Hornsea Offshore Wind Farm
Project Two

Scoping Report

October 2012

This report has been prepared with all reasonable skill, care and diligence within the terms of the agreement with SMart Wind Ltd.

Prepared by RPS
## ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AA</td>
<td>Appropriate Assessment</td>
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<tr>
<td>AAA</td>
<td>Anti-Aircraft Artillery</td>
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<tr>
<td>AADT</td>
<td>Average Annual Daily Traffic</td>
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<tr>
<td>AC</td>
<td>Assessment Criteria</td>
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<td>AC</td>
<td>Alternating Current</td>
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<tr>
<td>ACMI</td>
<td>Air Combat Manoeuvring Instrumentation</td>
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<tr>
<td>ADS</td>
<td>Archaeology Data Service</td>
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<tr>
<td>AGA</td>
<td>Air-Ground-Air AIS Automatic Identification System</td>
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<tr>
<td>AGDS</td>
<td>Acoustic Ground Discrimination System</td>
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<tr>
<td>AGLV</td>
<td>Area of Great Landscape Value</td>
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<tr>
<td>AHD</td>
<td>Acoustic Harassment Device</td>
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<tr>
<td>AIP</td>
<td>Aeronautical Information Publication</td>
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<tr>
<td>AIS</td>
<td>Automatic Identification System</td>
</tr>
<tr>
<td>ALC</td>
<td>Agricultural Land Classification</td>
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<tr>
<td>ANSP</td>
<td>Air Navigation Service Providers</td>
</tr>
<tr>
<td>AOD</td>
<td>Above Ordnance Datum</td>
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<tr>
<td>AON</td>
<td>Apparently Occupied Nests</td>
</tr>
<tr>
<td>AONB</td>
<td>Area of Outstanding Natural Beauty</td>
</tr>
<tr>
<td>AOS</td>
<td>Apparently Occupied Sites</td>
</tr>
<tr>
<td>APPLE</td>
<td>Air Pollution Planning and the Local Environment</td>
</tr>
<tr>
<td>AQAP</td>
<td>Air Quality Action Plan</td>
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<tr>
<td>AQMA</td>
<td>Air Quality Management Area</td>
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<tr>
<td>AQS</td>
<td>Air Quality Strategy</td>
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<tr>
<td>ASACS</td>
<td>Air Surveillance and Control System</td>
</tr>
<tr>
<td>ASCOBANS</td>
<td>Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas</td>
</tr>
<tr>
<td>ATBA</td>
<td>Area to be avoided</td>
</tr>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>AWACs</td>
<td>Acoustic Doppler Wave and Current Profilers</td>
</tr>
<tr>
<td>AWACS</td>
<td>Airborne Warning and Control System</td>
</tr>
<tr>
<td>BAG</td>
<td>Before-After-Gradient</td>
</tr>
<tr>
<td>BAP</td>
<td>Biodiversity Action Plan</td>
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<tr>
<td>BBC</td>
<td>British Broadcasting Corporation</td>
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<tr>
<td>BCT</td>
<td>Botney Cut Formation</td>
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<tr>
<td>BCT</td>
<td>Bat Conservation Trust</td>
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<tr>
<td>BDK</td>
<td>Bolders Bank Formation</td>
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<tr>
<td>BGS</td>
<td>British Geological Survey</td>
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<tr>
<td>BIS</td>
<td>Department for Business Innovation and Skills</td>
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<tr>
<td>BMEWS</td>
<td>Ballistic Missile Early Warning System</td>
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<tr>
<td>BoCC</td>
<td>Birds of Conservation Concern</td>
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<tr>
<td>BODC</td>
<td>British Oceanographic Data Centre</td>
</tr>
<tr>
<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>BP</td>
<td>Before present</td>
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<tr>
<td>BRE</td>
<td>Buildings Research Establishment</td>
</tr>
<tr>
<td>BSBI</td>
<td>Botanical Society of the British Isles</td>
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<tr>
<td>BTO</td>
<td>British Trust for Ornithology</td>
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<tr>
<td>BWEA</td>
<td>British Wind Energy Association (now RenewableUK)</td>
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<tr>
<td>CA</td>
<td>Cruising Association</td>
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<tr>
<td>CAA</td>
<td>Civil Aviation Authority</td>
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<tr>
<td>CCS</td>
<td>Carbon Capture and Storage</td>
</tr>
<tr>
<td>CCTV</td>
<td>Closed Circuit Television</td>
</tr>
<tr>
<td>CD</td>
<td>Chart Datum</td>
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<tr>
<td>CDM</td>
<td>Construction, Design and Management Regulations</td>
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<tr>
<td>CEFAS</td>
<td>Centre for Environment, Fisheries and Aquaculture Science</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
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<tr>
<td>CEMP</td>
<td>Construction Environmental Management Plan</td>
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<tr>
<td>Ciria</td>
<td>Construction Industry Research and Information Association</td>
</tr>
<tr>
<td>CNPMEM</td>
<td>Comité National des Pêches Maritimes et des Elevages Marins</td>
</tr>
<tr>
<td>CMP</td>
<td>Construction Management Plan</td>
</tr>
<tr>
<td>CNS</td>
<td>Communications, Navigation and Surveillance</td>
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<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
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<tr>
<td>COCP</td>
<td>Code of Construction Practice</td>
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<tr>
<td>CoP</td>
<td>Code of Practice</td>
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<tr>
<td>COWRIE</td>
<td>Collaborative Offshore Wind Research into the Environment</td>
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<tr>
<td>CPA</td>
<td>Coastal Protection Act</td>
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<tr>
<td>CPRE</td>
<td>Campaign for the Protection of Rural England</td>
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<tr>
<td>CPT</td>
<td>cone penetration test</td>
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<tr>
<td>DAP</td>
<td>Directorate of Airspace Policy</td>
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<tr>
<td>DBA</td>
<td>Desk Based Assessment</td>
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<tr>
<td>DC</td>
<td>Direct Current</td>
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<tr>
<td>DCLG</td>
<td>Department for Communities and Local Government</td>
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<tr>
<td>DCMS</td>
<td>Department for Culture, Media and Sport</td>
</tr>
<tr>
<td>DCO</td>
<td>Development Consent Order</td>
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<tr>
<td>DECC</td>
<td>Department of Energy and Climate Change</td>
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<tr>
<td>DEFRA</td>
<td>Department for Environment Food and Rural Affairs</td>
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<tr>
<td>DETR</td>
<td>Department of the Environment, Transport and the Regions (former Government department)</td>
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<tr>
<td>DfT</td>
<td>Department for Transport</td>
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<tr>
<td>DGPS</td>
<td>Differential GPS</td>
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<tr>
<td>DINO</td>
<td>Data and Information of the Dutch Subsurface</td>
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<tr>
<td>DME</td>
<td>Distance Measuring Equipment</td>
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<tr>
<td>DMRB</td>
<td>Design Manual for Roads and Bridges</td>
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<tr>
<td>DMV</td>
<td>Deserted Medieval Village</td>
</tr>
<tr>
<td>DIO</td>
<td>Defence Infrastructure Organisation</td>
</tr>
<tr>
<td>DPD</td>
<td>Development Plan Document</td>
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<tr>
<td>dSAC</td>
<td>Draft Special Area of Conservation</td>
</tr>
<tr>
<td>DSC</td>
<td>Digital Selective Calling</td>
</tr>
<tr>
<td>DTI</td>
<td>Department of Trade and Industry (now Department for Business Innovation and Skills)</td>
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<tr>
<td>DTLR</td>
<td>Department for Transport, Local Government and the Regions (now called Communities and Local Government)</td>
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<tr>
<td>DWT</td>
<td>Dead Weight Tonnage</td>
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<tr>
<td>EA</td>
<td>Environment Agency</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<tr>
<td>ECoW</td>
<td>Ecological Clerk of Works</td>
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<tr>
<td>EcIA</td>
<td>Ecological Impact Assessment</td>
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<tr>
<td>ECS</td>
<td>European Cetacean Society</td>
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<tr>
<td>EEA</td>
<td>European Environment Agency</td>
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<td>EEZ</td>
<td>Economic Exclusion Zone</td>
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<tr>
<td>EH</td>
<td>English Heritage</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<tr>
<td>ELDC</td>
<td>East Lindsey District Council</td>
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<td>EMF</td>
<td>Electromagnetic Fields</td>
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<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>ENA</td>
<td>Energy Networks Association</td>
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<td>EP</td>
<td>Environmental permitting</td>
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<tr>
<td>EPR</td>
<td>Environmental Permitting Regulations</td>
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<tr>
<td>EPS</td>
<td>European Protected Species</td>
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<tr>
<td>EPUK</td>
<td>Environmental Protection UK</td>
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<tr>
<td>ES</td>
<td>Environmental Statement</td>
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</tbody>
</table>
INTRODUCTION
Hornsea Project Two Scoping Report

INTRODUCTION

RDA Regional Development Agency
REA Regional Environmental Assessment
REC Regional Environmental Characterisation
REZ Renewable Energy Zone
RIGS Regionally Important Geological & Geomorphological Sites
ROV Remotely Operated Vehicle
RQO River Quality Objective
RPaG Registered Park and Garden
RPS RPS Planning and Development
RSPB Royal Society for the Protection of Birds
RTF Radio Telephone Facility
RYA Royal Yachting Association
SAC Special Area of Conservation
SAG SMart Wind Stakeholder Advisory Group
SAM Scheduled Ancient Monument
SAP Species Action Plans
SAR Search and Rescue
SCADA Supervisory Control and Data Acquisition
SCI Site of Community Importance
SEA Strategic Environmental Assessment
SFRA Strategic Flood Risk Assessment
SINC Site of Importance for Nature Conservation
SMW SMart Wind Limited
SNCI Sites of Nature Conservation Importance
SNH Scottish Natural Heritage
SNS Southern North Sea Sediment Transport Study
SNSOWF Southern North Sea Offshore Wind Forum
SoCC Species of Conservation Concern
SOCC Statement of Community Consultation
SOLAS Safety of Life at Sea
SOx Sulphur Oxides
SPA Special Protection Area
SPL Slowly permeable layer, which is a poorly structured soil horizon that inhibits the movement of water downwards through the soil profile
SPM Suspended Particulate Matter
SPV Siemens Project Ventures GmbH
SPZ Groundwater Source Protection Zone
SQW SQW (Socio-economics consultants)
SRI Sound Reduction Index
SSR Secondary Surveillance Radar
SSSI Site of Special Scientific Interest
SUDS Sustainable Urban Drainage System
SVIA Seascape and Visual Impact Assessment
TA Transport Assessment
TACAN Tactical Air Navigation
TCE The Crown Estate
TCPA Town and Country Planning Act
TEMPRO Trip End Model Presentation Programme
THLS Trinity House Lighthouse Services
TMP Traffic Management Plan
TSS Traffic Separation Scheme
UK United Kingdom
UKAS United Kingdom Accreditation Service
## GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td><strong>A-weighting</strong></td>
<td>Weighting of the audible frequencies designed to reflect the response of the human ear to noise. The ear is more sensitive to noise at frequencies in the middle of the audible range than it is to either very high or very low frequencies. Noise measurements are often A-weighted (using a dedicated filter) to compensate for the sensitivity of the ear.</td>
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<tr>
<td><strong>Accumulated Temperature</strong></td>
<td>The excess of daily temperatures above a selected threshold temperature, summed between January and June.</td>
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<tr>
<td><strong>Agri-environment scheme</strong></td>
<td>A government-funded scheme to encourage farmers to manage their land in an environmentally friendly way.</td>
</tr>
<tr>
<td><strong>Airborne Noise</strong></td>
<td>Noise propagating through air.</td>
</tr>
<tr>
<td><strong>Alluvium</strong></td>
<td>Unconsolidated (not cemented together into a solid rock) soil or sediments, which has been eroded, reshaped by water in some form, and redeposited in a non-marine setting.</td>
</tr>
<tr>
<td><strong>Ambient noise level</strong></td>
<td>BS 4142 defines the ambient noise level as: ‘Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.’ It is sometimes used to mean an environmental noise level defined specifically in terms of the LAeq noise index. The terms ambient and background may be colloquially synonymous when describing environmental noise levels.</td>
</tr>
<tr>
<td><strong>Appropriate Assessment (AA)</strong></td>
<td>An assessment to determine the implications of a plan or project on a European site in view of the site’s conservation objectives. An AA forms part of the Habitats Regulations Assessment and is required when a plan or project is likely to have a significant effect on a European site.</td>
</tr>
<tr>
<td><strong>Anthropic noise</strong></td>
<td>Noise from man-made sources.</td>
</tr>
<tr>
<td><strong>Aquifer</strong></td>
<td>A subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater.</td>
</tr>
</tbody>
</table>
### Areas of Outstanding Natural Beauty (AONB)

Designated under the National Parks and Access to the Countryside Act 1949, amended in the Environment Act 1995. The Countryside and Rights of Way Act 2000 clarifies the procedure and purpose of the designation. Primary purpose to conserve an area’s natural beauty (including wildlife, landscape, physiographic and cultural features). Account is taken of the need to safeguard economic and social needs of local communities. AONBs have equivalent status to National Parks as far as conservation is concerned.

### Artesian

Groundwater in a confined aquifer is under pressure and will rise up in a borehole drilled through low permeability rocks into the aquifer. Where the water level rises to the ground surface or even above the ground surface under natural pressure it is said to be artesian flow.

### At Grade

Where a feature, often a railway or road, is at the same level with the surrounding land.

### Auger boring

A core of soil taken for examination to a depth of 1m with a Dutch Combination hand auger.

### Background noise level

BS 4142 defines the background noise level as: ‘The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels’ (i.e. a noise level defined specifically in terms of the LA90 noise index). The terms ambient and background may be colloquially synonymous when describing environmental noise levels.

### Baseline Noise Levels

The existing noise levels before construction or operation of a development commences.

### Beach deposits

Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the form of dunes, sheets or banks, and 'Tidal Flat Deposits': commonly silt and clay with sand and gravel layers; possible peat layers; from the tidal zone.

### Bathymetry

The measurement of water depth in oceans, seas and lakes.

### Benthic ecology

Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.

### Best and Most Versatile Land

The highest quality grades 1, 2 and 3a agricultural land as determined by Defra.
**Biodiversity Action Plan (BAP)**
The UK Government’s response to the Convention on Biological Diversity (CBD), which the UK signed up to in 1992 in Rio de Janeiro. The CBD requires signatory countries to identify develop and enforce action plans to conserve, protect and enhance biological diversity. The UK BAP addresses this requirement. Local BAPs (LBAPs) have been produced by many counties, to detail measures to conserve, protect and enhance local/county biological diversity.

**BOD**
Refers to the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at a certain temperature over a specific time period.

**Broadband**
A noise containing a wide range of frequencies (for example, a whooshing noise like a waterfall or out of tune analogue radio).

**Cable corridor**
The cable route comprising a permanent land take area containing the cable, up to approximately 20m in width, plus adjacent temporary land take or construction working area considered to be up to approximately 20m wide for the purpose of this assessment.

**Cable route**
The route followed by the onshore cable, which runs from the landfall at Horseshoe Point to the grid connection point at Killingholme, and is approximately 40 km in length.

**Calcareous**
Containing lime or being chalky.

**Confined aquifer**
Permeable rock units containing ground water that are confined above or beneath lower permeability rock or superficial deposits such as clay, which limit groundwater movement into and out of the confined aquifer.

**Conservation Area**
A Conservation Area is an area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance.

**Countryside**
The rural environment and its associated communities (including the coast).

**Cumulative effects**
The combined effect of a number of different topic-specific impacts resulting from the assessed project on a single receptor/resource in combination with the effects from a number of different projects, on the same single receptor/resource.

**Designated heritage asset**
A World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area designated under the relevant legislation.
<table>
<thead>
<tr>
<th><strong>Designated site</strong></th>
<th>An area afforded protection under an International Convention, European Directive or a piece of UK legislation due to its nature conservation or landscape value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Development Consent Order (DCO)</strong></td>
<td>A legal order granting development consent for a project.</td>
</tr>
<tr>
<td><strong>Directivity</strong></td>
<td>The uniform/non-uniform directional characteristics of a noise source (as noise may be emitted from the source in different directions with varying intensities and frequencies).</td>
</tr>
<tr>
<td><strong>Drift deposit</strong></td>
<td>Unconsolidated (not cemented together into a solid rock).</td>
</tr>
<tr>
<td><strong>Effect</strong></td>
<td>Term used to express the consequence of an impact (expressed as the ‘significance of effect’), which is determined by correlating the magnitude of the impact to the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.</td>
</tr>
<tr>
<td><strong>EIA Regulations</strong></td>
<td>In the context of this document, the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009.</td>
</tr>
<tr>
<td><strong>Electromagnetic Field or Electric and Magnetic Field (EMF)</strong></td>
<td>All equipment that generates, distributes or uses electricity produces EMFs.</td>
</tr>
<tr>
<td><strong>Electric Field</strong></td>
<td>Electric field strengths depend on the operating voltage of the equipment producing them and are measured in V/m (volts per metre). The operating voltage of electrical equipment is a relatively constant value. Electric fields are shielded by most common materials, trees and fences. Electric fields diminish rapidly with distance from source. Some types of electrical equipment do not produce an external electric field. This applies to underground cables and gas insulated switchgear (GIS) equipment.</td>
</tr>
<tr>
<td><strong>Emission</strong></td>
<td>1. the act of emitting or sending forth; 2. (Physics / General Physics) energy, in the form of heat, light, radio waves, etc., emitted from a source; 3. a substance, fluid, etc., that is emitted; discharge. (Collins English Dictionary)</td>
</tr>
<tr>
<td><strong>Environmental Impact Assessment (EIA)</strong></td>
<td>A process which identifies the environmental effects (both negative and positive) of development proposals in accordance with the requirements of the EIA Directive (as transposed into UK law through various EIA Regulations).</td>
</tr>
<tr>
<td><strong>Environmental Statement (ES)</strong></td>
<td>Document accompanying the application for development consent outlining the potential environmental impacts of a development.</td>
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<tr>
<td><strong>European site</strong></td>
<td>A Special Area of Conservation (SAC) or candidate SAC, a Special Protection Area (SPA) or potential SPA, a site listed as a site of community importance, a site hosting priority habitats or species, or a Ramsar site.</td>
</tr>
<tr>
<td><strong>Environmental Stewardship</strong></td>
<td>A Natural England-funded agri-environment scheme providing financial grants to farmers and other land owners to manage their land in an effective environmentally sympathetic way.</td>
</tr>
<tr>
<td><strong>Entry level stewardship (ELS)</strong></td>
<td>Basic level of entry into the Environmental Stewardship scheme</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Our physical surroundings including air, water and land.</td>
</tr>
<tr>
<td><strong>Equivalent continuous sound pressure level (LAEqT)</strong></td>
<td>is defined in BS 7445 as the ‘value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time’. In more straightforward terms, it is a measure of the noise dose or exposure over a period. It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. It is also the unit best suited to assessing community response.</td>
</tr>
<tr>
<td><strong>Eutrophic waterbodies</strong></td>
<td>As defined in the Phase 1 habitat survey guidelines (JNCC 2010); alkaline (pH greater than 7) waterbodies, often with a considerable cover of algae, and highly organic silt substrate.</td>
</tr>
<tr>
<td><strong>Façade/Freefield</strong></td>
<td>This applies to the positions for either measurement or prediction. A façade position is one that effectively represents noise levels at a building but is conventionally taken at a position 1 m from the building; this includes reflections from the building. A freefield position is one that is at least 3.5 m from a building where reflection effects are not significant. The difference between a noise level measured at a façade position and a freefield position, assuming that there is a specific noise source that causes reflections, is that levels are around 3 dB higher at the façade, due to the reflection effects.</td>
</tr>
<tr>
<td><strong>Far-field</strong></td>
<td>A considerable distance from the source (contrast to near-field).</td>
</tr>
<tr>
<td><strong>Field capacity duration</strong></td>
<td>A meteorological parameter, which estimates the duration of the period when the soil moisture deficit is zero.</td>
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<tr>
<td><strong>Field pattern</strong></td>
<td>The pattern of hedges and walls that define fields in farmed landscapes.</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<td>-------------------------------</td>
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<tr>
<td>Geographical Information System</td>
<td>Computerised database of geographical information that can easily be updated and manipulated.</td>
</tr>
<tr>
<td>Geology</td>
<td>The scientific study of the origin, history and structure of the earth.</td>
</tr>
<tr>
<td>Geomorphological</td>
<td>Pertaining to the shape of, and processes forming the earth's landforms.</td>
</tr>
<tr>
<td>Geophysical</td>
<td>Pertaining to the physics of the earth and its environment.</td>
</tr>
<tr>
<td>Habitats Regulations</td>
<td>The Conservation of Habitats and Species Regulations 2010 (as amended).</td>
</tr>
<tr>
<td>Gleying</td>
<td>A soil-forming process that operates under poor drainage conditions and results in the reduction of iron and other elements and in grey colours and mottles.</td>
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<tr>
<td>Glacial till</td>
<td>Unsorted material deposited directly by glacial ice and showing no stratification.</td>
</tr>
<tr>
<td>GQA</td>
<td>A scheme undertaken by the Environment Agency to assess river water quality in terms of chemistry, biology and nutrients.</td>
</tr>
<tr>
<td>Ground conditions</td>
<td>An assessment of the history and chemical and physical characteristics of the soil conditions at a site.</td>
</tr>
<tr>
<td>Habitats Regulations Assessment (HRA)</td>
<td>A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of a European site. The process consists of up to four stages: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI).</td>
</tr>
<tr>
<td>Heritage asset</td>
<td>A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage asset includes designated heritage assets and assets identified by the local planning authority (including local listing).</td>
</tr>
<tr>
<td>Higher Level Stewardship (HLS):</td>
<td>A more demanding level of Environmental Stewardship (than Entry Level) designed to build on the Entry Level Stewardship agreement.</td>
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<tr>
<td>Impact</td>
<td>Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact).</td>
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<tr>
<td>Immission</td>
<td>The act of immitting, or of sending or thrusting in; injection; - the correlative of emission. (Webster's Revised Unabridged Dictionary)</td>
</tr>
<tr>
<td>In-combination impacts</td>
<td>Effects on important receptors that arise from different industry sectors within the same region or Zone.</td>
</tr>
<tr>
<td><strong>Indirect impacts</strong></td>
<td>Impacts on the subject of study which may not be the result of the development may be evident at distance from it, or as the result of a complex pathway. Sometimes referred to as secondary impacts.</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Infrastructure Planning Commission (IPC)</strong></td>
<td>An independent body responsible for examining and deciding applications for Nationally Significant Infrastructure Projects. The IPC was abolished on 1 April 2012. Its examination powers were transferred to the Planning Inspectorate (PINS) with its decision making powers transferred to the Secretary of State within the Department of Energy and Climate Change.</td>
</tr>
<tr>
<td><strong>Jack-up barge</strong></td>
<td>A type of mobile platform that is able to stand still on the sea floor, resting on a number of supporting legs</td>
</tr>
<tr>
<td><strong>Lacustrine deposit</strong></td>
<td>Sediment derived from a lake.</td>
</tr>
<tr>
<td><strong>Magnitude</strong></td>
<td>A combination of the extent, duration, frequency and reversibility of an impact.</td>
</tr>
<tr>
<td><strong>Landscape</strong></td>
<td>Human perception of the land conditioned by knowledge and identify with a place.</td>
</tr>
<tr>
<td><strong>Listed Building</strong></td>
<td>A building that has been placed on the statutory List of Buildings of Special Architecture or Historic Interest.</td>
</tr>
<tr>
<td><strong>Magnitude</strong></td>
<td>A combination of the extent, duration, frequency and reversibility of an impact.</td>
</tr>
<tr>
<td><strong>Main Drain</strong></td>
<td>The name of a water course owned and operated by IDB</td>
</tr>
<tr>
<td><strong>Mattress (concrete)</strong></td>
<td>Pre-cast concrete slabs that are laid alongside each other on the seabed over a pipeline or cable to protect it from damage and sometimes to allow another pipeline or cable to be laid over it where they need to cross each other.</td>
</tr>
<tr>
<td><strong>Met Mast</strong></td>
<td>A mast or tower structure on which meteorological observation and recording equipment is mounted.</td>
</tr>
<tr>
<td><strong>Mitigation</strong></td>
<td>Actions which may include process or design to avoid, reduce, remedy, or compensate for adverse impacts of a development. Avoids or reduces an effect, significant or otherwise.</td>
</tr>
<tr>
<td><strong>Monopile</strong></td>
<td>A foundation that is a single vertical column inserted deep into the seabed.</td>
</tr>
<tr>
<td><strong>Nacelle</strong></td>
<td>The nacelle of a wind turbine is the box-like component that sits on top of the tower and is connected to the rotor. The nacelle contains the low- and high-speed shafts, the gearbox, the brake and the generator. It also contains the blade pitch control, a hydraulic system that controls the angle of the blades, and the yaw drive, which controls the position of the turbine relative to the wind.</td>
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### Nationally Significant Infrastructure Project (NSIP)

Large scale developments including power generating stations which require development consent under the Planning Act 2008. An offshore wind farm project with a capacity of more than 100 megawatts (MW) constitutes an NSIP.

### Near-field

Close proximity to the source (contrast to far-field).

### Offshore Habitats Regulations

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

### Offshore Transmission Owner (OFTO)

The government introduced the Offshore Transmission Network Owners (OFTO) regime in 2009 as a new regulatory regime for licensing offshore electricity transmission, which uses competitive tendering to ensure the cable connections are delivered on time and at reasonable cost.

### Oligotrophic waterbodies

As defined in the Phase 1 habitat survey guidelines (JNCC 2010); clear, acidic (pH less than 7) water, typically supporting a sparse cover of plankton.

### Piling

Process of driving a foundation into the seabed by pushing, hammering or vibrating the pile.

### Planning Inspectorate (PINS)

The executive agency of the Department for Communities and Local Government responsible for operating the planning process for NSIPs.

### Project One

The first offshore wind farm project within the Hornsea Round 3 Zone. It has a maximum capacity of 1.2 gigawatts (GW) or 1,200 MW and includes all necessary offshore and onshore infrastructure required to connect to the existing National Grid substation located at North Killingholme, North Lincolnshire. Project One is the first of a number of wind farm projects planned for the Hornsea Zone to meet a target Zone capacity of 4 GW by the year 2020. Project One will be the subject of a single application to PINS for a DCO under the Planning Act 2008.

### Project Two

A proposed wind farm of up to 1,800 MW in maximum installed generating capacity. The project may comprise one or several wind farm arrays when constructed and will include all necessary offshore and onshore infrastructure required to connect to the existing National Grid substation located at North Killingholme, North Lincolnshire. The site will be situated within ‘Subzone 2’

Project Two is the second of a number of wind farm projects planned for the Hornsea Zone to meet a target Zone capacity of 4 GW by the year 2020. Project Two will be the subject of a single application to PINS for a DCO under the Planning Act 2008.
**Renewable Energy Zone (REZ)**
The area of UK waters designated pursuant to Section 84 of the Energy Act 2004. The designation of this Renewable Energy Zone is necessary so that renewable energy resources can be exploited for the generation of electricity, and thus make a contribution to meeting the Government’s renewable energy targets for 2020 and beyond.

**Round 3**
Round 3 was announced by The Crown Estate in 2008 with nine development zones. The successful bidders were announced in January 2010 with a potential generating capacity of 32 GW. The Crown Estate announced the first round of UK offshore wind farm development in December 2000 and the second round of larger sites in July 2003.

