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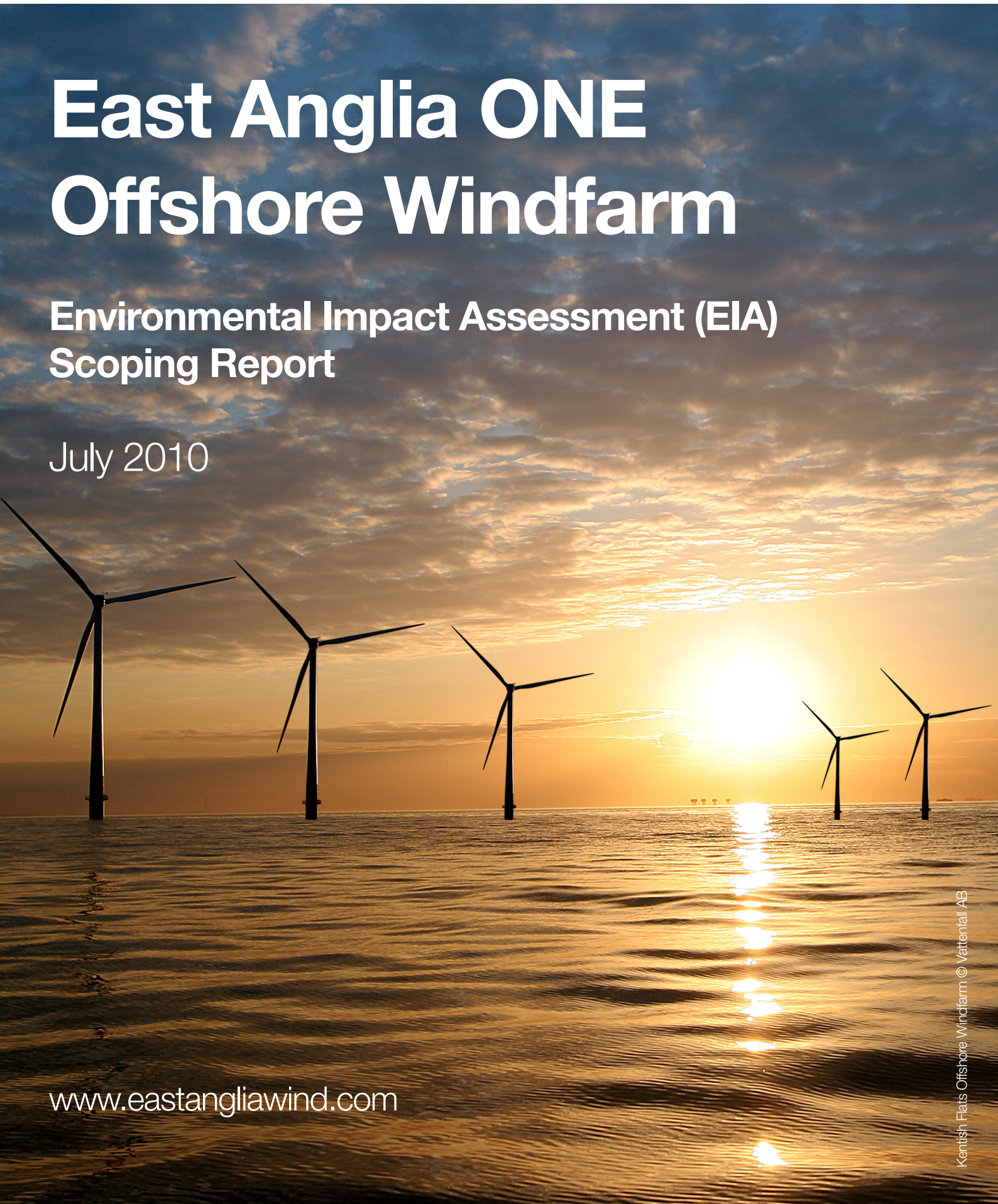
VATTENFALL

East Anglia ONE Offshore Windfarm

Environmental Impact Assessment (EIA) Scoping Report

July 2010



www.eastangliawind.com

Kentish Flats Offshore Windfarm © Vattenfall AB

East Anglia ONE Offshore Windfarm

July 2010

For and on behalf of
East Anglia Offshore Wind

Approved by: RALPH THORNTON

Signed:

Position: Senior Project Manager

Date: 12/07/10

For and on behalf of
Environmental Resources Management Limited

Approved by: Simon Hewitt

Signed:

Position: Partner

Date: 09 July 2010

GLOSSARY

AAR	Air to Air Refuelling
AC	Alternating Current
AIS	Automatic Identification System
ALSF	Aggregates Levy Sustainability Fund
ANSPs	Air Navigation Service Provider's
ASA	Archaeological Study Area
ATBA	Area To Be Avoided
AWACs	Acoustic Doppler Wave and Current Profiler
BERR	Business, Enterprise and Regulatory Reform
BODC	British Oceanographic Data Centre
BWEA	British Wind Energy Association (now RenewablesUK)
CAA	Civil Aviation Authority
CCTV	Closed Circuit Television
CCW	Countryside Council of Wales
CLG	Communities and Local Government
CMACS	Central Monitor and Control System
COWRIE	Collaborative Offshore Wind Research into the Environment
CPA	Coast Protection Act
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
DGPS	Differential GPS
DSC	Digital Selective Calling
DTI	Department for Trade and Industry (now Department for Innovation and Skills and Department for Energy and Climate Change)
DWR	Deep Water Route
DWT	Dead Weight Tons
EAOW	East Anglia Offshore Wind Ltd
EcIA	Ecological Impact Assessment
EEDA	East of England Development Agency
EIA	Environmental Impact Assessment
EMFs	Electromagnetic fields
EPS	European Protected Species
ERM	Environmental Resource Management
ES	Environmental Statement
FEPA	Food and Environment Protection Act
FSA	Formal Safety Assessment
GIS	Geographic Information System
GPS	Global Positioning System
GVA	Gross Value Added
HRA	Habitats Regulations Assessment
HMR	Hazardous Materials Regulations

HVDC	High Voltage Direct Current
ICES	International Council for the Exploration of the Sea
IECS	Institute of Estuarine & Coastal Studies
IEEM	Institute of Ecology and Environmental Management
IMO	International Maritime Organisation
IPC	Infrastructure Planning Commission
JNCC	Joint Nature Conservation Committee
JONSWAP	Joint North Sea Wave Project
LARS	Laser Angular Rate Sensor
MaRS	Marine Resource System
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MGN	Marine Guidance Notice
MMO	Marine Management Organisation
MMO	Marine Mammal Observers
NATS	National Air Traffic System
NE	Natural England
NNR	National Nature Reserve
NSIP	Nationally Significant Infrastructure Projects
NSP	National Planning Statements
NTS	Non Technical Summary
OREI	Offshore Renewable Energy Installations
OSPAR	Oslo / Paris Convention
PAM	Passive Acoustic Monitoring
PLA	Port of London Authority
PRS	Primary Radar System
REA	Regional Environmental Assessment
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Association
ROV	Remote Operate Vehicle
RYA	Royal Sailing Association
SAC	Special Area of Conservation
SAR	Search and Rescue
SCADA	Supervisory Control and Data Acquisition
SCI	Site of Community Interest
SEA	Strategic Environmental Assessment
SME	Small and Medium Enterprises
SPA	Special Protection Area
SPR	ScottishPower Renewables
TSS	Traffic Separation Scheme
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordinance
VHF	Very High Frequency
VMS	Vessel Monitoring Systems
VTS	Vessel Traffic System

VWPL	Vattenfall Wind Power Limited
WSI	Written Scheme of Investigation
XLPE	Cross Linked Polyethylene
ZAP	Zone Appraisal and Planning
ZEA	Zonal Environmental Assessment
ZTV	Zone of Theoretical Vision

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

East Anglia Offshore Wind Limited (EAOW) has been awarded a licence by The Crown Estate to develop approximately 7,200MW of wind capacity off the coast of East Anglia, known as Zone 5, under the Round 3 Offshore Wind Licensing Arrangements. The development rights are subject to EAOW being successful in gaining the necessary consents from statutory bodies for the construction, operation and eventual decommissioning of the offshore windfarms that will be located within the Zone.

The Zone will be developed as a number of individual windfarms, each of which will require the appropriate statutory consents and approvals. The location of the first windfarm within Zone 5 (known hereafter as 'East Anglia ONE'), is shown in *Figure 1.1*.

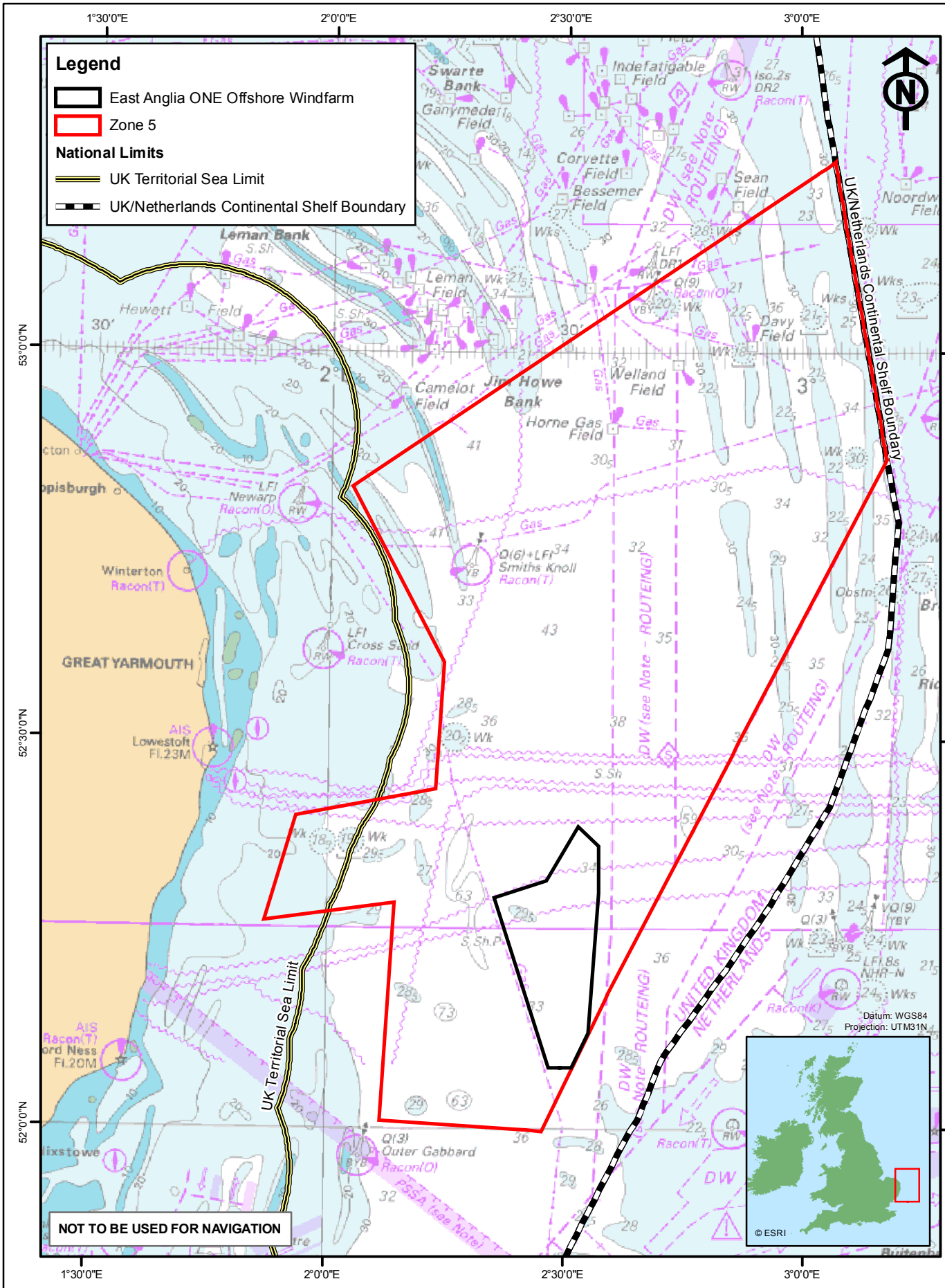
EAOW therefore intends to submit an application for a Development Consent Order (DCO) to the Infrastructure Planning Commission (IPC) for East Anglia ONE, the first windfarm to be developed within the Zone. The DCO application will also include associated development away from the windfarm site that is deemed necessary for its construction and operation, and for the transmission of power to the National Grid.

This Scoping Report deals with the EIA for offshore elements of the project only; namely, the proposed wind turbines, inter array cables, offshore substation platform(s) and meteorological monitoring mast(s). All associated infrastructure, including the export cable to shore, landfall and onshore grid connection infrastructure will be the subject of a separate Scoping Report.

The DCO application will comprise full details of the development proposals and will be accompanied by an Environmental Statement (ES) prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (known hereafter as the EIA Regulations) and other documents.

The purpose of this Scoping Report is to obtain a Scoping Opinion from the IPC, as enabled by Regulation 8 of the EIA Regulations. This document therefore sets out the proposed content, methodologies and key issues to be included in the EIA and the resulting ES to be submitted with the DCO application.

It is anticipated that EAOW will submit the DCO application and supporting documentation for East Anglia ONE in 2013 following a period of formal consultation in 2012.



East Anglia Offshore Wind

Proposed Location of East Anglia ONE Offshore Windfarm

Rev	Date	By	Comment
C	01/07/10	JH	Template updated
B	16/06/10	JH	Legend updated
A	07/06/10	JH	First Issue.

Original A4 Plot Scale 1:750,000

0 5 10 km 0 2 4 6 nm

Layout	Date	Rev	Dwg No.
N/A	01/07/2010	C	6115-500-PE-009

Figure 1.1

6115-500-PE-009-C_20100701_ZoneLoc.mxd

1.2 THE DEVELOPER AND PROJECT TEAM

East Anglia Offshore Wind Limited is a joint venture between ScottishPower Renewables (SPR) and Vattenfall Wind Power Limited (VWPL) and has been created for the development of Zone 5 of The Crown Estate's Round 3 process. SPR is part of Iberdrola Renewables, the world's largest renewable developer, which has over 10,000MW of installed capacity operational windfarms and is also currently developing the 500MW West of Duddon Sands offshore wind project. VWPL's ultimate holding company is a state owned Swedish energy utility company. It currently operates nearly 400MW of offshore wind capacity around Europe and has a pipeline of 2,700MW of offshore wind capacity at various stages of development. Vattenfall are current constructing Thanet Offshore Windfarm, located 12km off the Kent coast. The project consists of 100 turbines of 3MW installed capacity each.

Environmental Resource Management (ERM) has been commissioned by EAOW to undertake an EIA, including the initial review of the key environmental issues associated with the construction, operation and eventual decommissioning of East Anglia ONE, through a targeted scoping exercise.

Supporting ERM throughout the EIA process will be a number of organisations with expertise in specialist aspects of offshore wind EIA (see *Table 1.1*).

Table 1.1 Organisations Involved in Undertaking the EIA for East Anglia ONE

Parameter	Organisation
Lead EIA Consultant	ERM
Geology, Sea bed Sediments and Sediment Transport	ABPmer
Geophysical surveys	Gardline
Water Quality	ERM
Air Quality	ERM
Benthic and Epibenthic Environment	ERM, MESL
Fish Ecology	ERM, Brown and May Marine Ltd
Marine Mammals	ERM
Ornithology	ERM, IECS, BTO

Parameter	Organisation
Underwater Noise and Vibration	Subacoustech
Commercial Fisheries	Brown and May Marine Ltd
Shipping and Navigation	Anatec
Socio-economic Characteristics	ERM
Aviation and MoD	Osprey
Landscape, Seascape and Visual	ERM
Airborne Noise and Vibration	ERM
Archaeology and Cultural Heritage	Wessex Archaeology
Infrastructure and Other Users / Activity	ERM, Qinetiq

1.3 *PURPOSE OF THIS DOCUMENT*

The production and circulation of a Scoping Report is a well established early deliverable within the EIA process. The overall objective of the EIA for East Anglia ONE will be to satisfy the requirements of the Planning Act 2008 and associated Regulations, to identify, prevent and reduce or offset any potentially significant adverse impacts of the development and thereby enable the IPC to issue a DCO in a timely manner.

Therefore, this Scoping Report has been prepared according to Regulation 8 of the EIA Regulations which enables an applicant to seek a Scoping Opinion from the IPC on the information to be included in an EIA.

The EIA will also be conducted to satisfy the requirements of the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) that apply to East Anglia ONE since the site lies beyond the 12nm UK territorial water limit.

Further detail on the legislative context relating to the IPC and other Regulations of relevance to the offshore components of East Anglia ONE can be found in *Section 2* of this Scoping Report.

In accordance with Regulation 6(2) of the EIA Regulations, this Scoping Report has a number of key functions:

- to present the key environmental issues and to propose an approach to data gathering, data analysis and assessment for comment and agreement by key regulators;

- to present key considerations such as Appropriate Assessment, cumulative and in-combination assessment and the consultation strategy; and

- to engage with the IPC, regulators and stakeholders in the EIA process, inviting them to provide baseline information and to comment on the proposed approach to EIA.

The identification and subsequent assessment of potentially significant impacts will be based upon an understanding of the environmental conditions likely to be encountered at the development site and will utilise information gained from the development of Round 1 and Round 2 offshore windfarms.

A number of parameters are considered in this Scoping Report (see *Section 1.4*). The Scoping Report shows those parameters which are proposed to be 'scoped out' at this stage due to the fact that no potential significant impacts are anticipated to arise during the construction, operation and decommissioning phases of East Anglia ONE.

1.4 DOCUMENT STRUCTURE

The remainder of this Scoping Report is structured as follows:

- **Section 2** - provides the policy and legislative context, outlining the consents required for East Anglia ONE;

- **Section 3** – provides a description of East Anglia ONE and site location and provides information on the process which will be used to design the site;

- **Section 4** – describes the general methodology proposed for EIA, including approach to impact assessment, assessment of potential cumulative, in-combination impacts, transboundary impacts and mitigation. The section also presents the proposed outline of the ES;

- **Section 5** - provides a brief summary of the environmental baseline of the site and its immediate surroundings and details the proposed methods of additional data collection. Each topic is structured as follows:

- Baseline Conditions;
- Data Sources;
- Topic specific EIA Methodology;
- Potential Project Impacts;
- Cumulative and In-Combination Impacts;
- Transboundary Impacts (where identified); and
- Mitigation and Monitoring.

The parameters considered within Section 5 of this Scoping Report are listed below and encompass those matters considered relevant to the offshore components of East Anglia ONE from the list presented in Schedule 4, Part 1, paragraph 19 of the EIA Regulations:

- geology, sea bed sediments and sediment transport;
- water quality;
- air quality;
- benthic and epibenthic;
- fish ecology;
- marine mammals;
- ornithology;
- underwater noise and vibration;
- commercial fisheries;
- shipping and navigation;
- civil and military aviation and airborne radar;
- telecommunications and interference;
- archaeology and cultural heritage;
- socio-economic characteristics;
- airborne noise and vibration;
- landscape, seascape and visual; and
- infrastructure and other users.

This section also sets out a framework for Environmental Management throughout the development process (*Section 5.6*)

- **Section 6** – outlines the consultees to be consulted as part of this scoping exercise;

- **Section 7** – sets out some focussed scoping questions;

- **Section 8** – provides contact details for the developer; and

- **Section 9** – provides a list of References.

2 POLICY AND LEGISLATIVE CONTEXT

2.1 CLIMATE CHANGE POLICY

In line with the Kyoto Protocol, signatory states such as the UK have individual targets for their energy generation from renewables sources. The European Union's overall emission target under the Protocol is a reduction of greenhouse gas emissions to 8% below 1990 levels by the commitment period of 2008 to 2012. The UK Government's Climate Change Programme set out additional targets including a reduction of greenhouse gas emissions to 12.5% below 1990 levels by 2012 and cutting carbon dioxide (CO_2) emissions to 20% below 1990 levels by 2020.

The long term Government strategy for carbon reduction outlined in both the 2003 Energy White Paper (DTI, 2003) and the 2007 Energy White Paper (DTI, 2007), included provisions for a reduction of CO_2 emissions to 60% by 2050. This target has since been revised to a reduction of CO_2 emissions of 80% by 2050, following Government acceptance of a formal recommendation by the Committee of Climate Change, as set up under the Climate Change Act 2008. Both Energy White Papers also included a revised target to that set under the Climate Change Programme, increasing the target set for renewable sources of energy to 15% by 2015, with an aspiration of 20% of renewable energy supply by 2020.

2.2 RENEWABLE ENERGY

In March 2007, the European Council agreed a binding target for 20% of overall EU energy consumption to be fed by renewable energies by 2020. While many of the 27 EU Member States do not have sufficient resources to significantly contribute, the UK has a major role to play in meeting these targets as it has (amongst other sources) approximately 33% of the total EU wind resource (Risø National Laboratory, 1989).

The Government's targets for renewable energy will help the UK to meet its international obligations, but also obtain greater security of energy supply through the promotion of indigenous electricity generation. The construction of both onshore and offshore windfarms is expected to be the largest contributor to the development of the renewable energy sector and wind energy will provide the greatest contribution to the targets of all the renewable energy technologies.

The Stern Review on the Economics of Climate Change (2006) highlighted the urgent need for a major increase in renewable energy contributions to meet the global energy demand. In terms of renewable energy developments, it states:

> *"Renewable energy, and wind power in particular, can be a massive benefit to the prosperity of this country, providing secure, stably-priced energy supplies in the short term. In the future, UK companies could be generating significant export revenues in the emerging technologies of wave and tidal power, In order to achieve these results, however, the Government has to urgently show that the UK is a good place to do renewable business."*

The Energy Act 2008 implements the legislative aspects of the Energy White Paper 2007 (DTI, 2007). It provides an update to the Energy Act 2004 that enabled The Crown Estate to award licences for windfarm sites in the Renewable Energy Zone (REZ). The Offshore Production of Energy part of the Energy Act 2004 put in place a legal framework for offshore renewable energy projects – wind, wave and tidal – beyond the UK's territorial waters. The 2004 Act gave the UK Government additional powers to regulate renewable energy projects in the REZ, principally by extending the requirement for consent under Section 36 of the Electricity Act 1989.

2.3 *OFFSHORE WIND*

The impetus for Round 3 offshore wind projects came about following recommendations within a Strategic Environmental Assessment (SEA) launched in December 2007 by the (then) Government Department for Business, Enterprise and Regulatory Reform (BERR) to examine 33GW of additional UK offshore wind energy generation capacity by 2020. The (then) Department for Business, Enterprise and Regulatory Reform published the environmental report for the SEA for consultation in January 2009, providing consideration of areas identified by The Crown Estate as offering 'indicative economic potential for offshore wind' as part of a UK wide assessment.

Following the consultation period, the Government's decision on the SEA and The Crown Estate's Round 3 Zones was published in June 2009, which was to adopt a plan /programme for offshore energy, encompassing some 25GW of wind generation capacity and allowing The Crown Estate to continue with the competitive leasing round (Round 3).

East Anglia ONE is located within the Round 3 Zone 5 and thus conforms to the strategic development plan /programme for Round 3. In carrying out the EIA for East Anglia ONE, consideration will be given to the conclusions of the 2009 SEA report and the subsequent strategic level Appropriate Assessment conducted by The Crown Estate, together with consultation responses to the SEA, as given in the post-consultation report.

2.4 *PLANNING CONTEXT*

Significant changes have been made to the planning system under the Planning Act 2008 and its associated Regulations, with the introduction of the independent Infrastructure Planning Commission (IPC) that will decide applications for Nationally Significant Infrastructure Projects (NSIPs), including offshore energy developments over 100MW.

EAOW recognises that, since the establishment of the IPC, the Coalition Government formed in May 2010 intends to create a Major Infrastructure Unit within a revised Department for Communities and Local Government (CLG) structure that will also incorporate the Planning Inspectorate. Recommendations on NSIPs will be made to Ministers for final decision. These changes will require primary legislation which will not take effect for over a year. Therefore, for the purposes of this Scoping Report, East Anglia ONE will fall under the auspices of the current consents regime. EAOW will observe changes to the planning framework and responsible authorities from which development consent for East Anglia ONE will be sought.

This Scoping Report therefore refers to the advice and guidance notes provided on the IPC website (www.independent.gov.uk/infrastructure), as well as an applicant's duties under Chapter 2 of Part 5 of the Planning Act. For the purposes of this Scoping Report, specific reference has been made to IPC Advice Note 5 Scoping Opinion Consultation, IPC Guidance Note 1 Pre-application Stages and IPC guidance Note 2 Preparation of Application Documents. Additionally, the guidance published by Department of Communities and Local Government *Planning Act 2008: Guidance on pre-application consultation* has been used to frame the legislative backdrop of this Scoping Report.

2.5 DEVELOPMENT CONSENT AND EIA

2.5.1 *The Planning Act 2008*

The Planning Act 2008 introduces a new system for approving NSIPs in England and Wales. The majority of the Act is concerned with the creation of the new system, which comprises three elements. The first is the designation of a series of National Planning Statements (NSPs) setting out national policy in relation to specified descriptions of development. The second is the creation of a new independent body, the IPC, which would normally be the decision making body in respect of NSIPs, including offshore windfarms over 100MW. The third and final element is the DCO which could be granted by the IPC and which would replace the current consents process required for major infrastructure projects, that consists of a number of consents routes. As discussed in *Section 2.4,* revisions to the Planning Act 2008 are underway and will be closely monitored.

The two NPSs of relevance to the entire East Anglia ONE are NPS Overarching Energy (EN-1) and NPS Renewable Energy Infrastructure (EN-3), which identify the construction of offshore generating stations in excess on 100MW as NSIPs.

Under the Planning Act 2008, the EIA process is governed by the Infrastructure Planning (Environmental Impact Assessment) Regulations (2009) (the EIA Regulations). The EIA regulations are designed to ensure that the pre-application publicity and consultation requirements of the EIA process are consistent with those of the Planning Act 2008.

These Regulations subsume various other statutory requirements that would otherwise be relevant to this project, as follows:

- consent under Section 36 of the Electricity Act 1989;
- consents under Section 36A and 36 B of the Energy Act 2008;
- consent under Section 5 of the Food and Environment Protection Act (FEPA) 1985;
- consent under Section 34 of the Coast Protection Act (CPA) 1949;
- the Telecommunications Act 1984; and
- various Harbour Acts.

In many cases, these Acts and their associated consents are still relevant (such as FEPA issued by the Marine Management Organisation (MMO)), but now, for NSIPs, the IPC manages the process of obtaining the consents from the designated authority so that the consents are subsumed within the DCO. However, it remains to be the responsibility of the applicant to identify the various consents that the IPC would need to obtain on behalf

of the applicant by means of the applicant submitting a Draft Order with its DCO application. Further information on the current status of FEPA licences and the IPC's role in obtaining a FEPA licence (to be subsumed within the DCO) on behalf of the applicant is described in *Section 2.5.2.*

Those consents that would have been required for marine works landwards of the 12nm limit, landfall and onshore components of East Anglia ONE (such as consent under Section 37 of the Electricity Act 1989 and consent under the Transport and Works Act 1992), but that are now subsumed within the future DCO, will be identified in a subsequent Scoping Report dealing with the export cables and onshore components.

Under the Offshore Marine Regulations, it is an offence to deliberately disturb a European Protected Species (EPS) and a wildlife licence would be required for works which may affect an EPS or its shelter or breeding places. The wildlife licensing process is described in *Section 2.7.1* and identification of potential EPS and other species requiring a marine wildlife licence are detailed in *Section 5.3* of this Scoping Report.

2.5.2 *The Marine and Coastal Access Act 2009*

The Marine and Coastal Access Act 2009 is intended to sit alongside the Planning Act 2008 and aims to ensure clean, healthy, safe, productive and biologically diverse oceans and seas by implementing new planning and management systems for overseeing the marine environment. The Act's remit includes marine fisheries policy, marine conservation and certain planning approvals for the sea bed. Like the Planning Act, the Marine and Coastal Act introduces new processes for planning and consent in an attempt to simplify the consenting process.

The Marine Management Organisation (MMO) established under the Marine and Coastal Act will have responsibilities for the planning and licensing arrangements for offshore windfarm projects with a power output of less than 100MW. As highlighted above, since East Anglia ONE is greater than 100MW, the IPC will be responsible for the review of the application and issue of the DCO, although the MMO will remain a statutory consultee of the IPC and the applicant. In this way, the MMO will have a role in advising the IPC on conditions that should be imposed to mitigate any adverse impact that a development may have on the marine environment or other users of the sea. The MMO will be responsible for any subsequent monitoring and enforcement of any development approved by the IPC.

It is understood that, on the application for a DCO, the IPC will arrange any relevant FEPA licence on the applicant's behalf with the MMO. This dispenses with the need of the applicant to apply separately for a FEPA licence. Since FEPA licence conditions are assumed to be included in any future DCO, the ES will address all parameters required to satisfy a FEPA licence application.

The Marine and Coastal Access Act 2009 also brings about the opportunity for designation of Marine Conservation Zones. Although no such Zones have yet been designated (other than Lundy Island in the Bristol Channel), it is recognised that MCZs will be in place before the proposed construction of East Anglia ONE. Guidance on features of conservation importance likely to form future MCZs will be considered throughout the EIA.

2.6 'ROCHDALE APPROACH' IN THE EIA

As much detail as possible regarding the project design will be presented within the final ES (see *Section 3* of this Scoping Report for outline designs). However, much of the final design, ie windfarm layout, foundation types, inter-turbine cabling and turbine models, will be refined throughout the development process in response to site specificities in ground type, meteorological conditions and environmental sensitivities as well as technological improvement, consultation responses and economic considerations.

At this stage in the development of East Anglia ONE, the precise turbine model which will be procured for the site is unknown and may not be known until some time after any DCO has been granted. Turbine technology is continuously advancing; machines of up to 10MW are currently in development, although not commercially available. The site layout ultimately depends on the actual size (power rating) and the number of turbines installed (to reach the same output, a smaller number of larger turbines would be required and vice versa). In order to ensure that the project is adequately 'future proofed', turbines in the range of 3.0MW to 8.5MW will be assessed for the purpose of this EIA (see *Section* 3).

The aforementioned draft National Policy Statement for Renewable Energy Infrastructure (EN-3) recognises that some details of a proposed scheme may be unknown to the applicant at the time of the application and it endorses a flexible approach of assessing maximum potential adverse effects - a 'worst case' scenario within what is known as a Rochdale Envelope. Case law (ie R.V. Rochdale MBC Ex. Part C Tew 1999

– 'the Rochdale case') established that 'indicative' sketches and layouts cannot provide a sufficient basis for the determination of aspirations for outline planning permission for EIA development.

In respect of DCO, the final scheme constructed must have been covered by the scope of the EIA to ensure that environmental impacts have been properly considered. The IPC (or the future Major Infrastructure Unit, *Section 2.4*) should therefore accept that some flexibility may be required within the DCO. Where this flexibility is sought and the precise details of the project are not known, EAOW will assess the maximum potential adverse effects of the project to ensure that the project as it may be constructed has been properly assessed (the 'Rochdale Envelope').

By adopting this approach, it will be possible to conclude that the environmental impact of East Anglia ONE will be no greater than that set out in the ES and may indeed be notably less.

Where possible, the ES will contain a detailed project description. However, where there is uncertainty, the ES will provide a clear rationale for all parameters of the Rochdale Envelope.

The ES will address all aspects of installation and operation of the development, including a preliminary assessment of the decommissioning phase.

EAOW recognises that different worst cases may apply to different environmental parameters, ie the worst case for sediment transport may be different to that for ornithology, which may in turn differ to that for benthic ecology.

2.7 *HABITATS AND BIRDS DIRECTIVES AND ASSOCIATED CONSERVATION REGULATIONS*

2.7.1 *European Protected Species*

The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) (the Offshore Marine Regulations) and the Conservation of Habitats and Species Regulations 2010 (the Conservation Regulations) list dolphins, porpoises and whales, marine turtles and sturgeon as marine European Protected Species (EPS).

For EPS, Article 12 of the Habitats Directive sets out that it is an offence to deliberately capture, injure, kill or disturb any EPS. Following guidance on Article 12 provided by the European Commission in 2007, the amended Conservation Regulations and the Offshore Marine Regulations contain a revised definition of deliberate disturbance beyond direct intention as well as extending the limit of offence to beyond 12nm.

Under the revised definition, chronic exposure and / or displacement of animals could be regarded as a disturbance. If these risks cannot be avoided then EAOW is likely to be required to apply for a marine wildlife licence (for whales, dolphins, porpoises, all species of seal and twaite and allis shad) from the MMO in order to exempt EAOW from the offence.

The requirement for any marine wildlife licence will be reviewed for all phases of the project in discussion with relevant consultees.

2.7.2 *Requirement for Appropriate Assessment*

Under the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009, the relevant responsible authority must consider the effect of a proposed development, alone or in-combination with other plans or projects, on the integrity of a European site (including candidate and proposed sites). A European site constitutes a Special Area of Conservation (SAC) under the Habitats Directive, or a Special Protection Area (SPA) under the Birds Directive.

The formal assessment of whether a likely significant effect will occur and the undertaking of a project-level Appropriate Assessment, should this be required, is undertaken during the examination process by the responsible authority. For the purposes of a NSIP, such as East Anglia ONE, the responsible authority will be the IPC.

A plan-level Appropriate Assessment for potential implications for European sites has already been undertaken by The Crown Estate for the nine Round 3 development zones, in accordance with Regulation 25(1) of the Offshore Marine Regulations and 48(1) of the Conservation Regulations.

The plan-level Appropriate Assessment concludes that there will be no adverse effect on the integrity of a European/Ramsar site arising from the Round 3 plan. In reaching this conclusion, the Appropriate Assessment relies upon the following:

> *"(1) That general measures typically employed on offshore windfarms to avoid or mitigate adverse environmental effects will be implemented where necessary at project-level. These measures are referred to here as general environmental measures.*
>
> *(2) The fact that as a matter of law a project will be required to undergo project-level Appropriate Assessment wherever the possibility of a likely significant effect on a European/Ramsar site cannot be excluded."*

The plan-level Appropriate Assessment identified measures that will be required to avoid adverse effect on the integrity of a European and / or Ramsar site, to be incorporated into any future project-level Appropriate Assessment for East Anglia ONE. In doing so, the plan-level Appropriate Assessment identified specific issues relevant to Zone 5. These have been identified within *Section 5* of this Scoping Report, under the environmental parameters.

The ES for East Anglia ONE will present information in response to the plan-level Appropriate Assessment relating to:

- any mitigation and avoidance measures incorporated into the plan that are not delivered at project level; and/or
- new European/Ramsar sites that have been notified or designated following conclusion of the plan-level habitat risk assessment; and/or
- new information regarding the nature and/or sensitivities of interest features within sites which have been assessed at plan level, where with that information it is not possible to exclude likely significant effect on such features or sites; and/or
- additional information that is available regarding specific in-combination effects relating to defined project proposals, where with this additional information it is not possible to exclude likely significant effect on European/Ramsar sites.

In order to inform the EIA, there is a clear requirement to obtain site specific data on cited habitats and species. The approaches to data capture, including spatial and temporal scope specific to each discipline,

are presented in *Section 5* of this Scoping Report for subsequent discussion and agreement with regulators, stakeholders and statutory bodies. As identified in *Section 5*, no designations have been identified within the East Anglia ONE site boundary; the Marine Mammal and Ornithology sub-sections in *Section 5* identify any designations surrounding East Anglia ONE and their distances from the site boundary.

The outcomes of COWRIE (Collaborative Offshore Wind Research into the Environment) studies will also be taken into consideration when formulating an approach to addressing issues implied by any project- level Appropriate Assessment for Zone 5.

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 require developers to include information identifying any European site to which Regulation 61 of the Conservation Regulations applies or Regulation 25 of the Offshore Marine Regulations, or any other Ramsar site which may be affected by the development proposal. The information, to be supplied in a dedicated section of the ES, will be sufficient for the IPC to make an appropriate assessment of the implications for the site if required by Regulation 48(1), or Regulation 25(1) of the Offshore Marine Regulations.

3 DESCRIPTION OF THE DEVELOPMENT

3.1 ZONE SELECTION

The EAOW Zone 5 (formerly known as the Norfolk Zone) was originally identified by The Crown Estate as part of the Round 3 offshore wind zone tendering process. The Crown Estate used their Marine Resource System (MaRS) GIS tool to identify suitable areas for offshore windfarm development as part of a Strategic Environmental Assessment used for identifying the Round 3 licensing areas.

The Round 3 Zones were identified by removing any area unsuitable for windfarm development due to the presence of one or more 'exclusions' to development. An exclusion is defined as an area of sea bed which has been granted future permissions for, or has already been leased or licensed for, another purpose or activity.

The suitability of the areas remaining were then evaluated on the basis of further 'restrictions' that were present, with these restrictions then weighted according to the severity of the constraint that they may impose. Restrictions were defined as an activity, development or area of sea bed which could conflict with the proposed activity or development but may not preclude development. The Crown Estate reviewed the output of the national scale modelling exercise against a number of detailed datasets to check for consistency.

The Round 3 Zones were identified in an iterative process which took account of the exclusions and restrictions identified in the above process. The first iteration of the Round 3 Zones map was issued in June 2008 and originally highlighted 11 areas with the potential for significant windfarm development. The second iteration of the Round 3 Zones map built on the first and also took into account the views of developers, and was the subject of the SEA. A third iteration of the Zones map was subsequently issued in July 2009 which included minor adjustments to the Zone boundary coordinates.

The Zones map was based on the following exclusions and restrictions (*Box 3.1* and *Box 3.2*).

Box 3.1 Exclusions

- live cables (telecoms and electricity);
- areas outside of UK continental shelf;
- Round 1 windfarms;
- Round 2 windfarms;
- windfarm cables;
- dredging options areas;
- dredging licence areas;
- dredging application areas;
- dredging prospecting areas;
- tunnels;
- bathymetry <5 m and >60 m;
- windfarm anemometers;
- live pipelines;
- live interconnectors;
- mineral mining;
- protected wrecks;
- oil and gas surface installations;
- live wells;
- oil and gas safety zones;
- aquaculture and foreshore leases;
- seascape buffer (13 km); and
- Round 2 SEA regions.

Box 3.2 ***Restrictions***

- bathymetry (scored by depth);
- out of service cables;
- dumps;
- out of service pipelines;
- decommissioned oil and gas wells;
- shipping density;
- Sites of Special Scientific Interest;
- Special Areas of Conservation (SAC) and pSAC;
- gas storage areas;
- Round 1 windfarm exclusion zones;
- Special Protected Areas (SPA);
- anchorage areas and buoys (navigation and metocean);
- aggregate future interest areas;
- active dumping grounds;
- recreational craft routes and areas;
- Marine Nature Reserves;
- Ramsar sites;
- World Heritage sites;
- National Nature Reserves;
- disused dumping grounds;
- Local Nature Reserve;
- charted navigation;
- potential gas storage areas; and
- port navigation channels.

3.2 ZONE APPRAISAL AND PLANNING

Zone Appraisal and Planning (ZAP) is a term advocated by The Crown Estate to describe the non-statutory strategic approach to Zone design, project identification and consent for Round 3.

The Crown Estate is in the process of finalising a guidance document to explain the Zone Appraisal and Planning (ZAP) process to assist zone developers, statutory and non-statutory stakeholders and regulators in their understanding of the process (expected July 2010). However, individual developers have their own interpretations on how ZAP can be applied for their specific zones.

EAOW interprets ZAP to be an internal process to identify and agree project opportunities within the Zone. It is initially expected to be completed within a two year period but there will be opportunities for updates and review throughout the development of the Zone. There are two key elements to the ZAP: Environmental and Technical appraisal.

EAOW have initiated a programme of zonal survey works to provide sufficient data to inform both a Zonal Environmental Assessment (ZEA) of the Zone and the EIA for the first project within the Zone. The ZEA process will be informed by both desk based studies and broad scale zonal surveys to build up a good understanding of the environmental characteristics of the Zone (in a similar way to how regional environmental characterisation surveys inform the marine aggregates industry). A separate ZEA Scoping Report has been produced by EAOW for Zone 5.

The technical assessment will be informed by geotechnical/geophysical surveys as well as wind resource and metocean data review to identify engineering constraints and design for projects within the Zone.

Both the technical and environmental assessments will be utilised to optimise the development opportunities within the Zone and identify the project sites to be taken through EIA to consent application.

ZAP allows developers to have more control over the way a zone is developed and encourages a high level strategic approach to planning and stakeholder engagement of the Zone in terms of environmental, social and economic effects (particularly cumulative and in-combination effects). A key element to EAOW's approach is that a feedback loop is employed such that the information gained from the in-depth project EIA(s) is fed into the ZAP, updating the ZEA and therefore ensuring accurate information is utilised for identifying development opportunities.

Due to pressing targets for renewables (see *Section 2.2*), EAOW have selected an initial project site to accelerate the consenting timescale (based on detailed existing data reviews and assessment). The boundary of East Anglia ONE covered in this EIA Scoping Report will not be finalised until the ZAP is concluded.

In accordance with the programme requirements of the Zone Development Agreement, Zone 5 will be developed to achieve submission of application for consent for 7.2 GW of capacity in the following tranches:

- 1200MW - February 2013 (Project 1; East Anglia ONE);
- 2400MW - March 2014 (Projects 2 and 3);
- 2400MW - November 2015 (Projects 4 and 5); and
- 1200MW - July 2017 (Project 6).

3.3 SITE SELECTION

In order to establish East Anglia ONE's location within the Zone, a robust screening exercise was undertaken to ensure that the site is feasible taking into account known consenting and technical risks.

The first stage of this screening exercise involved a review of Zone 5 characteristics using GIS spatial mapping, in order to identify areas within the Zone suitable for development through the creation of a cumulative constraints map. Based on a number of key consenting and technical considerations, the consenting risks applied and mapped included potential impacts on:

- civil aviation radar;
- military air defence radar;
- commercial fisheries interactions, in relation to their economic value;
- shipping and navigation in terms of designated and heavily used routes;
- Ministry of Defence (MoD) training and exercise areas (PEXA areas);
- landscape, seascape and visual resources;
- tourism and recreation, through issues such as disturbance to recreational sailing routes;
- oil and gas operations;
- cables and pipelines;
- aviation routing, in particular helicopter flight paths;
- disposal sites;
- nature conservation designations;
- protected habitats other than designated sites;
- fish spawning and nursery areas;
- cumulative impacts with other windfarms; and
- distance to the nearest port.

The technical risks applied included:

- geological information and identification of distinct geological zones;
- geotechnical design parameters;
- identification of sea bed risks such as gas blanking and sea bed mobility;
- known metocean information;
- feasibility of foundation types across the Zone; and
- fabrication and installation costs.

After applying these weighted risks to the constraints map of the Zone, a 'heat map' was produced within which East Anglia ONE was identified as the most suitable first project area.

The site location selected is considered to be the most favourable site in terms of known technical and consenting risk at this stage. It should also be noted that due to the need to meet renewables targets by 2020 and the fact that the Round 3 projects will be developed further offshore and on a scale much larger than any project previously, it was felt that it was important to select the first project area to be one which was judged to have low technical and consenting risk.

3.4 ALTERNATIVES AND PROPOSED DEVELOPMENT SELECTION

The alternatives section of the ES will discuss the initial stages of site selection based on the criteria described above and any subsequent refinements to the project as a consequence of the EIA and ZAP process.

3.5 OVERVIEW OF THE PROJECT

3.5.1 Introduction

This section summarises the key aspects of the project design. It should be noted that, in defining the project that will be assessed during the EIA, the Rochdale Envelope approach (see *Section 2.6*) will be adopted. The detailed design of the scheme can then vary within this envelope without rendering the EIA inadequate.

The key offshore components of the windfarm are likely to comprise:

- offshore wind turbines and their associated foundations;
- offshore platforms (AC transformer substations and HVDC converter stations) supporting some of the windfarms electrical equipment, and possibly incorporating offshore facilities for operation and maintenance of the windfarm;
- subsea cables between the turbines and the offshore platforms, and between the offshore platforms and the shore;
- scour protection around foundations and on inter-array and export subsea cables as required; and
- meteorological masts and their associated foundations for monitoring wind speeds prior to and during construction and the performance of wind turbines during the operation phase.

The key onshore components of the windfarm are likely to compose the following:

- the landfall site with associated jointing between the offshore and onshore cable;
- onshore underground cable routes and/or overhead lines; and
- transformer substations/ converter stations.

As already identified, this Scoping Report deals with the offshore components (ie those outside 12nm) of East Anglia ONE only. The export cables and onshore components will be dealt with under a separate Scoping Report.

3.5.2 Evolution of the Site Design

Over the next two years, EAOW and the project team identified in *Section 1.2* will develop a Rochdale Envelope design for East Anglia ONE which will respond to technical, commercial and environmental constraints identified during site surveys and through consultation.

This process will lead to the identification of a development which minimises impacts and maximises power output.

The Rochdale Envelope will be developed and refined at key stages throughout the project life cycle, typically:

- post scoping and following initial public information days;
- following receipt of initial baseline information collected at a broad scale through the ZPA process;
- following receipt of detailed baseline information collected at a detailed scale for EIA; and
- following ongoing consultation, and prior to submission following consultation on preliminary environmental information, if considered appropriate.

3.5.3 Turbines

East Anglia ONE is likely to consist of up to 420 turbines, each having a rated capacity of between 3.0MW and 8.5MW, with a total installed capacity of up to 1,250MW. It should be noted, as described in *Section 3.5.2*, that the exact specifications for the project are yet to be

determined. For a mid-range turbine size, ie 5MW, it is envisaged that up to 250 turbines would be installed.

The estimated hub height is between 70m minimum and 100m maximum with a rotor diameter ranging from 90m to 150m, again depending on turbine model and rated capacity. It is possible that more than one turbine type will be used due to the ever evolving nature of the turbine market and the likely high demand for a number of turbines. The wind turbines will be of proven technology, incorporating tapered tubular towers and three blades attached to a nacelle housing which will contain equipment such as the generator, gearbox and other operating equipment.

