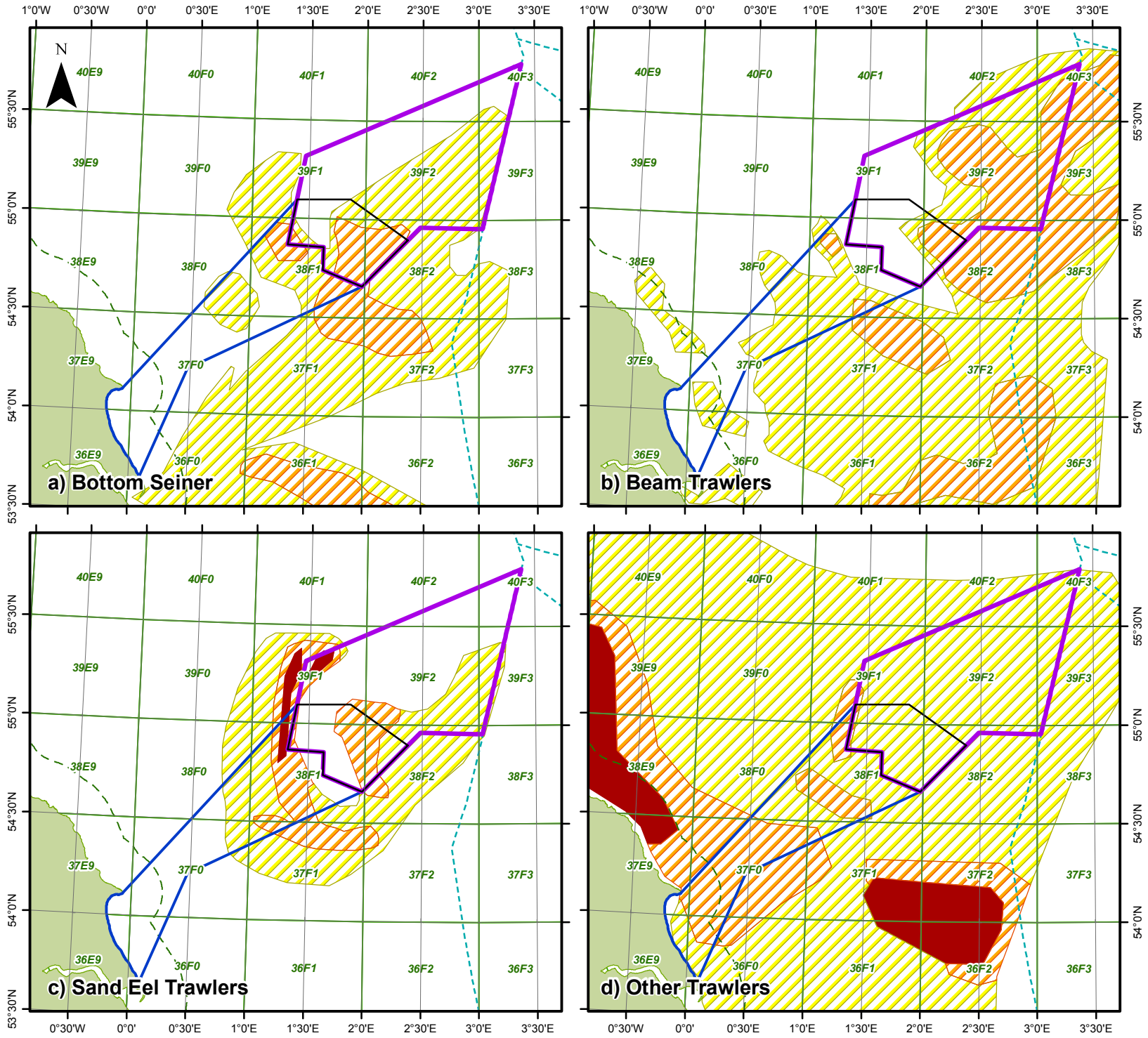
The general pattern of fishing activity within the Zone has been initially assessed by analysis of vessel monitoring system (VMS) and flight surveillance data from 2006 to 2008 (PMSL, 2010), which in particular indicates:

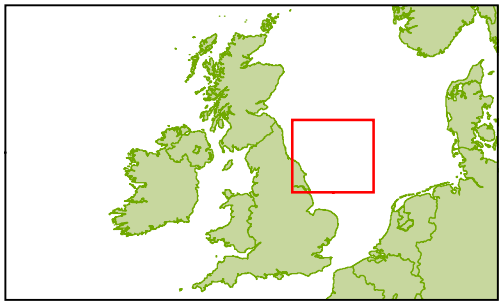
- UK beam trawling activity (mainly Dutch owned and operated) occurs throughout the year, although the western boundaries of the Zone appear to have a much less concentrated effort;
- UK demersal (bottom trawling/seining) trawling intensity is not as significant as beam trawling. Most of the activity is located in the eastern and southern part of the Zone (including the Tranche A area) with the western fringes showing the least activity;

- Non-UK demersal trawling included a significant Danish presence on the western fringes of the Zone (including the Tranche A area);
- There is a concentrated industrial fishery (predominantly Danish fleets) focused near the western boundary of the Zone, with lower levels of activity in the centre of the Zone (including the Tranche A area); and
- The Zone is not important for potting, scallop fishing, long lining or shrimp trawling and has limited use by pelagic fisheries.

Fishing vessel density data within the export cable corridor area, estimated based on 2006 satellite tracking data, and including both UK and non-UK vessels, indicates considerable variation in fishing vessel levels (**Figure 7.1a** and **b**). It should be noted that this data only covers vessels of 15m length and over. Smaller vessels, which are likely to be particularly active near to the shore, are not represented, but are monitored visually via Marine Management Organisation (MMO) surveillance.

The coastal waters in this area are known to support an important shellfishery. Annual landings values by ICES rectangle, averaged for the period 2000-2007, are some of the highest in the region (North Eastern Sea Fisheries Committee (NESFC), 2008). 90% of the landings from ICES rectangle 36F0, within the export cable corridor, are from potting vessels (mostly below 15m in length) and where lobster and crab are the principal species landed.





Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary
- ICES Rectangles

Fishing Vessel Density

- High Density
- Moderate Density
- Low Density

Sources: ICES Rectangles © DIFRES, 2009.
R3 Zone © TCE, 2010.

0 20 40 80 Kilometres
0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
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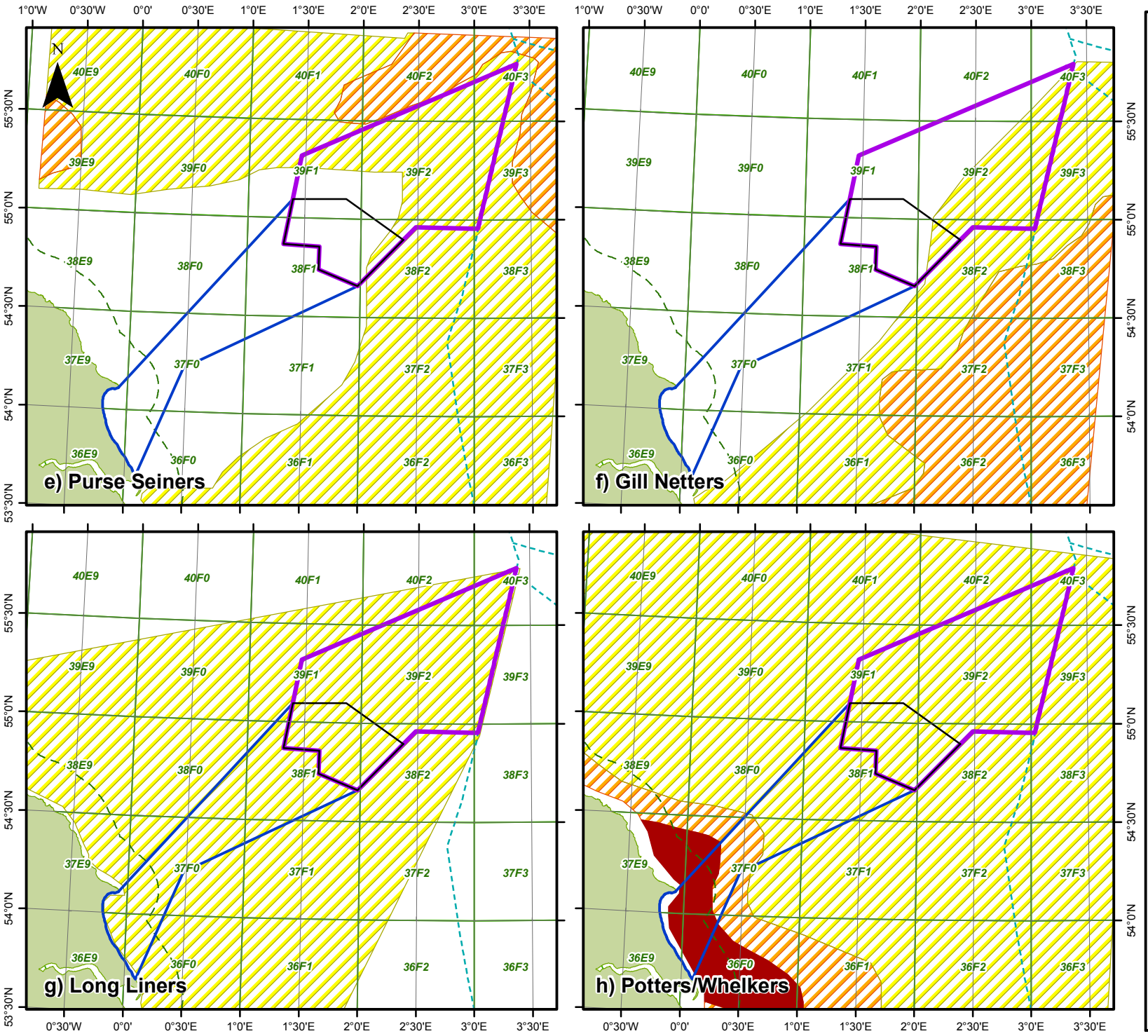

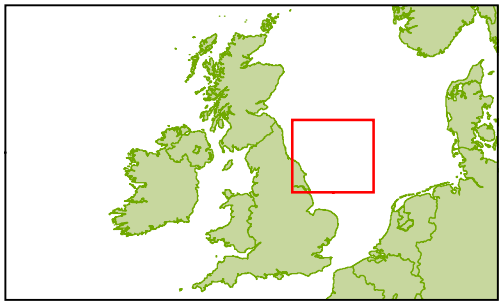

Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary
- ICES Rectangles

Fishing Vessel Density

- High Density
- Moderate Density
- Low Density

Sources: ICES Rectangles © DIFRES, 2009.
R3 Zone © TCE, 2010.

0 20 40 80 Kilometres
0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Commercial Fishing		
Figure No: Fig. 7.1b	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:3,000,000	
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7.1.2 Potential impacts

Potential impacts during construction

Displacement from established fishing grounds: During the construction phase Safety Zones of 500m are expected to be in place around construction vessels and installation activities, resulting in the short-term displacement of fishing effort.

Displacement of, or reduction in, fish and shellfish resource: Temporary displacement of sensitive species from the area of construction, as a result of underwater noise and increased activity, may have a knock on effect for vessels that will have to relocate to find target species. This is expected to be restricted spatially and temporally and, with appropriate liaison and co-operation, should not result in significant impact.

Loss or damage to gear: There may be increased potential for the loss of fishing gear as a result of the increased level of vessel activity associated with the construction of the wind farm and export cable corridor. Again, however, Forewind expects to be able to limit disruption to fisheries via the communication channels currently being developed as part of the pre-application process.

Navigational safety: Issues associated with navigational safety are covered in **Section 7.3, Shipping and Navigation**.

Potential impacts during operation

Displacement from established fishing grounds: Forewind may in the future be mindful to consider the requirement for operational safety zones. However this would be subject to consultation and approval with the relevant authorities and stakeholders.

Physical obstacles to permitted fishing gear: The presence of foundations and ancillary infrastructure may present an obstacle to fishing activity. Good site management will ensure that seabed obstacles as a result of the wind farm are minimised.

Increased pressure over diminished ground: As with construction, any activities that result in the diversion of fishing effort into neighbouring areas may result in an increase in the fishing intensity on the remaining, accessible areas of the Dogger Bank.

Displacement of, or reduction in, fish and shellfish resource: As is being reported from operational Round 1 and 2 projects, no significant or long term reduction in the fish and shellfish assemblage is anticipated as a result of the operation of the wind farm.

Refugia for fish species: Foundations and ancillary structures may act as refuge for certain fish species (Linley *et al.*, 2007). Furthermore, the displacement of certain types of fishing activity may have localised benefits for their target species within the wind farm.

Increased navigational risk and longer steaming distances: Vessel steaming times may be increased by navigational changes imposed by the physical presence of the wind farm and any safety Zones. The spacing of individual WTGs within the wind farm is likely to be maximised in order to optimise wind capture. As such, under suitable weather conditions it is likely that vessels will be able

to transit through the site. Issues associated with navigational safety are covered in **Section 7.3, Shipping and Navigation**

Potential impacts during decommissioning

Impacts arising during the decommissioning of the project are expected to be similar to those experienced during the construction phase. There is the potential for damage to fishing gear should any debris be left in situ following decommissioning.

Cumulative effects

Development of a 1.4GW project within Tranche A, other offshore wind farm development in both the Dogger Bank Zone (such as further projects within Tranche A if progressed along similar timescales) and the wider area (in particular the Hornsea and Norfolk Zones and Round 1 and 2 projects in The Wash and along the Yorkshire coast) and other uses and users of the sea in the area may have a cumulative impact on commercial fishing activity through incremental changes to the fishing grounds and/or resource. Consideration of these is a key part of the assessment process (especially with regard to transboundary considerations) and the approach to cumulative assessment is discussed in the following section.

7.1.3 Approach to EIA

A range of guidance relating to the assessment and management of potential impacts on commercial fisheries will be used by Forewind in undertaking the EIA. While a thorough identification of relevant guidance will be undertaken as part of the consultation process, the key guidance Forewind expects to use includes but is not limited to:

- Cefas (2004) Guidance note for Environmental Impact Assessment in respect of FEPA and CPA Requirements; and
- Blyth-Skyrme, R.E. (2010) Developing guidance on fisheries cumulative impact assessment for windfarm developers. Report for COWRIE Ltd, London. 7 pp.

Forewind firmly believes that in order to facilitate the co-existence of offshore development (in the form of renewable energy) and commercial fishing, effective liaison with the fishing industry is of significant importance. As such, Forewind has appointed Fisheries Liaison Coordinators (FLC) to develop a strategy for, and support consultation with the national and international fisheries industry. The process of consultation has already commenced and will continue throughout the EIA process. Forewind acknowledges that there is currently no single data set or model which can accurately quantify the precise levels or values of all categories of commercial fishing within discrete sea areas such as Round 3 Zones. As a result, data and information will need to be acquired from a range of sources including national and international fisheries bodies, local fishermen's associations etc.

Appropriate studies will be agreed as part of the overall fisheries strategy, but are expected to be undertaken in accordance with Cefas guidance (2004) and will be designed to:

- Provide evidence of the major fish and shellfish species in the area, stating which fisheries target these species and during which times of the year (supplemented with knowledge gained

from Cefas and the Marine Management Organisation (MMO), ICES and local sea fisheries committees on catch per unit effort (CPUE) data, operating practices, gear configurations and fishing grounds);

- Assess the potential impact to commercial fisheries;
- Evaluate the significance of this impact;
- Suggest effective mitigation measures, where appropriate; and
- Incorporate cumulative impacts, by examining the implications of the proposed development in conjunction with other wind farm developments and other human activities.

In line with recommended guidance, the EIA will identify the major commercial fish and shellfish species in the area, describing the fisheries, species and their seasonality. A wide range of sources including, but not limited to official UK landings and fishing effort data as well as international fishing information will be obtained where possible for this purpose.

Specific studies and information associated with other offshore wind farm sites will also be used to support the desk-based assessment, along with information collected through consultation with relevant authorities, including sea fisheries committees (or IFCAs), National Federations, regional and local associations, non affiliated fishermen, Fishery Producers Organisations (FPOs) and relevant fisheries management organisations. This baseline characterisation will be supplemented with information on fishing vessel activity obtained from the Automatic Identification Systems (AIS) and non-AIS 28 day shipping survey (see **Section 7.3**).

The implications of the wind farm and export cabling construction, operation and decommissioning to the fishing industry and any impacts will also be assessed and discussed, drawing on knowledge and studies from existing wind farms.

Key data collection/study required

Activity	Purpose
Observer trips and consultation.	Undertaken as part of the overall fisheries strategy, Forewind will work with fishermen to identify key grounds and seasons in order to aid the overall characterisation of commercial fishing activity and project location.
28 day vessel survey (AIS and non-AIS) data.	To help characterise the fishing vessel activity baseline of the study area.

7.2 Seascape and Visual Character

7.2.1 Existing environment

Tranche A of the Dogger Bank Zone is located approximately 125km from the Holderness coastline. Due to the curvature of the earth no element of the development will be visible.

The initial export cable corridor extends out from the Holderness Coastline to the Dogger Bank. This stretch of coastline forms part of the Holderness Landscape Character Area (Area 40, Countryside Character Initiative) and contains four Regional Seascape Units (RSUs): The Holderness Peninsula, Spurn Head and Sunk Island, Humber Estuary South Shore and Bridlington Bay. The areas range from heritage coastline considered of high sensitivity to development, to developed coast with a low sensitivity to development. The coastline is not designated as an Area of Outstanding Natural Beauty (AONB), the nearest is located approximately 18km inland, an area called the Lincolnshire Wolds.

The central and southern North Sea are key resources for the UK oil and gas industry, as such a number of platforms and drilling rigs are located in the wider area (**Section 7.6**). There are also other offshore wind farm sites along the Holderness Coast (Flamborough to Spurn Point), including Westermost Rough and Humber Gateway (both Round 2) and, further offshore, Hornsea (Round 3).

Recreational boating is popular around the coastline, and cruising routes pass through Tranche A and the Dogger Bank Zone on route to mainland Europe. Commercial shipping lanes and passenger vessels also pass through the Zone.

7.2.2 Potential impacts

Potential impacts during construction

Temporary change to landscape: The presence of marine plant involved in trenching and cable laying activities, as well as any lighting during the construction period, may cause temporary changes to the Holderness landscape and seascape. However any effect is expected to be limited, due to the small scale of the works and short time periods involved.

Temporary change to the Dogger Bank seascape: The presence of marine plant involved in construction activities at the wind farm site, as well as any lighting during the construction period, may cause temporary changes to the Dogger Bank offshore seascape. However any effect will be limited due to the small number of visual receptors in the area (recreational and commercial shipping).

Potential impacts during operation

Change to the Dogger Bank seascape: The presence of operational wind farm and the associated structures may cause changes to the Dogger Bank offshore seascape. However, any effect will be limited due to the small number of visual receptors present in the area (recreational and commercial shipping).

Cumulative effects

Change to the Dogger Bank seascape: There is the potential for cumulative effects on the Dogger Bank seascape as a result of the operation of the wind farm, oil and gas operations and potential development within the Round 3 Hornsea Zone. Any effects are likely to be limited due to the spatial separation between the site and other users.

7.2.3 Approach to EIA

Given that the proposed development, with the exception of the cable route will be located offshore and beyond the limit of visual acuity, it is assumed that with some explanation the seascape and visual impacts on land based receptors can be scoped out. Given the limited number of receptors and receptor types at sea, It is proposed that a reduced scale of Seascape and Visual Impact Assessment (SVIA) be undertaken, although it is not anticipated that photomontages or wireframes will be required.

This approach will be agreed in consultation with the relevant stakeholders including Natural England, the JNCC and East Riding of Yorkshire Council. Any assessment will take due consideration of the "Guidance on the assessment of the impact of offshore wind farms: seascape and visual impact report" DTI (2005a), the Seascape and Character Assessment Guidance to be drafted by Natural England (if available at the time of the assessment) and other relevant documentation, in particular Norman *et al*. (2007) for guidance on cumulative impact assessment, where appropriate.

Due to the short term impacts associated with the landscape impacts of the cable installation, any assessment will be limited, but undertaken in consultation with East Riding of Yorkshire Council, particularly regarding any mitigation measures that may be required.

7.3 Shipping and Navigation

7.3.1 Existing environment

Tranche A Area

Commercial shipping density across the Dogger Bank Zone is generally low. However, there are shipping lanes and cruising routes that transit the Zone. Vessels include merchant shipping, fishing and military vessels as well as marine aggregate dredgers (see **Figure 7.2**). Recreational shipping activity is discussed in **Section 7.7**.

There are no International Maritime Organization (IMO) routeing measures or offshore installations within 10nm of the Zone. Routine type vessel tracks recorded during a 28 day survey within 10nm of the wider Dogger Bank Zone in April-May 2010 were dominated by fishing vessels (55%), cargo ships (28%) and tankers (10%) (Forewind, 2010). There were 14 ships per day on average passing within the Dogger Bank Zone boundary.

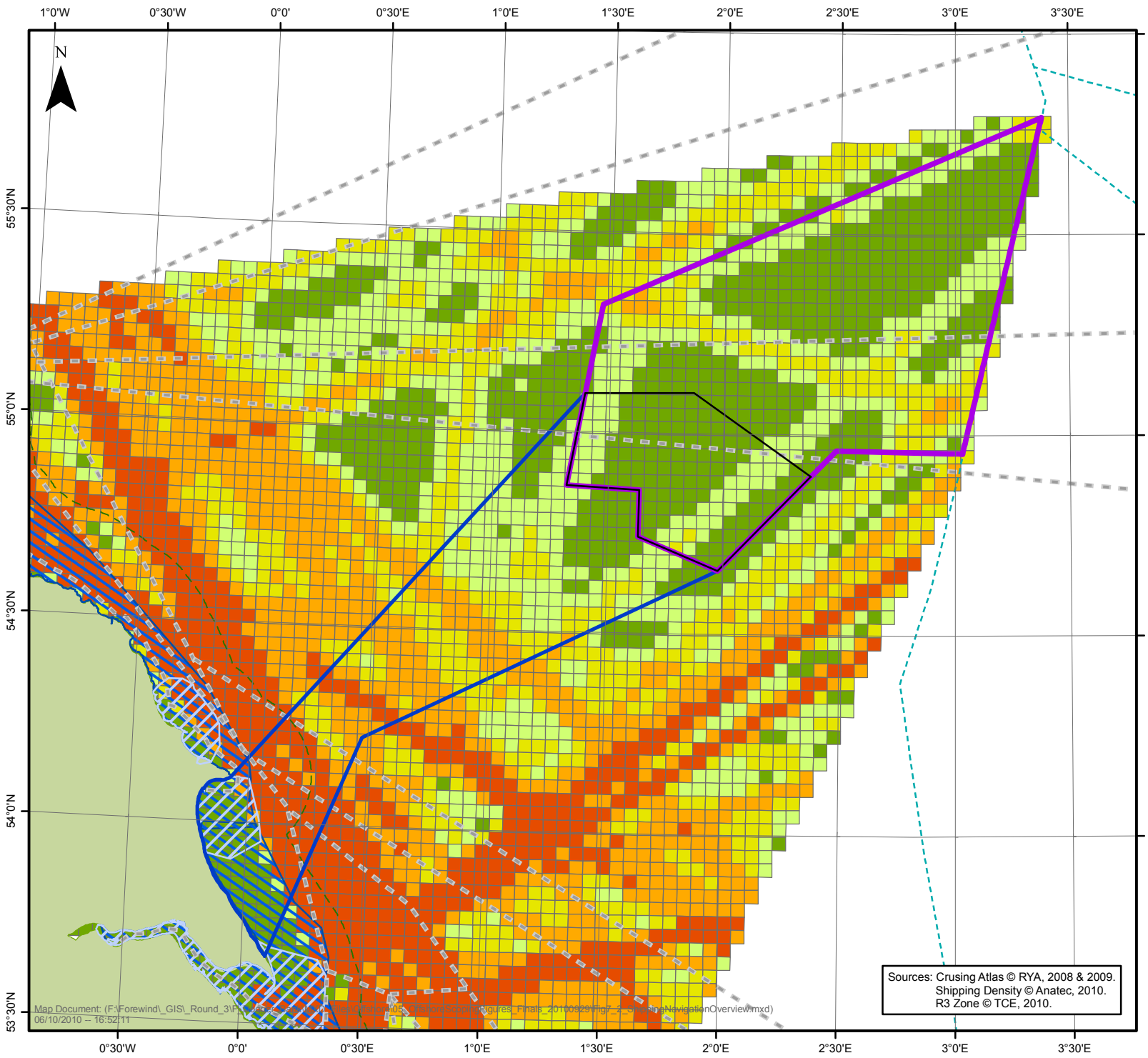
Recreational vessel activity at the Dogger Bank Zone has been reviewed based on information published by the Royal Yachting Association (RYA) and provided by the Cruising Association (CA), with detailed provided in **Figure 7.2**. There is one medium-use route between Newcastle-Esbjerg

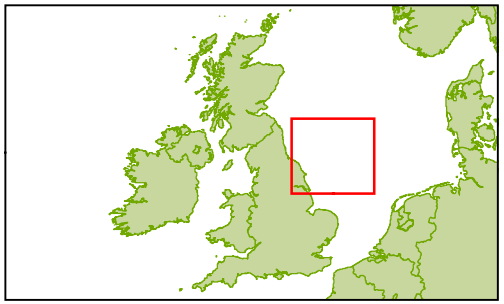
passing through Tranche A. Medium Recreational Routes are defined as “popular routes on which some recreational craft will be seen at most times during summer daylight hours” (RYA, 2009).