**Scheduled Monument**
Archaeological site that is recorded on the Schedule of Ancient Monuments by the Secretary of State. These monuments are recognised as being of national importance and are by definition legally protected and conserved.

**Scour**
Erosion holes around the foundations of offshore wind turbines created by tidal currents.

**Scour protection**
Protection against erosion of the seabed which can take a variety of forms, including rock dumping, gravel, artificial fronds or seaweed, concrete 'mattresses', bags filled with gravel, grout or other concrete.

**Sensitivity**
The extent to which a study subject can accept a change of a particular type and scale without unacceptable adverse effects.

**Significance**
The significance of an effect combines the evaluation of the magnitude of a potential impact and the sensitivity of the feature affected.

**Strategic Environmental Assessment (SEA)**
Relates to the process arising from European Union policy whereby environmental considerations are taken into consideration in plans, policies and strategies set out by member states.

**Subzone 1**
The area within the Hornsea Zone where the Project One offshore wind turbines will be sited.

**Subzone 2**
The area within the Hornsea Zone where the Project Two offshore wind turbines will be sited.
| **The Crown Estate** | The Crown Estate is a property business encompassing urban, rural and marine estates. The Crown Estate owns virtually the entire sea bed out to the 12 nautical mile territorial limit, including the rights to explore and utilise the natural resources of the UK continental shelf (excluding oil, gas and coal). More recently the Energy Act 2004 vested rights to The Crown Estate to license the generation of renewable energy on the continental shelf within the Renewable Energy Zone out to 200nm. The surplus revenue from the Estate is paid each year to HM Treasury. |
| **Transboundary** | Crossing into other states/nations. |
| **Zone** | The area of the seabed (which may be within the territorial limits of the UK and/or within the REZ) demarcated by the TCE for wind farm development in Round 3 and, in the context of this document, the Hornsea Zone. A distinction between the terms ‘Zone’ and ‘Zone Development Envelope’ is made to avoid confusion over ‘Zone’ being adopted for wider use beyond that defined by TCE for Round 3. Further, please see definition of ‘Zone Development Envelope’. |
| **Zone appraisal** | An appraisal of the capacity of the Zone by looking at consenting (with a focus on environment constraints and Zone stakeholder consultation), construction, operation, connection and determining the associated optimised Zone layout for wind farms through a process of data collation and interrogation. |
| **Zone Appraisal and Planning (ZAP)** | A framework intended to rationalise and balance the commercial aim of maximising development capacity aspirations with the practicalities of deliverability. |
| **Zone Appraisal Methodology (ZAM)** | A document which describes the methods to be used to assess potential impacts across the Zone. These are implemented within the ZEA. |
| **Zone Characterisation (ZoC)** | A broad description of the physical, biological, socio-economic and cultural heritage characteristics of the Zone at a resolution sufficient to support Zone layout and subsequent project identification. This will not necessarily take the form of a tangible output, but reflects the increase in understanding of the Zone over time. |
| **Zone Development Agreement (ZDA)** | A contractual arrangement for Round 3 wind farm development between a developer and TCE and, in the context of this document, the Agreement between TCE and SMart Wind Limited dated 22 December 2009. |
| **Zone Development Envelope (ZDE)** | The area comprising all development associated with the Zone including: the Round 3 Zone (as defined by TCE), onshore grid connection corridors and infrastructure and offshore cable corridors. The involvement of OFTOs in the development of Round 3 sites means that the Zone developer may not design and develop the transmission aspects of the projects themselves, but these will need to be considered in some form as part of the development of the Hornsea Zone as a whole. |
| **Zone Environmental Appraisal (ZEA)** | A report which presents the results from the Zone Appraisal. This incorporates information from the ZoC, implements the methodologies set out in the ZAM, and describes potential cumulative and in-combination effects across the Hornsea Zone. |
| **Zone of Theoretical Visibility** | Area within which a proposed development may have an influence or effect on visual amenity. |
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1 INTRODUCTION

1.1.1 This report considers the scope of assessment proposed for Project Two, within the Hornsea Zone. Project Two is the second offshore wind farm project proposed within the Hornsea Zone, the first of which being referred to as Project One. The application for Project Two will include all offshore development, including the associated offshore cable route and onshore infrastructure.

1.1.2 The developer of Project Two is SMart Wind Limited (SMart Wind), a joint venture of Mainstream Renewable Power Limited (Mainstream) and Siemens Project Ventures GmbH (SPV). The development is proposed with an estimated capacity of up to 1.8 gigawatts (GW), and will contribute to the overall target capacity of the Hornsea Zone of 4,000 MW (4 GW) by the year 2020.

1.1.3 The Hornsea Round 3 Zone is located in the central region of the North Sea, covering an area of 4,735 km² (Figure 1.1). The coast of the East Riding of Yorkshire lies 31 km to the west of the Zone’s boundary. The Zone’s eastern boundary is 1 km west of the median line between UK and Dutch waters.

1.1.4 Project Two will comprise a number of construction phases, though these have not been fully defined at this stage in the development process. The project will include all relevant offshore and onshore infrastructure, including onshore grid connection. The turbines will be situated within ‘Subzone 2’, which is located in the centre of the Hornsea Zone. Subzone 2 is likely to cover an area in the region of approximately 400 km². The coast of the East Riding of Yorkshire lies approximately 89 km to the west of the boundary of Subzone 2. The eastern boundary of Subzone 2 is 49.7 km west of the median line between UK and Dutch waters.

1.1.5 Project Two has secured a grid connection agreement and will connect to Killingholme North substation, an existing 400 kV substation located in the Humber region which is owned by National Grid Electricity Transmission plc. (NGET) (Figure 1.2). The route to be followed by the Project Two export cable will follow that of Project One, aside from the area immediately south of Subzone 2 where the cable enters Subzone 2 (see Figure 1.1).

1.1.6 Project Two will be submitted as a single application for a Development Consent Order (DCO) under the Planning Act 2008. The application for development consent will comprise full details of the development proposal and will be accompanied by an Environmental Statement (ES) prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the ‘EIA Regulations’) and supporting documents.

1.1.7 The Environmental Impact Assessment (EIA) will be informed by stakeholder responses to this Scoping Report. Specifically, in accordance with Regulation 8 of the EIA Regulations, a Scoping Opinion is requested from PINS.
Figure 1.1: Location of Project Two (offshore area).
Figure 1.2  Location of Project Two (onshore area).
1.2 THE DEVELOPER AND PROJECT TEAM

1.2.1 The promoter of this project, and the overall development of the Hornsea Zone, is SMart Wind Limited. SMart Wind is a 50/50 joint venture between Mainstream Renewable Power Limited and Siemens Project Ventures GmbH (SPV). SMart Wind Limited has been established specifically for the development of the Hornsea Zone.

1.2.2 Mainstream Renewable Power is a leading developer of large scale renewable energy projects that accelerate global progress towards a sustainable future. Siemens Project Ventures is a group company of Siemens Financial Services GmbH. Siemens is a global leader in electronics and electrical engineering, operating in the industry, energy and healthcare sectors.

1.2.3 RPS has been commissioned by SMart Wind to undertake the EIA for Project Two. This includes the initial review of the key environmental issues associated with the construction, operation and decommissioning of Project Two. RPS may outsource some of the technical expertise which shall be assessed on an as needs basis during the EIA.

1.2.4 Legal advice has been provided by Shepherd and Wedderburn LLP.

1.3 ZONE DEVELOPMENT

1.3.1 The Crown Estate (TCE) awarded SMart Wind the right to develop 4 GW of wind capacity off the east coast of England, in Zone 4 (the Hornsea Zone), under the Round 3 Offshore Wind Licensing Arrangements.

1.3.2 The right to develop the Hornsea Zone is subject to SMart Wind being successful in gaining the necessary consents and licences from statutory bodies for the construction, operation and decommissioning of each of the individual projects that will be located within the Hornsea Zone.

1.3.3 At the time of submission of this scoping report, SMart Wind are progressing the application for development consent for Project One in the Hornsea Zone. The plan to develop the remainder of the Hornsea Zone is likely to consist of a further two projects within the Zone which have not been fully defined at this stage.

1.3.4 This Scoping Report applies only to Project Two. Any future projects within the Hornsea Zone will be termed sequentially, i.e. Project Three, Project Four (etc.), and will each require a new scoping report that will consider the additional offshore and onshore infrastructure as separate applications to PINS.

1.4 PURPOSE OF THIS DOCUMENT

Aims

1.4.1 The purpose of this Scoping Report is to inform stakeholders about Project Two in order to elicit stakeholder input and to ensure a robust EIA is undertaken.
This document therefore sets out the proposed content, key issues and methodologies to be followed for the EIA, the results of which will be included in the ES to be submitted with the application for development consent.

1.4.2 SMart Wind are planning to submit the application and supporting documentation for Project Two in 2013, following a period of formal consultation.

1.4.3 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, transboundary, cumulative and inter-related assessment and the consultation strategy; and
- To engage with PINS, regulators and stakeholders in the EIA process, inviting them to provide relevant information and to comment on the proposed approach to the EIA.

1.4.4 The identification and subsequent assessment of potentially significant impacts will be based upon an understanding of the environmental conditions likely to be encountered within Project Two, utilising information that has been gained from the Hornsea Zone, Zone Appraisal Plan (SMart Wind 2012), the EIA for Hornsea Zone Project One and other wind farm environmental assessment studies.

1.4.5 A number of environmental topics are considered in this Scoping Report. These include topics which may have no significant impacts or effect-receptor pathways identified and which will therefore be proposed to be scoped out of the EIA. Only once evidence is sufficiently advanced to be confident that there are no significant impacts or receptor pathways that exist, will these topics be finally scoped out, in agreement with key stakeholders.

Get Involved

1.4.6 There are a number of ways that stakeholders (including non-statutory consultees) can be involved in the EIA process during this scoping stage. A programme of consultation will be undertaken to fulfil both environmental and planning regulations, and enable all stakeholders to comment on the proposed scheme and studies throughout the process.

1.4.7 While the final location of Project Two infrastructure will be subject to the final scheme layout for onshore infrastructure, all onshore infrastructure will be located wholly or partially within the following administrative areas:

- The districts of West Lindsey and East Lindsey;
- The unitary authorities of North East Lincolnshire, and North Lincolnshire; and
- The county of Lincolnshire.
1.4.8 The relevant local authorities within whose administrative areas the project will be located are:

- West Lindsey District Council;
- East Lindsey District Council;
- Lincolnshire County Council;
- North East Lincolnshire Council; and
- North Lincolnshire Council.

1.5 DOCUMENT STRUCTURE

1.5.1 This Scoping Report has followed the advice notes and guidance available on the National Infrastructure Planning website: (www.infrastructure.planningportal.gov.uk).

1.5.2 The remainder of this Scoping Report is structured as follows:

- **Section 2**: provides the policy and legislative context for obtaining a consent to develop Project Two;
- **Section 3**: provides a description of the development required for Project Two, including the Zone wide studies, Subzone selection, alternatives to the development, the project description and an overview of health and safety consideration for Project Two;
- **Section 4**: describes the general methodology proposed for the EIA, including the approach to impact assessment (transboundary, cumulative and inter-related assessment), monitoring and mitigation;
- **Section 5**: provides a summary of the offshore physical environment, identifies key potential physical environment receptors for Project Two, the proposed assessment methodology, potential impacts for each project development phase (construction, operation and decommissioning) and considers transboundary, cumulative, and inter-related impacts. Proposed monitoring and mitigation measures are identified for each;
- **Section 6**: provides a summary of the offshore biological environment, identifies key potential biological environment receptors for Project Two, the proposed assessment methodology, potential impacts for each project phase and considers transboundary, cumulative, and inter-related impacts. Proposed monitoring and mitigation measures are identified for each;
- **Section 7**: provides a summary of the offshore human and socio-economic baseline, identifies key potential human and socio-economic receptors for Project Two, the proposed assessment methodology, potential impacts for each project phase and considers transboundary, cumulative, and inter-related impacts. Proposed monitoring and mitigation measures are identified for each;
- **Section 8**: provides a summary of the onshore environment, identifies key potential onshore receptors for Project Two, the proposed assessment methodology, potential impacts for each project phase and considers transboundary, cumulative, and inter-related impacts. Proposed monitoring and mitigation measures are identified for each;

- **Section 9**: provides the draft contents for the Project Two ES.

- **Section 10**: provides a summary of the potential environmental impacts identified to date for each project phase, transboundary, cumulative, and inter-related impacts, and mitigation and monitoring anticipated for Project Two;

- **Section 11**: provides the consultation processes applicable to this application;

- **Section 12**: provides contact details for the developer; and

- **Section 13**: provides full citations for all references within the scoping report.
2 POLICY AND LEGISLATIVE CONTEXT

2.1 INTRODUCTION

2.1.1 Where policy or legislation exists in respect of specific topics, particularly in respect of EIA, it will be identified in the relevant chapters of the Draft ES.

2.1.2 A full assessment of Project Two in terms of planning policies will be provided in the Planning Statement which will be available in the second round of consultation (known as Phase 2) and will later accompany the application for planning consent.

2.1.3 The Planning Act 2008 has made significant changes to the planning system applicable to offshore wind development. Project Two is a development over 100 MW and therefore classified as a Nationally Significant Infrastructure Project (NSIP) requiring a DCO under the Planning Act 2008.

2.2 CONSENTING PROCESS

Introduction

2.2.1 The following section provides a summary of the consenting process which Project Two will follow as required under the Planning Act 2008.

2.2.2 The consenting process for Project Two is summarised with reference to the following:

- Planning legislation and infrastructure planning regulations under which the DCO application will be submitted;
- Overview of the DCO application process;
- EIA, HRA and associated legislation and regulations; and
- Other consents and licences

Planning Legislation Under Which the DCO Application will be Submitted

2.2.3 Section 31 of the Planning Act 2008 provides that development consent is required for development which is or forms part of a NSIP. In accordance with Section 15(3) of the Planning Act 2008, an offshore energy generating station with a generating capacity of more than 100 MW constitutes a NSIP. The proposed Project Two development in the Hornsea Zone, with a maximum generating capacity of up to 1.8 GW, satisfies the criteria for NSIP.

2.2.4 Section 37 of the Planning Act 2008 requires that an application for an order granting development consent must be made to the Secretary of State. In accordance with Section 104 (2) of the Planning Act 2008, in deciding applications the Secretary of State must have regard to:

- Any NPS which has effect in relation to development of the description to which the application relates (a relevant national policy statement);
- Any local impact report (within the meaning given by Section 60(3)) submitted to the Secretary of State before the deadline specified in a notice under Section 60(2);
- Any matters prescribed in relation to development of the description to which the application relates;
- Any other matters which the Secretary of State thinks are both important and relevant to the Secretary of State’s decision; and
- The appropriate marine policy documents (if any), determined in accordance with Section 59 of the MCAA 2009.

2.2.5 Section 104 (3) establishes the primacy of the NPSs in determining DCO applications. It requires applications to be decided “in accordance with any relevant national policy statement, except to the extent that one or more of subsections (4) to (8) applies”. Subsection (4) concerns a breach of international obligations, (5) a breach of a statutory duty, (6) illegality by virtue of any enactment, (7) where the Secretary of State “is satisfied that the adverse impact of the proposed development would outweigh its benefits” and (8) where a “condition prescribed for deciding an application otherwise than in accordance with a national policy statement is met”.

2.2.6 Section 106 of the Planning Act 2008 sets out matters that may be disregarded, including representations which “relate to the merits of policy set out in a [NPS]”.

2.2.7 The Planning Act 2008 and corresponding secondary legislation set out a comprehensive statutory framework for the granting of all of the principal consents required to develop, operate and decommission NSIPs and their associated infrastructure.

2.2.8 The Planning Act 2008 provides that a DCO may replace the need for certain other consents to be obtained, specifically planning permission under the Town and Country Planning Act (TCPA) 1990, listed building and conservation area consent under the Planning (Listed Buildings and Conservation Areas) Act 1990 and scheduled monument consent under the Ancient Monuments and Archaeological Areas Act 1979.

2.2.9 In addition, other consents can either be deemed under the Planning Act 2008 (i.e., a Marine Licence under Section 149A of the Planning Act 2008) or the requirement for them removed under the DCO.

**Development Consent Order Application Process**

2.2.10 The DCO will provide statutory consent for the development of Project Two. The process for obtaining a DCO is split into seven phases; pre-application; application; acceptance; pre-examination; examination; decision; and post decision (Figure 2.1). SMart Wind are currently in the pre-application phase for Project Two.
2.2.11 The Project Two application will be submitted to PINS with the prescribed forms and documents as required by the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009. Regulation 5-(2) (a) requires that, where applicable, an application must be accompanied by “the environmental statement required pursuant to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 and any scoping or screening opinions or directions”.

![Flow diagram of the DCO process](image)

**Figure 2.1:** Flow diagram of the DCO process

2.2.12 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (EIA Regulations) implement the EIA Directive for consent applications made under the Planning Act 2008. As noted above, only certain types of project require an EIA to be carried out. Schedule 1 of the EIA Regulations sets out those developments that are required to undergo an EIA; Schedule 2 to the EIA Regulations set out the developments that may need an EIA whilst Schedule 4 to the EIA Regulations provides details of the information to be included in an Environmental Statement.

2.2.13 According to Schedule 2 of the EIA Regulations, an EIA is required for installations for the harnessing of wind power for energy production likely to have significant effects on the environment.
2.2.14 Generic advice on EIA relevant to Project Two is provided by the National Policy Statements (NPS) EN-1 and EN-3. These NPSs provide the primary basis for decisions by the Secretary of State on applications for nationally significant renewable energy infrastructure (defined at 1.8 of NPS EN-3).

**Design envelope approach**

2.2.15 It is acknowledged in NPS EN-3 (Paragraph 2.6.43) that a high level of flexibility may be necessary in the description of a project being consented by a DCO. In relation to offshore wind farm development this is due to the complex nature of the projects and the fact that many of the details such as the precise location of the turbines, foundation type, exact turbine tip height and cable route may not be known at the time of application (Paragraph 2.6.42). At the same time it is important that the environmental effects of a proposal are robustly assessed. As accepted in the NPSs, developers may apply a ‘design envelope’ to describe the maximum extent of the project to be assessed in the EIA. This approach has also been accepted in the Scoping Opinions from the IPC on Project One (IPC, 2010 and IPC, 2012).

2.2.16 PINS Advice Note Nine: Rochdale Envelope (Planning Inspectorate, 2012) considers further the degree of flexibility in the design envelope that may be appropriate with regards to an application for a NSIP under the Planning Act 2008 regime.

2.2.17 The design envelope approach has been used in the majority of offshore wind farm applications. The use of the design envelope approach has also been recognised in NPS EN-1 and NPS EN-3. NPS EN-3 states that:

2.2.18 “the ‘Rochdale [Design] Envelope’ is a series of maximum extents of a project for which the significant effects are established. The detailed design of the project can then vary within this ‘envelope’ without rendering the Environmental Statement inadequate”.

2.2.19 It further states that:

2.2.20 “the Secretary of State should accept that wind farm operators are unlikely to know precisely which turbines will be procured for the site until sometime after any consent has been granted. Where some details have not been included in the application to the Secretary of State, the applicant should explain which elements of the scheme have yet to be finalised, and the reasons. Therefore, some flexibility may be required in the consent. Where this is sought and the precise details are not known, then the applicant should assess the effects the project could have to ensure that the project as it may be constructed has been properly assessed (the Rochdale [Design] Envelope).” (DECC, 2011d)

**EIA in the context of Project Two**

2.2.21 The main stages in the EIA process in respect of Project Two are as follows:

- Screening to determine the need for EIA;
• Scoping to determine the subject matter of the EIA and to identify potentially significant issues;

• Data review involving compiling and reviewing available data and/or undertaking of baseline surveys to generate site-specific data;

• Assessment and design iteration whereby the likely significant effects of the development during the construction, operational and decommissioning stages of its life are assessed and feedback is provided to the design and engineering team(s) to modify the development in order to avoid, prevent, reduce and, where possible, offset any significant adverse effects on the environment;

• Assessment of the construction methodology and the final design of the development;

• Identifying any residual effects and any further mitigation or compensation requirements;

• Preparing the Environmental Statement, reporting on the EIA; and

• Controlling and monitoring the effects of the project during construction, operation and decommissioning in accordance with the mitigation measures identified in the Environmental Statement and/or the requirements identified in the DCO.

Consultation

2.2.22 Under the Planning Act 2008, it is the responsibility of the developer to ensure that pre-application consultation fully accords with the requirements of the Act, and associated regulations and guidance, including the EIA Regulations. The full consultation programme for Project Two will be described in the Statement of Community Consultation (SoCC) that will be published in advance of the first phase of consultation. In addition, the Secretary of State has statutory obligations under the EIA Regulations which impose procedural requirements in relation to notifying and consulting prescribed consultation bodies in relation to Project Two and the DCO application.

Preliminary Environmental Information Report

2.2.23 The EIA Regulations require preliminary environmental information (PEI) to be provided for public consultation by those seeking a DCO for NSIPs. The level of detail required in the PEI is not defined by the EIA regulations however it must cover those areas considered by the Environmental Statement which will accompany the application for development consent.

2.2.24 Smart Wind plan to submit and consult upon an initial PEI report for Project Two as part of Phase 1 consultation in winter 2012/13. The initial PEIR is intended to allow those taking part in the consultation to understand the nature, scale, location and likely significant environmental effects of Project Two such that they
can make an informed contribution to the process of pre-application consultation under the Planning Act 2008 and to the EIA process.

2.2.25 SMart Wind plan to further refine Project Two based upon the consultation responses received from the PEI process. The final results of the EIA will be presented in an Environmental Statement that will accompany the DCO application. The draft Environmental Statement will be issued for consultation during Phase 2 of consultation.

**Environmental Statement**

2.2.26 The aim of an Environmental Statement is to demonstrate that the likely significant environmental effects have been properly assessed and support a DCO application for a scheme that is clearly defined and sufficiently detailed to enable the Secretary of State to make a determination. An Environmental Statement should include a description of the project, alternatives and site selection, a description of the environment likely to be affected and any inter-relationships between different environmental parameters. A non-technical summary of the conclusions of the Environmental Statement will also be provided.

2.2.27 Likely significant effects considered should include the direct effects and any indirect, secondary, cumulative, short, medium, long-term, permanent, temporary, positive and negative effects.

2.2.28 Where significant adverse effects on the environment are identified in the Environmental Statement, mitigation measures, which aim to reduce or remove such adverse effects and, if appropriate, monitoring, will be proposed.

**Habitats Regulation Assessment**

2.2.29 A key aspect in assessing Project Two as part of the DCO application is the requirement for the assessment by the competent authority (which will be the Secretary of State) under the Conservation of Habitats and Species Regulations 2010 and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) (together the Habitats Regulations) of any significant effects on internationally important nature conservation sites that are likely to arise as a result of the proposed project. These internationally important sites include SACs which have important species and habitat features, SPAs which relate to bird populations and Ramsar sites which are internationally important wetlands. These are often referred to as Natura 2000 or European sites.

2.2.30 In order to carry out this Habitats Regulations Assessment (HRA) the competent authority requires a separate report to the Environmental Statement which is described in PINS Advice Note Ten: Habitat Regulations Assessment. This is also required formally under Regulation 5(2)(g) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009.
2.2.31 PINS Advice Note Ten describes HRA as a step by step process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European sites. The assessment that is carried out by the competent authority in the context of HRA is called an Appropriate Assessment (AA).

2.2.32 The information intended to inform the competent authority in the HRA/AA process for Project Two as required under the Habitats Regulations is set out in the Habitats Directive, and will be submitted as part of the DCO application for Project Two.

2.2.33 The subsequent PEIR and Environmental Statement will outline the likely significant effects of Project Two on nature conservation designations, as set out in this Scoping Report.

Other Consents and Licences

European Protected Species licence

2.2.34 The Conservation of Habitats and Species Regulations 2010 (as amended) transpose the Habitats Directive into domestic law and implement aspects of the MCAA. The Regulations provide protection for European Protected Species (EPS) which are those animal species listed in Schedule 2 and the plant species listed in Schedule 5 of the Regulations. The Regulations make it an offence to:

- deliberately capture, injure or kill any wild animal EPS;
- deliberately disturb wild animals of any such species;
- deliberately take or destroy the eggs of such an animal; or
- damage or destroy a breeding site or resting place of such an animal.

2.2.35 The Regulations provide that ‘disturbance’ of animals includes any disturbance likely to impair their ability to survive, breed or reproduce, or to rear or nurture their young, or in the case of animals of a hibernating or migratory species, any disturbance likely to impair their ability to hibernate or migrate. Any disturbance likely to significantly affect the local distribution or abundance of the species to which they belong is also included.

2.2.36 With respect to the offshore elements of Project Two, the protected species present will be identified and the likely effects assessed within the HRA. Where possible, effects on protected species will be avoided or minimised. However, if disturbance cannot be avoided SMart Wind will be required to apply for an EPS licence. This will be confirmed following an EPS risk assessment and following consultation with the MMO, Natural England, the CEFAS and the JNCC.

Energy Act 2004 (Safety Zones)

2.2.37 Where an offshore renewable energy installation is proposed to be constructed, extended, decommissioned or operated, a notice declaring that specified areas of the sea are to be designated as safety zones may be issued by the Secretary
of State under the provisions of the Energy Act 2004. Safety zones may exclude non-wind farm vessels from navigating through the designated area for the designated period.

2.2.38 SMart Wind will make an application for safety zones to be implemented during the construction and decommissioning of Project Two. During the operational phase, safety zones will be applied for around individual structures during periods of major maintenance.

2.2.39 The application for safety zones around Project Two will be made separately to the main DCO application. However the potential implications of any such zone on other marine users are assessed as part of the navigational assessment (See Volume 2, Chapter 8: Shipping and Navigation). A ‘safety zone statement’ will be included with the DCO application.

Energy Act 2004 (Decommissioning)

2.2.40 Sections 105 to 114 of the Energy Act 2004 introduced a requirement for decommissioning schemes for offshore wind and marine energy installations to be approved by DECC prior to commencement of construction of such projects.

2.2.41 While some decommissioning detail is presented here, further detail will be available for presentation in the initial PEIR at Phase 1 consultation. This information will be further refined and detailed in the ES, which will accompany the application for development consent. Final details of decommissioning will not be agreed until later in the project's life and consent for decommissioning will be sought under the Energy Act 2004 process. In particular SMart Wind will consult on a decommissioning plan which is required to be approved by DECC prior to the commencement of construction of Project Two.
3 DESCRIPTION OF THE DEVELOPMENT

3.1 INTRODUCTION

3.1.1 Broadly, Project Two comprises ‘Subzone 2’ of the Hornsea Zone, the inter array cables, offshore accommodation platforms, offshore HVAC collector substations, offshore HVDC converter station(s) or offshore HVAC reactive compensation substation, the offshore export cable route to landfall, the onshore cable route to the grid connection point and the grid connection infrastructure (including an onshore HVDC converter station should this option be selected).

3.2 SUBZONE SELECTION

3.2.1 The context of selecting future projects within the Hornsea Zone beyond Project One has been informed by a variety of data sources, surveys, risk assessments and workshops. Notably, the Zonal Appraisal and Planning (ZAP) process has provided a non-statutory process intended to assist with Project identification and provide data to support the definition of an environmental baseline for EIA purposes. The Zone Characterisation (ZoC) documents the environmental receptors within the Hornsea Zone using desk-based literature, existing data and dedicated Zone survey data.