Wind turbines (in construction) at Thanet © Vattenfall Wind Power Limited

3.5.4 Foundations

The overriding factors influencing the choice of foundation for a specific project are the type of wind turbine to be used, the nature of the ground conditions on the site and the metocean characteristics. Currently there is only limited information available on site ground conditions pending more detailed studies, and turbine types have not been chosen. It is possible that more than one type of foundation may be used across the project area. A number of foundation design options would be considered:

- steel monopile;
- concrete monopole;
- jacket on piles or suction buckets;
- multipile;

- tripod on piles or suction buckets;
- gravity base structure; and
- suction caisson.

For all the foundation options, the foundation structure will extend by approximately 15 to 20m above mean sea level such that the base of the turbine tower is clear of the most extreme design wave height. The overall size and footprint of the foundation structure depends on the type of foundation but for each type the structure will also be sized to suit the actual turbine and site specific characteristics.

Indicative dimensions, construction materials and a brief description of the expected installation methods for each of the foundation options are outlined in *Table 3.1* below. The indicative dimensions are based on a mid-range turbine size and mid-range water depth that are to be used for illustrative purposes only and further work will have to be undertaken in parallel with the ES process to define appropriate parameters.

A detailed description of fabrication, installation and decommissioning methods for each foundation type considered will be included in the ES for East Anglia ONE.

The initial foundation options will be based on data from the geophysical and geotechnical campaigns which are being undertaken this year across the whole Zone with increased coverage across the first project area. The final engineering solution will be decided upon completion of a site-specific geotechnical campaign and in response to environmental constraints identified during the EIA process.

Table 3.1 Basic Foundation Types and Information

Type	Indicative Dimensions[1]	Construction Material	Installation Method
Steel monopile[2]	Up to 7.5m diameter. Pile embedment 30m plus.	Steel pile and transition piece	• Pile and transition piece transported to site by installation vessel or barge • Pile up-ended by crane and lowered to sea bed • Pile driven by hammer (sometimes drilled) • Transition piece installed by crane and connection grouted • Scour protection (if required)
Concrete monopile[2]	Up to 8.5m diameter. Pile embedment 30m plus.	Pre-cast reinforced concrete ring elements with steel post-tensioning	• Pile and ice cone platform transported to site by installation vessel or barge • Pile up-ended by crane and lowered to sea bed • Pile drilled from inside toe of pile • Ice cone platform installed • Scour protection (if required)
Jacket on piles	Numerous variants are being considered. Typically, lattice structure comprising tubular sections of diameter 0.5 to 1.2m. Approx. 25m x 25m footprint at base. Pile diameter approx. 1.8 to 2.5m. Pile embedment approx. 30m to 35m.	Steel jacket and piles	• Jacket and piles transported to site by barge • Installation template set down on sea bed • Piles stabbed and driven • Survey of pile levels and adjustment of jacket leg positions • Jacket lifted and set down on piles • Jacket levelled and pile connections grouted
Multipile	Typically three vertical piles, approx. 3.5m diameter, connected to transition piece. Approx. 25m diameter footprint. Pile embedment approx. 30m to 35m.	Steel piles and transition piece	• Piles and transition piece transported to site by barge • Piles sequentially up-ended by crane and lowered to sea bed • Piles sequentially driven • Transition piece installed

Type	Indicative Dimensions[1]	Construction Material	Installation Method
Tripod on piles	Typically main column approx. 5.5m diameter, with three diagonal braces approx. 4m diameter. Approx. 25m diameter footprint at base. Pile diameter approx. 1.8 to 2.5m. Pile embedment approx. 30m to 35m.	Steel tripod and piles Concrete tripod variants also being considered	• Tripod and piles transported to site by barge • Tripod lifted and set-down on mudmats on the sea bed by crane • Piles stabbed and driven • Tripod levelled and pile connections grouted
Gravity base structure	Typically conical tower, approx. 6.5m diameter at top. Approx. 30 to 40m diameter footprint at base.	Reinforced concrete shell with pumped sand ballast fill	• Sea bed preparation as necessary • GBS transported to site by barge or heavy lift vessel (or floated) • GBS lifted by crane (or up-ended) and lowered to sea bed • Levelling and underbase grouting • Ballasting and further levelling as necessary • Scour protection (if required)
Suction caisson	Tower section 5.5 to 6.5m diameter. Approx. 18m diameter footprint for bottom skirt. Skirt embedment approx. 10m depending of the soil conditions.	Primary material is steel	• Caisson transported to site by floating • Up-ended by crane and lowered to sea bed • Air deflated in bucket skirt to sink caisson • Scour protection (if required)

Notes
1 Initial estimate based on mid-range turbine size and mid-range water depth
2 These foundation types are limited to lower end of range of turbine sizes and water depths

3.5.5 *Offshore Electrical Infrastructure*

For the purposes of this Scoping Report, the offshore electrical infrastructure for the project will comprise the following key components:

- offshore transformer substations located within the turbine array – in addition, offshore converter stations at the site periphery may be required; and

- cables within the array which will collect energy from the turbines and transmit it to the offshore transformer substations.

Engineering design work is currently under way to review and assess a range of different design options for the electrical system. This process will determine the number and size of the offshore transformer substations and offshore converter stations. It is anticipated that there will be up to three offshore transformer substations and up to two offshore converter stations.

As with the turbines themselves, the offshore substation platforms will be mounted on foundations secured to the sea bed. Given the size of the substations, these foundations are likely to be of a steel jacket type. However, some of the other foundation types listed in *Section 3.5.4* will also be considered as part of the assessment.

The inter-array cables will be relatively short in length, typically 750 to 1500m, and will interconnect the wind turbines within the arrays to each other and to the offshore transformer substations. The cables are expected to be standard 3-core, copper conductor, cross-linked polyethylene (XLPE) (or equivalent) insulated and armoured submarine cable, rated at 33kV. The cables have an external diameter of approximately 150mm. The estimated total cable length is up to 350km. Cables will either be buried or layered on the surface with suitable protection.

At present, the grid connection location for East Anglia ONE is not known, and therefore the export cable, landfall and onshore components of the project will be covered by a separate scoping exercise. The cable landfall and onshore components are likely to be within the East Anglia region. The design has yet to be carried out and may use either Alternating Current (AC) connections or High Voltage Direct Current (HVDC). It is expected that up to four export cables linking the offshore transformer substations to the offshore converter stations (if required) and then to the onshore electricity system will be required.

3.5.6 *Construction Timescales*

Offshore construction work is proposed to commence in 2014/2015 with the preliminary engineering design work indicating that the offshore construction period will last up to four years.

The construction of East Anglia ONE is currently scheduled to take place throughout the year. Construction in the marine environment is potentially hazardous, and it will be in the interests of safe working for the project to take advantage of as much construction time in favourable conditions as is possible. Construction activity is expected to continue, subject to site weather conditions, for 24 hours per day until construction is complete.

3.5.7 *Construction Infrastructure*

Only limited information is available at present on the nature of the construction process, since the major parameters of East Anglia ONE have not yet been defined in detail. Key to defining the construction methodologies (and therefore the likely construction activities) will be choices on the following:

- port(s) used as the base for the construction phase;
- vessels to be used for the offshore construction works;
- foundation types; and
- wind turbine selection.

Decisions on the above will be addressed during the detailed design and will be presented as far as possible within the ES (see *Section 2.6*).

A number of ports exist on the east coast of England and mainland European coast that may be suitable for much of the construction and operation activities required for the windfarm project. Part of the detailed project design and logistics planning for the project involves assessing a number of potentially suitable port facilities.

In addition to using ports for the construction of the windfarm, consideration will be given to the components of the windfarm being brought directly to the project site from their point of manufacture.

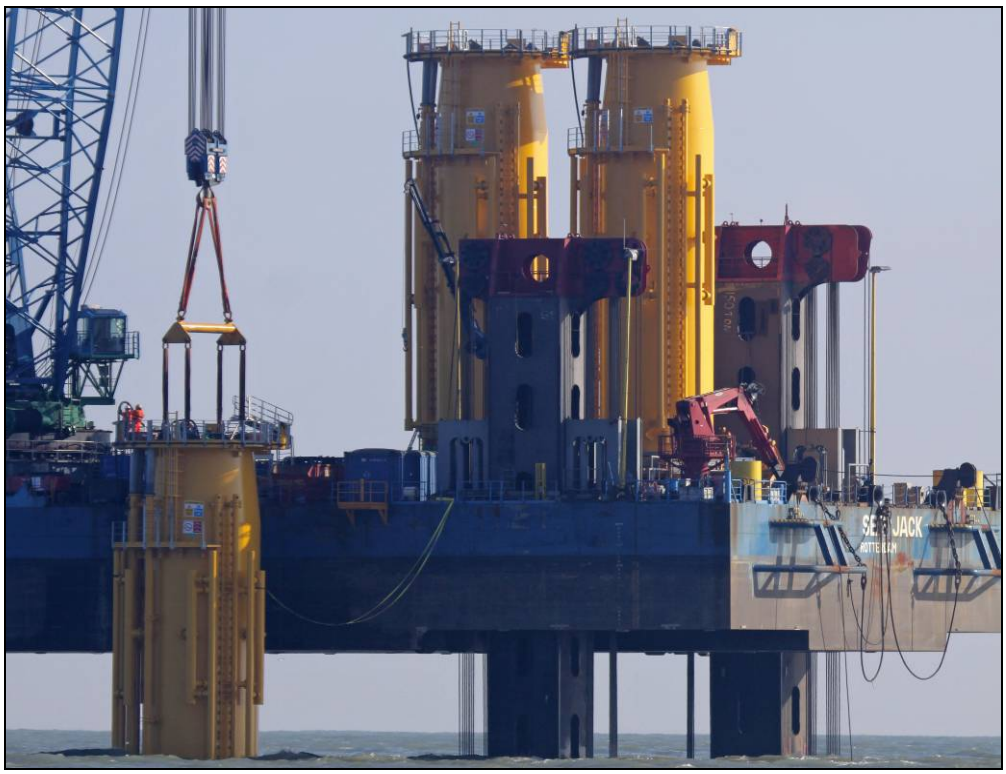
Port development is outside the scope of this Scoping Report and although the ES will recognise port development as a necessary aspect of East Anglia ONE, any such project would be covered by existing consent and impact assessment or subject to a separate and independent application process by the port operator.

3.5.8 Sequence of Construction Activities

Introduction

The key stages associated with the installation of the windfarm are likely to be as follows:

- detailed pre-construction site investigation (eg cone penetration tests, boreholes and high resolution geophysics), subject to a separate consent application process;
- foundation installation and associated site preparation;
- installation of tower, nacelle, hub and blades of the wind turbine generators;
- installation of monitoring meteorological masts;
- installation of offshore transformer substations; and
- installation of inter-array transmission cables.



Installation of foundations and tower at Thanet by Sea Jack © Vattenfall Wind Power Limited

Foundations

Foundation installation will be one of the first offshore construction activities to take place. Methods of installation for foundations vary significantly depending upon the foundation type selected. Techniques typically employed for foundation installation include:

- pile driving;
- pile drilling;
- sea bed levelling (for gravity base structures);
- ballasting (for gravity base structures); and
- grouted connections (eg for connecting piles to jacket); and
- vacuum installation (suction structures).

Wind Turbines

Following foundation installation, offshore wind turbines will be installed. Commonly, towers and nacelles are pre-erected or erected individually at the site using a crane barge. Blades are subsequently fitted to the tower/nacelle structure as individual components or in a part assembled state.

Aviation warning lighting will be fitted to some or all of the wind turbines, as required by the UK Air Navigation Order 2009 (see *Section 5.4.3*). Lighting will be designed in consultation with key stakeholders, eg Civil Aviation Authority (CAA). Additionally, international aviation regulatory documentation requires that the rotor blades, nacelle and upper two thirds of the supporting mast that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study.

Inter-Array Cables

The extent to which the cables will be buried will be dependent on the result of a detailed sea bed survey of the final cable route and associated burial risk assessment process. Cable burial would involve ploughing or jetting, or a combination of both.

Rock dumping, frond mats or grout bags may be used to protect the cable ends where they enter turbine or platform foundations and may be utilised when ground conditions result in the cable being laid near to or on the surface. It is conceivable that the laying of cable protection may also be necessary after burial, where sections of cables are too shallow or have otherwise become exposed as informed by the post installation inspection or periodic maintenance surveys.

Cable and Pipeline Crossings

A number of telecommunications cables and pipelines cross East Anglia ONE and it is therefore anticipated that a number of crossings will be required. The design of these crossing will be agreed with the cable/pipeline owner/operator to ensure that integrity of all the assets is maintained.

Scour Protection

Scour can occur around the base of a foundation when sea bed sediment is winnowed away as a result of the flow of water around the structure. A number of options for scour could be considered for installation at East Anglia ONE, depending on the final project design process, ground conditions and scour assessments. These could include:

- rock and gravel dumping;
- protective aprons;
- mattresses; and
- flow energy dissipation (frond) devices.

3.5.9 Operations and Maintenance Strategy

Once commissioned, the windfarm will operate automatically with each wind turbine operating independently of the others. In addition to the wind turbines, the offshore substations and any met masts will also be monitored and maintained.

The operation and control of the windfarm will be managed by a Supervisory Control and Data Acquisition (SCADA) system, connecting each turbine to the onshore control room. The SCADA system will enable the remote control of individual turbines, the windfarm in general, as well as remote interrogation, information transfer, storage and the shutdown/restart of any wind turbine if required.

Detailed operation and maintenance information will be provided in the final ES.

3.5.10 Monitoring Devices - Met Masts / Wave Buoys

Consent to construct the meteorological masts at the site will be applied for separately to the main windfarm application. The exact locations of these masts are yet to be confirmed. The need for further masts would be assessed once initial data have been evaluated.

A met mast consists of the following parts:

- lattice tower, typically up to 120m above mean sea level;
- foundation (typically a monopile but a jacket structure or similar may be required);
- platform, including boat landing;
- instrumentation (on a tower, above and possibly below water);
- control cabinet, solar panels and batteries;
- a platform for bird monitoring radar (if considered appropriate); and
- aerial and marine navigational lights and markings.

Waverider buoys and/or Acoustic Doppler Wave and Current Profiler (AWACs) will be deployed across the site to measure oceanographic conditions. Waverider buoys are free-moving floating buoys, while AWACs are bottom-mounted using an anchor with a small marker buoy. Both waveriders and AWACs collect a range of wave data; AWACs also collect current information.

Consent to deploy both AWACs and waveriders will be applied for separately to the main windfarm application.

3.5.11 Decommissioning

The design life of the turbines and other components of the windfarm are likely to be in the order of 20 to 30 years and therefore it is possible that some refurbishment or replacements may occur. If the decision to refurbish or replace the turbines is made, then any relevant consents or licences required would be applied for at that time.

At the end of The Crown Estate lease period, it is a condition of the lease as well as statutory requirement (through the provisions of the Energy Act 2004 (as amended)) that East Anglia ONE is decommissioned. Under the statutory process, EAOW is required to prepare a decommissioning plan at the request of the Secretary of State and, prior to construction, funds must also be set aside for the purposes of decommissioning. For the purposes of the EIA, the decommissioning of the windfarm is likely to be the reverse of the construction process, with some exceptions.

Current thinking suggests that piled foundations would be removed to just below sea bed with due consideration made of likely changes in sea bed level, whilst gravity base and suction caisson foundations would be removed completely. 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 operation and safety of the cables left *in situ*. Following decommissioning of

the windfarm components, sea bed equipment will be removed and the site reinstated. It is expected that decommissioning will require similar vessels to construction and will take approximately three to four years.

3.6 HEALTH AND SAFETY

As noted above, construction in the marine environment is potentially hazardous, as are activities involving working at height. For these reasons, ensuring health and safety during construction, operation and decommissioning of East Anglia ONE is essential. EAOW will comply with all relevant UK Health and Safety legislation.

4 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

4.1 INTRODUCTION

This section describes the broad principles of the EIA methodology. It outlines the approach that will be used to identify, evaluate and develop methods to mitigate environmental impacts. The method by which cumulative, in-combination impacts and transboundary impacts will be assessed in the EIA is also described. This section also sets out the proposed structure of the ES.

4.2 BASIS OF THE ASSESSMENT

During an EIA, the environmental impacts of East Anglia ONE are predicted for each relevant environmental topic (such as ecology, landscape, and noise) by comparing baseline environmental conditions (the situation existing without the project) with the conditions that would prevail under construction, operation and decommissioning phases if the project were to be undertaken.

During the EIA process, the environmental effects of the project will be predicted in relation to impacts on environmental receptors. These receptors can be people (such as those on passing vessels), built resources (such as existing marine infrastructure) or natural resources (such as ecological resources).

4.3 ASSESSMENT OF IMPACTS

4.3.1 *Predicting the Magnitude of Impacts*

The ES will describe what will happen by predicting the magnitude of impacts and quantifying these to the extent practicable. The term 'magnitude' is used as shorthand to encompass all the dimensions of the predicted impact including:

- the nature of the change (what is affected and how);
- its size, scale or intensity;
- its geographical extent and distribution;
- its duration, frequency, reversibility, etc; and
- where relevant, the probability of the impact occurring as a result of accidental or unplanned events.

It also includes any uncertainty about the occurrence of scale of the impact, expressed as ranges, confidence limits or likelihood (1).

Magnitude therefore describes the extent or degree of change that is predicted to occur in the resource or receptor (eg the area of sea bed habitat affected by the placement of foundations).

An overall grading of the magnitude of impacts will be provided taking into account all the various dimensions to determine whether an impact is generally of negligible, small, medium or large magnitude. This scale may be defined differently according to the type of impact and a more or less detailed scale may be used for particular impacts depending on the circumstances. For readily quantifiable impacts such as noise, numerical values can be used whilst for other topics a more qualitative classification is necessary.

4.3.2 Evaluation of Significance

The next step in the assessment will be to take the information on the magnitude of impacts and explain what this means in terms of its importance to society and the environment, so that decision makers and consultees understand how much weight should be given to the issue in deciding on their view of East Anglia ONE.

There is no statutory definition of significance. However, for the purposes of this EIA the following practical definition will be used:

> *"An impact is significant if, in isolation or in-combination with other impacts, it should, in the judgement of the EAOW EIA team, be reported in the ES so that it can be taken into account in the decision on whether or not the Project should proceed and if so under what conditions."*

The evaluation of impact significance that will be presented in the ES will be based on professional judgement and will be informed by reference to legal standards, government policy, current good practice and the views of stakeholders.

Where standards are not available or provide insufficient information on their own to allow grading of significance, significance will be evaluated taking into account the magnitude of the impact and the value or sensitivity of the affected resource or receptor.

(1) A distinction is made here between the probability of impact arising from a non-routine event such as an accidental explosion or spill, and the likelihood of an uncertain impact; for example it may not be certain that migrating species will be present during construction.

The value of a resource is judged taking into account its quality and its importance as represented, for example, by its local, regional, national or international designation, its importance to the local or wider community or its economic value.

Judging the sensitivity of receptors is a critical part of this process, because even important or valuable resources may be relatively insensitive to impacts. This is therefore an important stage in assessing the significance of an impact on a particular resource or receptor. This judgement needs to take account of the likely response to the change and the ability of the resource to adapt to the impact. Some species of birds, for example, may be sensitive to disturbance during construction activities but may recover rapidly once the activities have ceased.

Impacts will be categorised as minor, moderate or major, where the ES will make it clear if an impact is significant or not. Only moderate and major impacts are defined are being significant.

4.3.3 Mitigation

Schedule 4 to the EIA Regulations requires that where significant effects are identified, "*A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment*" should be included in the ES.

For each significant adverse effect identified during the assessment, mitigation will be proposed and discussed with the relevant authorities.

4.3.4 Assessing Residual Impacts

Following identification of appropriate mitigation measures, impacts will be re-assessed. All residual significant impacts will be described in the ES with discussion on why further mitigation is not practicable. Where the impact is of more than minor significance the ES will explain how the impact has been reduced to as low as reasonably practicable.

4.3.5 Cumulative and In-Combination Impacts

Definitions

An additional important part of the EIA process will be to consider cumulative and in-combination effects. For the purpose of this document these will be defined in simplistic terms as follows:

- Cumulative Impacts: impacts on sensitive receptors that arise from multiple windfarm development activities.

- In-Combination Impacts: impacts on sensitive receptors that arise from different industry sectors in combination with this project.

The cumulative impact assessment will consider impacts resulting from this project together with, for example, other windfarms at Greater Gabbard, Galloper, Scroby Sands etc. The potential for cumulative impacts will only be relevant to some environmental topics. For example, if the construction phases for these projects do not overlap, there may be no potential for cumulative impacts in relation to sediment plumes during foundation works. In other cases, particularly for operational impacts, there may well be cumulative impacts, for example in relation to impacts on recreational uses of the sea.

The in-combination impact assessment will focus on identifying areas where the predicted effects of windfarm construction and operation could interact with effects from different industry sectors within the same region and impact sensitive receptors. This could be through direct interactions in effects (eg plumes from cable installation overlapping with plumes from aggregate dredging) or spatially separated effects on the same population of a receptor (eg disturbance to different parts of an important fish spawning area by gas pipeline installation and turbine installation).

The in-combination assessment will use the data presented in the ESs for other developments and the conclusions of scientific studies to identify potential in-combination interactions.

Where consideration is being given to other projects, these will include those projects that are already built, are in construction, are in the formal planning process or which can be reasonably foreseen (other than future developments in Zone 5 – subsequent EIAs will consider the implications of the other projects in the Zone for which EIAs have already been carried out).

The other projects or activities that would be relevant include:

- other windfarms outside the Zone;
- aggregate extraction and dredging;
- navigation and shipping;
- established fishing activities;
- existing and planned construction sub-sea cables and pipelines;
- potential port / harbour development; and
- oil and gas installations.

Methodology

In considering cumulative and in-combination effects, the following steps will be carried out:

- define the temporal and spatial boundaries of the features affected by East Anglia ONE;
- undertake consultation with other agencies, organisations and individuals who may have an interest, or have responsibility for other projects or activities in the area;
- identify the pathways through which the environmental effects of East Anglia ONE are expected to occur;
- identify relevant past and existing projects and activities and their impacts on the environment of the future developments; and
- identify future proposed projects and activities and their potential link to the windfarm development.

Where specific topic-related guidance exists, this is mentioned later in this report in the environmental topic sections.

4.3.6 *Transboundary Impacts*

Transboundary issues are dealt with in Regulation 24 of the Infrastructure Planning (Environmental Impact Assessment) Regulations (2009) (the EIA Regulations). The Regulations put in place procedures to address situations where development is likely to have a significant effect on the environment in another European Member State. The procedures involve providing information to the Member State and provide an opportunity for that State to gain opinions from the public and their authorities.

Furthermore, the Infrastructure Planning Commission is obliged to enter into consultations with the Member State regarding the significant effects and also the measures envisaged to mitigate/eliminate such effects.

The potential for transboundary impacts is likely to be limited to natural and commercial fisheries, navigation and ornithological aspects, although other transboundary issues may emerge throughout the EIA process. The sub-sections in *Section 5* identify where transboundary effects may be an issue. *Section 5* of this Scoping Report presents methodologies for identifying cumulative impacts during the EIA. Throughout this process, any likely

significant effects on the environment of another Member State of the European Economic Area will be identified and reported in the ES.

The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)

The Convention on Environmental Impact Assessment in a Transboundary Context ('Espoo Convention') was adopted on 25 February 1991 and entered into force on 10 September 1997. Subsequent modifications were made in 2001 and 2004. The Espoo convention stipulates the obligations of parties to assess the environmental impact of certain activities that are likely to cause transboundary environmental impacts at an early stage of planning. It lays down the general obligation of states to notify and consult each other on all major projects that are likely to have a significant adverse transboundary environmental impact.

EC Directive 85/337 on the Assessment of the Effects of Certain Private and Public Projects on the Environment (as amended by EC Directive 97/11)

The 97/11 EC amendment implemented new requirements on Transboundary Consultation (implemented in the UK in March 1999 as Statutory Instrument 193). This requires that all significant transboundary issues set out in the 97/11 EC Directive must be addressed throughout the EIA process. All affected parties must have the opportunity to comment and all subsequent comments must be addressed in the EIA. To all intents and purposes, potentially affected parties in neighbouring state who may experience significant impacts have a role in the EIA process that is broadly equivalent to affected parties in the host state. This would include consultation at the scoping stage of an EIA, during the EIA process on specific issues if required and at the stage of submitting the ES and developing conditions for approval.

4.4 DRAFT OUTLINE OF THE ENVIRONMENTAL STATEMENT

The ES will include a clear description of all the aspects of the proposed development, including timescales at the construction, operation and decommissioning stages.

It is anticipated that the ES for East Anglia ONE will comprise a single document combining text and graphics. A separate Non Technical Summary (NTS) of the information contained in the ES will also be provided. Detailed specialist reports (for example, details of baseline data) will be available as a separate technical appendix if considered appropriate. If EAOW are also to take forward the application for consent for the works associated with the grid connection, a separate part of the ES will be included to deal with this.

It is proposed that the text of the ES will be divided into the following sections:

- **Non Technical Summary**

- **Section 1: Background**
  - Section 1.1: Background
  - Section 1.2: Definition of Study Area
  - Section 1.3: Statement of Need
  - Section 1.4: Alternatives
  - Section 1.5: The Impact Assessment Process
  - Section 1.6: Consultation
  - Section 1.7: Report Structure

- **Section 2: Legislative Background**

- **Section 3: Description of the Proposed Scheme**

- **Section 4: Baseline Environment, Potential and Predicted Impacts and Mitigation**
  - Section 4.1: Introduction
  - Section 4.2: Physical Environment
    - *Section 4.2.1: Marine Geology, Oceanography and Coastal Processes*
    - *Section 4.2.2: Water Quality*
  - Section 4.3: Biological Environment
    - *Section 4.3.1: Benthic and Epibenthic Environment (including shellfish)*
    - *Section 4.3.2: Fish Ecology*
    - *Section 4.3.3: Marine Mammals*
    - *Section 4.3.4: Ornithology (Marine and Coastal)*
    - *Section 4.3.5: Underwater Noise and Vibration*
  - Section 4.4: Human Environment
    - *Section 4.4.1: Commercial fisheries*
    - *Section 4.4.2: Shipping and Navigation*
    - *Section 4.4.3: Aviation and MoD*
    - *Section 4.4.4: Telecommunications and Interference*
    - *Section 4.4.5: Archaeology and Cultural Heritage*
    - *Section 4.4.6: Socioeconomics Characteristics*
    - *Section 4.4.7: Seascape Impact*
    - *Section 4.4.8: Infrastructure and Other Users/Activity*

- **Section 5: Summary of Effects and Mitigation Measures** (including Outline Environmental Management Plan)

- **Section 6: Information to Support Appropriate Assessment**
- **Section 7: References**
- **Technical Appendices**

5 ENVIRONMENTAL BASELINE AND POTENTIAL IMPACTS

5.1 INTRODUCTION

This section provides a high-level summary of the baseline physical, biological and human environment within and near to the East Anglia ONE boundary. It aims to provide an overview of the distribution and importance of resources (living and non-living) within, or in close proximity to, the East Anglia ONE boundary and to highlight the anticipated potential effects of East Anglia ONE upon the resources identified. This section considers all phases of the offshore components of East Anglia ONE including construction, operation and maintenance and decommissioning.

EAOW considers that the descriptions of the survey methodologies provided for each of the environmental parameters set out in this section are adequate for the purposes of this Scoping Report. However, if stakeholders wish to see detailed scopes of works for the surveys (where relevant), these can be provided upon request. In order to speed the process of response, an email point of contact is provided in *Section 8* of this Scoping Report.

The inter-relationship between the environmental parameters presented below will be cross referenced within the ES, as necessary. The ES will provide a comprehensive assessment drawing together the potential environmental impacts of East Anglia ONE as a whole.

The environmental parameters identified throughout this section as being scoped out will remain scoped out unless otherwise requested in the IPC Scoping Opinion.

5.2 PHYSICAL ENVIRONMENT

5.2.1 *Marine Geology, Oceanography and Coastal Processes*

Introduction

This section describes the baseline environment geology, oceanography and coastal processes within the East Anglia ONE study area, based on present understanding. Given the general scarcity of primary data within the East Anglia ONE area, these statements may be subject to change as further data and information are obtained to support project development.

Baseline Conditions

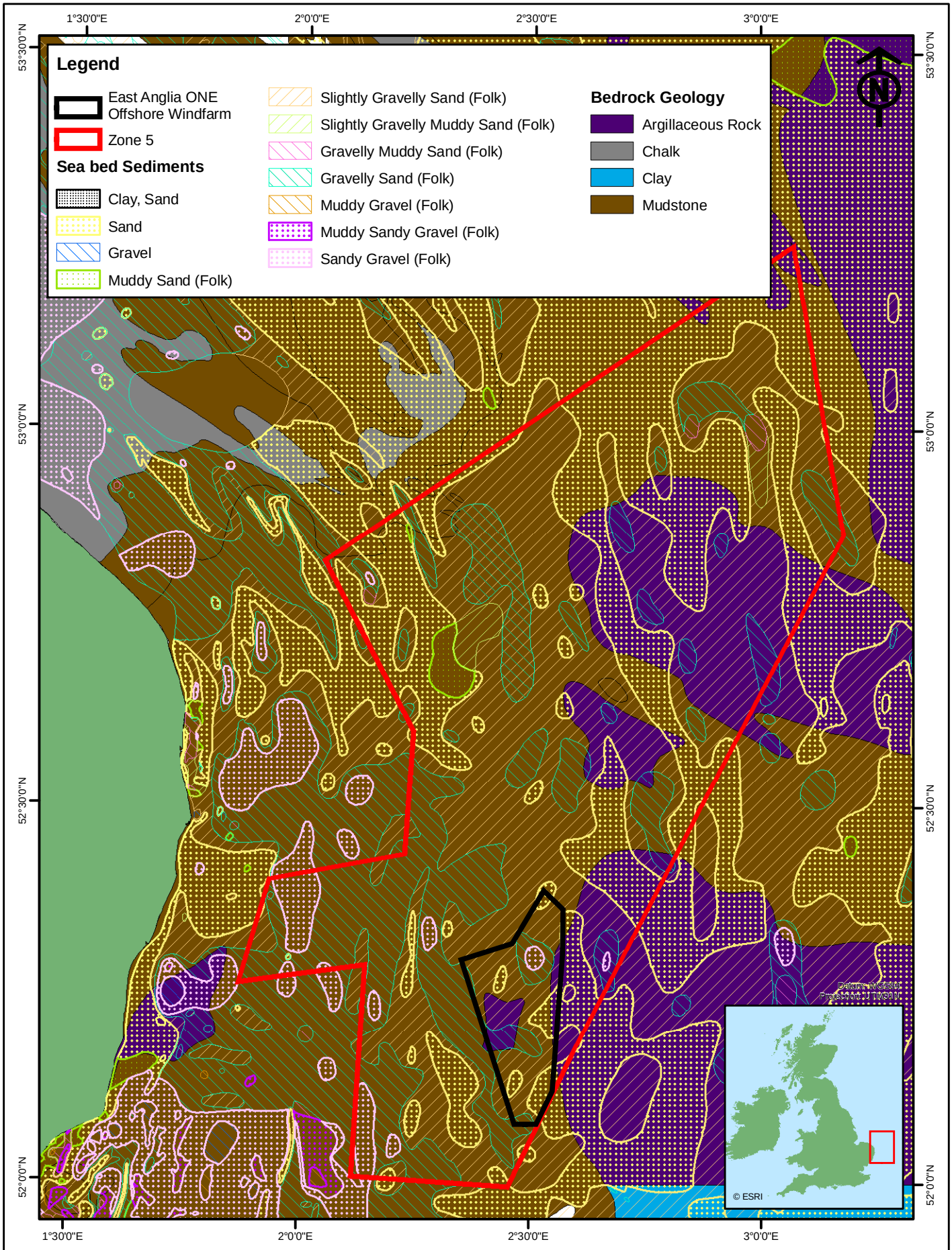
Geology

A broad-scale description of the regional geology is given in BGS (1992). The contemporary form of the sea bed and adjacent coast has developed in response to the last ice melt (Holocene Epoch from 12,000 years BP) and is associated with rapid increases in sea level. The geological make-up and surficial sediment cover of the sea bed under the footprint of East Anglia ONE and Zone 5 is represented in *Figure 5.1*. *Figure 5.2* indicates the relatively even bathymetry and water depth of less than 50m within the footprint of East Anglia ONE.

The limit of the glacial ice sheet probably remained to the north of Zone 5 and the area can be best described as part of a wider pereglacial plain. During the early part of the Holocene, between around 10,000 and 8,000 years BP, the ice began to melt and rapid sea level rise led to the English Channel eventually joining up with the North Sea.

Initially, the inundation of the tide broke through the Dover Strait and created a deep channel. Progressively the channel broadened as water levels increased further and the coastline eroded and retreated. Eventually these waters joined with waters advancing down the North Sea and past Dogger Bank. A more detailed reconstruction of the palaeo-geographies through the Holocene is given in Shennan *et al* (2000).

There appears to be no substantial natural hard geology that has inhibited further broadening of the Southern North Sea, although present rates of sea level rise have slowed and anthropogenic influence has tried to arrest rates of further coastal erosion.



East Anglia Offshore Wind

Bedrock geology and sea bed sediments

Rev	Date	By	Comment
C	05/07/10	FS	Symbology updated
B	16/06/10	JH	Symbology updated
A	07/06/10	JH	First Issue.

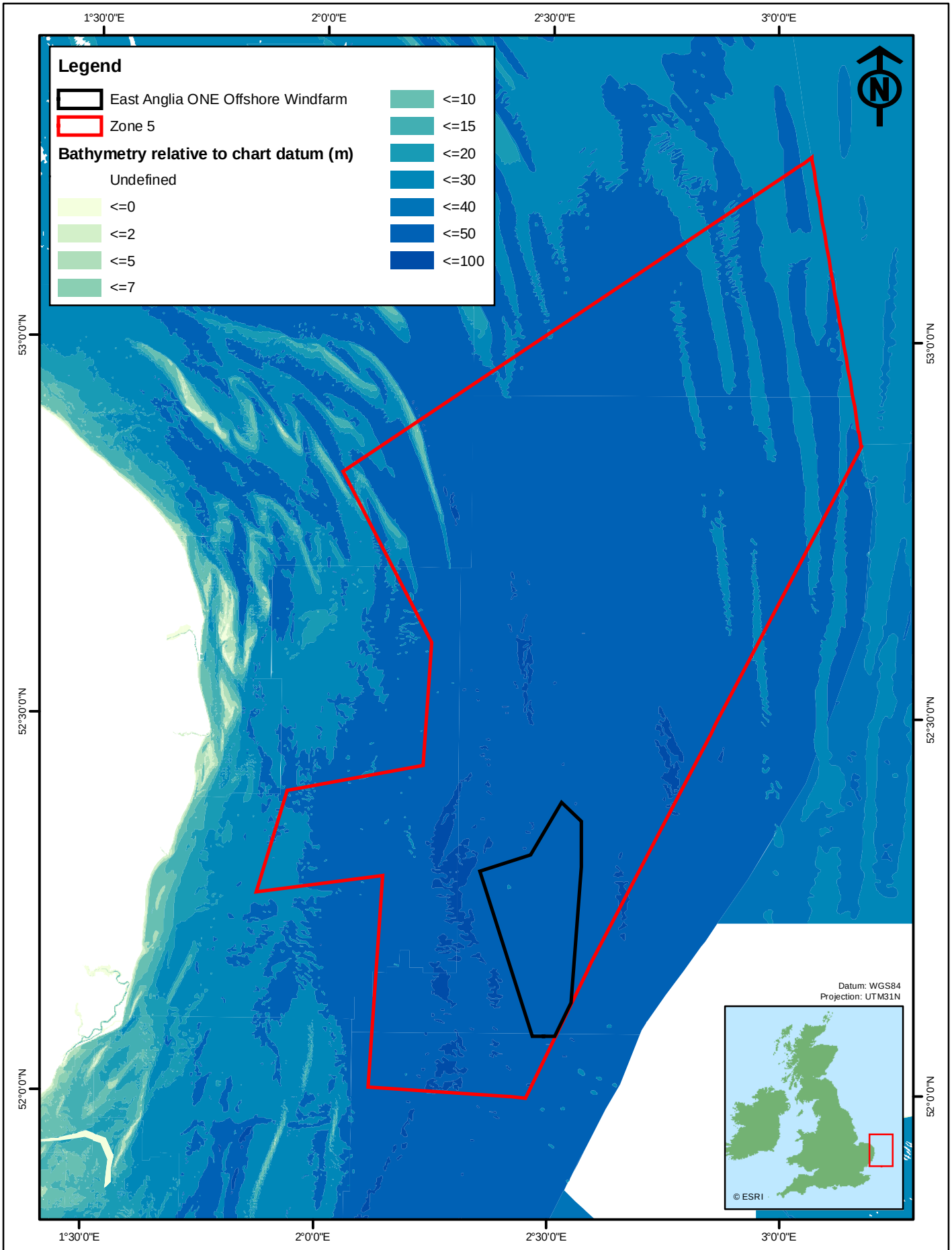
Original A4 Plot Scale 1:750,000

0 4 8 km 0 2 4 6 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	C	6115-500-PE-003

Figure 5.1

6115-500-PE-003-C_20100701_Geology.mxd



East Anglia Offshore Wind

Bathymetry

Rev	Date	By	Comment
B	05/07/10	FS	Labels removed
A	16/06/10	JH	First Issue.

Original A4 Plot Scale 1:750,000

0 4 8 km

0 2 4 6 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	B	6115-500-PE-023

Figure 5.2

6115-500-PE-023-B_20100701_Bathy.mxd

Tides

A notable feature in Zone 5 is the proximity of a tidal amphidrome which, at its centre, is a location with effectively zero tidal range (UKHO, 1980). Over distance, tidal range increases from the centre of the amphidrome leading to slightly higher tides at the coast.

The closest standard port for tides to Zone 5 is Lowestoft to the west, where the mean spring tidal range achieves 1.9m. East Anglia ONE is a shorter distance from the centre of the amphidrome and present evidence (ABPmer *et al*., 2008) suggests the mean spring tidal range here varies between 0.5m at the northern extent to around 1.5m at the southern extent. In relative terms, tides of this low range are commonly referred to as having a micro tidal range (less than 2m). The pattern of the rise and fall of the tide across the project area is not expected to conform to a standard sinusoidal type curve.

The movement of the tide around the amphidrome is anti-clockwise. Despite the low tidal range, tidal currents in the area remain relatively strong because the rate of rotation is rapid (ie co-phase lines are tightly spaced towards the coast). For East Anglia ONE, tidal currents are anticipated to achieve a little in excess of 1m/s during spring tides. The axis of the flow is to the south on the flood tide and to the north on the ebb. The tide exhibits some asymmetry between peak flows with slightly stronger flows on the ebb.

Surges

The North Sea basin is prone to the influence of storm surges. The effect of the surge can lead to gross modification to both water levels and currents, especially where the strength of the tide is weak. Surges can have both positive and negative effects on water levels. Strong storm surges tend to amplify as they move down the North Sea and generally reach a maximum elevation along the coast of the Netherlands. Local to Zone 5, the predicted 50 year return period surge elevation is 2.5m (HSE, 2002).

The equivalent maximum surge current is 0.4m/s and orientated in a south-westerly direction (HSE, 2002). This current may act either with or against the tide, depending on the phase and duration of the surge itself relative to the tide.

Waves

The Southern North Sea mainly responds to wind generated waves and tends to be sheltered from swell waves which have more influence on the west coast of the UK and Ireland. The standard method for predicting waves in the area is based on the JONSWAP spectrum (Joint North Sea Wave Project) for fetch

limited growing seas in the absence of swell. Wave exposure can therefore be correlated between prevailing winds and available fetches, with largest waves expected when strong winds occur for prolonged periods over the longest fetch, which here is from the northerly sector.

Across the project area, water depths are likely to be sufficient to limit the effect of wave stirring on local sea bed sediments apart from perhaps during exceptionally high seas and when wave periods are at their maximum.

Whilst waves are presently considered not to have a major role in local sediment transport across the project area waves do remain a controlling influence on erosion processes and littoral drift rates along the adjacent coastline. What is to be noted, however, is that the exposure of the adjacent coast to storm waves arising from the northerly sector is unlikely to be interrupted by East Anglia ONE unless large amounts of wave scattering are created.

Sea bed Sediments

The present local distribution of sea bed sediments is in response to the Holocene influence and tends to show a cover of coarse sediments (mainly gravels and medium sands) through a tidally worked channel (BGS, 1984). *Figure 5.1* shows the surficial sediment cover of the wider area around East Anglia ONE.

Over East Anglia ONE area, the Holocene sediments are thought to be relatively thin (less than 5m) and part of the Bligh Bank formation. Beneath this formation are sediments that date from the Pleistocene which are thought to be part of the Westkapelle Ground Formation (upward transition from grey clay to clays with sand laminae to fine muddy sands). This formation overlies the Red Crag Formation (shelly glaucontic marine sands) (Nobel Denton, 2009).

Sediment Transport

In broad terms, sediment transport is locally separated into the mobile sediments that are moving across the sea bed and the population of fine sediments that may, at times, be advected by the tide through the water.

In the main, the source of the fine sediments is remote from the project area and it originates from coastal erosion and sediment loads emanating from the Humber, Wash and Thames estuaries. There is high seasonal variation in these loads with maximum concentrations observed during the winter months. During this period, a large sediment plume can be observed to gather off the coast of East Anglia and migrate east into the North Sea, partly

due to the influence of prevailing westerly winds and partly tidal advection (see *Figure 5.3*).

Figure 5.3 ***Satellite Image Showing Winter Suspended Sediment Concentrations across the Southern North Sea***

Source: NASA Visible Earth, 2004

Across the sea bed, indicators for bed load transport are evident in the presence of sandwaves. These features appear to exhibit a consistent asymmetry which implies a net direction of transport to the north. The rate of transport remains uncertain, although the best explanation for a mechanism for transport is a dominant tidal influence. This transport direction appears to be consistent with the asymmetry in the tidal flows where the peak flows are stronger during the ebbing tide to the north.

Interpretations of net sand transport across the wider area suggest that to the south of East Anglia ONE there is a bed load parting zone and where net transport is to the south and into the Thames Estuary (Kenyon and Cooper, 2005). The bed load parting zone is also indicated to continue to the western side of the wider area of Zone 5 and parallel to the coast. This implies that inshore of East Anglia ONE and in the area of Zone 5 net transport is in a southerly direction. Since this area is shallower than the area of East Anglia

ONE it is likely that such transport is enhanced by the influence of waves from the north.

Climate Change

Considerations of climate change influences over the operational period of East Anglia ONE become important if they reach a level that alters the baseline conditions and become detectable above natural inter-annual variations.

Currently the best source of information on predictions of marine climate change around the UK is offered by the United Kingdom Climate Projections programme (UKCP09). This advisory body has produced a marine and coastal report (Lowe *et al*, 2009) which describes likely changes in the wave climate, sea levels, storm surges and ocean circulation. From this work, the following aspects of climate change can be identified for the Southern North Sea and Zone 5 in which East Anglia ONE is situated:

- a slight increase in mean sea level is expected - taking 2010 as the present day, by 2050 the medium emissions estimate suggests an increase of 16.2cm at the coast (relative sea level rise);

- an insignificant change in storm surges is predicted (largely indistinguishable from natural variability); and

- seasonal mean and extreme waves are expected to increase slightly to the south-west of the UK, reduce to the north but experience little change in the North Sea - there are large uncertainties especially with the projected extreme values.

Consequently, it appears only a relative increase in mean sea level has the potential to increase measurably over the operational period.

Data Sources

The key data sources identified to inform the geology, oceanography and coastal processes assessment are expected to include:

- local water levels from TotalTide (predicted);
- coastal tides from NTSLF (observed);
- co-tidal and navigation sourced from UKHO charts (interpreted);
- co-tidal mapping from Atlas of UK Marine Renewable Energy (predicted);
- local currents from Atlas of UK Marine Renewable Energy (predicted) (ABPmer *et al*, 2008);
- local currents from TotalTide (predicted);

- local currents from BODC (observed);
- extreme surge levels from HSE (2002) (stochastic);
- surge profiles from NTSLF (observation);
- extreme waves from HSE (2002) (stochastic);
- inshore waves from WaveNet (observed);
- average waves from Atlas of UK Marine Renewable Energy (predicted);
- regional geology from BGS report (1992);
- holocene evolution from Shennan *et al* (2000);
- sediment distributions from BGS map (1984);
- bedforms from BGS map (1984);
- sand transport pathways map, Kenyon and Cooper (2005);
- suspended sediment concentrations from CEFAS seasonal average data;
- information from monitoring carried out by EAOW as described in *Section 3.5.10*; and
- suspended sediment concentrations from surface distribution satellite data.

EIA Methodology

At the present time the following document offers the most relevant set of guidance to inform the EIA methodology for marine and coastal processes investigations:

- COWRIE (2009). Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment: Best Practice Guide. COAST-07-08. September 2009.

This guidance is aligned with the SEA 2009 recommendations and The Crown Estate enabling actions. The present generic guidance (Offshore Windfarms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA requirements: Version 2; Cefas, 2004) advises that a coastal process study should assess the magnitude and significance of change to the following coastal regimes:

- hydrodynamic regime, encompassing both the tidal and wave regimes (including, for example, tidal currents and wave heights); and

- sedimentological regime, including sea bed sediment distribution and transport pathways.

These regimes need consideration over a range of spatial and temporal scales that will be considered for the pre-construction stage (baseline), construction stage, operational stage and decommissioning stage of the development lifetime. The spatial scales to be considered are:

- near-field (the area within the immediate vicinity of the turbines and along the cable route); and

- far-field (the wider coastal environment over which impacts could occur).

Knowledge of the potential extent of effects which might affect a wider area, and the range of receptors involved will set a clear basis for defining a study area for investigations. The baseline conditions will provide the metric for comparison against the other phases of development.