A review of maritime incidents that have occurred in the vicinity of the Dogger Bank Zone in recent years provides a general indication that the area of the development is currently a low risk area in terms of maritime incidents.

Export Cable Corridor

The main offshore navigational activity identified within the export cable corridor is presented in **Figure 7.2**. The highest shipping density areas are off the east coast, where traffic is transiting between ports within the area, e.g., The Wash, Humber, Tees, as well as beyond the area, to the Forth in the north and the Thames in the south. Recreational RYA cruising routes pass through the export cable corridor (following the coastline to approximately 50km offshore) and there are designated RYA sailing and racing areas along the coastline (**Figure 7.2**).





Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

RYA Cruising Atlas

- RYA Crusing Route
- RYA Racing Area
- RYA Sailing Area

Shipping Density

- Very High
- High
- Medium
- Low
- Very Low

0 10 20 40 Kilometres

0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Shipping and Navigation		
Figure No: Fig. 7.2	Paper Size: A4	Rev: 3
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7.3.2 Potential impacts

Potential impacts during construction

Temporary short term obstructions to navigation: There will be a temporary increase in vessel movements in the area during the construction phase (both within Tranche A and along the export cable corridor), which has the potential to effect existing activity.

Collision risk due to increases in traffic flow and installation of new structures: Any restrictions on vessel routes that will result in the compression of vessel traffic because of construction activities could result in an increased chance of ship-to-ship collisions. There may also be an increased risk of vessels striking a fixed object, such as foundations, jack-up vessels or other wind farm components.

Potential impacts during operation

'Squeeze' of sea area and interference with established navigation routes: This and neighbouring projects in the area may compress established navigation routes, increasing the densities of vessels and collision risk.

Changes in collision risks due to changes in traffic flow: Interaction between ship-borne radar and the wind farm may increase the risk of collision.

Impacts due to the effects of buried cables: Buried cables may impact on activities such as anchoring, dredging and bottom trawling.

Potential impacts during decommissioning

There may be an incremental reduction of impact as the wind farm components are removed from the site, otherwise impacts during decommissioning are likely to be similar to those described above.

Cumulative effects

The main areas of concern with regard to the potential for cumulative impacts are considered to relate to the increased 'squeeze' of the sea area, increased transit times as a result of avoidance of wind farm areas and increased ship-to-ship collision risk as a result of the former two aspects. However, through continued consultation, following industry guidance and the development of effective mitigation measures, potentially significant impacts on navigational interests should be avoided.

7.3.3 Approach to EIA

A shipping and navigation review of the wider Dogger Bank Zone and export cable corridor has been conducted by Anatec, including a 28 day navigation survey to record AIS and non-AIS vessels (i.e. those of less than 300gt) in the Zone. Further to this, a Navigation Assessment (NA) and a Navigation Risk Assessment (NRA) will be undertaken to assess the construction, operational, decommissioning and cumulative impacts of the first project and export route, as well as to inform the orientation of the site boundary, design layout and adjustment to existing navigation channel marker buoys. The scope of the NA and NRA will be discussed with the Maritime and Coastguard Agency (MCA) and other national and international stakeholders (transboundary international issues will be part of the scope). These discussions will include the need for, or otherwise, of any Tranche/project specific survey data.

The NA will include a baseline review of commercial shipping and navigation, commercial fishing and recreational activities in the study area, specifically determining the proximity of the project site to shipping routes, navigation channels/separation schemes, port entrances and marking and lighting of the site and will include a radar survey to collect data on smaller vessels not covered by the AIS methodology employed by the main study.

The NRA will include a Formal Safety Assessment, in accordance with IMO requirements and will be carried out in accordance with the following guidance:

- MCA Guidance Note 371 on UK navigational practice, safety and emergency response issues (MCA 2008a);
- MCA Guidance Note 372 on guidance to mariners operating in the vicinity of UK Offshore Renewable Energy Installations (OREI) (MCA 2008b);
- MCA Guidance on Assessment of the Impact of Offshore Wind Farms (DTI, 2005b); and
- International Association of Lighthouse Authorities Recommendation O-139 (IALA 2008).

In accordance with consultation feedback from the MCA, Forewind will ensure that the ES supplies detail on the possible impacts on navigational interests for both commercial and recreational craft including:

- Collision risk;
- Navigational safety;
- Visual intrusion and noise;
- Risk management and emergency response;
- Marking and lighting of site and information to mariners;
- Effect on small craft navigation and communication equipment;
- The risk to drifting recreational craft in adverse weather and/or tidal conditions; and
- The likely squeeze of small craft into the routes of larger commercial vessels.

Key data collection/study required

Activity	Purpose
Ongoing navigation survey, using visual and AIS observation, as part of the geophysical survey programme for the Tranche A area.	To provide additional information on shipping activity within the study area.
A Navigation Assessment including site surveys and a Navigation Risk Assessment.	To inform the ES of the baseline shipping environment and the potential impacts on / from the proposed development.

7.4 Marine and Coastal Archaeology and Cultural Heritage

7.4.1 Existing environment

The project is within an area of potentially high prehistoric archaeological significance within which archaeological and palaeoenvironmental evidence related to human occupation of the UK may be preserved. A steady stream of pre-Devensian animal fossils and hominin artefacts have been recovered from the Dogger Bank as a result of seabed activities for the last 200 years (Coles, 1998; in Wessex Archaeology, 2009). The area is part of the wider prehistoric landscape of the southern North Sea which at a number of times in the past has been exposed as dry land due to sea level falls driven by climate change. The buried sediments are, therefore, likely to contain not only direct archaeological evidence of the human occupation of the area during such periods, but also palaeoenvironmental data which can be used to develop an understanding of the wider natural environment within which early humans will have lived.

The coastline and adjacent offshore area (including the export cable corridor and landfall) have changed significantly since the prehistoric period and studies suggest that the coastline may have receded by at least 6km since the Bronze Age, reflecting the intense levels of erosion along the Holderness coast (Humber Field Archaeology, 2008). However, this area could also have been exposed as dry land in the past and the potential for submerged paleolandscapes should not be disregarded. The Holderness coast has undergone significant retreat, most notably from the thirteenth century to sixteenth century (Fulford *et al*, 1997). Therefore, there is potential for lost settlements to exist off this coastline within the export cable corridor. It is also of note that there is high potential for wetland archaeological sites on the foreshore and under the coastal cliffs in the study area (Maritime Archaeology, 2009).

More recently (i.e. since the last mid-Holocene marine transgression), all human activity in the study area has been maritime in nature, and will be represented in the archaeological record by shipwrecks and aircraft crash sites. Records of known and located wrecks are available; although it is likely that as yet unknown shipwrecks also lie within the area (this includes the export cable corridor). Chartered wrecks and obstructions in the Project area are shown in **Figure 7.3**.

There are three known wrecks in the UKHO Wreck Index in the Tranche A area. In the export cable corridor there are many more (429), notably concentrated along the coastline and particularly at and around Flamborough Head. There are no known aircraft wrecks in the Project area.

7.4.2 Potential impacts

Potential impacts during construction

Direct physical disturbance of features: The installation of the foundations for the WTGs, scour protection, offshore substation(s), meteorological mast(s), cable installation, anchoring and jack-up activities all have the potential to cause direct physical disturbance and damage to surficial and subsurface archaeological features of interest, both known and, as yet, undiscovered. However, such impacts are limited in extent to the direct footprint of the works.

Indirect disturbance of features: Indirect impacts beyond the immediate physical footprint of the development may occur as a result of changes to the hydrodynamic regime. These impacts manifest as a result of changes to sediment transport, erosion patterns and currents. Indirect impacts may be positive (features buried by increased sedimentation are afforded increased protection) or negative (features are exposed due to erosion) (Wessex Archaeology, 2009).

Potential impacts during operation

Direct impacts during operation of the project will be largely confined to maintenance activities that result in interaction with the seabed, such as anchoring. There is also the potential for ongoing indirect impacts to occur from changes to the hydrodynamic regime.

Potential impacts during decommissioning

Works during the decommissioning phase will be focussed on the same areas discussed under construction and additional impact is unlikely.

Cumulative effects

Cumulative impacts could arise if development activities and other users of the sea affect the same archaeological resources, such as palaeo-landscapes. Given the localised nature of impacts, the likelihood of significant cumulative impacts is considered to be low.

On a wider strategic scale, while the potential for impacts on the archaeological resource will be present at any offshore wind farm development, Round 3 offers an unprecedented opportunity for study of the seabed and identification of previously unknown features of archaeological and cultural heritage interest. Forewind will work with its archaeological advisors and stakeholders to ensure that data collected is subject to archaeological assessment and that the results of this assessment are made available once used in the EIA process.

7.4.3 Approach to EIA

Archaeological surveys and assessments will be undertaken in a staged manner in close consultation with English Heritage and the Joint Nautical Archaeological Policy Committee, and in line with the latest guidance on the historic environment including: that published by COWRIE (Wessex Archaeology, 2007; Emu, 2010b), and due to be published in the near future (a project to produce

guidance for the optimisation of geotechnical survey to support archaeological interpretation and English Heritage's Action Plan for the implementation of the European Landscape Convention[6].

An archaeological desk-based assessment (ADBA) will be carried out by a specialist archaeological contractor. The ADBA will establish a Coastal Study Area (CSA) and a Marine Study Area (MSA) for assessment purposes. The CSA will consist of a 1km buffer around the cable landfall and onshore transition pit. The MSA will consist of two areas: a 1km buffer Zone around the offshore wind farm site and a 1km buffer Zone around the export cable route. The ADBA will build upon the data collected by Forewind to inform the overall characterisation of the Zone, as part of the ZAP process.

Identification and assessment of known and potential features of archaeological interest will be informed through interpretation of geophysical survey data (namely bathymetry and side scan sonar data to identify seabed features, such as wrecks; magnetometry data to identify magnetic anomalies and sub-bottom profile data to identify palaeo-features). High resolution geophysical surveys of Tranche A are well advanced as of autumn 2010, with an identical survey of the export cable corridor to follow in early 2011. The results of the interpretation will dictate the need for further investigation/mitigation measures, should avoidance of features not be possible.

Assessment of impacts on historic seascape character will be undertaken in consultation with English Heritage and in accordance with the intentions of the Action Plan for implementation of the European Landscape Convention.

Further to this, a borehole campaign is planned for autumn 2010 and an archaeological Written Scheme of Investigation will be developed as part of the methodology. The boreholes are being taken in order to inform engineering design and understanding of subsurface geology. However, the samples will be made available to the archaeologists for assessment in accordance with the latest guidance from COWRIE (Emu, 2010b).

The approach to addressing potential cumulative effects will follow EIA cumulative impact assessment guidance as set out by COWRIE (COWRIE, 2008). The scale of eventual development constrains the ability to adequately account for the whole development process at the time of the first project application. The current project will consider cumulative effects, within the project, with any other projects within Tranche A or the wider Zone that progress along a similar timescale to Dogger Bank Project One (in the context of the Dogger Bank) as well as with other projects in the planning system (all offshore wind Rounds and other uses and users of the sea). It is acknowledged that all subsequent wind projects in the Zone will take the impact of preceding projects into account at the time of assessment.

6 http://www.english-heritage.org.uk/professional/research/landscapes-and-areas/characterisation/european-landscape-convention/

Key data collection/study required

Activity	Purpose
Geophysical survey and geotechnical investigations including side scan sonar, magnetometer, sub-bottom profiler and boreholes.	To identify features of known and/or potential archaeological significance in the MSA.
Further archaeological investigation.	Additional surveys such as diving and drop down video/ROV work may be required if features are present that cannot be avoided and further information is necessary.

7.5 Military Activities and Civil Aviation

7.5.1 Existing environment

The Ministry of Defence (MoD) has rights to practice aerial, surface and submarine operations, which occur within defined Practice and Exercise Areas (PEXA), while the Civil Aviation Authority (CAA) require the safe passage of aircraft to and from airports and aerodromes. Both operate Communications, Navigation and Surveillance (CNS) infrastructure (e.g. radar and technical sites) to monitor airspace. Wind turbine generators (WTGs) have the potential to affect military activities and civil aviation (fixed-wing and helicopters), either through their physical dimensions limiting access and affecting safeguarding or safe passage, or through their effects on CNS infrastructure by electromagnetic interference.

MoD Practice and Exercise Areas

Tranche A is partially located in an area used by the MoD as a PEXA (**Figure 7.4**):

- RAF Danger Area D323B used for air combat training including high energy manoeuvres; and
- Flamborough Head Submarine Exercise Area used by the Navy for surface and sub-surface exercises.

Both areas are relatively large, such that the amount of overlap with the Tranche A project area is small relative to their overall extent (6% and 4% respectively). A number of other PEXAs are outside the Tranche A area but inside the wider Dogger Bank Offshore Zone Development Envelope (ZDE) (i.e. within the footprint of export cable route) (**Figure 7.4**). These areas are used for a variety of exercises by the RAF, Navy and Army.

Notably, the eastern limit of the Staxton danger area (D412), used for air to air firing, is 2km to the west of the Tranche A area. At the coastline, air force danger areas at Cowden (D306) and Donna Nook (D307) are outlined for a range of air to surface firing and bombing activities, as well as for the demolition of unexploded ordnance (**Figure 7.4**). An army PEXA at Rowlston (X5309) is used for surface firing exercises.

Civil aviation activities

Civil aviation aerodromes and air traffic control Zones occur along the coast within the Dogger Bank ZDE. However, Tranche A is outside the statutory notification radius of 30km of these locations and, as such, it is considered highly unlikely that objections to the development will be raised by NATS or CAA.

Offshore helicopter main routes and search and rescue

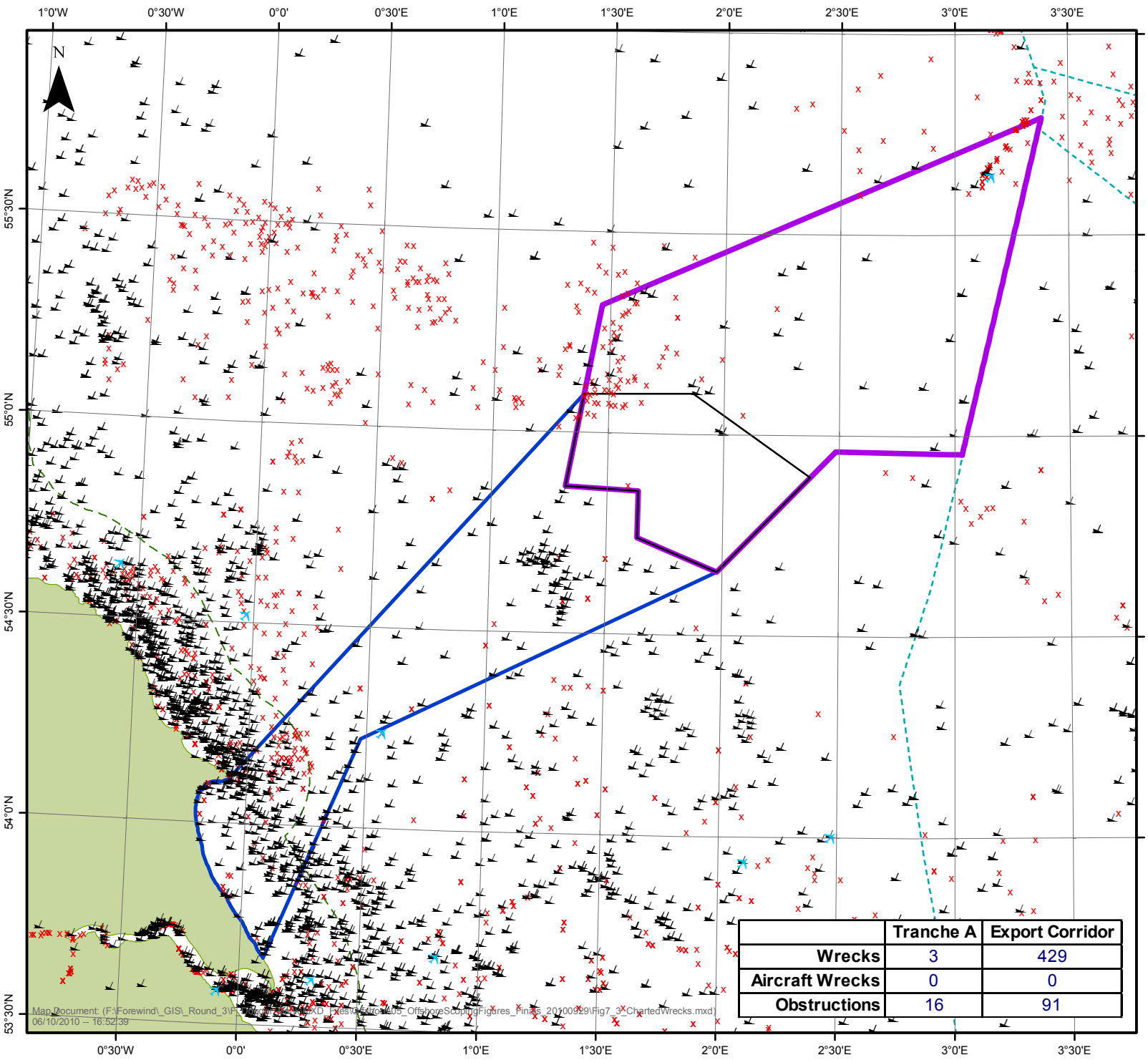
There are no Helicopter Main Routes (HMR) within the Tranche A area. It is noted that this situation might change, subject to future oil and gas exploration and development (OGED) activity in the area. HM Coastguard and MoD helicopter based Search and Rescue (SAR) operate from RAF Boulmer and RAF Leconfield, with an operating range that includes the Tranche A area.

Civil and military CNS

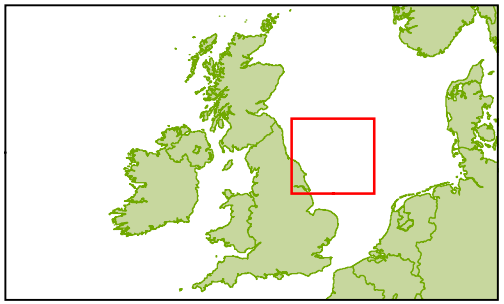
Interference Zones associated with civil and military CNS tend to be associated with, and radiate out from, the coast and will not therefore overlap with the offshore Tranche A area.

Meteorological radar

The Met Office radar network currently consists of 16 sites, of which two are within the Dogger Bank ZDE. However, given the considerable distance offshore, no adverse impact on Met Office radar is anticipated. Forewind will consult with the Met Office to ensure that there are no concerns in relation to the proposed development.



	Tranche A	Export Corridor
Wrecks	3	429
Aircraft Wrecks	0	0
Obstructions	16	91



Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

Wrecks and Obstructions

- Wreck
- Aircraft Wreck
- Obstruction

Sources: Wrecks and Obstructions © SeaZone, 2010.
R3 Zone © TCE, 2010.