3.2.2 Stakeholder engagement in the ZAP process is primarily delivered through the use of the SMart Wind Stakeholder Advisory Group (SAG) which has met on five occasions since its inaugural meeting in March 2011 to discuss the Zonal development issues. The SAG is comprises representatives of Crown Estate, MMO, JNCC, CEFAS, MCA, NFFO, RSPB and Natural England. Corresponding members are represented by English Heritage, MoD, CAA, NATS, Chamber of Shipping, Trinity House, Cruising Association, RYA, O&G UK and BMAPA.

3.2.3 The objectives of ZAP and SAG have been combined to discuss and agree locations of future projects. Specifically for Project Two, environmental, engineering, grid, HSE, O&M, energy analysis and commercial issues were evaluated to define a project boundary for the proposed project. A key consideration related to the grid connection offer at Killingholme, which highlighted the efficiency of using the same export cable route corridor for both Project One and Project Two.

3.2.4 In context of the existing boundary of Project One, which is located in the shallowest water depths within the Hornsea Zone, the immediate possibilities for the location of Project Two were identified as immediately north, east or west of the Project One boundary due to efficiencies in electrical engineering, optimal water depths and appropriate separation distances to gas platforms. Other material considerations that were assessed included civil engineering (water depth, depth to chalk substrate), operations and maintenance (distance from shore), commercial navigation, Helicopter Main Routes, commercial fishing, CAPEX/OPEX, wind resource, pipeline crossings, subsea infrastructure and current & potential future oil and gas exploration and production activity.
3.2.5 In parallel with this, existing environmental hard constraints in the Zone were mapped.

3.2.6 Hard constraints are those considered to preclude offshore wind farm development. The constraints used for project identification build upon the ones used by TCE, MaRS and SEA, and include the following:

- Bathymetry >60 m;
- Oil and gas subsurface installations and their 500 m safety zones;
- Live cables and pipelines and their buffers of 500 m;
- Protected wrecks and their buffers according to the Protection of Military Remains Act 1986; and
- International Maritime Organisation (IMO) shipping routes.

3.2.7 In addition to these hard constraints, consideration of other challenges to consent in terms of constraints were identified:

- Volume and routes of shipping;
- Civil aviation radar interference;
- Military air defence radar interference;
- Ministry of Defence (MoD) training and exercise areas (PEXA);
- Commercial fishing interactions;
- Helicopter main routes;
- Oil and gas surface installations with 9NM consultation buffers¹;
- Waste disposal sites and dredging sites;
- Other marine infrastructure including other renewables, wind farm developments, oil and gas activities, gas storage etc.
- Recreational users;
- Nature conservation designations and other protected habitats;
- Fish spawning and nursery areas;
- Geological information;
- Geotechnical design parameters;
- Metocean considerations;
- Foundation type suitability; and
- Fabrication and installation costs.

¹ Indicative distance given by Civil Aviation Authority (CAA): wind turbines within 9 NM of an offshore destination would potentially affect the feasibility to conduct some helicopter operations (namely, instrument procedures) at the associated site. Guidance on the effects of wind turbines on aviation – CAP 764.
3.2.8 Overlaying all of these constraints in the Hornsea Zone enabled the location of Subzone 2 to be identified.

3.3 ALTERNATIVES AND PROPOSED DEVELOPMENT SELECTION

Review of alternatives considered for Project One and relevant to Project Two

3.3.1 SMart Wind must install export cables to enable electrical power generated by Project Two to reach an onshore grid connection point. The policy framework for electricity transmission cables (marine and terrestrial) is provided in the National Policy Statement (NPS) for Energy (EN-1), Renewable Energy Infrastructure (EN-3) and Electricity Networks Infrastructure (EN-5).

3.3.2 Factors influencing site selection by applicants for electricity transmission networks are summarised in Section 2.2 of NPS EN-5. The general location of an electricity network project is determined by the location of a particular generating station and the existing network infrastructure available to take electricity to centres of energy use (NPS EN-5, paragraph 2.2.2). These give a location-specific beginning and end to a line. National Grid offered a grid connection point for Project Two at the Killingholme North substation. This offer was accepted by SMart Wind in October 2011.

**Onshore grid connection point and shared cable corridor and landfall**

**Grid connection point**

3.3.3 The onshore grid connection point offered by National Grid for Project Two is at the same location as that for Project One (Killingholme North substation).

**Shared cable corridor and landfall**

3.3.4 For Project One, a staged alternatives selection process was undertaken. Following definition of the potential Project One grid connection locations, this included:

- Engineering and environmental appraisal of candidate landfalls;
- Designation of early option cable corridors;
- Phase 1 consultation events, introduction of early project design options;
- Appraisal and definition of cable route, preferred landfall, Humber crossing appraisal, identification of four candidate offshore HVDC converter station sites;
- Phase 2 consultation events, presentation of refined project design options;
- Selection of the preferred offshore HVDC converter station(s) location;
- Further refinement of project design post review of consultation responses and EIA studies and inclusion in project scope of HVAC option; and
3.3.5 These stages were reviewed by SMart Wind to determine:

- Whether the considerations that applied to the selection of the preferred cable route corridor for Project One, including public consultation responses to Project One (Phase 1, Phase 2 and Phase 3 consultations) would also apply to Project Two; and

- Whether the physical constraints on cable routes to the south of the Humber Estuary would still allow for a cable route for Project Two to be located in the same corridor.

3.3.6 It was concluded that these considerations also applied to Project Two which allowed early designation of offshore and onshore cable route corridors for scoping in Project Two.

**Proposed development selection**

**Identification of scoping boundary for Project Two**

3.3.7 In context of the existing boundary of Project One, which is located in the shallowest water depths within the Hornsea Zone, the immediate possibilities for the location of Project Two were identified as immediately north, east or west of the Project One boundary. This is due to efficiencies in electrical engineering, optimal water depths and appropriate separation distances to nearby gas platforms. Other material considerations that were assessed included civil engineering (water depth, depth to chalk substrate), operations and maintenance (distance from shore), commercial navigation, HMRs, commercial fishing, CAPEX/OPEX, wind resource, pipeline crossings, subsea infrastructure and current & potential future oil and gas exploration & production activity.

3.3.8 Project Two will consist of a number of phases of turbine arrays and associated electrical infrastructure, the location of which are encompassed within the red boundary shown in Figure 1.1 and Figure 1.2. SMart Wind are currently considering the requirement to install electrical connections between Project Two and Project One. If taken forward this option will be clearly described as part of the project design envelope and fully assessed in the ES.

3.3.9 The location of the offshore accommodation platforms as required will be determined by the electrical engineering optimisation studies, assessment of project constraints, the potential environmental impacts from the platforms and the health, safety and welfare requirements for the personnel on the platforms.

**Engineering and environmental appraisal of landfall and cable corridor**

3.3.10 A range of different cabling options to transfer the electricity generated by the offshore wind turbines to the National Grid transmission system are under consideration. The final decisions will be reliant on the final wind turbine and
electrical design, as well as a detailed analysis of the costs, technical aspects and available technology of the various options. There are two main types of options available with respective infrastructure requirements: one solution based on High Voltage Alternating Current (HVAC) technology and one based on High Voltage Direct Current (HVDC).

3.3.11 The cable route for Project Two is proposed to run alongside that for Project One, with minor deviations near the onshore substations where there is insufficient space for co-location. This approach minimises the environmental disturbance required for the cable routing. The width of the cable corridor will be determined by the choice of HVDC or HVAC export option, as several cable configurations are currently under consideration.

**Consultation overlap between Project One and Project Two**

3.3.12 Public consultation events have introduced and referred to the shared connection point and resulting environmental and engineering appraisal for Project One.

3.3.13 Export cable design options that affect both Project One and Project Two have been the subject of formal consultation with PINS. This included the receipt of a Scoping Opinion informing the environmental assessment for Project One, parts of which described the assessment surrounding the shared concerns of the optimum location of the cable route corridor, and the location of a potential HVAC reactive compensation substation at a point along the length of the export cable.

**Project Two specific consultation programme**

3.3.14 Project Two will adopt a two phase consultation approach.

3.3.15 The first phase of consultation will be carried out on the basis of an initial Preliminary Environmental Information Report (initial PEIR) for Project Two and will follow the refinement of the EIA based on the scoping responses.

3.3.16 The second phase of consultation will be undertaken based on the Project Two draft ES. This will report the initial stages of site selection and impact assessment for the various project elements. It will also include any subsequent refinements to the project as a consequence of the EIA and ZAP process.

3.3.17 The ES will report where alternative options that are available for design technology, construction materials, methods of construction, operation, maintenance and decommissioning have been assessed.

**3.4 PROJECT DESCRIPTION**

3.4.1 The details of the key offshore and onshore components of Project Two are outlined below. These indicative details will be refined throughout the EIA process using a combination of desk studies, survey information, engineering
analyses, discussions with suppliers and feedback from the consultation process.

3.4.2 Consideration has been given to the construction, operation and maintenance and decommissioning phases for all of the proposed Project Two component options.

3.4.3 The EIA shall be undertaken in all instances considering the worst case scenario for potential environmental impacts (for example consideration of the maximum number of turbines), in line with the design envelope approach (see Section 1).

**Offshore Infrastructure**

3.4.4 The key offshore infrastructure of Project Two are likely to comprise:

- Offshore wind turbines;
- Wind turbine foundations;
- Offshore platforms supporting offshore HVAC collector substations, offshore HVDC converter station(s) or an offshore HVAC reactive compensation substation and accommodation facilities for operation and maintenance of Project Two;
- Inter-array cables between the wind turbines and offshore platforms and export cables between the offshore platforms and the shore;
- Scour protection around foundations as required; and
- Cable protection around inter-array and export cables as required.

3.4.5 Geotechnical site investigation surveys will be undertaken to inform the design and installation for the foundations, cables and jack-up operations.

3.4.6 The infrastructure for Project Two will not be procured until much later in the project programme. In this regard a description of the most likely components and their installation has been provided, together with any alternatives, as appropriate.

**Foundations**

3.4.7 Wind turbines and offshore platforms will be supported on foundations sitting on, or embedded in, the seabed. The factors influencing the choice of foundation are:

- Selection of wind turbine to be used;
- Costs and engineering;
- Environmental impact;
- Ground conditions / seabed stability; and
- Metocean conditions and detailed wind analysis.
3.4.8 More information is required to inform the choice of foundations and to determine which are the most cost effective and environmentally appropriate. It is possible that more than one type of foundation may be used across Project Two. The following foundation concepts will be considered in the Project Two EIA:

- Steel monopile;
- Steel jackets supported on piles or suction piles; and
- Concrete gravity base.

3.4.9 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. The indicative dimensions are based on a mid-range turbine size and mid-range water depths and are to be used for illustrative purposes only. Further work will be undertaken in parallel with the EIA to refine these parameters. A description of installation and decommissioning methods for each foundation type will be included in the ES for Project Two. The initial foundation options will be based on data from the geophysical and preliminary geotechnical campaigns which were commissioned in 2010. The final engineering solution will be decided upon completion of the detailed geotechnical campaign and in response to environmental constraints identified during the consultation and EIA process.

3.4.10 Scour can occur around the base of a foundation as a result of the flow of water around the structure. Scour may also occur on cable routes and at other offshore infrastructure such as the offshore HVDC converter station(s) and HVAC collection stations. A number of options for scour protection will be considered for installation with Project Two, 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.

| Table 3.1 | Potential approximate foundation types key footprint dimensions and seabed area take. |
|---|---|---|---|
| Indicative dimensions and seabed area take | Steel monopile | Steel Jacket | Gravity base |
| Indicative footprint dimensions | 4 m – 10 m external diameter | 15 m – 40 m leg spacing with piles of up to 3 m external diameter | 40 m – 60 m base diameter |
| Seabed area | 79 m² | 28 m² | 3,848 m² |
### Indicative dimensions and seabed area take

<table>
<thead>
<tr>
<th></th>
<th>Steel monopile</th>
<th>Steel Jacket</th>
<th>Gravity base</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scour protection seabed area take</strong></td>
<td>1,885 m^2</td>
<td>141 m^2</td>
<td>4,400 m^2</td>
</tr>
<tr>
<td><strong>Total seabed area take per wind turbine</strong></td>
<td>1,963 m^2</td>
<td>254 m^2</td>
<td>6,370 m^2</td>
</tr>
<tr>
<td><strong>Array seabed area take</strong></td>
<td>472,000 m^2</td>
<td>61,100 m^2</td>
<td>1,530,000 m^2</td>
</tr>
</tbody>
</table>

### Offshore Wind Turbines

3.4.11 Project Two will comprise between 80 and 360 wind turbines depending on the turbine type selected and their size, potentially ranging from 5 MW to 15 MW. The turbines will have a maximum rotor diameter of 250 m and a maximum hub height of 200 m. The turbines will have a minimum lower blade tip height of 31 m and a maximum upper blade tip height of 325 m. All figures quoted are relative to Lowest Astronomical Tide (LAT). Please see Figure 3.1 for an illustration of these parameters.

3.4.12 The spacing between the wind turbines in the final layout will be in the order of between six and 12 rotor diameters. The spacing between turbines within the array may also vary with direction. For the range of rotor diameters being considered at this stage, the spacing of the turbines could range between 720 m and 3 km.

3.4.13 It should be noted that the exact wind turbine specifications for Project Two are yet to be determined. The wind turbines selected however are likely to be of a proven technology, incorporating tapered tubular towers and three blades attached to a nacelle which will contain equipment such as the generator and other operating equipment.

3.4.14 The maximum capacity Project Two will be capable of delivering is 1.8 GW. A range of wind turbine models could be used.
3.4.15 Two options are available for connection of an offshore wind farm to the onshore national grid: High Voltage Alternating Current (HVAC) and High Voltage Direct Current (HVDC). These options differ in the way the electrical current is transmitted through the cables and have implications for the physical layout of the project export cables. The main difference of relevance to the project is that HVDC transmission is generally considered to entail lower electrical losses over long distances (generally greater than 80 km). HVAC is however being retained as an option for this project in order to allow for flexibility in procurement at the time of construction. Please see Figure 3.2 below for an illustration of the two transmission options.
3.4.16 It is envisaged that up to six offshore HVAC collector substations mounted on platforms will be required for the delivery of the electricity generated by the proposed wind farm. The primary function of the offshore HVAC collector substations is to transform the voltage of the electricity produced by the wind turbines from relatively low voltage (less than 150 kV) up to the level required for transmission over long distances in order to reduce electrical losses. The offshore HVAC collector substations interconnect the offshore HVDC converter station(s), in the case of the HVDC option, or the offshore HVAC reactive compensation substation in the case of HVAC export option with the wind turbines via inter-platform and inter-array cable circuits, respectively. Typically, the dimensions of an offshore HVAC substation may be up to 65 m in length x 60 m wide x 75 m high.

Offshore HVDC converter station(s)

3.4.17 The westernmost boundary of Subzone 2 is situated more than 89 km offshore and the developer may therefore select to connect to the existing electrical network by using HVDC technology. The primary function of an offshore HVDC converter station is to convert HVAC transmission voltage that it receives from the offshore HVAC collector substations to HVDC, which is more suitable for efficiently exporting electrical power over long distances. A maximum of two offshore HVDC converter stations would be required for the proposed generating capacity.
3.4.18 The offshore HVDC converter station(s) shall be mounted on platforms potentially located outside Subzone 2, but within the cable route corridor and within the general vicinity of Subzone 2. Co-location and/or consolidation with the offshore HVAC collector substation(s) cannot be ruled out at this stage. Typically, the dimensions of an offshore HVDC converter station will be up to 120 m in length x 60 m wide x 63 m high.

**Offshore HVAC reactive compensation substation**

3.4.19 In order to limit the electrical losses inherent in using HVAC transmission over long distances it is necessary to use shunt reactors to provide reactive compensation along the transmission cables. These shunt reactors would be housed in an offshore HVAC reactive substation, one of which would be required for Project Two. This would be located along the export cable route, no less than 20 km from the coast. The final siting of the HVAC reactive compensation substation will be subject to various engineering as well as environmental constraints. As with other offshore structures associated with Project Two, the HVAC reactive compensation substation will be marked according to the requirements of Trinity House Lighthouse Service (THLS), Maritime Coastguard Agency (MCA) and the Civil Aviation Authority (CAA).

**Submarine Cables**

**HVDC Export Cable**

3.4.20 The specific design of the HVDC export equipment has not yet been finalised and may comprise up to four submarine cables. The HVDC export cable(s) will be appropriately sized to efficiently and economically transmit the proposed electrical generation capacity.

3.4.21 Typically, the design voltage would be up to 1000 kV and would necessarily match the design voltage of the offshore HVDC converter station.

**HVAC Export Cable**

3.4.22 The design for the HVAC export equipment back to shore has not yet been finalised and may comprise up to four export submarine cables. This will be designed to maximise the efficiency of transfer of electricity to shore and is likely to operate at a voltage of 250 kV – 1000 kV.

**Inter-platform Cables**

3.4.23 An HVAC export option would require up to four HVAC submarine cables which would connect the offshore HVAC collector substation(s) to the offshore HVAC reactive compensation substation. Conceptual electrical design work to evaluate a range of different design options for the electrical system and identify the optimal design is ongoing and will be presented in more detail in the ES.
3.4.24 An HVDC export option would require HVAC cabling between the offshore HVAC collector substation(s) and the offshore HVDC converter station(s).

**Inter-array Cables**

3.4.25 Inter-array cabling will transmit power from the individual turbines to one of the offshore HVAC collector substation(s) at a voltage of 30 – 150 kV. The final configuration of the inter-array cabling will not be known until the design options have been fully evaluated.

**Cable Installation**

3.4.26 It is envisaged that all submarine cables will, where practicable, be installed below the seabed utilising either ploughing or trenching/jetting rock-cutting or surface laying techniques, depending on the seabed conditions. A cable burial specification will be developed based on geophysical and geotechnical assessments.

3.4.27 Where cable burial is not possible, placement of some form of cable protection (rocks, frond mattresses\(^2\) or grout bags) may be deployed to protect the cables e.g. where they enter wind turbine or platform foundations, crossing pipelines etc. 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. Full details of this process and installation, along with potential environmental impacts, will be provided in the ES.

**Offshore Operation and Maintenance**

3.4.28 Once commissioned Project Two will generally operate without intervention on a day to day basis, however turbines will require regular servicing. In order to operate and maintain offshore wind farms that are some distance from the coast, such as Project Two, offshore infrastructure will be required such as accommodation and servicing platforms. These platforms may be located within the offshore array and would have their own independent foundations. Further studies are underway to determine the amount of infrastructure needed for operation and maintenance but this could potentially consist of:

- Accommodation platform(s) or floating accommodation; and
- Vessel helicopter platforms on accommodation platforms, offshore HVAC collector substations, offshore HVDC converter station(s), offshore HVAC reactive compensation substation, vessels, and potentially on the wind turbines themselves.

\(^2\) A frond mattress reduces potential scour by replicating the natural way that seaweed reduces water velocity locally around a structure.
3.4.29 The exact number of vessels that will be used for operation and maintenance has not been defined at this stage. Options being considered include:

- Use of up to two fixed dedicated offshore platforms for accommodation and maintenance;
- Use of a Floatel, permanently stationed within the zone;
- Use of a dedicated Service Operations Vessel, permanently stationed within the Hornsea Zone; and
- Use of a dedicated jack-up vessel for accommodation, permanently stationed within the Hornsea Zone.

3.4.30 Depending on the accommodation strategy selected, it is also likely that supply vessels will periodically service the offshore accommodation, bring spare parts, fuel, food, water etc., to the accommodation. There will be occasional requirements for a jack-up vessel within the project, in order to replace major components. These visits are expected to be relatively infrequent.

3.4.31 Personnel transfers to the offshore accommodation may take place using helicopters or vessels. In any event, careful consideration will be made for provision of emergency helicopter access.

3.4.32 In addition to planned maintenance, unscheduled maintenance occurs on wind turbines. This can consist of minor maintenance, involving manual intervention through to significant repairs, involving heavy lifting equipment such as jack-up barges or alike. An overview of the key maintenance categories and repair strategies can be found below.

3.4.33 Regular maintenance inspections are carried out on critical aspects of the wind farm on a regular basis. This includes foundations and transition pieces (<5 years interval), interconnecting cable (<5 years) and other offshore electrical infrastructure. Important aspects of the wind farm will be monitored and controlled from a remote location using a Supervisory Control and Data Acquisition (SCADA) system.

Onshore Infrastructure

3.4.34 As Project Two shares an onshore cable route with Project One, many of the Project Two details will be similar and may be predetermined by the Project One parameters.

3.4.35 SMart Wind has signed an agreement with National Grid (NG) to connect into the existing UK onshore transmission network. The onshore transmission connection location is North Killingholme, which is an existing 400 kV substation owned by NG and located in Lincolnshire, close to the Humber Estuary (see Figure 1.2).

3.4.36 NG’s Killingholme North substation and the onshore HVDC converter and the offshore HVDC converter station(s) or reactive compensation substation can be considered as fixed points that need to be interconnected. Being the shortest
distance between the two points, a straight line would be the ideal route. However, physical constraints, environmental constraints, land ownership and project economics greatly influence the route possibilities. In this respect, SMart Wind has undertaken an onshore cable route option assessment, considering potential landfall points and route corridors and which takes into consideration both Project One and Project Two. As mentioned above, both projects will share an export cable route. The Project Two cable route will be fully assessed as a separate project and cumulatively with Project One.

3.4.37 The onshore electrical transmission infrastructure comprises a number of key elements:

- Landfall;
- Cable transition pit(s) at landfall;
- Cable route with jointing pits;
- Onshore HVDC converter station(s) if HVDC export option is chosen;
- Onshore HVAC substation if HVAC export option is chosen; and
- Interconnecting HVAC to National Grid substation at Killingholme.

Landfall

3.4.38 The landfall location for Project Two is at Horseshoe Point and has been identified, via a detailed site selection exercise and review of alternatives during Project One’s EIA process. Full details on the site selection process and how this landfall was selected will be provided in the ES. At the landfall point, the marine export cables will transition from the marine environment to the terrestrial environment. The final method for this transition and the crossing of the sea defence will depend on local ground conditions, environmental constraints and engineering feasibility. One of the following options will be selected, following more detailed surveys:

- Horizontal Directional Drilling (HDD);
- Thrust Bore;
- Trenching; and
- Open cut.

Cable Transition Pit(s)

3.4.39 Once the HVDC or HVAC submarine cable circuit(s) reaches shore it will transition to 'land based' HVDC or HVAC cables and will require a transition pit to accommodate the submarine and land based cables and transition cable joints. The number of transition pits constructed will be determined by the final design solution, i.e. number of HVDC or HVAC export cables installed.
Cable Jointing Pits

3.4.40 Physical constraints limit the size of the cable drum and this translates directly into a maximum length of cable that can be installed before a cable joint is required. The maximum cable length possible will vary depending on the final design solution but is estimated to be in the order of 750 m and in this respect cable jointing pits will be located along the HVDC or HVAC cable route at intervals of between 600 m and 1,000 m nominally. It is estimated that the dimensions of the cable jointing pits will be up to 15 m long x 5 m wide x 2 m deep.

3.4.41 Following construction, the ground above the cable joint pit will be reinstated although access for occasional maintenance/repair purposes may be required.

Cables

3.4.42 The HVDC or HVAC cable circuit will comprise cables routed underground to connect to the onshore HVDC converter station(s) or HVAC substation.

3.4.43 Where buried underground, the cables, either HVDC or HVAC, will be installed either together in a single trench or independently in separate trenches. The design solutions for both the HVDC and HVAC export circuits have not yet been finalised. The width of the cable corridor will be determined by the choice of HVDC or HVAC export option, as several cable configurations are currently under consideration.

Onshore HVDC converter station and HVAC substation

3.4.44 Depending on the power export system chosen, either a HVDC converter station(s) or an HVAC substation will be built in the vicinity of the existing Killingholme North substation.

3.4.45 If the HVDC export option is used then up to two HVDC converter stations of between approximately 500 MW and 1,500 MW will be required to convert the HVDC back into HVAC suitable for connection to the grid. If the HVAC export option is used a HVAC onshore substation will be required.

HVAC interconnection with National Grid substation.

3.4.46 The circuit, or circuits, delivering power from the onshore HVAC substation to the National Grid substation will be by underground cable.

Development of Project Two

Commencement of Construction

3.4.47 Offshore and onshore construction work is currently proposed to commence in 2015/2016, pending relevant project approvals. Preliminary engineering design and construction logistics work indicate that the construction period, including pre-construction and commissioning for Project Two, will last for up to five years.
3.4.48 The construction of offshore wind farm generation and transmission infrastructure is currently scheduled to take place 24 hours per day throughout the year, subject to weather conditions, until construction is complete. Construction in the marine environment is potentially hazardous and it will be in the interests of safe working for the construction to take place in favourable conditions for as much of the time as possible.

3.4.49 Further information will be gathered on the construction process, once all project parameters have been defined in detail. There are some key elements that will define the construction methodologies, including:

- Port(s) used as the base for the construction phase;
- Foundation types;
- Wind turbine selection; and
- Vessels used for the offshore construction works.

3.4.50 A number of ports exist on the east coast of England and the mainland coast of Europe that may be suitable for much of the construction and operation activities required for Project Two.

3.4.51 Any associated port development will be covered by separate existing or new consent applications and EIAs, however consideration will be given to potential cumulative/inter-related effects in the ES for Project Two.

3.4.52 Decisions on the above elements will be addressed during the detailed design and will be presented within the ES.

Construction Activities

3.4.53 The high level construction activities for Project Two are as follows (note that some of these activities will happen in parallel):

- Onshore manufacture of wind turbines, foundations, cables and electrical components;
- Construction site personnel are mobilised and the wind farm components are delivered to the ports;
- Seabed preparation, as necessary;
- The foundations are transported to site and placed in position by the installation vessel;
- The offshore HVDC converter station(s) and offshore HVAC collector substation modules are transported to site and installed from an installation vessel;
- If HVAC is selected, then an offshore HVAC reactive compensation substation is installed along the export cable route from an installation vessel;
- The subsea inter array cables are installed and terminated;
- Scour protection is installed, as necessary;
- The high voltage subsea cable is installed between the shore and offshore HVAC substation;
- The high voltage onshore cable is jointed to the high voltage subsea cable(s);
- Installation of tower, nacelle, hub and blades of the turbines;
- All systems are tested and commissioned; and
- The construction site and personnel are demobilised.

3.4.54 Foundation installation will be one of the first offshore construction activities to take place. Techniques typically employed for foundation installation include:
- Pile driving;
- Sea bed levelling (for gravity base structures);
- Ballasting (for gravity base structures); and
- Grouted connections (e.g. for connecting piles to jacket).

3.4.55 Following foundation installation, the electrical infrastructure will be installed and the wind turbines erected. Commonly, towers and nacelles are pre-erected or erected individually at the site using a crane barge. Alternatively a jack-up platform with a mounted crane may be utilised. Blades are subsequently fitted to the tower/nacelle structure as individual components or in a part assembled state.

3.4.56 Construction will require a variety of different vessel and helicopter options depending on the final turbine, foundation, construction port, and construction strategy taken. To optimise the construction programme, it is likely that installation of turbines, foundations and cables will be undertaken on the site at the same time, although not necessarily in the same location. Therefore at least 20 to 30 vessels (including support craft) may be on site at any one time.