Potential Project Impacts

The range of potential project effects has considered the generic guidelines for such work as well as the site-specific issues particular to East Anglia ONE.

During the construction and decommissioning phases, major sea bed preparations (foundations and cable laying) will be required which may lead to local sediment disturbance. The method of impact assessment employed will be to assess the risk of sediment mobility in areas of sea bed preparations and to consider relative to ambient conditions.

Large multiple foundations are likely to increase drag forces, tidal flows and change amphidrome behaviour. The method of impact assessment would be to model regional scale tidal movements and determine magnitude, phase and extent of any change in water level.

Large multiple foundations are likely to diffract and scatter waves that could lead to morphological and physical compositional changes at the coast. The method of impact assessment would be to model regional scale wave patterns and determine magnitude and extent of any change towards the coast and to model rates of inshore littoral drift if nearshore wave patterns are altered.

Large multiple foundations can create large-scale scour at an array scale and the potential for wider sea bed morphological effects. The method of impact assessment would be to investigate the risk of scour.

Large scale (natural) changes in sea bed morphology can lead to a risk of cable exposure and/or destabilisation of foundations. The method of impact assessment would be to investigate local sea bed morphology.

Large multiple foundations also alter sediment pathways (bedload and suspended load) possibly to the detriment of a down-drift receptor. The method of impact assessment would be to model regional scale sediment movements and determine magnitude and extent of any change.

Potential Cumulative and In-Combination Impacts

The most relevant activity in the area which presents a potential for in-combination effects is the procurement of marine aggregates from numerous locations inshore of Zone 5. However, these sites are some distance away to the western boundary of East Anglia ONE.

As the sea bed sediments in East Anglia ONE area are coarse grained and any dispersion is unlikely to be carried over any great distance, and the direction of sediment transport is most likely to form a north-south direction (ie contrary to the direction between activities which is east-west), this issue can be scoped out of the in-combination impact assessment.

However, there is the potential for East Anglia ONE to affect sand transport pathways with knock-on effects on, yet undefined, down-drift receptors (sand banks, reefs, etc) that are susceptible to sediment transport pathway changes. This issue will be considered within the potential effect of multiple foundations and in relation to the potential for any significant effect on a down-drift receptor.

There is local concern related to the procurement of marine aggregates off the coast of Suffolk and Norfolk and also a concern over the continued risk of local coastal erosion. The former issue is the subject of a Regional Environmental Assessment (REA) for the East Coast and, thereafter, individual licence applications and renewals.

Mitigation and Monitoring

Potential mitigation options, including the potential use of scour protection, will be considered as part of the EIA and will take into account the SEA recommendations on the use of scour protection. Details of the exact type and nature are pending the outcome of the assessment process.

5.2.2 *Water Quality*

Introduction

This section summarises the baseline water quality and potential impacts on the water quality within the East Anglia ONE study area, based on present understanding. Given the general scarcity of primary data within the East Anglia ONE area, these statements may be subject to change as further data and information are obtained during the EIA.

Baseline Conditions

Suspended sediment and contaminant levels (hydrocarbons and metals) are indicators of water quality. Suspension of sea bed sediments increases turbidity and reduces water quality. Sediment suspension may also release contaminants (such as metals and hydrocarbons) from the sediment and associated porewater into the water column, which can further reduce water quality.

Water quality is important on both local and regional scales as it can affect marine organisms. For example, fish population distributions may change, which in turn impact other species in the wider region such as birds and marine mammals.

The most important component of water quality is background turbidity, which is highly variable in space and time. It is also likely that contaminant concentrations may vary throughout East Anglia ONE project site and Zone 5 as there are existing (open and closed) disposal sites, oil and gas developments and shipping. The oil and gas developments towards the north of Zone 5 are at sufficient distance to make it unlikely that they have any effect on the water and sediment quality within the East Anglia ONE site.

Cefas has provided information that a disposal site is present under the entire footprint of East Anglia ONE. The site is known as Warren Springs Environmental Research Laboratory disposal site, and it is possible that site may have been used for disposal of materials such as tracer bullets, drilling muds or experimental oil slick dispersants. The disposal site has been closed since 1995. Further information on disposal sites near to the East Anglia ONE site boundary and a map (Figure 5.17) detailing the location of the disposal sites can be found in *Section 5.4.9.*

Sediment type is an important factor when considering the potential presence of contaminants that could be already present within the sediments or from contaminants that might be released in the future. Some sediments, such as clays and muds, can act as adsorption surfaces for some contaminants which may then be released into the marine environment on disturbing the settled sediments through site preparation and construction activities.

A desk top study of water and sediment quality will be carried out primarily from data acquired from the British Oceanographic Data Centre (BODC), which gathers data from a number of government agencies, and the 2010 OSPAR Quality Status Report, which is yet to be published. Supplementary data from other reports and studies will be used where necessary.

Data Sources

The key data sources identified to inform the water and sediment quality assessment are expected to include:

- data on water and sediment quality from the British Oceanographic Data Centre (BODC);
- OSPAR (2010). Quality Status Report (in preparation);
- HR Wallingford, Cefas, UEA, Posford Haskoning and Dr Brian D'Olier (2002). The Southern North Sea Sediment Transport Study. Report 4526, produced for Great Yarmouth Borough Council;
- DTI (2001). Strategic Environmental Assessment Region 2/3. Technical Report 4. Contamination. Contaminant Status of the North Sea;
- Environmental Statements for previous offshore infrastructure; and
- additional published reports and papers.

EIA Methodology

Guidance on the generic requirements for coastal process studies (including water and sediment quality) is provided in two main documents:

- Cefas (2004). Offshore Windfarms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA requirements: Version 2; and
- Defra (2005). Nature Conservation Guidance on Offshore Windfarm Development. A guidance note on the implications of the EC Wild Birds and Habitats Directives for developers undertaking offshore windfarm developments. Version R1.9.

The potential increase in turbidity and associated release of contaminants resulting from disturbance to the sea bed will be assessed on the basis of a qualitative analysis and comparison with the natural variability in these parameters.

Site specific information will be collected during the grab sampling survey identified in *Section 5.3.1*. This will provide information on sediment particle size and any potential contamination resulting from the identified Warren Springs Environmental Research Laboratory disposal site which will be used to model likely increases in suspended sediment during construction. The

need to analyse specific sediment contaminants will be discussed with relevant authorities.

Potential Project Impacts

Construction activities, such as installation of foundations and cable laying may increase suspended sediment concentrations for the duration of the activity. In addition, during operation the alteration to tidal current flows and waves caused by the physical presence of the wind turbines on the sea bed may result in changes in sea bed scour and deposition, which affects turbidity. Turbidity changes in the operational phase are likely to be localised. Increased turbidity can affect fish distribution, community composition and reduce light penetration, which can affect primary production.

Upon suspension, sediments may release nutrients and/or contaminants, such as metals and hydrocarbons, to the water column. A relatively small increase in nutrients could increase primary production, however a large increase in nutrients has the potential to reduce oxygen concentrations. The release of metals and hydrocarbons from the sediment and associated porewater can reduce water quality which may potentially impact marine organisms. Considering the Zone is offshore and the sea bed is predominantly sandy gravel and sand, it is unlikely that very high proportions of organic material and contaminants are present. High levels of nutrients and contaminants are commonly associated with very fine sediments (mud and silt).

Potential Cumulative and In-Combination Impacts

Cumulative and in-combination effects may occur where two or more plumes of suspended sediment from construction activities at neighbouring windfarms or dredging activities, for example, interact. Cumulative or in-combination effects may also occur during operation where increased turbidity in two adjacent areas interact. The potential of sediments to be contaminated, the extent of interaction of sediment plumes and the likelihood of this having a significant effect on the marine environment will be assessed during the EIA.

Mitigation and Monitoring

Potential mitigation options will be considered as part of the EIA. Contamination of the water column and sediment will be managed through adherence to standard protocols. Disposal of sea bed material, if required, will be in line with standard procedures and in agreement with relevant authorities. Good working practices will be adopted during the construction phase to prevent accidental spillage and loss of solid objects.

5.2.3 *Air Quality*

The concentration of air pollutants within the East Anglia ONE site boundary is highly variable in time and space. The main source of atmospheric emissions in the area is from shipping, which is covered in *Section 5.4.2*.

The application of a sulphur emission control area in the North Sea, implemented at the end of 2007, has led to a significant reduction in the output of SO_X. Conversely, NO_X emissions are falling only slowly. The 2010 targets set by the UK government under Directive 2001/81/EC on National Emission Ceilings have not been met (House of Commons, 2010).

Once East Anglia ONE is operational, it will reduce the emissions of other air quality pollutants (SO_x and NO_X) over its lifetime through the displacement of fossil fuel use, although quantification of this will depend on assumptions regarding the nature of generating capacity it replaces.

The construction and operation of East Anglia ONE will not significantly increase the overall CO_2, SO_X, NO_X and other pollutants within the East Anglia ONE site area, and air quality has therefore been scoped out of the EIA.

5.3 *BIOLOGICAL ENVIRONMENT*

5.3.1 *Benthic and Epibenthic Environment*

Introduction

This section describes the baseline benthic and epibenthic environment within the East Anglia ONE site based on currently available information. Data sources that will be used to inform the benthic and epibenthic impact assessment have been identified together with a description of the data capture methodology. Potential project effects on the benthic and epibenthic environment and cumulative and in-combination effects, together with mitigation are identified.

Baseline Conditions

Site Abundance and Diversity

East Anglia ONE is east of the Great Yarmouth outer bank system and south-east of the Norfolk offshore bank system. The majority of this area is composed of sand with patches of gravelly and muddy sand. Benthic fauna in the region are reported to have low abundance and biodiversity as a result of the abrasive effects of shifting sands under strong tidal currents and storm

action. However, patches of increased diversity have been observed in the southern North Sea, often in association with the polychaete *Sabellaria spinulosa* which builds tubes on hard surfaces in areas with strong tidal currents. *S. spinulosa* that form crusts or reefs can stabilise the sea bed and provide greater habitat diversity.

Information on the likely benthic fauna within the East Anglia ONE site is available from the results of the benthic survey that was collected for the Greater Gabbard Offshore Windfarm which is approximately 25km south west of East Anglia ONE (Gloyne-Philips, 2005). During this survey, undertaken in November 2004, 48 stations were sampled of which two had no fauna. One of these stations was located on top of a sandbank in approximately 5m deep water and the other was also a sandy site. The greatest species diversity was recorded at a station south of Inner Gabbard bank (72 taxa). Only four other sites were recorded to have more than 50 taxa. All five sites were located in deep water off the edge of the banks over muddy gravels in waters approximately 20 to 30m deep.

Wider Community Composition

The western North Sea is dominated by polychaetes which constituted 75 - 100% ash-free dry weight (AFDW) of samples taken during a broad scale survey by Cefas (2004). The remaining portion by AFDW was composed of echinoderms, crustaceans and molluscs.

Cluster analysis of the CEFAS (2004) data identified two benthic assemblages within the western North Sea: an impoverished offshore assemblage associated with clean sands in the east and a species-rich inshore assemblage associated with gravelly substratum in the west. The inshore assemblage in the west was characterised by polychaetes, ribbon worms (Nemertea), brittlestars and sea anemones. This assemblage also comprised two species of amphipod, two species of mollusc and the long-clawed porcelain crab (*Pisidia longicornis*). The impoverished offshore assemblage was dominated by bristleworms (*Spiophanes bombyx*).

More generally, there are four main communities in the southern North Sea (Heip and Craeymeersch, 1995) which are described as:

- fine sands in 50 to 70m, characterised by bristleworms (*Ophelia borealis)* and catworms (*Nephtys longosetosa*);

- muddy fine sands in 30 to 50m, characterised by bivalves (*Nucula nitidosa*), mud shrimps (*Callianassa subterranean*) and cumaceans (*Eudorella truncatula*);

- coarse sediments mainly in less than 30m, characterised by catworms (*Nephtys cirrosa*), sea potatoes (*Echinocardium cordatum)* and amphipods (*Urothoe poseidonis*); and

- coarse sediments mainly in less than 30m, characterised by bristleworms (*Aonides paucibranchiata* and *Pisione remota*) and amphipods (*Phoxocephalus holbolli*).

Sensitive Habitats and Rare / Protected Species

There are some small areas of Annex I sandbank habitat to the west of East Anglia ONE and along the coast (approximately 48km away at the nearest point). Sandbanks typically support populations of burrowing fauna including polychaete worms, crustaceans, bivalve molluscs and echinoderms. Mobile species such as shrimps, gastropods, crabs and fish may also be found within these habitats. These sandbanks are considered to be too far away from East Anglia ONE to be impacted by activities within it. However, information from the coastal processes assessment will serve to substantiate this.

The Ross worm *(S. spinulosa)* builds tubes using sand particles. It may be found as an individual or in colonies which, depending on their size and form, may constitute biogenic reef structures (1). Biogenic reefs are protected under Annex I of the Habitats Directive and are also classed as priority habitats under the UK Biodiversity Action Plan. Dense aggregations of tubes can be formed up to several metres across and up to 60cm in depth. *S. spinulosa* reefs often support a large abundance and high diversity of organisms. There are potential *S. spinulosa* reefs to the west and south west of East Anglia ONE, approximately 27km away at their nearest point, but there are not thought to be any reefs within the East Anglia ONE boundary. The presence or absence of *S. spinulosa* reefs will be confirmed during benthic surveys as part of the EIA.

There are currently two potential offshore Special Areas of Conservation (pSACs) in the vicinity of East Anglia ONE, put forward for designation as they support sandbanks and reef benthic habitats of conservation importance. These are Haisborough, Hammond and Winterton pSAC (approximately 40km from the north boundary of East Anglia ONE) and North Norfolk Sandbanks and Saturn Reef pSAC (approximately 63km north of East Anglia ONE). The former pSAC is located almost entirely within UK territorial waters and is therefore protected under the 2010 Conservation Regulations (see *Section 2.7*), the latter pSAC is located entirely outside UK territorial

(1) Biological concretions rising from the sea bed where the structure is created by the animals themselves.

waters and is therefore protected under the 2007 Regulations (as amended) (see *Section 2.7*).

The Offshore SEA 3 report (DTI, 2002) identified three species within the region which may be present within the East Anglia ONE site that are listed as priority species on the UK Biodiversity Action Plan. These are:

- lagoon seaslug (*Tenellia adspersa);*
- native oyster (*Ostrea edulis)*; and
- Ross worm (*S. spinulosa).*

The potential presence of these species within the East Anglia ONE site will be confirmed during the EIA benthic survey.

Data Sources

The key data sources identified to inform the benthic and epibenthic assessment are expected to include:

- Emu Limited (2009). Outer Thames Estuary Regional Environmental Characterisation. Prepared for Marine Aggregate Levy Sustainability Fund (MALSF);

- Cefas. (2004). The Benthic Ecology of the Western North Sea. Defra, London;

- Basford, D., Eleftheriou, A., Davies, I. M., Irion, G. & Soltwedel, T. (1993). The ICES North Sea benthos survey: the sedimentary environment. ICES Journal of Marine Science 50, 71-80;

- Dyer, M. F., Fry, W. G., Fry, P. D. & Cranmer, G. J. (1983). Benthic regions within the North Sea. Journal of the Marine Biological Association of the UK 63, 683-693;

- Jones, N. S. (1950). Marine Bottom Communities. Biological Reviews 25, 283-313;

- Künitzer, A. *et al* (1992). The benthic infauna of the North Sea: species distribution and assemblages. ICES Journal of Marine Sciences 49, 127-143;

- Heip, C. & Craeymeersch, J. A. (1995). Benthic community structures in the North Sea. Helgoländer Meeresuntersuchungen 49, 313-328;

- Callaway, R. *et al* (2002). Diversity and community structure of epibenthic invertebrates and fish in the North Sea. ICES Journal of Marine Science 59, 1199-1214;

- Gloyne-Phillips, I. (2005). Greater Gabbard Offshore Windfarm Marine Ecology EIA: Otter Trawl Survey:Field Report. Document: J3027 Otter Trawl Survey. CMACS;

- Hanson Aggregates Marine Ltd. (2005). Marine Aggregate Extraction Licence Area 401/2 (A&B) Environmental Statement for Renewal of the License. Hanson Marine Aggregates, Southampton; and

- Limpenny, D.S., Foster-Smith, R.L., Edwards, T.M., Hendrick, V.J., Diesing, M., Eggleton, J.D., Meadows, W.J., Crutchfield, Z., Pfeifer, S., and Reach, I.S. (2010). Best methods for identifying and evaluating *Sabellaria spinulosa* and cobble reef. Aggregate Levy Sustainability Fund Project MAL0008. Joint Nature Conservation Committee, Peterborough, 134 pp., ISBN - 978 0 907545 33 0.

EIA Methodology

Site specific information will be required and data will be collected from the East Anglia ONE site footprint and the area of impact (ie one spring tidal cycle). Surveys will include benthic grab sampling, drop down video and 2m epibenthic beam trawls. Sea bed sediment samples will also be collected for particle size analysis. Methodologies will be agreed with regulators including Cefas, MMO, JNCC and NE. Data collected will be used to establish broad scale community and species abundance throughout the survey area and to identify any sensitive areas.

The guidance from Limpenny *et al* (2010) will be consulted when identifying and evaluating the presence of *S. spinulosa*. In addition to *Sabellaria* reef, other biogenic reefs may also be present (eg mussel beds), as well as biotopes with high levels of biodiversity. The survey methodology will seek to avoid unnecessary damage to these potentially ecologically important areas.

The impact of suspended and deposited sediment on specific receptors may be modelled as part of the coastal processes assessment (see *Section 5.2.1).*

Sorting of benthic species after benthic grab survey © MESL

Potential Project Impacts

There is evidence to suggest that offshore windfarms do not have major impacts on benthic ecosystems. For example, monitoring studies at the North Hoyle Offshore Windfarm have shown no evidence of any major changes to invertebrate numbers or distribution as a result of the installation and operational activities of the windfarm, however minor changes, for example those under the footprint of the turbines, cannot be discounted.

Potential construction phase impacts on the benthic ecology of East Anglia ONE which will be investigated are:

- direct disturbance due to the installation of foundations and inter array cables;
- temporary loss of habitat from jack-up barges - this impact is dependent on access arrangements during construction;
- increased suspended and deposited sediments;
- remobilisation of contaminants from the sea bed leading to a reduction in water quality;

- potential discharge of contaminants (if present) from construction vessels resulting in a reduction in water quality; and

- noise and vibration which may have a physiological or behavioural effect on the marine benthos.

Potential operational phase impacts on the benthic ecology of East Anglia ONE which will be investigated are:

- permanent loss of habitat due to the presence of foundations and associated scour;

- provision of new habitat due to the presence of foundations and, if required, scour protection;

- changes in sediment transport and deposition patterns as a result of the presence of turbines - the assessment of this effect will be connected to the outputs of any hydrodynamic modelling carried out;

- noise and vibration which may have a behavioural effect on marine benthos; and

- electromagnetic fields (EMFs) from inter-array cables which may have a physiological or behavioural effect on the marine benthos.

Potential Cumulative and In-Combination Impacts

The majority of the potential impacts on the benthic community from the construction, operation and decommissioning of the windfarm are likely to be local and largely within the footprint of East Anglia ONE.

Cumulative effects with other windfarms in the region are therefore for the most part not predicted to occur, unless they are sited in very close proximity to East Anglia ONE site.

There is the potential for in-combination impacts to the benthos from the windfarm and other activities or developments in the region. The spatial scope within which other activities will be considered will depend upon the magnitude and spatial extent of the effect on the environment, and will take into consideration the following activities:

- aggregate extraction and dredging;
- navigation and shipping;
- established fishing activities;
- existing and planned construction sub-sea cables and pipelines;

- potential port or harbour development; and
- oil and gas installations.

The principal concerns for the benthos in relation to both cumulative and in-combination impacts are habitat loss, particularly if sensitive habitats occur within the site, and the potential for suspended sediment concentrations to become significantly increased over a prolonged period causing smothering.

Transboundary Impacts

There are unlikely to be any transboundary impacts of East Anglia ONE in relation to benthic ecology as the impacts on the sea bed will largely be focused within the footprint of East Anglia ONE. This topic has therefore been scoped out of the EIA.

Mitigation and Monitoring

Monitoring requirements will be identified as part of the EIA and agreed with the relevant authorities, with the degree and type required being dependent on issues including the nature and characteristics of baseline environmental resources and the proposed construction methodology.

Although no specific guidance exists for monitoring the potential impacts of offshore windfarm developments on the benthic ecology, the guidance published for marine aggregate dredging sites is of relevance (Cefas, 2002). Experience gained during Rounds 1 and 2, including the results of specific monitoring, will also be drawn upon. In addition, the survey methodology as part of any required monitoring will be consistent with the baseline survey to ensure that data from pre and post construction surveys are comparable.

5.3.2 Fish Ecology

Introduction

This section describes the baseline fish ecology conditions within the East Anglia ONE site based on currently available information. Data sources that will be used to inform the fish ecology assessment have been identified together with a description of the data capture methodology. Potential project effects on fish ecology and cumulative and in-combination effects, together with mitigation measures, are identified.

Baseline Conditions

Demersal

Demersal fish species are those that live and feed on the sea bed. According to a survey by Callaway *et al* (2002), there is a relatively high diversity of demersal fish species in the southern North Sea compared with the northern North Sea, many of which may be present within the East Anglia ONE site. The most common species observed were solenette (*Buglossidium luteum*), dab (*Limanda limanda*), dragonet (*Callionymus lyra*) and scaldfish (*Arnoglossus laterna*). Cluster analysis of the total area surveyed highlighted an increase in the demersal species plaice (*Pleuronectes platessa*) and lesser weever fish (*Echiichthys vipera*) in the southern North Sea where East Anglia ONE is located.

In addition to these species, the Greater Gabbard Offshore Windfarm EIA (Gloyne-Philips, 2005) otter trawl survey recorded the following species to the south-west of the project site:

- Dover sole (*Solea solea*);
- black goby (*Gobius niger*);
- lemon sole (*Microstomus kitt*);
- common ling (*Molva molva*);
- pogge (*Agonus cataphractus*);
- grey gurnard (*Eutriglia gurnardus*);
- three-bearded rockling (*Gaidropsarus vulgaris*); and
- striped seasnail (*Liparis liparis*).

Many of these species were also found during a survey undertaken for the aggregates extraction licence area 401/2 (Hanson Aggregate Marine Ltd, 2005).

Based on data from Coull *et al* (1998), there is a potential plaice spawning area that covers the vast majority of the project site. CEFAS are currently updating their spawning maps and these data will be reviewed as part of the EIA process.

Pelagic Species

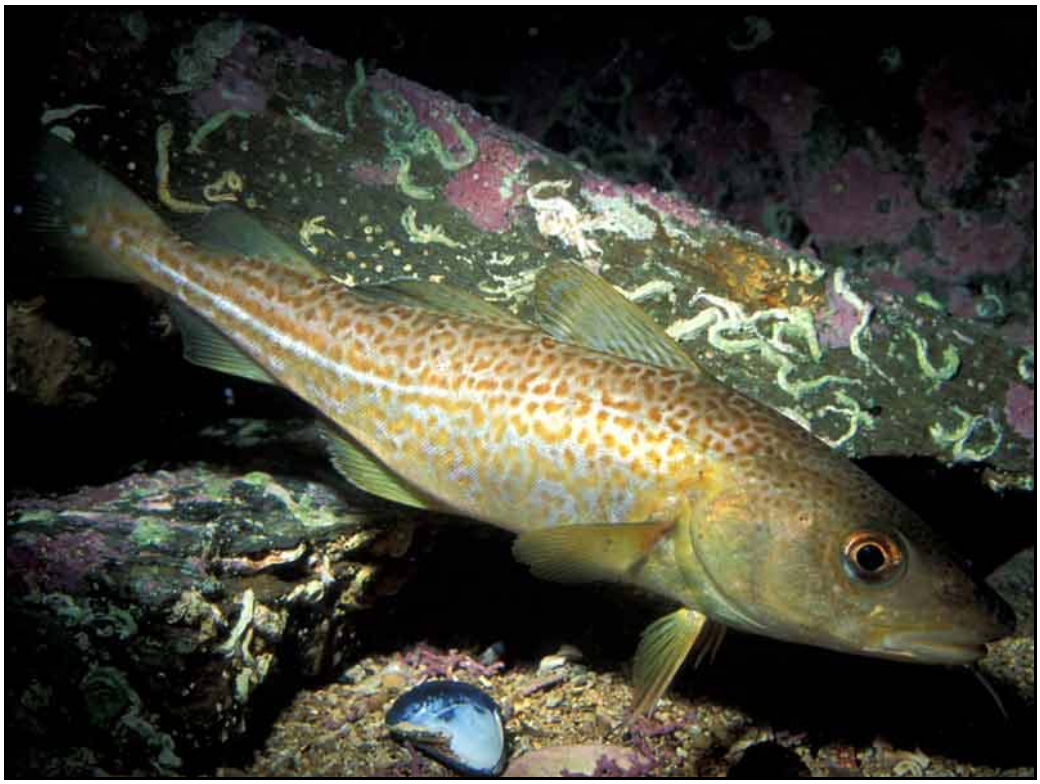
Pelagic fish species are those that live and feed in the water column. There are no available data from surveys using gears that target these species in the vicinity of the project, however the otter trawl surveys carried out for the Greater Gabbard to the south-west of the project area provide useful reference data (Gloyne-Philips, 2005). Callaway *et al* (2002) provides broad scale information.

The shallow water depth (less than 50m) within the majority of the East Anglia ONE site is not a suitable habitat for many pelagic fish species. However, according to the ranges for cod (*Gadus morhua*) and whiting (*Merlangius merlangus*) outlined by Rogers and Stocks (2002), these species are likely to be present within the project site. This is also supported by data from the beam and otter trawl survey of the North Sea (Callaway *et al*, 2002) and during the Hanson area 401/2 beam trawl survey (2005) to the west of the project site. These surveys also recorded mackerel, (*Scomber scombrus*) and scad or horse mackerel (*Trachurus trachurus*) in the region, and the Hanson survey recorded bass (*Dicentrarchus labrax*). Poor cod (*Trisopterus minutus*) were found during the Greater Gabbard otter trawl survey (2005).

Sprat (*Sprattus sprattus*) tends to inhabit shallower waters than other pelagic fish and it is very likely that the East Anglia ONE site will support this species. Sprat were recorded by the Greater Gabbard and Hanson Area 401/2 surveys, and by Birklund (2005) in the vicinity of the project site.

There is a known population of herring (*Clupea harengus*) within the southern North Sea which extends into the English Channel (Rogers and Stocks, 2002). This species was found during the Hanson Area 401/2 survey. Current understanding of the location of spawning grounds suggests there are no herring spawning grounds within the East Anglia ONE site. Coull *et al* (1998) show that the nearest herring spawning area is located approximately 9km south-east of the site.

Sandeel (*Ammodytes marinus*) are widespread across the North Sea. They inhabit sandy bottoms overnight but are pelagic during the day. A potential sandeel spawning area overlaps with the project site (Coull *et al*, 1998).



Photograph of Cod © Fishbase

Elasmobranchs

The otter trawl survey data for the Greater Gabbard Offshore Wind Farm (Gloyne-Philips, 2005) provide an indication of the elasmobranch species likely to be present within the wider East Anglia ONE area. Starry smooth hound (*Mustelus asterias*) and lesser spotted dogfish (*Scyliorhinus canicula*) were found across the Greater Gabbard site in abundant numbers. Thornback ray (*Raja clavata*), spotted ray (*Raja montagui*) and blonde ray (*Raja brachyura*) were also present but in low numbers over a large area.

The Hanson Aggregates Area 401/2 also found thornback ray, and in addition tope (*Galeorhinus galeus*) and spurdog (*Squalus acanthias*).

Surveys within the East Anglia ONE site will confirm whether or not these species are present in significant numbers.

Rare/Threatened and Protected Species

Table 5.1 summarises the various conservation measures in place to protect southern North Sea fish species. The Crown Estate carried out an Appropriate Assessment of the implications of the Round 3 plan for protected European

Sites. It was concluded that the following diadromous (1) species listed in Annex II of the Habitats Directive must be taken into account as part of a project-level Habitats Regulations Assessment (HRA):

- twaite shad (*Alosa fallax*);
- allis shad (*Alosa alosa*);
- Atlantic salmon (*Salmo salar*);
- sea lamprey (*Petromyzon marinus*); and
- river lamprey (*Lampetra fluviatilis*).

There are no data available to show the presence of these species within the East Anglia ONE site and they were not found during any of the surveys used to inform this section (Callaway *et al.*, 2002; Gloyne-Phillips, 2005; Hanson Aggregate Marine Ltd, 2005).

Further site-specific survey data would inform whether or not these species are present within the East Anglia ONE site.

Shellfish of Commercial Importance

There are some broad scale survey data available in relation to the distribution of shellfish species in the North Sea (Callaway *et al*, 2002) and within the Greater Gabbard windfarm site (Gloyne-Philips, 2005) and Hanson Aggregates Area 401/2 (2005). Given the similarity of habitat at these sites and East Anglia ONE, the results of these surveys provide an indication of the species that may occur in the East Anglia ONE site.

The otter trawl survey for the Greater Gabbard windfarm showed the presence of several species of crab to the south-west of the project site; *Pagarus bernhardus, Pagarus prideauxi, Liocarcinus holstatus, Liocarcinus depurator, Inachus dorsettensis* and *Necora puber* (species of hermit, swimming and spider crabs).

Shrimp species (*Crangon cragon, Crangon allmanni* and *Philoceras trispinosus*) were found to inhabit waters east off East Anglia towards the English Channel (Callaway *et al,* 2002).

Brown shrimp (*Crangon crangon*) and pink prawn (*Pandalus montagui*) were found to the west of the project site during the Hanson Aggregates Area 401/2 survey, and shrimp (*Processa canaliculata*) was found during the Greater Gabbard survey (2005).

(1) Fish species that migrate between fresh and sea waters

The East Anglia ONE benthic and fish surveys will provide site specific information on the shellfish species present within the East Anglia ONE boundary.

Table 5.1 Conservation Measures in Place to Protect Southern North Sea Fish Species

Species	EC Habitats Directive (Annex number)	Wildlife and Countryside Act (Schedule 5)	IUCN Red Data List Species	Bern Convention (Appendix III)	Nationally Important Marine Feature (NIMF)	Biodiversity Action Plan
Common skate *Dipturus batis*	-	-	Critically Endangered	-	-	Common skate Species Action Plan
Allis shad *Alosa alosa*	II and V	Yes	Data Deficient	Yes	-	Allis shad Species Action Plan
Twaite shad *Alosa fallax*	II and V	Yes	Data Deficient	Yes	-	Twaite shad Species Action Plan
Atlantic salmon *Salmo salar*	II and V (only in freshwater)	-	Least Risk	Yes (only in freshwater)	-	-
Sea lamprey *Petromyzon marinus*	II and V	-	Least Risk	Yes	-	-
River lamprey *Lampetra fluviatilis*	II and V	-	Least Risk	Yes	-	-
Cod *Gadus morhua*	-	-	Vulnerable	-	Yes	EU long term Cod Recovery Plan, Commercial marine fish grouped Species Action Plan
Herring *Clupea harengus*	-	-	-	-	-	Commercial marine fish grouped Species Action Plan

Species	EC Habitats Directive (Annex number)	Wildlife and Countryside Act (Schedule 5)	IUCN Red Data List Species	Bern Convention (Appendix III)	Nationally Important Marine Feature (NIMF)	Biodiversity Action Plan
Whiting *Merlangius merlangus*					Yes	Commercial marine fish grouped Species Action Plan
Mackerel *Scomber scombrus*	-	-	-	-	-	Commercial marine fish grouped Species Action Plan
Horse mackerel *Trachurus trachurus*	-	-	-	-	-	Commercial marine fish grouped Species Action Plan
Lesser sandeel *Ammodytes marinus*	-	-	-	-	Yes	-
Plaice *Pleuronectes platessa*	-	-	-	-	Yes	EU North Sea Plaice and Dover sole management plan, Commercial marine fish grouped Species Action Plan
Dover Sole *Solea solea*	-	-	-	-	-	EU North Sea Plaice and Dover sole management plan, Commercial marine fish grouped Species Action Plan
Sand goby *Pomatoschistus minutus*	-	-	-	-	Yes	-

Species	EC Habitats Directive (Annex number)	Wildlife and Countryside Act (Schedule 5)	IUCN Red Data List Species	Bern Convention (Appendix III)	Nationally Important Marine Feature (NIMF)	Biodiversity Action Plan

Table notes:

- Annex II EC Habitats Directive – This annex includes "*Animal and plant species of community interest whose conservation requires the designation of special areas of conservation*".
- Annex V EC Habitats Directive – This annex includes "*Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures*".
- Protection under the Wildlife and Countryside Act only extends to the 12 nm limit, however the first project site is located beyond this.
- Bern Convention – Conveys special protection to those species which are vulnerable or endangered. In England the Bern Convention is implemented through the *Wildlife and Countryside Act 1981*.
- Nationally Important Marine Feature – Identified as part of Defra's Review of Marine Nature Conservation (RMNC). Include species for which we have a special responsibility in a national, regional or global context, and/or species that have suffered significant decline in their extent or quality, or are threatened with such decline, and can thus be defined as being in poor status.
- Biodiversity Action Plan – This is the UK Government's response to Article 6 of the *Convention on Biological Diversity (1994)*. The overall goal is to conserve and enhance biodiversity in the UK. A Species Action Plan provides detailed information on the threats facing species and the opportunities for maintaining and enhancing populations. A 'Grouped' Species Action Plan has been produced for Commercial Marine Fish as a range of common policies and actions are required for all species listed.

Migratory Species

There is a general lack of information regarding the migratory patterns of anadromous (1) fish in UK coastal waters, such as allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*), Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta*) and sea lamprey (*Petromyzon marinus*).

Sea trout and sea lamprey do not generally migrate as far offshore as Atlantic salmon, hence it is more likely that Atlantic salmon will be present within the project site. However, if sea trout or sea lamprey are present in the wider region, there is the potential for East Anglia ONE to overlap with migratory routes (although this is considered unlikely given its distance offshore).

Atlantic salmon migratory patterns are not well documented, although a number of rivers containing stocks of this species exist on the eastern coast of the UK (primarily from Yorkshire up into Scotland). It is unlikely, given the tendency for northern distribution of this species and its transit from river sites to grounds in the northeast Atlantic, that there will be significant migratory routes in the region. However, the East Anglia ONE survey may highlight whether there are any significant migratory routes crossing the East Anglia ONE site.

Data Sources

The key data sources identified to inform the fish ecology assessment are expected to include:

- Cefas (2004). Offshore Windfarms – Guidance Note for EIA in Respect of FEPA and CPA Applications;
- Defra (2005). Nature Conservation Guidance on Offshore Windfarm Development. A guidance note on the implications of the EC Wild Birds and Habitats Directives for developers undertaking offshore windfarm developments. Version R1.9;
- BWEA (2001). Windfarm Development and Nature Conservation;
- OSPAR (2008). Guidance on Environmental Considerations for Offshore Windfarm Development;
- landings statistics from the Marine Management Organisation Fisheries Statistics Unit and Data and Communications Team;

(1) Migrating from the sea to fresh water to spawn

- Coull, K. A., Johnstone, R. and Rogers, S. I. (1998). Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd;
- International Council for the Exploration of the Sea (ICES) publications including ICES Herring Working Group Reports;
- Cefas publications;
- Eastern Sea Fisheries Joint Committee publications;
- COWRIE reports;
- information from JNCC and Natural England on protected species;
- Callaway, R. *et al* (2002). Diversity and community structure of epibenthic invertebrates and fish in the North Sea. ICES Journal of Marine Science 59, 1199-1214;
- Birklund, J., Wijsman, J. W. M. (2005). Aggregate Extraction: a review on the effect on ecological functions. SANDPIT Fifth Framework Project No. EV K3-CT-2001-00056;
- DECC (2009). UK Offshore Energy Strategic Environmental Assessment. DECC, London;
- Rogers, S. & Stocks, R. (2002). North Sea Fish and Fisheries. Technical report produced for Strategic Environmental Assessment – SEA2. Technical Report TR_003, DTI, London;
- WWT Consulting (2009). UK Offshore Oil and Gas and Wind Energy Strategic Environmental Assessment: Distributions of Cetaceans, Seals, Turtles, Sharks and Ocean Sunfish recorded from Aerial Surveys 2001-2008. DECC, London;
- JNCC (2009). SAC Species Web Resource. Available at: http://www.jncc.gov.uk/ProtectedSites/SACselection/SAC_species.asp;
- Gloyne-Phillips, I. (2005). Greater Gabbard Offshore Windfarm Marine Ecology EIA: Otter Trawl Survey: Field Report. Document: J3027 Otter Trawl Survey. CMACS;
- Hanson Aggregates Marine Ltd. (2005). Marine Aggregate Extraction Licence Area 401/2 (A&B) Environmental Statement for Renewal of the License. Hanson Marine Aggregates, Southampton; and

- any appropriate scientific publications.

EIA Methodology

There are a number of fish species present in the vicinity of East Anglia ONE, as described above, and the area may be used for migration, spawning and as a nursery area for different fish species at different times of year. It is not known how sensitive each fish species is to different activities. Impacts will depend on the level of disruption (spatial magnitude, duration) and the function of the site for each species, eg migration or spawning area.

Given that fish are mobile species and can potentially avoid disturbance, impacts are not anticipated to be significant in all instances. Construction disturbance to the sea bed and subsequent impacts to fish are short-term events that are likely to cause a relatively small impact (compared to activities such as marine aggregate extraction that have much greater long term effects over a wider area). The recoverability of fish populations is expected to be high as they will quickly return to areas at the end of the period of disturbance. The sensitivity of fish species to disturbance will be assessed. This is generally thought to be low to medium, with the exception of the twaite shad, allis shad, Atlantic salmon, sea lamprey and river lamprey, which are considered to have high sensitivity given their European protected status. In addition, herring are a particularly sensitive species due to their specialised hearing ability and their requirement for a particular substrate type for spawning.

In order to inform the baseline for the EIA, the primary source of data will be targeted fish surveys within the East Anglia ONE site using 2m beam trawls and otter trawls. These surveys are scheduled to take place in January and May 2011 and aim to target adults and juveniles of the key species present. Survey methods will be agreed with the MMO, CEFAS, JNCC and NE. The data will be used to characterise East Anglia ONE in terms of broad scale species and community abundance and distribution patterns present. The need for other types of survey, such as a herring spawning survey, will be considered following the desk study, a review of the findings of the ongoing surveys and discussions with statutory consultees.

The EIA methodology will focus on establishing the baseline of East Anglia ONE in terms of the ecology of fish species present. Baseline noise and disturbance levels, as well as suspended sediment and contaminant concentrations, will also be assessed. Predictions and/or modelling of the effects of the development of East Anglia ONE will then be carried out. The impact of these changes relative to the baseline will be used to assess the predicted impact on fish species.

Liaison with the local fishing community will be maintained throughout the development and operation of East Anglia ONE (see *Section 5.4.1*).

Potential Project Impacts

The potential construction phase impacts on fish ecology which will be investigated throughout the EIA and reported in the ES are:

- direct disturbance to, and loss of, spawning, nursery and feeding grounds and migration routes due to installation and decommissioning of foundations and inter-array cable laying;
- temporary loss of habitat from jack-up barges - this impact is dependent on access arrangements during construction;
- introduction (or removal during decommissioning) of new habitat from the addition of foundations and associated scour protection;
- impacts on fish habitat from an increase in sediment suspension and deposition;
- remobilisation of contaminants from sea bed sediments resulting in a reduction in water quality;
- potential discharge of contaminants from construction vessels resulting in a reduction in water quality; and
- noise and vibration which could have physiological or behavioural impacts on fish and shellfish - of particular concern are the effects of pile driving noise on fish spawning and other sensitive life cycle stages including migration (Thomsen *et al*, 2006).

The potential operational phase impacts on fish ecology which will be investigated throughout the EIA and reported in the ES are:

- loss of fish habitat (spawning, nursery and feeding grounds) and migration routes due to the presence of foundations and associated scour;
- loss of habitat during maintenance - this impact is dependent on access arrangements;
- changes in sediment transport and deposition patterns as a result of the presence of turbines - the assessment of this effect will be connected to the outputs of any hydrodynamic modelling carried out;

- noise and vibration which could have behavioural impacts on fish and shellfish; and

- electromagnetic fields (EMFs) from inter-array cables which could have physiological / behavioural impacts on fish and shellfish.

Evidence from monitoring conducted at Round 1 offshore windfarms suggests that construction activities do not have a discernible adverse effect on post-construction fish catches. Information from Barrow Offshore Windfarm shows that potting recommenced in the windfarm within a matter of weeks from completion of construction activities. Monitoring at Kentish Flats Offshore Windfarm showed no clear effects on herring catch rates 12 months after completion (Brown and May, pers comm.). Annual monitoring at the North Hoyle Offshore Windfarm construction phase (spring 2004), found that, during the latter stages and possibly throughout the summer-autumn of 2004, fish distributions or behaviour were affected in some way that resulted in poor catches for all sectors. However, from spring 2005, netting (for rays) in close proximity to North Hoyle Offshore Windfarm picked up and spring fishing was not significantly different from how it was immediately before construction work began.

In the autumn of 2005, netters found that fishing around North Hoyle grounds was poor and better further to the west. By spring 2006, however, set-net catches were once again comparable to fishing before the windfarm was constructed. Cefas and CMACS data indicate a stable, if not increasing trend in sole catches at the site.

Potential Cumulative and In-Combination Impacts

It is anticipated that, due to the mobility of the majority of fish species present within the region, there will be no significant cumulative impacts as a result of the development of East Anglia ONE and other offshore wind operations in the region. Cumulative impacts may be of concern if the windfarms are sited in very close proximity and regionally there is a large increase in suspended sediment concentrations or noise levels. This may be the case if a large amount of pile driving activity is scheduled to be carried out at the same time and on a regular basis.

There is the potential for in-combination impacts to fish from the windfarm and other activities or developments in the region. The spatial scope within which other activities will be considered will depend upon the magnitude and spatial extent of the effect on the environment, and will take into consideration the following activities:

- aggregate extraction and dredging;
- navigation and shipping;

- established fishing activities;
- existing and planned construction sub-sea cables and pipelines;
- potential port and harbour development; and
- oil and gas installations.

Of particular concern are effects of the aggregates dredging industry and other shipping traffic. However the proximity of the dredging areas to East Anglia ONE, and the fact that the fish species are likely to be already habituated to the large amount of vessel traffic in the area, suggests that these in-combination impacts are unlikely to be significant.

Transboundary Impacts

Any potential impacts to the natural ecology of fish species that are of commercial importance for foreign fleets that operate within the UK EEZ will be of concern for the Member States in question. These are covered in more detail in *Section 5.4.1.*

Mitigation and Monitoring

Monitoring will be agreed with statutory consultees as required. The survey methodology as part of any required monitoring will be consistent with the baseline survey to ensure that data from pre and post construction surveys are comparable.

Experience gained during Round 1 and 2, including the results from site specific monitoring for Round 1 projects, will be drawn upon to inform the proposed mitigation and monitoring package.

Contamination of the water column and sediment will be managed through adherence to standard protocols. Disposal of sea bed material, if required, will be in line with standard procedures and in agreement with relevant authorities.

5.3.3 Marine Mammals

Introduction

This section identifies the potential of marine mammal presence in the East Anglia ONE site boundary and in the vicinity of the site. Data sources that will be used to inform the marine mammal impact assessment have been identified together with a description of the data capture methodology. Potential project effects on marine mammals and cumulative and in-combination effects and transboundary effects, together with mitigation measures, are identified.

Baseline Conditions

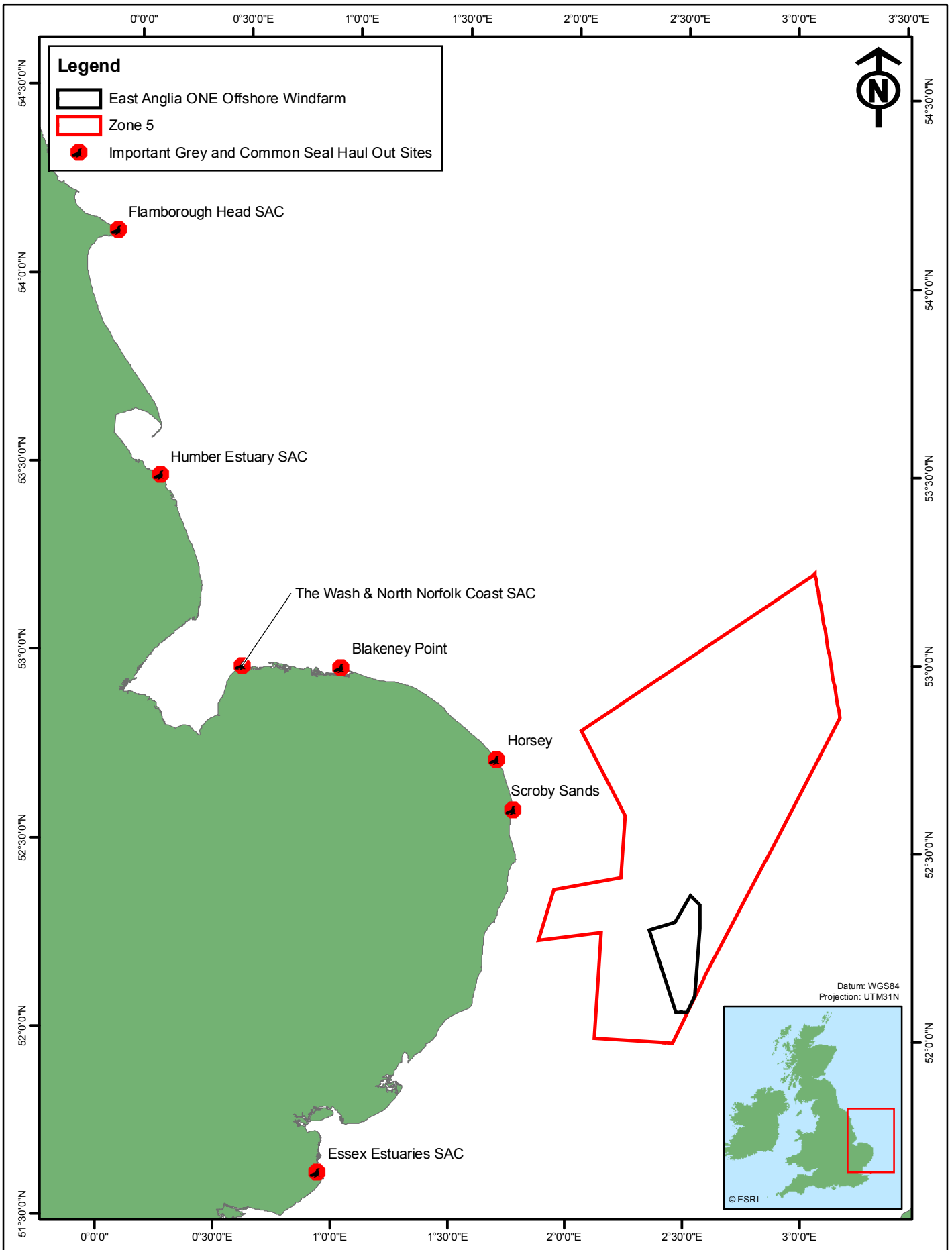
Marine mammals occurring in UK waters can be divided into cetaceans (whales and dolphins) and pinnipeds (seals).