0 10 20 40 Kilometres
0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT

Dogger Bank Project 1

Figure Title:

Wrecks and Obstructions

Figure No: Fig. 7.3	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:1,500,000	
Drawn On: 29/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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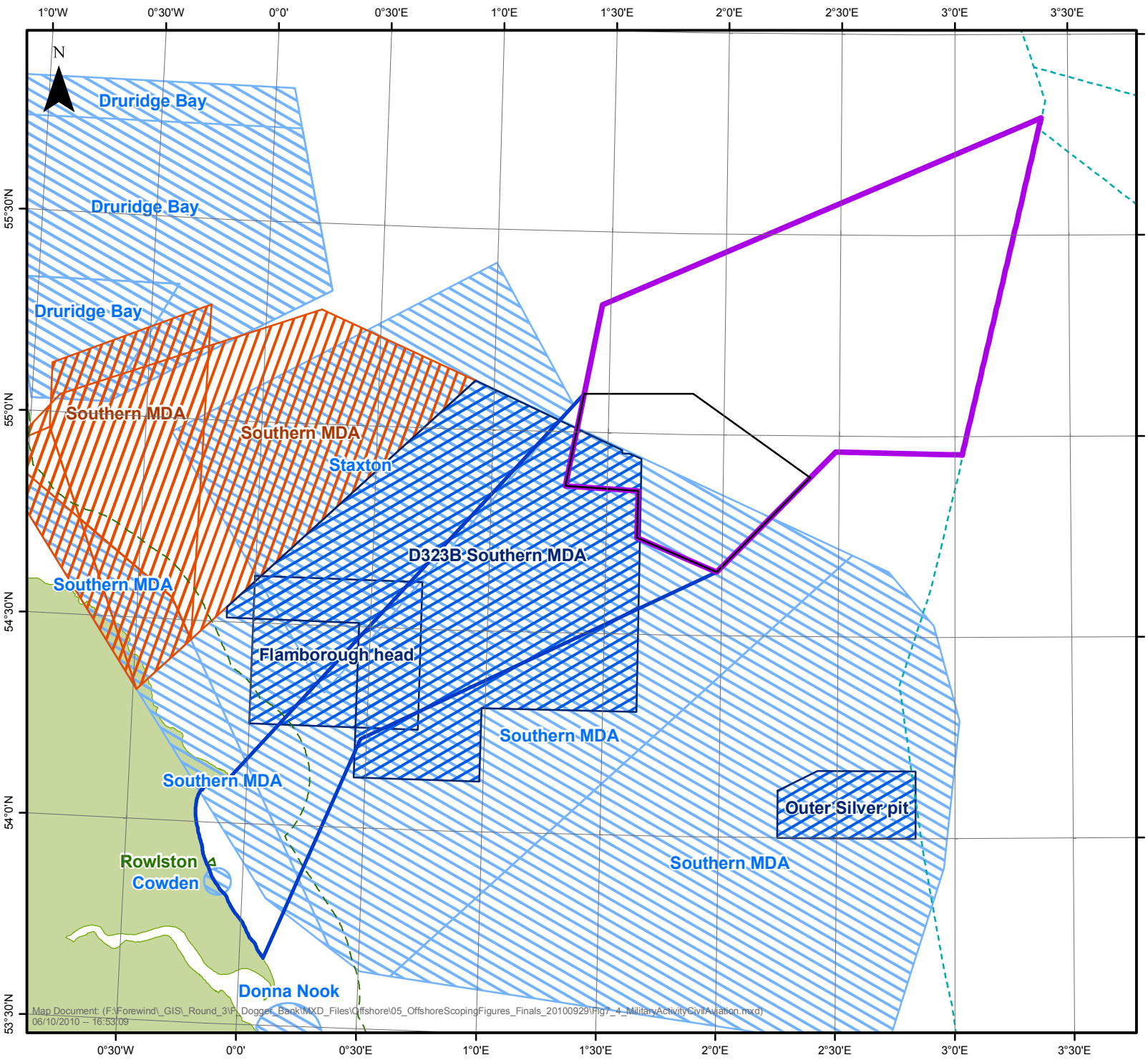
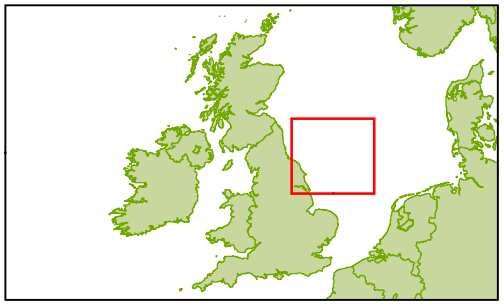




Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

PEXA and Flying Areas

- CAA
- Air Force
- Navy
- Army

Sources: PEXA and Flying Areas © SeaZone, 2010.
R3 Zone © TCE, 2010.

0 10 20 40 Kilometres
0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT	
Dogger Bank Project 1	
Figure Title:	
Military Activity and Civil Aviation	
Figure No: Fig. 7.4	Paper Size: A4 Rev: 3
Drawn By: DJM	Scale: 1:1,500,000
Drawn On: 29/09/10	Projection: UTM31N
Checked By: PTG	Datum: WGS1984

FOREWIND

7.5.2 Potential impacts

Potential impacts during construction

Interference and/or obstruction to MoD activity: Construction activities that overlap with PEXAs have the potential to impact on MoD activity. However, given the nature of the PEXA that overlaps with Tranche A, significant impacts are considered unlikely. Forewind will work alongside The Crown Estate in order to ensure that effective consultation with the MoD is undertaken and that any concerns in relation to the development of Tranche A are identified and addressed.

Potential impacts during operation

Disruption to military radar: Such effects may occur where WTGs are present within radar coverage areas. Consultation with the MoD will take place throughout the EIA process to ensure that any potential impacts on radar and/or CNS systems are identified and assessed.

Disruption to civil aviation aerodromes and air traffic control Zones: Tranche A is well outwith statutory notification areas for civil aerodromes and is not within line of sight of ATC radar. As such, Forewind does not anticipate the potential for significant impacts. The CAA and NATS will be consulted, as a matter of course, as part of this Scoping phase and, where necessary, throughout the EIA process in order to confirm that there is no issue. Forewind seeks to scope this issue out of the EIA, subsequent to consultation feedback.

Interference with aviation: Helicopters travelling to oil and gas infrastructure, surveillance aircraft and search and rescue helicopters could be forced to higher altitude in order to maintain safe vertical separation from wind turbines. Given the lack of HMR's or platforms nearby the only collision risk will be through SAR activities, which will be mitigated through adherence to industry best practice.

Cumulative effects

No significant cumulative impacts are anticipated. However, further consultation will be required in order to confirm this.

Transboundary impacts

It is acknowledged that the airspace in the Project area is used by North Atlantic Treaty Organisation (NATO) aircraft and that NATO has an interest in the various ground-based radar systems that form the Recognised Air Picture (RAP) of UK and NATO airspace. It is acknowledged that the, albeit unlikely, potential for transboundary impacts on NATO activity will need to be considered as part of the assessment process.

7.5.3 Approach to EIA

A technical desk-based assessment (DBA) will be undertaken to establish the baseline conditions and assess the impacts (including cumulative and any transboundary effects) of the project on all military and civil aviation matters. The DBA will include, though is not limited to, assessing issues for the Royal Navy (surface and air), the type of airspace and associated air traffic control in the area, the technical and physical safeguarding of military airfields and nearby civil aerodromes, and initial indicative radar line of sight projections from any radar in the area, MoD Meteorological radars,

Danger Areas and areas of intense air activity. Submission of the standard wind farm developer's application pro-forma will be made to the CAA, NATS and MoD in order to aid assessment.

Whilst no significant impacts are anticipated, Forewind will continue to commit to the consultation process established by The Crown Estate (as part of their enabling actions process) and that any issues arising will be addressed via this consultation.

7.6 Other Human Activities

7.6.1 Existing environment

Underground coal gasification and carbon capture & storage

A licence for underground coal gasification (UCG) has been granted within the Humber Estuary (Humberside Coastal Area) (**Figure 7.5a**). Additionally, there is a further area under application to the north (Holderness Offshore Area) and to the south (South Humber Offshore Area). Although there are no active sites for carbon capture and storage (CCS) in the area, there is the potential for future development associated with nearby depleted oil and gas fields and UCG schemes.

Telecommunications and power cables

The VSNL North Europe and UK-Germany 6 telecommunications cables pass through the Tranche A area and continue through the wider Dogger Bank Zone en route to landfall at Filey on the Yorkshire Coast. The out of service UK-Denmark 4 cable runs north east from Scarborough, also passing through the Tranche A area. Other telecommunications cables pass through the Zone but do not approach the Tranche A area or intersect the likely export cable route for the project. There are no active power cable interconnectors within the Dogger Bank Zone.

Oil and gas activity

There are no known oil, gas or condensate fields within the Tranche A area. Five exploration wells have been drilled but have either been plugged and abandoned (four wells) or released as a dry hole (one well). There are blocks licensed for oil and gas exploration and development (OGED) in the southern part of the Tranche A area (Promote Production Licences) and numerous other licensed areas and gas fields to the south and within the export cable corridor (**Figure 7.5a**).

The latter areas host a variety of surface and subsurface infrastructure (**Figure 7.5a**) and are likely to be the subject of ongoing seismic survey as part of the 26th and ongoing licensing round.

Shell UK's Shearwater Elgin Area Line (SEAL) runs through the western portion of the Tranche A area (**Figure 7.5a**). The 34 inch diameter line transports gas from the Shearwater and Elgin Franklin platforms to the Bacton Gas Terminal on the Norfolk coast. It was commissioned in 2000 and has a total length of 474km. The Langeled gas pipeline exports natural gas from Nyhamna in Norway to the Easington terminal in Yorkshire. The export cable route is likely to cross this pipeline (**Figure 7.5a**). There are also numerous pipelines at and along the coastline. Most are wastewater outfalls and

sewers associated with water companies. Some are associated with underground gas storage facilities

Marine aggregate industry

The majority of marine aggregate industry activity is focussed on an area east of the Humber estuary and northeast of The Wash ('the Humber Region'), avoiding interaction with both the Tranche A area and the export cable route. Currently, there are no production licenses within the Dogger Bank Zone. There is one area under application approximately 600m north west of the Tranche A area (466/1) for which CEMEX UK Marine Ltd is pursuing a production license for an 11.13km^2 site. In general terms, the sand and gravel resource on the north and west margins of the Dogger Bank elevation is of higher value compared to sediments on the bank itself and therefore this area is more likely to be prospected in the future. The next closest area (again under application) is more than 20km southwest of the Tranche A area (Prospecting Area 485) (**Figure 7.5b**).

Marine disposal activity

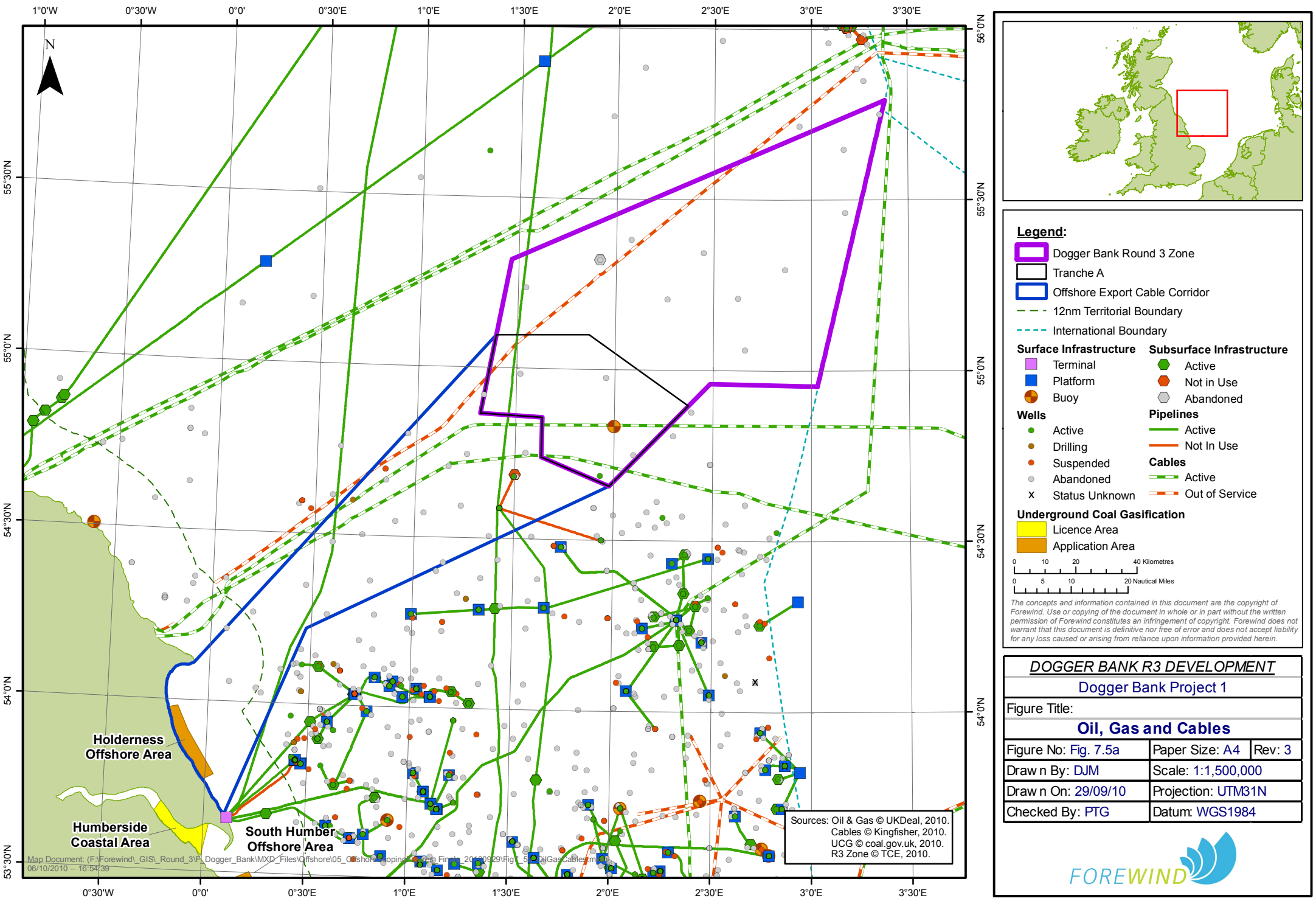
There are no marine disposal grounds within or adjacent to the Tranche A area, which tend to be concentrated instead within 12nm of the coast, providing easy access for the disposal of waste from coastal dredging operations (**Figure 7.5b**).

Other wind farm developments

The Round 3 Hornsea Zone is approximately 60km south of the Tranche A area. The indicative export cable corridor has been routed to avoid this Zone, passing around its north-west corner (**Figure 7.6**). There is a Round 2 offshore wind farm site within the export cable corridor (Westermost Rough) and one more just to the south off the coast at Spurn Head (Humber Gateway). All of the Round 2 sites are in the planning or pre-planning stages.

Other renewable energy developments

The Pulse tidal energy project is the only other known renewable energy installation in the vicinity. The 100 kW 'Pulse-Stream 100' test site, approximately 1km off the south bank of the Humber near Immingham, began generating electricity in May 2009. The power is exported to Millennium Chemicals, a large plant on the south bank of the estuary.



Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary
- International Boundary

Surface Infrastructure
- Terminal
- Platform
- Buoy

Subsurface Infrastructure
- Active
- Not in Use
- Abandoned

Wells
- Active
- Drilling
- Suspended
- Abandoned
- Status Unknown

Pipelines
- Active
- Not In Use

Cables
- Active
- Out of Service

Underground Coal Gasification
- Licence Area
- Application Area

0 10 20 40 Kilometres
0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Oil, Gas and Cables		
Figure No: Fig. 7.5a	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:1,500,000	
Drawn On: 29/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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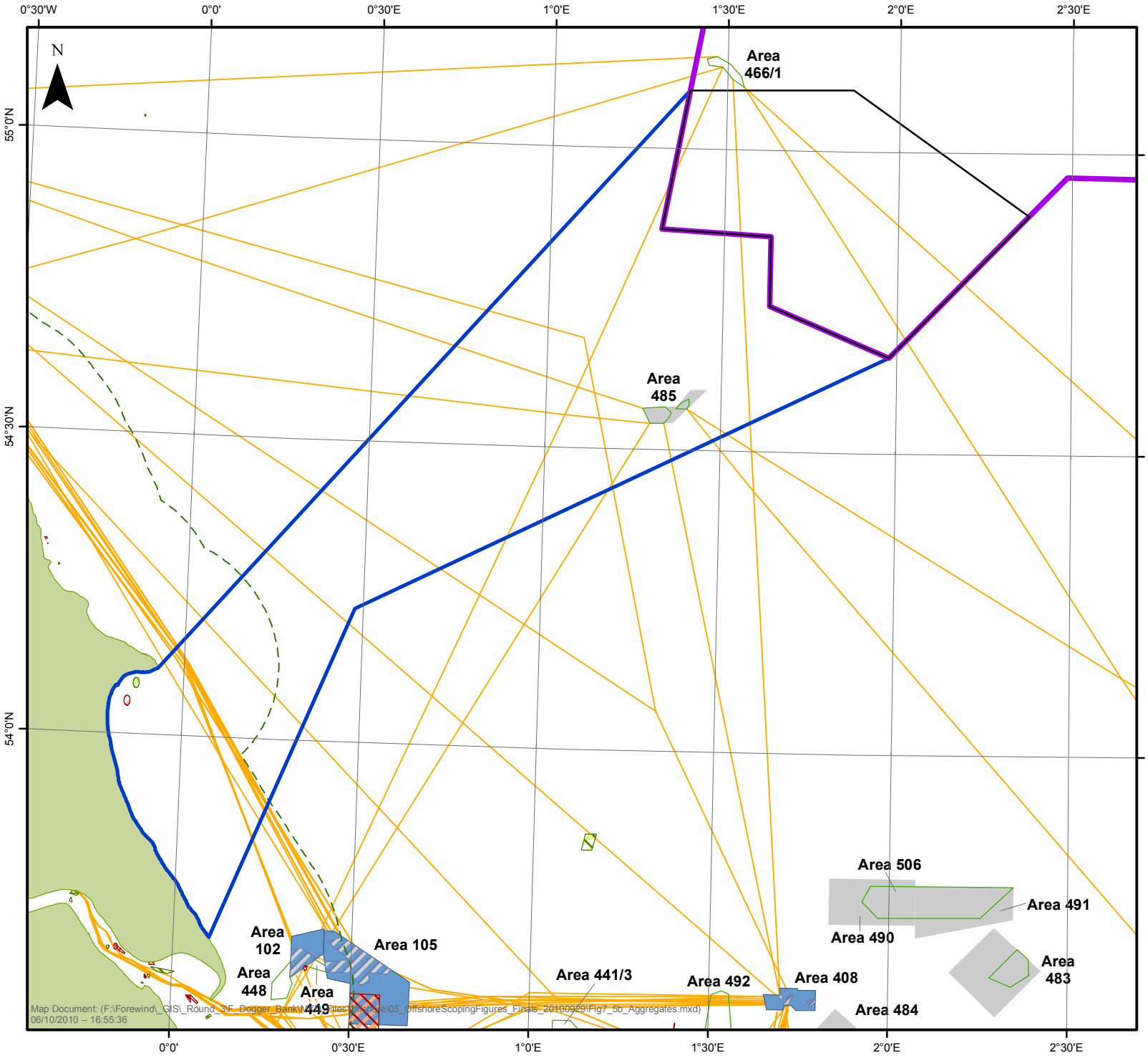

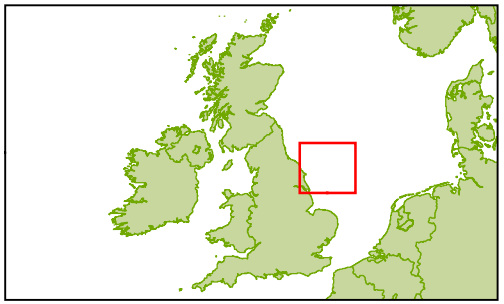

Legend:

- Dogger Bank Round 3 Zone
- Tranche A
- Offshore Export Cable Corridor
- 12nm Territorial Boundary

Dredger Transit Routes

- Dredger Transit Route

Aggregate Areas

- Active Dredge Zone
- Licence Area
- Application Area
- Prospecting Area

Dumping Gounds

- Open
- Closed
- Disused

Sources: Aggregate Areas © TCE, 2010.
Dumping Grounds © CEFAS, 2010.
Transit Routes © BMAPA, 2010.
R3 Zone © TCE, 2010.

0 10 20 40 Kilometres
0 5 10 20 Nautical Miles

DOGGER BANK R3 DEVELOPMENT

Dogger Bank Project 1

Figure Title:

Aggregates

Figure No: Fig. 7.5b	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:1,000,000	
Drawn On: 08/09/10	Projection: UTM31N	
Checked By: PTG	Datum: WGS1984	

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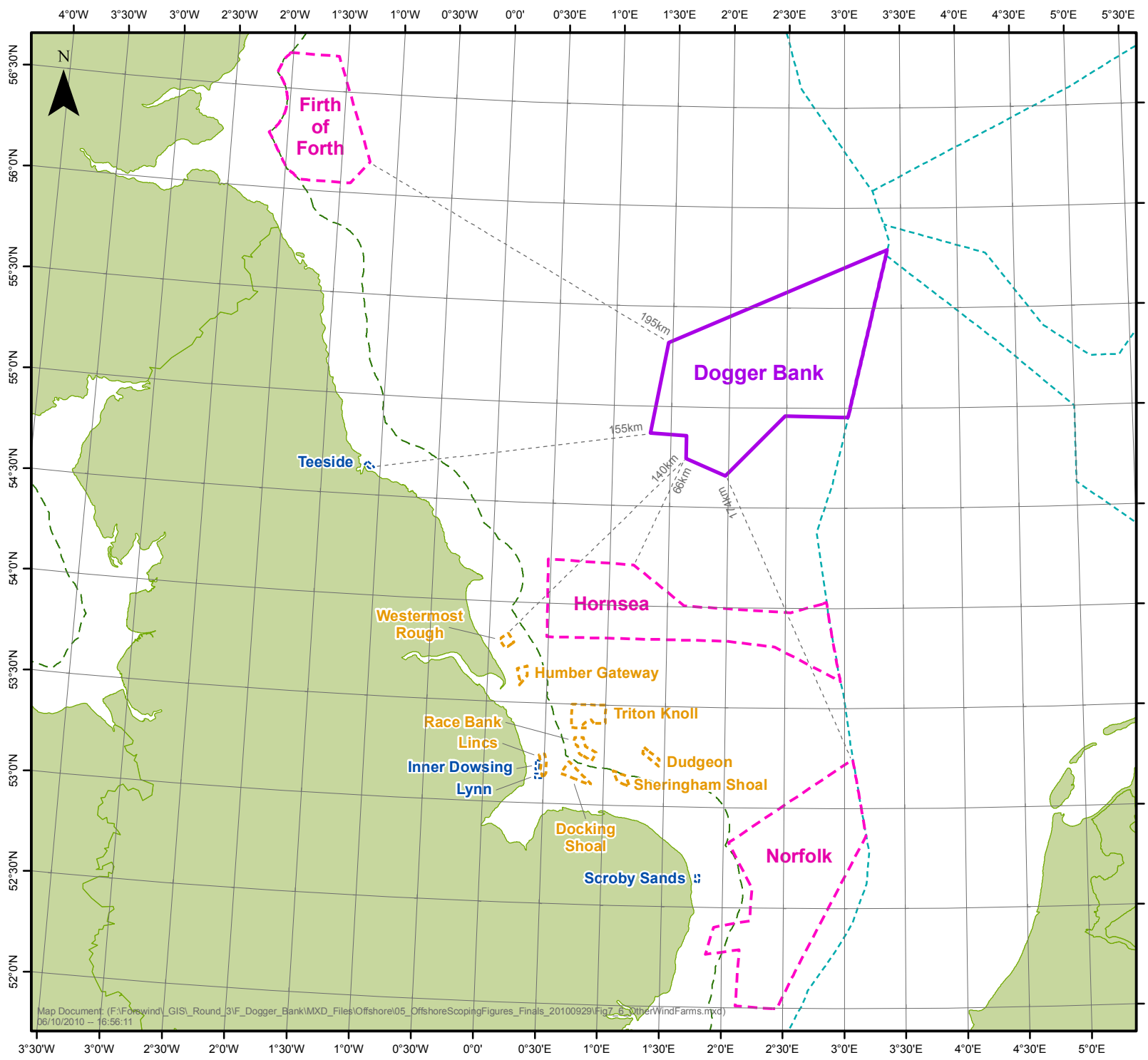

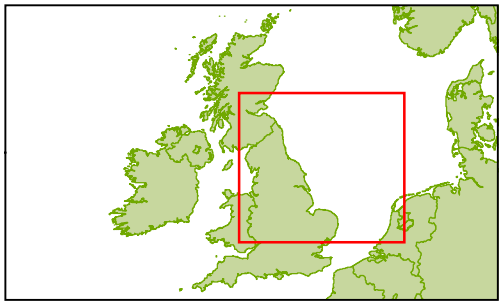

Legend:

- Dogger Bank Round 3 Zone
- 12nm Territorial Boundary
- International Boundary

Windfarms

- Other Round 3 Zone
- Round 2 Zone
- Round 1 Zone

Source: Wind Farm Zones © TCE, 2010.