Onshore construction

3.4.57 Onshore construction will include:
- Landfall works and construction of transition bays;
- Installation of onshore export cable;
- Construction of onshore convertor station or HVAC substation; and
- Manufacturing and fabrication of wind turbines, foundations, cables and substations.

3.4.58 The construction sequence will be identified in the ES.

3.4.59 The laying of the onshore HVDC or HVAC cable and construction of the HVDC convertor station(s) or HVAC substation will have an effect on local traffic movements. A full transport assessment will be undertaken for Project Two,
taking into consideration the onshore cable route and HVDC converter station(s) or HVAC substation site, as selected.

**Operation and maintenance**

**Offshore operation and maintenance**

3.4.60 Once commissioned, Project Two arrays will operate automatically, with each wind turbine operating independently of the others. Maintenance will be required for project components which will include:

- Offshore convertor station(s) or reactive compensation substation, and offshore HVAC collector substations;
- Accommodation platforms;
- Wind turbines;
- Foundations; and
- Inter-array and offshore export cables.

3.4.61 Each component will require a detailed operation and maintenance programme which will be further discussed in the ES, along with vessel and helicopter requirements.

**Onshore operation and maintenance**

3.4.62 Onshore facilities generally require less maintenance than offshore. Maintenance programmes will include requirements for the following components:

- Onshore underground cables; and
- HVDC converter station(s) or HVAC substation.

3.4.63 Detailed operation and maintenance programmes will be further discussed in the ES along with the required traffic movements.

**Repowering**

3.4.64 The wind turbines and other components of the wind farm will have a design life of around 20 to 30 years and some refurbishment or replacement will be required. Any such activities will be subject to the relevant consents or licences required and dimensions of any project components being replaced, e.g. wind turbines, would not exceed the maximum dimensions assessed within the original application.

**Decommissioning**

3.4.65 At the end of The Crown Estate lease period, it is a condition of the lease as well as a statutory requirement (through the provisions of the Energy Act 2004 (as amended)) that Project Two is decommissioned. A decommissioning plan will
be prepared at the request of the Secretary of State and, prior to construction, funds must also be set aside for the purposes of decommissioning.

3.4.66 It is anticipated that there will be a requirement for all structures above the seabed to be completely removed. This will be confirmed with the appropriate regulators at the time to agree the optimal solution in terms of environmental impact and the interests of ongoing users of the sea and seabed. The decommissioning sequence will generally be the reverse of the construction sequence. Decommissioning industry best practice/legislation will be applied at that time.

3.4.67 Currently there is no statutory requirement for decommissioned cables to be removed, however the necessity to remove cables will be reviewed at the end of the TCE lease period, after consideration of the environmental impact of the removal operation and safety of the cables left in situ.

3.4.68 The onshore cables will have a design life in excess of that of other wind farm components. To minimise the environmental disturbance during wind farm decommissioning it is likely that the onshore cables will be left in place in the ground with the cable ends cut, sealed and securely buried as a precautionary measure. If installed within ducts and suitable with minimal disturbance, sections of cable can be removed and the ducts refilled.

3.4.69 In the event of the wind farm being decommissioned, the case for decommissioning the HVDC converter station(s) and HVAC substation will be reviewed through discussions with the transmission system operator and the regulator in light of any other existing or proposed future use that may be available.

Noise and vibration

3.4.70 Underwater and airborne noise from construction operation and decommissioning will be assessed within the EIA, the extent of which is presented in Section 5.2 and 5.3.

Navigational and aviation markings

3.4.71 Wind turbine generators, foundations, the offshore accommodation platforms and any construction phase temporary buoys, will be marked according to the requirements of THLS, MCA and CAA, as agreed via consultation undertaken during the EIA process.

Safety, Health, Environment and Quality Management

SMart Wind Integrated Management System

3.4.72 The SMart Wind Integrated Management System (SIMS) has been developed specifically for the delivery of the entire Round 3 Hornsea Zone. The SIMS has been established in accordance with the requirements of OHSAS 18001:2007, ISO 9001:2008, and ISO 14001:2004 to effectively manage all health, safety,
environmental and quality aspects of the project. SMart Wind achieved certification to all three of these internationally recognised management system standards in 2011.

**Air emissions**

3.4.73 Air emissions from construction, operation and decommissioning of the onshore elements of the project will be assessed within the EIA under the air quality and health assessment, the extent of which is presented in Section 8.4. Air quality impacts relating to offshore activities are considered insignificant and have been scoped out of this assessment.

**Waste**

3.4.74 Wastes generated during the construction of the offshore and onshore elements of Project Two will be presented within the project description of the Environmental Statement. The types and likely volumes of the waste will be identified within a Site Waste Management Plan (SWMP). The SWMP will also establish a strategy for managing these wastes according to the waste hierarchy principle, an overview of existing waste management facilities in the vicinity of the scheme and a framework for recording how the wastes are actually managed during the construction process.

**Health and Safety**

3.4.75 Health and Safety will be managed at each project phase through the application of the SMart Wind SIMS. In addition a Construction Phase Plan (CPP) shall be required to satisfy the requirements of the Construction (Design & Management) Regulations 2007. The CPP will be completed by principal contractors and approved by SMart Wind before work on site is allowed to proceed.

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3 Please note: currently the project is being developed as described in this section. However, in the future SMart Wind's management systems may be supplanted by another equivalent set of management systems.
4 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

4.1 INTRODUCTION

4.1.1 This section describes the principles of EIA and the approach being taken to identify and evaluate potential impacts associated with Project Two. It outlines the methodologies for cumulative and inter-related impact assessment including transboundary issues, and (where appropriate) monitoring and mitigation measures required to address any potential negative impacts.

4.1.2 The assessment will use an evidence-based approach that is systematic and auditable to evaluate and interpret potential impacts of Project Two activities on sensitive physical, biological and human receptors.

4.1.3 The report documenting the EIA process is the Environmental Statement (ES) and will be prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the EIA Regulations).

4.2 BASELINE

4.2.1 It is important that the effects of Project Two can be defined in their own right and clearly presented to stakeholders. The status of Project One at the time Project Two would be built is not known. Therefore the environmental effects of Project Two will be assessed against the existing baseline conditions i.e. without Project One.

4.2.2 It is not known if Project Two would be built simultaneously with Project One or following Project One. In order to cover such eventualities, the interaction between Project One and Project Two will be assessed in the cumulative impact assessment of each specialist topic chapter (see section 4.7).

4.3 BASIS OF THE ASSESSMENT

4.3.1 The impact assessment methodology follows the EIA principles and also draws upon a number of guidance documents and legislation, including:

- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (EIA Directive);
- The EIA Regulations;
- NPS EN-1;
- NPS EN-3;
- Highways Agency et al. (2008). The Design Manual for Roads and Bridges (DMRB) Volume 11: Environmental Assessment (and updates);
- Best practice guidance on how to address cumulative impacts with respect to birds and wind farms has been published by COWRIE (King et al., 2009);
▪ Maclean et al (2009) A Review of Assessment Methodologies for Offshore Wind farms (COWRIE METH-08-08);

▪ CEFAS (2004). Offshore Wind farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA requirements: Version 2;

▪ CEFAS (2011). Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects;

▪ Institute of Environmental Management and Assessment (IEMA) (2004) Guidelines for Environmental Impact Assessment; and


4.3.2 Further guidance and legislation will be considered, should they become available during the EIA process.
4.4 IMPACTS AND EFFECTS

4.4.1 Project Two has the potential to create a range of ‘impacts’ and ‘effects’ with regard to the physical, biological and human environments. The definitions of impact and effect used in this assessment are drawn from the Highways Agency and the Devolved Administrations for highways projects Design Manual for Roads and Bridges (DfT, 2008) (and relevant updates).

4.4.2 For this assessment the term ‘impact’ is used to define a change that is caused by an action. For example, piling of turbine foundations (action) during construction which results in increased levels of subsea noise (impact).

4.4.3 Impacts can be classified as direct, indirect, secondary, cumulative and inter-related. They can be either positive or negative, although the relationship between them is not always straightforward.

- **Direct impacts**: Arise from activities undertaken in direct connection to the project;

- **Indirect impacts**: Occur as a consequence of a direct impact (sometimes as part of a chain of events) and may be experienced at a point in space or time that is removed from the direct impact;

- **Secondary impacts**: Socioeconomic and cultural changes which may be experienced at a point in space or time that is removed from both direct and indirect impacts;

- **Cumulative impacts**: Arise from activities associated with the development when considered alongside those of other existing or planned developments where there is spatial or temporal overlap for receptors. Onshore will arise from activities associated with the development when considered with those developments not yet constructed or within the planning system;

- **Inter-related impacts**: The impacts resulting from the inter-relationship of the different impacts on the same receptor (e.g. where the impacts from noise and impacts from air quality affect a single receptor such as fauna); and

- **Positive or negative impacts**: Impacts can be either negative or positive. Positive impacts merit just as much consideration as negative ones, as international, national and local policies increasingly press for projects to deliver positive biodiversity outcomes. Positive impacts can be considered for all the definitions above.

4.4.4 It is also important to consider the reversibility of impacts. An irreversible (permanent) impact is when recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. By contrast, a reversible (temporary) impact is one where spontaneous recovery is possible naturally or where mitigation measures can be effective at reversing the impact. It is possible for the same activity to cause both irreversible and reversible impacts.
4.4.5 The term 'effect' is used in this assessment to express the consequence of an impact (expressed as the 'significance of effect'). This is determined by considering the magnitude of the impact alongside the importance, or sensitivity, of the receptor or resource, in accordance with defined significance criteria. For example, the piling of turbine foundations results in an impact of increased levels of subsea noise, the effect of which is determined by the significance of this disturbance on a receptor (such as marine mammals).

4.5 DEFINING MAGNITUDE OF IMPACT AND SENSITIVITY OF RECEPTOR

Magnitude of impact

4.5.1 In order to assess the potential effects of Project Two, the magnitude of the impacts assessed will be evaluated against the sensitivity of the receptors in question. In determining the magnitude of any given impact, the following need to be considered:

- Spatial extent of the impact;
- Duration of the impact;
- Frequency of the impact; and
- Reversibility of the impact.

4.5.2 Each topic will define the magnitude of impact in a manner that is relevant to their assessment. This may differ between topics, drawing upon relevant external guidance and other material, including specialist knowledge, relevant to that topic. Each topic will categorise magnitude of impact according to the following scale:

- No change;
- Negligible
- Low;
- Medium; and
- High

Sensitivity of receptor

4.5.3 For this assessment receptors are defined as the physical or biological resource or user group that would be affected by the project. This is informed by baseline studies that will have been completed by the time of ES preparation. The sensitivity of the various receptors throughout the project will vary depending on a wide array of factors. In defining this sensitivity the following factors will be considered:

- Vulnerability of the receptor;
- Recoverability of the receptor; and
- Value/importance of the receptor.
4.5.4 In some chapters value/importance (as defined by designations) might not be part of the definition of sensitivity. This is outlined where relevant.

4.5.5 Sensitivity will be defined within each topic according to the following scale:
- Negligible
- Low;
- Medium;
- High; and
- Very high.

4.6 EVALUATION OF SIGNIFICANCE OF EFFECT

4.6.1 Throughout the ES significance will be assigned on the basis of the following terms. These terms will be defined separately within each topic and will take into account any relevant topic specific guidance to inform the level at which an effect is likely to become significant:
- **Not significant**: An effect that is found not to be significant in the context of the stakeholder objectives or legislative requirements;
- **Minor significance**: An effect considered sufficiently small (with or without mitigation) to be well within accepted standards. No action is required as it can be controlled by adopting normal good working practice;
- **Moderate significance**: An effect within accepted limits and standards. Moderate effects may cover a broad range, although the emphasis is on demonstrating that the effect has been reduced to a level that is as low as reasonably practical. This does not mean reducing to ‘minor’ effects but managing ‘moderate’ ones effectively and efficiently; and
- **Major significance**: An effect where an acceptable limit or standard may be exceeded.

4.6.2 As outlined above, the overall significance of an effect is determined by the consideration of the magnitude of impact alongside the sensitivity of receptor. In accordance with this the determination of significance of effect in the Project Two ES will be based upon a matrix approach. An example of the matrix used to inform the topic-specific methodologies in each topic is set out in Table 4.1 below.

<table>
<thead>
<tr>
<th>Sensitivity of receptor</th>
<th>Magnitude of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Change</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

Table 4.1: Proposed matrix for assessment of significance showing the combinations of receptor sensitivity and the magnitude of impact.
### Sensitivity of receptor

<table>
<thead>
<tr>
<th>Sensitivity of receptor</th>
<th>Magnitude of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Change</td>
</tr>
<tr>
<td><strong>Negligible</strong></td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Very high</strong></td>
<td>Negligible</td>
</tr>
</tbody>
</table>

4.6.3 A significance of effect of moderate adverse or greater is considered ‘significant’ in EIA terms and will normally trigger additional analysis and consultation in order to discuss and possibly further mitigate impacts where possible. Where further mitigation is not possible a residual effect may remain.

### Uncertainty

4.6.4 It is also important to establish the uncertainty of data that are used to predict the magnitude of impacts and the sensitivity of receptors, as the level of confidence in the decisions made on significance depend on it. It is proposed that three levels of uncertainty are used in the Project Two EIA:

- **Low uncertainty:** Interactions are well understood and documented. Predictions are modelled and maps based on interpretations are supported by a large volume of data. Information/data have very comprehensive spatial coverage/resolution;

- **Medium uncertainty:** Interactions are understood with some documented evidence. Predictions are modelled but not validated and/or calibrated. Mapped outputs are supported by a moderate degree of evidence. Information/data have relatively moderate spatial coverage/resolution; and

- **High uncertainty:** Interactions are poorly understood and not documented. Predictions are not modelled and maps are based on expert interpretation using little or no quantitative data. Information/data have poor spatial coverage/resolution.

4.6.5 In the absence of certainty, it will be necessary to adopt a precautionary approach. Data gaps and uncertainties will be reported within the impact assessment.
Mitigation

4.6.6 Schedule 4 of 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.

4.6.7 Agreed mitigation will ultimately form part of the requirements attached to the application for development consent for construction and operation of Project Two.

4.6.8 A key assumption of environmental impact assessment for Project Two is that the assessment of impact is based upon a level of inherent mitigation that would be ‘designed in’ as part of the development. These designed-in measures would be specific to particular environmental parameters and based on current best practice.

4.6.9 Following identification and incorporation into the design of appropriate mitigation measures, the significance of any residual impacts will be assessed. If further mitigation is not possible or practicable then a discussion on why this is the case will be supplied. Where the impact is of more than minor significance an explanation will be given of how the impact has been reduced to as low as reasonably practicable.

4.7 CUMULATIVE IMPACT ASSESSMENT

Offshore

4.7.1 The cumulative impact assessment (CIA) for Project Two will take full account of guidance provided in PINS Advice Notes Nine and Appendix 3 of Advice Note Ten (PINS, 2012a; 2012b), and will ensure that the cumulative impacts of Project Two with the following development types will be fully considered:

- Built and operational projects;
- Projects under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined;
- Projects on the PINS Programme of Projects;
- Projects identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited; and
- Projects identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.
4.7.2 In practice, the Project Two EIA will consider Project One from the Hornsea Zone and also future Projects Three and Four. All other Round 1, 2 and 3 projects in the central North Sea Region (including Dogger Bank and East Anglian Zone) will be included. The CIA will also consider all other activities in the region, including but not limited to marine aggregate extraction, oil and gas development, shipping, commercial fisheries and recreational activities.

4.7.3 To assist the CIA for Project Two, the Hornsea Zone Assessment Methodology (ZAM), developed by SMart Wind, will be referenced where appropriate. The ZAM is a ‘live’ document (available at www.smartwind.co.uk) which will be updated as more information becomes available, and as feedback is received from consultees. This ensures the data and methodologies remain up to date and fit for purpose. It also ensures the statutory requirements of EIA relating to cumulative issues are met.

Onshore

4.7.4 The cumulative assessment for onshore topics follows the advice given in PINS Advice Note Nine: Rochdale Envelope (PINS, 2012a) for Nationally Significant Infrastructure Projects (NSIPs) of which Hornsea Offshore Wind Farm is one. The advice is as follows:

4.7.5 “The potential cumulative impacts with other major developments will also need to be carefully identified such that the likely significant impacts can be shown to have been identified and assessed against the baseline position (which would include built and operational development). In assessing cumulative impacts, other major development should be identified through consultation with the local planning authorities and other relevant authorities on the basis of those that are:

- under construction;
- permitted application(s), but not yet implemented;
- submitted application(s) not yet determined;
- projects on the Planning Inspectorate’s Programme of Projects;
- identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited; and
- identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

4.7.6 In preparing such information, it should not be forgotten that the purpose of an EIA is to inform the examination, and decision making process. The EIA should be clear and practical.” (PINS, 2012a)

4.7.7 The following projects are to be considered in the cumulative assessments of the onshore chapters:
• A18/A180 Link (Immingham By-Pass);
• Able Humber Ports Northern Area, Halton Marshes;
• Able Marine Energy Park, Killingholme Marshes;
• North Killingholme Power Plant;
• URSA, North Killingholme;
• Heron Renewable Energy Park, Immingham Dock;
• A160/A180 Highway Improvements (Immingham Ports access improvements);
• Tetney to Saltfleet Tidal Flood Defence Scheme, East Lindsey;
• National Grid Substation Extension, North Killingholme;
• Bioethanol Limited, Bioethanol Plant, North Killingholme;
• Hornsea Project One, North Killingholme;
• Dogger Bank Offshore Wind Farm: Creyke Beck onshore grid connection;
• Conoco Philips Replacement Pipeline, East Lindsey DC;
• Helius Energy, Hobson Way Stallingborough;
• Vireol PLC, Moody Lane, Great Coates;
• Lenzing Fibres Grimsby Limited, Moody Lane, Healing;
• Wind Turbine, Eastfield Road, South Killingholme; and
• Industrial Park, Queen’s Road, Immingham.

4.7.8 The onshore cumulative impact assessment will assess Project One and Project Two together using one of four possible scenarios:

• Project One in construction at the same time as Project Two (simultaneous),
• Project One in Construction with an overlap for Project Two construction,
• Project One operational,
• No change (no Project One).

4.7.9 Each onshore chapter will assess the worst case for that particular topic.

4.7.10 The onshore assessment for Project Two will not consider Project Three or Four as cable routes for these projects will differ to the Project Two route and are not yet known.

4.8 INTER-RELATED EFFECTS

4.8.1 The EIA process for Project Two will examine the inter-relationship between the aspects of the environment likely to be significantly affected by the development including population, fauna, flora, soil, water, air, climatic factors, socioeconomic, material assets, including architectural and archaeological heritage, landscape and these interrelationships will be reported within the ES.
4.8.2 The approach will adopt a two tier approach for assessment:

- **Level 1 (receptor-led impacts):** Assessment of the scope for all impacts to interact, spatially and temporally, to create inter-related effects on a receptor (for example all impacts on a given receptor such as benthic habitats – direct habitat loss or disturbance, sediment plumes, scour, jack-up vessel use etc. – these might be short term, temporary or transient impacts or incorporate longer term impacts then combined to determine a significance of effect; and

- **Level 2 (project lifetime impacts):** Assessment of the scope for impacts that occur throughout the lifetime of the project, from the construction phase, through operational and in decommissioning, to act in combination to create a more significant impact on a receptor than if just assessed in isolation in these three key project stages.

**Transboundary assessment**

4.8.3 Transboundary issues are dealt with in Regulation 24 of 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.

4.8.4 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 (modified in 2001 and 2004). This convention stipulates the obligation of parties to assess the environmental impact of certain activities that are likely to cause transboundary environmental impacts at an early stage of planning.

4.8.5 The EIA Directive implements requirements on transboundary consultation and requires that all significant transboundary issues set out in the 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.

4.8.6 PINS Advice Note Twelve: Development with significant transboundary impacts consultation sets out the procedures for consultation in association with an application for a development consent, where such development has significant transboundary impacts (PINS, 2012c).

4.8.7 The potential for transboundary impacts is likely to be limited to physical processes, natural and commercial fisheries, navigation, marine mammals and ornithological aspects; although this list is not exhaustive and other transboundary issues may emerge through further assessment during the EIA process. Any likely significant effects on the environment of another Member State of the European Economic Area will be identified and reported in the EIA. As part of early consultation, potential transboundary impacts are identified within the relevant sections of this scoping report.
5 OFFSHORE PHYSICAL ENVIRONMENT

5.1 MARINE GEOLOGY, PHYSICAL PROCESSES AND WATER QUALITY

Introduction

5.1.1 This section is relevant to the offshore components of Project Two and refers to Subzone 2 and the cable route corridor as appropriate. For the purpose of this report the offshore physical environment covers the disciplines of marine geology, physical processes and water quality. The physical environment has important implications in its own right in terms of engineering considerations and also acts as a critical pathway to other aspects of the marine environment, including a number of biological and human receptors.

Environmental baseline

Marine Geology Quaternary Deposits

5.1.2 During glacial maxima, lower sea levels exposed Subzone 2 as land. Hence, the underlying geology comprises unconsolidated sediments of glacial and fluvial origin. Post-glacial marine transgression led to the re-working of these sediments.

5.1.3 The Quaternary Period consists of the Pleistocene and Holocene Epochs and encompasses the period during which humans first occupied and exploited the landscape. Until around 10,000 years ago, the Hornsea Zone would have been occupied by Palaeolithic people and terrestrial fauna. In the Hornsea Zone, the majority of the Quaternary deposits lying close to the seabed consist of Bolders Bank and Botney Cut Formation. Some Eem Formation lies close to the seabed towards the east of the Zone, particularly in Markham’s Hole. Other underlying Quaternary deposits are present at greater depths (and their stratigraphic relationships will be determined following interpretation of detailed geophysical surveys of Subzone 2).

5.1.4 The complete succession of Quaternary deposits within the Hornsea Zone consists of (youngest to oldest):

- Botney Cut Formation;
- Bolders Bank Formation;
- Eem Formation;
- Egmond Ground Formation;
- Swarte Bank Formation; and
Figure 5.1  Bathymetry across the Hornsea Zone and southern North Sea.
Solid Geology (bedrock)

5.1.5 Cretaceous bedrock may be exposed or lies close to the seabed in the north-west and south-west corners of the Hornsea Zone and may be composed of chalk (Chalk Group) or mudstone (Cromer Knoll Group) (BGS; 1985a; 1985b; 1987c; 1988b). It is unlikely that exposed bedrock occurs near the seabed within Subzone 2.

Bathymetry

5.1.6 The southern North Sea is relatively shallow with water depths up to 60m below Chart Datum (CD). There are extensive bank systems parallel to the north Norfolk coast and deep elongated depressions such as Silver Pit north-east of the Wash, within which depths can exceed 80m below CD. The northern North Sea is considerably deeper, exceeding 100m below CD.

5.1.7 Water depths across the Hornsea Zone range from 24 m to 70 m below CD with the greatest depths found within Markham’s Hole (located in the eastern part of the Zone). Within Subzone 2, water depths are more uniform with the majority of the area being between 25 m and 30 m, although the greatest depth is approximately 40 m (Figure 5.1).

Seabed Features

5.1.8 Seabed features (or bedforms) within the Hornsea Zone include sandwaves and mega ripples. On the continental shelf these bedforms develop as a result of sediment transport processes and may, therefore, indicate potential active sediment transport. The crests of sandwaves, for example, are approximately perpendicular to the direction of transporting current and generally occur in areas where current velocities exceed 65 cm/s (Johnson and Baldwin, 1996). Current speeds within the Hornsea Zone can reach 100 cm/s and are therefore of sufficient magnitude to form sandwaves. Cameron et al. (1992) reported sandwaves in the North Sea occurring in water depths between 18 m and 60 m, which encompasses the water depths in Subzone 2.

British Geological Survey (BGS) and SeaZone data indicate that conditions within Subzone 2 are favourable to sand wave formation. Sandwaves heights in the order of 1 m to 3 m have been confirmed by the preliminary results from geophysical surveys. These are lower than those found elsewhere in the wider Hornsea Zone where maximum heights reach 10 m to 15 m (5.1.9).

Seabed Sediments

5.1.10 The majority of seabed sediment within Subzone 2 consists of sand and gravelly sand, with slightly gravelly sand and sandy gravel as minor components (Figure 5.3). Examples of sand and slightly gravelly sand, collected to the south of the Hornsea Zone, are indicative of the sediments for this region of the southern North Sea.
5.1.11 The seabed sediments within the Hornsea Zone are generally variable in thickness with gravelly sands or sandy gravels usually less than 2 m to 3 m thick, although slightly finer sediments such as sand or slightly gravelly sand may be thicker (BGS; 1987a; 1987b; 1988c; 1990). These sediment thicknesses are also found within Subzone 2.
Figure 5.2  sand wave heights and bathymetry in the Hornsea Zone.
Figure 5.3 Seabed sediment map of Hornsea Zone, southern North Sea and example sediment images.
Geomorphology and Sediment Movement

5.1.12 The Holderness coastline north of the Humber is characterised by a rapid rate of erosion, estimated to average 1.4m/year (Valentin, 1954; 1971). Eroded material is transported southwards, much of it being swept offshore around Easington and about 3% feeding Spurn Head in the mouth of the Humber estuary (HR Wallingford et al., 2002). Whilst Spurn Head has extended and migrated south-west in recent centuries, its further migration is now constrained by the tidal channel and tidal prism of the Humber estuary.

5.1.13 Sediment within the Humber estuary is likewise considered to be almost entirely derived from the Holderness coastline, not from offshore (HR Wallingford et al., 2002).

5.1.14 The Lincolnshire coast has also been eroding and consists of narrow, relatively steep beaches with a thin covering of sand above a clay substrate. Cross-shore movement of sediment is predominantly offshore, as evidenced by the pattern of deposition on the western side of former tidal channels in the near shore zone.

5.1.15 The North Norfolk Coast, to the south of the Hornsea Zone, is a classic barrier beach coastline with features such as spits and islands created by longshore drift. These underpin the qualifying features of the North Norfolk Coast Special Area of Conservation.

5.1.16 Suspended sediment moving southwards along the Lincolnshire coastline is either redistributed onshore around Donna Nook, transported offshore or continues southwards and largely accumulates in The Wash (HR Wallingford et al., 2002).

5.1.17 The differences in character between the offshore and near shore sediment deposits, together with evidence from bedforms (which shows north/south sediment transport being dominant), indicated that there is no significant onshore sediment transport off the mouth of the Humber Estuary.

Physical Processes

5.1.18 The physical processes (including tides, currents and waves) that operate within the Hornsea Zone and Subzone 2, and drive sediment transport, are described below.

Tides

5.1.19 Offshore tidal data have been analysed for sites to the south-west of Subzone 2 and to the south-east. These show the tide to be semidiurnal, with macrotidal ranges (greater than 4 m) to the south-west of Subzone 2 and mesotidal ranges (between 2 m and 4 m) to the south-east of Subzone 2. The Mean Spring Range for the Hornsea Zone varies between approximately 1.75 m and 4.5 m. Tidal current information off the Humber estuary shows a predominantly north/south tidal flow, unaffected by flows into and out of the Humber estuary.
The maximum speeds on spring tides here are around 0.9 m/s, capable of transporting medium sized sand. Closer inshore, off the Outer Binks, the peak flood flow is 1.3 m/s, while the ebb is as high as 1.8 m/s. Thus, the ebb flows out of the Humber Estuary are dominant locally, transporting sediment out of the estuary.