Use of the East Anglia ONE site by cetaceans is relatively limited compared to other coastal waters around the UK (Reid *et al*, 2003). Harbour porpoise (*Phocoena phocoena*) has been recorded in moderate numbers within the vicinity of East Anglia ONE, although the activity of other cetaceans is low and white-beaked dolphins (*Lagenorhynchus albirostris*), bottlenose dolphins (*Tursiops truncatus*) and minke whales (*Balaenoptera acutorostrata*) (otherwise relatively common cetaceans of the North Sea) are believed to be largely absent or infrequent (Reid *et al*, 2003).

Use of the area defined within the East Anglia ONE boundary by pinnipeds is also relatively limited. There are a number of small colonies of common seal (*Phoca vitulina*) along the Suffolk and outer Thames estuary coast, as well as well-established colonies of both grey seal (*Halichoerus grypus*) and common seal at Blakeney National Nature Reserve (NNR) approximately 115km away.

Seals are currently protected under the Conservation of Seals Act 1970, under which it is an offence to kill or take any seal at any time, except under licence from the MMO. The Marine Bill will replace the 1970 Act and will also make it an offence to intentionally disturb seal colonies. The Marine Bill also extends the requirement to obtain a licence if an applicant considers it may disturb seal colonies up to 200nm from the UK coastline. Local seal haul out sites to the East Anglia coastline are represented in *Figure 5.4.*

Photograph of harbour seal © Shutterstock



IBERDROLA RENOVABLES VATTENFALL

East Anglia Offshore Wind

Known seal haul out sites around East Anglia ONE and Zone 5

Rev	Date	By	Comment
B	05/07/10	FS	Template updated, scales increased
A	23/06/10	JH	First Issue.

Original A4 Plot Scale 1:1,500,000

0 10 20 km 0 4 8 12 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	B	6115-500-PE-034

Figure 5.4

6115-500-PE-034-B_20100701_Seals.mxd

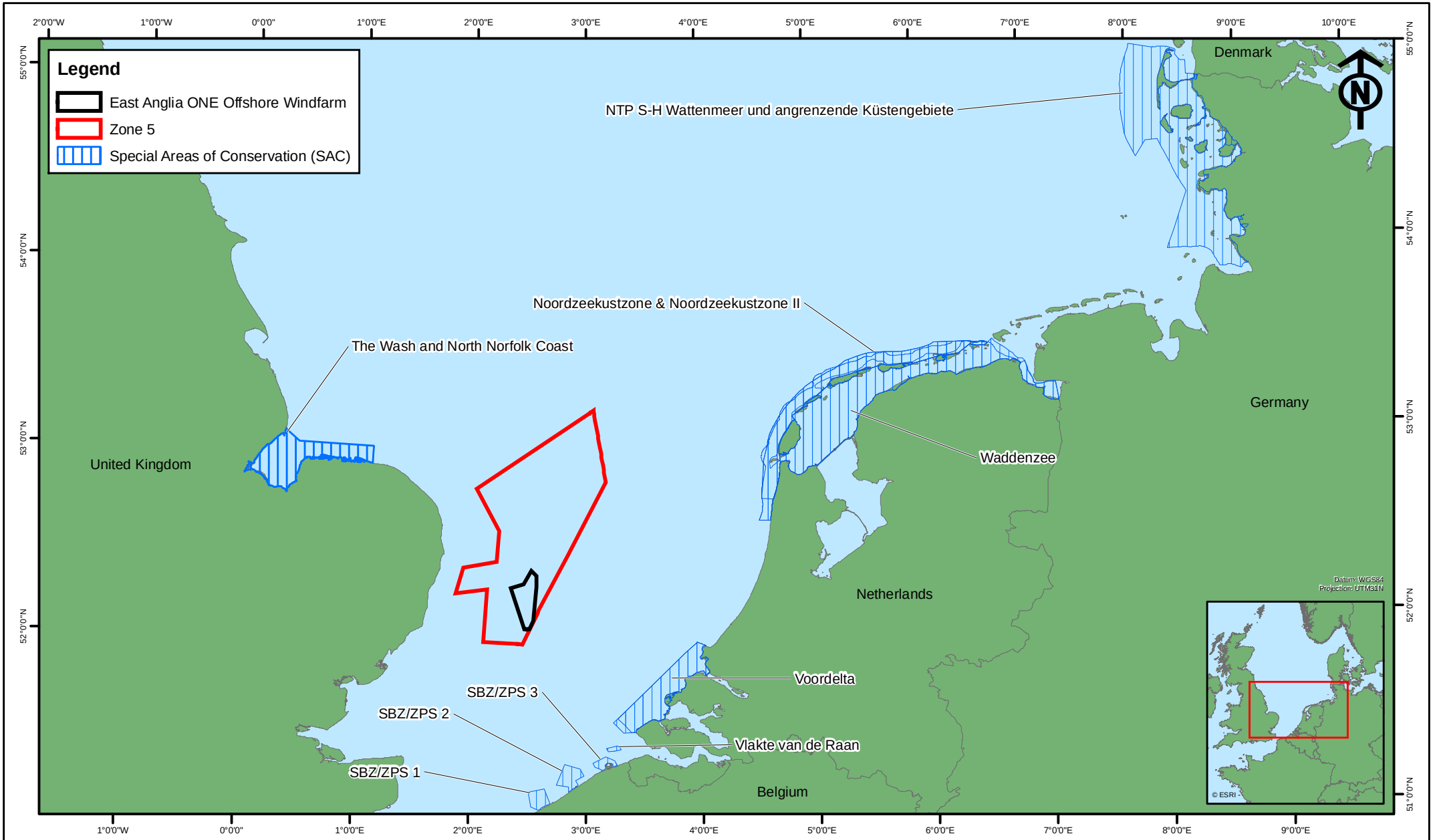
There are a number of sites potentially affected by East Anglia ONE which have been designated as Special Areas of Conservation (SACs) because they support populations of marine mammals. The sites have been identified within the Habitats Regulations Assessment (HRA) undertaken for the Round 3 Zones by The Crown Estate and are shown in *Table 5.2* below. European designated sites identified in the HRA as having marine mammal interests, as listed in *Table 5.2*, are represented geographically in *Figure 5.5.*

In the UK, these sites are designated under The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended 2009) and under the Conservation of Habitats and Species Regulations 2010. Due to the highly mobile nature of marine mammal species, many of these sites are in Dutch or Belgian coastal waters and are therefore designated under country specific legislation which enacts the requirements of the EU Habitats Directive (Council Directive 92/43 EEC).

The 2007 Regulations (as amended) (The Offshore Marine Regulations) set out that any disturbance to marine mammals requires a wildlife licence, as described in *Section 2.7.* EAOW will refer to the forthcoming guidance document by Defra and JNCC on the definition of disturbance in order to ascertain whether a wildlife licence for marine mammals will be required for East Anglia ONE.

Table 5.2 ***Special Areas of Conservation (SACs) supporting Marine Mammals which may potentially be affected by East Anglia ONE***

Site Name	Designated Interest Feature	Distance from Site
The Wash and North Norfolk Coast SAC (UK)	Common seal	111km
NTP S-H Wattenmeer und angrenzends Kustengebiete SAC (NL)	Bottlenose dolphin	422km
Voorelta SAC (NL)	Bottlenose dolphin	75km
Waddenzee SAC (NL)	Bottlenose dolphin	159km
SBZ 1/ZPS 1 SAC (Belgium)	Harbour porpoise	95km
SBZ 1/ZPS 2 SAC (Belgium)	Harbour porpoise	83km
SBZ 1/ZPS 3 SAC (Belgium)	Harbour porpoise	88km
Vlakte van de Raan SAC (Belgium)	Harbour porpoise	76km



IBERDROLA RENOVABLES VATTENFALL

Rev	Date	By	Comment
B	05/07/10	FS	Data change
A	23/06/10	JH	First issue

Original A4 Plot Scale 1:3,000,000

0 20 40 km 0 10 20 30 nm

East Anglia Offshore Wind

Special Areas of Conservation identified in Round 3 Appropriate Assessment

Drg No	6115-500-PE-032
Rev	B
Date	05/07/10
Layout	N/A

Figure 5.5

6115-500-PE-032-B_20100701_MMSAC.mxd

Data Sources

Key data sources that will be consulted to inform the marine mammal impact assessment are expected to include:

- Information from aerial surveys of Zone 5 already completed, including:
    - Hexter, R. (2009). High Resolution Video Survey of Seabirds and Mammals in the Norfolk Area. Cowrie Ltd;
    - WWT Consulting (2009). Aerial Surveys of Round 3, Zone 5 for waterbirds on behalf of Cowrie Ltd; and
    - data from further Zonal aerial surveys undertaken by WWT Consulting and HiDef Aerial Surveys Ltd.
- Existing literature on the distribution and abundance of marine mammals in the vicinity of East Anglia ONE.
- Background noise studies and underwater noise modelling will be used to predict the impacts of the development on increases in underwater noise which may affect marine mammals.
- JNCC, NE and CCW guidance on when deliberately disturbing or injuring/killing a marine European Protected Species (EPS) is likely to occur as the result of an activity. This is due to be published later in 2010.

EIA Methodology

The primary sources of data for the marine mammal impact assessment will be the East Anglia ONE boat and aerial surveys.

- **Site specific boat surveys.** A programme of boat surveys is being undertaken at East Anglia ONE to record sitings of birds and marine mammals. Each survey follows a series of transects running east to west across the East Anglia ONE site boundary, including a 4km buffer to the north, south and west; the eastern edge of the project area lies close to the IMO shipping lane which runs north-south (see *Section 5.4.2*). The survey methods used are based on those described in Camphuysen *et al* (2004), taking account of recommendations made in Maclean *et al* (2009). A transect separation of 2.5km is being used to avoid double-counting and to allow completion of the surveys within a three day period. This will be particularly important outside the summer months when the day length is shorter and there are fewer consecutive days of suitable survey weather for marine mammals (ie sea state of 3 or better). A trained marine mammal observer (MMO) will undertake the surveys and be present on

all surveys. Passive acoustic monitoring (PAM) will be deployed from July 2010 to compliment the visual observations, for an initial period of six months – its efficacy will be reviewed at that stage by comparing results with visual observations. If the results show that there is limited additional data being collected, its continuing use will be re-considered. The PAM system will be used to detect and record marine mammals and estimate a bearing, and where possible distance, although the latter is heavily affected by many factors. Detections obtained through this method can be used to augment the sightings, provide a calibration for the visual effort and provide additional behavioural information. However, PAM is only able to detect vocalising cetaceans which pass within the detection range of the hydrophone and so is not as reliable as visual observations. For this reason the use of PAM will be reviewed after six months of deployment and compared with visual observation data over the same period that will help underpin the use of the site and the Zone by Marine Mammals. *Section 5.3.4* further describes the noise and vibration assessment methodology.

- **Site specific aerial surveys**. A programme of at least 18 months of aerial surveys has begun at the East Anglia ONE site, using high definition still photography which is detailed enough to record marine mammals at the surface of the water. Each survey is being undertaken across the survey area which comprises the windfarm site area plus a 4km buffer zone. The surveys comprise stills taken on a grid system, with a grid resolution of approximately 1km between nodes. The camera resolution is 5cm or higher. Calibration of the existing aerial survey data gathered by WWT and HiDef Aerial Surveying Ltd against the site-specific aerial surveys is under review. This would provide over two years of data which will be used to inform the baseline assessment of East Anglia ONE.

The aerial surveys are being conducted by APEM Ltd, with the boat based surveys being conducted by the Institute of Estuarine and Coastal Studies (IECS).

The detailed methodologies used for both the boat and aerial surveys will be agreed with regulators including JNCC and NE. The need for other types of survey, such as tagging, will be considered following the desk study, a review of the findings of the ongoing surveys and discussions with statutory consultees.

The methodology for marine mammals will focus on establishing the baseline of East Anglia ONE in terms of noise and disturbance levels and suspended sediment and contaminant concentrations at the site. The requirement for baseline noise surveys will be established once the existing available information on baseline noise levels has been reviewed and following consultation with regulatory bodies (see *Section 5.3.4*). The effects of the

development will be predicted or modelled, the results of which will be used to assess the impact of the development on marine mammal activity (including effects on prey species) in the area.

Potential Project Effects

The potential construction phase effects from East Anglia ONE on marine mammals include the following:

- noise disturbance during construction and decommissioning due to construction activities, including vessel movements;
- loss of/ changes to feeding habitat; and
- collision with construction vessels.

The potential operational phase effects from East Anglia ONE on marine mammals include the following:

- disturbance due to noise generated by the operating turbines;
- loss of or changes to feeding habitat;
- collision with maintenance vessels; and
- barrier effect created by the presence of turbine structures.

Underwater noise and vibration during construction are likely to be the key impacts on marine mammals and the magnitude of the impacts will depend on the foundation type chosen for the turbine. For the purposes of the underwater noise and vibration assessment, driven piling is likely to be considered as a worst case. The significance of any disturbance impacts will be assessed in line with guidance provided by JNCC (2008) (due to be updated later in 2010). The requirement for a wildlife licence under the Habitats Regulations 2007 for England and Wales and the Offshore Marine Regulations will be discussed with relevant authorities.

Sightings data from annual monitoring surveys at North Hoyle offshore windfarm initially suggested that marine mammals appear reluctant to enter the operational windfarm array. However, other evidence (from CMACS surveys and 139 tracking studies, as well as evidence from Horns Rev windfarm (Tougaard *et al* 2003)) demonstrates that both harbour porpoise and grey seal will enter the site.

The reason for this disparity is not clear. Marine mammal sightings are, in general, relatively rare events in the context of many hours observations at sea and it may be that further monitoring will reveal more animals to be using the windfarm array area.

Potential Cumulative and In-Combination Impacts

Marine mammals are capable of moving and foraging over large distances and there are potential cumulative effects on marine mammals from the construction of East Anglia ONE with existing Round 1 and Round 2 windfarms and other proposed developments in the Thames Estuary and the Wash. Potential cumulative impacts will be assessed as part of the EIA.

The assessment of in-combination effects will take into consideration the following activities:

- aggregate extraction and dredging;
- navigation and shipping;
- established fishing activities;
- existing and planned construction sub-sea cables and pipelines;
- potential port and harbour development; and
- oil and gas installations.

The potential in-combination effects which may result from the development of East Anglia ONE and these activities include habitat loss and disturbance.

Transboundary Impacts

Due to the wide ranging nature of some marine mammal species, there is the potential to affect marine mammal populations or individuals that constitute part of the interest features of Natura 2000 sites (Special Areas of Conservation (SAC) or Site of Community Interest (SCI)) designated in France, Belgium or Holland. The sites which may be affected are identified in *Table 5.2*. During the EIA, consideration will be given to potential transboundary impacts on these sites and others which may be identified during the course of the EIA.

Mitigation and Monitoring

Monitoring will be agreed with statutory consultees as required. The survey methodology as part of any required monitoring will be consistent with the baseline survey to ensure that data from pre and post construction surveys are comparable.

Experience gained during Round 1 and 2, including the results from site specific monitoring for Round 1 projects, will also be drawn upon to inform the proposed mitigation and monitoring package. Current industry best-practice approaches will be considered to mitigate against the risk of injury or disturbance to marine mammals from high levels of underwater noise (JNCC, 2009). The use of Marine Mammal Observers (MMOs) may also be employed to ensure that no animals are present within a specified radius before pile-driving commences.

Other developing mitigation options, for example novel noise reduction methods (eg bubble curtains) (SMRU, 2007 and Nehls *et al*, 2007) and the use of acoustic deterrents, will be considered as part of the EIA.

5.3.4 Underwater Noise and Vibration

Introduction

This section details the approach that will be taken to assess and mitigate any underwater noise effects of the East Anglia ONE project.

Baseline Conditions

There is currently a degree of variability in background underwater noise and vibration within and around the East Anglia ONE site as a result of several different noise sources present in the area (platforms to the north, shipping lanes, dredging to the east, etc).

The requirement for an underwater noise and vibration survey is not clear at this stage, but will be determined following a detailed review of existing baseline data and new data gathered in relation to potential sensitive receptors informed by the fish ecology and marine mammal surveys (see *Sections 5.3.2* and 5.3.3), and from consultation with regulatory bodies and stakeholders.

Data Sources

Key data sources that will be consulted to inform the underwater noise and vibration assessment are expected to include:

- turbine layouts and details of turbines including sound power levels at various wind speeds;
- bathymetry, topography and sediment type (available from site specific geophysical and geotechnical surveys);
- construction methodologies and project description documents;
- underwater noise data (background, construction and operational) on which the INSPIRE acoustic model is tested and validated from Subacoustech Environmental's own database of high quality underwater acoustic measurements; and
- information on sensitive areas such as designated areas, spawning grounds or seal haul out areas to inform the decision on which modelling locations are identified in order to inform the assessment. Desk study work has been carried out to establish the species in the area (see *Sections 5.3.2* and *5.3.3*).

EIA Methodology

At present, the assumption is that actual underwater noise and vibration data will not be captured from a specific noise survey, although this may be subject to change after consultation with regulatory authorities and informed by data captured from the fish ecology and marine mammal surveys (see *Sections 5.3.2* and *5.3.3*). On this basis, it is likely that sufficient noise and vibration data from existing reports of the surrounding area already available and together with the use of standard noise statistics will inform desk-based modelling studies in order to base the underwater noise and vibration assessment.

The underwater noise and vibration assessment will include the following:

- Review of the available information, including the requirement for further background noise and vibration measurements.

- Review of the publically available literature and studies of the impact of impulsive underwater noise on fish and marine mammal species, including an assessment of the sensitivity of fish and marine mammals to underwater sound, and derivation of criteria for estimating the impact. The review will incorporate peer reviewed audiogram data for the key species of fish and marine mammals.

- Estimation of source level noise for impact piling operations at the site (used as a worst case).

- Desk based subsea acoustic modelling of sound propagation for impact piling operations. Model transects will be chosen to best represent the potential impacts of underwater noise on sensitive areas local to the site and also to determine areas where impacts may be reduced such as shallow water areas and sand banks.

- Impact zone analysis for key species of fish and marine mammal. Good quality audiogram will be required for each species. If an audiogram is not available for a species then a surrogate audiogram from another species with similar hearing abilities will be used to estimate the effects. Data for the impacts of piling on some species (eg crabs) is currently limited, and the detail of the assessment in the EIA will reflect the current level of research data that is available at the time of writing.
- Description of the variability of sound propagation around the East Anglia ONE site for various transects and for different foundation laying techniques and locations.

- Identification and review of mitigation measures that may be used to reduce the impacts of underwater noise from impact piling operations (or other foundation locations) in the East Anglia ONE site boundary.

- Consideration will be given to the use of other frequency weighting techniques (such as M-weighting) and a comparison of the various approaches will be compared and discussed in relation to the dBht metric approach.

If measurements of underwater noise from ships are required, the data will be collected in order to exceed the accepted standards set out in American National Standards Institute (ANSI) S12.64 guidance note on the Quantities and Procedures for Description and Measurement of Underwater Sound from Ships (2009), wherever possible. Since there will not be any control over the vessels themselves, this may not be possible in all cases.

The advice of key stakeholders, including Cefas, JNCC, NE and the Marine Management Organisation will also be taken into account.

Fish and marine mammals have been identified in *Sections 5.3.2* and *5.3.3* as being sensitive receptors for underwater noise. Modelling of existing audiograms of marine species will be related to modelled noise distribution of different foundation laying techniques and locations and other construction activities.

Potential Project Impacts

As noted above, the effects of underwater noise and vibration from the key construction activities, for example foundation installation, on marine mammals and fish are expected to be the key potential impacts and will therefore be the prime area of investigation.

Potential Cumulative and In-Combination Impacts

A discussion of the potential cumulative impacts of East Anglia ONE with other windfarms in the region in relation to underwater noise will be provided in the ES. It is anticipated that only the construction of the Galloper windfarm project (extension to the existing Greater Gabbard windfarm) which is in close proximity to East Anglia ONE will merit assessment.

However, in terms of in-combination impacts with other industries, details of other projects such as the development of the port of Great Yarmouth and dredging in the area will be reviewed to establish if these need to be assessed in more detail during the EIA process.

Mitigation and Monitoring

Any mitigation or monitoring which might be required by the findings of the EIA process will be developed specifically in relation to the receptor identified, and via consultation with the relevant statutory bodies.

Current industry best practice approaches to mitigation will be considered if necessary to minimise the risk of injury or disturbance to both fish and marine mammals from high levels of underwater noise (JNCC, 2009).

The use of Marine Mammal Observers (MMOs) may also be employed to ensure that no animals are present within a specified radius before foundation laying, that might include pile-driving, or other noisy construction activity commences. Other developing mitigation options, for example novel noise reduction methods such as bubble curtains (SMRU, 2007 and Nehls *et al*, 2007) and acoustic deterrents, will be reviewed.

5.3.5 Ornithology

Introduction

This section establishes the baseline for ornithological presence within the East Anglia ONE site and sets out data sources and methodology for data capture in order to expand existing knowledge of the site in terms of ornithological interests. Potential project effects on ornithology, cumulative and in-combination effects and transboundary effects are addressed, together with mitigation measures.

Baseline Conditions

The East Anglian coast and offshore waters support a range of bird species throughout the year and include a number of areas designated for the importance of their ornithological interests (see below). The flat coastlines of this region are reflected in the range of seabird species which occur, with the breeding seabird colonies largely comprising tern and gull species (Mitchell *et al*, 2004). The waters off the east coast are, however, used by a wider range of species during the passage and winter periods.

Broad scale aerial (WWT Consulting, 2009) and 'HiDef' video surveys (Hexter, 2009) have been conducted over much of Zone 5, including the proposed East Anglia ONE area for which the current EIA is being scoped. The findings of the surveys in March and April 2009 showed awk species, gulls and divers to the three main groups recorded within the Zone, although numbers of gannets and fulmar were also recorded.

The Crown Estate commissioned additional aerial surveys in the summer of 2009 (May to August undertaken by WWT Consulting) and the winter of 2009/2010 (November 2009 to March 2010 undertaken by HiDef Aerial Surveys Ltd) which recorded similar findings, with additional concentrations of post breeding terns and auks and high numbers of gannet during the early winter (data from The Crown Estate) (see *Table 5.3*).

Table 5.3 Preliminary Numbers of Birds (1)

Date	Comic tern	Auk	Lesser black-backed gull	Gannet	Fulmar	Black-legged Kittiwake	Tern Sp.	Diver Sp.	Little Gull
WWT Conventional Aerial Surveys									
May 2009	10	95	35	110	70	130	8	-	-
June 2009	10	74	20	11	36	41	3	-	-
July/ Aug 2009	436	1381	152	293	470	283	155	-	-
High Resolution Video Surveys									
Nov/ Dec 2009		2741	161	1678	40	417	-	68	42
Dec 2009		1591	23	51	48	756	-	22	9
Jan/ Feb 2009		5694	61	33	158	609	-	193	13
Early March 2009		1720	26	59	62	512	-	202	1
Late March 2009		896	132	54	106	114	-	370	-

The bird species which are likely to be affected by the East Anglia ONE project will be determined predominantly through the findings of the ongoing aerial and boat based surveys of the project area and immediate surrounds. A review of the currently available ornithological data, including the recently produced JNCC Report No. 431 (2010), indicates that the focal bird species or groups likely to be affected by the construction and operation of the East Anglia ONE windfarm are:

- breeding and passage / wintering gannet;
- breeding lesser blacked back gull;
- wintering divers;

(1) Numbers are total numbers and only include specific identifications (*ie* exclude large gull, small gull *etc*)

- post breeding / wintering auks;
- passage gulls, terns and skuas and wintering gulls; and
- other migrating waterbirds.

It should be noted that the importance of the East Anglia ONE site (and Zone 5) for the above species and groups is yet to be determined.

A summary of published information on each of these species, the reasons why they are considered to be focal species, and their sensitivity to windfarm development is given below. As the aerial surveys undertaken to date also recorded other species such as fulmars and kittiwakes, and East Anglia ONE's location within the extremities of the foraging ranges of breeding colonies of sandwich terns, it is possible that these species and other species may also be affected by the windfarm.

Breeding and passage/wintering gannet

Northern gannet are a wide ranging species with an estimated UK breeding population of more than 1.1 million individuals. The closest colony to the East Anglia ONE site is Bempton Cliffs which supported 7,859 apparently occupied nests in 2009 (JNCC, 2010). This colony is part of Flamborough Head and Bempton Cliffs SPA and is located a minimum of 259km from the East Anglia ONE site and 199km from the closest part of Zone 5. Mean feeding range for gannets has been estimated at 140km but they are capable of foraging up to 640km from colonies. Surveys of the EAOW Zone undertaken during May 2009 recorded 110 gannets, whilst surveys undertaken during November and early December 2009 recorded a peak of 1,678 gannets. These data suggest a lower use of Zone 5 by breeding gannets compared to passage / winter numbers, although the population trends at the nearest breeding colony show a steady increase. Gannets are believed to have a moderate risk of collision, but because the UK supports a high proportion of the bio-geographical population, it is a species with particular conservation obligations and the overall sensitivity to windfarm developments is considered to be high.

Breeding Lesser Black-Backed Gulls

Lesser black backed gulls are a migratory species which have a large breeding distribution in the UK. The current UK breeding population is estimated at 208,000 pairs. The closest colonies to the project site are at Havergate Island and Orford Ness, designated under the Alde-Ore Estuary SPA/Ramsar site, which is approximately 54km from the East Anglia ONE site.

The designated population recorded for the Alde-Ore population is 14,070 pairs, although the population has decreased since the site was first designated in 1996, with a count in 2003 recording an estimated total of 6,249 pairs at Orford Ness and Havergate Island. Surveys of Zone 5 undertaken

during 2009 positively identified 152 lesser black-backed gulls during July/August across the entire Zone (although more may be present due to the difficulty in identifying gulls to a species level). These figures suggest a limited use of the Zone by lesser black-backed gulls. This species is believed to have a moderate risk of collision, but because the UK supports a high proportion of the bio-geographical population the overall sensitivity to windfarm developments is considered to be high, it is a species for which there is a particular conservation obligation.

Wintering Divers

The Outer Thames Estuary and Suffolk and Norfolk coasts are important areas for wintering red-throated diver. The wintering UK population is estimated to be in the region of 17,068 individuals. The Outer Thames Estuary potential marine SPA lies 7km from the East Anglia ONE site boundary, and is estimated to support 6,486 individuals. Arial surveys of Zone 5 undertaken from November 2009 to March 2010 recorded 370 divers, all assumed to be red-throated divers, in late March to April 2010. Red-throated divers are believed to have a high sensitivity to displacement and moderate sensitivity to barrier affects and changes to prey distribution and habitats.

Post Breeding/Wintering Auks

During autumn and winter, auks breeding around the North Sea disperse away from breeding colonies. The most common auks wintering in the North Sea are guillemots, razorbills and puffins. Wintering populations of auks are hard to estimate because they disperse offshore, however breeding populations of guillemots in the UK is estimated to be 2 million individuals, the breeding razorbill population is estimated to be 188,576 and the wintering puffin population is estimated at 580,799 (1). Aerial surveys of the EAOW zone undertaken from November 2009 to March 2010 recorded a maximum of 5,694 auks in late January/early February 2010. Razorbill, guillemot and puffins are believed to have moderate sensitivity to displacement, barrier affects and changes to prey distribution and habitats (RSPB, 2010).

(1) Baker *et al* (2005) Population estimates of birds in Great Britain and the United Kingdom. BTO

Photograph of Razorbill © Andy Coates

Passage Gulls, Terns and Skuas and Wintering Gulls

The surveys undertaken across Zone 5 by WWT and HiDef in 2009 do not cover the main passage periods for these groups, and these movements will be determined from the findings of the ongoing surveys. The general southern migration movements of large numbers of many species within these groups is well documented (Wernham, 2002; Flegg, 2004), and a number of gull species are known to winter offshore in the North Sea (Kober *et al*, 2010). Information from the July / August 2009 aerial survey (WWT, 2009), which is currently being reviewed, indicates that a large number of post breeding terns (comic or tern sp) were recorded in the Zone. Terns, skuas and many of the gull species are regarded as being at moderate risk from collisions, and terns from effects on habitats / prey species.

Little gull is predominantly a passage and winter species in UK waters, migrating south along the east coast of the UK during the autumn and winter. The winter population of little gull is estimated to be between 400 and 800 individuals, but the passage population in autumn is more uncertain. An estimate of 32,000 birds as a Regional Autumn population was used in EIAs for several Round 2 projects. Aerial surveys of Zone 5 undertaken from November 2009 to March 2010 recorded a maximum of 42 gulls in November/December. The effects of offshore windfarms on little gull was raised as an issue by Natural England for the Humber Gateway Offshore

Windfarm. However, the RSPB has suggested more recently that windfarms pose a low risk to little gull.

Information contained within Kober *et al* (2010) suggests that concentrations of other gull species such as black-legged kittiwake, common gull, herring gull and great black-backed gull occur offshore in the general area of the Zone in winter. Numbers may also pass through the Zone on passage. As noted above, windfarms are considered to pose a moderate risk to several of these gull species from collisions.

Other Migrating Waterbirds

The southern North Sea and east coast of England are both important flyways for migrating waterbirds including waders and wildfowl with birds migrating to and from wintering and breeding areas in the Thames Estuary, and along the coasts of Suffolk and Norfolk. Table 5.4 presents designated sites which support a range of migratory water birds which may or may not be affected by East Anglia ONE.

Photograph of Kittiwakes in flight © Andy Coates

Designated Sites

A number of protected areas exist along the Norfolk coast and east coast of England which have been designated for their bird interests. The Habitats Regulations Assessment (HRA) undertaken for the Round 3 Zones has

identified a number of sites which may potentially be affected by developments within Zone 5, shown in Table 5.4, together with other sites close to those identified and with similar interest features. European designated sites identified in the HRA as having ornithological interests are represented geographically in *Figure 5.6.*

Some of these sites are also designated for interests other than birds. Those listed in this section include Special Protection Areas (SPAs), potential Special Protection Areas (pSPAs) and Ramsar sites. It is possible that some more distant European sites supporting bird species which travel greater distances may be affected (eg Flamborough Head and Bempton Cliffs or Bass Rock which support breeding gannet colonies).

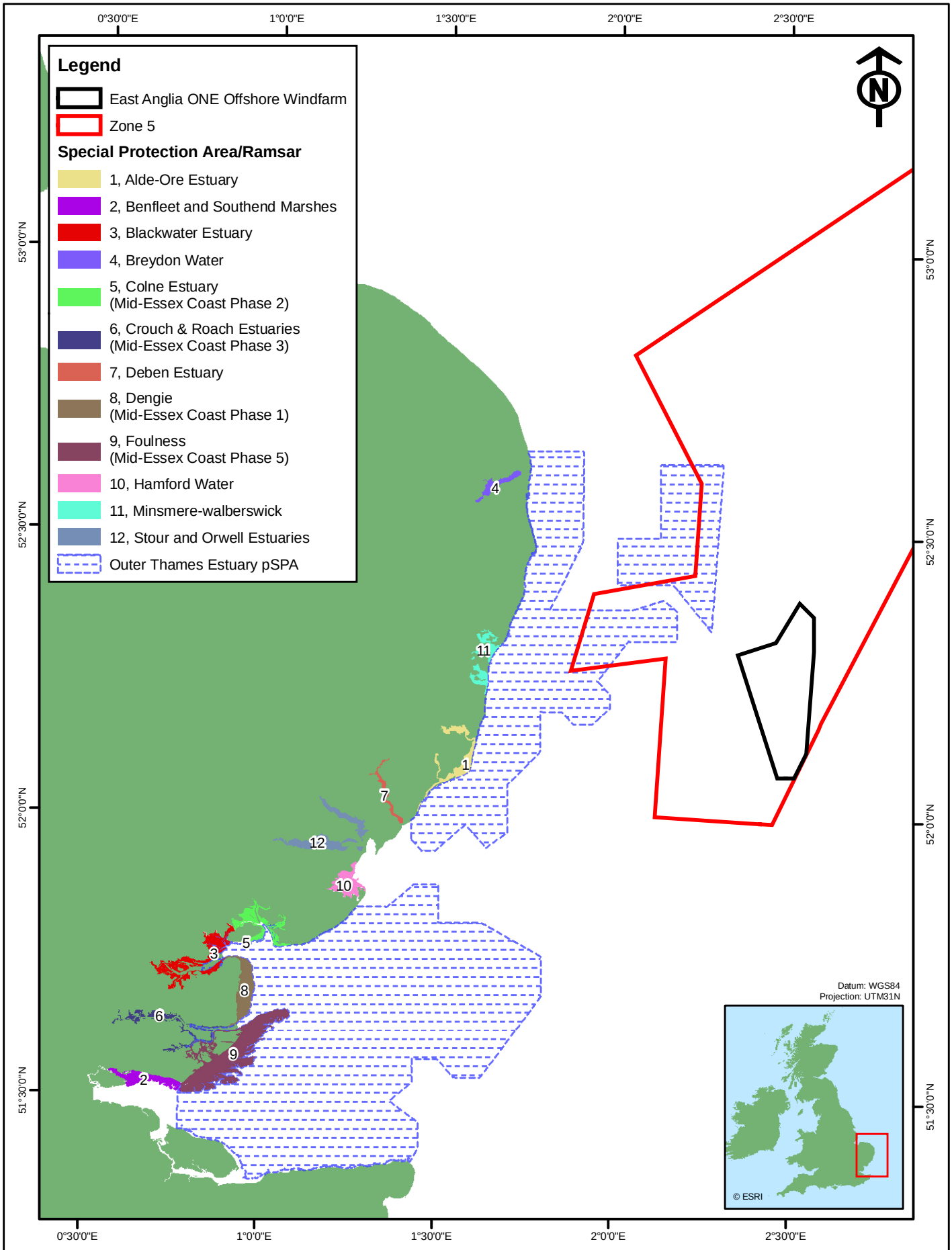
In addition, the ornithological impact assessment will also consider whether any other sites will be affected by the East Anglia ONE development as a result of cumulative and in-combination effects including continental European designated sites (eg those supporting little passage / wintering little gull) (1). Some sites which may be affected by the marine export cable and terrestrial cable route have been scoped out at this stage, but will be addressed separately within the export and onshore components Scoping Report, when more information about the route is known.

Table 5.4 Preliminary List of Designated Sites and their Qualifying Interests which may be affected

Name and Designation	Species the site has been designated for either as Annex 1 species or regularly occurring migratory species not listed in Annex I	Minimum distance from the site
Aide-Ore Estuary SPA /Ramsar Site (UK)	Breeding avocet, sandwich and little terns, marsh harrier, lesser black-backed gull, wintering avocet and redshank and assemblages of breeding seabirds and wintering waterfowl.	54km
Benfleet & Southern Marshes SPA / Ramsar Site (UK)	Wintering dark-bellied brent goose, grey plover and knot. Wintering waterfowl assemblage. On passage ringed plover.	132km
Blackwater Estuary (Mid-Essex Coast Phase 4) SPA / Ramsar Site (UK)	Wintering avocet, golden plover, hen harrier, ruff, dark-bellied brent goose, black-tailed godwit, dunlin, grey plover, redshank, ringed plover, shelduck. Wintering waterfowl assemblage. On passage, ringed plover. Breeding little tern.	111km

(1) Annex C lists additional UK designated sites which may be relevant as part of the in-combination / cumulative assessment, and hence revisions to *Table 2.1* may be required.

Name and Designation	Species the site has been designated for either as Annex 1 species or regularly occurring migratory species not listed in Annex I	Minimum distance from the site
Breydon Water SPA / Ramsar Site (UK)	Breeding common tern, wintering avocet, Bewick's swan and golden plover and wintering waterfowl assemblage.	56km
Colne Estuary SPA / Ramsar Site (Mid Essex Coast Phase 2)	Breeding little tern and overwintering dark-bellied brent goose, avocet, golden plover, redshank and hen harrier. Wintering waterfowl assemblage.	100km
Crouch & Roach Estuary (Mid-Essex Coast Phase 3) SPA / Ramsar (UK)	Wintering dark-bellied brent goose, bar-tailed godwit, grey plover, knot and waterfowl assemblage.	118km
Deben Estuary SPA / Ramsar Site (UK)	Breeding avocet.	72km
Dengie (Mid-Essex Coast Phase 1) SPA / Ramsar Site (UK)	Wintering bar-tailed godwit, dark-bellied brent goose, grey plover, knot, hen harrier and waterfowl assemblage.	110km
Foulness (Mid-Essex Coast Phase 5) SPA / Ramsar site (UK)	Wintering dark-bellied brent goose, avocet, bar-tailed godwit, grey plover, knot, oystercatcher, redshank, and breeding sandwich tern, little tern common tern, ringed plover and avocet.	107km
Hamford Water SPA / Ramsar Site (UK)	Wintering avocet, golden plover ruff, black-tailed godwit, dark-bellied brent goose, grey plover, ringed plover, teal. Wintering waterfowl assemblage. On passage ringed plover. Breeding little tern.	84km
Minsmere-Walberswick SPA / Ramsar Site (UK)	Wintering shoveler, gadwall, greater white-fronted goose, avocet, bittern and hen harrier. Breeding shoveler, teal, gadwall, little tern, avocet, bittern, marsh harrier, nightjar and woodlark.	47km
Outer Thames Estuary pSPA (UK)	Wintering red-throated diver.	7km
Stour & Orwell Estuaries SPA / Ramsar Site (UK)	Wintering hen harrier, black-tailed godwit, grey plover, dunlin, pintail, redshank, ringed plover, shelduck and turnstone. Wintering waterfowl assemblage.	80km



East Anglia Offshore Wind

Special Protection Areas identified in Round 3 Appropriate Assessment

Rev	Date	By	Comment
B	05/07/10	FS	Symbology updated
A	23/06/10	JH	First Issue.

Original A4 Plot Scale 1:1,000,504

0 5 10 km

0 2 4 6 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	B	6115-500-PE-033

Figure 5.6

6115-500-PE-033-B_20100701_BirdSPA.mxd

Data Sources

The data that will used to compile the baseline in the ES will come from a number of existing data sources, including:

- survey reports which have been published for the East Anglia Windfarm Zone, including aerial bird and mammal survey findings from studies undertaken during February – April 2009 by WWT (WWT Consulting, 2009) and HiDef undertaken during March – April 2009 (Hexter, 2009) for COWRIE Ltd;

- data from two additional aerial bird surveys of the East Anglia Windfarm Zone commissioned by the Crown Estate; WWT surveys from May-August 2009 and HiDef surveys from November 2009 – March 2010;

- published reports on all the Round 3 Zones which include Norfolk (eg Offshore Windfarms and Birds, Langston, 2010) and the Appropriate Assessment (AA) of the Round 3 Zones undertaken by The Crown Estate (Entec 2009);

- information where relevant and available from other offshore windfarm developments on the east coast;

- other published information sources including:

    - atlases of seabirds (eg Stone *et al*, 1995) and other data from European Seabird at Sea (ESAS) database;

    - seabird populations (eg Mitchell *et al*, 2004);

    - migration movements (eg Wernham *et al*, 2002; Flegg, 2004 and Newton, 2010; Griffin *et al,* 2010);

- information (if available from Observatory Trusts) on migration timings of bird species (including continental passerines) from relevant bird observatories along the east coast of England;

- information from tagging studies being undertaken by statutory and non-statutory nature conservation organisations including at designated sites, for example gannets at Bempton Cliffs and lesser black-backed gulls at Alde-Ore Estuary; and

- any other information which is made available through consultations with organisations such as JNCC, NE, TCE, RSPB, BTO and WWT, and from local bird groups and recorders.

In addition, EAOW are undertaking project specific aerial and boat based surveys as described below. At present, other detailed surveys using radar or tagging are not proposed. The need for such surveys will be considered following the desk study, a review of the findings of the ongoing surveys and discussions with statutory consultees.

Aerial Bird Surveys

Within the East Anglia ONE site, the overall distribution, density of birds and population estimates will primarily be determined by a high resolution (ie stills) aerial survey that will be undertaken monthly by APEM Ltd over an 18 month period (subject to weather conditions) from April 2010. The survey area for East Anglia ONE comprises the windfarm site area together with a 4km buffer zone around it. The surveys will comprise stills taken on a grid system, with a grid resolution of approximately 1km between nodes to provide data at a finer scale than that of the Zone. The camera resolution will be 5cm or better.

The aerial survey will gather information about the species of bird (or groups if specific species identification is not possible), location, numbers, sex and age (where possible), flight heights and direction. Where species specific identification is not possible, reference will be made to the findings of the boat based surveys to help apportion bird records to specific species.

APEM will undertake a calibration exercise, to allow the findings of previous aerial surveys by HiDef and WWT to be used as part of the baseline data set. This will allow over two years of data to be available for the baseline description and the subsequent assessment.

The detailed approach for the aerial survey will be agreed with NE, JNCC and RSPB.

Boat Based Survey

Monthly boat surveys will be undertaken by IECS over an 18 month period (subject to weather conditions) from May 2010. The surveys will be undertaken through a series of transects running east to west across East Anglia ONE at a distance of 2.5km from one another. A 4km buffer around East Anglia ONE site boundary to the north, south and west will also be included within the transects.

To the east, the East Anglia ONE site boundary lies close to the IMO Deep Water Route shipping lane which runs north to south through Zone 5. The shipping lane is heavily used, and as the bird survey transects are orientated east to west, the survey vessel would need to both survey and turn within the shipping lane.

This would increase the risk of collisions with other vessels during the survey and the likelihood of disruption to the surveys, depending on the timing of the movements of other vessels in the IMO shipping lane. In addition, the shipping lane is unlikely to be an important area for birds due to the extent of vessel movements within it. Any birds using it will in any event be recorded by the aerial surveys described above. Hence the approach adopted for the boat based surveys will be to extend the buffer zone on the eastern side of East Anglia ONE up to, but not into, the shipping lane. The survey vessel will, therefore, turn to start its next transect between the site boundary and the shipping lane.

The boat surveys will be based on the survey methods described in Camphuysen *et al* (2004), taking account of recommendations made in Maclean (2009). The surveys will be undertaken using a team of four experienced surveyors (three bird observers and one MMO/PAM operator as described in *Section 5.3.3*) surveying a 300m wide strip on one side (in a 90 degree arc) and ahead of the boat in one minute sequential time periods (each viewing area is therefore approximately 300m x 300m) for birds on the sea. A transect separation of 2.5km will be used to avoid double-counting and to allow completion of the surveys within a three day period. This will be particularly important outside the summer months when the day length is shorter and there are fewer consecutive days of suitable survey weather (ie sea state of 4 or better).

The location of the vessel will be recorded at all times using a GPS and all birds encountered on the sea will be recorded including details of species, numbers, times, distance from the boat (in one of five distance bands) and behaviour. Birds in flight will be recorded in transect over distances of 500m during snapshot counts undertaken every two minutes, including details of the bird species, numbers, times, flight height and direction.

EIA Methodology

The majority of ornithological assessments on both onshore and offshore windfarms have been based on previous guidance developed by SNH and the BWEA. These guidance documents describe either a matrix approach to the assessment or an approach based on favourable conservation status and expert judgement to determine significance, an approach recommended in the recent Marine Ecological Impact Assessment (EcIA) guidance produced by the Institute of Ecology and Environmental Management (IEEM) (due for publication in mid-2010). For the purposes of this assessment, the approach will be to use a refined matrix approach to back up the expert judgement in line with recent recommendations proposed by Maclean *et al* (2009).

The conservation status of a species is defined in the Habitats Directive as the sum of the influences acting on the species concerned that may affect the long term distribution and abundance of its populations. The guidance states that the conservation status of a species is considered 'favourable' when:

> *"population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats, and the natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future, and there is (and will probably continue to be) a sufficiently large habitat to maintain its population on a long-term basis."*

In order to arrive at a judgement of the effects on favourable conservation status, the following information is typically used:

- the number of individuals of a species lost, for example due to habitat loss, through displacement or collision, informed by the known sensitivities of species to disturbance, collision etc;
- the existing natural mortality of a species, and the added mortality that will result from the above losses;
- trends of each species within the geographical area under consideration, especially where a species is in decline;
- distribution of each species within the geographical area under consideration (ie strongholds, gaps); and
- mitigation and enhancement measures which will be implemented.

Where collision risk assessment is required, data from the aerial surveys (drawing on the findings from the boat based surveys to assist with identification of species and flight heights) will be used to undertake collision risk modelling (Band *et al*, 2000). If modelling is required, avoidance and survival rates to be used in the modelling will be discussed and agreed with NE, JNCC and RSPB.

Potential Project Impacts

There are a number of impacts associated with the proposed development of a windfarm which may affect bird species and populations, as follows.