0 20 40 80 Kilometres

0 10 20 40 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
East Coast Offshore Wind Farms		
Figure No: Fig. 7.6	Paper Size: A4	Rev: 3
Drawn By: DJM	Scale: 1:3,000,000	
Drawn On: 29/09/10	Projection: UTM31N	
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7.6.2 Potential impacts

Potential impacts during construction operations and decommissioning

- Interference with oil and gas and dredging operations from the increased navigational risk arising from a cumulative increase in vessel activity;
- Potential for disruption to helicopter access routes to existing oil and gas platforms from multiple wind farm development;
- Physical barrier to future oil and gas exploration (including seismic survey) and/or dredging activity; and
- Potential interaction with existing subsea cables and pipelines.

7.6.3 Approach to EIA

A desk study will be conducted, which will also involve consultation with stakeholders, to establish the relevant status of the known offshore human activities that occur within the vicinity of the project, and which may be subsequently impacted by the activities. Consultees will include, though not be limited to telecommunication and gas pipeline operators, aggregate companies, oil and gas operators, and the MMO for dredging and disposal issues.

Existing and planned licenses need to be identified, any potential for conflict of seabed use or in combination effects identified and assessed. This requires knowledge of the timing of ongoing and planned activities. The EIA will give due consideration to relevant guidance e.g. Cefas (2004).

Key data collection/study required

Activity	Purpose
Desk based assessment informed through review of available data sets and consultation with relevant industries.	To characterise the baseline environment for the ES, identify where potential impacts may occur and highlight any necessary mitigation to reduce anticipated impacts.

7.7 Tourism and Recreation

7.7.1 Existing environment

The following section discusses the recreation baseline for the offshore waters associated with Tranche A and the export cable corridor. **Section 10.7** details the coastal and onshore considerations, including any associated tourism.

Given the distance from shore, limited recreation activity occurs within Tranche A and the majority of the offshore export cable corridor. However, two medium-use[7] recreational routes do pass through

[7] As defined by the RYA: Popular routes on which some recreational craft will be seen at most times during summer daylight hours.

Tranche A and the wider Dogger Bank Zone. Four additional light use routes[8] pass across the export cable corridor. In addition to yacht cruising, there is an annual North Sea Triangle race, which crosses the North Sea and may also pass through the Zone.

Closer inshore, recreational boating is popular, with RYA cruising routes, sailing and racing areas, marinas, clubs and training centres located along the coastline. Key hubs for marine recreation are Bridlington Harbour, Hull Marina, South Ferriby Marina and Boston Marina. Other recreational activities such as recreational fishing, diving and the use of jet skis are also likely to be popular in inshore areas around centres of tourism.

7.7.2 Potential impacts

Potential impacts during construction

Disturbance and disruption: During construction, disruption to marine and coastal recreational activities could occur as a result of construction activities and Safety Zones around them. Any such disruption will be temporary in nature with exclusions removed or reduced following completion of construction.

Potential impacts during operation

Disruption to recreational activity: The only main source of impact is likely to be from any safety Zone associated with maintenance activity, or around wind turbine generators (if applied). Impacts on recreational sailing vessels will be minimal, as routes transiting the site are likely to remain open, providing that any operational safety Zones are adhered to.

Potential impacts during decommissioning

Any impacts as a result of decommissioning are anticipated to be similar to those discussed during construction.

Cumulative effects

Cumulative effects as a result of other activities or other wind farms are only anticipated to occur if construction at Tranche A is undertaken at the same time as other activities (such as Westermost Rough offshore wind farm, development of the Hornsea Zone, Humber Gateway offshore wind farm and future oil and gas development) within the area, or there is shared usage of ports for construction and or operation activity.

7.7.3 Approach to EIA

A desk-based study will be undertaken to inform the EIA. Consultation with the key statutory bodies (such as RYA and local councils) is currently ongoing and this will continue to inform the study. Further consultation will also be undertaken with local users of the coastal and offshore environment (such as local yacht clubs, diving clubs and recreational angling groups) in order to establish the importance of the study area to these groups and any impacts as a result of the proposed development. No site specific surveys are anticipated.

[8] Routes known to be in common use but which do not qualify for medium or heavy classification.

Key data collection/study required

Activity	Purpose
Consultation with relevant authorities and key stakeholders.	To ensure any exclusion from marine areas or further disruption is kept to a minimum and any positive economic impact on the area is maximised.

It is envisaged that the studies to inform these aspects will be carried out in conjunction with those for the onshore tourism and recreation (as detailed in **Section 10.7**) to ensure consistency in approach and avoid overlap of consultation effort.

8. Physical Environment - Onshore

8.1 Ground Conditions & Water Resource

The proposed areas for the potential landfall, cable route and substation(s) include a number of key hydrological features, including the River Hull, Holderness Drain and Leven Canal. There are also a number of major streams such as Monkbridge Stream and Old Howe; and Hornsea Mere (the largest freshwater lake in Yorkshire) is also situated within the study area.

The drift geology across the study area, is generally glacial till (boulder clay) with some areas of glacial sand and gravels. The underlying solid geology is characterised by chalk of the upper cretaceous period and is classed as a principal aquifer.

This section describes the methodology proposed to assess the effects of the onshore parts of the project on hydrology, flood risk, ground conditions and geology.

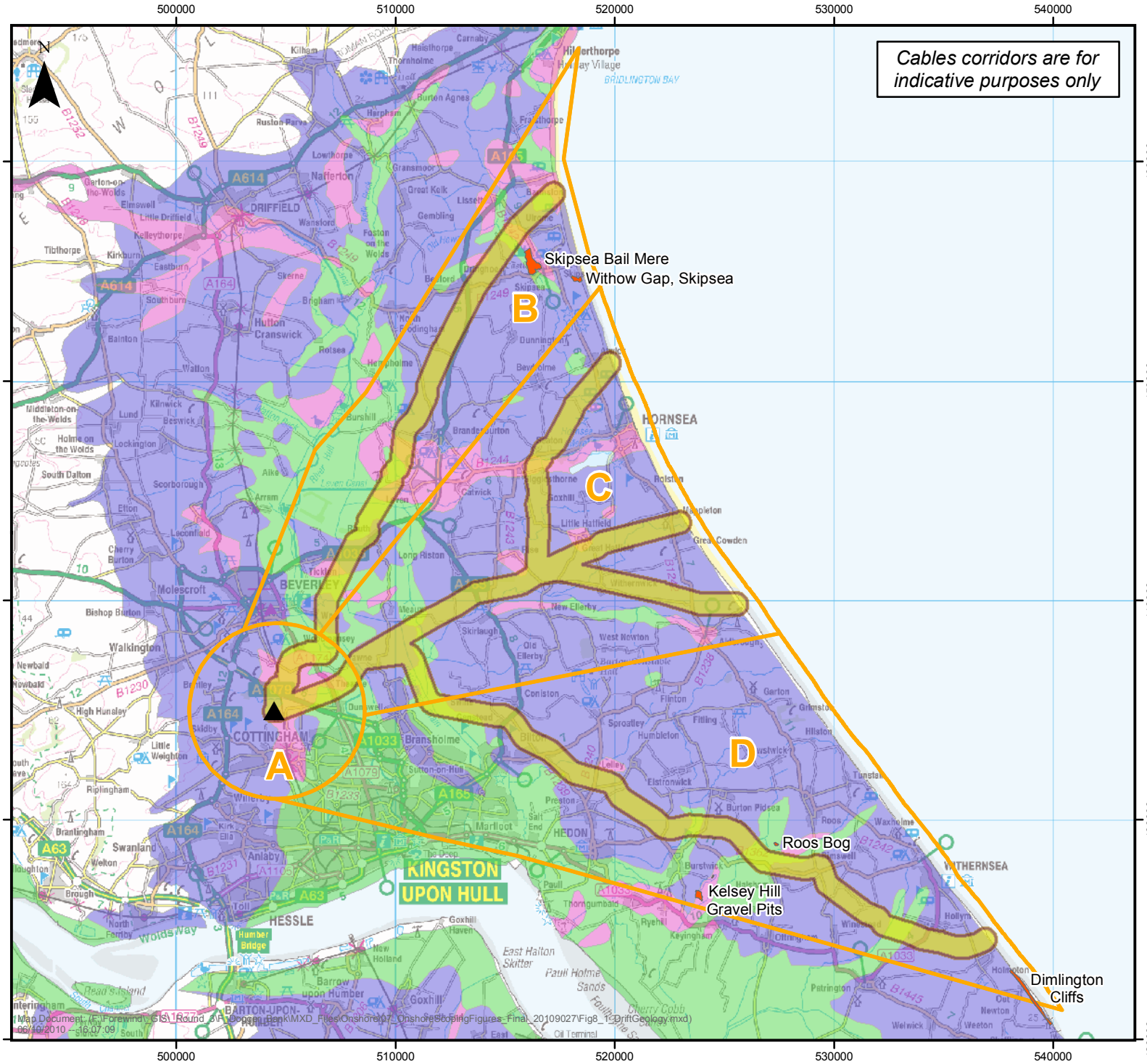
8.1.1 Existing environment

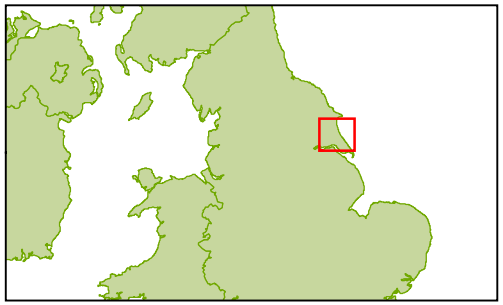
An initial review of the main hydrological, geological, topographic and groundwater features of the study area have been identified below for each Project Area. **Figure 8.1** and **Figure 8.2** show the geology and hydrology of the entire study area.

General Description of Project Area A (Substation Area)

Geology

The geological map sheets produced by the British Geological Survey (1985, 1990 & 1995), indicate that the solid geology in the north and west of this Project Area comprises the Flamborough Chalk Formation overlain by drift deposits of till described as stony clay. The drift deposits in the central area of the Project Area (around the existing substation) are peat and to the east of this, clay and silt estuarine deposits overly the chalk. The drift deposits of Project Area A are indicated to be approximately 20m thick, whilst the chalk here is approximately 150m thick.





Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Designations

- Geological SSSI

Superficial Drift Deposits

- Clay, Silt and Sand
- Diamicton
- Sand and Gravel
- Unknown Lithology

0 2 4 8 Kilometres

0 1 2 4 Nautical Miles

DOGGER BANK R3 DEVELOPMENT

Dogger Bank Project 1

Figure Title:

Drift Geology

Figure No: Fig 8.1	Paper Size: A4	Rev: 9
Drawn By: DJM	Scale: 1:250,000	
Drawn On: 28/09/10	Projection: BNG	
Checked By: RH	Datum: OSGB36	

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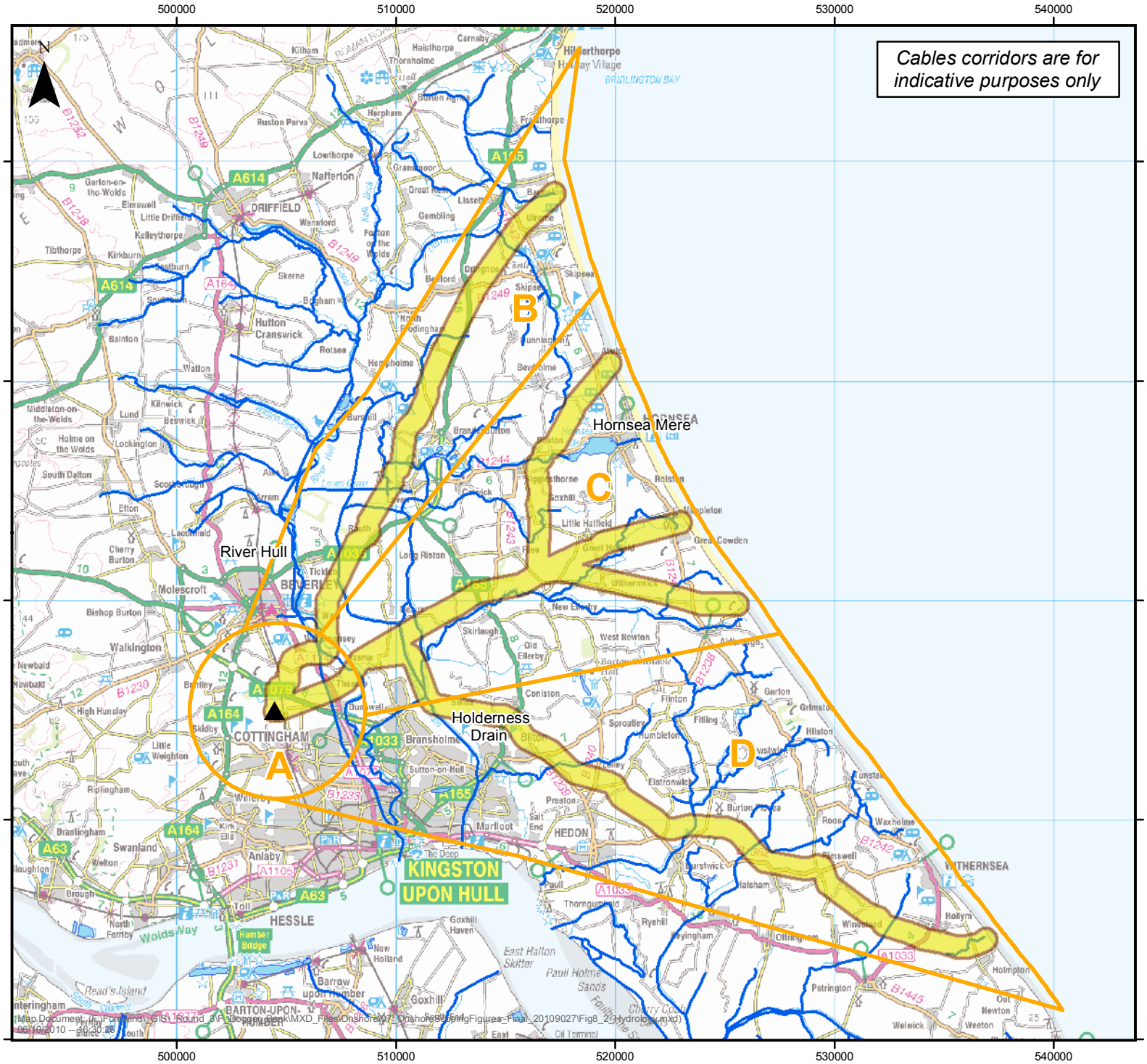

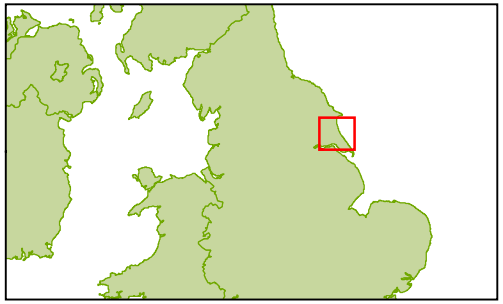

Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Hydrology

- Water Course (Major River/River/Canal)
- Lake

Source: Water Courses © The Automobile Association, 2001. Lakes © Crown copyright and database right, 2010. Ordnance Survey 250k Raster © Crown copyright and database right, 2010.

0 2 4 8 Kilometres

0 1 2 4 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Hydrology		
Figure No: Fig 8.2	Paper Size: A4	Rev: 9
Drawn By: DJM	Scale: 1:250,000	
Drawn On: 28/09/10	Projection: BNG	
Checked By: RH	Datum: OSGB36	

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Geological SSSI's

A desk based review has indicated that there are no geological Sites of Special Scientific Interest (SSSI) within Project Area A.

Topography

Project Area A is low-lying, between 2 and 60m above sea level and is predominantly flat or gently undulating. To the west of the existing Creyke Beck substation is gently sloping farmland which constitutes the eastern extent of the Yorkshire Wolds.

Groundwater

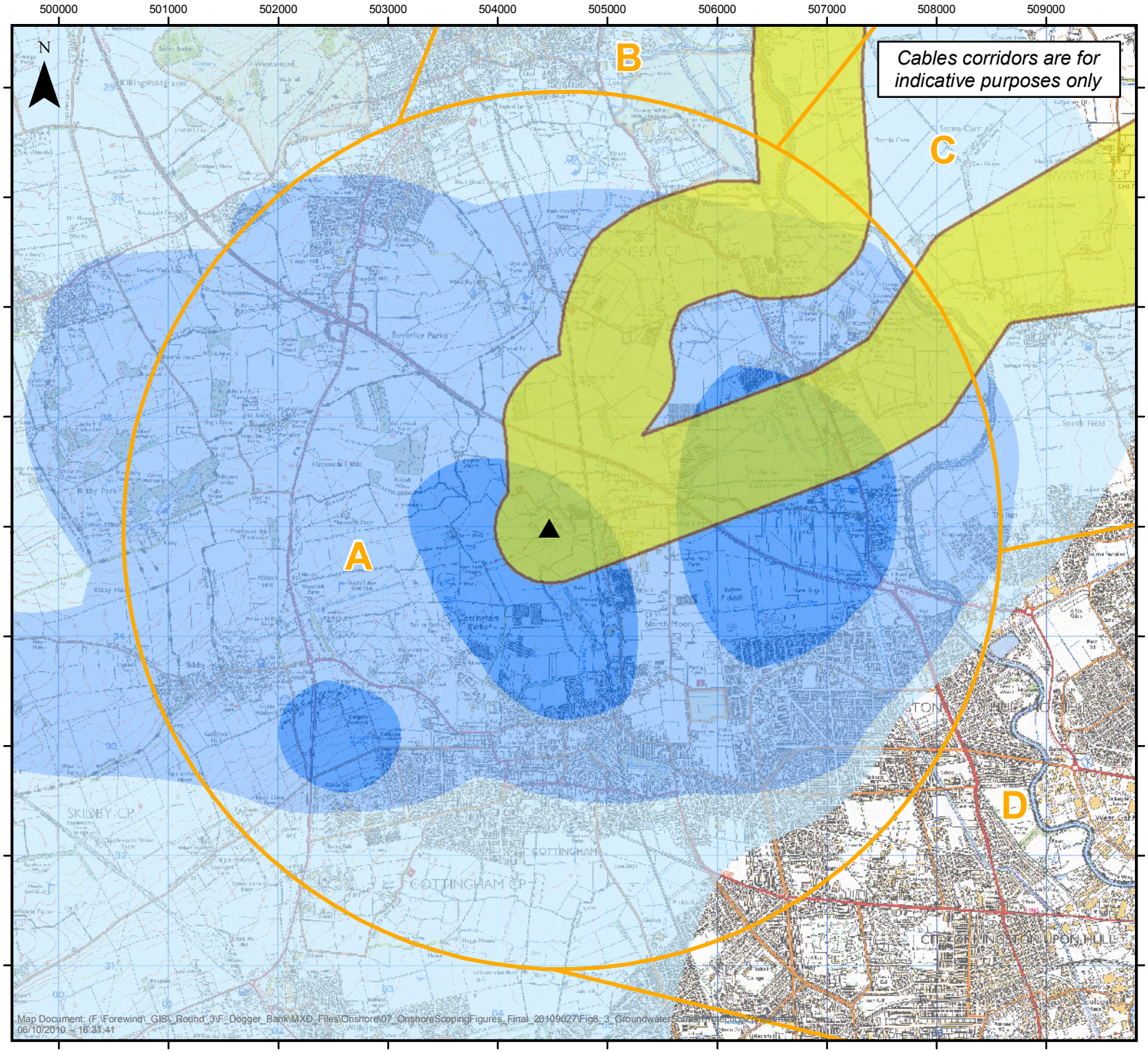
Figure 8.3 displays the Environment Agency (EA) Groundwater Sensitivity map (Environment Agency, 2010a). The chalk bedrock is classified as a principal aquifer[9], the peat as a 'Secondary A' aquifer[10] and the till as unproductive strata[11]. Much of Project Area A falls within inner (red shading) or outer (green shading) groundwater source protection zones[12]. Four groundwater source protection zones are present in this Project Area, with the footprint of the existing Creyke Beck substation sitting directly within Source Protection Zone 1 (SPZ1[13]) to the north of Cottingham.

Surface water

The existing Creyke Beck substation and surrounding land is bounded by small watercourses to the north, east and south (Wanlass Beck, Creyke Beck and Mill Beck respectively) as well as a number of minor agricultural drains.

Figure 8.4 displays the flood risk zones identified in the vicinity of the existing substation. The River Hull and Holderness Drain floodplains extend throughout the eastern part of Project Area A. Certain areas of this Project Area are designated as Flood Zone 3a area for flood risk – High Probability (fluvially dominated) as well as Flood Zone 2 – Medium Probability.

[9] Principal aquifers usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
[10] Secondary aquifers usually support water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers.
[11] Unproductive strata have negligible significance for water supply or river base flow
[12] The EA define Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The EA has a duty to protect water supplies intended for human consumption.
[13] SPZs are defined around a known groundwater source, such as an abstraction borehole. SPZ1 is the Inner Protection Zone. Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside SPZ1, which applies at and below the water table. SPZ2 is the Outer Protection Zone and is defined by a 400 day travel time and SPZ3 is the Source Catchment Protection Zone and is the total area of groundwater recharge for the source.



Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Groundwater Source Protection Zones

- Inner Zone
- Outer Zone
- Total Catchment

Source: Source Protection Zones © Environment Agency, 2010. Ordnance Survey 25k Raster © Crown copyright, All rights reserved, 2010. Licence number: 0100031673.