5.1.20 The tidal wave passing through the Hornsea Zone propagates from north to south, i.e. high tide occurs earlier in the north and moves southwards. There is an estimated variation of 2.75 m in tidal range and 10 minutes in high water interval across the Hornsea Zone.

5.1.21 The major axis of the flood-ebb and tidal ellipse is aligned along a north-east/south-west plane. Consequently, flood and ebb currents travelling across the Hornsea Zone do so in a south-west and north-east direction respectively.

**Currents**

5.1.22 Analysis of the offshore tidal data has determined that the mean spring and neap current speeds for the Hornsea Zone vary from 0.52 m/s to 0.62 m/s and 0.28 m/s to 0.32 m/s respectively.

**Waves**

5.1.23 In the Hornsea Zone, the prevailing winds come from the south-west and the wave climate is dominated by locally generated short period waves. Long period swell waves are generated from storm activity in the North Atlantic with the resulting swell waves propagating into the North Sea. These approach the Hornsea Zone from a north-easterly direction, which is more distinct in winter months than summer. A wind rose for the study area is shown in Figure 5.4 and a wave rose in Figure 5.5.

5.1.24 Based on data collected close to the Hornsea Zone, the estimated average wave heights for summer and winter are 1.2 m and 1.8 m respectively, and associated periods increase from 7.8 to 8.0 seconds during the summer to 8.2 to 8.5 seconds in the winter. Maximum wave predictions for near shore are on average 1.5 m lower than those for the offshore across 1 in 1, 10 and 100 year events. For a 1 in 50 year significant wave event, the average offshore wave height is predicted to be 5.1 m. These extremes are characterised by long period swell waves that are generated by storm activity in the North Atlantic.
Stratification and Mixing

5.1.25 The Flamborough Front is a key oceanographic feature that occurs during the summer months and is a result of the meeting of the colder, deeper stratified waters of the Northern North Sea and the warmer, shallower, well-mixed waters of the Southern North Sea (Pingree and Griffiths, 1978) (Figure 5.6). During the spring-neap tidal cycle and strong prevailing winds, the front advances and...
retreats to cause greater mixing through the water column (Simpson and Bowers, 1981). Where these two distinct water masses meet it forms an area rich in nutrients, with increased plankton growth and secondary productivity and, therefore, forms an important ecological feature (Institute of Estuarine Coastal Studies, 1992). The existence and position of the Flamborough Front may also affect the distribution of suspended sediment and observed wave shape within the Hornsea Zone.
Figure 5.6  Indicative location of the Flamborough Front.
Suspended Sediment Regime

5.1.26 Both tide and wind are important processes affecting sedimentation and erosion in the North Sea. In addition, storms can enhance resuspension, although only for a few days, and so these may not have a large effect on suspended sediment concentrations. By contrast, periods with consistently high winds from one direction (usually south-west) are probably more important, since these significantly affect the suspended sediment. Such periods are often found from December to March. It has been observed from previous studies that suspended sediment concentrations are much lower during the summer (typically less than 4 mg/l) than winter (Gerritsen et al., 2000; HR Wallingford et al. 2002). This may be compared to areas such as The Wash and the Humber within which concentrations typically exceed 300mg/l all year round.

5.1.27 Resuspension of seabed sediment is due to the shear stress exerted on the seabed. Waves and tidal currents combine to generate bed shear stress throughout the North Sea – waves enhance the bed stress so that sediment is mobilised and currents determine the magnitude and direction of transport (Mitchelson-Jacob and Jago, 2009).

5.1.28 In the Southern North Sea, the summer and winter distribution of suspended sediments in surface waters has been mapped by CEFAS (HR Wallingford et al., 2002) (Figure 5.7). The concentration of suspended sediment appears to be low in offshore areas (0-4 mg/l) compared to the higher concentrations found in estuaries. In the winter months, concentrations are higher; in general, suspended sediment concentrations are doubled.
Figure 5.7   Suspended sediment concentrations (mg/l) based on data in the CEFAS archive (a) for winter months and (b) for summer months. The data are from discrete water samples.

5.1.29 The cable route corridor encompasses the Lincolnshire coastline. There is a strong southerly flux of sand past Flamborough Head and along the Holderness coast, which leads to strong southerly transportation of sediment across the Humber to the Lincolnshire coast. Prandle et al. (2001) modelled suspended sediment concentrations along the Holderness coastline and showed that, for sediment with a median grain diameter of approximately 50 microns, the eroded material could be transported within a few kilometres of the coast solely by tidal forcing.

Water quality

5.1.30 Suspended sediment and contaminant levels (hydrocarbons and metals) are indicators of water quality. Sediments are present in the marine environment as both suspended and deposited particles and comprise both organic and inorganic components. The suspension of seabed sediments increases turbidity and reduces water quality. The extent to which sediments are suspended or deposited is a function of their density and the hydrodynamics of the water column (see section above). Sediment suspension may also release historic contaminants into the water column (such as metals and hydrocarbons), which can further reduce water quality.

5.1.31 The most important component of water quality is background turbidity, which is highly variable in space and time. Adverse changes to turbidity can affect both local and ecosystem level interactions. Potential receptors to changes in water quality will be addressed within the relevant topic of the ES, for example fish and shellfish ecology, other marine users and marine mammals. There are designated bathing waters in the study area at Cleethorpes and Humberstone Fitties. From 2002 to 2011, Cleethorpes recorded excellent quality and the first year’s data at Humberstone Fitties (2011) also shows excellent water quality.

Data and guidance to inform EIA

5.1.32 A number of information sources will be used in relation to geology and physical processes including:

- A variety of relevant British Geological Survey (BGS) mapping data (to include regional reports, solid geology, quaternary geology and sea bed sediments map sheets);
- Relevant SeaZone data;
- Data for the Oil and Gas industry (e.g. UK DEAL);
- British Oceanographic Data Centre, including projects such as Land-Ocean Interaction Study (LOIS);
- Southern North Sea Sediment Transport Study 2 (SNS2) (HR Wallingford et al., 2002);
- Centre for Environment Fisheries and Aquaculture Science (CEFAS) studies;
5.1.33 In addition to water quality data that becomes available as part of the data collection process within the Hornsea Zone, a number of other key data sources have been identified to inform the water and sediment quality assessment:

- Data on water and sediment quality from the British Oceanographic Data Centre (BODC);
- Environmental Statements for previous offshore infrastructure; and
- Additional published reports and papers.

5.1.34 Geophysical and geotechnical surveys have been commissioned for Project One and Project Two as part of the site investigations to inform the EIA and engineering design. All survey data will be processed, interpreted and reported in order to inform the physical processes assessment within the main EIA. These data include:

- Multibeam (swath) bathymetry sonar with line spacing optimised to ensure 100% seabed coverage;
- High and low resolution sidescan sonar with line spacing optimised to ensure 100% seabed coverage to depict seabed features, seabed sediment classification and seabed debris;
- High resolution seismic boomer surveys to determine subsurface layers to inform turbine foundation design and cable route corridors;
- Ultra high resolution seismic pinger surveys to determine the nature of the surface layers of the seabed to inform the suitability for cable installation, and cable route corridors;
- RoxAnn Acoustic Ground Discrimination System (AGDS) surveys to classify and map seabed sediments (also used to detect the presence of biogenic reefs and protected ecological habitats);
- Marine magnetometer surveys to identify major items of debris, wreck or changes in near surface bedrock within the Subzone and cable route corridors; and
- Geotechnical sampling using vibrocoring, cone penetration tests (CPT) and boreholes to ground-truth geophysical data interpretations.

5.1.35 A metocean campaign has been completed across the Zone to collect site-specific data. This consisted of seven moorings in total, six of which collected a
current profile through the water column, wave data and suspended sediments, plus meteorological data from a surface buoy, and one which collected wave data only (a waverider). Three of the metocean moorings and the waverider were deployed for one year, and the remaining three for six months only over the winter period.

5.1.36 Subzone 2 lies between moorings 2 and 3. The measurements at this site include:

- Oceanographic data:
  - Wave regime (height, period and direction);
  - Current regime (speed and direction through the water column);
  - Water level (including tides and surges);
  - Water temperature; and
  - Suspended sediment values (near bed).

- Meteorological data:
  - Wind speed;
  - Wind direction;
  - Atmospheric pressure; and
  - Air temperature.

- The meteorological buoys transmit data to shore in real-time so the conditions on site can inform site survey activity and ongoing data integrity can be checked. Specific details of the measurements are given in the Zone Assessment Methodology (ZAM) document available on the SMart Wind website (http://www.smartwind.co.uk/).

Methods supporting EIA

5.1.37 Data from the geophysical survey using sub-bottom seismic reflection (boomer and pinger), multibeam bathymetric and sidescan sonars, and RoxAnn AGDS will be used to establish surface and subsurface geology and the nature of the seabed within Subzone 2 and the wider Zone. These data will be ground-truthed using vibrocoring, borehole sampling and grab sampling. This will be augmented with seabed photography and drop-down underwater video cameras where appropriate. The survey results will allow interpretation of the most appropriate turbine foundation design.

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

Habitats Directives for developers undertaking offshore wind farm developments. Version R1.9;

- HM Government (2011). UK Marine Policy Statement; and

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

5.1.40 Site specific sediment data will be collected during the Subzone benthic study. This will provide an analysis of sediment particle size and distribution, this information will be used to model likely increases in suspended sediment during construction.
Figure 5.8 Location of metocean campaign moorings.
5.1.41 The observations from the metocean moorings, plus bathymetry and sediment information from the geophysical and benthic surveys (including particle size analysis), will be used to calibrate a physical processes model. A two-dimensional (2D) model has been developed for Hornsea Project One. This model will be further developed to enhance the understanding of oceanographic processes and thus, in conjunction with the measurements themselves and a literature review, be used to describe the baseline for physical processes within the Subzone. The model will also extend across the Zone and wider region to ensure the processes are understood in the near and far-field areas. The model consists of a series of modules to represent the hydrodynamics, wave and sediment transport conditions; these interlink to describe the overall oceanographic regime. This model has a variable grid to give a higher resolution within Subzone 2 and coarser resolution over the wider area.

5.1.42 Having established that the model is representative of site conditions, the likely changes over the next 50 years will be considered. This will give context to the predicted changes resulting from the wind turbines themselves. Modelling will be undertaken to establish the likely effects of the turbines at both the near-field and far-field scales. Interactions between individual turbines will be identified and the conditions where these could potentially occur determined. In conjunction with the ZEA, these results will then be used to assess potential cumulative and far-field impacts.

5.1.43 Modelling tools will be used alongside a thorough understanding of the baseline environment derived from available literature, various data characterising the physical environment within Subzone 2 and across the wider zone and far-field areas.

5.1.44 Information for the cable route will be gained from existing studies and the baseline and assessment undertaken as part of the Project One ES. In areas where the cable route crosses sandwaves, the development and behaviour of the sandwaves along the cable route and the implications with respect to cable burial and integrity will be considered. This will draw on the geophysical and geotechnical survey data.

5.1.45 The outputs from the sediment transport models will identify whether there are any likely changes to the seabed due to Project Two, with particular attention to scour holes. In addition, plume modelling techniques will be utilised to assess any changes to background suspended sediment concentrations as a resultant of sea bed disturbance during construction (foundations and cable laying) and operation (scour) of the wind farms. This information will be used to provide an assessment of potential impact on receptors considered within other topics of the EIA, such as benthic ecology, fish and shellfish ecology, commercial fisheries, other marine users and marine mammals.
Potential project impacts

5.1.46 Potential changes to physical processes due to the construction, operation and decommissioning phases of the wind farm include:

- Changes to the tidal regime e.g. water levels and currents. These changes are likely to be restricted to the operational phase due to the presence of the wind turbines themselves. Localised changes to the tidal regime will be considered as well as potential changes further afield. These will be assessed through numerical modelling techniques using TELEMAC-2D, or an equivalent two-dimensional hydrodynamic model.

- Changes to the wave regime. The changes are also likely to be restricted to the operation phase and may result from the presence of the turbine foundations (the physical blockage within the water column) or turbine operation reducing wind speed and therefore the locally-generated wave climate. Waves will be modelled using ARTEMIS (near-field) and SWAN (far-field) or equivalent numerical modelling tools. Wave modelling will encompass a number of wave direction and height scenarios;

- Changes to the sediment regime and water quality. There is potential for changes in the sediment regime during all phases of the development (construction, operation and decommissioning). Foundation and cable (inter-array and export) installation will involve sea bed disturbance and the potential for the release of sediment into the water column, the volume of which will depend on the nature of the sea bed and the method of construction. Previous studies have shown suspended sediments from offshore wind farm construction are typically within background conditions and so unlikely to be significant impacts. Potential elevations in suspended sediment concentrations will be modelled using a combination of SEDPLUME, SANDFLOW and empirical methods. In addition there is potential for the operational presence of the wind farm to change baseline sediment transport pathways, due to changes to the wave and tidal regime. This will be assessed drawing on a conceptual understanding of the sediment regime and sediment transport modelling. In addition, the potential for scour around turbine foundations will be assessed through reference to an understanding of the baseline regime and the use of empirical methods; and

- Changes at the cable landfall. Changes to the sediment regime and/or coastal erosion associated with cable installation at the landfall will be considered qualitatively and using numerical techniques, if appropriate.

5.1.47 In many cases the potential changes outlined above do not represent impact in themselves. Rather changes to physical processes are a pathway with the receptor for these changes lying in other topics within the EIA. As such, the changes predicted from the assessment above, will be considered in terms of receptors across other EIA topics. For example: benthic ecology, fish and shellfish ecology, commercial fisheries, marine archaeology, other marine users and marine mammals.
5.1.48 However, there are a number of physical receptors for changes to the physical process regime. For each of these, a full impact assessment will be carried out and presented within the physical processes section of the ES. These receptors are:

- Adjacent shorelines (e.g. changes in erosion or accretion characteristics);
- Low-lying backshore areas (as a result of changes to flood risk from changes to the wave regime); and
- Sea bed morphology (e.g. offshore features, such as sand banks and other bedforms).

5.1.49 Each assessment undertaken for physical processes will initially consider the full range of options provided in the project description. From these options, the worst case in terms of potential changes to the physical process regime will be determined based on experience and where required sensitivity testing. The worst case will then be assessed and where appropriate, evidence will be provided to demonstrate that all other options will lie within the envelope assessed.

5.1.50 The specific identified potential changes to physical processes as a result of Project Two are outlined in the following sections below, according to project phase.

**Construction phase**

5.1.51 The identified potential impacts on physical processes and water quality during the construction phase are as follows:

- Increases in suspended sediment concentrations during foundation and cable (inter-array and export) installation;
- The fate of sediments suspended during foundation and cable (inter-array and export) installation; and
- Changes as a result of vessel activity and other plant e.g. accidental release of contaminants into marine environment through spillage or leakage of contaminants from vessels and/or other plant.

**Operation and maintenance phase**

5.1.52 The identified potential impacts on physical processes and water quality during the construction phase are as follows:

- Changes to the tidal regime as a result of the presence of the wind farm (to include changes to water levels, current flow around foundations and downstream of foundations (wake effects) and tidal residuals);
- Changes to the wave regime as a result of the presence of the wind farm (e.g. due to dispersion of energy, possibly affecting both wave height and direction);
▪ Changes to sedimentary processes as a result of the presence of the wind farm;
▪ Introduction of scour as a result of the presence of the wind farm;
▪ Increased suspended sediment concentrations as a result of scour;
▪ Fate of sediments suspended arising from scour;
▪ Changes to geomorphological controls acting to maintain the offshore sand banks and other bedforms;
▪ Changes to geomorphological controls acting to maintain adjacent coastlines (to include assessment and interpretation of changes to the wave, tidal and sediment regimes in terms of impacts to adjacent coastlines such as Holderness, Lincolnshire and North Norfolk);
▪ Cable route: Changes to sea bed morphology along the export cable route and potential cable exposure; and
▪ Accidental release of contaminants into marine environment during operation and maintenance activities through spillage or leakage of contaminants from vessels and/or other plant.

Decommissioning phase

5.1.53 The potential impacts during decommissioning are considered to be similar to those previously described during construction.

Potential transboundary impacts

5.1.54 No transboundary impacts are anticipated from Project Two, as the project lies approximately 40 km from the international boundary. It is proposed that this impact is therefore scoped out of the Project Two EIA process for physical processes. However, transboundary implications will still be considered within the ZEA.

Potential cumulative impacts

5.1.55 There is potential for cumulative impacts to arise during the construction phase Project Two. These impacts relate to the potential interaction between plumes of sediment created by aggregate extraction (from adjacent licensed areas) and foundation / cable installation associated with Project Two. These potential impacts will be assessed based on a conceptual understanding, combined with numerical modelling, where appropriate. Information regarding the sediment released during the aggregate extraction activities will be ascertained from available information to assist in this assessment.

5.1.56 In addition, there is potential for cumulative impacts to arise due to the operational presence of Project Two alongside the operational presence of other wind farms in this region of the North Sea. For example, cumulative effects may arise due to changes to the wave or tidal regime and consequential implications
for sediment transport. These issues will be assessed through reference to a conceptual understanding and numerical modelling where required.

**Potential inter-related effects**

5.1.57 No inter-related impacts are anticipated for Project Two under physical processes due mainly to the fact that this topic acts as a pathway with receptors lying within other EIA topics.

**Potential mitigation and monitoring**

5.1.58 Potential mitigation options will be identified and considered as part of the main EIA. These options may include the use of scour protection. Details of the exact nature of the mitigation options to be considered are pending the findings of the assessment outlined here.

5.1.59 Measures will be adopted to ensure the potential release of pollutants is minimised during all phases of the development. An Environmental Management Plan (EMP) will be produced, adhering to published guidelines and best practice, and will include planning for accidental spillages and potential contaminant releases.

### 5.2 AIRBORNE NOISE AND VIBRATION

**Environmental baseline**

5.2.1 A description of airborne noise and vibration sources and the location of airborne noise and vibration sensitive receptors in relation to the offshore components of Project Two are considered in this section. Underwater noise and vibration is assessed within the Underwater Noise technical annex that will be provided alongside the ES, the impacts of which are considered in the Fish and Shellfish Ecology and Marine Mammals sections (Section 6.2 and Section 6.4 respectively).

5.2.2 Airborne noise and vibration sources considered include the construction noise associated with the development of the project, both at the wind farm and along the cable route to MHWS; and the operational noise once the development is complete.

5.2.3 Construction noise and vibration sources may include piling, hammering or drilling and will include the use of barges and vessels and heavy machinery and generators on the vessels. Operational noise will include aerodynamic noise from wind turbine blades passing through the air and mechanical noise from the gearbox and generator of the turbines.

5.2.4 Airborne noise and vibration sensitive receptors include the foreshore, coastal towns and cities, and other marine users. The foreshore receptors include coastal birds which are considered in Section 6.3 and recreational users (considered in Section 8.11). The coastal towns and cities in the Humber region include Mablethorpe, Cleethorpes and Grimsby and Easington. These towns are
accustomed to an intermittent level of noise from existing sources of shipping and industrial activities. Other marine users include fishing fleets, vessel and recreational shipping and the accommodation platforms associated with Project Two.

**Data and guidance to inform EIA**

**Data currently obtained**

5.2.5 The data requirements to inform the noise assessment will include the use of the following regulatory requirements and guidance:

- Overarching NPS for Energy (EN-1) (DECC 2011a) Chapter 5.11 Noise and Vibration;
- Merchant Shipping and Fishing Vessels (Control of Noise at Work) Regulations 2007;
- Part 1 of the British Standard 5228-1:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites Standard (BSI, 2009);
- Noise Policy Statement for England (Defra 2010);
- British Standard 7445: Description and measurement of environmental noise. Part 1: Guide to environmental quantities and procedures (BSI 2003);
- The Offshore Technology Report 2001/068: Noise and Vibration (HSE, 2001); and

**Outstanding data requirements**

5.2.6 The data sources identified above will be reviewed for any relevant new data for 2011/2012.

**Methods supporting EIA**

5.2.7 A noise assessment has been undertaken for Hornsea Zone Project One (EMU, 2011). This report shall be reviewed and referenced as appropriate for the Project Two EIA.

5.2.8 The noise assessment shall consider construction related and operational noise. The main construction related noise sources shall be from the use of hydraulic pile drivers for installing turbines. Use of vessels, machinery, generators and other construction activities such as cable laying will also emit noise. When operational noise sources shall be emitted from the turbines both as mechanical noise from gear boxes and as aerodynamic noise from the air through the turbine blades. Given the distance to shore the main receptors have been identified offshore as:

- Offshore oil and gas and wind farm accommodation platforms in the vicinity of the Project Two site;
- Fishing vessels (see Section 7.1); and
- Shipping (see Section 7.2).

5.2.9 The results of the assessment shall be used to inform the EIA. Appropriate noise attenuation and mitigation measures shall be developed as required to reduce potential noise impacts to within regulatory requirements.

5.2.10 Consultation on the noise assessment results and mitigations measures proposed shall be held with JNCC, and other marine user stakeholders.

Potential project impacts

Construction phase

5.2.11 There is the potential for airborne noise and vibration resulting from construction activities, particularly from near shore activities including cable laying activities, vessel mounted machinery including generators and vessel movement. Potential receptors include coastal birds, coastal dwellings and recreational users. The duration of near shore construction noise sources will be short and are expected to be masked from background noise levels from port activity.

5.2.12 Offshore noise sources including piling and hammering activities, vessel mounted machinery including generators and vessel movement. In all cases, the noise source is considered to be too far from the coast to impact near shore and coastal receptors. The main receptors shall include other marine users and offshore oil and gas or wind farm accommodation platforms.

5.2.13 Construction related airborne noise shall be assessed in the EIA.

Operation and maintenance phase

5.2.14 The impact of airborne operational noise on human offshore receptors is not likely to be significant and as such as been scoped to of this assessment.

Decommissioning phase

5.2.15 Decommissioning noise will be similar to noise generated during construction activities. A detailed decommissioning plan will be prepared at the appropriate time which will include the requirement for noise assessment and mitigation measures. This will be further assessed during the EIA.

Potential transboundary impacts

5.2.16 The offshore components of Project Two will be located at least 39.6 km from the UK/EEZ boundary. Stationary noise and vibration sources are unlikely to have any significant impact over this great a distance. There is the potential however for construction vehicles to travel through or operate at a shorter distance to the UK/EEZ boundary.

5.2.17 Potential transboundary impacts from noise and vibration sources during construction and decommissioning activities shall be included in the EIA. It is
proposed that potential transboundary impacts from noise and vibration sources from operational and maintenance activities shall be scoped out of the EIA.

Potential cumulative impacts

5.2.18 There is the potential for cumulative impacts to arise from airborne noise and vibration sources during all project phases particularly in regard to other wind farm developments, particularly Project One in the Hornsea Zone and other marine users.

5.2.19 Potential cumulative impacts of airborne noise and vibration will be considered for construction, maintenance, operation and decommissioning phases within the EIA.

Potential inter-related effects

5.2.20 There is the potential for potential impacts to arise from noise and vibration in relationship with other potential impacts from the project on the identified sensitive receptors. During construction activities potential inter-related impacts may include noise and vibration impacts (this section) and impacts to navigation and shipping (see Section 7.2), impacts on other marine users particularly oil and gas (Section 7.8) and impacts on fishing vessels (Section 7.1).

5.2.21 Potential inter-relationship impacts during construction, operation, maintenance and decommissioning phases will be included in the EIA.

Potential mitigation and monitoring

5.2.22 Noise mitigation measures that will be implemented during Project Two start at the project design. Any accommodation platforms shall be designed to meet best practice guidance and shall be sited to take noise considerations into account.

5.2.23 Construction timing and location shall consider results of the noise assessment and construction programmes planned accordingly. High noise operations may be restricted in coastal areas at night, for example.

5.2.24 Construction management plans shall be developed to ensure construction noise is kept to a minimum. This shall include the requirement for maintenance programmes on all noise generating equipment.

5.2.25 A noise monitoring programme shall be developed as part of the construction and operation management plans for the Project Two.

5.3 UNDERWATER NOISE

Environmental baseline

5.3.1 This Section addresses underwater noise sources and potential impacts from the construction, operation, maintenance and decommissioning of the offshore components of Project Two. The sources of noise from the project for
underwater noise are the same as that for airborne noise and vibration which is discussed in Section 5.2. The main potential impacts that have been identified from underwater noise are on marine mammals which is discussed in Section 6.4, and fish and shellfish which is discussed in Section 6.2, commercial fishing which is discussed in Section 7.1 and on seismic acquisition by oil and gas industry (see Section 7.8).

5.3.2 Background noise sources in the Project Two area will arise primarily from shipping and the oil and gas industry. The shipping routes and shipping traffic is discussed in Section 7.2 and the oil and gas infrastructure and activities in the area are discussed in Section 7.8.

Data and guidance to inform EIA

Data currently obtained

5.3.3 Noise modelling was undertaken for Project One and the wider Hornsea Zone (EMU, 2011; Appendix A2.3.1: Underwater Noise). This assessment shall be reviewed and used where applicable to inform the noise modelling for Project Two.

5.3.4 The main legislation and guidance that shall be used in the noise assessment includes the following:

- The European Union (EU) Marine Strategy Framework Directive (Directive 2008/56/EC). This seeks to achieve good environmental status (GES) in Europe’s seas by 2020. The qualitative descriptors for determining GES include "Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment." This Directive has been transposed into UK law by the Marine Strategy Regulations 2010; and

- The NPS EN-1 (DECC, 2011) section 5.11 noise and vibration.

5.3.5 Legislation and guidance relating to the effect of underwater noise on marine mammals are discussed in Section 6.4 and fish and shellfish in Section 6.2.

Outstanding data requirements

5.3.6 The data identified above shall be reviewed for relevant new information for 2011/21012.

5.3.7 Consultation regarding underwater noise shall continue through the Project Two EIA with the Planning Inspectorate, JNCC, NE and MMO.

5.3.8 It is understood from previous consultation on Project One that an Expert Panel meeting shall be required with JNCC and marine fish and shellfish ecology experts to agree on the defined scope specification and methodology for the Project Two noise assessment.

5.3.9 JNCC and NE have previously requested that a noise exposure assessment should be undertaken for Project One. This assessment will also be included as part of the Project Two specific noise modelling.
Methods supporting EIA

Noise model

5.3.10 Consideration shall be given to the two acoustic modelling tools which were used in the noise assessment for Project One: Environmental Risk Management Capability (ERMC) (Harrison, 1998) and Directional Noise Array Model (DINAMO) (Schofield, 2008).

5.3.11 As part of the adopted EIA methodology for this project, and as consistent with Project One advice, the worst case scenario of impacts will be assessed. This will included those arising during decommissioning, particularly where the impacts will differ from that during construction (such as the use of explosives to remove infrastructure).

5.3.12 It should be noted that while much of the noise modelling will be shared with Project one, additional modelling will be undertaken that is specific to Project Two, in order to inform the impact assessment process.