- Direct habitat loss from the permanent structures including turbine footprints and the offshore substation. Temporary habitat loss from the installation of the inter-array cables and the jack-up barges during construction of the turbines. The loss of sea bed habitat and the associated

benthic and fish species that it supports may have an impact on the bird species which feed on them.

- Disturbance of birds and fish due to activities associated with construction, maintenance and decommissioning of the windfarm, including the presence and movement of vessels, work activities such as piling, and effects of sediment dispersal. This could result in reduced access of birds to important areas (eg for feeding, loafing, moulting).

- Displacement of birds due to the normal operation of the windfarm (ie its presence and turning blades) could result in the loss of foraging / loafing / moulting areas. Seabird species may be displaced by the noise or visual disturbance of the turbines. The distances over which displacement effects are likely to affect individual bird species will be based on the available evidence at the time and presented by stakeholders.

- The creation of a barrier to bird movement including migrating birds and those undertaking more regular foraging movements. This may result in some birds expending more energy flying around the windfarm. The assessment will consider the number of birds involved and the extent to which the windfarm is likely to create a barrier.

- The attraction of migrating passerines due to the presence of bright lights during darkness (eg from construction or maintenance vessels, navigational lights on the turbines). This phenomenon is usually coupled to migration during poor weather conditions.

- Birds which choose to fly through the turbine array, for example whilst foraging or on migration (including nocturnal movements), could be at risk of colliding with the turbines.

Potential Cumulative and In-Combination Impacts

As part of The Crown Estate's Round 1, 2 and 2.5, and 3 offshore leasing programmes, there are at least 21 wind development projects on the east coast of England which are being planned, are within the consenting process, have been given consent, are under construction or are operational (see *Section 5.4.9*, *Table 5.6* and *Figure 5.15*).

All these projects have the potential to have cumulative impacts on bird populations in the North Sea along with the East Anglia ONE. A further number of developments and activities may also lead to in-combination effects, including the following (which are covered in more detail in the relevant parameter of the *Human Environment Section* of this Scoping Report):

- Dredging activities;

- gas exploration at Hewett, Camelot, Aberdonia and Arthur Fields;
- cable laying;
- fishing; and
- shipping.

The main effects and species affected will be assessed in the EIA based on the information which is available about birds and effects on them at other development sites, informed by the results of the site specific surveys. The assessment will be undertaken in consultation with NE, JNCC and RSPB and take account of the evolving guidance on cumulative impact assessment (eg King *et al*, 2009).

The current guidance (King *et al*, 2009) recommends the preparation of six tables to identify the key ornithological interest features which may be susceptible to cumulative impacts, as well as other projects which may cause cumulative impacts. These tables are included in *Annex A*.

Transboundary Impacts

Due to the wide ranging nature of some sea bird species, there is the potential for the windfarm to affect bird species and populations that constitute part of the qualifying interest features of Natura 2000 sites designated in France, Belgium, Holland, Germany or Denmark. As noted above, assessment of any impacts on any such sites will be discussed and agreed with statutory consultees. A list of sites which may potentially be affected will be developed, using HRA as a basis.

Mitigation and Monitoring

Where significant impacts are identified, EAOW will agree mitigation measures with the regulators and their advisors. These measures may include refinements to the design and layout, the timing of activities and monitoring. Where impacts still remain after mitigation the impact and its significance will be reported as a residual impact.

5.4 HUMAN ENVIRONMENT

5.4.1 Commercial Fisheries

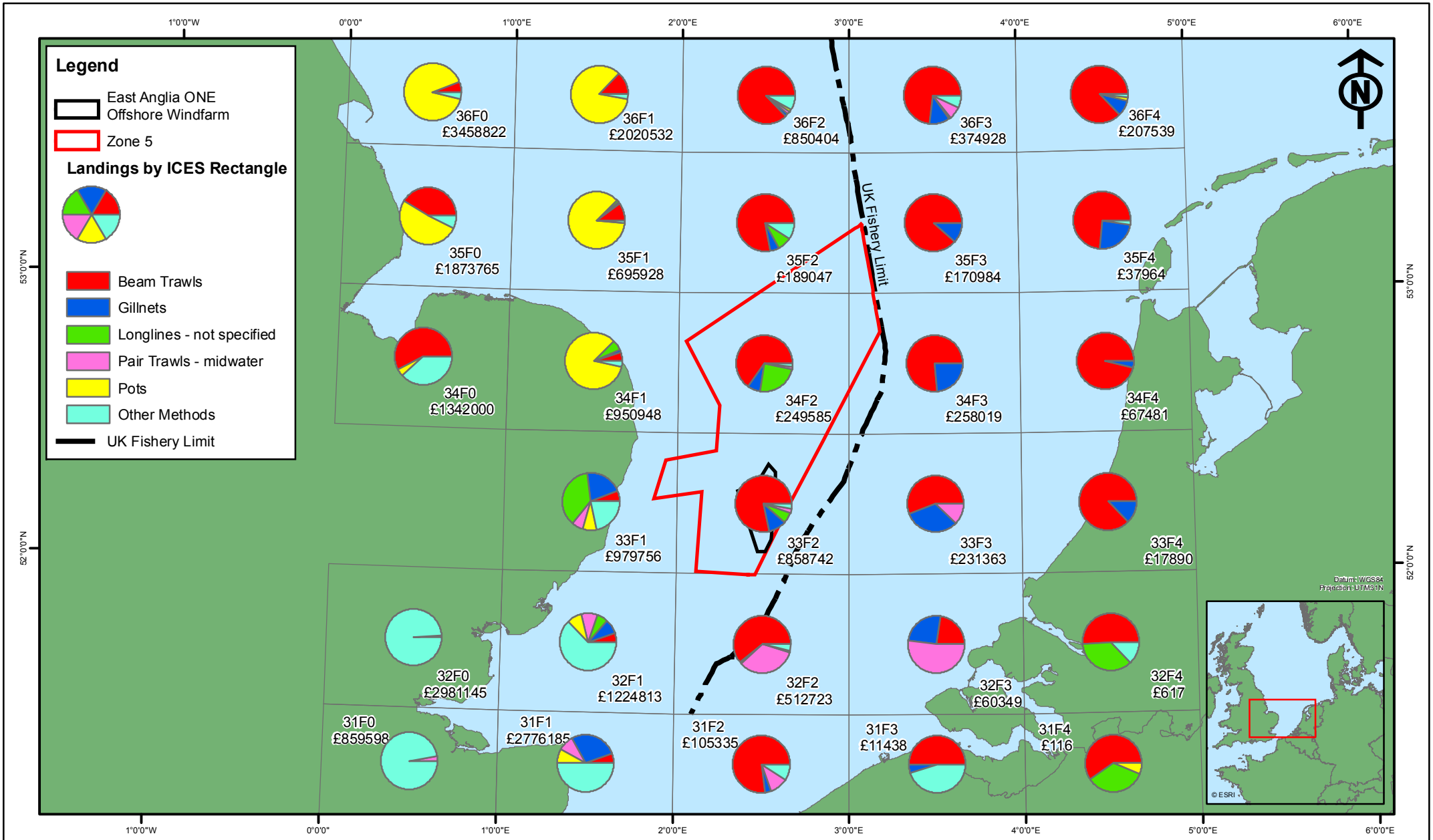
Introduction

This section identifies the main characteristics of commercial fisheries within the East Anglia ONE catchment, identifies data sources and methodology to be used for the commercial fisheries assessment and identifies initial potential project effects and mitigation that will be explored further in the EIA and reported in the ES.

Baseline Conditions

Vessel Monitoring Systems (VMS) data from January 2005 to October 2006 (the period during which the Marine Mammal Organisation (MMO) was permitted to release data on non UK vessels) indicates that there is a high level of Dutch vessel activity within the East Anglia ONE site, with Belgian and UK vessels also operating in the area. The majority of these vessels are identified as beam trawlers, principally targeting Dover sole and plaice. A significant proportion of both the Belgian and UK vessels working in the area are 'flag' vessels, owned and operated by Dutch interests but fishing under UK licences and quotas.

Figure 5.7 and *Figure 5.8* illustrate the commercial landings values into UK ports by method and species by International Council for the Exploration of the Sea (ICES) Rectangle. These further confirm the predominance of beam trawling targeting flatfish species within the East Anglia ONE site and wider Zone 5. *Figure 5.9a* and *Figure 5.9b* indicate commercial fish spawning grounds by species.



IBERDROLA RENOVABLES VATTENFALL

Rev	Date	By	Comment
B	01/07/10	JH	Template amended
A	18/06/10	JH	First Issue

Original A4 Plot Scale 1:2,000,000

0 10 20 30 km

0 5 10 15 nm

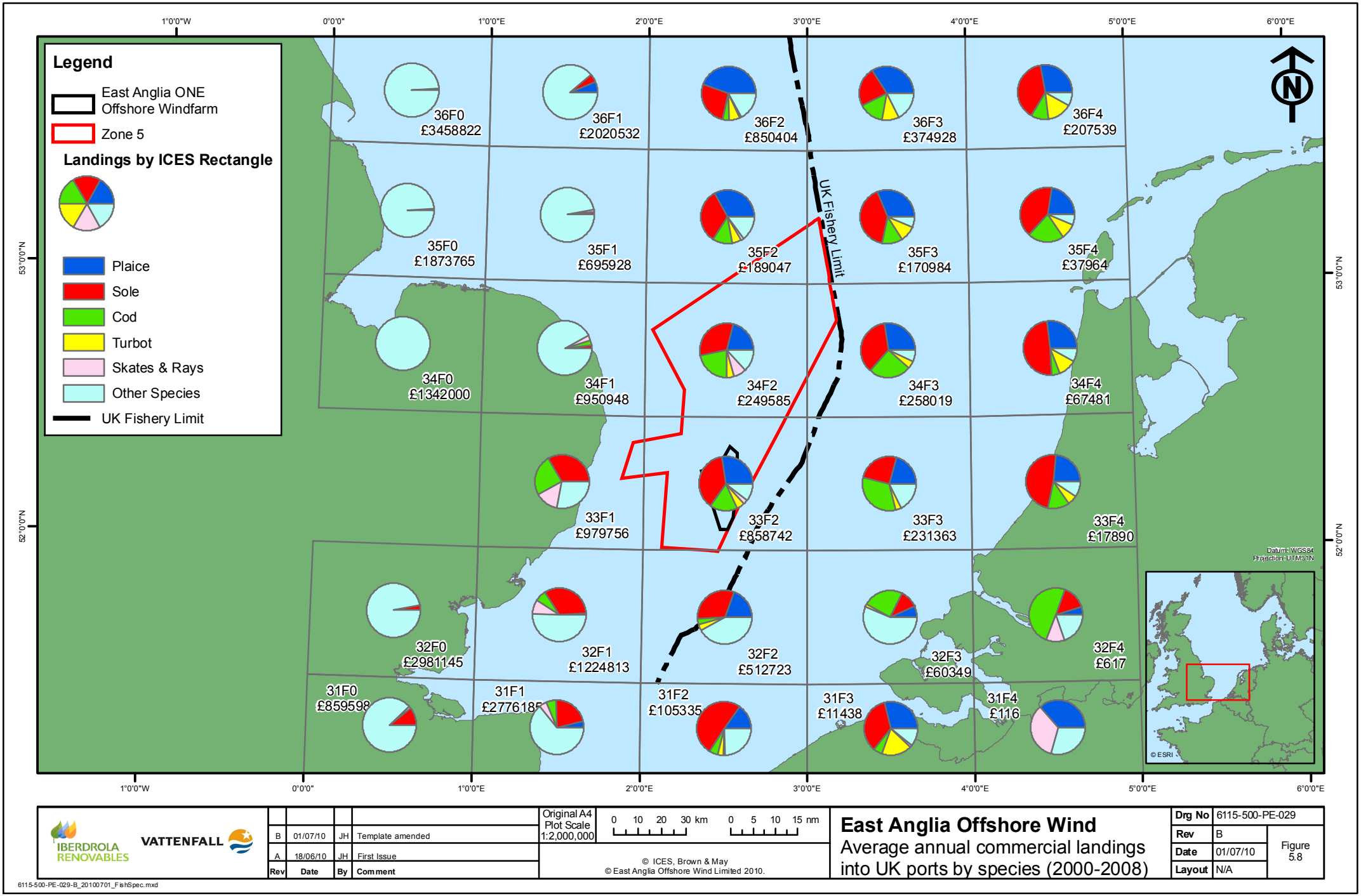
East Anglia Offshore Wind

Average annual commercial landings into UK ports by method (2000-2008)

Drg No	6115-500-PE-028
Rev	B
Date	01/07/10
Layout	N/A

Figure 5.7

6115-500-PE-028-B_20100701_FishMeth.mxd



IBERDROLA RENOVABLES VATTENFALL

Rev	Date	By	Comment
B	01/07/10	JH	Template amended
A	18/06/10	JH	First Issue

Original A4 Plot Scale 1:2,000,000

0 10 20 30 km

0 5 10 15 nm

East Anglia Offshore Wind

Average annual commercial landings into UK ports by species (2000-2008)

Drg No	6115-500-PE-029
Rev	B
Date	01/07/10
Layout	N/A

Figure 5.8

6115-500-PE-029-B_20100701_FishSpec.mxd

Plaice

Mackerel

Lemon Sole

Herring

Cod

1°30'0"E 2°0'0"E 2°30'0"E 3°0'0"E 3°30'0"E

53°0'0"N 52°30'0"N 52°0'0"N

Legend

East Anglia ONE Offshore Wind Farm

Zone 5

Nursery Grounds Intensity

Lower

Undetermined

Higher

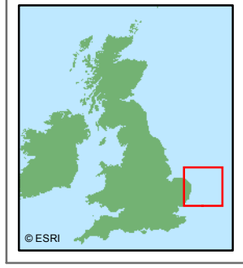
Spawning Grounds Intensity

Lower

Undetermined

Higher

Datum: WGS84
Projection: UTM31N



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IBERDROLA RENOVABLES

VATTENFALL

Rev	Date	By	Comment
B	01/07/10	JH	Template amended
A	16/06/10	JH	First issue

Original A3 Frame Plot Scale 1:1,500,000

0 10 20 km 0 10 20 nm

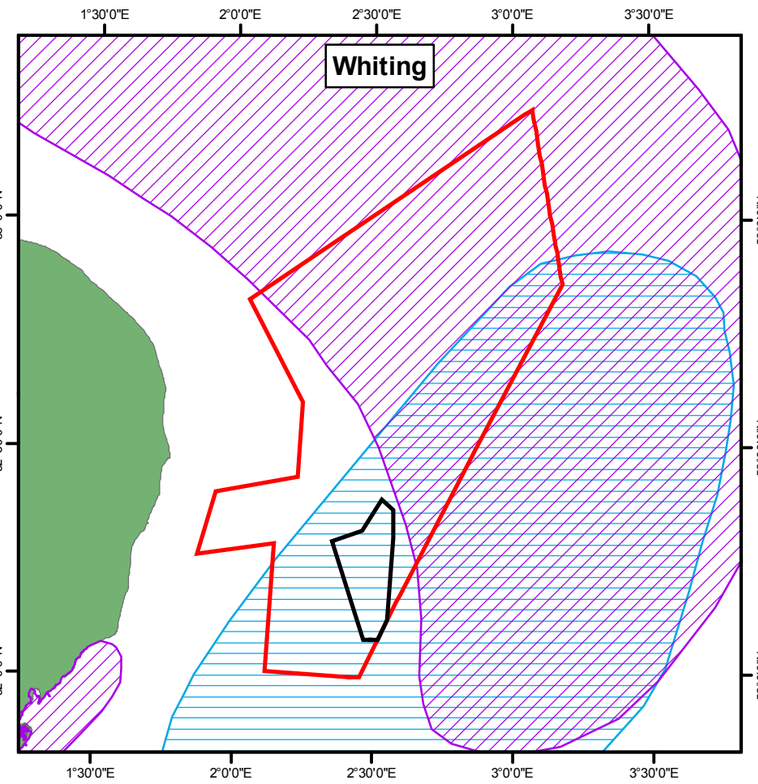
East Anglia Offshore Wind

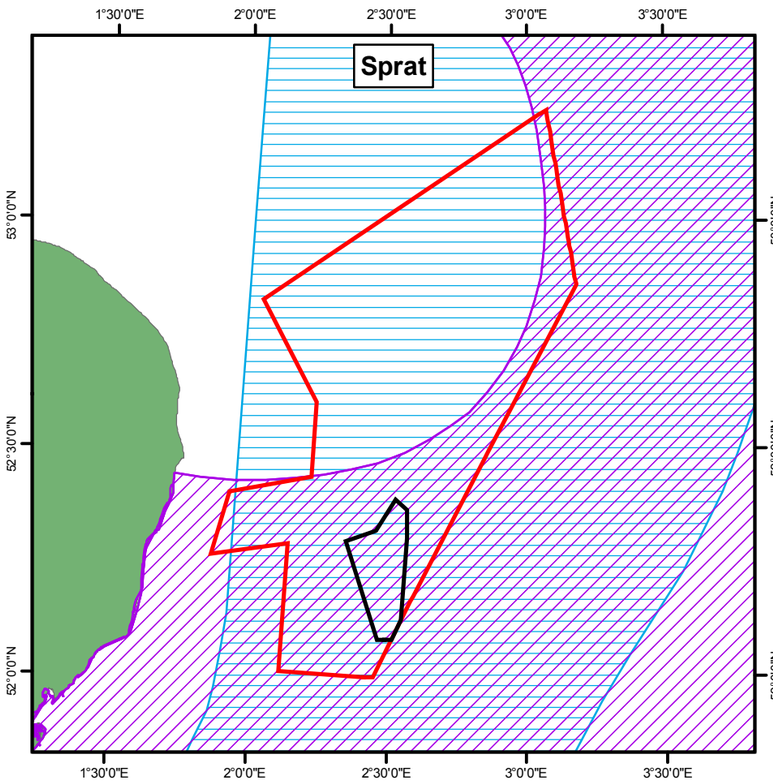
Commercial fish spawning grounds by species

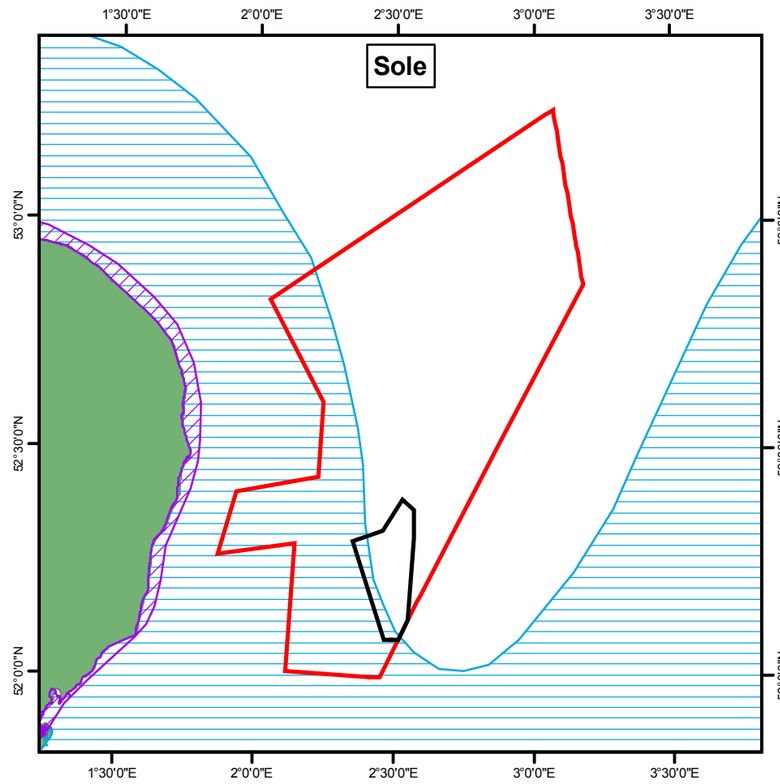
Drg No	6115-500-PE-025
Rev	B
Date	01/07/10
Layout	N/A

Figure 5.9a

6115-500-PE-025-B_20100701_Spawn1.mxd







Legend

- East Anglia ONE Offshore Wind Farm
- Zone 5
- Surveyed Area

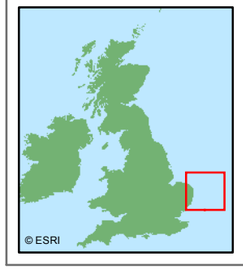
Nursery Grounds Intensity

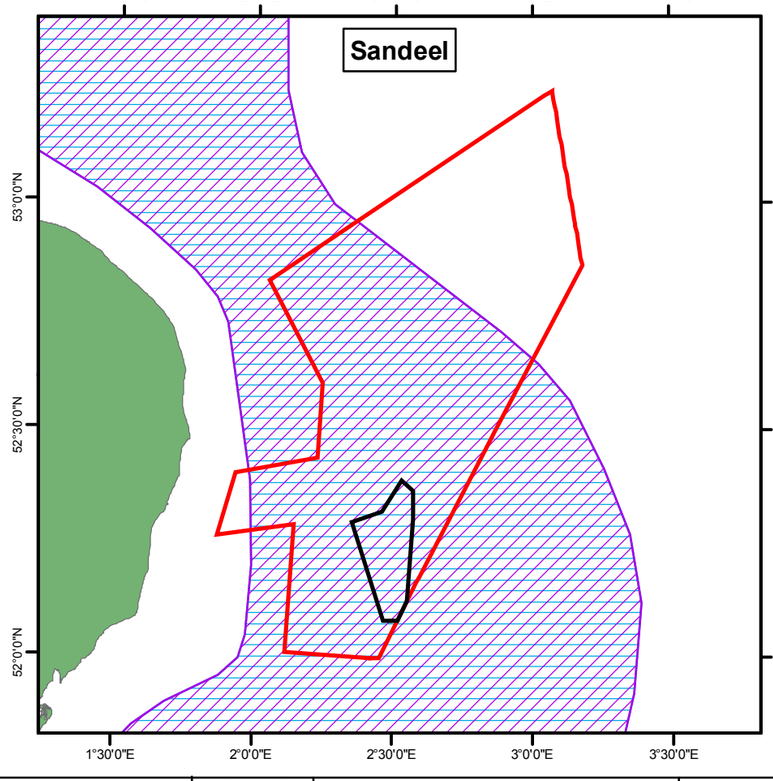
- Lower Intensity
- Undetermined Intensity
- Higher Intensity

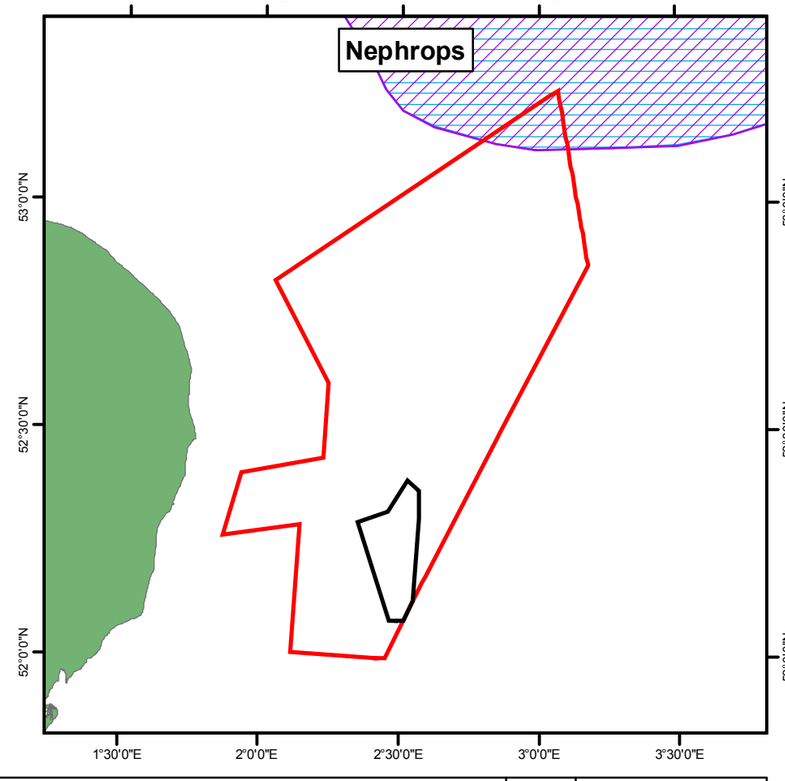
Spawning Grounds Intensity

- Lower Intensity
- Undetermined Intensity
- Higher Intensity

Datum: WGS84
Projection: UTM31N







IBERDROLA RENOVABLES VATTENFALL

Rev	Date	By	Comment
B	01/07/10	JH	Template amended
A	16/06/10	JH	First issue

Original A3 Frame Plot Scale 1:1,500,000

0 10 20 km 0 10 20 nm

East Anglia Offshore Wind

Commercial fish spawning grounds by species

Drg No	6115-500-PE-026
Rev	B
Date	01/07/10
Layout	N/A

Figure 5.9b

6115-500-PE-026-B_20100701_Spawn2.mxd

Data Sources

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 East Anglia ONE. As a result, data and information will need to be acquired from a range of sources.

The importance of consultation with the various fishermen who operate in the region is recognised, and the sources listed below include statutory and non-statutory consultees.

Key data sources to inform the commercial fisheries assessment are expected to include:

- International Council for the Exploration of the Sea (ICES) Publications;
- EU Fisheries Committee publications and data sets (Europa and Eurolex);
- Marine Management Organisation (2009). Fisheries Statistics Unit and Data and Communications Team (catch, effort, and landings statistics, VMS and surveillance sighting for years 2005 to 2009);
- Eastern Sea Fisheries Joint Committee Annual Reports 2005 to 2009;
- Kent & Essex Sea fisheries committee Annual Reports 2005 to 2009;
- review of publications and consultation with Dienst voor de Zeevisserij (Fisheries Agency) – Ostende, Belgium;
- review of publications and consultation with Direction Departementale des Affaires Maritimes, France;
- review of publications and consultation with Comite Regional des Peches Maritimes et des Elevages Marins, France;
- review of publications and consultation with Algemene Inspectie Dienst (Fisheries Agency), Netherlands;
- review of publications from Netherlands Institute for Fishery Investigations (RIVO);
- review of publications from North Sea Regional Advisory Council;
- relevant published environmental statements of adjacent windfarms and other offshore installations including the findings of zonal adult and juvenile fish surveys;

- Cefas (2008). Regional Environmental Assessment - A Framework for the Marine Minerals Sector;
- Cefas (2004). Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements;
- COWRIE (2010). Options and Opportunities for Marine Fisheries Mitigation Associated with Windfarms;
- FLOW (2008). Recommendations for Fisheries Liaison;
- UK Oil & Gas (2008). Fisheries Liaison Guidelines – Issue 5, UK;
- UK Oil & Gas (2006). Guidelines to Improve Relations between Oil & Gas Industries and Near-shore Fishermen;
- International Cable Protection Committee (2009). Fishing & Submarine Cables – Working Together;
- review of publications and consultation with National Federation of Fishermen's Organisation – UK;
- review of publications and consultation with UK regional affiliated and non affiliated fishermen's associations and producer organisations;
- review of publications and consultation with MMO District Fisheries Inspectors;
- review of publications and consultation with relevant regional and local fishermen's associations and producer organisations;
- review of publications and consultation with a representative sample of local unaffiliated fishermen;
- review of publications and consultation with Federatie van Visserijverenigingen – Netherlands;
- review of publications and consultation with Nederlandse Visserbond – Netherlands;
- review of publications and consultation with Redercentrale - Belgium; and
- review of publications and consultation with Union Nationale des Armateurs à la Peche de France.

ICES Rectangles (indicated on *Figure 5.7* to *Figure 5.9b*) are the smallest spatial statistical units used for collating fisheries data. Rectangle boundaries align to 1° longitude and 30′ latitude, and for the most part have sea areas equating to approximately 900nm². East Anglia ONE is located within the 33F2, 858742 Rectangle. Zone 5 is located over six Rectangles in total, where in some instances it occupies a small portion of an individual Rectangle. It should be noted that fishing activity may not be evenly distributed over the area of a Rectangle. As indicated in *Figure 5.7*, the main methods of fishing within the East Anglia ONE site are beam trawling, gill-netting, long-lining, otter and pair trawling. As indicated in *Figure 5.8*, the main species caught in East Anglia ONE are sole, plaice, cod, other, turbot, skates and rays.

The MMO does not currently release VMS data on foreign vessel activity in UK waters unless the specific written permission of the relevant Member State's agency is received. Requests will therefore be made to the relevant Member State's agencies and fishermen's federations for VMS data and to obtain the necessary permissions to allow release of MMO data for subsequent publication within the ES.

Photograph of Fishers onboard fishing vessel © Shutterstock

EIA Methodology

The various potential effects for the construction, operation and decommissioning phases of the development, on a local, regional and national scale, will be assessed separately. The assessment will consider:

- the anticipated extent of the impact (ie the proportion of the fishing industry affected in the immediate area and the wider region);

- the temporal duration of significant impacts (ie temporal impacts associated with construction/decommissioning activities and long term impacts during the operational phase); and
- the sensitivity of the fishing fleets to the impact in question.

The potential impacts as defined in the 2004 Cefas Guidelines will be used as a basis for assessment and will be informed by consultation.

In each instance, potential mitigation measures will be identified and the significance of effects will be assessed taking into consideration the mitigation measures. Residual effects and monitoring requirements will be identified.

Potential Project Impacts

The potential effects of construction and operation of offshore windfarms on commercial fishing, as given in the 2004 Cefas Guidelines, are summarised below. Subject to 2010 revisions, these will form the basis of the commercial fisheries assessment of relative significance of the effects of the project:

- the presence of sea bed objects;
- adverse impacts on commercially exploited species;
- increased steaming times to traditional grounds;
- safety issues for fishing vessels;
- loss or restricted access to traditional fishing grounds;
- potential benefits associated with the development acting as fish attracting device, and
- any other issues raised by fishermen.

Potential Cumulative and In-combination Impacts

Cumulative impacts from the development of East Anglia ONE and other windfarms in the region may be of interest if a significant proportion of the region's fishing fleets are affected by any loss of access or displacement from fishing grounds during construction and operation, or if populations of target species are adversely impacted.

There is the potential for in-combination impacts to commercial fisheries from the windfarm and other activities or developments in the region. The assessment of in-combination effects will take into consideration the following activities:

- aggregate extraction and dredging;
- navigation and shipping;

- existing and planned construction sub-sea cables and pipelines;
- potential port and harbour development; and
- oil and gas installations.

Transboundary Impacts

As discussed above, a significant proportion of the fishing activity in the project area is by vessels from other EU member states, principally the Netherlands and Belgium. It is therefore recognised that in this context there will be transboundary effects and the baseline and assessment processes will take account of this.

Mitigation and Monitoring

Mitigation and monitoring measures for this project will be assessed and proposed in light of recommendations in the 2004 Cefas guidance (including the updated guidance document expected to be published in 2010), DTI (2004) and Blyth-Skyrme (2009).

For monitoring purposes, the fishery can be usefully monitored using future landing records and effort data, as well as through comparison with fish ecology survey results (see *Section 5.3.2*).

5.4.2 *Shipping and Navigation*

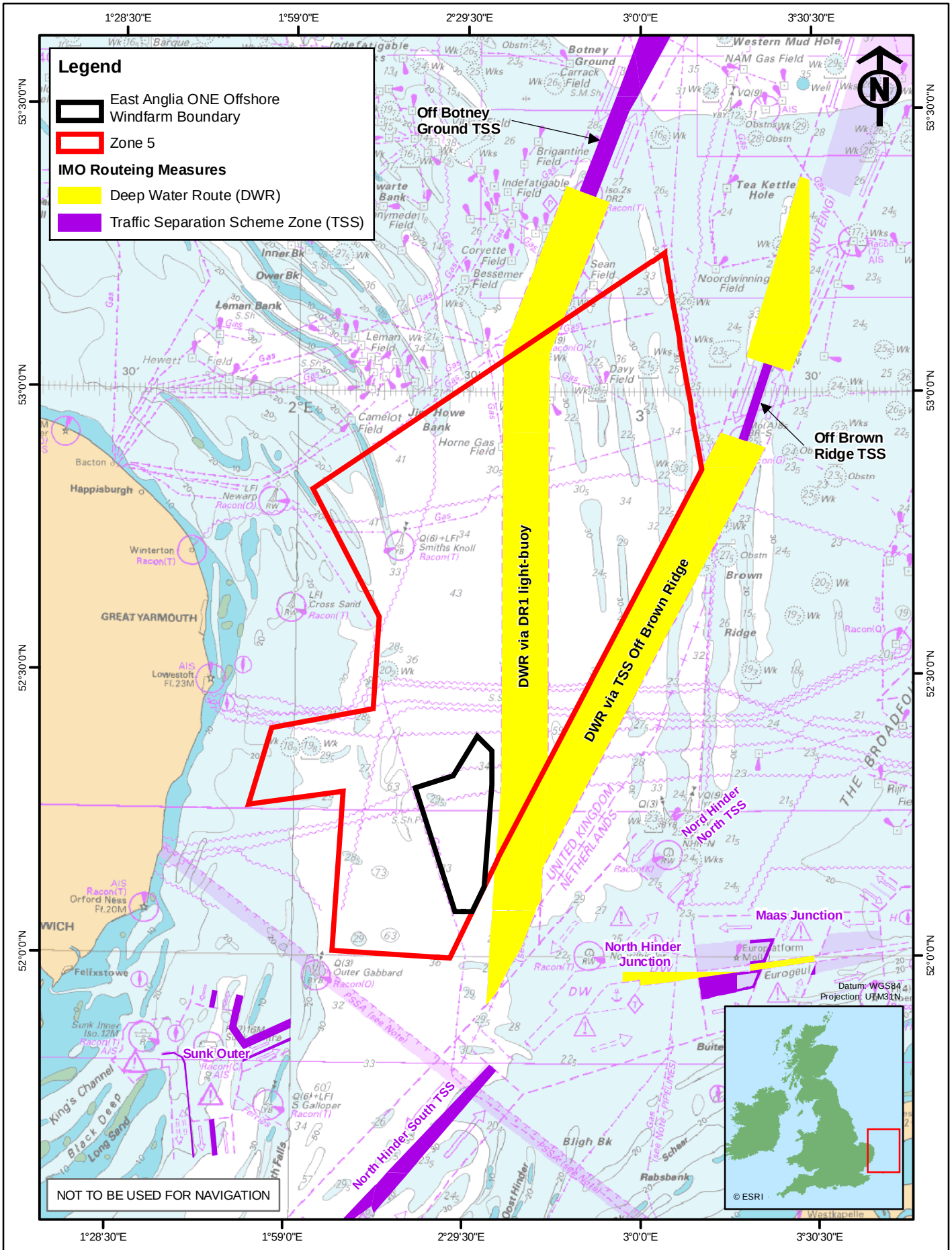
Introduction

This section considers the main navigational features and forms of shipping within and in the vicinity of the East Anglia ONE site boundary, identifies data sources and methodology to be used for the shipping and navigation impact assessment and identifies initial potential project effects and mitigation that will be explored further in the EIA and reported in the ES.

Baseline Conditions

Navigation features

The main navigational feature in close proximity to East Anglia ONE is the International Maritime Organisation (IMO) Routeing Measures. The IMO Deep Water Route (DWR) via the DR1 light-buoy is, at its minimum, one nautical mile from the site (see *Figure 5.10*).



East Anglia Offshore Wind

IMO Routeing Measures

Rev	Date	By	Comment
B	05/07/10	FS	Juctions labels added
A	21/06/10	JH	First Issue.

Original A4 Plot Scale 1:1,000,000

0 5 10 km 0 5 10 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	B	6115-500-PE-031

Figure 5.10

6115-500-PE-031-B_20100705_DWR.mxd

The DWR is mainly used by deep-draught ships passing north to south through the southern North Sea. It connects the Off Botney Ground Traffic Separation Scheme (TSS) to the north with the North Hinder TSS to the south (as labelled on *Figure 5.10*). A typical ship using the DWR over its full length, between the two TSSs, may be sailing between Hamburg and the Dover Strait, although ships also join and exit the DWR at various points depending upon their ports of departure and destination.

There is a second DWR further east from East Anglia ONE, running north to east to south to west approximately parallel to the eastern boundary of Zone 5. This DWR via the TSS off Brown Ridge merges with the DWR via the DR1 light-buoy near the southern end of Zone 5.

Merchant Shipping

East Anglia ONE is located in the southern North Sea which is relatively busy in terms of merchant shipping.

Traffic in the vicinity of the site mainly comprises cargo ships and tankers, although there are also regular passenger ferries and a limited amount of aggregates dredgers and other / miscellaneous vessel types. Oil and gas industry vessels supporting the Southern Gas Basin from bases at Great Yarmouth and Lowestoft tend to operate well to the north of the site.

The traffic passing through the site is mainly trading between UK east coast ports (eg Humber, Thames, Harwich, Felixstowe and Tees) and continental European ports (eg Amsterdam, Rotterdam, Zeebrugge, Antwerp, Bremen and Hamburg).

There is also shipping passing through the southern North Sea from countries further afield, such as between Norway and France, heading via the Dover Strait.

The main passenger ferry traffic through the site is between Hull and Zeebrugge (P&O). There is also regular ro-ro freight ferry traffic between Killingholme-Zeebrugge (Cobelfret Ferries) and Tees-Zeebrugge (P&O).

Shipping ranges in size from small general cargo vessels below 100m length and 2,000 DWT to large container ships, bulk carriers and crude oil tankers, of over 300m length and 100,000 DWT.

Fishing Vessels

The catchment of East Anglia ONE has moderate fishing vessel activity, which is distributed across the whole of the site. The three main fishing fleets operating in the area are from The Netherlands, Belgium and UK, with limited

activity from other countries such as Germany, France and Denmark. Commercial fishing activity is detailed in *Section 5.4.1.*

Recreational Vessels

East Anglia ONE is located well to the east of the general sailing and racing areas identified by the Royal Yachting Association (RYA) Coastal Atlas, off the east coast of England. Consideration of the potential effects of East Anglia ONE on the seascape in the context of recreational vessels is detailed in *Section 5.4.7*.

One medium-use (1) RYA cruising route is indicated to pass through East Anglia ONE between Lowestoft and Rotterdam (as identified in *Figure 5.14*).

There will be other cruising yachts passing through the site heading between the east coast of the UK and the continent, though transits would be relatively infrequent and have therefore been scoped out.

Data Sources

Some of the baseline information needed for the assessment is readily available, such as from the DECC Maritime Data website. Desk-based data sources which will be consulted will include:

- port / harbour details;
- IMO routeing measures;
- recreational vessel activities and facilities (coastal atlas);
- fishing vessel landings, surveillance and satellite data;
- admiralty charts and sailing directions; and
- Anatec ship routes and shipping density data.

Automatic Identification System (AIS) information will also available from shore-based receivers. However, East Anglia ONE ranges from approximately 25 to 35 nautical miles from the East Anglian coast, therefore shore-based coverage is not fully comprehensive.

(1) Popular routes on which some recreational craft will be seen at most times during summer daylight hours

Despite potential data gaps in AIS information, AIS data from the UKCS, collecting using survey vessels and in some cases offshore installations (predominantly mobile drilling rigs), has been captured from the last five years(1).

AIS carriage is not mandatory on all vessels, in particular, fishing and recreational vessels. Therefore, a site-specific radar survey will also be required (see below).

Consultation with navigational stakeholders throughout the project will be used to provide supplementary information. Consultees will include:

- MCA (including MRCC Yarmouth);
- Trinity House;
- Chamber of Shipping;
- RNLI;
- RYA;
- Cruising Association;
- ports on the east coast of the UK (eg Great Yarmouth and Lowestoft);
- ship operators (eg P&O, Cobelfret and Stena Line); and
- fisheries associations and officers.

EIA Methodology

The assessment methodology will principally be based on the following:

- BERR (2005). Methodology for Assessing the Marine Navigational Safety Risks of Offshore Windfarms; and

- MCA Marine Guidance Notice 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues.

The BERR (now DECC) methodology provides a template for preparing a navigation risk assessment. The methodology is centred on risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows that sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions. The BERR assessment methodology includes:

- defining a scope and depth of the submission proportionate to the scale of the development and the magnitude of the risk;
- estimating the 'base case' level of risk;
- estimating the 'future case' level of risk;

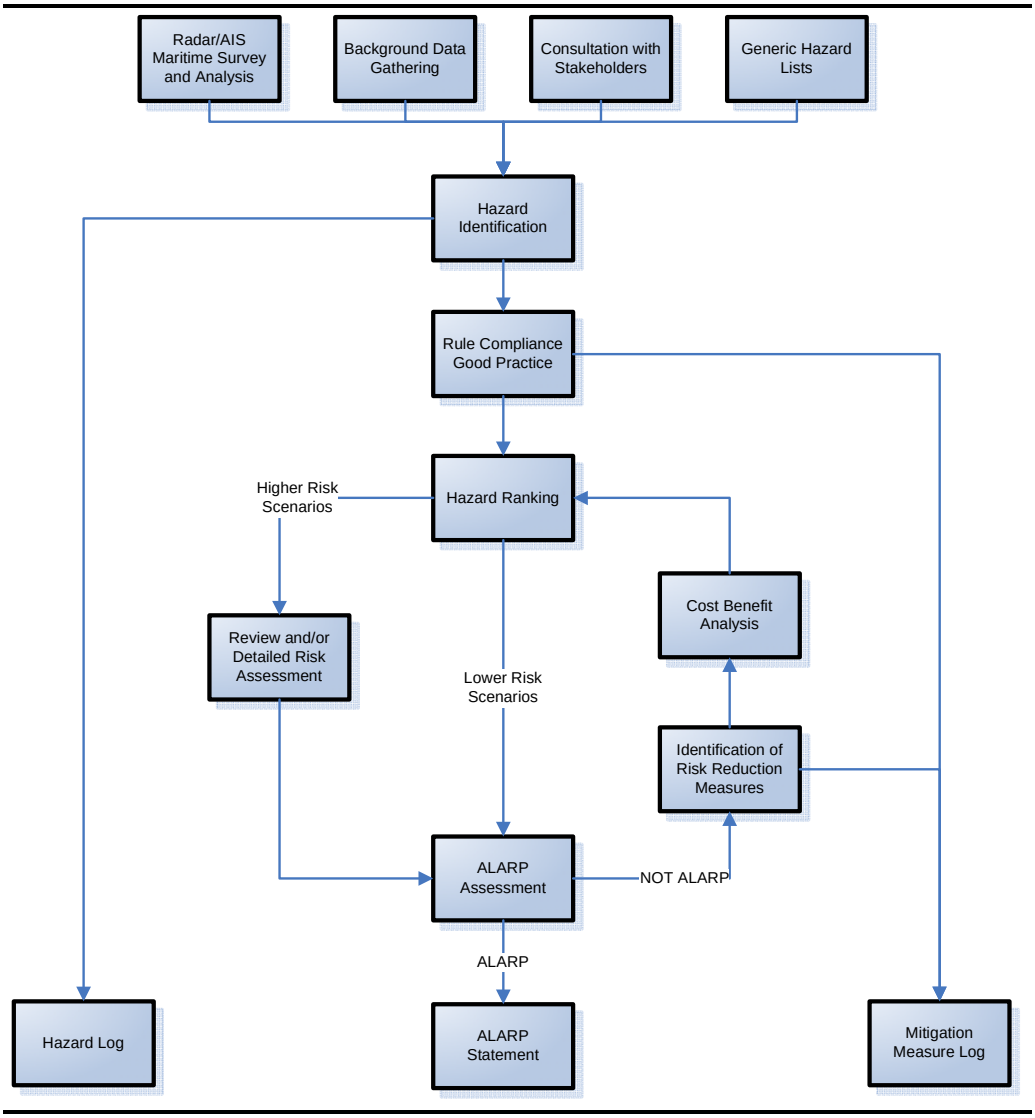
(1) Anatec data

- creating a hazard log;
- defining risk control and creating a risk control log;
- predicting 'base case with windfarm' level of risk; and
- predicting 'future case with windfarm' level of risk.

The key features of the Marine Safety Navigational Risk Assessment Methodology are risk assessment (supported by appropriate techniques and tools), creating a hazard log, defining the risk controls (in a Risk Control Log) required to achieve a level of risk that is broadly acceptable (or tolerable with controls or actions), and preparing a submission that includes a Claim, based on a reasoned argument, for a positive consent decision.

The general methodology which will be applied for the navigational risk assessment is presented in *Figure 5.11*.

Figure 5.11 Overview of Methodology for Navigation Risk Assessment



The MCA guidance MGN 371 highlights issues that need to be taken into consideration when assessing the impact on navigational safety from offshore renewable energy developments in the UK. Specific annexes of the guidance that address particular issues include:

- Annex 1: Site position, structures and safety zones;
- Annex 2: Developments, navigation, collision avoidance and communications;
- Annex 3: MCA's windfarm shipping template for assessing windfarm boundary distances from shipping routes;
- Annex 4: Safety and mitigation measures recommended for OREI during construction, operation and decommissioning; and
- Annex 5: Search and Rescue (SAR) matters.

The MCA guidance MGN 371 sets out the requirement for a maritime traffic survey of at least 28 days duration, including seasonal and tidal variations. The survey would need to record AIS, radar and visual observations of vessel movements within the East Anglia ONE site and its vicinity.

Commercial shipping movements within the East Anglia ONE site and vicinity are fairly regular all-year round and additional longer-term AIS data is available for the site from other sources. Therefore, the survey period would be targeted at periods of peak fishing and recreational activity. These can be identified from baseline data and stakeholder consultation.

The 28 days of survey data would be seasonally weighted and gathered within twelve months of the ES submission, or as per the timetable agreed in advance with the MCA.

There may be scope to use vessels working in the East Anglia ONE site boundary for other purposes, such as for geophysical or bird survey work, to collect data or provide anecdotal information. This method of data collection is being used at a number of other Round 3 Zones. Its application will depend on the work programmes and specifications of the vessels serving those studies. The suitability of this option would be agreed with the MCA.