0 0.5 1 2 Kilometres

0 0.25 0.5 1 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title: **Groundwater Source Protection Zones within proj. Area A**		
Figure No: Fig 8.3	Paper Size: A4	Rev: 8
Drawn By: DJM	Scale: 1:50,000	
Drawn On: 27/09/10	Projection: BNG	
Checked By: RH	Datum: OSGB36	

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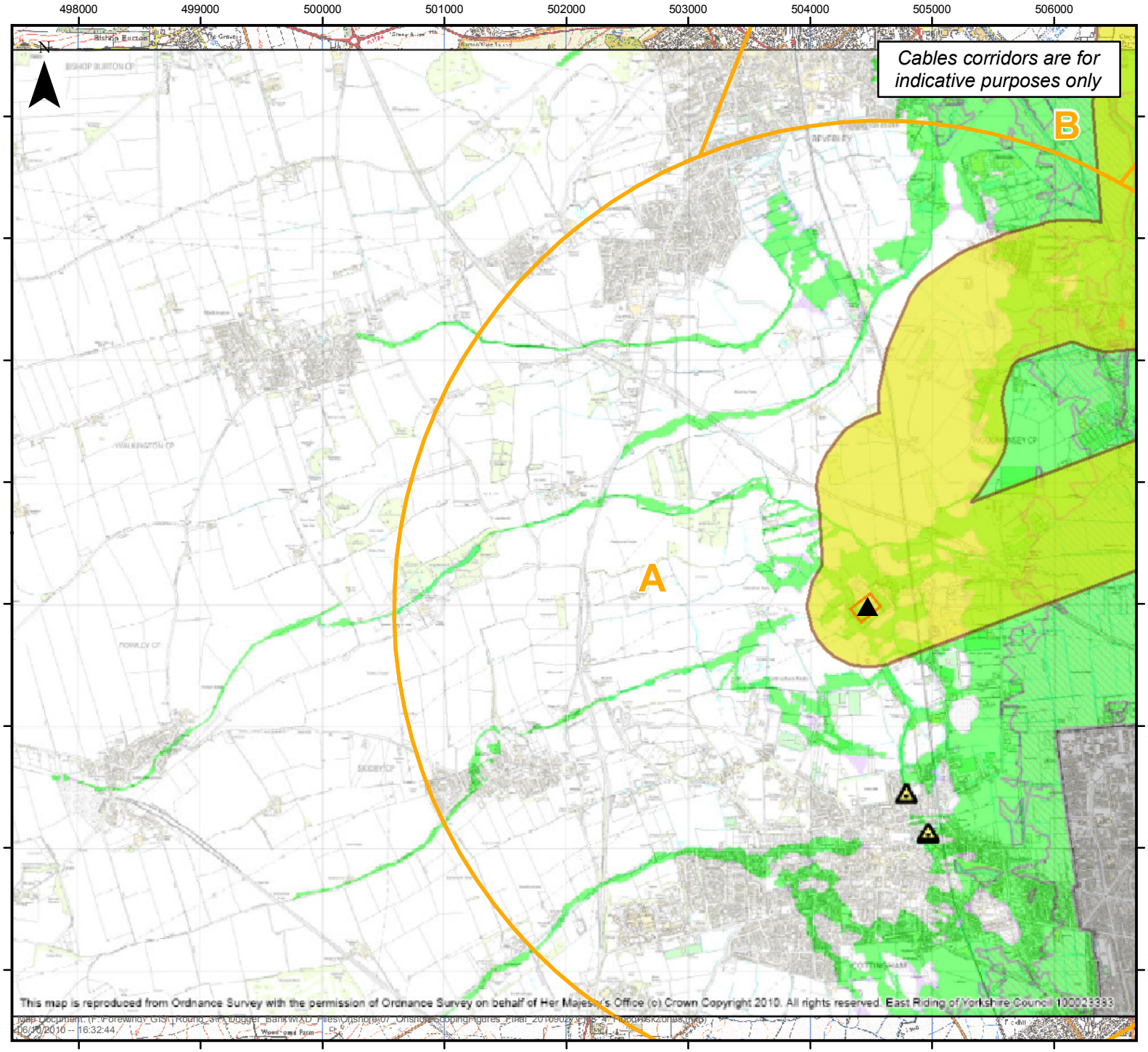


Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Flood Risk Zones

- Land Around Creyke Beck Substation
- Zone 3a 'High Probability' (Fluvially Dominated)
- 1 in 25 Year Flood Extent if Undefended
- Localised Drainage Issue

Source: Flood Risk Zones © East Riding Council, 2008.
Ordnance Survey 25k Raster © Crown copyright,
All rights reserved, 2010. Licence number: 0100031673.

0 0.5 1 2 Kilometres

0 0.25 0.5 1 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Flood Risk Zones		
Figure No: Fig 8.4	Paper Size: A4	Rev: 4
Drawn By: DJM	Scale: 1:45,000	
Drawn On: 27/09/10	Projection: BNG	
Checked By: RH	Datum: OSGB36	

FOREWIND

General description of project Areas B, C and D

Geology

The Flamborough Chalk Formation is overlain by poorly sorted glacial till (diamicton) which for much of this area is in turn overlain by alluvial clay and silt. Lenses of glaciofluvial sands and gravels are occasionally present, typically associated with rivers. Deposits of alluvial clay and silt are present at Bransholme, Hedon, Halsham and to the south west of Withernsea.

Geological SSSI's

Project Area B includes two geological Sites of Special Scientific Interest (SSSI), Skipsea Bail Mere SSSI, located west of Skipsea, and Withow Gap SSSI located east of Skipsea on the coast. There are also three geological SSSIs in Project Area D; they are Roos Bog, north of the village of Halsham; Kelsey Hill Gravel Pits just south of Burstwick; and Dimlington Cliff to the south of Withernsea. All five SSSIs are shown on **Figure 8.1**.

Topography

Project Area B – D is predominantly low lying, generally flat or slightly undulating farmland. The area is between 2m below sea level and 30m above sea level with an average altitude of approximately 5m.

Groundwater

The EA Groundwater Sensitivity map shows the chalk is classed as a principal aquifer (may support water supply and/or river base flow on a strategic scale), and the alluvial and glaciofluvial drift deposits are classed as secondary A aquifer (capable of supporting water supplies and/or river base flow at a local rather than strategic scale), with the till as unproductive strata. According to the EA map, there are no groundwater source protection zones although, the areas around Beverley and Meaux fall within total catchment protection zones.

Surface water

There are many watercourses, including the Leven Canal (a designated SSSI), and the River Hull within the study area.

8.1.2 Potential impacts

Potential impacts during construction

Ground conditions: If contaminated soils are encountered during construction there may be an increased risk to construction workers from contact with contaminants. Removal of contaminated soils may also have an effect during construction due to increased vehicle movements and use of landfill void.

Hydrogeology: Within the study area, the chalk is a principal aquifer (high sensitivity) and much of Area A sits within a SPZ1 for a public potable water supply. Given the sensitivity of the groundwater setting potential effects during construction relate to the risk of pollution and degradation of the water quality from construction.

Geology: Potential effects on features of geological interest may arise during construction, for example at the landfall, where the effect of coastal erosion along the Holderness coastline is a consideration for the project.

Hydrology and flood risk: Potential effects during construction relate to the risk of contaminated water or sediment laden run-off from the construction area entering nearby watercourses with subsequent effects on water quality. In addition, specific consideration of the Water Resources Act 1991 (and associated Land Drainage Byelaws 1980) will be required where the cable corridor passes within 8m of a Main River.

Potential impacts during operation

Hydrology and flood risk: Potential operational effects are likely to relate to the potential for flooding on, and arising from, above ground aspects of the project which will be limited to the converter substation(s).

Hydrogeology: The majority of Area A sits within an SPZ1 for a public potable water supply. The use of non-mains drainage (for surface water discharges to ground) and/or Sustainable Drainage Systems could potentially impact groundwater quality.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

8.1.3 Approach to EIA

The potential effect that construction and operation of the onshore elements of the project may have on identified hydrological features, flood risk, ground conditions (including contamination) and geology will be described. The significance of the impacts will be assessed using relevant guidance such as Guidance Note 208/07: Design Manual for Roads and Bridges (DMRB) (Department for Transport, 2007a) and taking into account the Water Framework Directive in terms of maintaining good ecological and chemical status of surface and groundwater's within the study area.

Ground and groundwater conditions

A preliminary desk study will be undertaken in consultation with the Environment Agency (EA), East Riding of Yorkshire Council and other regulatory bodies to establish potential hydrogeological and ground contamination constraints within the cable route study area. Initially existing sources will be used, including Environment Agency mapping and East Riding of Yorkshire Council contaminated land records. All data will be gathered and reviewed including a site visit and environmental records search. In addition, early engagement with Yorkshire Water Services Limited will be undertaken to ensure that the requirements for protecting the groundwater potable water source are fully understood.

The desk study will include a review of available information to identify the potential sources of contamination, pathways by which contamination may migrate and receptors (such as watercourses and ecologically important sites) which may be affected. This assessment will allow an assessment of:

- Historical land uses to assess the potential for ground contamination;
- Areas of known contaminated land; and
- Environmental setting to assess the sensitivity of the surrounding environment (receptors) to contamination and pollution.

The desk study will be in accordance with Environment Agency best practice i.e. *CLR11 Model Procedures for the Management of Land Contamination (2004)*.

Water resources and flood risk

The assessment of likely effects on water resources would include the effects on the prevailing hydrological, surface water drainage, flooding and water quality environments at the landfall site, along the cable corridor and at the proposed converter substation(s).

A desk study will be undertaken in liaison with the EA, the local water authority and other regulatory authorities to establish key hydrological constraints to the development. The desk study will determine any likely requirements for specific site investigation.

As shown in **Figure 8.4** the need for, and extent of, any Flood Risk Assessment (FRA) will be dependent upon the location chosen for the proposed converter substation(s) and the flood zone within which it sits. If the proposed converter substation(s) should be located within Flood Zone Area 3a there may be a potential risk of flooding. Therefore a FRA would need to consider the potential for risk of flooding and any alteration of the surface water runoff regime to assess any impacts on the local and catchment-wide risk of flooding. Any future planning application will address the implications of *Planning Policy Statement 25 (PPS 25) Development and Flood Risk*. .

Mitigation measures

The ES will include any necessary mitigation measures to protect features of geological importance and water resources. The ES will also provide measures to address any waste management issues arising from the project. Typical measures will include commitments to comply with specific Environment Agency Pollution Prevention Guidelines (2009).

Key data collection/study required

Activity	Purpose
Desk Study including a contaminative uses (historic) search.	To identify geology and hydrology features, and possible sources of historical contamination.
Characterisation of project risks to water environment.	To establish the sources of potential risks and whether or not they are deemed significant and thus require mitigation measures.
Flood Risk Assessment (FRA) - dependent upon location of the converter substation(s).	Consider the potential alteration of surface water runoff, and assess the adverse impacts on the local and catchment-wide risk of flooding.

9. Biological Environment - Onshore

9.1 Ecology and Nature Conservation Designations

The study area is predominantly comprised of low-lying agricultural land, with a wide range of other habitat types also present throughout the study area. These comprise areas of woodland, grassland, hedgerows, ponds, reservoirs and lakes. In terms of landfall, the export cables and location of the onshore transition pit is expected to be along the Holderness coast. This coastal area comprises a range of intertidal, cliff, urban and arable habitats.

The main water body present in the study area is the River Hull, and its tributaries, which drain into the Humber Estuary. The Estuary is of international importance, designated as a Special Protection Area (SPA), a Ramsar wetland and a Special Area of Conservation (SAC). It is located to the south of the study area under consideration within this report.

This section describes the methodology proposed to assess the effects of the onshore elements of the project on ecology and nature conservation interests.

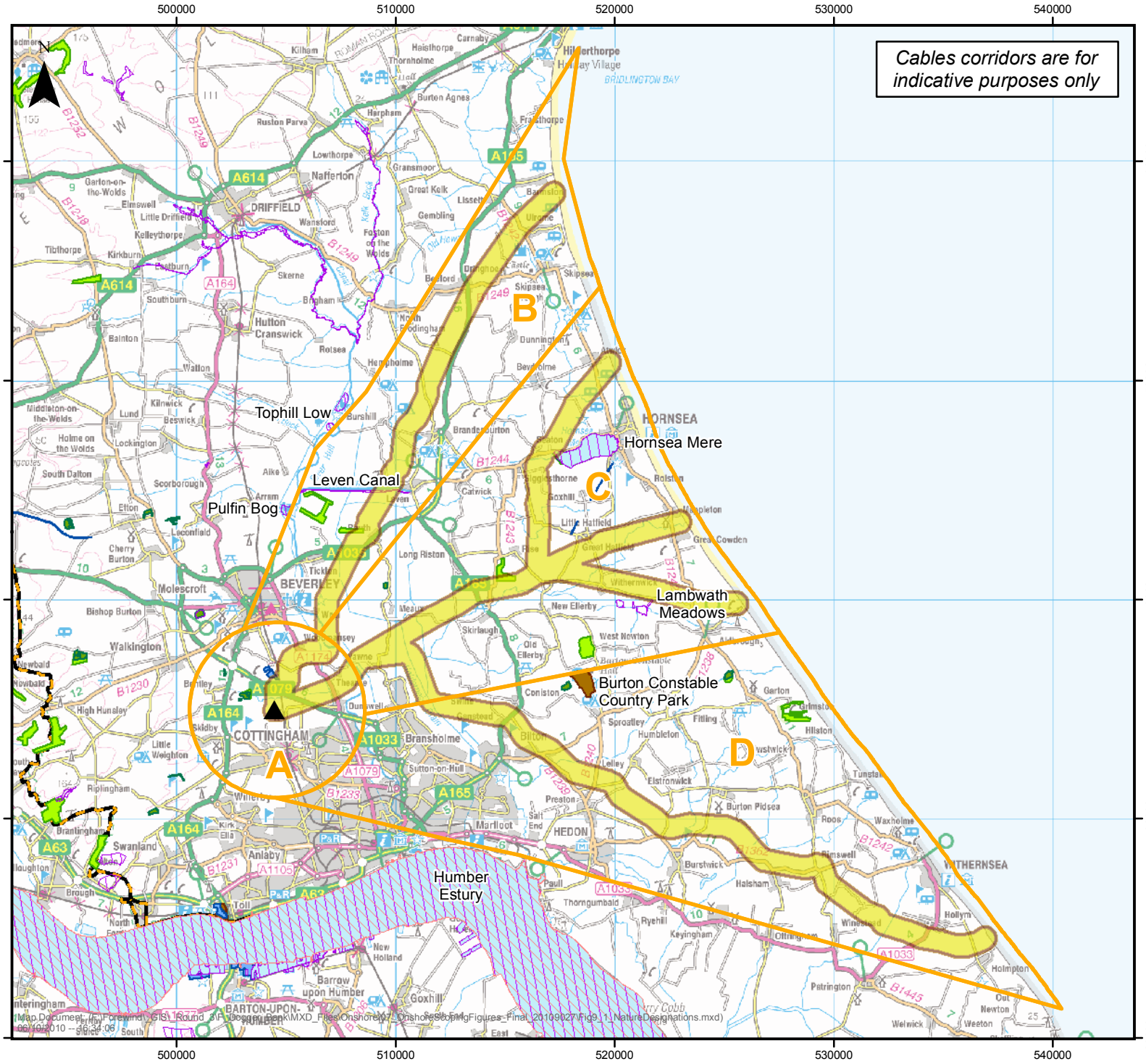
9.1.1 Existing environment

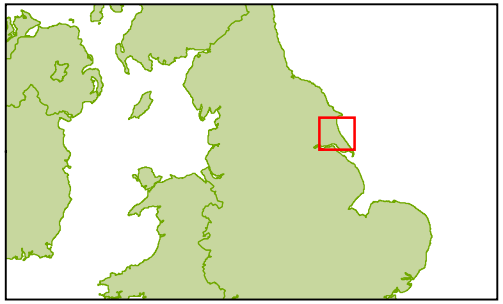
An initial review of the main ecological and nature conservation designations within the study area has been undertaken (including: Natural England, 2010b), these are shown on **Figure 9.1**. Dedicated onshore ecological field surveys are programmed to take place commencing in spring 2011.

General description of project Area A (Substation Area)

Designations

There are no national designations present within Project Area A. Ancient woodland at Birkhill Wood lies approximately 1.4km to the north west and a Local Nature Reserve at Beverley Park lies 1.5km north of the existing Creyke Beck substation.





Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Designations

- SPA
- SAC
- Ecological SSSI
- LNR
- Ancient Woodland
- Woodland
- Country Park
- National Trail

Source: Designations © Natural England, 2010.
Ordnance Survey 250k Raster © Crown copyright and database right, 2010.

0 2 4 8 Kilometres
0 1 2 4 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Ecology and Nature Designations		
Figure No: Fig 9.1	Paper Size: A4	Rev: 9
Drawn By: DJM	Scale: 1:250,000	
Drawn On: 27/09/10	Projection: BNG	
Checked By: RH	Datum: OSGB36	

FOREWIND

Species and Habitats

The habitats within the area are predominantly grassland (pasture) and arable land, with hedgerows throughout. These habitats have been identified as having potential to support to a range of species including bats, breeding birds, badger *Meles meles*, reptiles, and great crested newt *Triturus cristatus*.

General description of project Area B (Northern Area)

Designations

The key nature conservation designation within Project Area B is the Leven Canal, Site of Special Scientific Interest (SSSI), which runs west from Leven to the River Hull. The Leven Canal has been designated for its wetland flora which represents an important remnant of formerly more widespread marshland species.

In addition, Pulfin Bog SSSI and Tophill Low SSSI are situated on the boundary and just outside of the study area respectively. Pulfin Bog SSSI is on the study area boundary to the western extent of the Leven Canal SSSI; it is designated for its botanical interest and reedbed habitat. Tophill Low SSSI lies just outside the study area boundary to the north.

In addition to these biological SSSIs there are also a number of County Wildlife Sites in the vicinity of the River Hull and Beverley.

Species and Habitats

The habitats that may be crossed by the cable route within Project Area B include:

- Sea cliffs and slopes;
- Rivers and streams (including the River Hull);
- Ponds;
- Grassland;
- Arable land;
- Hedgerows; and
- Woodlands.

Habitats that could be potentially affected by the development within Project Area B are likely to provide potential to support bats, great crested newt, reptiles, water vole *Arvicola terrestris*, breeding birds, and badger.

General description of project Area C (Central Area)

Designations

Designations within Project Area C include Hornsea Mere SSSI and SPA and Lambwath Meadows SSSI. Hornsea Mere SSSI and SPA is designated for its importance for overwintering birds and a variety of habitats. Lambwath Meadows SSSI is designated for its species rich low-lying seasonally flooded hayfields and is located to the south of Withernwick.

Project Area C also includes ancient woodlands at Low Wood and Cote Wood. Furthermore, there are Local Nature Reserves at Sigglesthorpe Station and Southorpe at Bilton and Halsham.

Species and Habitats

The species and habitats are considered to be similar to those as described above for Project Area B.

General description of project Area D (Southern Area)

Designations

This Project Area also contains two areas of ancient woodland at Bail Wood and Old Wood and Burton Constable County Park.

Species and Habitats

Species and habitats are considered to be similar to those as described above for Project Area B.

9.1.2 Potential impacts

Potential impacts during construction

Permanent habitat loss: There is potential for permanent loss of habitat as a result of the construction of the new converter substation(s).

Temporary habitat loss and species disturbance: There is potential for temporary disturbance to habitats and species e.g. as a result of the construction of the onshore cable route and the onshore transition pit. The impacts may include direct effects such as physical loss of habitat and indirect impacts such as; disturbance due to noise, vibration, lighting and the presence of construction workers and plant.

Temporary habitat fragmentation and species isolation: There is potential for temporary habitat fragmentation and species isolation as a result of the construction of the onshore cable route.

Temporary discharge/pollution: There is potential for temporary discharge/pollution to adversely impact species and habitats as a result of the onshore construction works.

Potential impacts during operation

Species disturbance: There is potential for disturbance to species e.g. as a result of the operation of the onshore converter substation(s).

Species and habitat disturbance along cable route and landfall: During the operational phase, activity along the cable route and landfall is likely to be restricted to routine maintenance visits. These are not anticipated to be frequent and would not be expected to cause significant disruption to species or habitats.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

9.1.3 Approach to EIA

Scope and methodology

A desk study, together with relevant site and species specific surveys will be carried out to establish the existing ecology and nature conservation interest of the areas covered by the different elements of the onshore development.

The relevant legislation that will be considered in relation to protected/notable species and habitats includes the Wildlife and Countryside Act 1981 (as amended), the Conservation of Habitats and Species Regulation 2010, the Protection of Badgers Act 1992 and the Hedgerow Regulations 1997, along with relevant non-statutory guidance.

Desk study

The Multi-Agency Geographic Information for the Countryside[14] and Joint Nature Conservancy Council[15] (www.jncc.gov.uk) websites will be reviewed for information on nationally and internationally designated sites of nature conservation importance and Local Nature Reserves within 2km of the study area. The search area will be extended to 5km for sites designated for bats.

Information on locally designated sites of nature conservation importance (non-statutory sites) and records of notable habitats (such as ancient woodlands) and notable species within 1km of the study area will be requested from the local Biodiversity Records Centre. The search area will be extended to 5km for records of bats and bat roosts. Local County recorders will also be contacted for any relevant records that they hold.

Extended Phase 1 Habitat survey

An Extended Phase I Habitat survey will be undertaken of the study area in order to provide information on the habitats in the study area and to assess the potential for notable or protected fauna to occur in or adjacent to the study area. A search will also be undertaken for any invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

A Phase 1 Habitat survey will be undertaken broadly following the methodology outlined in the '*Handbook for Phase 1 Habitat Survey: A technique for environmental audit*' (Joint Nature Conservation Committee (JNCC), 2003) and the *Guidelines for Baseline Ecological Assessment* (Institute of Environmental Assessment, 1995).

The Phase 1 Habitat survey will be extended in order to assess the potential of the habitats present to support notable or protected fauna. Notable species are those which are legally protected, identified in a Red Data book, nationally or locally rare or endangered, or are identified as a priority species in the UK Biodiversity Action Plan (BAP) or the Local BAP.

This will include the recording and mapping of any suitable habitat, evidence or sighting of protected, rare or uncommon species. The findings of the habitat assessment, in consultation with key stakeholders will inform the scope and extent of any additional species specific survey requirements. A potential initial list of further surveys is provided below:

[14] http://www.magic.gov.uk
[15] http://www.jncc.gov.uk

Amphibians

The potential for the survey area to support great crested newts will be recorded. Detailed great crested newt surveys (outlined below) will also record the presence of other amphibians in the water bodies surveyed.

Habitat within the study area is considered likely to support great crested newts and therefore further surveys of waterbodies will be undertaken. Surveys will be conducted following the survey methodology outlined in the 'Great Crested Newt Mitigation Guidelines' (Natural England, 2001).

Generally the terrestrial habitat of great crested newts can extend to include habitats up to 500 m from a breeding pond (Natural England, 2001). However if suitable terrestrial habitat is present great crested newts are more likely to stay within 250 m of their breeding pond (Cresswell & Whitworth, 2004). The findings of the recent research report published by English Nature (ENRR Number 576) suggest that great crested newts predominantly use habitats within 50m of their breeding ponds and only rarely move further than 250m from the breeding pond. Therefore, following pre-scoping discussions with Natural England it is proposed that a distance of 250m either side of the cable route and from the converter substation is a suitable survey area for this project.

Badgers

Signs of badger activity will be recorded during the Phase 1 Habitat survey. This will include, setts, latrines, feeding signs, hairs, tracks and scratch marks. Any badger setts recorded will be subject to a further level of sett-specific survey to record sett characteristics and activity levels.

Bats

During the Phase I Habitat survey, potential bat roost sites, such as mature trees and dilapidated buildings will be noted and mapped, along with any foraging opportunities. The Phase 1 data will be combined with any bat data gathered from the desk based study and an assessment will be undertaken to identify the potential for bat commuting corridors within the study area. The results of this analysis will be discussed with Natural England.

Breeding and wintering birds

For the cable route and converter substation(s) suitable habitat for breeding birds will be recorded and mapped during the Phase I Habitat survey and sightings of breeding birds noted. Specific surveys for breeding birds are not proposed along the entire route, based upon the predominantly arable habitat and temporary characteristics of the project. Where specific ornithological sensitivities are identified during the desk based survey, Phase 1 Habitat Survey or during consultation with stakeholders, further ornithological surveys may be undertaken at specific sites.

For the coastal areas the ornithological interest is likely to be determined by the habitats present in the vicinity of the final landfall location. Coastal habitat may include breeding and foraging habitat for a range of species, including migratory (over wintering and passage) species.

An initial desk based study will be undertaken for the area of the preferred landfall location to identify any ornithological interest and/or sensitivity that will then form the basis of consultation with relevant authorities, and stakeholders. Where the potential for adverse impacts is identified, Forewind will

identify the need for additional survey/data collection requirements and agree them with the relevant authorities. Subject to the results of this assessment, mitigation and/or monitoring plans will be developed. As a general mitigation, where possible, works will be undertaken outside of the breeding season, in terms of vegetation clearance, to minimise any effects on breeding birds.