Baseline data to inform the noise modelling

5.3.13 Baseline data required for the noise modelling will be provided by site specific surveys that were carried out across the Hornsea Zone (SMart Wind, 2012). This data shall be augmented by the most recent data sets that are available to Project Two and shall include the following sources:

- Bathymetry and seabed morphology: Digital Bathymetric Database Variable Resolution (DBDB-V) (U.S. Naval Oceanographic Office, 1997) 5' arc grid depth data. This data may be used in preference to the geophysical survey data because it provides a consistent dataset beyond the range of the project specific geophysical survey. Geophysical survey data is also available for the Project Two area, wider Hornsea Zone and shall be available for the cable route corridor.

- Seabed sediments: Data available from the Hornsea Zone geological survey data (SMart Wind, 2012).


- Wind speed: A recent new wind speed data set shall be available from the SMart Wind meteorological buoys positioned in the Hornsea Zone.

- Shipping data: Project Two AIS based shipping survey data and shipping routes including that transecting the cable corridor, see Section 7.2)

- Oil and Gas activities in the region: Information on platforms, vessel movement and planned oil and gas activities in particular drilling and seismic surveying (see Section 7.8 Oil and Gas).
Potential project impacts

5.3.14 In addition to the results from the quantitative modelling scenarios, underwater noise impacts shall be assessed by an expert panel who can provide an assessment of the potential impacts for aspects which cannot currently be addressed by modelling alone, including:

▪ Potential physical and behavioural impacts on mammal species (see Section 6.4);
▪ Potential impact on fish in the region (see Section 6.2); and
▪ Potential impact on shellfish in the region (see Section 6.2).

Construction phase

5.3.15 Potential impacts during construction, primarily from piling of wind turbine and substation foundations, shall be assessed further during the EIA. Identified receptors shall include fish and shellfish (see Section 6.2) marine mammals (see Section 6.4) commercial fisheries (see Section 7.1) and oil and gas industry (see Section 7.8).

Operation and maintenance phase

5.3.16 Potential impacts during operation and maintenance, particularly from turbine noise and maintenance vessel noise shall be assessed further during the EIA. Identified receptors shall include fish and shellfish (see Section 6.2) marine mammals (see Section 6.4) commercial fisheries (see Section 7.1) and oil and gas industry (see Section 7.8).

Decommissioning phase

5.3.17 Potential impacts, particularly from removal of infrastructure and use of explosives, shall be further assessed during the EIA. Potential receptors shall include fish and shellfish (see Section 6.2) marine mammals (see Section 6.4) commercial fisheries (see Section 7.1) and oil and gas industry (see Section 7.8).

Potential transboundary impacts

5.3.18 In order to assess the potential for transboundary noise impacts noise propagation modelling will be required to be run for Project Two. The potential transboundary impacts shall be assessed further during the EIA.

Potential cumulative impacts

5.3.19 Consideration shall be given to cumulative impacts from noise in particular during construction related piling activities. There is the potential for cumulative impacts with the Project One and future wind farms in the Hornsea Zone. Cumulative impacts may also arise from Dogger Bank and East Anglia Zones,
as well as Round 2 projects including Triton Knoll. A more detailed assessment of the wind farm developments within the area and their construction windows will be required for the EIA to identify which other wind farm developments should be considered in terms of the cumulative underwater noise assessment.

5.3.20 There is the potential for cumulative impacts with shipping and navigation (see Section 7.2) and oil and gas operators in the region (see Section 7.8).

**Potential inter-related effects**

5.3.21 There is the potential for underwater noise to interact with other impacts such as habitat loss, increased suspended sediment loads to create inter-related impacts on fish and shellfish, marine mammals and indirectly, commercial fisheries. This will be assessed further in the EIA for Project Two.

**Potential mitigation and monitoring**

5.3.22 Noise mitigation considerations shall include piling operation techniques in particular the use of different energies and the employment of soft start (discussed further in Section 6.4 marine mammals) and concurrency of piling.

5.3.23 Construction timing consideration shall be made considering the source attenuation variance for different times of the year, the location of receptors within range of the source at different times of the year, and the cumulative impacts of construction timing with other project schedules.

6 **OFFSHORE BIOLOGICAL OFFSHORE ENVIRONMENT**

6.1 **BENTHIC AND EPIBENTHIC ENVIRONMENT**

*Environment Baseline*

6.1.1 The site-specific benthic ecology study area includes Subzone 2 (and One) and a 2 km buffer outside of the Subzone, the offshore cable route corridor (500 m corridor) and the landfall of the cable route. The zonal benthic ecology study area includes the central area of the Hornsea Zone and a 5 km buffer. Zone and site-specific surveys have been and/or are proposed across the Hornsea Zone and together with an initial desktop review, have been used to inform this Scoping report.

*Baseline Description*

**Hornsea Zone and Subzone 2**

6.1.2 The Hornsea Zone is predominantly sandy, mixed sand and gravel habitats that support a variety of benthic communities. The distributions of these habitats are subject to a number of physical factors such as substrate type, depth, tidal conditions and thermal stability at the seabed.
6.1.3 Broad scale mapping of the habitats within the region has been undertaken as part of the Mapping European Seabed Habitats (MESH) pan-European initiative and this indicates dominant habitats including circalittoral coarse sediments and circalittoral fine sand and muddy sand within Project Two and along the cable route corridor (Figure 6.2).
Figure 6.1  Benthic ecology surveys across the Hornsea Zone including Subzone 1 and the offshore cable route corridor. Additional sites proposed for Project Two are shown in red.
Figure 6.2 Predicted MESH EUNIS habitats across the Hornsea Zone and Project Two.
Data and Information to Inform EIA

6.1.4 A site-specific benthic survey was carried out in November/December 2010 to characterise the benthic communities across the Hornsea Zone (see Section 6.1.29). The dominant sediment class in the Hornsea Zone survey area was slightly gravelly sand, followed by gravelly sand and sandy gravel, based on the Folk Classification System (Folk, 1974). The sand dominated sites were characterised by rippled sands, with varying proportions of shell and gravel. The dominant sediment types agreed well with the historical data and the predicted MESH EUNIS habitats.

6.1.5 The infaunal and mobile species encountered were, in the majority of cases, characteristic of dynamic, predominantly sand habitats, including a number of small bodied, short lived species such as the polychaete worms *Sabellaria spinulosa*, *Goniada maculata* and *Notomastus* sp., Nemertean worms, amphipod crustaceans *Bathyporeia* sp, the pea urchin *Echinocyamis pusillus* and basket shell *Corbula gibba*. Larger and longer lived species (thereby indicative of more stable sediments) were also represented e.g. the bivalve mollusc *Dosinia* sp., and *Chamelea striatula* which can live upwards of 10 years.

6.1.6 Fourteen biotopes\(^4\) were identified (Figure 6.3), with the dominant biotope SS.SSa.IMuSa.FfabMag ‘*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand, covering much of the western and central areas of the Zone and grading into the sandy biotope SS.SSa.IFiSa.NcirBat ‘*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand’ in areas of increasing sediment disturbance.

6.1.7 The biotope SS.SBR.PoR.SspiMx ‘*Sabellaria spinulosa* on stable circalittoral mixed sediment’ was allocated to a single sample within Subzone 1. Assessment of the video recorded from the site against the criteria for ‘reefiness’ (Gubbay, 2007 and Limpenny et al., 2010) found this was ‘not a reef’.

6.1.8 Levels of sediment contaminants were generally below relevant guideline concentrations, with the exception of cadmium and nickel which both exceeded guidelines at different locations.

Offshore Cable Route

6.1.9 The cable route surveys recorded sedimentary habitats in all sampled locations along the cable route with no areas of rocky or hard seabed identified.

6.1.10 The dominant Folk sediment classification along the cable route corridor was slightly gravelly sand followed by sandy gravel and muddy sandy gravel (Folk (1974)). Together, these three sediment types were recorded at 86% of the sample locations. Levels of fine sediments (silt and clay) were generally low

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\(^4\) Three sites across the survey area assigned to two level 3 broad sediment types only.
(<5%) with a small number of more mixed sediment samples with levels of fine sediments of up to 11%.

6.1.11 Over 300 taxa, represented by 5991 individuals, were recorded from the grab sampling sites along the cable route corridor. Polychaete worms dominated, including species such as Polycirrus sp., Spiophanes bombyx, Mediomastus fragilis, Sabellaria spinulosa, Spio armata, Scoloplos armiger, Nephtys cirrosa, Aonidies paucibranciata and Ophelia borealis. Other taxa represented included bivalve molluscs such as Abra alba, Goodallia triangularis and Hiatella arctica, and the amphipod crustaceans Bathyporeia elegans, and small crabs Pisidia longicornis and squat lobster Galathea intermedia.

6.1.12 Of the 14 biotopes that were identified across the Hornsea Zone (see paragraph 6.1.7), all, with the exception of the SS.SMx.OMx.PoVen ‘Polychaete-rich deep Venus community in offshore mixed sediments’, were also identified within surveys along the export cable route corridor (Figure 6.4).
Figure 6.3  Distribution of biotopes across the Hornsea Zone.
Figure 6.4  Distribution of biotopes across Project One: Subzone 1 and along the cable route corridor.
6.1.13 The predominant biotope in the north eastern section of the export cable route corridor was the sandy biotope SS.SSa.IFiSa.NcirBat which was a continuation of the predominant biotope in the western area of the main site (see paragraph 6.1.7). The Phase II video transects in this area also identified two clusters of potential Annex I \textit{Sabellaria spinulosa} reefs adjacent to the main site boundary. Assessment of one of these clusters (Sites 51, 52 and 53) were scored as medium and high ‘reefiness’. The majority of the assessments for the second cluster of sites (Sites 54, 55 and 56) concluded that they were ‘not reef’.

6.1.14 Towards the central region of the export cable route corridor the sandy biotope graded into the coarse sediment biotopes SS.SCS.ICS.MoeVen ‘\textit{Moerella} spp. with venerid bivalves in infralittoral gravelly sand’ and SS.SCS.CCS.MedLumVen ‘\textit{Mediomastus fragilis}, \textit{Lumbrineris} spp, and venerid bivalves in circalittoral coarse sand or gravel’. These biotopes, which are typical of moderate to strong tidal streams, are characterised by communities of polychaetes and bivalves which have high levels of recoverability to disturbances such as smothering, increased suspended sediment concentrations and physical displacement.

6.1.15 The biotope SS.SBR.PoR.SspiMx ‘\textit{Sabellaria} spinulosa on stable circalittoral mixed sediment’, which is typical of areas of strong tidal streams, dominated the western extent of the cable route corridor. Typically the habitats formed by \textit{S. spinulosa} are associated with diverse epifaunal and infaunal communities and although \textit{S. spinulosa} dominated communities may be particularly affected by physical disturbance it is likely that recovery from short term or intermediate levels of disturbance is rapid. An assessment of the sites sampled in this biotope concluded that they did not constitute an Annex I \textit{S. spinulosa} reef.

6.1.16 Beam trawl sampling across the cable route corridor identified epibenthic assemblages comparable to those found within the Zone, including common starfish \textit{Asterias rubens} and the flying crab \textit{Liocarcinus holstatus}, dragonet \textit{Callionymus lyra} and solenette \textit{Buglossidium luteum}. In addition, the pink shrimp was recorded patchily in high abundance.

6.1.17 The seabed contaminants measured along the cable route corridor show that, with the exception of arsenic, all metal concentrations in the sediments sampled along the cable route corridor are below relevant guideline levels.

**Cable route corridor landfall site**

6.1.18 The cable landfall at Horseshoe Point is located within the Humber Estuary Special SAC, SPA, Ramsar Site and SSSI. The saline lagoon at Northcoates Point is also a BAP habitat and an Annex I priority feature habitat (coastal lagoons), listed as a qualifying feature but not a primary reason for the selection of the Humber Estuary SAC. The cable landfall point is in close proximity to the southern end of the lagoon. Feeder channels in the upper intertidal area are likely to be important in maintaining the silled lagoon.
6.1.19 The intertidal area surveyed is backed by a system of vegetated dunes and comprises predominantly sedimentary habitats including intertidal sand and muddy sandflats supporting characteristic invertebrate communities. These include molluscs, shells, polychaete worms and small crustacean amphipods. Areas of pioneer saltmarsh occur on the upper shore areas. The intertidal survey classified and mapped nine biotopes (Figure 6.5).

6.1.20 All of the biotopes, with the exception of LS.LSa.St.Tal ‘Talitrids on the upper shore and strand-line’ and LS.LMp.Sm ‘Saltmarsh’ identified during the survey, are illustrative of the Annex I habitat “mudflats and sandflats not covered by seawater at low tide”, a primary reason for which the Humber Estuary SAC is designated. Additionally, muddy sand biotopes fall under the broader UK BAP habitat classification “intertidal mudflats” (JNCC, 2010; 2011b). The pioneer saltmarsh habitat, LS.LMp.Sm, is illustrative of the Annex I habitat “Salicornia and other annuals colonising mud and sand” which is a qualifying feature for the Humber Estuary designation and in addition, is typical of the Annex I habitat ‘Estuaries’ (a primary reason for selection of the site). The LS.LMp.Sm biotope is illustrative of the ‘Coastal Saltmarsh’ UK BAP habitat.

6.1.21 Chemical analysis of sediments at the landfall site identified a number of metals at concentrations above guideline values at some locations in the intertidal area. These included chromium, copper and nickel, although concentrations are considered to be below levels likely to have a deleterious effect.
Figure 6.5 Intertidal site survey and biotope map of the cable landfall area.
Features of nature conservation importance

6.1.22 The only benthic species of conservation concern identified from the benthic survey (along the offshore cable route) was the bivalve (Ocean quahog) *Arctica islandica*. Note that only one specimen of this species was recorded during site specific surveys. This long-lived bivalve mollusc is listed by OSPAR as a threatened and/or declining species and is a Feature of Conservation Interest (FOCI) for which MCZs may be designated. In addition, the FfabMag, NcirBat and MoeVen biotopes fall within the umbrella UK BAP habitat “Subtidal sands and gravels”.

6.1.23 No cobble reefs were identified based on the method detailed by Irving (2009). Sampling sites were also assessed for biogenic *Sabellaria spinulosa* ‘reefiness’ (based on Gubbay, 2007; Limpenny *et al*., 2010), with medium to high potential reef recorded at three sites (Sites 51, 52 and 53) in the north eastern end of the export cable route corridor.

6.1.24 There was good evidence from the patchy nature of the reef recorded and moribund tubes, that these are hydrodynamically active areas. It is suggested that reefs forming in this area may be ephemeral and although the specific locations may change, the propensity for the presence of reef is evident. Further benthic survey work will be required to determine the presence and distribution of Annex I habitats in the Subzone 2 boundary, however based upon the Zone and Subzone 1 surveys no Annex I habitats have been identified to date in this area.

6.1.25 No species of conservation importance were identified during the intertidal survey. The glasswort *Salicornia* spp. is a flowering saltmarsh plant and was found within the site. Although not identified to species level as part of the current intertidal survey, several glasswort species do have Red List status.

Data and Information to inform EIA

6.1.26 An initial desk based review of literature and data sources to support the consultation phase of Project Two has highlighted the following sources:

- UK Benthos Database accessed via Oil and Gas UK (www.ukooa.co.uk). Department for Transport, Local Government and the Regions (DTLR) (2002). Guidelines for the conduct of benthic studies at aggregate dredging site (now updated, see Ware and Kenny, 2011);
- CEFAS (2011). Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects;
- MMO, JNCC, NE, CCW (2010). Guidance on the assessment of effects on the environment and cultural heritage from marine renewable developments;
6.1.27 In addition to these data sources, specific Subzone 2 and offshore cable route corridor information will be available through site specific benthic ecology surveys as described in Section 6.1.29 below) and will be used to inform the EIA process.

6.1.28 The following guidance documents will also be considered during the EIA process:

- Offshore Wind Farms. Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements (CEFAS, 2004);
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR 2008); and
- Guidelines for the conduct of benthic studies at aggregate dredging sites (DTLR, 2002).

**Methods Supporting EIA**

6.1.29 A detailed site specific benthic and epibenthic survey encompassing the wider Zone, and Subzone 1 including a 2 km buffer, was undertaken in late 2010 and 2011 respectively (Table 6.1). A further 40 site specific sampling sites were undertaken within Subzone 2 in 2012 to augment the existing site-specific data collected, and will be used to provide a robust description of the baseline environment for benthic and epibenthic habitats and species (including Annex I habitats such as biogenic and geogenic reef). The information collected will be used to inform the EIA process.

6.1.30 Grab sampling stations across the zone were selected on a stratified random basis with consideration of the acquired geophysical data to ensure adequate coverage of the different types of sediment habitats anticipated. Refinement of sampling sites for Subzone 2 has been enabled by the broad scale data collected for the wider Zone and were collected in 2012 to complement this existing data, to enable a robust assessment of the baseline conditions in order to inform the EIA process. Some samples for Project Two were undertaken at the same sites sampled previously for Project One, so that natural variability over time for the habitats across the Zone can also be assessed.
6.1.31 Beam trawl sampling was undertaken using a Lowestoft two metre scientific beam trawl.

6.1.32 The Subzone 2 benthic survey included the following activities:

- 0.1 m$^2$ mini-Hamon grab sampling for the collection of quantitative seabed sediment samples for determination of macrofaunal content and particle size distribution analysis at 59 sites;
- Seabed digital photography and video for collection of qualitative/semi-quantitative data on seabed habitats and associated sessile epibenthos at 59 sites and at an additional 6 sites which had been previously sampled during the Project One surveys in July 2011;
- 2 m scientific beam trawling for information on larger mobile epibenthos such as fish, crabs, shrimps and prawns at 21 sites; and
- 0.1 m$^2$ Day grab sampling of seabed sediment for contaminants analysis at 11 sites (15 sites were proposed but sampling was unsuccessful at four locations).

6.1.33 The location of grab, beam trawl and seabed video sampling stations within this survey array are shown in Figure 6.6. The samples are concentrated within Subzone 1 (completed) and Subzone 2 (completed) with fewer stations near the margins of the site, and some additional sites also located within the offshore cable route corridor.

6.1.34 The same methods used for the Hornsea Zone and Subzone 1 surveys will be used across Subzone 2. The proposed survey design, methodology and survey specification has been consulted on and agreed with the MMO, JNCC/NE and CEFAS prior to commencement. This includes an agreement that existing cable corridor data are adequate to inform the Project Two assessment.
Figure 6.6 The Zonal and Project One benthic survey sites with the proposed Project Two benthic sampling sites overlaid.
Table 6.1  Benthic survey activities for the Hornsea Zone, Subzone 1, Subzone 2 and offshore cable route. Survey Four – Subzone 2 and cable route proposed for this summer.

<table>
<thead>
<tr>
<th>Survey Area</th>
<th>Methods used</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone Benthic Survey</td>
<td>Seabed grab sampling (122 sites)</td>
<td>November 2010</td>
</tr>
<tr>
<td></td>
<td>Seabed video surveillance (122 sites)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scientific trawling (40 sites)</td>
<td></td>
</tr>
<tr>
<td>Survey One – Subzone 1</td>
<td>Seabed grab sampling (161 sites)</td>
<td>July and September 2011</td>
</tr>
<tr>
<td></td>
<td>Seabed video surveillance (163 sites)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scientific trawling (41 sites)</td>
<td></td>
</tr>
<tr>
<td>Survey Two – Cable route corridor</td>
<td>Seabed grab sampling (57 sites)</td>
<td>June 2011 (Phase One) and October 2011 (Phase Two)</td>
</tr>
<tr>
<td></td>
<td>Seabed video surveillance (75 sites)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scientific trawling (42 sites)</td>
<td></td>
</tr>
<tr>
<td>Survey Three – Intertidal (Landfall)</td>
<td>Habitat mapping (including core sampling)</td>
<td>August 2011</td>
</tr>
<tr>
<td>Survey Four – Subzone 2 and eastern end of offshore cable route corridor</td>
<td>Seabed grab sampling (40 sites)</td>
<td>August 2012</td>
</tr>
<tr>
<td></td>
<td>Seabed video surveillance (30 sites)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scientific trawling (30 sites)</td>
<td></td>
</tr>
</tbody>
</table>

6.1.35 Biotope maps showing the distribution of habitats and communities across Subzone 2, the offshore and onshore cable route will be produced and used to inform the EIA process. Biotopes offer a convenient ecological unit for assessment of receptor sensitivity and considerable information is available as to their tolerance and recoverability to disturbance effects. Data provided on the MarLIN website will enable an assessment of the sensitivities and re-colonisation characteristics of individual biotopes and species to be included as part of the ES. Habitat and species data will also be compared against features of conservation interest to appraise importance and further inform potential sensitivity as part of the EIA process.

6.1.36 Where required, biomass information will be used to assess bird prey availability to further inform the EIA process.

Potential Project Impacts

Construction Phase

6.1.37 Potential impacts resulting from the construction of Project Two on benthic and epibenthic communities are:

- Temporary habitat loss under jack-up barges, inter-array and export cabling and seabed preparation for turbine foundations;
▪ Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures;
▪ Increased suspended sediments and smothering from resettling of sediments during cable trenching, vessel anchoring, piling and or drilling;
▪ Change to water quality from accidental release of contaminants; and
▪ Re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance.

Operation and Maintenance Phase

6.1.38 Potential impacts resulting from the O&M phase of Project Two on benthic and epibenthic communities are:
▪ The long term loss of existing seabed habitats under foundations, scour protection and as a result of scour around the structures;
▪ The deployment and presence of artificial hard substrate structures and associated increase in colonisation of benthic species adapted to hard surfaces;
▪ Change to water quality from accidental release of contaminants during servicing and maintenance;
▪ Changes in sediment transport and deposition patterns as a result of the presence of turbines and associated structures; and
▪ Changes in the hydrodynamic regime leading to changes in seabed sediment distribution, grain size, structure with changes to resultant benthic habitat.

Decommissioning Phase

6.1.39 Potential impacts resulting from the decommissioning of Project Two on benthic and epibenthic communities will be similar to those described for construction, excluding piling and drilling.

Potential Transboundary Impacts

6.1.40 There are unlikely to be any transboundary impacts in relation to benthic ecology resulting from Project Two as the predicted impacts on the benthic and epibenthic communities will largely be focused within the footprint of Project Two. The potential for Project Two to impact on the benthic and epibenthic interest features of nature conservation designations outside of the UK EEZ will be considered within the EIA process, including the interaction between physical processes and benthic ecology.

Potential Cumulative Impacts

6.1.41 Cumulative effects, particularly assessment of the different timing scenarios between Project One and Project Two (i.e. concurrent; phased-continuous; phased-discontinuous with reinstatement in between phases), will be assessed.
6.1.42 The predicted impacts on benthic and epibenthic communities resulting from the construction, maintenance and decommissioning of Project Two are considered to be local and largely within the footprint of the project. Therefore, cumulative impacts on benthic and epibenthic communities resulting from Project Two, and other wind farm developments are considered to be unlikely.

6.1.43 There is the potential for impacts on benthic and epibenthic communities resulting from Project Two together with other developments within the region. The extent of these impacts will depend on the spatial extent and magnitude of the impacts from these developments combined with those of Project Two. The following activities have been identified as having the potential for impacts when considered cumulatively with Project Two:

- Oil and gas infrastructure/development;
- Existing and future seabed infrastructure (cables and pipelines);
- Commercial fishing activities;
- Navigation and shipping; and
- Aggregate extraction and disposal of dredging spoil.

Potential inter-related effects

6.1.44 Inter-relationships between impacts on benthic ecology considered in isolation (e.g. loss of habitat, sedimentation, suspended sediments etc.) will also be considered together as part of the EIA process. Furthermore, inter-relationships with other receptors i.e. all of the impacts of Project Two on benthic ecology, and the potential for secondary effects on other receptors (e.g. fish and shellfish ecology, ecology, ornithology, shipping and navigation etc.) will also be considered as part of the EIA process.

Potential Mitigation and Monitoring

6.1.45 Potential mitigation will include looking to minimise the amount of scour/cable protection used within the site and managing water quality through strict EMP / MPCP documentation for the main developer and all contractors.

6.1.46 Proposed monitoring requirements will be identified as part of the EIA process and agreed with the relevant competent authorities, with the degree and type required being dependent on existing baseline environmental conditions, project design and proposed construction methodology.

6.2 FISH AND SHELLFISH ECOLOGY

Environment Baseline

6.2.1 The Hornsea Zone area supports a diverse but typical array of bottom-dwelling and pelagic fish associated with the southern North Sea. Among the most characteristic fish species are those that spawn and/or migrate through the Hornsea Zone, e.g., herring *Clupea harengus*, mackerel *Scomber scombrus* and
plaise *Pleuronectes platessa* (CEFAS, 2004). The Zone also provides important habitat conditions for nursery grounds that support these species and others such as lemon sole *Microstomus kitt*, monkfish *Lophius piscatorius*, sandeels *Ammodytes marinus* and sprat *Sprattus sprattus*.

6.2.2 Fish species of conservation and commercial significance present include elasmobranches (e.g., thornback ray *Raja clavata* and spotted ray *Raja montagui*). This group also includes basking shark *Cetorhinus maximus*, which is known to inhabit the southern North Sea waters (Sims et al., 2003).

6.2.3 The Hornsea Zone supports a range of shellfish species typical for the southern North Sea, and is immediately adjacent to some of the most productive shellfish ground in the UK (MMO, 2011). These include, for example, Norway lobster *Nephrops norvegicus* (also referred to as *Nephrops*), brown crab *Cancer pagurus*, scallops *Pecten maximus* and shrimp *Pandalina borealis*. *Nephrops* and brown crab are commercially important species and both have spawning and nursery grounds within the Hornsea Zone.

6.2.4 Site-specific survey data collected across the Hornsea Zone in 2011 (Figure 6.7) has been used to further inform this Scoping report (see Section 6.1.29 for data collection methods).
Figure 6.7: Hornsea survey area for fish and shellfish ecology including otter trawl and potting sampling sites across the Hornsea Zone, Project One and Two.
Subzone 2 and Offshore Cable

Subtidal fish

6.2.5 A total of 46 fish taxa were recorded during two otter trawl surveys conducted across the Hornsea Zone in 2011. In addition to fish species, shellfish representing 13 taxa were observed during the two surveys, 11 of which were identified to species level.

6.2.6 The fish communities within the study area were found to be typical of the southern North Sea. Species richness was moderate across the Hornsea Survey Area but was dominated by eight species, which constituted greater than 95% of the catch. The ten most abundant and frequently occurring species were whiting *Merlangius merlangus*, dab *Limanda limanda*, sprat, herring, European common squid *Alloteuthis subulata*, grey gurnard *Eutrigla gurnardus*, plaice, lesser weaver *Echiichthys vipera*, mackerel and poor cod *Trisopterus minutus*.

6.2.7 Abundance was relatively high across the study area, particularly during spring when the pelagic species, herring and sprat occurred in greater numbers. Conversely, species richness was greatest during autumn. The fish assemblages across the study area were similar. As expected, sediment type (and water depth) had some influence on the assemblages although seasonal effects were more pronounced.

6.2.8 Commercially important species encountered in high abundances and at high frequencies of occurrence across the study area were whiting, dab, sprat, herring, plaice, mackerel and lemon sole. Other commercially important species including cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, sole *Solea solea*, ling *Molva molva* and the spotted, cuckoo *Leucoraja naevus* and thornback rays were encountered less frequently (less than 50% frequency) and at lower abundances.