Other key guidance and reference materials that will be used in the assessment are listed below:

- Trinity House Lighthouse Service (2008). Guidance based on IALA Recommendation O-139 On The Marking of Man-Made Offshore Structures, 1st Edition;

- BERR (2007). Guidance Notes on Applying for Safety Zones around Offshore Renewable Energy Installations – Guidance Notes;

- IMO (2002). Guidelines for Formal Safety Assessment for use in the IMO Rule Making Process (MSC/Circ.1023/MEPC/Circ.392);

- Howard, M. and Brown, C. (2004). Results of the Electro-Magnetic Investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle Windfarm by QinetiQ and the MCA;
- BWEA, DTI, MCA & PLA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Windfarm; and

- MCA Marine Guidance Notice 372 (2008). Guidance to Mariners Operating in the Vicinity of UK OREIs.

Potential Project Impacts

The sections below summarise the potential impacts of East Anglia ONE from a navigational risk perspective.

Merchant Shipping

From the merchant shipping review, it was identified that several routes currently pass through the East Anglia ONE site, used by a mixture of traffic from small cargo vessels to large container ships, bulk carriers and tankers. A proportion of these vessels are carrying hazardous cargoes.

It is unlikely that larger vessels would deliberately pass between turbines with the site. The extent to which East Anglia ONE will impact merchant shipping navigation (ie increase voyage distances and times) as well as present a collision risk to ships will depend upon the turbine layout and orientation of the turbines.

Displacement of merchant traffic to outside the site and subsequent reduction in sea room could lead to a change in vessel-to-vessel encounters and hence collision risk. There is also the potential for radar interference effects on vessels passing in proximity to wind turbines, including large vessels using the IMO DWR, which is at a minimum of one nautical mile of the East Anglia ONE site boundary (in line with the minimum requirements of the MCA's 'Shipping Route Template (MGN 371)), which could lead to increased ship collision risks, especially in fog. This distance will be reviewed during the EIA process.

Finally, any merchant ships dragging anchor or emergency anchoring in the area could pose a hazard to the subsea cables associated with the project.

Fishing Vessels

Vessels navigating between ports and fishing grounds would be exposed to collision risks (and radar interference) in the same way as merchant ships. In addition, if fishing within the site, there would be a risk of collision and subsea cable interaction.

If fishing activity is displaced to outside the site during construction and/or operation, this will influence the rate of vessel-to-vessel encounters and hence the collision risk.

Recreational Vessels

It is likely that recreational vessels will still pass close to and in some cases between turbines, which exposes vessels to increased collision risk as well as changes in traffic movements in the vicinity.

There is also a risk of blade/mast interaction which depends upon the clearance of the rotor blades in different tidal and sea conditions, and the air draught of yachts using the area. The risk can be minimised through adequate clearance height and implementation of an emergency shutdown system of the rotor blades.

Other Issues

The impact of construction, maintenance and decommissioning activity at the site, including exclusion zones and additional vessel traffic operating within and transiting to and from the site, will need to be assessed once more details are known.

A review of the potential impact on search and rescue resources will also need to be provided once the risks associated with the development have been assessed.

Potential Cumulative and In-Combination Impacts

Provided appropriate safety measures are undertaken at the East Anglia ONE site to reduce the risk of collision as far as practically possible, at the present stage it is considered to be unlikely that the presence of East Anglia ONE alone would have a significant effect on shipping and navigation within the southern North Sea.

However, East Anglia ONE in combination with the presence of and construction of future offshore windfarms in the region (including the Greater Gabbard extension and those planned for Netherlands and Belgium), may have the potential to alter the routeing of merchant ships in the southern North Sea. An assessment of cumulative, in-combination and transboundary shipping and navigation impacts will be carried out as part of the Navigational Risk Assessment that will be reported in the ES.

Mitigation and Monitoring

There are a range of measures that can be applied to mitigate the impacts of a windfarm development (including through site design). MGN 371 lists the following potential measures that could be applied to a particular development, as appropriate to the level and type of risk determined during the EIA:

- promulgation of information and warnings through notices to mariners and other appropriate media;
- continuous watch by multi-channel VHF, including Digital Selective Calling (DSC);
- safety zones of appropriate configuration, extent and application to specified vessels;
- designation of the site as an area to be avoided (ATBA);
- implementation of routeing measures within or near to the development;
- monitoring by radar, AIS and / or closed circuit television (CCTV) or other agreed means;
- appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs;
- any other measures and procedures considered appropriate in consultation with stakeholders (including the MCA); and
- creation of an Emergency Response Co-operation plan with the relevant Maritime Rescue Co-ordination Centre from construction phase onwards.

Other mandatory control measures and/or standard industry practice include:

- marking and lighting the site in accordance with General Lighthouse Authority requirements (which will include a system of routine inspection and maintenance of lights and marks);
- MCA standards and procedures for wind turbine generator shut-down in the event of a search and rescue, counter pollution or salvage incident in or around a windfarm;
- turbine rotor blade tip clearance at a minimum 22m above Mean High Water Springs; and
- vessel nominated as guard vessel during construction /decommissioning activities.

Mitigation for East Anglia ONE will be identified during the Marine Navigation Assessment and may include, in addition to the points listed above, measures such as an IMO adopted traffic routeing system (eg a traffic separation scheme) and changes to presently charted anchorages, if necessary.

5.4.3 Civil and Military Aviation and Airborne Radar

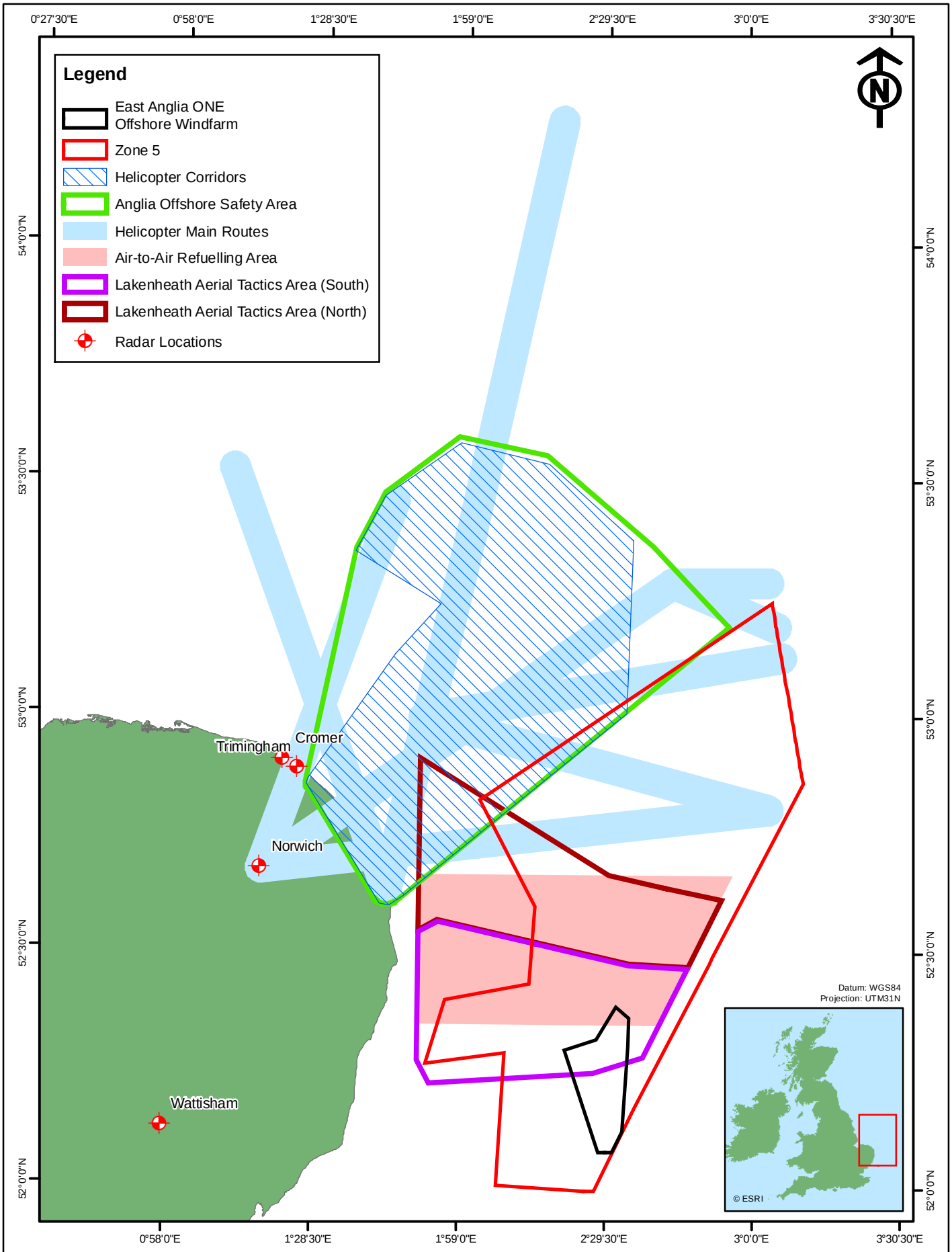
Introduction

This section considers civil and military aviation and airborne radar. *Section 5.4.4* considers other telecommunications and interference and *Section 5.4.9* considers remaining military interests, such as practice and exercise areas (PEXA), unexploded ordnance (UXO) and any associated dumping / disposal grounds.

Baseline Conditions

Figure 5.12 indicates civil and military aviation and airborne radar interests within and in proximity to East Anglia ONE. With reference to *Figure 5.12*, no major known constraints affect East Anglia ONE, although it should be noted that the northern half of the site boundary is under the Lakenheath Aerial Tactics Area. As previously identified in *Section 3*, the location of East Anglia ONE has been chosen to ensure minimal interaction with existing aviation and radar operations.

In summary, East Anglia ONE is located outside the line of sight of Cromer National Air Traffic Services (NATS) radar and helicopter routes to platforms. The northern edge of the site is visible to the MoD radar at Trimmingham.



East Anglia Offshore Wind

Aviation & Military Interests

Rev	Date	By	Comment
C	05/07/10	FS	Symbology updated
B	17/06/10	JH	Areas added
A	07/06/10	JH	First Issue.

Original A4 Plot Scale 1:1,200,000

0 5 10 km

0 2 4 6 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	C	6115-500-PE-001

Figure 5.12

6115-500-PE-001-C_20100705_Aviation.mxd

Civil Airports and Airstrips

East Anglia ONE lies within an area that has no effect on adjacent main civil airports. The nearest airport is Norwich (85km). Any air traffic over East Anglia ONE would be handled by NATS.

Military Airfields

There are five military airfields located in proximity to the East Anglia ONE site, as follows:

- RAF Wattisham (120km);
- RAF Honington (124km);
- RAF Marham (134km);
- RAF Lakenheath (136km); and
- RAF Mildenhall (141km).

Air Defence Radars

East Anglia ONE lies 83km from the nearest Air Defence radar at Trimmingham.

Military Training Areas

The northern half of the East Anglia ONE site boundary lies beneath the RAF Lakenheath aerial tactics area.

Air to Air Refuelling (AAR) Areas

The northern tip of the East Anglia ONE site boundary lies beneath an AAR area.

En-Route Services

East Anglia ONE will not be visible to the NERL radar at Cromer which provides en-route services to civil and military aircraft.

There are a number of studies that will act as baseline information (including the QinetiQ Greater Wash infill radar study and Bommell (2008) Offshore Round 3 selection helicopter constraints). In particular, the modelling conducted by Lockheed Martin for the introduction of the TPS-77 Air Defence radar at Trimmingham will be of relevance to this study.

Helicopter Routes

There are a number of helicopter routes in the vicinity of Zone 5. However, these are well to the north of East Anglia ONE and can be scoped out of the civil and military aviation and airborne radar assessment.

Data Sources

The following are key data sources that will inform the civil and military aviation and airborne radar assessments:

- UK Civil Aeronautical Information Publication;
- UK Military Aeronautical Information Publication;
- the UK Low Flying Handbook;
- ADTI HerTZ Mapper Radio Network Simulation and Analysis Software for radar line of sight profiles;
- radar location and data gathered by Osprey from NATS, MoD and the CAA;
- DfT/ODPM Circular 1/2003, Annex 2;
- CAP764: The Effects of Windfarms on Aviation published by the Civil Aviation Authority; and
- ATDI Line of Sight software.

EIA Methodology

The potential effect on aviation impact was carefully considered when selecting the East Anglia ONE site. As identified from existing data, there is limited activity taking place within the northern part of the site (almost exclusively military).

Within the EIA, the following issues will be investigated, and subsequently reported in the ES:

- identify all MoD, NATS and civil radar systems which may provide coverage overhead the windfarm site;
- assess standard air traffic operations and routings overhead the site;
- assess local airspace classification and typical air traffic users;

- include radar line of sight profiles from proposed turbine locations to local radar systems;

- provide an operational impact assessment of the significance of radar line of sight from individual radar systems to turbine locations;

- provide an operational assessment of air traffic density in the region and the types of air traffic that regularly fly overhead;

- assess the impact of turbine development on national security with respect to Air Defence operations and develop appropriate Aviation Specifications to satisfy any concerns raised by MoD;

- assess the impact of turbines as potential aviation obstacles to MoD low flying aircraft and commercial offshore helicopters flying in the vicinity of the site;

- confirm the absence of Helicopter Main Routes (HMRs) and offshore platforms within the area;

- assess plans for future airspace design and its potential impact on the site;

- propose technical and operational mitigation where applicable; and

- include a draft assumed aviation specification which will highlight boundaries where a loss of radar coverage can be managed and accepted – this specification will be compared to the existing radar infrastructure to ascertain whether a radar mitigation solution can be offered.

Potential Project Impacts

In addition to the potential effects associated with radar clutter, there is a small possibility that the MoD may have concerns relating to the likely effect of the removal of an area of low level training (shown as Lakenheath Aerial Tactics Area in *Figure 5.12*). However, the area is not one frequently used and it is noted that the RAF Lakenheath training areas have a base height well above the height of the turbines, restricting any potential effects to those relating to radar rather than physical effects. The MoD Low Flying cell will be consulted to establish their position.

Civil operators, particularly helicopter operators, may also take a view on potential physical impact with the turbines. Experience shows that this manifests itself in re-routing around the windfarm, although this impact will need to be assessed on a case-by-case basis as there is no consistency between operators. Individual helicopter operators will be consulted through the EIA process.

Potential Cumulative and In-Combination Impacts

Round 3 windfarms could have cumulative or in-combination impacts with those already permitted under Rounds 1 and 2. In particular, cumulative radar impact will be assessed throughout the EIA.

Mitigation and Monitoring

Mitigation may include aviation warning lighting to be fitted to some or all of the wind turbine masts, which will be designed in consultation with key stakeholders such as the CAA. The legal requirement for aviation obstruction lighting on offshore wind turbines is documented within the UK Air Navigation Order 2009 (Article 220).

The colour of the turbines will be white. International aviation regulatory documentation requires that the rotor blades, nacelle and upper 2/3 of the supporting mast that are deemed to be an aviation obstruction should be painted white, unless otherwise indicated by an aeronautical study.

EAOW will liaise with the relevant authorities, such as the CAA, as soon as construction and decommissioning stages start so that East Anglia ONE can be charted for aviation purposes, as required by DfT/ODPM Circular 1/2003, Annex 2. The Defence Geographic Centre will also be kept informed of the development.

5.4.4 Telecommunications and Interference

Introduction

This section considers the maritime telecommunications within and surrounding the East Anglia ONE site and potential interference by the project. This section does not consider airborne radar related to civil and military aviation and defence systems, which is covered in *Section 5.4.3*, nor does it cover subsea cables and physical infrastructure relating to general telecommunications, which is covered in *Section 5.4.9*.

Baseline Conditions

The type of vessels operating in and around the East Anglia ONE site includes commercial passenger ferries, fishing boats, piloting activities, cargo vessels and traffic associated with oil and gas installations located outside of the site to the north east (see *Figure 5.16* that shows the locations of the oil and gas installations). Search and rescue vessels, primarily lifeboats, also operate in the area.

Due to the diversity and density of traffic within and surrounding East Anglia ONE, the range of maritime telecommunications in use will be varied and usage will be relatively high. The systems that will be considered in the EIA will be:

- communication tools (mobile phones, satellite phones, very high frequency (VHF) radio);
- navigation aids (radio beacons, Automatic Identification System (AIS), Global Positioning System (GPS)); and
- search and rescue specific aids (personal and vessel rescue beacons, search and rescue transponders).

The impact on television reception and fixed links between the shore and oil and gas installations to the north and west of East Anglia ONE will also be considered as part of the EIA.

Data Sources

The following data sources will be used to inform the telecommunications and interference impact assessment:

- navigational aid information will be obtained from consultation with the Maritime Coastguard Agency. The information which will be gathered includes:
    - onshore Automatic Identification System (AIS) stations;
    - location of navigational aids, including those transmitting AIS signals; and
    - radio beacons;
- differential GPS (DGPS) transmitter locations and frequencies will be taken from the Trinity House website: http://www.trinityhouse.co.uk/aids_to_navigation/the_task/satellite_navigation.html#;
- television transmitter locations and frequencies will be obtained from the sitefinder resource, www.sitefinder.co.uk;
- data for fixed links will be identified through consultation with the relevant oil and gas operators to the north west of East Anglia ONE and the Zone. The PMSS Oil and Gas Installation Report (PMSS, 2009) will be used to identify the relevant stakeholders for this activity; and

- standard radar cross section textbooks, such as Radar Cross Section (Knott, Schaeffer and Tuley).

EIA Methodology

The methods described in Bacon (2002), relating to the establishment of an exclusion zone around a terrestrial fixed radio link, will be used when assessing potential impacts on fixed link infrastructure.

There are no other relevant guidance documents for the telecommunication assessments. Therefore, modelling tools will be used to predict the impact on the following telecommunication systems:

- AIS;
- television;
- VHF radio;
- fixed links;
- mobile and satellite telephony;
- radio beacons;
- GPS and differential GPS (DGPS); and
- search and rescue (SAR) beacons.

Potential Project Impacts

East Anglia ONE has the potential to interfere with any of the systems listed above. The interference typically comes about in two ways:

- reflections from the wind turbine can interfere with the direct signal; and

- strength of a signal can be reduced when a receiver is in a shadow region behind a turbine, with respect to the transmitting device.

The impact of these effects will vary from system to system. Some systems, such as GPS, have built in redundancy, ie if reception from one satellite is lost, there are usually sufficient signals still available to operate effectively. In other cases there will be little or no system redundancy, for example where an already weak VHF radio signal is rendered useless due to signal reduction in a turbine shadow.

The impact of any effects will be discussed for each system of interest within the ES.

Potential Cumulative and In-Combination Impacts

The presence of other windfarms may further degrade certain aspects of a system's performance, leading to a greater overall impact. An example might be where mobile phone reception from one base-station is impaired and reception from another base-station is impaired by another windfarm.

For each system, the potential cumulative effects will be assessed.

5.4.5 *Archaeology and Cultural Heritage*

Introduction

There is a reasonable understanding of the archaeological potential in the East Anglia ONE region. This is partly due to information gathered during the exploration and mining of marine aggregates near the coast and through the ongoing Recognised Environment Condition (REC) and Regional Environmental Assessment (REA) programmes as well as through initiatives such as the British Marine Aggregate Producers Association, Environmental Heritage, The Crown Estate Protocol for reporting archaeological finds on the seabed which has given rise to a wide range of material from the East Anglian region.

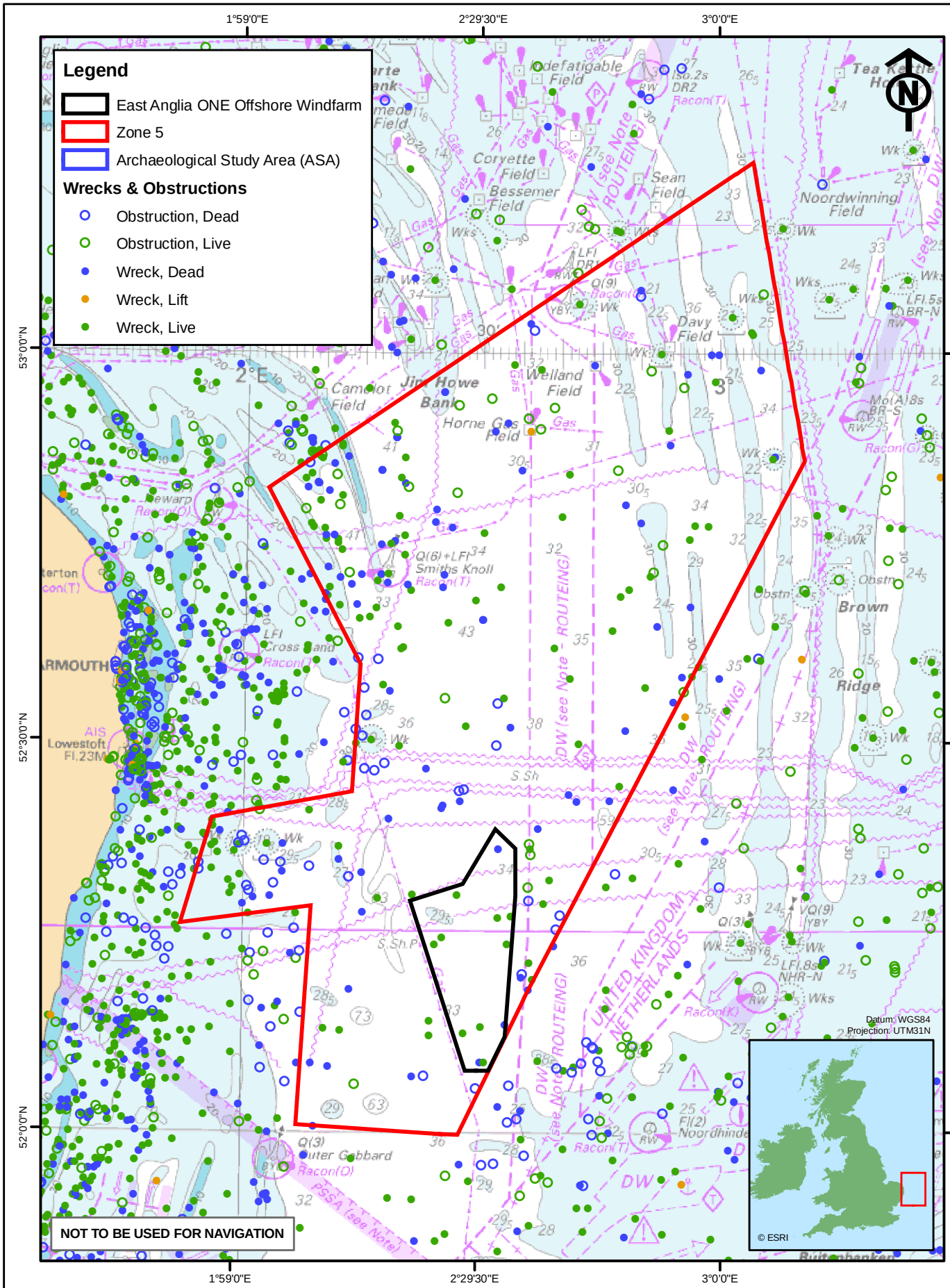
Archaeological remains in the site may include maritime sites, aviation sites and submerged prehistoric archaeological sites.

Maritime sites include artefacts, features and structures, including wrecks and wreckage arising from prehistory to the present.

Baseline Conditions

An Archaeological Study Area (ASA) has been established which extends 1km beyond the East Anglia ONE site boundary. This area defines the search area to be used for the collection of archaeological records and sea bed features and will be the area within which the archaeological impacts will be assessed.

The 1km buffer area provides confidence that all relevant sites are captured given the relatively poor positional data for historic wreck sites and possible distributions of archaeological material. *Figure 5.13* represents known live and dead wrecks and obstructions within and near to East Anglia ONE site.



East Anglia Offshore Wind

Known Wrecks

Rev	Date	By	Comment
C	05/07/10	FS	Symbology updated
B	17/06/10	JH	Data changed
A	07/06/10	JH	First Issue.

Original A4 Plot Scale 1:750,000

0 4 8 km 0 2 4 6 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	C	6115-500-PE-018

Figure 5.13

6115-500-PE-018-C_20100705_Wrecks .mxd

There are no designated archaeological sites within the ASA – the nearest protected wreck is the HMS *Amphion*, a Protected Place under the Protection of Military Remains Act (1986), which is located almost 2km east of the buffer boundary. At the time of writing, 13 known live wrecks, dead wrecks and obstructions can be identified within the ASA from SeaZone data. However, this is likely to be a conservative number and there could be many more sites of maritime importance that have not yet been identified. Interpretation of geophysical data within the 1km buffer will help identify any potential unrecorded wrecks and obstructions, with detailed analysis to be provided in the ES.

Desk based assessment of public domain data will reveal known, charted wrecks in the ASA. As yet unknown wrecks and wreckage may be identified through archaeological interpretation of geophysical data.

Due to increased activity and increased official and commercial documentation, the largest volumes of known wrecks tend to date to the later part of the 19th century and to the 20th century. These wrecks may be deemed significant because of the rapid changes in ship technology during this period or through association with wartime activity, which may have resulted in significant loss of life. Although wrecks of earlier vessels are less often known, this is partly due to less original documentation being produced concerning them, and partly due to them presenting relatively ephemeral remains above the sea bed. Earlier vessels are also likely to be very important.

Aviation sites principally consist of air crash sites. These are increasingly recognised as a significant element of the historic offshore environment. They may be isolated structural elements or artefacts, or relatively whole surviving remains. The majority of sites date to WWII, when the east coast was a particular focus for military aviation. Aviation losses from both earlier and later periods are known, and may encompass civilian activity and non-combat military losses. Military air crash sites are automatically protected under the Protection of Military Remains Act 1986.

Submerged prehistoric sites includes artefacts, features and deposits that are originally attributable to/associated with human activity on land, but are now underwater as a result of changes in relative sea level. These sites may be little disturbed, or heavily modified by natural processes associated with glaciation and changes in relative sea level. They may date to the very earliest periods of human habitation in England, over 700,000 years ago, through to the early Mesolithic. The history of sea level change in the area makes it unlikely that later submerged sites will be extant in the ASA.

Data Sources

The key data sources expected to inform the archaeological impact assessment will include:

- secondary sources related to historic shipping patterns and potential wreck sites and casualties, specifically the Aggregates Levy Sustainability Fund (ALSF) reports such as England's Shipping;
- secondary sources relating to historic aviation patterns and the potential for aircraft crash sites, specifically the ALSF Aircraft Crash Sites at Sea project, and the East Coast Aggregate Regional Environmental Characterisation;
- secondary sources relating to the palaeo-environment of the North Sea, with specific reference to submerged palaeo-landscapes and coastal change including the Scope of Strategic Environmental Assessment of North Sea Areas SEA3 and SEA2 in regard to Prehistoric archaeological remains, and the East Coast Aggregate Regional Environmental Characterisation;
- previous archaeological studies in the area;
- UKHO wreck data;
- National Monuments Record data;
- Historic Environment Records data, principally from Suffolk and Norfolk;
- Receiver of Wreck (Maritime and Coastguard Agency);
- Portable Antiquity Scheme;
- geophysical survey data (including side scan sonar, sub bottom profiler, magnetometer and multibeam/swathe bathymetry data;
- geotechnical data (including geotechnical contractors core logs and digital logs, and cores if deemed necessary);
- relevant and readily accessible primary and secondary historic and sources; and
- contemporary sources, principally published scientific studies, including the relevant SEA studies and research frameworks, and the East Coast Aggregate Regional Environmental Characterisation;

- A review of available survey reports and ESs in the region supplemented by the above.

EIA Methodology

The potential impact of the proposed development on archaeology will be assessed using standard EIA methodologies. COWRIE's Historic Environment Guidance for the Offshore Renewable Energy Sector (2007) and Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (2008) will be closely adhered to during the assessment of the impacts. The report will comply with the Institute for Archaeologist's Guidance for desk-based assessment (2008), and will refer to the relevant regional and thematic research frameworks, the strategic environmental assessment and the regional environmental characterisation.

The desk-based assessment will collate information from those sources listed under data sources, in order to analyse the known archaeological assets in the area and provide position, description and dimensions of known sites. It will also provide baseline data which will create a regional context that will be interrogated to provide insight into the archaeological potential of the area. This baseline data will also be used to inform the geophysical and geotechnical assessments. The desk-based assessment will provide statutory planning and policy context relating to the historic environment.

A GIS containing the relevant data on the heritage resource will be created. The GIS will be formatted and referenced in accordance with the overall data management requirements of the project.

Surveys have been commissioned to collect geophysical data across the ASA. The data collected during these surveys will be assessed in order to identify features and deposits of archaeological significance as follows:

- side scan sonar data will be reviewed to confirm the location and character of known wrecks and to identify previously unrecorded features of anthropogenic origin on the seabed, including ship wrecks, aircraft and other material;

- magnetometer data will be reviewed in order to identify further anomalies of anthropogenic origin and assist in confirming the identification as anthropogenic of anomalies seen on the side scan sonar;

- a proportion of the sub-bottom profiler data will be reviewed to identify palaeo-geographic features, for example palaeo-channels and peat horizons and these will be traced through the data with a view to establishing the palaeo-landscape during period of possible hominid occupation; and

- the multibeam/swathe bathymetry data review will provide vertical datum for the sub-bottom interpretation and will aid in the identification of palaeo-geographic features, for example unfilled palaeo-channels. It will also help establish a baseline against which sea level change can be assessed and will provide additional information on wreck sites identified from the side scan sonar and desk based assessment.

An integrated gazetteer and GIS layer will be created that shows site extents, anomalies and exclusion zones.

Geotechnical investigations will be carried out across the ASA, and the following analysis will be carried out:

- review of the pre-survey geological assessment with a view to suggesting sediment types and intervals likely to be of archaeological interest, including a nominal sampling strategy in relation to these sediments;

- review the borehole location summaries to ensure archaeological features on the seabed will not be impacted and identify appropriate core sample locations;

- review of core logs (paper copy) and digital logs (in spreadsheet / database format) as they become available - this will provide an initial assessment of the recommendations made on the basis of the pre-survey geological assessment the presence and location of sediment units with likely archaeological, palaeo-environmental and/or dating potential, as a basis for confirming or adjusting the sampling strategy; and

- carry out an initial assessment of the archaeological samples which will include detailed logging and sub-sampling as appropriate.

Archaeological, geophysical and geo-archaeological specialists have been consulted early in the process in order to ensure that any data being collected is suitable for use in assessing the heritage resource.

The ES will include an impact assessment that identifies:

- exclusion zones around known wreck sites and archaeological features;
- anomalies interpreted as of anthropogenic origin;
- highlights awareness of risk factors to facilitate project planning; and
- areas which may require avoidance or mitigation.

The Crown Estate is currently working towards standardising Written Schemes of Investigation (WSI). They are also establishing a protocol for unexpected discoveries (currently out for consultation). These will be incorporated as appropriate into the EIA.

Potential Project Impacts

There is potential for damage to occur during pre-construction sea bed preparation, windfarm construction, cable laying and intrusive geotechnical survey to:

- submerged prehistoric archaeological sites and finds on the sea bed;
- wrecks that could potentially date from the later Mesolithic through to the present day;
- aircraft, in particular military aircraft lost during WWII; and
- submerged prehistoric sites and finds and submerged topographic features and deposits that contain palaeo-environmental evidence.

Potential damage may also occur where local changes in sediment movement caused by the new structures results in scour, which may result in heritage assets (wrecks, aircraft, submerged prehistoric archaeological sites and archaeological finds) being exposed or undermined. As heritage assets underwater have usually survived as a result of achieving a broadly stable equilibrium with their immediate environment, changes in this environment may trigger renewed degradation as a result of alterations in the physical, chemical and biological processes that the asset is subject to.

Potential Cumulative and In-Combination Impacts

Potential cumulative and transboundary impacts are outlined in COWRIE 2007 (Wessex Archaeology, 2007) and COWRIE 2008 (Oxford Archaeology and George Lambrick, 2008). Activities that will potentially have to be considered in relation to cumulative and transboundary impact assessment are:

- subsea cables and pipelines;
- marine waste disposals;
- oil and gas infrastructure and operations;
- marine aggregate dredging; and
- other offshore windfarm schemes.

The main impacts envisaged are movements of sediment and changes in sediment regime deriving from the construction of the windfarm or the construction or operation of the above activities in the proximity of the windfarm and potentially affecting the ASA.

5.4.6 *Socio-Economic Characteristics*

This section considers the socio-economic environment of East Anglia, including coverage of the Counties of Norfolk, Suffolk and Essex, as being the closest counties that may be affected by the project in relation to socio-economics. The potential impacts of the offshore components of the development and operation of East Anglia ONE will be identified, incorporating both sea-based users and land-based users. Any sea-based and land-based impacts resulting from the export cable and onshore components of the proposed development will be considered in a separate Scoping Report.

The baseline provided in the ES will identify and assess the existing level of services and facilities in the areas associated with East Anglia ONE, such as port facilities and storage and assembly points, including an overview of the services and facilities available. Economic benefits of East Anglia ONE, in terms of skills, employment and opportunities, will also be assessed.

Baseline Conditions

In 2008, the UK became the world leader in offshore wind capacity with 598MW installed to date. The UK is now the world's largest market for offshore wind development through 2009 to 2013, with a forecast expenditure of 10.7 billion Euros. The Carbon Trust estimates that this could create and/or support up to 70,000 UK jobs and create £8 million in annual turnover by 2020.

The East of England is the UK's most dense area of offshore wind energy development, with projects being concentrated between the Humber, Greater Wash and Thames Estuary.
Large-scale offshore windfarm development has meant that offshore energy specific infrastructure, facilities and services are already in place and are being aligned to the further development of offshore windfarms such as East Anglia ONE.

Included within offshore windfarm servicing infrastructure are established ports such as the ports of Great Yarmouth, Harwich, Felixstowe and Lowestoft. Smaller seaports such as Ipswich, Tilbury, Brightlingsea, Kings Lynn and Wells also offer facilities that could support offshore energy generation and minor ports such as Harwich Navy Yard and Mistley Quay offer opportunities as the offshore sector develops.

The Port of Great Yarmouth, owned by EastPort, is currently undergoing a £40 to £50 million port expansion project in order to extend the outer harbour into a deep water port with longer berth facilities and container storage. The investment has been raised from International Port Holdings, Singapore's PSA and from UK and EU public bodies. This expansion will have clear access and

facility benefits to the North Sea oil and gas exploration and offshore windfarm construction and maintenance requirements.

The East Anglia region and counties forming the region are diversifying from economic sectors of farming, food production, tourism and financial and insurance districts to also include alternative energy sector in manufacturing, servicing, maintenance and distribution.

Other facilities and services in the supply chain are also benefitting from the siting of offshore windfarms off the East Anglia coast, contributing to the regional economy, skills and education. With the location of many offshore windfarm projects being sited off the East Anglian coast, companies directly involved in windfarms or indirectly involved through the supply chain are forming clusters within the counties of Norfolk, Suffolk and Essex.

The East of England Development Agency (EEDA) has established a regional enterprise hub for offshore renewables, termed OrbisEnergy, located near Lowestoft Port, to support Small and Medium Enterprises (SMEs), to maximise the supply chain opportunities associated with offshore renewables. EEDA launched OrbisEnergy in 2008 with a £2.7 million investment and management partnership including Suffolk County Council, Waveney District Council and Renewables East.

The transition of the skills set within the region is also aligned to offshore windfarm development and the supply chain from the oil and gas sector. This is being enhanced in form of new research and development support and new courses aligned to renewable and alternative energy offered by the University of East Anglia and other educational establishments in the region.

The opportunities for regional economic benefit afforded by The Crown Estates Round 1 and Round 2 projects were a combination of short-to-medium terms benefits from onshore assembly, deployment and offshore installation, as well as larger longer term benefits from operations and maintenance. With the scale of Round 3, longer term regional opportunities now exist in all areas of the offshore wind supply chain, with many regional companies starting to explore these market opportunities. In a study conducted by Renewables East, it is suggested that 2,300 direct operation and maintenance jobs and 1,500 supply chain jobs could be secured into the region, delivering over £100 million per annum to regional Gross Value Added (GVA) by 2030.

Data Sources

The following resources (regional focus) have been initially identified to be used in the desk-based assessment:

- regional and local newspaper articles in relation to the economy, skills and renewable energy industry in Norfolk and Suffolk;
- Renewables East – East of England Renewable Energy Statistics publications 2005-2007;
- review of material produced by East of England Development Agency;
- EEDA (unknown). Low carbon innovation cluster – an overview of the offshore wind sector (accessed at http://www.eeda.org.uk/files/Low_carbon_innovation_-_offshore_wind.pdf);

Reports providing the national context include the following:

- The Crown Estate (2010). A Guide to an Offshore Windfarm;
- The Crown Estate (2009). BWEA Towards Round 3: Building the Offshore Wind Supply Chain;
- BWEA (2009). UK Offshore Wind: Charting the Right Course, Scenarios for offshore capital costs for the next five years;
- The Crown Estate (2008). Socio-economic indicators of marine related activities in the UK economy;
- Glasgow Caledonian University (2007). Economic Impact of Windfarms on Scottish Tourism (commissioned by the Tourism Unit of the Scottish Government);
- Scottish Renewables Economic Impact Report (2007);
- DEFRA (2007). Consultation on a recreational sea angling strategy for England;
- Energy for Sustainable Development (2004). Offshore wind, onshore jobs, - A new industry for Britain;
- Drew Associates (2004). Research into the economic contribution of sea angling;

- Royal Yachting Association and The Cruising Association (2004). Sharing the Wind - Regional Boating in the Offshore Windfarm Strategic Areas;

- Tourist Attitudes Towards Windfarms, Scottish Renewables and British Wind Energy Association (2002); and

- DTI (2002). Human Activities in the SEA 3 Area.

This list will be expanded as the scope is defined in more detail throughout the EIA process.

EIA Methodology

Establishing the baseline for the potential sea-based and land-based impacts of the offshore components of East Anglia ONE is primarily a desk-based exercise, drawing on national and regional economic data and nationally available sources such as the Census, Labour Force Survey and Indices of Deprivation. Local publications, such as newspapers, and documents produced by public bodies and academic institutions from the region will also be reviewed.

The scope of the onshore assessment will be developed further, and reported in the ES, when the location of port facilities and onshore storage and assembly points and the supply chain have been more clearly defined.

In terms of the offshore impacts, the socio-economic assessment will use the baseline developed for the future commercial fisheries assessment and the future shipping and navigation assessment. It will also draw on other nationally available data sources. These will provide a baseline of human activity on the sea, including use by commercial operations such as shipping, fisheries and marine aggregates as well as recreational activities.

The methodology for the socio-economic assessment will consist of the following stages:

- definition of the study areas for the socio-economic assessment;

- establishment of the socio-economic baseline conditions for these areas;

- identification of potential significant impacts of construction, operational and decommissioning phases of the development for the off-shore elements of the project;

- identification of mitigation and enhancement measures; and

- assessment of residual impacts, taking into account all mitigation measures.

A series of study areas will be defined taking account of the nature of the main impacts and the extent to which they are dispersed. This will include study areas at the local, regional, national and international scales.

Work is continuing to identify a land based site for construction. The location of this construction site will be important in establishing the wider impact areas for the socio-economic assessment. The role of local ports, the local community and the intended supply chain, with links to manufacturing and assembly sites, will determine the nature and significance of the economic and social impacts from the project during the construction, operation and decommissioning stages. Consultation with key agencies and industry representative will be a critical starting point for defining the study areas to be assessed.

Potential impacts will be assessed on the basis of professional judgement taking into account relevant research and assessments of other offshore renewable developments. The factors to consider include:

- scale of impact;

- context of change (ie the magnitude of the effect in its local context, such as how significant additional employment is in relation to the size and structure of the local labour market); and

- timing of change (some effects may occur in the short-term following the implementation of the project, others may take longer to be realised).

The timing and scope of the surveys relating to the physical environment will be agreed with the relevant statutory bodies.

Potential Project Impacts

The socio-economic impacts of the construction and operation of any offshore windfarm of this size, including East Anglia ONE, is likely to be significant, and may impact at a local, regional and national level.

Onshore impacts will include job creation and employment retention, during all three temporal phases. There are likely to be direct and indirect benefits to the local and regional economies, through the creation of jobs within the supply chain. Some of the potential economic effects are listed below:

- direct and indirect creation of jobs through economic multiplier effects during construction operation and decommissioning phases of the project;

- potential requirement for improved infrastructure within local ports;

- use of local services or manufactured products; and

- increased long term security and reliability of supply and more evenly distributed energy generation,.

Economic impacts will vary considerably at each level depending on the technology deployed, contracting strategy, commercial impacts and other factors such as the availability and capacity of the supply chain. Impacts will be quantified separately at each spatial scale, using industry and sector specific multipliers.

Onshore impacts could include demands on services, such as infrastructure and housing. This will be dependant on the number of workers, where the workers come from and the duration of employment.

Offshore impacts would include a potential economic impact on commercial fishing. The commercial fisheries assessment will assess the impact on:

- commercially exploited species;
- increased steaming times for fishing vessels; and
- loss or restricted access to traditional fishing grounds.

The socio-economic assessment will build upon the findings of the commercial fisheries assessment to assess the likely economic effects on commercial and sport fisheries, and their consequential economic effects on local communities. Similarly, the shipping and navigation assessment will assess the impact on ferry and other shipping operations and the socio-economic assessment will use this to provide an overall assessment of economic effects.

Given the distance of the windfarm from land, it is unlikely that leisure activities such as yachting will be significantly affected by the operation of the project. However, dependant on movements during construction there may be short term impact on recreational use in the selected ports used for construction and supply.

The assessment will also consider the scale of investment arising from the proposed development and impacts on job creation, GVA, skills, local regeneration initiatives and regional supply chains, sustainable energy supply for the region, maintaining security and resilience of supplies, and effects on the regional economy.

Potential Cumulative and In-Combination Impacts

The assessment of cumulative and in-combination effects will take into account other offshore wind projects and any other permitted projects such as marine aggregate extraction. The assessment will consider:

- employment, the skill sets and labour force availability;
- availability of local infrastructure and services;
- any cumulative benefits or adverse impacts in terms of recreation and tourism; and
- any cumulative impacts on commercial fishing, ferry and other shipping operations.

The ES will identify cumulative impacts, opportunities and potential synergies associated with relationships between the East Anglia ONE project and other related and significant proposals. In this vein, the ES will include evidence to demonstrate how the development proposals will help to promote successful and competitive businesses, strong and inclusive communities and an effective and confident region.

Transboundary Impacts

Given the size of the project there is potential for transboundary effects. It is likely that ships passing through this area are from various international destinations. It is also likely that, depending on the supply chain for components, materials and related skills, there will be measurable economic effects extending through the supply chain to manufacturing locations outside the UK. The socio-economic assessment will primarily take account of the shipping and navigation findings and details of the supply chain to assess any potential effects.

Mitigation and Monitoring

Consultation will take place with key local industries and ports, local authorities and organisations and interest groups throughout the project, to ensure that their concerns are addressed through the EIA process.

If the EIA assessment identifies any adverse impacts on the socio-economic environment of the area, mitigation measures will be identified. The assessment will also highlight any positive effects that the proposed windfarm may have on the local community.

During construction, safety exclusion zones will be imposed to ensure other marine users are not placed in danger by construction activities. Effective

communication of survey and construction activities through Notices to Mariners and directly to local ports will ensure impacts are minimised throughout the life of the project.

5.4.7 Landscape, Seascape and Visual

Introduction

Seascape is defined as the coastal landscape and adjoining areas of open water, including views from land to sea, from sea to land and along the coastline. Every seascape has three defined components:

- an area of sea (the seaward component);
- a length of coastline (the coastline component); and
- an area of land (the landward component).

By contrast, the landscape starts at the coastline and includes all areas inland.

Seascape effects are the changes in the character and quality of the seascape as a result of development. Therefore, seascape assessment is concerned with direct and indirect effects upon specific seascape elements and features, as well as more subtle effects on seascape character and effects upon acknowledged special interests such as designated landscapes.

Visual effects result from the changes in the landscape or seascape, and are defined as changes in the appearance of the landscape, and the effects of those changes on people. Visual impact assessment is concerned with the impacts of the development on views of the landscape through intrusion, obstruction or changing the content and focus of views and the overall changes in visual amenity.

Baseline Conditions

The East Anglia ONE windfarm will be located over 44km from the Suffolk coastline at its closest. Other parts of the boundary are located further away from the coast.

Current guidance (DTI, 2005) indicates that the limit of any significant effect on areas of moderate sensitivity in terms of landscape can be considered at a distance of 30 to 35km, Therefore, 35km is the limit of visual influence of wind turbines. At sea, this distance can be dramatically reduced by climatic conditions. In order to include areas where turbines might be visible whilst not necessarily being significant, a distance of 40km from the actual turbines will be used for the study area. The UK Offshore Energy SEA recommends that for a variety of impact reduction reasons (relating to landscape/seascape),

a general guideline of 12 nautical mile (approximately 22km) buffer zone is recommended for large (more than 100MW) windfarm developments.