Invertebrates

Habitats likely to contain important assemblages of invertebrates will be noted, along with any incidental sightings.

Otters and water voles

The Extended Phase I habitat survey will include an assessment of the suitability of waterbodies/watercourses to support otter or water vole. The surveys will include the characteristics of the water body and any evidence of otter, water vole, rat *(Rattus norvegicus)*, mink *(Mustela vison)* and other wildlife. Further more detailed water vole or otter surveys may be required and they will follow guidance from the '*Water Vole Conservation Handbook'* (Strachan, 2006) and the *New Rivers and Wildlife Handbook* (RSPB, NRA & RNSC, 1994). Signs of water vole activity searched for (and mapped if present) will include droppings, latrines, burrows, nests, feeding stations, runs and any sightings. Signs of otter activity searched for will include spraints, footprints, slides, and potential holt and resting sites.

Reptiles

Potential habitat suitable for reptiles will be identified within the Extended Phase 1 Habitat Survey and incidental sightings noted. Following the identification of suitable habitat, further targeted reptile surveys may be undertaken in areas of identified habitat that have potential to be affected by the onshore electrical connection.

Assessment and consultation

The data gathered during the desk study and field surveys will be used to inform the Ecological Impact Assessment (EcIA) for the project, which will be based on guidance issued by the Institute of Ecology and Environmental Management (IEEM, 2006).

As part of the EcIA, statutory and non-statutory nature conservation organisations will be consulted including Natural England (NE), the Environment Agency, the County Ecologist for East Riding of Yorkshire, the Yorkshire Wildlife Trust, the RSPB, British Trust for Ornithology (BTO), and local ecology groups. In particular NE will be consulted on the scope of baseline surveys and fieldwork undertaken during the course of the EcIA. A summary of the relevant planning policy, legislative context and key ecological legislation will be provided.

Mitigation measures

The presence of statutory designated and non-designated sites will be taken into consideration in the selection of the converter substation(s), the landfall, and during the routing of the onshore cable route. For example a pre-scoping consultation was undertaken with NE regarding potential landfall locations and the location of ecological receptors along the Holderness coast-line, so that their presence could be considered at an early stage. Further more detailed constraints will be considered as they become known, throughout the site design and EIA processes.

The results of detailed surveys will be discussed with statutory consultees to determine likely mitigation measures required. The design phase will be an iterative process with, mitigation measures incorporated into the project design to avoid impacts where possible. Opportunities to enhance biodiversity, in line with the Natural Environment and Rural Communities Act 2006 will be identified where possible.

Key data collection/study required

Activity	Purpose
Extended Phase 1 survey of the route and potential substation locations.	To supplement and update the desk-based study and to obtain detailed information on habitats present.
Detailed ecological surveys of terrestrial habitats and species, as required.	Where the Phase 1 Habitat survey has identified the need, additional species or habitat surveys will be undertaken to identify potential impacts and inform any necessary mitigation measures.

10. Human Environment - Onshore

10.1 Historic Environment

The historic environment assessment will consider both the direct impacts of the project on archaeological and cultural heritage sites, and the indirect impacts on the setting of designated sites. An Archaeological Desk-Based Assessment (ADBA) will be undertaken as part of the EIA process to identify the known and potential cultural heritage resources that may be affected by the onshore elements of the project. The assessment will identify any Scheduled Ancient Monuments (SAMs), listed buildings, registered parks and gardens, and other known or potential archaeological features within the vicinity of the converter substation(s) and the proposed cable route. Indirect impacts including the setting of archaeological and cultural heritage features and the historic landscape more generally will also be assessed.

The Humber region has a rich and varied history of archaeological and geological interest, providing local distinctiveness and contributing to the area's character, culture and economy (East Riding of Yorkshire Council, 2005). The secure hill-tops, fertile floodplains, mineral resources and navigable rivers have all contributed to the Region's historic environment (Government Office for Yorkshire and The Humber, 2008). There are a large number of SAMs in the area. Of particular note are Skipsea Castle and the Meaux Cistercian Abbey. There are a number of historic towns, most notably Hull and Beverley, and medieval villages and hamlets.

10.1.1 Existing environment

An appraisal of national heritage designations has been undertaken as part of the initial converter substation(s) and cable route planning process, including scheduled monuments, listed buildings, and registered parks and gardens. These features are shown in **Figure 10.1**.

General description of project Area A (Substation Area)

The nearest SAM to the existing substation at Creyke Beck is Bowl Barrow, approximately 500m to the north east. There are also a number of SAMs, listed buildings and registered parks and gardens in Cottingham, located more than 1km to the south of the existing substation. Risby Hall's garden is registered and lies to the west of the Project Area. There are also a number of isolated listed buildings within Project Area A, whose locations will be taken into consideration in the route planning and EIA processes.

General description of project Area B (Northern Area)

No major cultural heritage constraints have been identified in the initial assessment of Project Area B.

There are four Scheduled Monuments, namely: Skipsea Castle, Bamston Old Hall, Mallgath Medieval Hall and Moat, and the Deserted Village of Eske located within this Project Area. There are also a number of listed buildings in Project Area B, most of which are sited within settlements. There are no identified Registered Parks and Gardens.

General description of project Area C (Central Area)

No major cultural heritage constraints have been identified within Project Area C.

There are a number of Scheduled Monuments in this area – most notably the Meaux Cistercian Abbey. As in Project Area B a number of listed buildings are located within settlements within Project Area C. There is approximately 200 acres of Registered Park and Gardens in Burton Constable which sits in both Project Area C and D.

General description of project Area D (Southern Area)

No major cultural heritage constraints have been identified within Project Area D.

Hedon Medieval Town sited to the east of Kingston upon Hull is a designated Ancient Monument and is surrounded by a number of Listed Buildings. There are also a large number of listed buildings and registered parks and gardens within Kingston upon Hull. The cable route will avoid the main built up area of Hull due to the high density of residential properties and as such it will avoid these cultural heritage features. There are a number of other isolated listed buildings in Project Area D, outside of Kingston upon Hull, most of which are located within settlements.

10.1.2 Potential impacts

Potential impacts during construction

Archaeological resources: Direct impacts on archaeological resources within the cable corridor are likely to be limited to ground disturbance in the construction phase. The cable route, substation(s) and landfall transition pit will be located to reduce the impact on all recorded sites where possible. However, there remains a risk of discovering previously unrecorded finds, this risk will be considered as part of the EIA assessment and procedures put in place to address risk should it arise during construction.

Historic monuments, buildings and structures: Temporary impacts from noise and vibration may directly or indirectly effect historic monuments and buildings. The historic and cultural environment will be taken into consideration during the project design process to ensure that the overall impacts from the project are minimised.

Historic setting: The construction of the substation(s) has potential to impact on the setting of archaeological resources and the historic landscape. The historic setting of the substation(s) will be taken into consideration during the site selection and project design process to ensure that the overall impacts from the project are minimised.

Potential impacts during operation

Once operational it is considered that the landfall transition pit, cable route and substation(s) will have no permanent adverse impact during the lifetime of the wind farm on any archaeological resources or their setting.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

10.1.3 Approach to EIA

Scope and methodology

Specific tasks that will be undertaken as part of the Archaeological Desk Based Assessment (ADBA) include:

- Identification and assessment of any nearby Scheduled Monuments and listed buildings;
- Collection of National Monument Record (NMR) data;
- Collection and compilation of data from the county Sites and Monuments Record Service held by Humber Archaeology Partnership;
- Collection and compilation of cartographic data from the County archives offices, and aerial photographic data, where appropriate;
- Assessment of the direct impact of the cable route on any nearby SAMs and listed buildings;
- Assessment of the indirect impact of the converter substation(s) on the setting of designated sites within the Zone of Theoretical Visibility (ZTV);
- Assessment of the impact of the development on non-scheduled sites within a corridor centred on the cable route;
- Assessment of the likelihood of previous unrecorded archaeological finds and features; and
- Devising proposals for mitigation as appropriate.

The EIA will include an assessment of the impact of the project on the historic landscape. The impact of the cable route and landfall transition pit is likely to be limited to the construction phase; once the ground is reinstated impacts during the operational phase will be minimal. The proposed converter substation(s) will be assessed to determine any potential impact on the historic landscape from its construction and operation. The assessment is likely to comprise of:

- The selection of viewpoints within the ZTV, identified by virtue of their sensitivity;
- Description of the historic landscape, utilising site visits and photography; and
- An assessment of the likely impact of the project on the historic environment.

The assessment will be undertaken in accordance with the following legislation and guidance:

- Ancient Monuments and Archaeological Areas Act (1979);
- National Heritage Act (1983);
- Planning (Listed Building and Conservation Areas) Act (1990);
- Planning Policy Guidance 16: Archaeology and Planning; and

- Planning Policy Guidance 15: Planning and the Historic Environment.

Consultation will be undertaken at key stages throughout the EIA process with relevant stakeholders including; English Heritage, the archaeological advisor to the relevant planning authorities, and the Humber Archaeology Partnership.

Mitigation measures

As part of the route planning phase, designated sites of archaeological and cultural heritage importance will influence route selection. Route micro-siting at a pre-construction stage will also help ensure sites are avoided where possible. If it is not possible to avoid designated sites, which is thought unlikely, specific consents will be sought from, and in consultation with English Heritage. Pre-construction and construction monitoring and further investigations may be necessary on a site specific basis.

Key data collection/study required

Activity	Purpose
Archaeological Desk-Based Assessment.	To identify any scheduled monuments, listed buildings, registered parks and gardens, and other known and potential archaeological features.

10.2 Landscape and Visual Character

A Landscape and Visual Impact Assessment (LVIA) will be undertaken to identify and assess potential effects from the construction, operation and decommissioning of the proposed landfall, cable route and converter substation(s) on landscape resources and visual receptors, with reference to established methodology and guidance.

The area has a predominantly flat low lying agricultural landscape and lies within the jurisdiction of East Riding of Yorkshire Council. Kingston upon Hull is the largest settlement in the study area to the south of the existing Creyke Beck substation. The town of Beverley lies approximately 5km to the north. The seaside towns of Hornsea and Withernsea are the dominant settlements along the coast in Project Areas C and D respectively. The sandy coastline offers opportunities for tourism and leisure activities.

10.2.1 Existing environment

A high level, desk based review of the main landscape designations, landscape character assessments and public rights of way has been undertaken, the results of which are described below.

There are no nationally designated sites e.g. Areas of Outstanding Natural Beauty (AONB) and National Parks, within any of the Project Areas and therefore each description starts with the National level characterisation.

General description of project Area A (Substation Area)

National Character Assessment

As part of a national mapping exercise, Natural England produced a series of Countryside Character reports, including Volume 3: Yorkshire & The Humber (2005). This report locates the existing substation option within the Holderness National Character Area (Area 40). Key characteristics of this area include:

- Low-lying, predominantly flat or gently undulating plateau jutting into the North Sea and dividing it from the Humber Estuary;
- Rapidly eroding, soft clay, cliff coast;
- High-quality agricultural land used predominantly for large-scale arable cultivation and intensive livestock farming;
- Winding roads linking dispersed villages and hamlets, with village churches providing important landmarks in the generally flat landscape; and
- Vernacular buildings of red brick and red pantile with some older buildings, especially churches, built in limestone. Use of cobbles near the coast.

County Level Character Assessment

Part of Project Area A is located within a local designation under the East Yorkshire Borough Wide Local Plan (1997) as the 'Wolds Area of Landscape Protection' (under Policy EN3). This policy states:

Within the Wolds area of landscape protection, proposals which are otherwise acceptable in the open countryside and, in particular, small scale tourism and recreation proposals associated with the area's cultural and natural heritage, will only be permitted where:

1) *They will not be prominent in or harm the quality of the landscape; and*

2) *In terms of design, materials, colour and landscape treatment, they are of a high standard in scale and character with their surroundings; and*

3) *Individually and cumulatively with other development, they will not give rise to levels of traffic, noise or visitor pressure likely to harm the quiet character or nature conservation interest of the area.*

Creyke Beck substation is near the eastern edge of this Area of Landscape Protection, with the eastern boundary limit at the north-south Bridlington to Hull rail line, which is approximately 150m to the east of the existing substation. This policy is of relevance for the construction of a converter station near to Creyke Beck. The EIA will assess the capacity of the landscape for such a development.

East Riding of Yorkshire Council published a landscape character assessment in 2005. This document identified 67 individual landscape character zones over 23 geographical regions within the county.

The substation at Creyke Beck lies within character area 17B: North Cottingham Farmland. It is farmed urban fringe with a mixed use combining agriculture, horticulture and recreation. Further details on the landscape character of East Riding can be found in East Riding of Yorkshire Landscape Character Assessment (2005).

General description of project Area B (Northern Area)

National Character Assessment

The Natural England Countryside Character (2005) report locates this route option within National Character Area 40: Holderness, as described above for Project Area A.

County Level Character Assessment

The following Landscape Character Areas, identified in East Riding of Yorkshire Council's Landscape Character Assessment (2005) are present in Study Area B:

- 18A River Hull Corridor, 18B Quarry Farmland and 18F Beverley Parks Farmland: Holderness low lying drained farmland;
- 19A Rise Parkland and 19C North Holderness Open Farmland: Holderness open farmland with gently undulating topography; and
- 20C Bridlington to Hornsea Coast: Holderness coastal farmland and boulder clay cliffs eroding into the sea.

East Riding of Yorkshire Council has also identified approximately 100 acres at Brandesburton Pits as an area of Special Landscape Character and has set up the 'Countryside Project', which aims to implement landscape improvements and improve the recreational use of the project area.

General description of project Area C (Central Area)

National Character Assessment

The Natural England Countryside Character report (2005) locates this route option within National Character Area 40: Holderness, as described above for Project Area A.

County Level Character Assessment

East Riding of Yorkshire Council's Landscape Character Assessment (2005) identifies the coastline through Project Area C falling within Character Areas 20B: Hornsea to Withernsea Coast, and 20C: Bridlington to Hornsea Coast which is coastal farmland and eroding boulder clay cliffs. In addition this study area includes Character Areas 18C: Catfoss Dyke, 18D: Hornsea Mere 19A: Rise Parkland and 19D: Central Holderness Open Farmland.

General description of project Area D (Southern Area)

National Character Assessment

The Natural England Countryside Character report (2005) locates this study area within National Character Area 40: Holderness, as described above for Project Area A.

County Level Character Assessment

East Riding of Yorkshire Council's Landscape Character Assessment (2005) identifies the coastline through Project Area D falling within Character Area 20A: Withernsea to Spurn Coast and Character Area 20B: Holderness to Withernsea Coast which is coastal farmland and eroding boulder clay cliffs. In addition, the following Landscape Areas fall within Project Area D: 17A: Hedon, Preston and Bilton Farmland, 18A: River Hull Corridor, 19B: Burton Constable Farmland and Parkland, 19D: Central Holderness Open Farmland and 19E: Burstwick to Withernsea Farmland.

10.2.2 Potential impacts

Potential impacts during construction

Landfall and cable system: The onshore cable corridor will predominantly pass through a low lying flat agricultural landscape. There are likely to be some temporary landscape impacts as a result of the cable route construction stage. However, as there are no major landscape designations e.g. AONBs within the study area, it is not envisaged that these impacts will represent a significant adverse impact on the local environment.

Substation(s): The proposed converter substation(s) within 4km of Creyke Beck is considered to be the only permanent above ground infrastructure giving rise to potential impacts on the landscape. Minimising landscape and visual impacts will be one of the key factors in siting the converter substation(s), and both new and existing vegetation cover will be used to screen sensitive receptors where possible.

Potential impacts during operation

Landfall and cable system: During operation, there will be no significant permanent landscape impacts as a result of the cable route as the cables will be buried and the landscape reinstated above ground.

Substation(s): In the absence of mitigation, there are likely to be permanent landscape impacts arising during the operational life of the substation.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

10.2.3 Approach to EIA

Scope and methodology

A Landscape and Visual Impact Assessment (LVIA) will be undertaken as part of the EIA. The LVIA will include the following:

- Scoping and consultation with key stakeholders, including Natural England and East Riding of Yorkshire to establish valued landscape resources and key viewpoints within the zone of theoretical visibility (ZTV) of the converter substation(s);
- Assess the sensitivity of key landscape resources and visual receptors to the project;
- Identify the potential effects of the project on the landscape resources and visual receptors during the construction and operation and decommissioning phases of the project;
- Assess the significance of those effects, and produce visualisations of the converter substation(s); and
- Provide advice on proposed mitigation e.g. layout, ground modelling and planting.

The LVIA will be undertaken with reference to best practice outlined in published guidance, including:

- Guidelines for Landscape and Visual Impact Assessment, Second Edition (2002) Landscape Institute and the Institute for Environmental Management and Assessment; and
- Landscape Character Assessment: Guidance for England and Scotland (2002) Countryside Agency and Scottish Natural Heritage.

The principal objectives of the assessment will be:

- To describe, classify and evaluate the existing landscape likely to be affected by the onshore elements of the project during the construction and operational phases;
- To identify visual receptors with views of the onshore elements of the project; and
- To assess the significance of the effects on landscape character and visual resources, taking into account the measures proposed to mitigate any of the effects identified.

Key steps in the assessment process will be:

- Desk study to establish the landscape character and visual receptors in the study area;
- Agree the viewpoints through consultation with the local planning authority and Natural England;
- Determine the Theoretical Zone of Visual Influence, where relevant; and
- Production of wireframes/photomontages where required.

Mitigation measures

Mitigation proposals will include the replanting of vegetation, including hedgerows, over the top of buried cables, in order to minimise the effects of the development in landscape terms.

With reference to a new converter substation(s), strengthening of any existing hedgerow planting, tree belts or woodland may be required or there may be a need for additional planting.

Key data collection/study required

Activity	Purpose
Landscape baseline study.	To establish the current landscape character, importance and sensitive receptors that may be impacted by the scheme.
Visual baseline study.	To identify visual receptors with views of the onshore elements of the project.
Production of wireframes/photomontages (where necessary)	Subject to consultation identifying the need for wifeframes/photomontages: to provide visual representation of the development from sensitive receptors.

10.3 Soils, Agriculture and Land Use

The majority of land within the study area is agricultural, predominantly large scale arable cultivation and intensive livestock farming, the main exception being the urban areas of Kingston upon Hull and Beverley (Natural England, 2005).

The assessment will use the Agricultural Land Classification (ALC) system. This system grades agricultural land from Grade 1 (best quality) through to Grade 5 (poorest quality) based on factors including climate, nature of the soil and site-based factors. This section describes the methodology proposed to assess the effects of the proposed landfall, cable route and up to two converter substations on soils, agriculture and land use.

10.3.1 Existing environment

An initial review of existing ALC information for the area has been undertaken, illustrated in **Figure 10.2**.

General description of project Area A (Substation Area)

With the exception of the urban areas of Cottingham and Kingston upon Hull the majority of Project Area A is in agricultural use. The Creyke Beck substation site sits within an area that is currently in agricultural use and is classified as ALC Grade 2 – very good quality agricultural land, as is most of the land within Project Area A to the west of the Kingston upon Hull to Scarborough railway line. Land to the east of the railway line is typically classified as ALC Grade 3 - good to moderate quality agricultural land.

General description of project Area B (Northern Area)

A large proportion of Project Area B is classified as ALC Grade 3 - good to moderate quality agricultural land. Much of the north eastern part of this Project Area (land to the east of the A165) is classified as ALC Grade 2 – very good quality agricultural land.

There are also other pockets of Grade 2 land – between Leven and Brandesburton and also at Routh. The coastal zone landward of the cliffs is predominantly classified as ALC Grade 3 - good to moderate quality agricultural land.

General description of project Area C (Central Area)

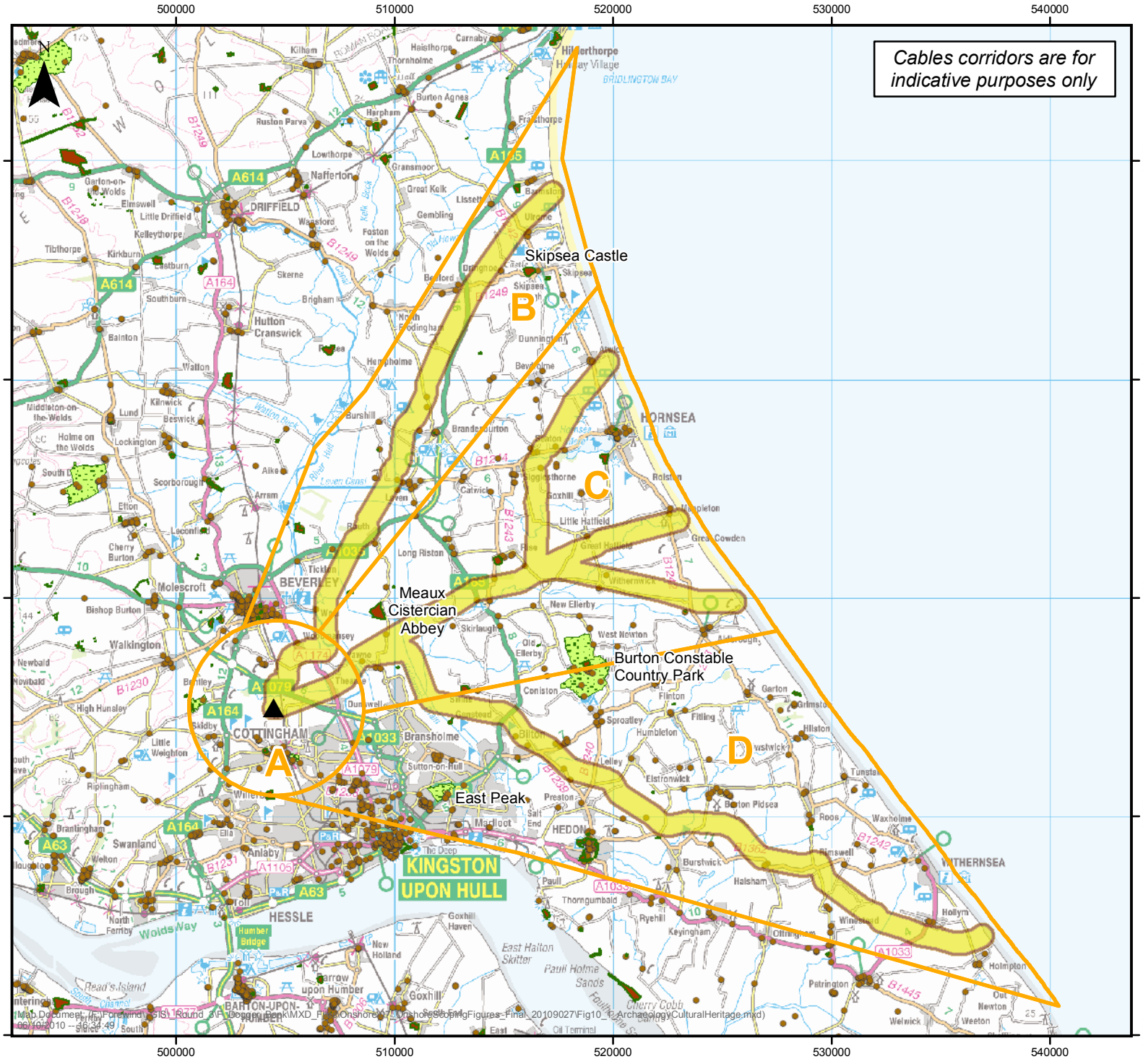
The majority of Project Area C is classified as ALC Grade 3 - good to moderate quality agricultural land. A wide band (up to 3km wide) of land classified as ALC Grade 2 – very good quality agricultural land is present either side of the A165 corridor throughout this Project Area.