6.2.9 The greater sandeel *Hyperlopus lanceolatus* and lesser sandeel *Ammodytidae* spp., (both keystone species as they are important prey items for fish, birds and marine mammals) were recorded during the surveys (less than 25% frequency). They were found in highest abundance during the spring surveys but did not occur in the muddy sediments to the northeast of the Hornsea Survey Area or in the deeper waters to the north of the Hornsea Zone.

6.2.10 Whilst not the primary intention of the otter trawl surveys, juvenile fish of the following species were recorded in moderate abundance; whiting, dab, herring, grey gurnard and lemon sole. No particular patterns in the distribution of these species were evident; juveniles were present at the majority of sites where adult fish were found. Further details on the distribution of spawning and nursery

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5 Hornsea Survey Area for fish ecology includes the central Hornsea Zone and offshore/onshore cable (Figure 6.5)
grounds within the vicinity of the Hornsea Zone are provided in Section 0 onwards).

**Subtidal shellfish**

6.2.11 The lobster and brown crab fishery is one of the most important commercial shell fisheries in the UK. There are approximately four vessels that fish for lobster and crab along the proposed cable route corridor for Project Two. As such, it is important that the EIA process for Project Two assesses the abundance and distribution of key crustacean species via a dedicated potting survey.

6.2.12 Four commercially important species were encountered during survey activity; European lobster *Homarus gammarus*, brown crab, velvet swimming crab *Necora puber* and whelk *Buccinum undatum*. Of these commercially important species, in size, undersized, soft and berried specimens were caught for all three crustacean species at all sampling sites (see Figure 6.7).

**Intertidal fish and shellfish**

6.2.13 A total of 22 taxa of fish were caught in the intertidal fish surveys (see Section 6.2.30 for sampling methods) at Horseshoe Point. The fauna encountered were considered typical of the inshore environment of the Humber region. The fauna was characterised by commercially and ecologically important fish species such as the lesser sandeel *Ammodytes tobianus*, sprat, plaice, sand goby *Pomatoschistus minutus*, flounder *Platichthys flesus* and the greater pipefish *Syngnathus acus*.

6.2.14 The invertebrate fauna recorded in the surveys were found to be relatively diverse with several species of commercial importance recorded including the brown shrimp *Crangon crangon* and the pink shrimp *Pandalus* spp.

6.2.15 The data revealed that a high proportion of the community was comprised of juvenile marine commercial species such as sprat, plaice and sandeel, indicating that the area is being utilised as a nursery ground.

6.2.16 Several species of potential conservation concern were found. These included herring, bass *Dicentrarchus labrax*, whiting and the migratory European smelt *Osmerus eperlanus*.

**Spawning and Nursery Grounds**

A wide range of finfish and shellfish are known to utilise the region for spawning and nursery grounds and many of these areas are located within the Project Two boundary. Known spawning and nursery grounds for these species are shown in Figure 6.8 to Figure 6.10 and summarised in Table 6.2.

6.2.17 Although potential herring spawning grounds have been identified by Coull *et al.* (1998) along the export cable corridor, data from the International Herring Larvae Survey (IHLS) between 2001 and 2010 have shown that the key spawning ground for this herring population (i.e. the Banks population) is located
to the west of the Hornsea Zone, off Flamborough Head. This population spawns in autumn, with peak spawning occurring in September and October. A smaller, spring spawning herring population is also known to occur within The Wash (CEFAS, 2009).

6.2.18 Gonadal assessment during the trawling surveys did not confirm any significant fish spawning populations (0.5% of the herring caught in autumn were actively spawning) although current fisheries sensitivity maps indicate herring spawning areas are in close proximity to the Hornsea Zone (Table 6.2). Berried individuals of brown crab, lobster and *Nephrops* were all recorded at very low abundances. Juvenile brown crab nursery areas were identified inshore from the potting surveys (more than 70% of catch was undersized). A potential spring herring nursery ground was identified at Horseshoe Point and is consistent with current understanding of the wider distribution of inshore nursery habitat in the North Sea.

Table 6.2  Summary of finfish and shellfish spawning and nursery areas within Subzone 2 and the Offshore Cable Route (Coul et al., 1998; Ellis et al., 2012).

<table>
<thead>
<tr>
<th>Species</th>
<th>Subzone 2</th>
<th>Offshore Cable Route</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spawning</td>
<td>Nursery</td>
</tr>
<tr>
<td>Haddock</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Plaice</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cod</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Whiting</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Lemon sole</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dover sole</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Herring</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Monkfish</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Mackerel</td>
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<td></td>
</tr>
<tr>
<td>Sandeel</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sprat</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Nephrops</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Brown shrimp</td>
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</tr>
<tr>
<td>Scallop</td>
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</tbody>
</table>
**Figure 6.8**  Haddock, plaice and cod spawning and nursery grounds.
Figure 6.9 Whiting, lemon sole, Dover sole and herring spawning and nursery grounds.
Figure 6.10  Monkfish, mackerel, sandeel and sprat spawning and nursery grounds.
Figure 6.11    Shrimp, *Nephrops*, edible/brown crab and scallop spawning and nursery grounds.
**Migratory fish**

6.2.19 There are a number of diadromous species known to occur in the wider Project Two region (in proximity to the offshore cable route), of which the smelt, Atlantic salmon *Salmo salar* and twaite shad *Alosa fallax* were recorded during this study. Like many diadromous species they have suffered declines in recent decades due to pollution, overfishing, habitat loss and barriers inhibiting their spawning migrations.

6.2.20 One salmon individual was recorded in close proximity to the shore; this species spawns in the upper reaches of rivers including tributaries of the Humber.

6.2.21 Other diadromous species likely to occur in the Project Two study area include the sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis*, sea trout *Salmo trutta*, allis shad *Alosa alosa* and European eel *Anguilla anguilla*. These species were not recorded during the survey, in part due to their comparative rarity but also because of their seasonality.

**Species of Conservation and Commercial Importance**

6.2.22 A UK BAP was published in 1995, which identified a list of Species of Conservation Concern (SoCC). These are species considered to be threatened by anthropogenic activities, listed as nationally or internationally important.

6.2.23 Many UK BAP listed species occur within the Project Two boundary including plaice, whiting, herring, mackerel and Atlantic cod. A number of species present within the Project Two boundary, mainly the elasmobranches, are also classified under the IUCN Red List of Threatened Species. The migratory species listed above are also protected as UK BAP priority species, and are protected or scheduled by National and/or EC legislation or international conventions.

6.2.24 Key species targeted by commercial fishing activities are discussed in further detail within Section 7.1.

**Data and Information to Inform EIA**

6.2.25 An initial desk based review of literature and data sources to support the consultation phase of Project Two has highlighted the following sources of information:

- Ellis *et al.* (2012). Spawning and nursery grounds of selected fish species in UK waters;
- MMO, JNCC, NE, CCW. (2010). Guidance on the assessment of effects on the environment and cultural heritage from marine renewable developments;
- Information on the sensitivity of fish to EMF fields (e.g., Gill *et al.*, 2009);
6.2.26 Any further data sources that become available during the consultation phase of Project Two will be used to inform the EIA process.

6.2.27 SMart Wind has also undertaken site specific surveys for the Hornsea Zone (see Section 6.2.30 below).

**Methods Supporting EIA**

6.2.28 The importance of consultation during the EIA for offshore wind farm projects is an important process, in particular for fish and shellfish ecology, which has species and populations of both commercial and conservation value. SMart Wind have ongoing consultation with the following organisations/bodies:

- MMO;
- The Centre for Environment, Fisheries and Aquaculture Sciences (CEFAS);
- National Federation of Fisherman’s Organisations (NFFO);
- North Eastern Inshore Fisheries Conservation committee (NEIFCA);
- The Environment Agency (EA) for inshore waters; and
- The commercial fishing industry (see Section 7.1).

6.2.29 Consultation can provide invaluable data and information on, and understanding of, key fisheries, their ecology and sensitivities in proximity to Project Two, which can be used to inform the EIA process for Project Two.
Fish Trawl and Netting Surveys

6.2.30 SMart Wind conducted two seasonal trawling surveys, using representative commercial gears, across the Hornsea Zone and along the route of the Project One and Two export cable corridor (Table 6.3) in 2011. Figure 6.7 shows the distribution of these trawl sampling locations in relation to each project boundary. In addition, a series of seasonal intertidal fish netting surveys have been undertaken at the site of the landfall of the export cable at Horseshoe Point. Survey methodologies followed CEFAS guidance and received statutory approval prior to survey mobilisation.

<table>
<thead>
<tr>
<th>Survey Area</th>
<th>Methods used</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey 1 – Subtidal Fisheries (Zone and cable route corridor)</td>
<td>High opening Otter trawl with 40 mm cod-end.</td>
<td>April and September/October 2011</td>
</tr>
<tr>
<td>Survey 2 – Intertidal Fisheries (cable landfall)</td>
<td>Fyke nets; Push nets; and Beach seines.</td>
<td>April and September 2011</td>
</tr>
</tbody>
</table>

6.2.31 Relevant fisheries information is also being collected as part of the commercial fisheries EIA (Section 7.1). These data have been collected through detailed consultations in conjunction with a literature review of MMO landings, buyers and sellers register and log books, as well as monitoring through VMS and surveillance. A series of 2 m epibenthic beam trawls have been undertaken across the Hornsea Zone and further epibenthic trawls were undertaken as part of the Project Two specific benthic ecological survey (Section 6.1). Whilst accepted as generally not suitable for characterising larger fish and shellfish populations, these types of trawls do collect information on smaller demersal species, allowing for a qualitative assessment of these species.

6.2.32 Given the quantities and coverage of fisheries information currently available, together with the supporting information that will be collected during planned benthic ecology survey, no further trawling surveys are considered necessary to provide a robust baseline characterisation against which Project Two impacts can be assessed. Key ecosystem species such as sandeels have been covered by the mapping of sandeel fisheries through VMS and consultation data (Section 7.1).

6.2.33 Similarly, no further trawls or netting surveys are planned along the offshore cable route corridor shared by Project One and Two.
Shellfish Potting Surveys

6.2.34 SMart Wind intends to continue the current experimental and observational potting surveys along the route of the cable which began in 2011 (Table 6.3). Three experimental surveys will be undertaken during peak months for the fishery (May, October and November) together with an observational study to monitor commercial lobster catches along the Holderness coast during September. Figure 6.7 shows the location of the experimental potting strings. These surveys will add to the time series data already compiled for the high value potting fishery and will ensure continued local community engagement with the Hornsea development.

6.2.35 Survey methodology and sampling frequency will be intelligence led following consultation with local fisheries organisations and in consideration of current CEFAS advice.

Potential Project Impacts

Construction Phase

6.2.36 The identified potential impacts on fish and shellfish ecology resulting from the construction of Project Two are as follows:

- Temporary loss of habitats under jack-up barges, inter array and export cabling, and seabed preparation for turbine foundations, including subsequent impacts on spawning stocks, nursery areas and recruitment;
- Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures and associated increased suspended sediments leading temporary disruption to migratory pathways and feeding activity;
- Change to water quality from accidental release of contaminants;
- Noise and vibration disturbance from piling and vessel movements including disturbance to early life stages, and temporary disruption to migratory pathways of salmonids, lamprey and other migratory fish and shellfish species;
- Acoustic surveys that are conducted in the pre-construction phase may disturb fish and shellfish spawning;
- Changes in sediment transport and deposition patterns as a result of the presence of turbine foundations and associated structures impacting on seabed spawning habitat;
- Changes to water quality from the re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance; and
- Habitat modification due to introduction of hard substrate in the form of foundations and scour.
**Operation and Maintenance Phase**

6.2.37 The identified potential impacts on fish and shellfish ecology resulting from the O&M of Project Two are as follows:

- The long term loss of existing seabed habitats for under foundations, scour protection and as a result of scour around the structures;
- Noise and vibration disturbance from servicing vessel movements having physiological and behavioural impacts on fish and shellfish species, including disruption to migratory pathways fish and shellfish species;
- Changes in sediment transport and deposition patterns as a result of the presence of turbine foundations, remedial work on offshore cables and associated structures impacting on seabed spawning habitat;
- Local effects on fish and shellfish community structure caused by the reduction/elimination of commercial trawling within the area; and
- Electromagnetic fields (EMF) from inter-array and export cabling causing a disturbance to fish and shellfish species, in particular elasmobranches, but also effects on migratory species, such as eels, salmonids and lamprey.

**Decommissioning Phase**

6.2.38 Potential impacts on fish and shellfish ecology resulting from the decommissioning of Project Two will be similar to those in the construction phase but will also include:

- Local effects on fish and shellfish community structure caused by the reinstatement of the area for commercial trawling; and
- Decreased habitat complexity due to the removal of artificial hard substrate structures and associated benthic species adapted to hard surfaces.

**Potential Transboundary Impacts**

6.2.39 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. A proportion of the fishing activity within the Project Two boundary is undertaken by vessels from other EU member states, it is, therefore, recognised that in this context there is the potential for transboundary impacts via impacts on commercially fished species and the EIA will take account of this.

**Potential Cumulative Impacts**

6.2.40 Cumulative impacts, particularly the different timing scenarios between Project One and Project Two (i.e. concurrent; phased-continuous; phased-discontinuous with reinstatement in between phases) will be assessed.
6.2.41 There is the potential for cumulative impacts on fish and shellfish ecology between Project One and the Round 2 wind farms in The Greater Wash area and the Round 3 Dogger Bank and East Anglia Zone developments. The mobile nature of many fish and shellfish species will be considered during the assessment of cumulative impacts within the EIA Process.

6.2.42 There is the potential for impacts on fish and shellfish ecology as a result of the construction, operation, maintenance and decommissioning of Project Two when considered together with 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 same activities as listed in the benthic ecology section.

Potential Inter-relationship Impacts

6.2.43 Inter-relationships between impacts on fish and shellfish ecology considered in isolation (e.g. loss of spawning and nursery grounds, displacement and disturbance) will also be considered together as part of the EIA process. Furthermore, inter-relationships with other receptors i.e. all of the impacts of Project Two on fish and shellfish ecology, and the potential for secondary effects on other receptors (e.g. benthic ecology, ornithology, shipping and navigation etc.) will also be considered as part of the EIA process.

Potential Mitigation and Monitoring

6.2.44 Mitigation may take the form of cable burial and protection to reduce EMF effects and development of a piling strategy and use of soft-start to minimise impacts from underwater noise.

6.2.45 Proposed monitoring requirements will be identified as part of the EIA process and agreed with the relevant competent authorities, with the degree and type required being dependent on existing baseline environmental conditions, project design and proposed construction methodology.

6.3 ORNITHOLOGY

Environmental Baseline

6.3.1 Seabird data from the first year of seabird surveys across the Hornsea Study Area⁶ have been used to inform this Scoping report in conjunction with existing published information on seabirds in the area, in particular the European Seabirds at Sea (ESAS) database which contains over 1.5 million records collected across the North Sea since 1979.

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⁶ The Hornsea Study Area comprises the Hornsea Zone survey area plus 10 km buffer. For the EIA this Study Area will include site-specific surveys of the Subzone 2 area plus 4 km buffer (see Section 6.3.13).
Breeding Seabirds

6.3.2 Seabird colonies occur along the whole of the English east coast, with the nearest breeding seabird colonies to Subzone 2 at Flamborough Head and Bempton Cliffs, approximately 38 km north of Subzone 2. The proximity of this colony and the known foraging ranges of seabird species that breed as part of this colony, such as gannet *Morus bassanus*, kittiwake *Rissa tridactyla* and guillemot *Uria aalge* suggest that seabirds from this colony may forage within Subzone 2 during the breeding season. To the south of Flamborough, there is a lack of habitat suitable for cliff nesting seabirds and consequently there are few large seabird colonies. However, terns and gulls breed on saltmarshes, undisturbed beaches or offshore sandbanks, particularly along the north Norfolk coast. It is considered unlikely that breeding birds from these colonies will feed in the vicinity of Subzone 2, as it is located beyond the known foraging ranges of these species which is typically less than 50 km. Information on the important breeding seabird species occurring in the Hornsea region is presented in Table 6.4. Locations of these seabird colonies are shown in Figure 6.12.

<table>
<thead>
<tr>
<th>Colony</th>
<th>Main Species</th>
<th>Total</th>
<th>Percentage of UK breeding population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humber Estuary 89 km</td>
<td>Little tern</td>
<td>63 pairs</td>
<td>3.2</td>
</tr>
<tr>
<td>Flamborough Head and Bempton Cliffs 94 km</td>
<td>Kittiwake</td>
<td>42,659 AON</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>Guillemot</td>
<td>46,685 Inds</td>
<td>3.5</td>
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<tr>
<td></td>
<td>Razorbill</td>
<td>8,539 Inds</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>Gannet</td>
<td>3,940 AOS</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Puffin</td>
<td>2,615 Inds</td>
<td>0.5</td>
</tr>
<tr>
<td>North Norfolk coast 104 km</td>
<td>Sandwich tern</td>
<td>3,457 pairs</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td>Little tern</td>
<td>377 pairs</td>
<td>19.4</td>
</tr>
<tr>
<td></td>
<td>Common tern</td>
<td>460 pairs</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Roseate tern</td>
<td>2 pairs</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>Mediterranean gull</td>
<td>2 pairs</td>
<td>1.9</td>
</tr>
<tr>
<td>Gibraltar Point</td>
<td>Little tern</td>
<td>23 pairs</td>
<td>1.2</td>
</tr>
</tbody>
</table>

8 Approximate distance from colony to nearest point of Subzone 2.
9 Wanless et al. (2005).
<table>
<thead>
<tr>
<th>Colony</th>
<th>Main Species</th>
<th>Total</th>
<th>Percentage of UK breeding population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 km</td>
<td></td>
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<tr>
<td>The Wash</td>
<td>Little tern</td>
<td>33 pairs</td>
<td>1.7</td>
</tr>
<tr>
<td>121 km</td>
<td>Lesser black-backed gull</td>
<td>1,378 AON</td>
<td>1.610</td>
</tr>
<tr>
<td></td>
<td>Common tern</td>
<td>152 pairs</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Herring gull</td>
<td>1,003 AON</td>
<td>0.710</td>
</tr>
</tbody>
</table>

AON – Apparently Occupied Nests; AOS – Apparently Occupied Sites; Inds – Individuals.

*Coastal colonies only*
Figure 6.12  Locations of the main seabird colonies inshore of the Hornsea Zone (Subzone 2 boundary shown in red).
6.3.3 The best available published data on seabird distribution in the central North Sea region are contained in the "Important Bird Areas for seabirds in the North Sea, including the Channel and the Kattegat" (Skov et al., 1995), which combined a series of ESAS datasets, collected between 1980 and 1994, and covering offshore and inshore areas.

6.3.4 In addition to these data, relevant information from the Year 1 monthly boat-based bird surveys for the Hornsea Study Area (March 2010 to February 2011) has also been used to inform this scoping report and is summarised in Table 6.5 and Table 6.6. An indication of the monthly mean density for the main species in the Hornsea Study Area is presented in Table 6.5, with peak mean densities for the Hornsea Study Area shown in Table 6.6.

6.3.5 From these tables, it can be noted that key seabirds recorded within the Hornsea Zone (in terms of densities from boat-based surveys) include little gull, kittiwake, guillemot and razorbill.

Table 6.5 Indicative relative monthly mean density of regular seabird species in the Hornsea Study Area in Year 1.

<table>
<thead>
<tr>
<th>Species / group</th>
<th>M</th>
<th>Ap</th>
<th>Mr</th>
<th>Ju</th>
<th>Ju</th>
<th>Au</th>
<th>Sg</th>
<th>Oc</th>
<th>Nv</th>
<th>De</th>
<th>Ja</th>
<th>Fe</th>
</tr>
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<tbody>
<tr>
<td>Fulmar</td>
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<td>Gannet</td>
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<tr>
<td>Little gull</td>
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<tr>
<td>Lesser black-b. gull</td>
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<tr>
<td>Herring gull</td>
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<tr>
<td>Great black-b. gull</td>
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<tr>
<td>Kittiwake</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Common tern</td>
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<tr>
<td>Arctic tern</td>
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<tr>
<td>Guillemot</td>
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<tr>
<td>Razorbill</td>
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<tr>
<td>Little auk</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Puffin</td>
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<td></td>
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</tr>
</tbody>
</table>
Table 6.6  Highest mean density of regular seabird species in the Hornsea Study Area in Year 1.

<table>
<thead>
<tr>
<th>Species</th>
<th>Peak mean density (birds/km²)</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subzone 1 plus 4 km buffer</td>
<td>Hornsea Zone survey area plus 10 km buffer</td>
</tr>
<tr>
<td>Fulmar</td>
<td>2.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Gannet</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Little gull</td>
<td>12.6</td>
<td>3.8</td>
</tr>
<tr>
<td>LBB gull</td>
<td>0.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Herring gull</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>GBB gull</td>
<td>0.7</td>
<td>3.49</td>
</tr>
<tr>
<td>Kittiwake</td>
<td>14.2</td>
<td>7.5</td>
</tr>
<tr>
<td>Common tern</td>
<td>3.9</td>
<td>1.6</td>
</tr>
<tr>
<td>Arctic tern</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Guillemot</td>
<td>52.2</td>
<td>26.3</td>
</tr>
<tr>
<td>Razorbill</td>
<td>26.8</td>
<td>7.1</td>
</tr>
<tr>
<td>Little auk</td>
<td>0.8</td>
<td>2.1</td>
</tr>
<tr>
<td>Puffin</td>
<td>2.9</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Wildfowl and Waders**

6.3.6  Three of the top six sites currently monitored as part of the UK-wide Wetland Bird Survey (WeBS) are located on the east coast of England near to Subzone 2; the Wash, North Norfolk Coast and Humber Estuary. Key species of non-breeding wildfowl and waders occurring at these sites include: pink-footed goose *Anser brachyrhynchus*, dark-bellied Brent goose *Branta bernicla*, shelduck *Tadorna tadorna*, pintail *Anas acuta*, oystercatcher *Haematopus ostralegus*, ringed plover *Charadrius hiaticula*, golden plover *Pluvialis apricaria*, grey plover *Pluvialis squatarola*, lapwing *Vanellus vanellus*, knot *Calidris canuta*, sanderling *Calidris alba*, dunlin *Calidris alpina*, black-tailed godwit *Limosa limosa*, bar-tailed godwit *Limosa lapponica*, curlew *Numenius arquata* and redshank *Tringa totanus*. All three sites hold internationally important numbers of both wildfowl and waders at certain times of year and are considered key sites of the East Atlantic Flyway (regular routes used by migrating waders and other water birds that generally migrate between breeding, staging (areas where they rest and feed up during migration) and wintering areas). Eight global flyways have been identified of which this is one (Delany et al., 2009).

6.3.7  A total of 359 birds of 20 species of wildfowl, heron or wader were recorded in the Hornsea Study Area in Year 1. Golden plover was the most frequently recorded species with a total of 142 birds recorded. Whimbrel *Numenius phaeopus* (41 birds) and teal *Anas crecca* (37 birds) were the next most commonly recorded species. Overall, these three species accounted for 61.1 % of all wildfowl, herons and waders recorded in Year 1.
**Terrestrial Birds**

6.3.8 A total of 661 individuals of 34 terrestrial bird species were recorded in the Hornsea Study Area in Year 1. Starling *Sturnus vulgaris* was the most frequently seen species with a total of 487 birds recorded. Meadow pipit *Antus pratensis* (41 birds) and blackbird *Turdus merula* (17 birds) were the next most commonly recorded species. Overall, these three species accounted for 82.6% of all land birds recorded in Year 1.

**Nature Conservation Designations**

6.3.9 As mentioned above (Section 6.1) there are a number of onshore protected sites close to the Hornsea Zone, which may support bird populations that utilise Subzone 2 (Table 6.5). The closest SPAs and/or Ramsar sites to the Hornsea Zone and Subzone 2 are Flamborough Head and Bempton Cliffs SPA, Humber Estuary SPA, North Norfolk Coast SPA, Broadland SPA and The Wash SPA.

6.3.10 It is also recognised that there may be other designated sites further away than those presented below that could potentially be affected due to the far-ranging nature of the qualifying species. It is, therefore, proposed that consideration will be given to seabird species surveyed in Subzone 2 (see site specific surveys shown in Figure 6.13) that form a component of SPAs along the east coast of the UK from the Shetland Islands (Hermaness) to Kent (Foreness Point) and that this area will delineate the study area for birds. The defined study area for ornithological impacts will need to be agreed with Statutory Bodies.

**Data and Information to Inform EIA**

6.3.11 An initial desk based review of literature and data sources to support the consultation phase of Subzone 2 has highlighted the following sources:

- An atlas of seabird distribution in north-west European waters (Stone *et al.*, 1995);
- Important Bird Areas for seabirds in the North Sea (Skov *et al.*, 1995);
- DTI report on - An analysis of ESAS seabird surveys in UK waters to highlight gaps in coverage (Pollock and Barton, 2006);
- Seabird populations of Britain and Ireland (Mitchell *et al.*, 2004);
- UK Offshore Energy Strategic Environmental Assessment (DECC, 2009a);
- Birds and Wind Farms (De Lucas *et al.*, 2007);
- Ecological Research on Offshore wind Farms (Zucco *et al.*, 2006);
- A review of assessment methodologies for offshore wind farms (Maclean *et al.*, 2009);
- The Migration Atlas (Wernham *et al.*, 2002);
An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs (Kober et al., 2010);

Data from aerial bird surveys undertaken within the Hornsea Zone (TCE, 2010h);

The Wetland Bird Survey 2006/07 (Calbrade et al., 2010); and

RSPB Research Report: Offshore wind farms and birds - Round 3 Zones, extensions to Round 1 and 2 sites, and Scottish territorial waters (Langston, 2010).

6.3.12 Additionally, regional and Subzone 2-specific boat based surveys are being undertaken (see paragraph 6.3.13). Aerial bird and marine mammal surveys of the Hornsea Zone have been operating on behalf of Project Two since June 2012.

Methods Supporting EIA

Data Acquisition

6.3.13 Detailed site-specific boat-based surveys at the scale of Subzone 2 are required to allow the potential impacts of Project Two to be assessed. Dedicated monthly boat-based seabird surveys commenced in the Hornsea Study Area in March 2010, covering the Hornsea Zone and a 10 km buffer at 6 km transect spacing running north to south across the survey area. Site-specific monthly boat-based seabird surveys for Subzone 2 Study Area, covering Subzone 2 and a 4 km buffer at 2 km transect spacing also running north to south, commenced in April 2012. Both the regional and Subzone 2 seabird surveys will continue through until April 2013. Combined, these surveys will provide a three year dataset for Subzone 2. The Zone level survey work also provides contextual information for the Subzone 2 specific surveys. The survey designs were discussed and agreed with the statutory consultees and the results of these surveys will provide the baseline data to inform the EIA process and enable the assessment of the potential impacts of Project Two.

6.3.14 The surveys follow ESAS survey methods (Webb and Durink, 1992), and comply with COWRIE recommendations (Camphuysen et al., 2004), with modifications for recording the height of flying birds. In addition, all terrestrial bird species seen are recorded. The ESAS survey method includes recording of marine mammals. Any turtles, sharks and sunfish seen are also recorded.