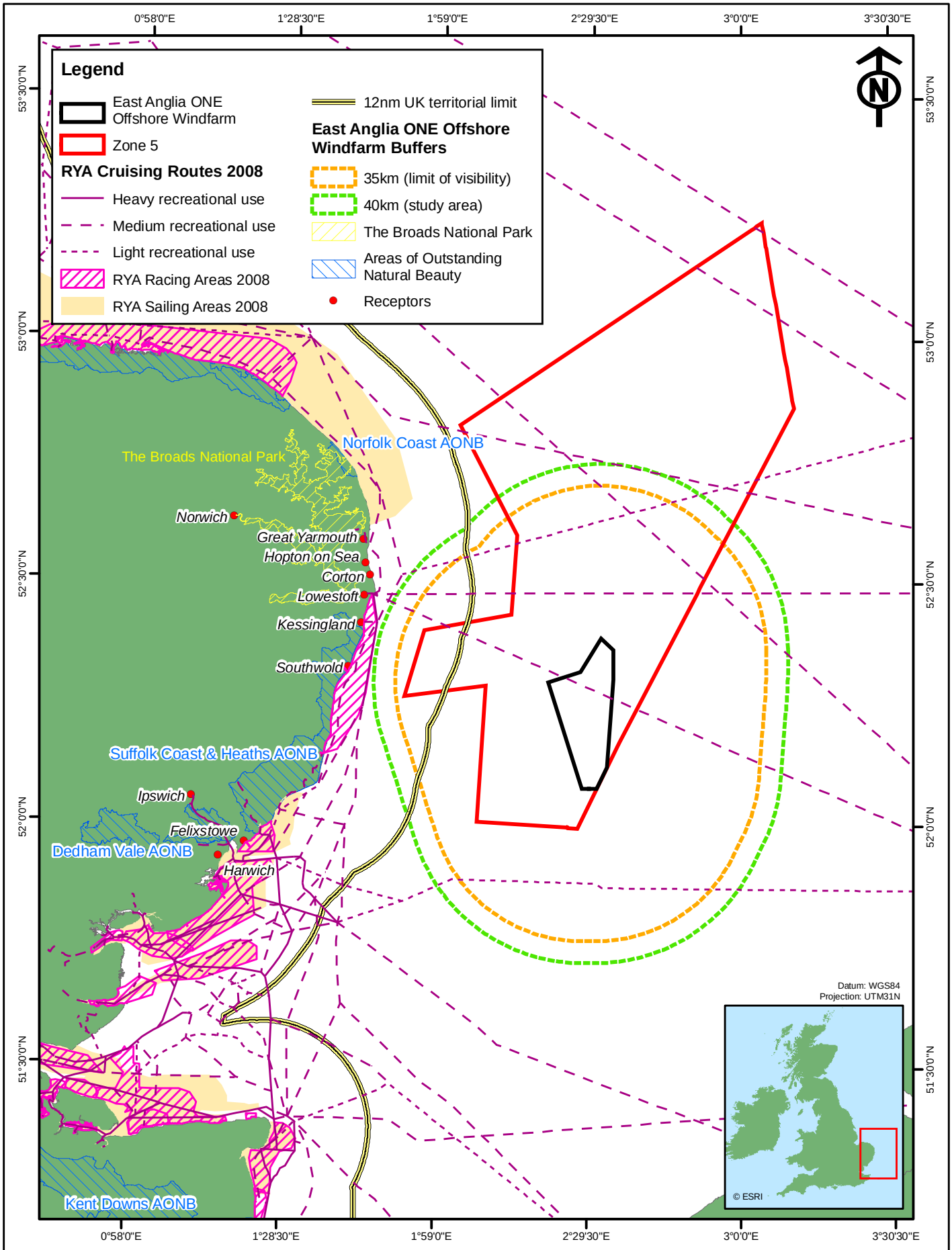
Figure 5.14 illustrates the location of various sensitive landscape designations and likely locations of sensitive visual receptors along the Norfolk and Suffolk coastlines. In addition, it illustrates the relative location of the East Anglia ONE site boundary and buffers of 12nm, the 35km limit of visibility and the 40km study area. Sensitive designations and their approximate distance to the project boundary include the Norfolk Coast AONB (65km), the Broads National Park (50km) and the Suffolk Coast and Heaths AONB (44.5km).

The figure demonstrates that all of the sensitive landscape, seascape and visual receptors are outside of the 35km limit of visibility. As noted previously, the East Anglia ONE windfarm is located over 44km from the coastline at its closest point. Therefore, all landscape, seascape and land - based receptors are scoped out of the EIA.

The scope of the landscape, seascape and visual assessment will therefore focus on sensitive visual receptors at sea, such as those on recreational boats, passenger ferries and cruises within the study area.

The East Anglia ONE windfarm is adjacent to one medium used Royal Yachting Association cruise route running north-south and a heavily used ferry route running east-west. The ferry route, situated just south of the East Anglia ONE site boundary appears to be used by StenaLine Ferries which operate from Hoek van Holland to Harwich (and vice versa) twice a day, and DFDS Seaways Ferries which operates from Esbjerg to Harwich (and vice versa) three to four times a week.

In addition, there is considerable recreational boating activity near to the East Anglia coastline (as represented in *Figure 5.14).* Ordnance, Admiralty and RYA cruising and racing data will be referred to throughout the EIA for the distribution and location of sea-based potential sensitive visual receptors and the compilation of accurate GIS figures.



East Anglia Offshore Wind
Potential Landscape Receptors

Rev	Date	By	Comment
C	05/06/10	FS	Buffers changed, 12nm added, RYA data added
B	17/06/10	JH	Updated
A	07/06/10	JH	First Issue.

Original A4 Plot Scale 1:1,164,893

0 9 18 km 0 3 6 9 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	C	6115-500-PE-027

Figure 5.14

6115-500-PE-027-B_20100617_Landscape.mxd

Data Sources

The sensitive receptors are set out under baseline conditions. Therefore, in relation to potential sensitive seascape receptors, Ordnance, Admiralty, RYA cruising and racing data and ferry data will be collected and referred to for the compilation of figures and seascape impact assessment.

Relevant good practice guidance will be used and examples of such guidance are provided below:

- DTI (2005). Guidance on the Assessment of the Impact of Offshore Windfarms: Seascape and Visual Impact Report;
- Landscape Institute and Institute of Environmental Management and Assessment (2002). Guidelines for Landscape and Visual Impact Assessment;
- Department of Energy and Climate Change (2009). UK Offshore Energy. SEA – Environmental Report; and
- SNH. Horner and MacLennan and Envision (2007). Visual Analysis of Windfarms: Good Practice Guidance.

EIA Methodology

The potential impact on seascape receptors will be assessed in terms of sea users. The desk based seascape impact assessment will use the above data sources and guidance together with GIS mapping in order to assess any impact of East Anglia ONE on the potential seascape receptors already identified.

The assessment process will be undertaken as follows:

- establish seascape sensitive receptor points (from RYA cruise and ferry routes) and identify representative viewpoints in liaison with key stakeholders;
- compile baseline identifying sensitivities and capacity of resources;
- undertake seascape impact assessment identifying magnitude of change and significance of impacts on each sensitive resource and viewpoint; and
- carry out cumulative assessment of other windfarms within 40km of East Anglia ONE and report the significance of the additional impacts contributed by the development.

Potential Project Impacts

As described above, the development has the potential to impact users at sea only. *Figure 5.14* identifies the 35km limit of visibility and the 40km study area. The RYA cruising routes are shown in *Figure 5.14* with one route marked through the East Anglia ONE site. Potential receptors based on vessels using the IMO Deep Water Route (DWR) running east of the East Anglia ONE site boundary (see *Figure 5.10)* have been scoped out since they will generally be commercial vessels.

Potential impacts to sea based visual receptors during construction may include the following:

- the visual impact of already constructed turbines on site over the construction programme; and

- the visual impact associated with increased vessel movements in the area as plant, materials and personnel are moved to and from site.

Potential operational impacts may include the following:

- the visual impact of the operating windfarm from sensitive receptors on yachts, recreational boating, passenger ferries and cruise ships; and

- the visual impact of increased vessel movements as a result of operation and maintenance activities.

Cumulative and In-Combination Impacts

Current guidance provided by Scottish Natural Heritage (SNH) on the cumulative effect of windfarms requires a base plan to be prepared showing all built windfarms, consented and undetermined applications within a 60km radius cumulative study area. The assessment will focus on assessing the impacts of windfarms within the smaller 40km study area. *Figure 5.17* illustrates known windfarm projects located outside and within 40km of the East Anglia ONE site boundary.

Based on the criteria outlined above, landscape, seascape and land based visual receptors have been scoped out of the cumulative baseline. Cumulative visual impacts therefore will only be assessed on sea based sensitive visual receptors.

In addition, it is not proposed to utilise Zone's of Theoretical Visibility (ZTV) for the analysis of cumulative impacts as these illustrate visibility based on variations in topography. As a sea based study, the theoretical visibility is

unaffected by topographic variation and therefore will extend to the limits of visibility.

Only sequential cumulative visual impacts will be assessed as receptors will be moving through the study area.

Existing oil and gas developments (see *Figure 5.16)* within the study area will be included in the cumulative baseline.

Mitigation and Monitoring

The most significant area of potential mitigation for the effects of the windfarm on visual resources is during the design of the layout of the windfarm and the location of individual turbines. Input into this iterative process will ensure that the potential effects on the most sensitive visual resources are mitigated as fully as possible.

5.4.8 Airborne Noise

Introduction

This section considers the location of airborne noise sensitive receptors in relation to the East Anglia ONE project boundary, and describes the noise sources that already affect the noise sensitive receptors. Underwater noise and vibration is dealt with in *Section 5.3.4.*

Baseline Conditions

The proposed East Anglia ONE site is located at the distances from land-based receptors as shown in *Table 5.5*

Table 5.5 Approximate Distances to Land Based Receptors from the East Anglia ONE Project Boundary

Land based receptor	Approximate distance to East Anglia ONE site boundary (km)
Aldeburgh	22,391km
Thorpeness	20,412km
Dunwich	16,616km
Southwold	14,368km
Kessingland	15,617km
Lowestoft	15,159km

Land based receptor	Approximate distance to East Anglia ONE site boundary (km)
Ipswich	53,664km
Felixstowe	49,000km
Great Yarmouth	26,550km

The area of North Sea in which East Anglia ONE will be located is close to busy shipping lanes from Harwich to Esbjerg and Harwich to the Hoek van Holland (see *Section 5.4.2*). Therefore, the area is already affected by intermittent airborne noise from shipping, and marine species will have had to become acclimatised to the current levels of both underwater (see *Section 5.3.4*) and airborne noise.

Since the East Anglia ONE site is approximately 44km from land based receptors, the effect of both airborne construction noise and operational noise on land based receptors will be low due to the attenuation of noise over the large distances involved, and noise is extremely unlikely to result in significant impacts.

Therefore, the potential impact of airborne noise resulting from construction, operation and maintenance and decommissioning of the offshore elements of East Anglia ONE has been scoped out of the EIA.

Since the location of East Anglia ONE is sufficiently distant from any land based receptors not to cause any impact in relation to airborne noise, then potential cumulative and in-combination impacts of the offshore windfarm have also been scoped out of the EIA.

5.4.9 Infrastructure and Other Users

Introduction

This section includes consideration of impacts on:

- other windfarm and renewable energy installations in the area;
- non-aviation military and MoD issues (including PEXA, any unexploded ordnance and disposal grounds);
- oil and gas pipelines and platforms;
- subsea cables; and
- aggregates dredging and dumping/disposal sites.

As described in *Section 3.3*, the location of East Anglia ONE was carefully selected to minimise interactions with other users. *Figure 5.17* represents other neighbouring offshore wind developments and *Figure 5.7* and *Figure 5.17* below represent neighbouring infrastructure and other user's interests within and surrounding East Anglia ONE and Zone 5.

Baseline Conditions

Other Windfarms and Offshore Renewables

Table 5.6 lists offshore windfarms with the southern North Sea, which are also shown geographically in *Figure 5.15.* The Inner Gabbard and Galloper sites that form the Greater Gabbard Offshore Windfarm development are approximately 34km south west of East Anglia ONE site boundary. This site was licensed to Greater Gabbard Offshore Wind as part of Round 2 and the sites are currently under construction. The capacity of Greater Gabbard will be 500MW.

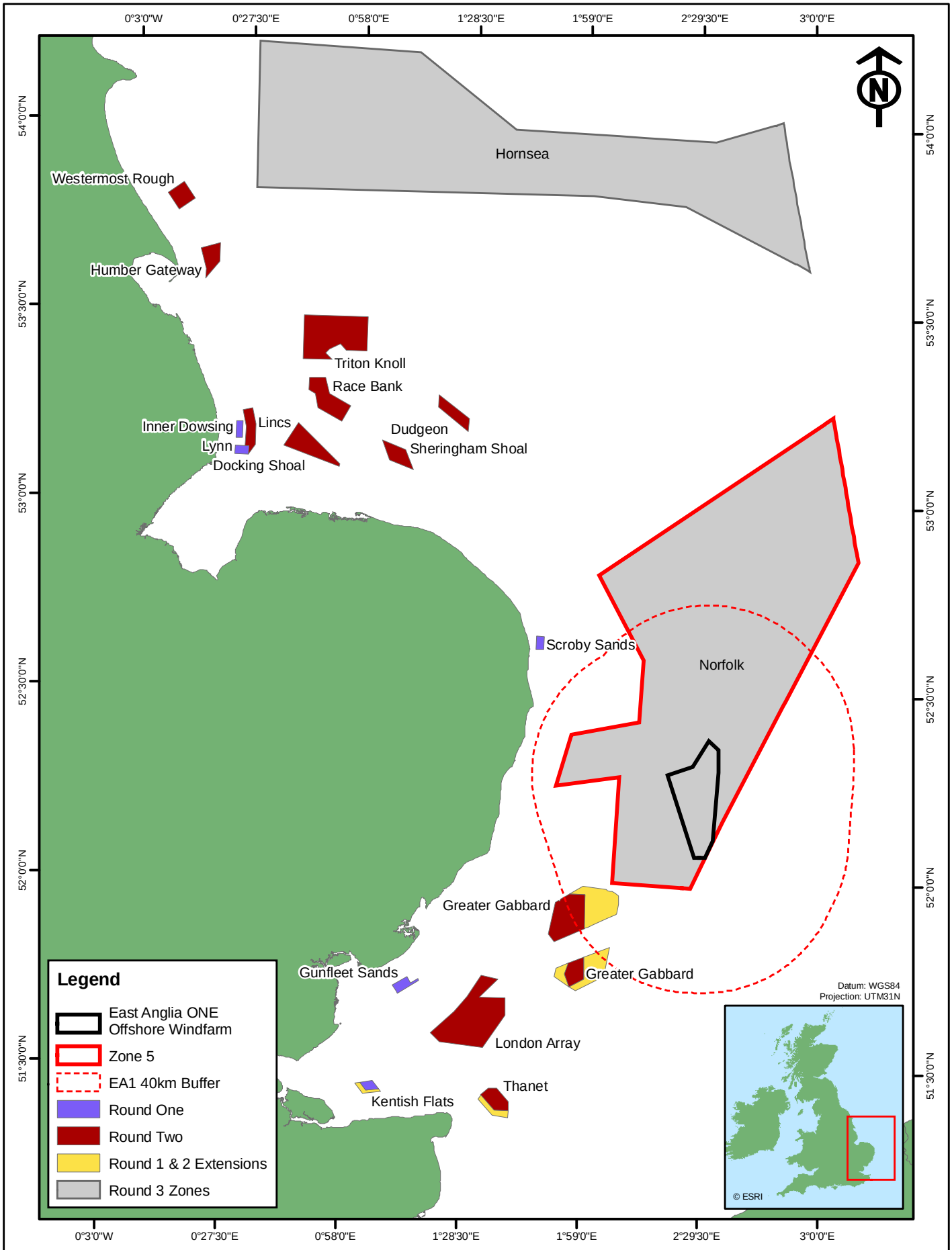
In addition, in May 2010 The Crown Estate announced extensions to both windfarms forming the Greater Gabbard Offshore Windfarm development which are mostly seaward from the existing developments and which will bring their site boundaries closer to the Zone 5 site boundary and to the East Anglia ONE site. The shortest distance between the Greater Gabbard extension boundary and the East Anglia ONE site boundary is approximately 25km.

Scroby Sands was developed by E.ON UK and is approximately 52km north-west of East Anglia ONE. This site was developed following the announcement of the Round 1 Zones. This site has a capacity of 60MW.

Table 5.6 ***UK Offshore Windfarms in the Southern North Sea*** *(constructed, in construction and in the consenting process)*

Offshore Windfarm Site Name	Crown Estates Leasing Round
Kentish Flats	Round 1
Gunfleet Sands	Round 1
Gunfleet Sand II	Round 1
Scroby Sands	Round 1
Lynn	Round 1
Inner Dowsing	Round 1
Thanet	Round 2
London Array	Round 2
Greater Gabbard	Round 2
Sheringham Shoal	Round 2
Dudgeon	Round 2
Race Bank	Round 2

Offshore Windfarm Site Name	Crown Estates Leasing Round
Docking Shoal	Round 2
Lincs	Round 2
Triton Knoll	Round 2
Humber Gateway	Round 2
Westermost Rough	Round 2
Greater Thames (extension to projects)	Round 2.5
Greater Wash (extension to projects)	Round 2.5
East Anglia Zone	Round 3
Dogger Bank Zone	Round 3
Hornsea Zone	Round 3



East Anglia Offshore Wind

Other UK offshore wind developments

Rev	Date	By	Comment
C	05/07/10	FS	Figure number updated
B	17/06/10	JH	Legend updated
A	07/06/10	JH	First Issue.

Original A4 Plot Scale 1:1,500,000

0 10 20 km 0 5 10 15 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	C	6115-500-PE-007

Figure 5.15

6115-500-PE-007-C_20100705_OtherDev.mxd

Unexploded Ordinance (UXO)

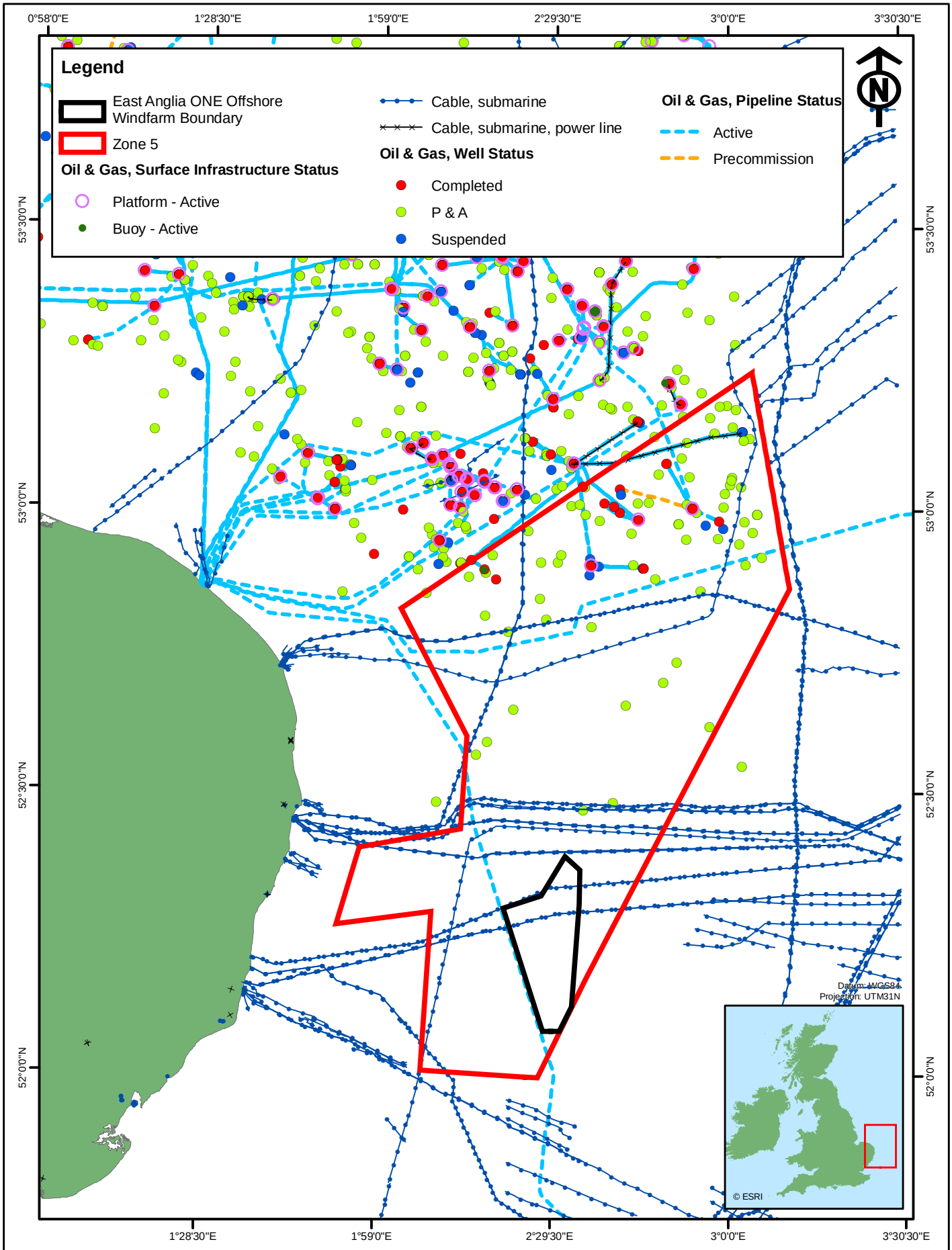
There are currently two identified explosives dumping grounds due west and south west of East Anglia ONE, although both lie outside of the site and outside of Zone 5. These are identified in *Figure 5.17*. There is also the potential for unmarked UXO to be present within or in the vicinity of East Anglia ONE area.

Oil and Gas Pipelines and Platforms

There is an active oil and gas pipeline running the length of the western boundary of the East Anglia ONE site. No oil and gas platforms or any other associated infrastructure lies within the East Anglia ONE site, although there are a number oil and gas pipelines and platforms and wells situated north of the site. Oil and gas pipelines and other oil and gas infrastructure are represented in *Figure 5.16*.

Sub Sea Cables

The are two submarine cables running east to west through the northern part of the East Anglia ONE site, and a number of other sub sea cables north and south of the site. Sub sea cables are represented in *Figure 5.16*.



IBERDROLA RENOVABLES VATTENFALL

East Anglia Offshore Wind

Infrastructure interests

Rev	Date	By	Comment
C	05/07/10	FS	Symbology updated
B	17/06/10	JH	Data changed
A	07/06/10	JH	First Issue.

Original A4 Plot Scale 1:1,000,000

0 6 12 km 0 4 8 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	C	6115-500-PE-005

Figure 5.16

6115-500-PE-005-C_20100705_Infrastruc.mxd

Aggregates Dredging and Dumping / Disposal

The East Anglia ONE site lies within a large closed disposal site know as the Warren Springs Environmental Research Laboratory site (labelled at TH075 on *Figure 5.17*). It is understood that this area was used to test the dispersion of oil slicks in the North Sea.

The Warren Springs Environmental Research Laboratory site was used between 1987 and 1995, where 157 tonnes of material is recorded to have been disposed at the site. The site is now closed.

Liaison with Cefas will continue, involving research of records held by Cefas, appraisal of monitoring studies etc, to ascertain the nature of the disposed material.

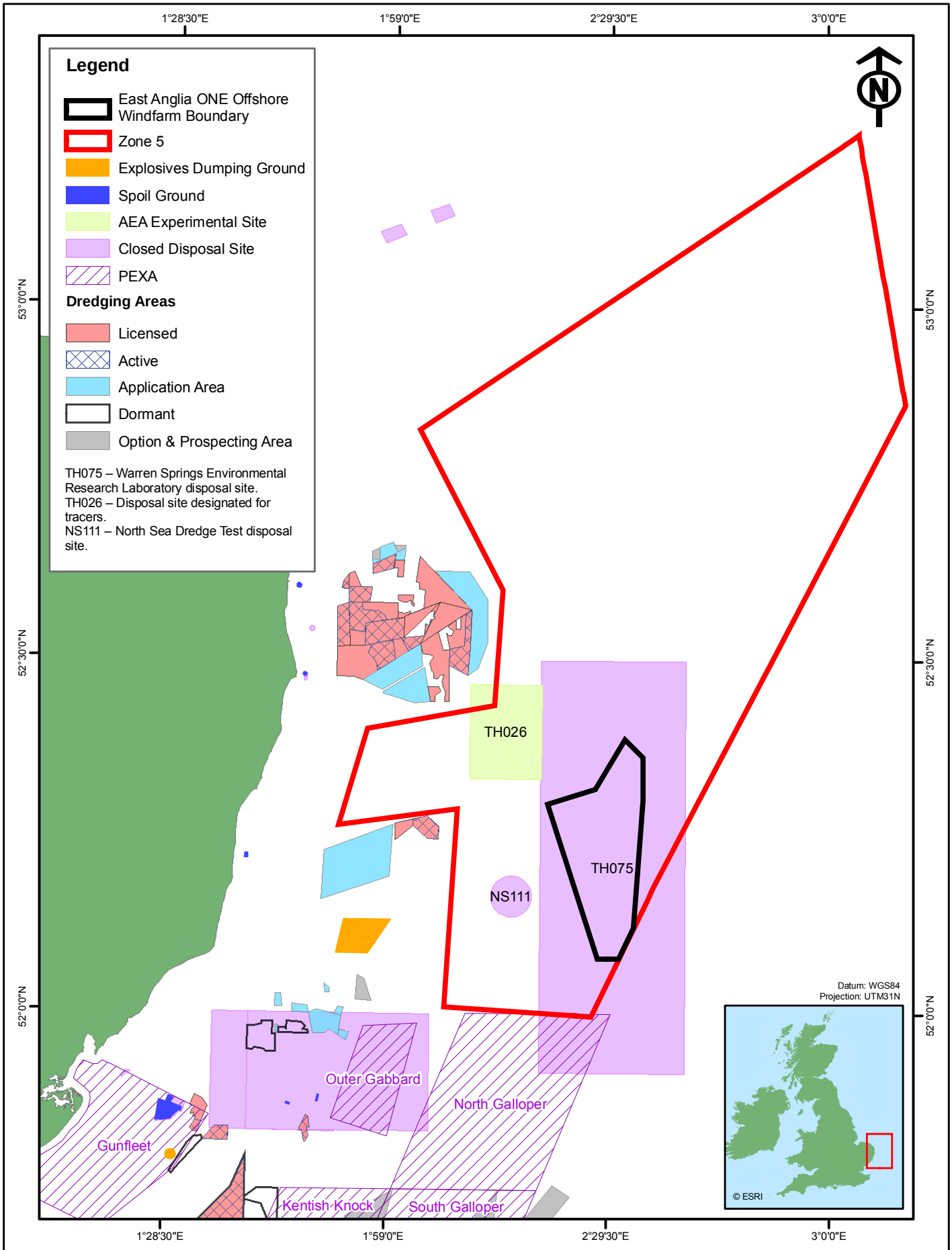
There are no other disposal sites within the East Anglia ONE site boundary, although other disposal sites in the vicinity of the East Anglia ONE site boundary (and within Zone 5) include (pers. comm., Cefas):

- site TH026, designated for tracers - the disposal site remains open, although records indicate nothing has ever been deposited here; and

- site NS111, termed the 'North Sea Dredge Test' - the disposal site is recorded to have received 13,520 tonnes of sediment in 1998.

Both sites are indicated on *Figure 5.17*.

There are no dredging areas within the East Anglia ONE site or Zone 5, although licence Area 430 located on the western boundary of Zone 5 and the North Inner Gabbard is an option area (498) approximately 35.9km south-west of East Anglia ONE. There are a number of aggregate dredging licences further south in the Outer Thames Estuary region and to the north-west in the East Anglia region. These are identified on *Figure 5.17*.



East Anglia Offshore Wind

Dredging, PEXA and Dumping Areas

Rev	Date	By	Comment
B	05/07/10	FS	Disposal Sites addded
A	21/06/10	JH	First Issue.

Original A4 Plot Scale 1:800,000

0 4 8 km

0 2 4 6 nm

Layout	Date	Rev	Dwg No.
N/A	05/07/2010	B	6115-500-PE-030

Figure 5.17

6115-500-PE-030-B_20100705_DrgPEXADmp.mxd

Non-Aviation Military and MoD Activity

No known non-aviation military or MoD activities take place within the East Anglia ONE site or Zone 5. PEXA areas are located south of East Anglia ONE and Zone 5, with the North Galloper PEXA area lying at the Zone 5 boundary. Military aviation and radar issues are dealt with in *Section 5.4.3.*

Data Sources

The following list identifies the key guidance and data sources that will inform the infrastructure and other sea users section of the EIA:

- The Crown Estate (2010). Round 3 Zone Appraisal and Planning. A Strategic Approach to Zone Design, Project Identification and Consent;
- The Crown Estate (2010). Active Dredge Zones for the East Coast Region. Available online at: http://www.thecrownestate.co.uk/dredge_areas_statistics [accessed 4/06/10];
- The Crown Estate (2010). Active Dredge Zones for the Thames Region. Available online at: http://www.thecrownestate.co.uk/dredge_areas_statistics [accessed 4/06/10];
- The Crown Estate (2010). Licensed Dredging Areas for the East Coast Region. Available online at: http://www.thecrownestate.co.uk/dredge_areas_statistics [accessed 4/06/10];
- The Crown Estate (2010). Licensed Dredging Areas for the Thames Estuary Region. Available online at: http://www.thecrownestate.co.uk/dredge_areas_statistics [accessed 4/06/10];
- DTI (2002). Human Activities in the SEA 3 Area. DTI, London;
- SeaZone (2009). GIS PEXA areas and offshore munitions disposal sites;
- Kingfisher (2009). Kingfisher Cable Awareness Chart: North Sea South, December 2009, Issue 12, available online at: http://www.kisca.org.uk/Charts/Web_NSeaSouth.pdf; and
- DECC (2009). UK Offshore Energy Strategic Environmental Assessment Appendix 3h – Other Users and Material Assets. DECC, London.

EIA Methodology

The methodology for the assessment will consist of the following stages:

- definition of study area for the infrastructure and other users/activity assessment;
- establishment of the baseline in terms of UXO, oil and gas platforms and pipelines, subsea cables, aggregates dredging and dumping / disposal, non aviation military activities and other windfarms in the study area;
- identification of potential significant impacts of construction, operational and decommissioning phases of the development for the offshore elements of the project;
- identification of mitigation and enhancement measures; and
- assessment of residual impacts, taking into account all mitigation measures.

Potential Project Impacts

The following section outlines the potential effects of the construction, operation and decommissioning phases of East Anglia ONE on infrastructure and other sea users within the development area.

During construction, there is a risk that construction activities may disturb unmarked unexploded ordinance (UXO). If this interaction were to occur there is the potential for significant impacts to the health and safety of construction workers and for damage to construction equipment and vessels. Surveys will be conducted prior to construction to ensure there is no UXO within the construction footprint.

The development of the offshore windfarm has the potential to cause changes to sea bed composition, bathymetry and hydrodynamics by increasing scour, where the physical processes are considered in *Section 5.2* This effect has the potential to impact the aggregate dredging industry if the size of sediment particles within an aggregate licence area alters as a result of the construction of the windfarm (see *Figure 5.17* for locations of dredging and dumping / disposal activities).

East Anglia ONE is not expected to cause any significant impacts to the oil and gas industry due to its location significantly south of oil and gas activity (as indicated in *Figure 5.16*) or to other offshore windfarms in the area (see *Figure 5.15*).

Potential Cumulative and In-Combination Impacts

The cumulative effects of East Anglia ONE with other activities identified above will be assessed as part of the EIA. Of the cumulative and in-combination effects, the greatest potential impacts would be expected from the accumulation of effects from East Anglia ONE with neighbouring offshore windfarm developments on dredging and use of ports and harbours for construction and operation and maintenance works.

Mitigation and Monitoring

Where conflicts between surface and subsea infrastructure are identified, owners and/or operators will be consulted and legal agreements will be put in place relating to setback distances and crossing arrangements.
Upon review of geophysical data, Remote Operate Vehicle (ROV), diving surveys and possible recovery operations may be undertaken prior to construction to confirm details of any suspected UXO. Construction staff will be briefed on the potential presence of UXO prior to deployment and will remain alert for any further unidentified ordnance.

5.5 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS, MITIGATION AND MONITORING

5.5.1 Introduction

East Anglia ONE has the potential to result in a range of environmental impacts. The likely environmental effects are collated and summarised in this section, together with a summary of mitigation and monitoring.

5.5.2 Summary of Potential Impacts

An initial qualitative assessment of all potential effects has been based on the information presently available on the project and the baseline environmental description presented above. *Table 5.3* summarises the main potential effects associated with the project. This table is not intended to be exhaustive and should be used as a guide to the likely environmental effects only.

As potential effects will vary between each phase of the project, effects have been split into the following categories:

- construction and installation;
- operation;
- maintenance; and
- decommissioning.

Note that for some of the potential effects, the significance of the effect is unknown at this stage (highlighted orange) and will require further data collection and analysis.

Table 5.7 also includes details of the issues that are considered not to be significant in nature and which have been 'scoped out' of the EIA. Consultees are invited to consider these non-significant issues and advise whether they agree with the view that these issues need not be addressed within the EIA.

Table 5.7 Summary of the Potential Project Impacts of East Anglia ONE

Potential effect	Construction	Operation	Maintenance	De-comm.
PHYSICAL ENVIRONMENT				
Marine Geology, Oceanography and Coastal Processes				
Changes to local wave climate	×	y	×	×
Changes to tidal flow regime	×	y	×	×
Increase in drag forces	y	y	×	×
Change in amphidrome behaviour	×	y	×	×
Changes to sediment pathways	y	y	×	y
Increase in suspended sediment and settlement	y	×	×	y
Changes to or interference with seabed morphology (migration of sand waves, sand banks, scour)	y	y	y	y
Changes to coastal sediment processes (coastal erosion, littoral drift)	×	y	×	y
Water Quality				
Increased suspended sediment concentration	y	×	y	Y
Increased turbidity through increased scour and deposition	y	y	y	y
Changes to fish distribution, community composition due to turbidity	y	y	y	y
Decreased primary production due to increased turbidity	y	y	y	y
Release of nutrients and contaminants into marine environment	y	×	y	y
Accidental release of contaminants into marine environment	y	×	y	y
Disturbance of existing contaminants into marine environment	y	×	y	y
Creation of obstacle to munitions	y	y	y	×
Disturbance of seabed sediments	y	×	y	y

Potential effect	Construction	Operation	Maintenance	De-comm.
Air Quality				
Contribution to greenhouse gas emissions and airborne particulates	y	×	y	×
BIOLOGICAL ENVIRONMENT				
Benthic and Epibenthic				
Loss of habitat	y	y	×	y
Sea bed disturbance	y	×	×	y
Increased suspended sediments and smothering	y	×	×	y
Change to water quality/accidental release of contaminants	y	×	×	y
Noise and vibration disturbance	y	×	×	y
Changes in grain size distribution (scour) with changes to resultant habitat	y	y	×	y
Electromagnetic field disturbance to benthic community	×	y	×	×
Increased colonisation of benthic species to hard surfaces	y	y	×	y
Fish Ecology				
Loss of fish habitat	y	y	×	y
Impact of electromagnetic fields to fish	y	y	×	×
Noise and vibration disturbance	y	y	y	y
Displacement of fish due to suspended sediments	y	×	y	y
Change to water quality/accidental release of contaminants	y	×	y	y
Increased shelter to fish	×	y	×	×
Impacts of spawning grounds due to changes to seabed composition, bathymetry and hydrodynamics by scour	y	y	×	y
Marine Mammals				
Noise disturbance	y	y	y	y
Barrier effect created by the presence of turbine structures	y	y	y	y
Loss of feeding habitat	×	y	y	×
Collision risk (vessels and underwater structure)	y	y	y	y

Potential effect	Construction	Operation	Maintenance	De-comm.
Ornithology				
Collision risk with turbines	y	y	×	×
Noise disturbance	y	y	y	y
Loss of foraging and/or breeding/nesting habitats		y	y	×
Barrier effect created by the presence of turbine structures	y	y	×	×
Change to water quality/accidental release of contaminants	y	y	y	y
HUMAN ENVIRONMENT				
Commercial Fisheries				
The presence of infrastructure on the seabed	y	y	×	×
Adverse impacts on commercially exploited species	y	y	y	y
Increased steaming times to traditional grounds	y	y	×	y
Collision risk of fishing vessels with turbines and windfarm vessels	y	y	y	y
Loss or restricted access to traditional fishing grounds	y	y	y	y
Underwater Noise and Disturbance				
Effects on fish and marine mammals as highlighted in relevant sections above	y	y	y	y
Shipping and Navigation				
Increased voyage distances and times through displacement	y	y	y	×
Increased risk of collision with turbines and other marine traffic	y	y	y	y
Maritime radar interference	×	y	×	×
Anchoring hazard with subsea cables	y	y	×	×
Increased risk of blade / mast interaction	×	y	×	×
Socio-Economic Characteristics				
Disturbance to recreational activity	y	y	×	y
Employment opportunities	y	y	y	y
Opportunities for local tourism	×	×	×	×
Improved port infrastructure	y	y	y	y
Impacts on commercial fishery (as covered in Commercial Fisheries section)	y	y	y	y

Potential effect	Construction	Operation	Maintenance	De-comm.
Increased demand for local public services/goods	y	y	y	y
Aviation				
Impact on airborne radar and defence	×	y	×	×
Impact on helicopter routes	×	y	×	×
Impact on military training paths	×	y	×	×
Increased collision risk	×	y	×	×
Landscape, Seascape and Visual				
Change to seascape character	y	y	×	y
Visual impact to receptors at shoreline and on coastal walks	×	×	×	×
Visual impact to recreational boat users	y	y	y	y
Visual impact to passengers on ferries and cruises	y	y	y	y
Visual impacts of increased vessel movements	y	y	y	y
Airborne Noise				
Noise generated from vessels, helicopters and equipment associated with the windfarms	y	×	y	y
Archaeology and Cultural Heritage				
Disturbance and destruction of submerged prehistoric archaeological sites	y	×	×	y
Disturbance and destruction of known and unknown wreck sites	y	×	×	y
Disturbance and destruction of known and unknown aviation sites	y	×	×	y
Influence to cultural heritage setting	y	y	×	×
Indirect effect: changes to sedimentation regime exposing previously protected submerged, prehistoric, maritime and aviation sites	×	y	×	×
Infrastructure and Other Users				
Degrade / interference with performance with maritime radar	×	y	×	×
Increased risk of collision of dredging vehicles with other vessels due to route change (covered in shipping above)	y	y	y	y
Disturbance to UXO during construction	y	×	×	y

5.5.3 *Summary of Mitigation and Monitoring*

Careful site selection for the East Anglia ONE project within the Zone, having regard to environmental constraints, has avoided many of the potential environmental effects. Evolution of the most sensitive layout of individual turbines through an optimisation process will also assist in minimising impacts, and additional mitigation measures will be identified where appropriate.

Where elements of uncertainty remain regarding predicted effects (as part of the full EIA), a monitoring programme and period of review may be required.

Any requirements for monitoring programmes will be discussed with the relevant regulatory authority and committed to as part of the ES. It would be expected that monitoring commitments would become subsequent consent conditions.

5.6 *ENVIRONMENTAL MANAGEMENT FRAMEWORK*

EAOW is committed to the development of the East Anglia ONE project in an environmentally responsible way, which will significantly contribute to the reduction of greenhouse gases for the UK.

An Environmental Management System is proposed to be utilised throughout all stages of East Anglia ONE project development, construction, operation and decommissioning to ensure early identification, communication and monitoring of third party environmental requirements throughout the lifetime of the project. This will include:

- a process of developing the most appropriate alternatives for the site, including site location, cable route, foundation design and construction methodology to minimise the environmental impact of the development;

- the requirement for the main contractors and their subcontractors to demonstrate that they have a project specific Environmental Management Plan and that they adhere to it; and
- procedures for the selection, management and auditing of contractors, including the requirement for the principal contractor to produce their own Environmental Management Plan encompassing a description of environmental constraints and the procedures and method statements used to prevent or minimise and mitigate any environmental impacts.

The Environmental Statement will present a preliminary Environmental Management Plan (EMP) and proposals based on the findings of the ES (see *Section 4.4)* to ensure that the key commitments in the EIA are completed, primarily covering:

- the requirements of third parties;
- the potential impacts and effects outlined in the ES;
- the requirements for any mitigation measures and monitoring;
- the results of site investigation surveys; and
- any conditions in the consents.

High level mitigation measures incorporated into the preliminary design process, from responses to this Scoping Report and initial assessments, will be recorded. During the EIA process, as each aspect of the environment has been assessed, a more detailed set of mitigation measures will evolve which will need to be implemented during the particular phases of the project in order to avoid exceeding the predicted residual impacts identified in the ES.

A table will be produced summarising all of the mitigation and control measures that that have been identified during the construction, operational and decommissioning phases of the project. Against each measure, an initial responsibility will assigned to form a preliminary Environmental Management Plan. This will then be taken by the Project Management Team and built into their forward planning.

The mitigation measures likely to arise from the decommissioning aspects of the work will be subject to further assessment at the end of the operational life of East Anglia ONE and will be agreed with the relevant licensing authorities at that time.

It should be noted that a realistic worst-case approach has been adopted throughout the EIA in order to define the most substantial likely effects on the environment. In this way, it is clear that the environmental impact of East Anglia ONE will be no greater than that set out in the ES and may indeed be notably less.

6 CONSULTATION

6.1 OVERVIEW

As described earlier in this document, this Scoping Report forms the principal material for submission to the IPC for the purposes of requesting a Scoping Opinion under section 8(3) of the Infrastructure Planning (EIA) Regulations 2009.

In preparing this Scoping Report to provide for the requirements under section 8(3) of the Infrastructure Planning (EIA) Regulations, preliminary consultation with a number of bodies and organisations has been conducted.

In consulting on this project it is EAOW's aim to:

- introduce the proposed project;
- identify and discuss particular issues of concern;
- establish what existing information is available; and
- discuss the need and scope of studies/surveys that may be required to inform the EIA process.

Statutory and non-statutory organisations that EAOW intends to consult with during the EIA process include, *inter alia,* those statutory and non statutory organisations listed below.

- 1st East;
- All Saints and St Nicholas, St Michael and St Peter South Elmham Parish Council;
- Andrew Weir Shipping Ltd;
- Ashby with Oby Parish Council;
- Associated British Ports;
- Barnby Parish Council;
- Barsham and Shipmeadow Parish Council;
- Beccles Town Council;
- Belton with Browston Parish Council;
- Benacre Parish Meeting;
- Blundeston and Flixton Parish Council;
- Blyford and Sotherton Parish Council;
- BP Shipping Ltd;
- Bradwell Parish Council;
- Brampton with Stoven Parish Council;
- Bristow Helicopters;
- British Divers Marine Life Rescue;
- British Marine Aggregate Producers Association;

- British Sub Aqua Club;
- British Trust for Ornithology;
- Broads Authority;
- Bungay Town Council;
- Burgh Castle Parish Council;
- Civil Aviation Authority;
- Caister on Sea Parish Council;
- Carlton Colville Parish Council;
- Carnival UK;
- Centre for Environment, Fisheries & Aquaculture Science (CEFAS);
- Chamber of Shipping;
- CHC Helicopters;
- City College Norwich;
- CMA CGM (UK) Holdings Ltd;
- Coastal Partnerships/ Fora;
- College of West Anglia;Comité National des Pêches Maritimes et des Elevages Marins (CNPMEM);
- Commission for Rural Communities;
- Corton Parish Council;
- Country Land and Business Association;
- Covehithe Parish Meeting;
- Cruising Association;
- DFDS Seaways;
- DFDS Tor Line plc;
- East of England Fish Producers Association;
- East of England Tourism;
- East Port UK;
- Eastern Region Wind Energy Group;
- Eastern Sea Fisheries Joint Committee;
- Easton College;
- East of England Development Agency;
- English Heritage;
- Environment Agency – East Anglia;
- Equality and Human Rights Commission;
- Europeche;
- Evergreen Marine (UK) Ltd;
- Federatie van Visserijverenigingen (FV);
- Federation of Dredging Companies;
- Filby Parish Council;
- Fleggburgh Parish Council;
- Flixton, St Cross South Elmham and St Margaret South Elmham Parish Council;
- Fred Olsen Cruise Lines;
- Friends of the Earth;

- Friends of the Earth Norfolk;
- Fritton with St Olaves Parish Council;
- Frostenden, Uggeshall and South Cove Parish Council;
- Gisleham Parish Council;
- Great Yarmouth Port;
- Great Yarmouth and District Round Table;
- Great Yarmouth and Gorleston Sailing Club;
- Great Yarmouth Haven Rotary Club;
- Greenpeace;
- Grimsby District Fishing Officer;
- Gulf Offshore NS Ltd;
- Halesworth Town Council;
- Health and Safety Executive;
- Hemsby Parish Council;
- Henstead with Hulver Street Parish Council;
- HM Coastguard;
- Holton Parish Council;
- Homersfield Parish Council;
- Honourable Company of Master Mariners;
- Hopton on Sea Parish Council;
- Hunstanton Sea Life Sanctuary;
- Hutchison Ports;
- Infrastructure Planning Commission (IPC);
- International Dolphin Watch;
- International Port Holdings;
- International Ports;
- Ipswich Borough Council;
- Joint Nature Conservation Committee (JNCC);
- Joint Nautical Archaeology Policy Committee;
- Kent & Essex Fisheries Committee;
- Kessingland Parish Council;
- Lound Parish Council;
- Lowestoft and District;
- Lowestoft College;
- Lowestoft Cruising Club;
- Lowestoft Rotary Club;
- Lowestoft South Rotary Club;
- Maersk Company;
- Maersk Ship Management BV;
- Marine Biological Association;
- Marine Conservation Society;
- Marine Management Organisation;
- Maritime and Coastguard Agency (MCA);
- Martham Parish Council;

- Mautby Parish Council;
- Mettingham Parish Council;
- Marine Mammal Organisation (MMO) Eastern District office – Lowestoft;
- Ministry of Defence (MoD)
- Mutford Parish Council;
- National Federation of Fishermen's Organisations;
- National Grid;
- National Air Traffic Systems (NATS);
- Natural England;
- Nautical Institute;
- NetGain;
- Nederlands Instituut voor Visserij Onderzoek (RIVO);
- Norfolk and Norwich Naturalists' Society;
- Norfolk Biodiversity Partnership;
- Norfolk Chamber of Commerce;
- Norfolk County Association of Parish and Town Councils;
- Norfolk County Council;
- Norfolk Federation of Women's Institutes;
- Norfolk Foundation;
- Norfolk Wildlife Trust;
- Norfolkline;
- North Cove Parish Council;
- North Norfolk District Council;
- North Sea Regional Advisory Council;
- Norwich Airport;
- Norwich Sub Aqua Club;
- Ofcom;
- Oil & Gas UK;
- Ormesby St Margaret with Scratby Parish Council;
- Ormesby St Michael Parish Council;
- Otley College;
- Oulton Parish Council;
- P&O Ferries Ltd;
- P&O Steam Navigation Company;
- Passenger Shipping Association;
- PD Ports;
- Rederscentrale;
- Redisham Parish Meeting;
- Renewable Energy Association;
- Renewables UK (formally BWEA);
- Repps with Bastwick Parish Council;
- Reydon Parish Council (including Easton Bavents);
- Ringsfield and Weston Parish Council;
- Rollesby Parish Council;

- Royal Institute of Naval Architects;
- Royal Institute of Navigation;
- Royal National Lifeboat Institution (RNLI);
- Royal National Mission to Deep Sea Fishermen;
- Royal Norfolk & Suffolk Yacht Club;
- Royal Society for the Protection of Birds (RSPB) east of England;
- Royal Society for the Protection of Birds (RSPB);
- Rumburgh Parish Council;
- Rushmere Parish Meeting;
- Royal Yachting Association (RYA);
- Sea Mammals Research Unit (SMRU);
- Sea Watch;
- Seafish;
- Shadingfield, Sotterley Willingham and Ellough Parish Council;
- Shell International Trading and Shipping Co Ltd;
- Society of Maritime Industries;
- Somerleyton, Ashby and Herringfleet Parish Council;
- Somerton Parish Council;
- Southwold Town Council;
- Spexhall Parish Council;
- St Andrew Ilketshall Parish Council;
- St James South Elmham Parish Meeting;
- St John Ilketshall Parish Meeting;
- St Lawrence Ilketshall Parish Council;
- St Margaret Ilketshall Parish Meeting;
- Stena Line Ltd;
- Stokesby Parish Council;
- Suffolk Chamber of Commerce;
- Suffolk County Council;
- Suffolk East Federation of Women's Institutes;
- Suffolk Foundation;
- Suffolk New College;
- Suffolk Wildlife Trust;
- Surfers Against Sewage;
- Swire Pacific Offshore (North Sea) Ltd;
- Tarmac Marine Dredging Ltd;
- Thames Estuary Partnership University College;
- The Commission for Architecture and the Built Environment;
- The Crown Estate;
- The Crown Estate Fishing Liaison Officer;
- Thurne Parish Council;
- Tilbury - Forth Ports;
- Trico Supply (UK) Ltd;
- Trinity House;

- UK Business Council for Sustainable Energy;
- United Kingdom Major Ports Group Ltd (UKMPG);
- VisNed;
- Vroon Offshore Services Ltd;
- Wangford with Henham Parish Council;
- Waveney District Council;
- Wells-next-the-Sea;
- West Caister Parish Council;
- West Suffolk College;
- Westhall Parish Council;
- Whale and Dolphin Conservation Society;
- Wildfowl & Wetlands Trust;
- Wildlife and Countryside Link;
- Winterton on Sea Parish Council;
- Wissett Parish Council;
- Worlingham Parish Council;
- Wrentham Parish Council; and
- World Wildlife Fund (WWF) UK.