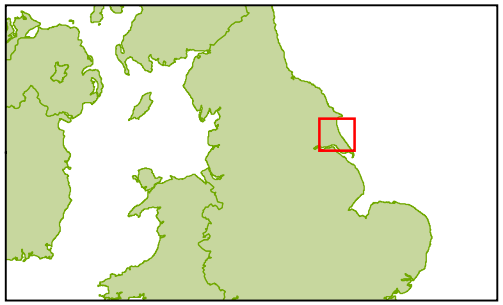
With the exception of the urban area of Hornsea, the coastal zone landward of the cliffs is predominantly classified as ALC Grade 3 - good to moderate quality agricultural land.

General description of project Area D (Southern Area)

With the exception of Kingston upon Hull the majority of Project Area D sits within an area that is classified as ALC Grade 2 – very good quality agricultural land.

With the exception of the urban area of Withernsea, the coastal zone landward of the cliffs is predominantly classified as ALC Grade 3 - good to moderate quality agricultural land.





Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Archaeology and Cultural Heritage

- Scheduled Ancient Monument
- Park or Garden
- Listed Building

Source: Archaeology and Cultural Data © English Heritage, 2010. Ordnance Survey 250k Raster © Crown copyright and database right, 2010.

0 2 4 8 Kilometres

0 1 2 4 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Archaeology and Cultural Heritage		
Figure No: Fig 10.1	Paper Size: A4	Rev: 9
Drawn By: DJM	Scale: 1:250,000	
Drawn On: 27/09/10	Projection: BNG	
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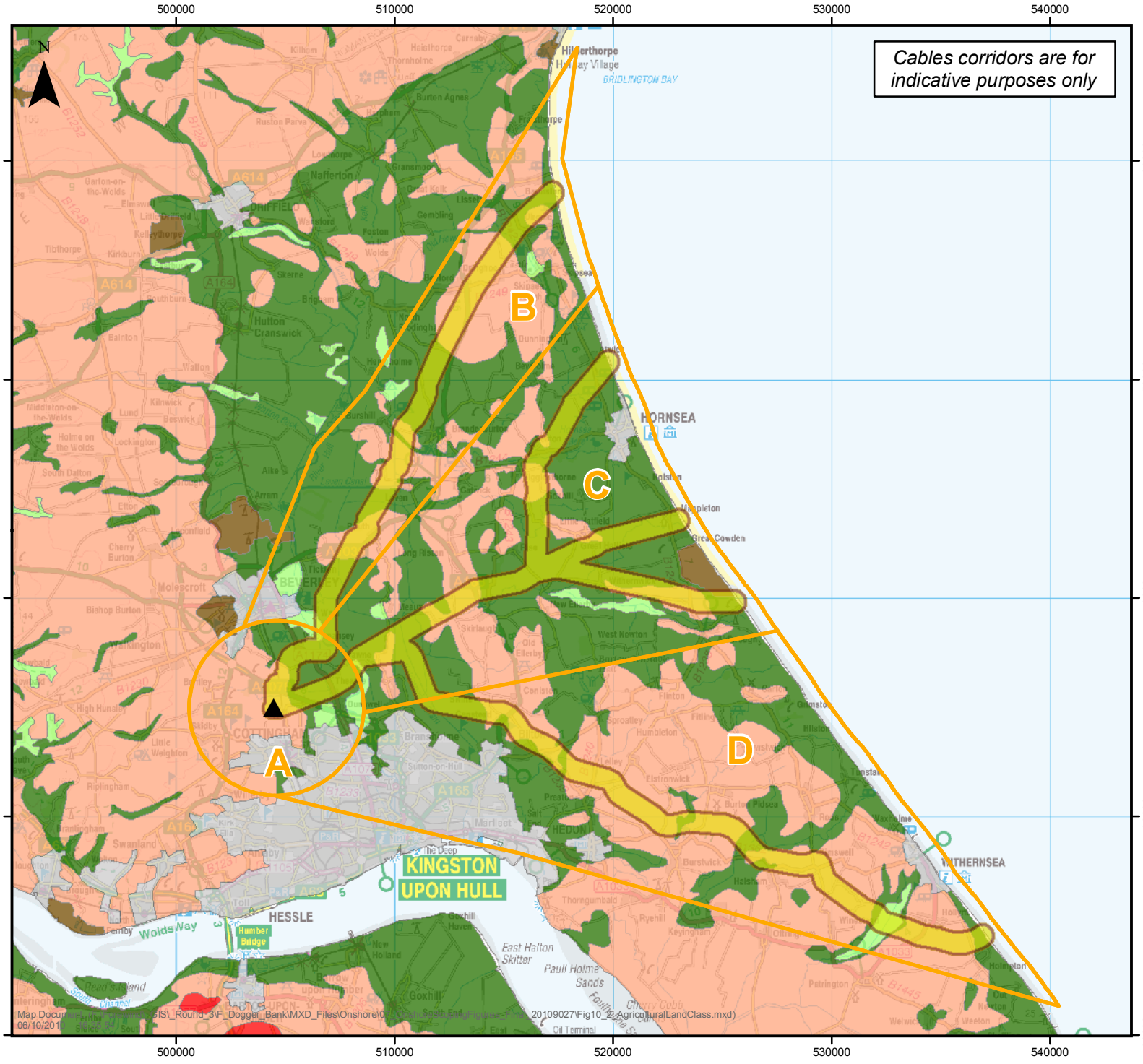

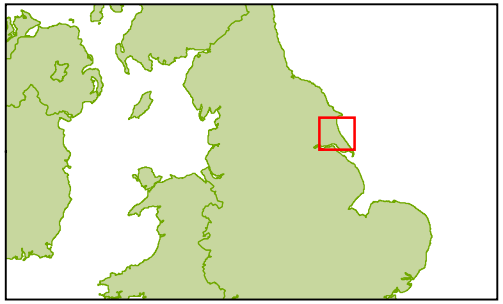

Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Agricultural Land Classification

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Non Agricultural
- Urban

Source: Agricultural Land Classification © Natural England, 2010. Ordnance Survey 250k Raster © Crown copyright and database right, 2010.

0 2 4 8 Kilometres

0 1 2 4 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Agricultural Land Classification		
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Drawn On: 27/09/10	Projection: BNG	
Checked By: RH	Datum: OSGB36	

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10.3.2 Potential Impacts

Potential impacts during construction

Soils and productivity: There is potential for an adverse impact to soil structure and future agricultural productivity of soils impacted by the construction of the cable system.

Drainage: There is potential for an adverse impact to the natural and artificial field drainage systems during construction of the cable system.

Disruption to farming: There is potential for an adverse impact on farming and other land use practices through the temporary loss of land availability and disruption caused by working areas and construction traffic.

Potential impacts during operation

During the operational phase of the wind farm the onshore cable system and substation(s) are not anticipated to have a adverse impact on soils, farming or other land use.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

10.3.3 Approach to EIA

Scope and methodology

The assessment of effects in relation to agriculture will include an assessment of:

- Soil resources affected by construction activities;
- Agricultural land quality of the soils affected; and
- Likely effects on farm holdings and other land uses during the construction phase.

The methodology for the assessment of the effects on land use, agriculture and soils will be informed by the following current guidance:

- Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 6 (Land Use); and
- DEFRA guidance including the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009).

In addition, the assessment will include consideration of the farm holdings. This will draw on the following published information to identify patterns of farming and land use along the proposed route:

- Aerial photography;
- DEFRA farming statistics; and
- Land Registry information.

The effects on farm holdings will consider information provided by the projects land agents and/or directly from the farmers at the potential landfall, any substation site and along the cable route.

Mitigation measures

The incorporation of good practice in soil handling and land restoration can assist in minimising any damage to soils and drainage during the construction process. This could include the development of a soil and drainage management strategy for the restoration of the cable construction corridor.

Ongoing consultation, through land agents, will ensure that farmers' concerns are well understood and that site specific conditions can be taken into account so that potential impacts upon land holdings can be minimised from the outset.

Key data collection/study required

Activity	Purpose
A desk based assessment of relevant published information, including data on soils and farm holdings.	To establish the existing environment and identify features which may be impacted by the project.

10.4 Traffic and Transport

The A165 north-south corridor is a principal road corridor in the area, together with the A1035 and A1033/A1079 to the north of Kingston upon Hull. The area has numerous villages and a relatively high rural population. In addition traffic is significantly increased in the summer months when visitors travel to the area's coastal resorts. Current heavy goods vehicle (HGV) traffic on these roads is expected to be lower than the national average. The Hull to Scarborough railway line passes the existing Creyke Beck substation approximately 150m to the east.

This section describes the methodology proposed to assess the effects of the project on traffic and transport. It is anticipated that the greatest impact on traffic and transport will come from temporary construction traffic, resulting in increasing overall traffic flows, in relation to the construction of the project. In terms of onshore construction, local traffic may be affected as a result of temporary road closures and diversions associated with cable laying and the converter substation(s) construction.

10.4.1 Existing environment

An initial review of the proposal documents and mapping has been undertaken, including consideration of internet based aerial mapping for the potential landfall areas, cable routes and converter substation(s). **Figure 10.3** shows the transportation infrastructure within the Study Area.

General description of project Area A (Substation Area)

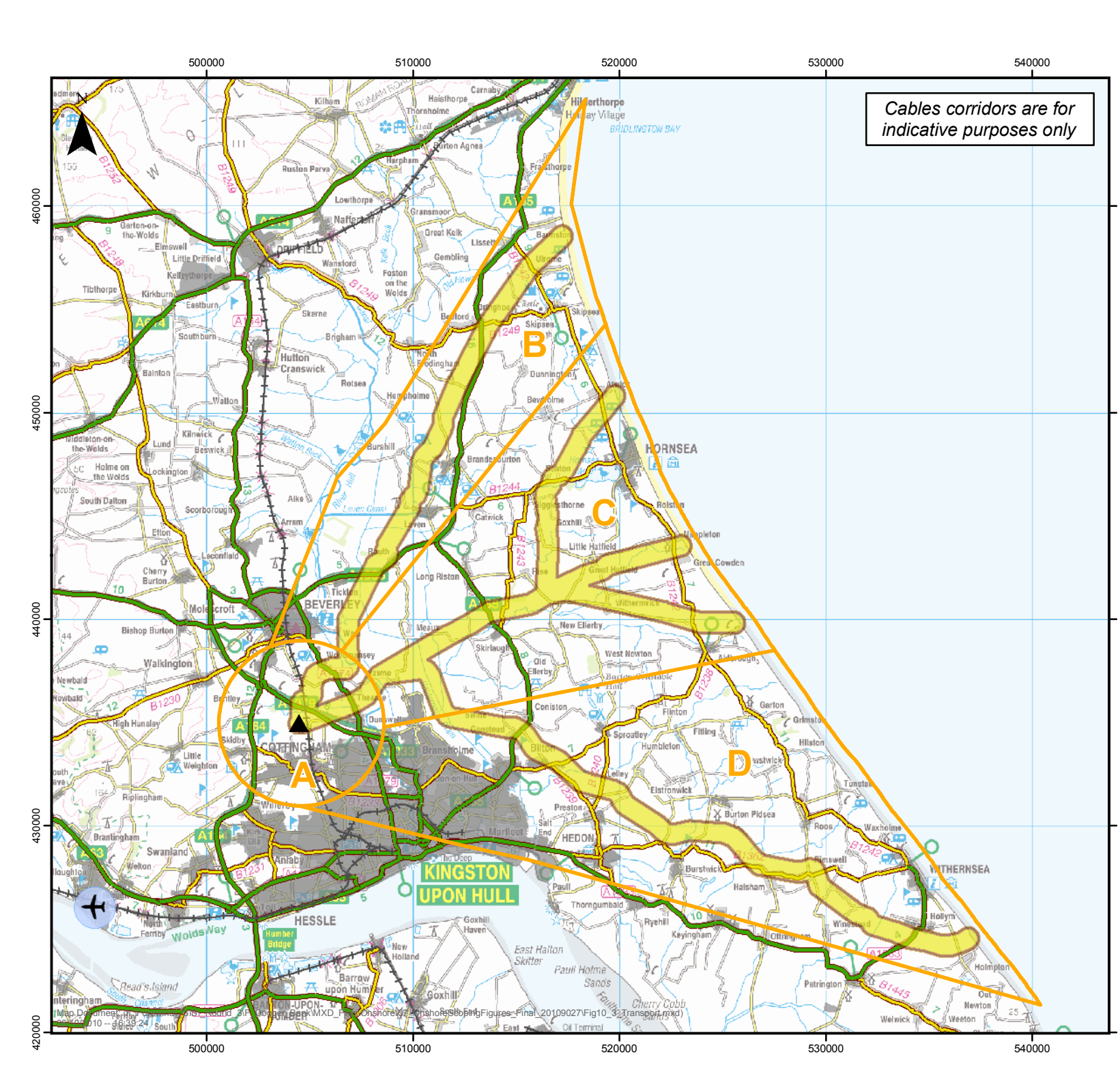
Cable Route

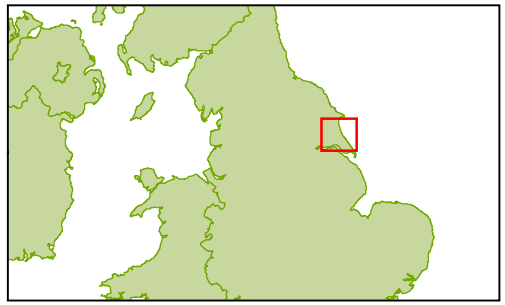
The cable route is likely to enter Project Area A at a point located somewhere between Kingston upon Hull and Beverley, although this is not confirmed at this stage of the project design. The cable route is therefore likely to cross the A1079, A1174, and the Hull to Scarborough Railway Line as well as a number of minor roads.

Substation Details

The centre of Project Area A is the Crekye Beck site, which is an existing substation, and extends up to four kilometres radius from this point. Access to the converter substation(s) for both construction and operation will be largely determined by its final location and therefore cannot be confirmed at this point. It is likely however, that traffic to the new converter substation(s) will utilise one or more of the main traffic arteries within the Project Area, namely the A1079 and/or the A164.

Abnormal loads similar to those brought in for the existing facility may also be necessary for the construction of the proposed converter substation(s). Routes for the passage of abnormal load vehicles to the specific site once defined, will be researched and discussed with the existing facility operations staff





Legend:

- Creyke Beck Study Area (Project Areas A - D)
- Creyke Beck Substation
- Indicative Cable Corridor

Transport Infrastructure

- A Road
- B Road
- Rail Line
- Airfield
- Airfield 1km Buffer
- Built Up Area

Source: Meridian 2 © Crown copyright and database right, 2010. Ordnance Survey 250k Raster © Crown copyright and database right, 2010.

0 2 4 8 Kilometres

0 1 2 4 Nautical Miles

DOGGER BANK R3 DEVELOPMENT		
Dogger Bank Project 1		
Figure Title:		
Transport Infrastructure		
Figure No: Fig 10.3	Paper Size: A4	Rev: 8
Draw n By: DJM	Scale: 1:250,000	
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General description of project Area B (Northern Area)

Landfall

A landfall in Project Area B could be located between Skipsea and Hilderthorpe (south of Bridlington). Should this option be chosen access is likely to be off the A165 along minor roads towards the coast. Some areas have existing beach access via vehicle access ramps. Tourist caravan parks are present along some of the frontages in the study area, along with coastal paths running along the cliff tops in many places, suggesting increased seasonal traffic.

Cable Route Option

The following roads are found within Project Area B: the B1242 coastal road B1249, A165 north of Leven and the A1035 east of Beverley. These roads are all single carriageway except for a section of the A165. In addition there are a number of minor roads in the area. A cable route in this area could be accessed from the A165 and along these minor roads.

General description of project Area C (Central Area)

Landfall

A landfall in Project Area C could be located between land north of Atwick and Aldbrough. Should this option be chosen, access for landfall is likely to be off the B1242 coastal road, and then along minor roads to the coast.

Caravan parks in the vicinity of the coast and a coastal path runs along the cliff top suggest increased seasonal traffic. The car park at Mappleton provides parking for beach users, including surfers, bathers and visitors.

Cable Route Option

The key roads in this area are the B1242 coastal road, B1249, B1244, B1243 and the A165. These roads are all single carriageway, except a small section of the A165. There are also a number of minor roads. A cable route in this area could be accessed from the B1244 and other local roads.

General description of project Area D (Southern Area)

Landfall

A landfall in this project area would likely be accessed from the A1033 and along minor roads and possibly farm tracks to the landfall location. There are caravan parks in the vicinity of Withernsea, suggesting increased seasonal traffic, and a coastal path runs along the cliff top.

Cable Route Option

A southern route within Project Area D route is likely to be the longest of the potential cable routes at approximately 40km long. The key roads in this area are the A1033, B1362, B1240, B1238 and A165. There are also a number of minor roads in this project area.

10.4.2 Potential impacts

Potential impacts during construction

During the construction phase, there will be a potential adverse impact on local transport from an increase in traffic generated by a range of activities including:

- Construction workers arriving and leaving site areas;
- Supply of construction materials and plant including cable and substation components;
- Movement of plant;
- Removal of soil resources, spoil or waste; and
- Service vehicles and visitors.
- Loss of amenity for local residents next to road transport routes during construction

In addition, local traffic local receptors may also be adversely affected as a result of temporary road closures and diversions associated with construction works including cable laying, and also the impacts of any abnormal loads on the road network.

Potential impacts during operation

Once construction is complete, the effect on the local road system will be minimal. There will be no permanent staffing requirements, and access will only be required for routine maintenance.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

10.4.3 Approach to EIA

Scope and methodology

The scope of the traffic and transport assessment will consider the potential environmental effects on the local highway and transport network at, and in the vicinity of, the potential landfall location, converter substation(s) and the preferred cable route, arising from predicted travel demand associated with the project.

The main traffic effects are expected to occur during the construction period, and include the transport of construction materials and abnormal loads to the converter substation(s), as well as traffic disruption associated with cable laying.

Collation of data

Consultation will be carried out throughout the EIA process with the East Riding of Yorkshire Highways Departments (and the Highways Agency if any trunk roads are affected) in order to discuss proposed access routes, site planning and issues which need to be taken into account during the EIA and planning process.

The following items of work will provide important baseline data to inform the environmental traffic and transport assessment:

- The identification of transport movements associated with landfall works, cable laying and substation(s) site;
- A desktop review of the proposed sites and route(s) to identify the key locations where transport issues may be raised;
- A site visit to review the sites and routes and access to and from compound areas;
- The identification of constraints associated with existing transport infrastructure, vehicle or pedestrian movements or other committed developments;
- The identification of areas where traffic management or route diversions may be necessary;
- The identification of likely access points off the highway to the cable route for the consideration of junction geometry and highway safety; and
- An abnormal loads study and route access study.

Impact assessment

An impact assessment will be undertaken, based on the following items of work:

- A review of available traffic flow data;
- The commissioning of further traffic surveys in areas where no data currently exist;
- The calculation of traffic flows for use in the assessments;
- The calculation of the percentage impact of new traffic flows on key parts of the highway network;
- The possible operational assessment of junctions affected by development traffic flows;
- A review of personal injury road traffic accident records on the parts of the network affected by the project;
- The consideration of possible driver delay resulting from traffic management required by the scheme; and
- The identification of measures to mitigate adverse transport impacts.

The construction transport assessment will concentrate on road traffic associated with the construction of the onshore elements of the project i.e. it excludes the supply of personnel and materials to ports elsewhere serving the offshore construction project. It is anticipated that the main potential impacts on the road network will mainly relate to two relatively short periods (construction and decommissioning), with negligible traffic associated with its operation.

The environmental effects of traffic and transport will be assessed in accordance with guidance contained in the following principal sources:

- Guidance for Transport Assessment, Department for Transport (2007b);
- The Design Manual for Roads and Bridges (various volumes);
- The Manual of Streets, Department of Transport/Department for Communities and Local Government (2007c);
- Guidelines for the Assessment of Road Traffic, The Institute of Environmental Management (2003);
- Department of Transport – Transport Analysis (2010); and
- Best Practice Guidelines for Wind Energy Development by BWEA (1994).

Mitigation measures

Appropriate mitigation measures will be identified for the construction phase of the project, this is expected to include:

- The procedure for road closures and diversion routes, taking into account existing bus and emergency service routes, schools, any other planned diversion routes likely to coincide with the project timing;
- The consideration of a range of potential construction techniques for crossing transport infrastructure, e.g. open cut trenching, HDD and cable ducting; and
- The production of an agreed draft Traffic Management Plan (TMP).

Key data collection/study required

Activity	Purpose
Collection of baseline traffic data (likely to be a combination of existing data supplemented with survey information).	To establish existing traffic movements and identify where impacts are likely to be greatest.
Characterisation of construction traffic requirements including weights and dimensions of abnormal loads.	To identify the potential impact characteristics.
Site access.	To sensitively locate marshalling areas and main corridor access points (incl. design of junctions) taking traffic levels and road widths into account.
Route access study for abnormal loads.	To establish the optimum routes for vehicles with abnormal loads to take to minimise negative impacts.
Development of draft construction travel plan.	To propose travel arrangements for the construction phase of the project.
Impact assessment.	To evaluate the impact of the project on traffic and transport and propose mitigation accordingly.

10.5 Air Quality

Policy guidance for local planning authorities (in England) regarding local air quality and new development is provided in Planning Policy Statement 23 (PPS 23): Planning and Pollution Control (ODPM, 2004). PPS23 states that "any air quality consideration that relates to land use and development is capable of being a material planning consideration PPS23 also re-iterates that the presence of an Air Quality Management Area (AQMA) should not be a presumption against development.

10.5.1 Existing environment

Project Areas A, B, C and part of D are located within the jurisdiction of East Riding of Yorkshire Council. The rest of Area D is located within Kingston upon Hull City Council area. Both local authorities have a statutory duty[16] to periodically review air quality in their respective areas.

An Air Quality Progress Report for East Riding of Yorkshire (2010) concluded that Air Quality Objectives were likely to be achieved in the Council area in respect of all pollutants. There are no AQMAs within the Council area.

Kingston upon Hull City Council has declared an AQMA due to the annual mean nitrogen dioxide (NO2) Air Quality Strategy (AQS) Objective being exceeded.

General description of project Area A to D

Project Area A comprises a mix of agricultural land and residential settlements, including Cottingham. Project Areas B to D are largely rural in nature, with a long coastal strip along the eastern edge. Inland, the areas are a mix of agricultural land and small villages, with pockets of industry associated with urban areas. Throughout the entire study area air quality is likely to be lower in urban areas and along main roads, with fewer pollutants in agricultural land and rural villages. Emissions from road vehicles are considered to be the most significant source of air pollution in areas B to D. Existing air quality in rural areas within project areas B to D are considered to be good[17].

10.5.2 Potential impacts

Potential impacts during construction

The air quality impacts from the project will primarily occur during the construction phase, and be of a temporary nature. The potential impacts are likely to be associated with dust and exhaust gas emissions generated by on site activities, including movements of non-road mobile machinery (NRMM) and on-road construction vehicles. The key pollutant likely to be produced by earth moving activities is particulate matter, comprising dust and finer particle fractions including PM10. Plant and

[16] Under The Environment Act 1995

[17] The AQMA located in Hull City Centre is outside project area D

vehicle exhaust emissions are associated with a range of air pollutants, the most important in respect of the AQS Objectives being NO_2 and PM10.

Potential impacts during operation

Converter substations do not have emissions to air and, as such, no direct impact would be anticipated.

During operation the proposed substation(s) and cable route will only require limited access for maintenance and monitoring tasks, and it is considered that the impact of this on air quality will be negligible. It is proposed that this issue is scoped out of the EIA.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

10.5.3 Approach to EIA

Scope and methodology

A qualitative approach to the assessment of construction phase emissions will be undertaken. Construction activity information and schedules will be correlated with local meteorological data to assess the potential impacts of dust and exhaust emissions. Existing baseline and construction traffic data will be screened in accordance with Environmental Protection UK (EPUK, 2010) guidance to determine the extent of the impact.

Where any such significant changes are identified, pollutant concentrations will be assessed qualitatively using the Design Manual for Roads and Bridges (DMRB) model, published by the Department for Transport (2007d).

Mitigation measures

Potential air quality impacts identified within the ES will be addressed through the recommendation of appropriate mitigation measures.

Key data collection/study required

Activity	Purpose
Existing 24 hour Annual Average Daily Traffic (AADT) data.	To estimate existing transport air pollution and gauge the impact of construction traffic above this.
Characterisation of construction traffic requirements including weights and dimensions of abnormal loads.	To identify the potential impact characteristics.
Development of draft construction travel plan.	To allow an estimation of the potential impact of construction on air quality.

10.6 Noise and Vibration

This section of the EIA will address potential noise and vibration effects upon human receptors only; effects on ecological receptors will be addressed in their relevant sections.

The assessment of potential noise and vibration effects will examine those associated with the construction of the onshore cable route (including landfall) and converter substation(s) as well as the operational noise effects of the existing substation. The assessment will address noise and vibration from both on-site activities as well as effects from off-site activities, such as the movement of additional construction-related traffic on the public road network, where appropriate.

The assessment will incorporate both quantitative and qualitative assessment, description of the significance of impacts along with discussions or recommendations for suitable control and mitigation measures, where appropriate.

10.6.1 Existing environment

Consultation will be undertaken with the relevant local authority Environmental Health Departments to agree the scope and methodology for any surveys and to identify any relevant existing datasets. Discussions will also be held to identify areas where particular local sensitivities or constraints may exist, with regard to noise and vibration.

General description of project Area A (Substation Area)

In addition to the existing 400kV Creyke Beck electrical substation, the area around Project Area A is predominantly agricultural, located between the northern outskirts of Hull and the southern edge of Beverley. The project area includes areas of residential housing which represent potentially noise sensitive receptors. These areas are interspersed with agricultural land where properties are fewer and more isolated. The main transport infrastructure within the study area is the Hull to Scarborough railway line and a busy road network including the A1079 and A164. The surrounding area also includes commercial units, including the Swift Group caravan manufacturing plant and various agro-commercial properties to the east of the existing substation.

The ambient noise environment within Project Area A is, therefore, likely to be dominated by transportation noise, both day and night, but with reduced levels at night. Additional intermittent contributions may arise from the various commercial premises and from military, commercial and private aircraft over-flights. In the vicinity of the existing substation, transformer noise may also contribute to background ambient noise.

General description of project Area B to D (Cable Area)

The Project Areas B to D include a mixture of rural villages, scattered hamlets and individual residences. There are also a number of tourism and leisure facilities towards the coast including camping and caravan sights which may be particularly noise sensitive.

The preferred cable route will need to cross various transport routes and public rights of way. There are also pockets of commercial / industrial use throughout.

The ambient noise situations will therefore be highly variable, depending on proximity to major sources of noise such as roads, railways and commercial / industrial areas. Away from such areas, ambient noise levels would be expected to be relatively low, typical of rural areas, with day time noise levels reduced to 30 dB LA90 or lower and night time noise levels potentially reduced to 20 dB LA90 or lower.

10.6.2 Potential impacts

Potential impacts during construction

The potentially significant noise and vibration effects associated with the construction of the scheme are:

- Noise and vibration from the operation of mobile and static plant equipment and vehicles at the cable landfall site, at construction compounds and along the proposed cable route;
- Noise and vibration from off-site vehicle and plant equipment movement on the public road network; and
- Noise and vibration associated with the construction of the proposed converter substation(s).

Potential impacts during operation

There are no identified impacts arising from noise or vibration from the operation of the cable system during its operation. The is potential for an adverse impact from the noise associated with the operation of the substation(s), including potentially audible transformer 'hum' at a frequency of 100Hz.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

10.6.3 Approach to EIA

Scope and methodology

Consultation with East Riding of Yorkshire Environmental Health Department will be undertaken to agree the precise scope and methodology for the survey and assessment, including agreement on a suitable number of noise survey locations.

The baseline noise survey will record the quantitative and qualitative noise situation at selected representative receptor locations, to be agreed between Forewind and the local authority. The survey would comprise short-term "snapshot" measurements at a limited number of locations adjacent to the cable route and longer duration measurements at receptors adjacent to the proposed converter substation(s).

The survey will incorporate attended and, possibly, unattended measurements of both day and night time noise levels, and will be carried out in accordance with current best practice guidance, including British Standard (BS) 7445 Description and Measurement of Environmental Noise (2003) and BS4142:97 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas (1997).

The desk-based assessment will assess potential effects on human receptors, examining construction noise potentially affecting properties close to the proposed cable landfall, cable route, substation(s) and construction traffic routes, as well as operational noise effects on properties close to the proposed substation(s). This will include:

- An assessment of on-site construction noise using current best practice guidance including BS 5228 Code of Practice for noise and vibration control on construction and open sites (2009) and other relevant national and international guidance as appropriate;
- An assessment of off-site construction-related vehicle noise in accordance with guidance such as the Department of Transport Calculation of road traffic noise [CRTN] and the Design Manual for Roads and Bridges (DMRB): Volume 11, Part 3, Section 7 – Noise and vibration (Department for Transport);
- An assessment of construction-related vibration encompassing both airborne and ground-borne vibration, with reference to BS 5228, DMRB BS 7385 Evaluation and measurement for vibration in buildings (1993) and BS 6472 Guide to evaluation of human exposure to vibration in buildings (2008); and
- An assessment of operational noise from the substation(s) that will utilise guidance contained in BS 5228 and with reference to BS 8233 Sound insulation and noise reduction for buildings (1999), the World Health Organisation (WHO) Guidelines for community noise and relevant published research and guidance on low frequency noise (1999).

The assessment will follow the standard method for the qualitative description of impact magnitude and significance, supplemented by quantitative assessment according to relative changes in noise level or exceedance of defined noise limits.

Where the assessment identifies significant impacts, appropriate methods for controlling or mitigating noise and vibration will be recommended.

Mitigation measures

Mitigation of construction noise is likely to require generic controls which may include restrictions on hours of operation and the use of good practice in construction techniques.

Mitigation of operational noise will need to consider three principal issues:

- Broadband noise associated with the operation of cooling fans and other static equipment; this may be achieved through the use of quiet plant equipment and the use of generic noise screens etc;
- Broadband noise associated with the operation of the transformers; this may be addressed through careful design and layout of the site and the use of enclosures or screens, where necessary; and
- Low frequency, tonal noise from the operation of the transformers. Depending on the significance of any low frequency noise effects, in the context of the existing substation noise, mitigation may necessitate some form of solid enclosure around the transformers.

It is not anticipated that there will be a requirement for noise or vibration monitoring, during either construction or operation unless particularly sensitive receptors are identified adjacent to the project footprint.

Key data collection/study required

Activity	Purpose
Identification of noise or vibration sensitive receptors in agreement with the local authority environmental Health Department.	To identify relevant receptors which will be particularly sensitive to noise and vibration impacts of the project.
Baseline noise measurement survey at agreed receptors.	To establish the current situation in terms of noise and vibration to determine the impact of the project above this.
Review of potential construction traffic numbers and existing traffic flows for the affected road network.	To estimate the current and proposed noise and vibration impact from traffic.
Review of construction method including determination of likely construction plant to be used.	To assess the potential noise and vibration impacts associated with the cable construction.
Review of substation(s) design including details of equipment and equipment noise levels.	To assess the magnitude of likely noise and vibration impacts of the project.

10.7 Recreation and Tourism

The EIA will assess the impact of the project on recreation and tourism. The study area presents a number of tourist and leisure opportunities; in particular located in the vicinity of the seaside towns of Withernsea and Hornsea. Water and beach based activities are popular, along with a number of camping and caravanning sites throughout the study area.

10.7.1 Existing environment

An initial desk based review has been undertaken using existing sources – ordnance survey data, regional and local planning documents and Public Rights of Way mapping, to characterise the area.

General description of project Area A (Substation Area)

The immediate area surrounding Creyke Beck substation is characterised by farmland and associated buildings. The residential area of Cottingham on the outskirts of Kingston upon Hull lies towards the south of the Project Area and the market town of Beverley just north of this Area. There are a large

number of footpaths, bridleways and cycle paths within this area which will be considered as part of the route planning process.

General description of project Area B (Northern Area)

Landfall

The coastal zone within Project Area B is characterised by sandy beaches and cliffs. There are a number of camping and caravan sites on the cliff-tops with pedestrian access routes down to the beach.

Cable System

This area is mainly comprised of arable farming with a few small settlements. Skipsea, Leven and Brandesbourton are the largest villages, which support a small cluster of camping and caravan sites on the outskirts of both villages. Hainsworth Park Golf Club, an 18-hole golf course, lies to the north of Brandesbourton.

General description of project area C (Central Area)

Landfall

The main area of coastal protection is Hornsea, which is a relatively small seaside resort protected by a sea wall and groynes. The remaining coastal zone, within this Project Area, is characterised by sandy beaches and cliffs. A cliff-top path runs along part of the coast in this area. A number of water based recreational activities take place here including sailing, surfing and water skiing.

Cable System

Hornsea is the largest town in Area C. The economy relies heavily on tourism and is surrounded by a number of camping and caravan sites. Within Hornsea itself there are a number of amenities including a hospital, secondary school and golf course to the south. To the west is Hornsea Mere which is a Special Protection Area (SPA) and plays host to a number of recreational activities including sailing, rowing and angling. Hornsea is at the eastern extent of the Trans Pennine Trail which passes through this area, in a south westerly direction towards Hull.

General description of project Area D (Southern Area)

Landfall

Apart from the coastal town of Withernsea this Project Area is characterised by sandy beaches and cliffs. A number of water based recreational activities take place here including sailing, surfing and water skiing.

Cable System

To the west of Project Area D are the outskirts of Kingston upon Hull, these are not discussed further here as any cable route is likely to avoid this area. Hedon Medieval Town, a tourist attraction lying to the south east of Kingston upon Hull, is a designated Ancient Monument and as such will be highlighted as an area to avoid as part of the route planning process. There are a number of golf

courses, caravan and camp sites, footpaths and bridleways which will also be considerations during the route planning and micro-siting process.

Outside of Kingston upon Hull, the coastal town of Withernsea is the largest settlement in this Project Area. It is a popular tourist resort supporting a hospital, primary and secondary school.

10.7.2 Potential impacts

Potential impacts during construction

It is anticipated that any disruption associated with the scheme is likely to be temporary and associated primarily with the construction phase. Temporary Public Rights of Way closures and diversions may be necessary in which case they will be undertaken in consultation with the Council's Rights of Way department. Recreation and tourism provisions and businesses may be temporarily disrupted through access route diversions, as a result of construction work.

Potential impacts during operation

Once operational there are no anticipated adverse impacts on recreation or tourism within the study area.

Potential impacts during decommissioning

Impacts from decommissioning are anticipated to be similar to those identified for construction activities.

10.7.3 Approach to EIA

Scope and methodology

The tourism and recreation assessment will comprise of the following:

- A desk-based study to identify tourism and recreation provisions which may be affected by the scheme, using maps and local sources.
- A review of local and national planning policy documents and guidance;
- Consultation with land owners, occupiers and the local community;
- Public Rights of Way (PRoW) will be identified and classified with reference to the definitive map and statement held by East Riding of Yorkshire Council. PRoW that may be affected by the development will be considered on a case by case basis in consultation with the Council's Rights of Way team; and
- An assessment of the impacts of the scheme on recreation and tourist facilities.

Mitigation measures

Mitigation measures will be incorporated within the ES as appropriate, following consultation with relevant parties and landowners. Typical measures may include:

- Adjusting the construction programme to minimise impacts;
- Timing PRoW and other recreation site closures to minimise any impact, for example, avoiding the holiday season; and

- Micro-siting discussions with landowners, occupiers, and the local community.

Key data collection/study required

Activity	Purpose
Desk-based study including PRoW.	To establish the current level and provision of recreation and tourism opportunities in the area.
Consultation with relevant authorities and land owners/ occupiers.	To ensure any nuisance or disruption is kept to a minimum.

10.8 Socio-Economics

10.8.1 Existing environment

Round 3 economic potential overview

Offshore wind farm development has been largely recognised as an important growth sector within the UK. Round 3 alone has been predicted to have the potential to create some 70,000 new jobs over the next decade, with this figure potentially rising to 200,000 by 2050 (The Carbon Trust, 2009). The ability for the UK to achieve these potential figures will be largely dependant on its capacity to provide competitive supply chain solutions for the industry.

General description of offshore

Coastal and offshore employment along the Holderness coast is centred around tourism, recreation, fisheries (particularly the inshore shellfisheries for which the area is one of the most productive within Europe) and industry (mainly through the oil and gas industry).

General description of onshore

With the exception of Kingston upon Hull and Beverley, the area is mainly low-lying productive agricultural land with small rural villages connected by winding roads. The study area also presents a number of tourist and leisure opportunities; in particular located in the vicinity of the seaside towns of Withernsea and Hornsea. Water and beach based activities are popular, along with a number of camping and caravanning sites throughout the study area.

10.8.2 Potential impacts

Offshore wind farms, of the scale of the Dogger Bank, can have significant positive socio-economic effects in terms of providing employment, and wind energy market development at a national level. It is anticipated that the economic impact, both direct and indirect will be most significant during the construction phase, with less direct impact on the local economy during the operational phase. The impacts described below exclude tourism and recreation which are considered separately for onshore (See **Section 10.7**) and offshore (See **Section 7.7**) impacts.

Potential impacts during construction

- **Supply chain**: The proposed wind farm will require local goods and services, which will be supplied by local businesses such as security, catering, hotel facilities or maintenance;
- **Infrastructure**: Potential for upgrade of existing or new ports and improved infrastructure;
- **Employment**: The offshore wind farm will require staff, employed directly by Forewind, contractors or manufacturers. There is potential for these positions to be filled by UK workers, some of whom could come from areas local to the landfall; and
- **Local expenditure**: There will be a social and economic impact that relates to the new spending power generated from employees directly and indirectly attached to the wind farm. A significant amount of the earning capacity of these individuals will be expected to be spent locally, for example shopping, accommodation, leisure and local taxes.

Potential impacts during operation

- Employment: The design life of the offshore wind farm is 25 years, rising to potentially 50 years following any future re-powering, and will require the employment of staff for operations, maintenance, potentially repowering after 25 years, and ultimately decommissioning.

10.8.3 Approach to EIA

Scope and methodology

There is currently no specific UK guidance for assessing the socio-economic impacts of offshore wind farms; however the following resources will be used inter alia in a desk-based assessment:

- The Crown Estate (2010b). A Guide to an Offshore Windfarm;
- The Crown Estate (2009). BWEA Towards Round 3: Building the Offshore Wind Supply Chain; and
- Energy for Sustainable Development (2004). Offshore wind, onshore jobs, - A new industry for Britain.

Key data collection/study required

Study to inform EIA	Purpose
Socio-economic Desk-Based Assessment.	To compile information on the existing socio-economic environment.
Impact Assessment.	To identify the significance of beneficial and adverse socio-economic effects of the development

11. Scoping Conclusion and Summary of Key Issues

11.1 Conclusions

The information in this Scoping Report is provided to support Forewind's formal request to the IPC for a Scoping Opinion in relation to the up to 1.4GW Dogger Bank Project One offshore wind farm and, consequently, the required scope of the EIA and ES.

This Scoping Report represents the first reporting stage in the EIA process and sets out the proposed way forward for the assessment of the likely environmental effects arising from the development proposals.

The process of EIA is iterative and will evolve as the assessment progresses and as our understanding of the baseline environment develops. The surveys and investigations necessary to provide the baseline data for the assessment of effects are presented in **Sections 5** to **10** above, along with an outline of the key environmental issues likely to be associated with development of the project. The ES will build on this work and present a comprehensive account of the potential environmental effects of the development proposals, both adverse and beneficial. It will also identify measures to prevent, reduce, offset or enhance the effects of the development where appropriate.

As summarised in **Section 4**, the process leading up to the formal application involves a series of consultations with statutory and non-statutory stakeholders and the local community. One of the key aims of the consultation process is to allow consultees to influence the way projects are developed by providing feedback on potential options and the design development process. Furthermore, the consultation process, and in particular consultation with statutory consultees, will assist in further defining and agreeing the scope and methodology of the EIA and resultant ES.

11.2 Summary of Key Issues

The following table summarises the aspects to be considered within the EIA and the potential impact associated for the relevant parameter.

Potentially significant impacts anticipated. Further investigation is required through the EIA process to confirm the extent and significance of impact and inform appropriate mitigation.

Significant impacts are not anticipated but further work will be necessary through the EIA to confirm this

No significant impacts anticipated. Potential impacts will be discussed within the EIA but it is thought unlikely at this stage that further detailed investigations will be required.

Parameter	Construction	Operation	Decommissioning	Cumulative
Offshore environment				
Bathymetry & Hydrodynamics				
Geology				
Geomorphology				
Water Quality				
Ornithology				
Marine ecology				
Fish & shellfish resource				
Marine mammals				
Intertidal ecology				
Commercial fisheries				
Seascape and Visual Character				

Parameter	Construction	Operation	Decommissioning	Cumulative
Shipping & navigation				
Marine and coastal archaeology				
Military & civil aviation radar				
Other human activities				
Coastal tourism & recreation				
Socio-economics				
Onshore environment				
Geology & water resources				
Terrestrial ecology				
Historic environment				
Landscape and visual character				
Soils, agriculture and land use				
Traffic and transport				
Air quality				
Noise and vibration				
Recreation and tourism				
Socio-economics				

Issues recommended as being Scoped Out

The reader should note that not all issues presented above in green are recommended as being scoped out, as certain issues will require further study to confirm that no significant impacts will arise as a result of Dogger Bank Project One.

Based on the preliminary investigations undertaken to inform this Scoping Report (namely the ZoC), combined with Forewind's existing combined experience of consenting Round 1 and 2 projects within the UKCS, it is recommended that the following aspects are 'scoped out' of the EIA:

- Impacts on geology offshore;
- Landscape impacts from the offshore components;
- Impacts on civil aviation; and
- Air quality impacts during the operation of the onshore aspects.

Individual issues and parameters of study will only be scoped out of the EIA process where properly addressed and justified and confirmed as being scoped out by the IPC.

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Table A1 – Qualifying SPA species

Name	Qualifying species during the breeding season	Qualifying species during the overwintering season	Other
North Norfolk Coast Ramsar / SPA	Under Article 4.1: Avocet *Recurvirostra avosetta* Bittern *Botaurus stellaris,* Common tern *Sterna hirundo,* Little tern *Sterna albifrons*, Marsh harrier *Circus aeruginosus*, Mediterranean gull *Larus melanocephalus,* Roseate tern *Sterna dougallii*, Sandwich tern *Sterna sandvicensis*. Under Article 4.2: Redshank *Tringa totanus,* Ringed plover *Charadrius hiaticula.*	Under Article 4.1: Avocet, Bar-tailed godwit *Limosa lapponica,* Bittern, Golden plover *Pluvialis apricaria,* Hen harrier *Circus cyaneus*, Ruff *Philomachus pugnax*. Under Article 4.2: Dark-bellied Brent goose *Branta bernicla bernicla*, Knot *Calidris canutus*, Pink-footed goose *Anser brachyrhynchus*, Pintail *Anas acuta*, Redshank, Wigeon *Anas Penelope*.	Under Article 4.2: Ringed plover on migration Assemblage qualification for over 20,000 waterfowl
The Wash	Under Article 4.1: Common tern Little tern Marsh harrier	Under Article 4.1: Avocet Bar-tailed godwit Golden plover Whooper Swan *Cygnus Cygnus* Under Article 4.2: Black-tailed godwit Curlew *Numenius arquata,* Dark-bellied Brent goose Dunlin *Calidris alpina alpina* Grey plover *Pluvialis squatarola* Knot Oystercatcher *Haematopus ostralegus* Pink-footed goose	Under Article 4.2: On passage: Ringed plover Sanderling *Calidris alba* Assemblage qualification for over 20,000 waterfowl

Name	Qualifying species during the breeding season	Qualifying species during the overwintering season	Other
		Pintail Redshank Shelduck *Tadorna tadorna* Turnstone *Arenaria interpres*	
Gibraltar Point	Under Article 4.1: Little tern	Under Article 4.1: Bar-tailed godwit Under Article 4.2: Grey plover Knot	Under Article 4.2: Assemblage qualification for over 20,000 waterfowl
Humber Flats, Marshes and Coast	Under Article 4.1: Little tern	Under Article 4.1: Bar-tailed godwit Bittern Golden plover Hen harrier Under Article 4.2: Dunlin Knot Redshank Shelduck	Under Article 4.2: On passage: Redshank Sanderling Assemblage qualification for over 20,000 waterfowl
Teesmouth and Cleveland Coast	Under Article 4.1: Little tern	Under Article 4.2: Knot Redshank	Under Article 4.1: On passage: Sandwich tern Under Article 4.2: On passage: Ringed plover Assemblage qualification for over 20,000 waterfowl
Lindisfarne	Under Article 4.1: Little tern	Under Article 4.1: Bar-tailed godwit Golden plover Whooper swan Under Article 4.2: Grey plover Greylag goose, *Anser anser* Knot	Under Article 4.2: On passage: Ringed plover Assemblage qualification for over 20,000 waterfowl

Name	Qualifying species during the breeding season	Qualifying species during the overwintering season	Other
		Light-bellied Brent goose *Branta bernicla hrota* Wigeon	
Firth of Forth		Under Article 4.1: Bar-tailed godwit Golden plover Red-throated diver *Gavia stellata* Slavonian grebe *Podiceps auritus* Under Article 4.2: Knot Pink-footed goose Redshank Shelduck Turnstone	Under Article 4.1: On passage: Sandwich tern Under Article 4.2: Assemblage qualification for over 20,000 waterfowl
Firth of Forth Islands	Under Article 4.1: Arctic tern Common tern Roseate tern *Sterna dougallii* Sandwich tern Under Article 4.2: Gannet *Morus bassanus* Lesser Black-backed Gull *Larus fuscus* Puffin *Fratercula arctica* Shag *Phalacrocorax aristotelis*		Under Article 4.2: Assemblage qualification for over 20,000 seabirds
Hornsea Mere		Under Article 4.2: Gadwall *Anas strepera*	
St Abb's Head to Fast Castle			Under Article 4.2: Assemblage qualification for over 20,000 seabirds