6.2 PUBLIC INFORMATION DAYS

In addition to the written consultation with stakeholders presented above, EAOW will engage in person with those stakeholders and members of the local community via a series of public information days to be held to coincide with the EIA scoping process. At these information days, members of the EAOW team will be on hand to answer queries on the scoping process and to explain the development in further detail.

Great Yarmouth: Tuesday 20th June
Imperial Hotel
3pm – 8pm

Lowestoft: Wednesday 21st June 2010
Orbis Energy
3pm – 8pm

Further information on the public information days and general information relating to East Anglia ONE and EAOW can be found on the EAOW website (http://www.eastangliawind.com/).

7 SCOPING QUESTIONS

EAOW wishes to request authorities to consider the questions outlined below when reviewing this Scoping Report.

1. Have all the legislative and consenting requirements relevant to East Anglia ONE been identified and adequately described (with reference to *Section 2*)?

2. Does the description of East Anglia ONE provide enough information with regards to the nature of the development, at this early stage of project development (with reference to *Section 3*)?

3. Does the approach outlined for the assessment of effects look appropriate for the nature and scale of East Anglia ONE (with reference to *Section 4*, and having regard to the fact that further, detailed scopes of work are available on request)?

4. Are the proposed areas included for the cumulative impact assessment appropriate (with reference to *Section 5*)?

5. Are the suggested topics for assessment adequate for the purposes of East Anglia ONE (with reference to *Section 5*)?

6. Are there any other sources of environmental information that should be consulted (with reference to *Section 5*)?

7. Is the EIA methodology described for each topic sufficiently detailed in order to provide a robust assessment (with reference to *Section 5*)?

8. Have the most likely and significant potential project effects been identified? Are there any other appropriate potential effects that should be considered for inclusion in the full assessment process (with reference to *Section 5*)?

9. Does the list of proposed consultees reflect the range of stakeholders that should be considered (with reference to *Section 6*)?

8 FURTHER INFORMATION

EAOW invites consultees to comment on this Scoping Report, provide comment on the methodologies proposed, identify any concerns that they consider have not been addressed in this document and provide details of any relevant environmental information that would inform the assessment. This information will then be taken into account in developing the scope and approach to the EIA.

Detailed scopes of work are available for all of the key environmental topic areas which provide more information than is included in this Scoping Report. Copies of these are available on request.

EAOW is now seeking consultees' views on East Anglia ONE in order to incorporate these into the EIA process. All responses should be addressed to:

Helen Thompson
Project Manager
ScottishPower Renewables
4th Floor
1 Atlantic Quay
Glasgow
G2 8JB
0141 614 0444

Or email response to:

Helen.thompson@scottishpower.com

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Annex A

Scoping Tables

A1 SCOPING TABLES

Table A1.1 Species Table

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Bewick's Swan	Low	High	Low	-	✓	Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Whooper Swan	Low	High	Low	-	✓	Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Bean Goose	Medium	Medium	Low	-		Passage	No	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Pink-footed Goose	Medium	Medium	Low	-	✓	Passage	No	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Eurasian White-fronted Goose	Medium	Medium	Low	-	✓	Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Dark-bellied Brent Goose	Medium	Medium	Low	-	✓	Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Shelduck	Low					Passage	No	Migration Atlas UK & Ireland 2002

(1) Information source column to include details of evidence base for information set out in previous column including vulnerability, SPA designation, cumulative impact etc. Sources may include Seabirds at Sea database, SEA data, preliminary surveys, historic

(2) 'Displacement' includes direct habitat loss

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Wigeon	Unknown	Unknown	Unknown	-	✓	Passage	No	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Shoveler	Unknown	Unknown	Unknown	-	✓	Passage	No	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Pochard	Unknown	Unknown	Unknown	-	✓	Passage	No	Migration Atlas UK & Ireland 2002
Pintail	Unknown	Unknown	Unknown	-	✓	Passage	No	Migration Atlas UK & Ireland 2002
Tufted Duck	Unknown	Unknown	Unknown	-		Passage	No	Migration Atlas UK & Ireland 2002
Long-tailed Duck	Medium	Low	Medium	Medium		Wintering	No	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Velvet Scoter	Medium	Low	Medium	Medium		Wintering	No	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Common Scoter	Medium	Low	Medium	Medium		Passage, Wintering	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Red-breasted Merganser	Low	Low	Low	Medium		Wintering	No	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Red-throated Diver	High	Low	Medium	Medium	✓	Passage, Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Black-throated Diver	High	Low	Medium	Medium		Passage, Wintering	No	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Northern Fulmar	Low	Low	Low	Medium		Breeding, Passage, Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Little Grebe	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Great Crested Grebe	Medium	Low	Medium	Medium		Passage, Wintering	No	Cowrie CIA Report Appendix 7
Balearic Shearwater	Low	Low	Unknown	Medium		Breeding, Passage	No	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Northern Gannet	Low	Medium	Low	Low	✓	Breeding, Passage, Wintering	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Shag	Medium	Low	Medium	Medium		Passage, Wintering	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Great Cormorant	Low	Medium	Medium	Medium	✓	Breeding, Passage, Wintering	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Grey Heron	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Oystercatcher	Low	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Ringed Plover	Medium	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Golden Plover	High	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Grey Plover	Medium	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Lapwing	Low	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Knot	High	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Dunlin	Medium	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Snipe		Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Woodcock		Unknown	Unknown	Unknown		Passage	No	Cowrie CIA Report Appendix 7
Black-tailed Godwit	High	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Bar-tailed Godwit	Medium	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Curlew	Medium	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Redshank	High	Unknown	Unknown	Unknown	✓	Passage	No	Cowrie CIA Report Appendix 7, Construction & Waterfowl: Defining Sensitivity, Response, Impacts and Guidance IECS 2008
Turnstone	High	Unknown	Unknown	Unknown	✓	Passage	No	Migration Atlas UK & Ireland 2002
Pomarine Skua	Low	Medium	Low	Low		Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Arctic Skua	Low	Medium	Low	Low		Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Great Skua	Low	Medium	Low	Low		Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Little Gull	Low	Low	Low	Low		Passage, Wintering	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Black-headed Gull	Low	Low	Low	Low		Breeding, Passage, Wintering	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Common Gull	Low	Low	Low	Low		Breeding, Passage, Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Lesser Black-backed Gull	Low	Medium	Low	Low	✓	Breeding, Passage, Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Herring Gull	Low	Medium	Low	Low		Breeding, Passage, Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Great Black-backed Gull	Low	Medium	Low	Low		Breeding, Passage, Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Black-legged Kittiwake	Low	Medium	Low	Low	✓	Breeding, Passage, Wintering	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Sandwich Tern	Low	Medium	Low	Medium	✓	Breeding, Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Roaseate Tern	Low	Medium	Low	Medium	✓	Passage	No	RSPB Research Report No. 39 2010
Common Tern	Low	Medium	Low	Medium	✓	Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Arctic Tern	Low	Medium	Low	Medium		Passage	Yes	Seabird Atlas 1995, JNCC Report No.431 2010
Little Tern	Low	Low	Low	Medium	✓	Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Guillemot	Medium	Low	Medium	Medium		Wintering, Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010
Razorbill	Medium	Low	Medium	Medium		Wintering, Passage	Yes	Cowrie CIA Report Appendix 7, RSPB Research Report No. 39 2010

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Little Auk	Medium	Low	Medium	Medium		Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Atlantic Puffin	Low	Medium	Medium	Medium		Wintering	Yes	Seabird Atlas 1995, JNCC Report No.431 2010, RSPB Research Report No. 39 2010
Common Cuckoo	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Long-eared Owl	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Short-eared Owl	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Skylark	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Sand Martin	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Barn Swallow	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Tree Pipit	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Meadow Pipit	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Rock Pipit	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Grey Wagtail	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Pied/White Wagtail	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Waxwing	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Robin	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Redstart	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Winchat	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002

	Vulnerability to wind farm development? (high, medium, low, unknown)				**Feature of SPA with potential for interaction with site?** (if yes, see table 2 below**)**	**Use of site (breeding, wintering, passage, combination)**	**Potential for cumulative impact?** (if yes, see table 4 below)	**Information sources used (see notes)** [1]
	Displacement [2]	**Collision**	**Barrier effect**	**Indirect effects eg prey species**				
Wheatear	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Ringed Ouzel	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Blackbird	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Fieldfare	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Redwing	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Song Thrush	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Lesser Whitethroat	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Blackcap	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Chiffchaff	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Willow Warbler	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Goldcrest	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Starling	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Chaffinch	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Brambling	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Greenfinch	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Siskin	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Redpoll	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002
Reed Bunting	Unknown	Unknown	Unknown	Unknown		Passage	No	Migration Atlas UK & Ireland 2002

Notes: This table is intended to outline core information about bird sensitivities to inform early stakeholder liaison and support a formal scoping request.

Table A1.2 Special Protection Area – Summary of Potential Affected Sites

Species [1]	Site name(s)	Site number(s)	Minimum distance of development from site	Qualifying feature? [2]	Population of SPA [3] and status (current, at designation or from SPA review)	Sensitivity [4]	Additional notes [5]
Bewick's Swan	Arun Valley	UK9020281	241 km		115W	High	
	Avon Valley	UK9011091	323 km		135W		
	Breydon Water	UK9009181	56 km		391W		
	Broadland	UK9009253	48 km		320W		
	Dungerness to Pett Level	UK9012091	163 km		179W		
	Lough Foyle	UK9020031	689 km		78W		
	Lough Neagh and Lough Beg	UK9020091	625 km		136W		
	Lower Derwent Valley	UK9006092	275 km		72W		
	Martin Mere	UK9005111	380 km		449W		
	Nene Washes	UK9008041	159 km		1,718W		
	Ouse Washes	UK9008031	141 km		4,639W		
	Ribble and Alt Estuaries (Phase 2)	UK9005103	382 km		229W		
	Severn Estuary	UK9015022	330 km		280W		
	Somerset Levels and Moors	UK9010031	373 km		191W		
	Walmore Common	UK9007051	327 km		104W		
Whooper Swan	Ouse Washes	UK9008031	141 km		963W	High	
	Broadland	UK9009253	48 km		133W		
	Martin Mere	UK9005111	380 km		621W		
Pink-footed Goose	Broadland	UK9009253	48 km		3,290W	Medium	
	North Norfolk Coast	UK9009031	111 km		23,802W		
	The Wash	UK9008021	142 km		33,265W		

(1) From Table 1 above

(2) Some species fall within definition of aggregations rather than being listed by species (All species listed are Qualifying Interests of the Relevant SPAs in Column 2, no Assemblage species have been included at this time) W = Wintering population, B = Breeding population, P = Passage population.

(3) From SPA data form unless more recent data available

(4) From 2nd column of Table 1 (Given the current lack of data this is taken to be the highest value from column 2)

(5) Please note here, if relevant, any relationship between the sites – e.g. shared population, key ecological linkage etc – or other relevant information

Species [1]	Site name(s)	Site number(s)	Minimum distance of development from site	Qualifying feature? [2]	Population of SPA [3] and status (current, at designation or from SPA review)	Sensitivity [4]	Additional notes [5]
Eurasian White-fronted Goose	Alde-Ore Estuary	UK9009112	54 km		97W	Medium	
	Breydon Water	UK9009181	56 km		164W		
	Broadland	UK9009253	48 km		746W		
	North Norfolk Coast	UK9009031	111 km		352W		
	Severn Estuary	UK9015022	330 km		2,664W		
	Thames Estuary and Marshes	UK9012021	137 km		88W		
	The Swale	UK9012011	128 km		1,309W		
	The Wash	UK9008021	142 km		100W		
Dark-bellied Brent Goose	Benfeet and Southend Marshes	UK9009171	132 km		3,819W	Medium	
	Blackwater Estuary	UK9009245	111 km		15,392W		
	Chesil Beach and The Fleet	UK9010091	382 km		3,182W		
	Chichester and Lagstone Harbours	UK9011011	267 km		17,119W		
	Colne Estuary (Mid-Essex Coast Phase 2)	UK9009243	75 km		4,907W		
	Crouch and Roach Estuaries (Mid-Essex	UK9009244	118 km		3,074W		
	Coast Phase 3)	UK9009242	110 km		2,308W		
	Dengie (Mid-Essex Coast Phase 1)	UK9010081	439 km		1,905W		
	Exe Estuary	UK9009246	107 km		13,075W		
	Foulness (Mid-Essex Coast Phase 5)	UK9009131	84 km		6,892W		
	Hamford Water	UK9006111	184 km		2,553W		
	Humber Flats, Marshes and Coast (Phase 1)	UK9012031	139 km		3,205W		
	Medway Estuary and Marshes	UK9009031	111 km		11,512W		
	North Norfolk Coast	UK9010111	343 km		1,480W		
	Poole Harbour	UK9011051	282 km		2,847W		
	Portsmouth Harbour	UK9011061	289 km		7,506W		
	Solent And Southampton Water	UK9009121	80 km		2,711W		
	Stour and Orwell Estuaries	UK9012011	128 km		1,961W		
	The Swale	UK9008021	142 km		22,248W		
	The Wash						
Shelduck	Medway Estuary and Marshes	UK9012031	139 km		4,465W	Unknown	
	Blackwater Estuary (Mid-Essex Coast Phase	UK9009245	111 km		4,594W		
	4)	UK9009121	80 km		3,672W		
	Stour and Orwell Estuaries	UK9008021	142 km		15,981W		
	The Wash						

Species [1]	Site name(s)	Site number(s)	Minimum distance of development from site	Qualifying feature? [2]	Population of SPA [3] and status (current, at designation or from SPA review)	Sensitivity [4]	Additional notes [5]
Wigeon	Ouse Washes North Norfolk Coast	UK9008041 UK9009031	141 km 111 km		29,713W 14,039W	Unknown	
Shoveler	The Swale Abberton Reservoir Nene Washes Ouse Washes Rutland Water Broadland	UK9012011 UK9009141 UK9008031 UK9008041 UK9008051 UK9009253	128 km 111 km 159 km 141 km 205 km 48 km		471W 654W 413W 155B 526W 401W	Unknown	
Teal	Abberton Reservoir Hamford Water	UK9009141 UK9009131	111 km 84 km		5,326W 4,206W	Unknown	
Pochard	Ouse Washes	UK9008041			3,590W	Unknown	
Pintail	Medway Estuary and Marshes The Swale Stour and Orwell Estuaries Nene Washes Ouse Washes The Wash North Norfolk Coast	UK9012031 UK9012011 UK9009121 UK9008031 UK9008041 UK9008021 UK9009031	139 km 128 km 80 km 159 km 141 km 142 km 111 km		697W 966W 878W 1,435W 1,755W 923W 1,139W	Unknown	
Common Scoter	North Norfolk Coast	UK9009031	111 km		2,909W	Medium	
Red-throated Diver	Outer Thames Estuary pSPA	UK1452147	7 km		6,486W	High	
Northern Gannet	Flamborough Head and Bempton Cliffs	UK9006101	259 km	Assemblage only	7,859B	High	
Cormorant	Abberton Reservoir	UK9009141	111 km		490B	Cormorant	

Species [1]	Site name(s)	Site number(s)	Minimum distance of development from site	Qualifying feature? [2]	Population of SPA [3] and status (current, at designation or from SPA review)	Sensitivity [4]	Additional notes [5]
Ringed Plover	Thames Estuary & Marshes Medway Estuary and Marshes Benfleet and Southend Marshes The Swale Blackwater Estuary (Mid-Essex Coast Phase 4) Stour and Orwell Estuaries Hamford Water The Wash North Norfolk Coast	UK9012021 UK9012031 UK9009171 UK9012011 UK9009245 UK9009121 UK9009131 UK9008021 UK9009031	137 km 139 km 132 km 128 km 111 km 80 km 84 km 142 km 111 km		559P, 541W 1,337P, 768W 800P 683P 955P, 600W 578W 1,572P, 520W 1,185P 1,256P	Unknown	
Dunlin	Medway Estuary and Marshes Blackwater Estuary (Mid-Essex Coast Phase 4) Stour and Orwell Estuaries The Wash	UK9012031 UK9009245 UK9009121 UK9008021	139 km 111 km 80 km 142 km		25,936W 33,267W 23,940W 35,620W	Unknown	
Black-tailed Godwit	Medway Estuary and Marshes The Swale Blackwater Estuary (Mid-Essex Coast Phase 4) Stour and Orwell Estuaries Hamford Water Nene Washes Ouse Washes The Wash North Norfolk Coast	UK9012031 UK9012011 UK9009245 UK9009121 UK9009131 UK9008031 UK9008041 UK9008021 UK9009031	139 km 128 km 111 km 80 km 84 km 159 km 141 km 142 km 111 km		957W 1,755W 1,280W 2,475W 1,121W 16B 26B, 1,198W 859W 1,236W	Unknown	
Bar-tailed Godwit	Foulness (Mid Essex Coast Phase 5) The Swale Dengie (Mid-Essex Coast Phase 1) The Wash Gibraltar Point	UK9009246 UK9012011 UK9009242 UK9008021 UK9008022	107 km 128 km 110 km 142 km 162 km		7,639W 542W 1,156W 11,250W 719W	Unknown	

Species [1]	Site name(s)	Site number(s)	Minimum distance of development from site	Qualifying feature? [2]	Population of SPA [3] and status (current, at designation or from SPA review)	Sensitivity [4]	Additional notes [5]
Curlew	Blackwater Estuary (Mid-Essex Coast Phase 4) Foulness (Mid Essex Coast Phase 5) Medway Estuary and Marshes Stour and Orwell Estuaries The Wash The Swale	UK9009245 UK9009246 UK9012031 UK9009121 UK9008021 UK9012011	111 km 107 km 139 km 80 km 142 km 128 km		2,682W 2,127W 1,900W 2,153W 3,835W 1,622W	Unknown	
Redshank	Alde-Ore Estuary Medway Estuary and Marshes The Swale Foulness (Mid Essex Coast Phase 5) Blackwater Estuary (Mid-Essex Coast Phase 4) Colne Estuary (Mid-Essex Coast Phase 2) Stour and Orwell Estuaries The Wash North Norfolk Coast	UK9009112 UK9012031 UK9012011 UK9009246 UK9009245 UK9009243 UK9009121 UK9008021 UK9009031	54 km 139 km 128 km 107 km 111 km 100 km 75 km 142 km 111 km		1,919W 2,144P 1,640W 3,690W 4,015W 2,077W 3,545W 2,953W 220B, 2,998W	Unknown	
Knot	Benfleet and Southend Marshes The Swale Foulness (Mid Essex Coast Phase 5) Dengie (Mid-Essex Coast Phase 1) The Wash Gibraltar Point	UK9009171 UK9012011 UK9009242 UK9009246 UK9008021 UK9008022	132 km 128 km 107 km 110 km 142 km 162 km		8,850W 5,582W 40,429W 8,393W 186,892W 10,155W	Unknown	
Grey Plover	Benfleet and Southend Marshes The Swale Foulness (Mid Essex Coast Phase 5) Blackwater Estuary (Mid-Essex Coast Phase 4) Dengie (Mid-Essex Coast Phase 1) Hamford Water The Wash Gibraltar Point	UK9009171 UK9012011 UK9009246 UK9009245 UK9009242 UK9009131 UK9008021 UK9008022	132 km 128 km 107 km 111 km 110 km 84 km 142 km 162 km		3,789W 2,021W 4,209W 5,090W 2,411W 3,251W 9,708W 2,017W	Unknown	

Species [1]	Site name(s)	Site number(s)	Minimum distance of development from site	Qualifying feature? [2]	Population of SPA [3] and status (current, at designation or from SPA review)	Sensitivity [4]	Additional notes [5]
Golden Plover	The Swale Foulness (Mid Essex Coast Phase 5) Abberton Reservoir Colne Estuary (Mid-Essex Coast Phase 2) Stour and Orwell Estuaries Hamford Water The Wash North Norfolk Coast Breydon Water	UK9012011 UK9009246 UK9009141 UK9009243 UK9009121 UK9009131 UK9008021 UK9009031 UK9009181	128 km 107 km 111 km 75 km 80 km 84 km 142 km 111 km 56 km		2,862W 3,359W 3,714W 2,530W 3,360W 4,118W 11,037W 2,667W 5,040W	Unknown	
Oystercatcher	Foulness (Mid Essex Coast Phase 5) The Wash	UK9009246 UK9008021	107 km 142 km		11,756W 25,651W	Unknown	
Turnstone	Thanet Coast and Sandwich Bay Stour and Orwell Estuaries The Wash	UK9012071 UK9009121 UK9008021	104 km 80 km 142 km		940W 836W 717W	Unknown	
Lesser Black-backed Gull	Alde-Ore Estuary	UK9009112	54 km		14,070B 550,000 Bio-geographic Population	Medium	Alde-Ore Estuary regularly supports 59,118 seabirds including herring, black-headed and lesser black-backed gull as well as little and sandwich tern species.
Black-legged Kittiwake	Flamborough Head and Bempton Cliffs	UK9006101	259 km		83,370B	Low	
Sandwich Tern	Alde-Ore Estuary Foulness (Mid Essex Coast Phase 5) North Norfolk Coast	UK9009112 UK9009246 UK9009031	54 km 107 km 111 km		170B 320B 3,457B	Medium	
Roseate Tern	North Norfolk Coast	UK9009031	111 km		2B	Medium	

Species [1]	Site name(s)	Site number(s)	Minimum distance of development from site	Qualifying feature? [2]	Population of SPA [3] and status (current, at designation or from SPA review)	Sensitivity [4]	Additional notes [5]
Common Tern	Foulness (Mid Essex Coast Phase 5)	UK9009246	1056 km		220B	Medium	
	The Wash	UK9008021	142 km		152B		
	North Norfolk Coast	UK9009031	111 km		460B		
	Breydon Water	UK9009181	56 km		155B		
Little Tern	Alde-Ore Estuary	UK9009112	54 km		48B	Medium	
	Medway Estuary and Marshes	UK9012031	139 km		28B		
	Foulness (Mid Essex Coast Phase 5)	UK9009246	107 km		24B		
	Blackwater Estuary (Mid-Essex Coast Phase 4)	UK9009245	111 km		36B		
		UK9009243	75 km		38B		
	Colne Estuary (Mid-Essex Coast Phase 2)	UK9009131	84 km		55B		
	Hamford Water	UK9009101	47km		28B		
	Minsmere-Walberwick	UK9009291	44 km		53B		
	Benacre to Easton Bavents	UK9008021	142 km		33B		
	The Wash	UK9009031	111 km		377B		
	North Norfolk Coast	UK909271	55 km		220B		
	Great Yarmouth and North Denes	UK9008022	162 km		23B		
	Gibraltar Point						

Notes: This table is intended to provide further details of SPA features identified in table 1 as being likely to be affected by offshore wind farm development.

Table A1.3 Species not associated with Special Protection Areas

Species (1)	Use of area (2)	Distance from site	Relevant population (3)	Is species part of another designated feature or class? (SSSI, Ramsar, BAP etc)	Potential for SPA designation?	Sensitivity	Additional notes
Bean Goose	Passage	Unknown	400 UKW		Low	Medium	
Tufted Duck	Passage	Unknown	90,100 UKW		Low	Unknown	
Long-tailed Duck	Wintering	Likely within site	16,000 UKW		Moderate	Medium	
Velvet Scoter	Wintering	Likely within site	3,000 UKW		Moderate	Medium	
Red-breasted Merganser	Passage, Wintering	Likely within site	9,840 UKW			Medium	
Black-throated Diver	Passage, Wintering	Likely within site	700 UKW		Moderate	High	
Northern Fulmar	Breeding, Passage, Wintering	Within site	538,000 UKB*			Medium	
Little Grebe	Passage	Unknown	7,770 UKW		Low	Unknown	
Great Crested Grebe	Passage, Wintering	Likely within site	15,900 UKW		Low	Medium	
Balearic Shearwater	Breeding, Passage	Unknown	3,300 – 4,100 WP*~		Low	Medium	
Shag	Breeding, Passage, Wintering	Within site	37,500 UKB*			Medium	
Grey Heron	Passage	Unknown	**		Low	Unknown	
Pomarine Skua	Passage	Unknown	40,000 – 100,000 BGP*~		Low	Medium	

(1) From Table 1 above
(2) From Table 1
(3) For purposes of environmental impact assessment – provide further details/evidence to justify selection of this quantum, minimum and maximum size should be stated. UKB –UK Breeding population; UKW – UK Wintering; BGP – Bio-geographic Population WP – World Population. Data taken from British Birds 99 Jan 2006 Population Estimates of in Great Britain and the United Kingdom.
*Taken from JNCC Report 431. *~ Taken from Detailed species account from Birds in Europe: population estimates, trends and conservation status (BirdLife International 2004).
** Population sizes where ** has been given are unknown as the relevant population relates to populations of non-UK breeding birds which migrate to the UK on passage or during winter. The numbers that pass through the UK of these species are presently unknown.

Species [1]	Use of area [2]	Distance from site	Relevant population [3]	Is species part of another designated feature or class? (SSSI, Ramsar, BAP etc)	Potential for SPA designation?	Sensitivity	Additional notes
Arctic Skua	Passage	Unknown	2,136 UKB 80,000 – 280,000 BGP*~		Low	Medium	
Great Skua	Passage	Unknown	40,800 BGP*~		Low	Medium	
Little Gull	Passage, Wintering	Likely within site	112,000 BGP*~		High	Low	
Black-headed Gull	Passage, Wintering	Within site	1,682,385 UKW		Moderate	Low	Alde-Ore Estuary SPA supports 1,582 breeding pairs
Common Gull	Breeding, Passage, Wintering	Within site	48,163 UKB; 429,331 UKW		Moderate	Low	Alde-Ore Estuary SPA supports 6,050 breeding pairs.
Herring Gull	Breeding, Passage, Wintering	Within site	131,469 UKB; 376,755 UKW		Moderate	Medium	
Great Black-backed Gull	Breeding, Passage, Wintering	Within site	17,08 UKB; 43,108 UKW		Moderate	Medium	
Guillemot	Breeding, Passage, Wintering	Within site	>2,000,000 UKB*		High	Medium	Assemblages species at Flamborough Head & Bempton Cliffs SPA supporting 16,150 breeding pairs.

Species [1]	Use of area [2]	Distance from site	Relevant population [3]	Is species part of another designated feature or class? (SSSI, Ramsar, BAP etc)	Potential for SPA designation?	Sensitivity	Additional notes
Razorbill	Breeding, Passage, Wintering	Within site	99,160 UKB*		High	Medium	Assemblages species at Flamborough Head & Bempton Cliffs SPA supporting 5,133 breeding pairs.
Atlantic Puffin	Breeding, Passage, Wintering	Within site	600,700 UKB*		High	Medium	Assemblages species at Flamborough Head & Bempton Cliffs SPA supporting 3,473 breeding pairs.
Little Auk	Winter	Likely within site	>11,000,000 BGP*~		High	Medium	
Common Cuckoo	Passage	Unknown	**		Low	Unknown	
Long-eared Owl	Passage	Unknown	**		Low	Unknown	
Short-eared Owl	Passage	Unknown	**		Low	Unknown	
Skylark	Passage	Unknown	**		Low	Unknown	
Sand Martin	Passage	Unknown	**		Low	Unknown	
Barn Swallow	Passage	Unknown	**		Low	Unknown	
Tree Pipit	Passage	Unknown	**		Low	Unknown	
Meadow Pipit	Passage	Unknown	**		Low	Unknown	
Rock Pipit	Passage	Unknown	**		Low	Unknown	
Grey Wagtail	Passage	Unknown	**		Low	Unknown	
Pied/White Wagtail	Passage	Unknown	**		Low	Unknown	
Waxwing	Passage	Unknown	<100 UKW		Low	Unknown	
Robin	Passage	Unknown	**		Low	Unknown	
Redstart	Passage	Unknown	**		Low	Unknown	
Winchat	Passage	Unknown	**		Low	Unknown	

Species [1]	Use of area [2]	Distance from site	Relevant population [3]	Is species part of another designated feature or class? (SSSI, Ramsar, BAP etc)	Potential for SPA designation?	Sensitivity	Additional notes
Wheatear	Passage	Unknown	**		Low	Unknown	
Ringed Ouzel	Passage	Unknown	**		Low	Unknown	
Blackbird	Passage	Unknown	**		Low	Unknown	
Fieldfare	Passage	Unknown	680,000 UKW		Low	Unknown	
Redwing	Passage	Unknown	650,000 UKW		Low	Unknown	
Song Thrush	Passage	Unknown	**		Low	Unknown	
Lesser Whitethroat	Passage	Unknown	**		Low	Unknown	
Blackcap	Passage	Unknown	**		Low	Unknown	
Chiffchaff	Passage	Unknown	**		Low	Unknown	
Willow Warbler	Passage	Unknown	**		Low	Unknown	
Goldcrest	Passage	Unknown	**		Low	Unknown	
Starling	Passage	Unknown	**		Low	Unknown	
Chaffinch	Passage	Unknown	**		Low	Unknown	
Brambling	Passage	Unknown	45,000-1,800,000 UKW		Low	Unknown	
Greenfinch	Passage	Unknown	**		Low	Unknown	
Siskin	Passage	Unknown	**		Low	Unknown	
Redpoll	Passage	Unknown	**		Low	Unknown	
Reed Bunting	Passage	Unknown	**		Low	Unknown	

Notes: This table is intended to summarise information relating to bird species using the development site but not linked to an SPA.

Table A1.4 Projects and Activities to be considered as Part of Cumulative Impact Assessment

Project / activity	Cumulative factor in respect of? (yes/no) (1)				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Windfarm Projects						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Greater Thames (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	Y	Y	N	-	Dark-bellied Brent Goose	Benfeet and Southend Marshes Blackwater Estuary Chesil Beach and The Fleet Chichester and Lagstone Harbours Colne Estuary (Mid-Essex Coast Phase 2) Crouch and Roach Estuaries (Mid-Essex Coast Phase 3) Dengie (Mid-Essex Coast Phase 1) Exe Estuary Foulness (Mid-Essex Coast Phase 5) Hamford Water Humber Flats, Marshes and Coast (Phase 1) Medway Estuary and Marshes North Norfolk Coast Poole Harbour Portsmouth Harbour Solent And Southampton Water Stour and Orwell Estuaries The Swale The Wash
Scorby Sands (R 1)	N	Y	N	-	Bewick's Swan	Arun Valley Avon Valley Breydon Water Broadland Dungerness to Pett Level Lough Foyle Lough Neagh and Lough Beg Lower Derwent Valley Martin Mere Nene Washes

(1) Insert information from Table 1 Yes (Y) value given were values from table 1 were Medium or Higher.

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
						Ouse Washes Ribble and Alt Estuaries (Phase 2) Severn Estuary Somerset Levels and Moors Walmore Common
Kentish Flats (1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Greater Thames (R 2.5) Honsea (R 3)	Y	Y	N	-	Eurasian White-fronted Goose	Alde-Ore Estuary Breydon Water Broadland North Norfolk Coast Severn Estuary Thames Estuary and Marshes The Swale The Wash
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Greater Thames (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	Y	N	Y	Y	Red-throated Diver	Outer Thames Estuary pSPA
Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Triton Knoll (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)					Northern Fulmar	
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1)					Shag	

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Greater Thames (R 2.5) Dogger Bank (R 3) Hornsea (R 3)						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Greater Thames (R 2.5) Dogger Bank (R 3) Hornsea (R 3)					Great Cormorant	
Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)					Northern Gannet	Flamborough Head and Bempton Cliffs
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1)	N	N	N	N	Little Gull	

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)						
Scorby Sands (R 1) Greater Thames (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	N	N	N	N	Common Gull	
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2)	N	N	N	N	Black-headed Gull	

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	N	Y	N	N	Lesser Black-backed Gull	Alde-Ore Estuary
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	N	Y	N	N	Herring Gull	
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2)	N	Y	N	N	Great Black-backed Gull	

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
London Array (R 2) Greater Gabbard (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Dudgeon (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	N	Y	N	N	Black-legged Kittiwake	Flamborough Head and Bempton Cliffs
Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2)	Y	N	Y	Y	Common Guillemot	Flamborough Head and Bempton Cliffs

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)						
Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	Y	N	Y	Y	Razorbill	Flamborough Head and Bempton Cliffs
Dogger Bank (R 3) Honsea (R 3)	Y	N	Y	Y	Little Auk	
Humber Gateway (R 2) Westermost Rough (R 2) Dogger Bank (R 3) Honsea (R 3)	Y	N	Y	Y	Atlantic Puffin	Flamborough Head and Bempton Cliffs
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1)	N	Y	N	N	Arctic Skua	

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3)	N	Y	N	N	Pomarine Skua	

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Hornsea (R 3)						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)	N	Y	N	N	Great Skua	
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2)	N	Y	N	Y	Arctic Tern	

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5) Dogger Bank (R 3) Hornsea (R 3)						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5)	N	Y	N	Y	Common Tern	Foulness (Mid Essex Coast Phase 5) The Wash North Norfolk Coast Breydon Water
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2)	N	Y	N	Y	Sandwich Tern	Alde-Ore Estuary Foulness (Mid Essex Coast Phase 5) North Norfolk Coast

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5)						
Kentish Flats (R 1) Gunfleet Sands (R 1) Gunfleet Sand II (R 1) Scorby Sands (R 1) Lynn (R 1) Inner Dowsing (R 1) Thanet (R 2) London Array (R 2) Greater Gabbard (R 2) Sheringham Shoal (R 2) Dudgeon (R 2) Race Bank (R 2) Docking Shoal (R 2) Linc (R 2) Triton Knoll (R 2) Humber Gateway (R 2) Westermost Rough (R 2) Greater Thames (R 2.5) Greater Wash (R 2.5)	N	N	N	Y	Little Tern	Alde-Ore Estuary Medway Estuary and Marshes Foulness (Mid Essex Coast Phase 5) Blackwater Estuary (Mid-Essex Coast Phase 4) Colne Estuary (Mid-Essex Coast Phase 2) Hamford Water Minsmere-Walberwick Benacre to Easton Bavents The Wash North Norfolk Coast Great Yarmouth and North Denes Gibraltar Point
Aggregates Projects						
Anglian/East Coast Dredging	Y	N	N	Y	Red-throated Diver, Common Scoter,	Outer Thames Estaury pSPA

Project / activity	Cumulative factor in respect of? (yes/no) [1]				For which species?	Potential cumulative / in-combination impact on SPA?
	Displacement	Collision	Barrier effect	Indirect effects eg Prey species		
Thames Dredging	Y	N	N	Y	Red-throated Diver, Common Scoter,	Outer Thames Estuary pSPA
Oil and Gas Activities						
Active gas fields including Hewett, Camelot, Aberdonia and Arthur	Y	N	N	Y	Red-throated Diver, Common Scoter, Common Guillemot	
Supply of drilling platforms	Y	N	N	Y	Red-throated Diver, Common Scoter,	
Other Regulated Activities						
Cable Laying	Y	N	N	N	Red-throated Diver, Common Scoter,	
Fishing	Y	N	N	Y	Red-throated Diver,	
Shipping	Y	N	N	N	Red-throated Diver,	

Notes: This table is intended to record other activities and projects along with which the development under EIA will be considered. The guidance note which accompanies this document provides more details on which projects should be considered within the scope of a CIA.

Table A1.5 Summary of Potential Cumulative Impacts of Wind Farm Projects on a Species by Species Basis

Sensitive receptors	Sensitive receptors identified at table 4?	Sensitive receptors identified at Table 4 in respect of other wind farms in planning or construction?																
	East Anglia One	Gunfleet Sands I	Gunfleet Sands II	Thanet	London Array	Greater Gabbard	Sheringham Shoal	Dudgeon	Race Bank	Docking Shoal	Linc	Triton Knoll	Humber Gateway	Westermost Rough	Greater Thames	Greater Wash	Dogger Bank	Hornsea
Dark-bellied Brent Goose	x	x	x	x	x	x									x		x	x
Bewick's Swan	x																	
Eurasian White-fronted Goose	x	x	x	x	x	x									x		x	x
Red-throated Diver	x	x	x	x	x	x									x		x	x
Northern Fulmar	x			x	x	x	x	x				x			x	x	x	x
Shag	x	x	x	x	x	x									x		x	x
Great Cormorant	x	x	x	x	x	x									x		x	x
Northern Gannet	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Little Gull	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Common Gull	x					x									x		x	x
Black-headed Gull	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lesser Black-backed Gull	x	x	x	x	x	x									x		x	x
Herring Gull	x	x	x	x	x	x							x	x	x	x	x	x
Great Black-backed Gull	x																	
Black-legged Kittiwake	x	x	x	x	x	x	x	x				x		x	x	x	x	x
Common Guillemot	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Razorbill	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Little Auk	x																x	x
Atlantic Puffin	x												x	x			x	x
Arctic Skua	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pomarine Skua	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Great Skua	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Arctic Tern	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Common Tern	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sandwich Tern	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

	Sensitive receptors identified at table 4?	Sensitive receptors identified at Table 4 in respect of other wind farms in planning or construction?																
Little Tern	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Notes: This table is intended to summarise sensitive receptors (identified in table 4) on a species-by-species basis (rather than according to project). The wind farms included within this table will be those whose effects will not yet be visible in the baseline i.e. those in planning, consented or under construction. The box is marked with 'x' if the species is present as sensitive receptor. Species sensitive at more than one site are then easily identified as being potentially cumulatively impacted.

Table A1.6 Proposed Survey and Analysis Methodologies

Bird species (1)	Survey or analysis technique (2)	Frequency and duration of surveys (3)	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact (4)				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
Bewick's Swan	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months, to be combined with existing aerial survey data.	Quarterly and Annual review.	N/A	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Whooper Swan	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months, to be combined with existing aerial survey	Quarterly and Annual review.	N/A	Use of the Band (2000) model in conjunction with species data on avoidance and	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator

(1) As identified in table 1

(2) e.g. boat based survey, aerial with observer, aerial with high definition camera, radar, thermal imaging, shore based observation, tagging

(3) e.g monthly

(4) Methodologies for assessment will follow those as set out in Maclean, I.M.D., Wright, L.J., Showler, D.A., Rehfisch, M.M. 2009 *A review of Assessment Methodologies for Offshore Windfarms*. COWRIE Ltd

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
		data.			survival rates.			
Bean Goose	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Qualitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Pink-footed Goose	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Eurasian White-fronted Goose	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Qualitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Dark-bellied Brent Goose	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Qualitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Shelduck	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Wigeon	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Shoveler	Boat Based,	Monthly boat and	Quarterly and	N/A	N/A	N/A	N/A	To be

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Aerial High Definition Survey	aerial high definition survey for 18 months	Annual review.					discussed with the regulator
Pochard	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Pintail	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Tufted Duck	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Long-tailed Duck	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Velvet Scoter	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Common Scoter	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Red-breasted Merganser	Boat Based, Aerial High Definition	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Survey							
Red-throated Diver	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Black-throated Diver	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Northern Fulmar	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Little Grebe	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Great Crested Grebe	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Balearic Shearwater	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Northern Gannet	Boat Based, Aerial High Definition	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Survey				species data on avoidance and survival rates.			
Shag	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Great Cormorant	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Grey Heron	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Oystercatcher	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Ringed Plover	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Golden Plover	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Grey Plover	Boat Based,	Monthly boat and	Quarterly and	N/A	N/A	N/A	N/A	To be

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Aerial High Definition Survey	aerial high definition survey for 18 months	Annual review.					discussed with the regulator
Lapwing	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Knot	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Dunlin	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Snipe	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Woodcock	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Black-tailed Godwit	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Bar-tailed Godwit	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
Curlew	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Redshank	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Turnstone	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Pomarine Skua	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Arctic Skua	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Great Skua	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Little Gull	Boat Based, Aerial High	Monthly boat and aerial high definition	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in	Qualitatively Assessed	Qualitatively Assessed	To be discussed with

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Definition Survey	survey for 18 months			conjunction with species data on avoidance and survival rates.			the regulator
Black-headed Gull	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Common Gull	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Lesser Black-backed Gull	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Herring Gull	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Great Black-backed Gull	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
					avoidance and survival rates.			
Black-legged Kittiwake	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Sandwich Tern	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Roaseate Tern	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Common Tern	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Arctic Tern	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
Little Tern	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Guillemot	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Razorbill	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Little Auk	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Atlantic Puffin	Boat Based, Aerial High Definition Survey	Monthly boat and aerial high definition survey for 18 months	Quarterly and Annual review.	Quantitatively Assessed	Use of the Band (2000) model in conjunction with species data on avoidance and survival rates.	Qualitatively Assessed	Qualitatively Assessed	To be discussed with the regulator
Common Cuckoo	Incidental Boat Based	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Survey. Observatory Records							the regulator
Long-eared Owl	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Short-eared Owl	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Skylark	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Sand Martin	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Barn Swallow	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Tree Pipit	Incidental Boat Based Survey. Observatory	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Records							
Meadow Pipit	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Rock Pipit	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Grey Wagtail	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Pied/White Wagtail	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Waxwing	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Robin	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Redstart	Incidental	Monthly boat based	Quarterly and	N/A	N/A	N/A	N/A	To be

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Boat Based Survey. Observatory Records	survey for 18 months.	Annual review.					discussed with the regulator
Winchat	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Wheatear	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Ringed Ouzel	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Blackbird	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Fieldfare	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Redwing	Incidental Boat Based Survey.	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Observatory Records							
Song Thrush	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Lesser Whitethroat	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Blackcap	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Chiffchaff	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Willow Warbler	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Goldcrest	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
Starling	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Chaffinch	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Brambling	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Greenfinch	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Siskin	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Redpoll	Incidental Boat Based Survey. Observatory Records	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with the regulator
Reed Bunting	Incidental Boat Based	Monthly boat based survey for 18 months.	Quarterly and Annual review.	N/A	N/A	N/A	N/A	To be discussed with

Bird species [1]	Survey or analysis technique [2]	Frequency and duration of surveys [3]	Proposed review dates/ milestones	Summary of proposed methodology to assess potential impact [4]				Validation/ discussion with regulator and /or statutory advisor required?
				Displacement	Collision	Barrier effect	Indirect effects eg prey species	
	Survey. Observatory Records							the regulator

Notes:
This table is intended to record details of the survey and analysis techniques intended to be used to address EIA and CIA issues.

Table A1.7 Record of Scoping Response, Communication and Review

Date	Action (1)	Comments / observations						
		Developer	**Consultant**	**BERR**	**MFA**	**Natural England / CCW / JNCC / SNH**	**RSPB**	**Other stakeholder**
January 2010	*Preliminary Videoconference with RSPB, NE, JNCC*							
July 2010	*Pre-scoping meeting with RSPB, NE, JNCC*							
	Issue of scoping request							
	Scoping meeting							
	Issue of scoping opinion							
	First review meeting							
	Second review meeting							
	Third review meeting							
Proposed date for review of this document: *[insert date, suggest 3-6 months from first review, align with survey milestones, see table 6 above]*								

Notes: This table is intended to reflect the intention that CIA scoping is likely to be an ongoing iterative process and that challenges are most likely to be most successfully overcome if addressed early in the consenting process

(1) Project specific

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