6.3.15 The site specific surveys employ a Before-After-Gradient (BAG) study design which assumes that impacts decline with increasing distance from the source of impact (Ellis and Schneider, 1997; Morrison et al., 2008; Manly, 2009; Smith, 2002).
Figure 6.13  Hornsea Study Area showing the Hornsea Zone (and 10 km buffer) with 6 km transect spacing and Subzone 2 (and 4 km buffer) with 2 km transect spacing.
**Aerial Surveys**

6.3.16 In addition to the boat based surveys, SMart Wind have commissioned APEM Ltd to undertake aerial surveys across the Zone. These surveys have been operating since June 2012 and will continue through to the stage where they can feed into the draft ES.

**Assessment of Baseline Data**

6.3.17 Analysis of the data collected will provide the following information required to inform the EIA process for Project Two:

- Estimate of the population size and densities of seabirds using Subzone 2 (and surrounding waters) throughout the year based on the data collected during the boat-based surveys using the distance Sampling Technique (Buckland et al., 1993; 2001; 2004). This will allow the importance of Subzone 2 (and surrounding waters) to be assessed at regional, national and international levels;

- Assessment of how birds are using Subzone 2 (and surrounding waters) throughout the year, e.g., migration, feeding, breeding. This will allow the importance Subzone 2 (and surrounding waters) to be assessed at regional, national and international levels;

- Distribution of birds within Subzone 2 (and surrounding waters) throughout the year. This will allow for the comparison of different areas within the Hornsea Zone and the development of potential mitigation measures;

- Estimate of collision risk to seabirds to assess potential impacts at a regional scale using collision risk modelling based on the SNH/Band collision risk model (Band et al., 2007); and

- Estimate of any potential effects due to habitat loss and displacement, ‘barrier effects’ created by the presence of structures and the availability of alternative suitable habitats.

**Potential Project Impacts**

**Construction Phase**

6.3.18 The identified potential impacts on birds resulting from the construction of Project Two are as follows:

- Disturbance and displacement of birds from the Subzone 2, and the offshore and onshore cable route (in particular along the foreshore) resulting from construction activities, the presence of construction vessels and other associated plant (physical presence, noise and vibration);

- Possible reduction in prey availability through the disturbance and displacement of fish and other prey from the Subzone 2 area resulting from the presence of construction vessels and other associated plant; and
**Operation and Maintenance Phase**

6.3.19 The identified potential impacts on birds resulting from the operation and maintenance of Project Two are as follows:

- Displacement of birds from Subzone 2 area resulting from the presence of turbines;
- Direct collision of birds utilising Subzone 2 for feeding and migration with the turbines;
- Barrier to daily movements and migration as a result of the turbines within Subzone 2 disrupting the flight-lines of birds which may cause an increase in the energetic costs; and
- Disturbance and displacement of birds from the Subzone 2 resulting from the presence of service and maintenance vessels, leading to a physical loss of foraging habitat.

**Decommissioning Phase**

6.3.20 The potential impacts during decommissioning are considered to be similar to those for the construction phase.

**Potential Transboundary Impacts**

6.3.21 Due to the highly mobile nature of birds, and the proximity of the Hornsea Zone and Subzone 2 to the waters of other North Sea bordering countries, there is the potential for transboundary impacts from the proposed development.

6.3.22 Desk-based studies will gather data on the species present in the Hornsea Zone and Subzone 2 with breeding colonies beyond the UK coast. These data will be used to assess the importance of the numbers of each species (i.e. percentage of the population) using the Hornsea Zone and Subzone 2 at national and international levels. The assessment methods described previously will be used to ascertain potential impacts on these populations.

6.3.23 Throughout the EIA, any likely significant effects from the development of Subzone 2 on the bird population of another EU Member States will be identified and reported in the ES.

**Potential Cumulative Impacts**

6.3.24 Cumulative impacts, in particularly assessment of the different timing scenarios between Project One and Project Two (i.e. concurrent; phased-continuous; phased-discontinuous with reinstatement in between phases) will be assessed.

6.3.25 The proximity of Project Two to a number of important seabird colonies and the presence of other Round 2 and 3 Zones in the southern North Sea indicate that there is the potential for a cumulative impact.
6.3.26 Cumulative impacts may arise in relation to any of the potential impacts described in the previous sections. It is recognised that assessing cumulative impacts is a significant challenge and that best guidance on how to address cumulative impacts with respect to birds and wind farms has been published by COWRIE (King et al., 2009), this guidance will inform the assessment of cumulative impacts within the EIA process.

6.3.27 In addition, there is potential for impacts to birds resulting from the construction, operation, maintenance and decommissioning of Subzone 2 together with 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, dredging and spoil disposal;
- Navigation and shipping;
- Established commercial fishing activities;
- Potential port and harbour developments; and
- Existing and potential future oil and gas installations.

Potential Inter-related Effects

6.3.28 Inter-relationships between impacts on birds considered in isolation (e.g. collision risk, barrier effects, displacement) will also be considered together as part of the EIA process. Furthermore, inter-relationships with other receptors i.e. all of the impacts of Project Two on birds, and the potential for secondary effects on other receptors (e.g. benthic ecology, fish and shellfish ecology, shipping and navigation etc.) will also be considered as part of the EIA process.

Potential Mitigation and Monitoring

6.3.29 There is a range of standard mitigation measures which can, if appropriate, be incorporated into any offshore wind farm development including the layout and siting of turbines (to avoid key areas for birds), the timing of construction (to avoid key periods for certain bird species), the routes taken by construction vessels (including following existing shipping lanes) and taking precautions to avoid rafts of moulting flightless birds (by using dedicated observers on the vessels).

6.3.30 Recognised standard mitigation measures are listed below:

- Aviation and navigation lighting should be optimised to avoid attracting birds taking into account impacts on safety;
- Subject to other constraints, wind turbines should be laid out within a site, to minimise collision risk, where the collision risk assessment shows there is a significant risk of collision;
Construction vessels associated with offshore wind farms should, where practicable and compatible with operational requirements and navigational safety, avoid rafting seabirds during sensitive periods; and

6.3.31 The Subzone 2 boat-based bird survey started in April 2012 and will continue until April 2013. Potential mitigation and future monitoring will be informed by the Zone-wide and Subzone 2 survey results and analysis.

6.4 MARINE MAMMALS

Environmental Baseline

6.4.1 The waters around the Hornsea Zone support a diverse range of marine mammals (cetaceans and pinnipeds).

6.4.2 With respect to cetaceans, a range of these species occur in the vicinity of the Hornsea Zone, however knowledge on the abundance, population structure and seasonal distribution remains limited. Information on seasonal movements, inter-annual variation in abundance/density, and the distribution range for the majority of cetaceans in western European waters is lacking.

6.4.3 The cetacean species most relevant to Subzone 2 are harbour porpoise, minke whale, white-beaked dolphin, and bottlenose dolphin (see Figure 6.14 for marine mammal atlas density plots; Reid et al., 2003), as these species were recorded in the Year 1 surveys for the Hornsea Study Area. Only one sighting was made of bottlenose dolphins (three individuals) during the dedicated surveys.

6.4.4 Two species of seal also occur in UK waters; the grey seal *Halichoerus grypus* and common seal *Phoca vitulina*. Other species, (typically Arctic species) occasionally occur in UK coastal waters, including ringed seal *Phoca hispida*, harp seal *Phoca groenlandica*, bearded seal *Erignathus barbatus* and hooded seal *Cystophora cristata*.

6.4.5 Monthly boat based surveys of the Hornsea Study Area commenced in March 2010. These surveys gathered both acoustic and visual data on marine mammals using the Hornsea Zone. The results from Year 1 of these surveys, and the data review, have been used to inform this Scoping report.

Species overview

**Harbour porpoise Phocoena phocoena**

6.4.6 Harbour porpoise was the most common marine mammal in the Hornsea Study Area in Year 1, with 2,571 animals recorded, which accounted for 89.55% of all marine mammals recorded. Harbour porpoise sightings were made in every month in Year 1 in the Hornsea Study Area. Peak monthly mean abundance

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11 The Hornsea Study Area comprises the Hornsea Zone survey area plus 10 km buffer. For the EIA this Study Area will include site-specific surveys of the Subzone 2 area plus 4 km buffer (see Section 6.3.13).
was recorded in June 2010 with a total of 1.5 animals/km$^2$. The highest seasonal abundance of harbour porpoise (per 2 km x 2 km grid square) recorded was 7.93 animals/km$^2$ in June and July.

6.4.7 Peak mean density for all areas recorded in June 2010 was 0.53 animals/km$^2$. In comparison, the SCANS II harbour porpoise density estimate for the south central North Sea (which includes the Hornsea Study Area, see Figure 6.15) was 0.562 animals/km$^2$ (SCANS II, 2008).
Figure 6.14  Minke whale, white beaked dolphin, harbour porpoise and common bottlenose dolphin sightings between 1979 and 1997 (Reid et al., 2003).
Figure 6.15 Harbour porpoise estimated density surface (animals/km²) in 2005, data from SCANSII survey.
White-beaked dolphin *Lagenorhynchus albirostris*

6.4.8 White-beaked dolphin was the second most common marine mammal recorded in the Hornsea Study Area in Year 1, with 114 animals recorded, which accounted for 3.97% of all marine mammals recorded. In Year 1, white-beaked dolphins were recorded between March and June and between October and January in the Hornsea Study Area.

6.4.9 Peak monthly mean abundance for the Hornsea Study Area was recorded in November with a total of 0.1 animals/km recorded. The highest seasonal abundance of white-beaked dolphin (per 2 km x 2 km grid square) recorded was 3.79 animals/km$^2$ in March and April.

Bottlenose dolphin *Tursiops truncatus*

6.4.10 The SCANSLII survey estimated 395 bottlenose dolphins in the English Channel and contiguous southern North Sea. A total of 12,645 animals were estimated in western European continental shelf waters during July 2005 (SCANS II, 2008).

6.4.11 A group of three bottlenose dolphins was recorded in the Hornsea Study Area in Year 1. This sighting was to the north (outside of the Hornsea Zone) in June 2010.

Minke whale *Balaenoptera acutorostrata*

6.4.12 The SCANS surveys provided estimates of minke whale populations for 1994 and 2005 for the North Sea, Celtic Sea and Skagerrak (Figure 6.16 and Figure 6.17). Highest concentrations of animals were predicted for the central North Sea, off Norway, northeast Scotland, southwest England and southern Ireland in 2005 (Figure 6.17) in contrast to the 1994 survey (Figure 6.16) where highest densities were predicted in the north western North Sea.

6.4.13 A total of 51 minke whales were recorded in the Hornsea Study Area in Year 1. There were no minke whales seen between December and April inclusive.
Figure 6.16  Minke whale estimated density surface (animals/km$^2$) in 1994, data from SCANS survey.
Figure 6.17  Minke whale estimated density surface (animals/km²) in 2005, data from SCANSII survey.
Harbour seal *Phoca vitulina*

6.4.14 On the east coast of Britain, harbour seal distribution is more restricted, with concentrations in The Wash, Firth of Tay and the Moray Firth. Approximately 54% of the European sub-species breed in the North Sea, and Britain is home to around 33% of this population (SCOS, 2009). Between 1996 and 2004, approximately 33,000 harbour seals were counted in the whole of Britain, of which 29,500 (90%) were in Scotland and 3,500 (10%) were in England (SCOS, 2009).

6.4.15 There were 86 separate sightings of harbour seals during the Year 1 boat-based bird and marine mammal surveys, with all except two sightings being of single individuals. The overall density of common seals across the survey study area was 0.017 animals/km$^2$ in Year 1. Density estimates from historical survey data indicate 0.2 animals/km$^2$ for the southern North Sea.

6.4.16 There was a clear density gradient across the Hornsea Study Area with the highest harbour seal densities closest to shore. This is consistent with telemetry data collected previously by SMRU which showed seals from The Wash area foraging in the south west of the study area but otherwise only crossing it occasionally (Figure 6.18).

6.4.17 Harbour seals were seen in all months except November. Peak sightings of harbour seals were in the spring.

6.4.18 The numbers of harbour seals recorded during population monitoring/moult survey counts of colonies on the east coast of England during the last decade (1999 to 2009; SCOS, 2009) show that overall, colonies at The Wash and Donna Nook have increased, and colonies at Blakeney Point and Scroby Sands have decreased. The total for all colonies combined has increased slightly, indicating a potential increase in the numbers of harbour seals using the cable route corridor.

Grey seal *Halichoerus grypus*

6.4.19 About 39% of the world population of grey seals is found in Britain, with over 90% of British grey seals breeding in Scotland, mostly in the Hebrides and Orkney. There are also breeding colonies on the north and east coasts of mainland Britain (SCOS, 2009).

6.4.20 Grey seals feed mostly on fish that live on or close to the seabed. The diet is composed primarily of sandeels, whitefish and flatfish, but varies seasonally and from region to region (SCOS, 2009).

6.4.21 At sea, grey seal movements range from short-range return trips from haul-out sites to local foraging areas, to extended journeys between distant haul-out sites. Grey seals target localised areas, generally within 50 km from their haul-out site and frequently forage over sand/gravel seabed sediments, the preferred
habitat of sandeels, which are their primary prey (McConnell et al., 1999; Hammond et al., 2008).

6.4.22 Long-term telemetry studies have revealed that the study area is likely to be used by grey seals travelling from haul-outs at Donna Nook, Humberside and the Farne Islands, off the Northumberland coast (SMRU, 2011).

6.4.23 There were 119 sightings of grey seals during the Year 1 boat based surveys with all but two of these sightings single individuals. Overall density of grey seals in the Hornsea Study Area was 0.024 animals/km\(^2\). As for harbour seals, highest densities of grey seals were noted closer to shore. This is consistent with SMRU telemetry data for seals from Donna Nook foraging in the central North Sea (Figure 6.19). No significant seasonal patterns in grey seal abundance were noted.
Figure 6.18 Tracks of the 24 harbour seals which were tagged in The Wash. Each seal recorded shown in the above plot is represented by a different colour.
Figure 6.19 Tracks of the 12 grey seals which were tagged at Donna Nook.
6.4.24 Grey seal pup production estimates based on ground counts carried out during the grey seal breeding season (September to December) by the Lincolnshire Wildlife Trust (at Donna Nook), Natural England (at East Horsey) and the National Trust (at Blakeney Point), for the period 1999 to 2008 show that overall, grey seal numbers at all east coast colonies have increased (SCOS, 2009). Numbers at Donna Nook were over 6.5 times larger in 2009 (at just over 2000 seal counts) than in 1999.

**Special Areas of Conservation (SACs)**

6.4.25 Three SACs along the east coast of the UK have qualifying marine mammal species whose populations may make use of the study area. These are; Berwickshire and North Northumberland Coast SAC (grey seal), Humber Estuary SAC (grey seal) and The Wash and North Norfolk Coast SAC (common seal). In addition, there are two candidate Special Area of Conservation/proposed Site of Conservation Importance (cSAC/pSCI) along the east coast; Inner Dowsing, Race Bank and North Ridges cSAC/pSCI and Haisborough, Hammond and Winterton cSAC/pSCI (both grey seal and harbour porpoise), and offshore the Dogger Bank cSAC (harbour porpoise, grey and common seal).

6.4.26 The two closest non-UK Natura 2000 sites with qualifying marine mammal species whose populations may also make use of the study area are Klaverbank pSCI (grey seal, common seal and harbour porpoise) and Doggersbank pSCI (grey seal, common seal and harbour porpoise) (see Section 6.4.6 onwards).

**Data and Information to Inform the EIA Process**

6.4.27 An initial desk based review of literature and data sources to support the consultation phase of Project Two has highlighted the following sources:

- Background Information on North Sea Marine Mammals, Strategic Environmental Assessment – Area 2 (DTI, 2001b);
- Background Information on North Sea Marine Mammals, Strategic Environmental Assessment – Area 3 (DTI, 2001c);
- Round 2 offshore wind SEA (DTI, 2003);
- Offshore Energy SEA (DECC, 2009d);
- Small cetaceans in the European Atlantic and North Sea (SCANS-II, 2008);
- An atlas of cetaceans distribution in north-west European waters (Reid *et al.*, 2003);
- Special Committee on Seals (SCOS) – scientific Advice on Matters Relating to the Management of Seal Populations (SCOS, 2010);
- Summary of SMRU seal count and telemetry data from the Humber area (SMRU Ltd., 2011);
- A review of offshore wind farm related underwater noise sources (Nedwell and Howell, 2004);
- An assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore wind farms, and comparison with background noise (Nedwell et al., 2004);
- Data from an underwater noise survey during impact piling to construct the Barrow offshore wind farm (Parvin and Nedwell, 2006a);
- Data from an underwater noise survey during impact piling to construct the Burbo Bank offshore wind farm (Parvin and Nedwell, 2006b);
- Methodologies for measuring and assessing potential changes in marine mammal behaviour, abundance or distribution arising from the construction, operation and decommissioning of offshore wind farms (Diederichs et al., 2008);
- Proceedings of the ASCOBANS/ECS workshop – Offshore wind farms and marine mammals: impacts and methodologies for assessing impacts (Evans, 2008);
- The protection of marine European Protected Species from injury and disturbance Guidance for the marine area in England and Wales and the UK offshore marine area (JNCC, 2010f);
- Report: Towards Standardised Seabirds at Sea Census Techniques in Connection with Environmental Impact Assessments for Offshore Wind farms in the UK (Camphuysen et al., 2004); and
- The JNCC Seabirds at Sea team has carried out a programme of survey and research on seabirds and cetaceans in the marine environment in the north-east Atlantic since 1979. Standardised survey methods for census of primarily seabirds, but also marine mammals, from ships have been produced by JNCC (Tasker et al., 1984; Webb and Durinck, 1992).

6.4.28 In addition to these data sources, regional and Subzone 2 site specific boat based are being undertaken (see Section 6.3).

**Methods Supporting EIA**

**Data acquisition**

6.4.29 Detailed site-specific surveys at the Subzone 2 scale are required to allow the potential impacts of the project to be assessed. Obtaining sufficient data on the abundance and behaviour of marine mammals is challenging, as is determining the sensitivity and responses of marine mammals from the impacts of sound (Diederichs et al., 2008).
**Boat based survey**

6.4.30 Marine mammals are being observed in conjunction with the Subzone 2 specific bird boat-based surveys (as described in Section 6.4.29). These surveys will provide the baseline data for EIA purposes and enable the assessment of the potential impacts of Subzone 2.

6.4.31 Site specific surveys employ a Before-After-Gradient study design which assumes that impacts decline with increasing distance from the source of impact (Ellis and Schneider, 1997; Morrison et al., 2008; Manly, 2009; Smith, 2002).

6.4.32 The visual survey method to quantify the distribution and abundance of marine mammals is following ESAS survey methods (Webb and Durink 1992), and complies with COWRIE recommendations (Camphuysen et al., 2004). Any turtles, sharks and sunfish seen are also recorded. Monthly ESAS surveys within the Hornsea Zone and 10 km buffer zone and Subzone 2 and 4 km buffer zone (see Section 6.4.29) record all marine mammals encountered at the same time as recording seabirds. In addition, angle and distance of the animals from the transect line are recorded using an angle board and rangefinder. Only marine mammal data in suitable sea state (i.e., sea state 3 or less) are used for analysis.

6.4.33 Acoustic surveys using a towed hydrophone\(^\text{12}\) deployed from the survey vessel are also being undertaken to detect odontocetes cetaceans (porpoises and dolphins), which provides an independent method for detecting animals that is less affected by sea state and sighting conditions, and being semi-automated, provided more consistent datasets. Depending on the vessel, it is possible to operate a hydrophone successfully up to sea state 6 (Scheidat et al., 2007). The hydrophone is linked to a computer running PAMGUARD software to record cetacean vocalisations, in particular those made by harbour porpoises and dolphin species, although, it is recognised that animals will not vocalise at all times.

6.4.34 Acoustic surveys commenced in July 2010 (across the entire Hornsea Zone) and are ongoing. For the first six months of acoustic survey, the hydrophone was deployed continuously during surveys. However, following discussion with fisherman in the Hornsea Zone in January 2011, the hydrophone was not towed south of 53°50’N.

**Aerial Surveys**

6.4.35 In addition to the boat based surveys, SMart Wind have commissioned APEM Ltd to undertake aerial surveys across the Zone. These surveys have been operating since June 2012 and will continue through to the stage where they can feed into the draft ES.

\(^{12}\) The equipment comprises: 200 m towed hydrophone array, Magnatec HP27 amplifier and filter unit, National Instruments USB digitiser, depth sensor, Fujitsu laptop and 1TB WD external hard drive.
Assessment of Underwater Noise

6.4.36 In order to assess potential impacts from underwater noise on marine mammals using the Subzone 2 area, the distribution and abundance of marine mammal species with respect to the development area will be mapped. Sound modelling of different construction scenarios (see Section 5.2) will allow the potential zone of influence from Subzone 2 (with respect to noise) to be mapped on both spatial and temporal scales. This will allow the estimation of impact radii for each species of marine mammal using the area. Impact radii depend on the animals’ specific sensitivity, the source level and properties of sound (e.g. frequency band, continuous or impulsive), sound radiation at the site and effect level. Ranges at which animals may be affected will be estimated using measurements of source levels (peak, Sound Exposure Level), a sound propagation model (developed and tested for the site) and information on sound exposure levels potentially significant for the different marine mammal species/species groups (from Nehls et al., 2008). Reference will be made to the thresholds presented in JNCC (2010f) in relation to Permanent and Temporary Threshold Shift (PTS and TTS) effects.

Assessment of Baseline Data

6.4.37 Analysis of the data collected will provide the following information required for the EIA:

- Estimate of the abundance and densities of marine mammals using Subzone 2 (and surrounding waters) throughout the year. This will allow the importance of Subzone 2 (and surrounding waters) to be assessed at regional, national and international levels;
- Assessment of how marine mammals are using Subzone 2 (and surrounding waters) throughout the year, e.g. migration, feeding, breeding. This will allow the importance of Subzone 2 (and surrounding waters) to be assessed at regional, national and international levels;
- Distribution of marine mammals within Subzone 2 (and surrounding waters) throughout the year. This will allow the importance of Subzone 2 (and surrounding waters) to be assessed at regional, national and international levels;
- Assessment of marine mammal disturbance during construction (from piling noise and vibration); and
- Estimate of any potential effects due to habitat loss and displacement, and the availability of alternative suitable habitats.
Potential Project Impacts

Construction Phase

6.4.38 The identified potential impacts on marine mammals resulting from the construction of Project Two are as follows:

- Potential mortality, injury, masking effects and/or disturbance leading to behavioural modification resulting from the noise and vibration from piling;
- Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from piling, vessels, cable trenching and other construction activities; and
- Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during construction activities.

Operation and Maintenance Phase

6.4.39 The identified potential impacts on marine mammals resulting from the operation and maintenance of Project Two are as follows:

- Disturbance and displacement of marine mammals resulting from the noise and vibration from servicing and maintenance vessels;
- Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from O&M vessels;
- Potential physical damage, masking effects, and disturbance resulting from the noise and vibration from O&M vessels;
- The introduction of artificial hard substrates and underwater structures will be colonised by sessile animals and algae, and may enrich the local biomass, resulting in an increase in food availability; and
- Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during O&M activities.

Decommissioning Phase

6.4.40 The potential impacts during decommissioning are considered to be similar to those for the construction phase, though will be considered in full during the assessment phase.

Potential Transboundary Impacts

6.4.41 Due to the highly mobile nature of marine mammals, and the proximity of Subzone 2 to Dutch, German and Danish waters, there is the potential for transboundary impacts from the proposed development.
6.4.42 Dogger Bank is a Candidate SAC (cSAC) with harbour porpoise, grey seal and common seal listed as interest features. The boundaries of the cSAC adjoin the Dutch and German Dogger Bank Natura 2000 sites (pSCIs) (see Section 6.4.26).

6.4.43 Subzone 2 has the potential to have an effect on these features (species) both in the UK and adjoining waters. There are also a number of other European sites which listed marine mammals as features which will need to be considered. A desk-based study will gather data on marine mammal distribution in these areas and the assessment methods described previously will be used to ascertain potential impacts on these European sites.

6.4.44 Throughout the EIA, any likely significant effects from the development of Project Two on the environment of another Member State of the European Economic Area will be identified and reported in the ES.

Potential Cumulative Impacts

6.4.45 Cumulative impacts, in particularly assessment of the different timing scenarios between Project One and Project Two (i.e. concurrent; phased-continuous; phased-discontinuous with reinstatement in between phases) will be assessed.

6.4.46 There is also the potential for cumulative impacts on marine mammals between Project Two and the Round 2 wind farms in the Greater Wash area and the Round 3 Dogger Bank and East Anglia Zone developments. The mobile nature of marine mammals will be considered during the assessment of cumulative impacts within the EIA Process.

6.4.47 The potential impacts on any given species will be considered in relation to the wider population, particularly where these are of conservation interest. Defining geographical and temporal scope for cumulative impacts is vital and likely to vary depending upon both the species and potential impacts under consideration. COWRIE guidelines will be taken into account during consideration of geographical scope for impact assessment.

6.4.48 In addition, there is the potential for impacts on marine mammals as a result of the construction, operation, maintenance and decommissioning of Project Two together with 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, dredging and spoil disposal;
- Navigation and shipping;
- Established commercial fishing activities;
- Potential port and harbour developments; and
- Existing and potential future oil and gas installations.
Potential inter-related effects

6.4.49 Inter-relationships between impacts on marine mammals considered in isolation (e.g. increase risk of vessel strikes, disturbance, and displacement) will also be considered together as part of the EIA process. Furthermore, inter-relationships with other receptors i.e. all of the impacts of Project Two on marine mammals, and the potential for secondary effects on other receptors (e.g. benthic ecology, fish and shellfish ecology, shipping and navigation etc.) will also be considered as part of the EIA process.

Potential Mitigation and Monitoring

6.4.50 Mitigating noise produced during any marine activity is based upon either minimising the noise at source or ensuring a marine mammal is not in the vicinity of operations exposed to noise. For example:

- At design stages and within the EIA process, the assessment of engineering options will include consideration of the noise produced during construction and operation of Project Two;

- During construction, 24 hour working practices may be employed so that the overall construction programme and the potential for impacts to marine mammal communities is reduced in time. If piling is used, consideration will be given to engineering solutions to mask the piling noise as described in Nehls et al., (2007); Monitoring of the surrounding area before and during the piling procedure can be undertaken;

- Depending upon the foundation design chosen, soft start procedures during pile driving may be implemented. This enables marine mammals in the area to move away from the piling location before full power is achieved with the piling device. Site specific guidance such as that described by JNCC (2010e) would be developed regarding the use of Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) Operators; and

- The effectiveness of acoustic deterrent devices (ADDs) such as seal scarers, and pingers (both of which were employed during the construction of the Horns Reef wind farm (Tougaard et al., 2003, 2004) would be investigated further.

6.4.51 In order to minimise risk of a vessel strike, a bespoke Code of Conduct for interactions between marine mammals and vessels associated with Project Two will be commissioned and actively communicated to all vessels and crew.

6.4.52 Mainstream Renewable Power already effectively uses a similar Code on their Scottish offshore wind farm, ‘Neart na Gaoithe’. This is based on the Scottish Natural Heritage (SNH) Wildlife Watching Code of Conduct, and agreed with all interested parties.
6.5 OFFSHORE AND ONSHORE NATURE CONSERVATION DESIGNATIONS

Introduction

6.5.1 In order to provide a holistic approach to nature conservation this section considers both onshore and offshore designated sites. This section is therefore relevant to both the offshore and onshore components of Project Two.

6.5.2 Sites include those that have been designated under International agreement, European directives and national legislation, in both the UK and other Member States (offshore and onshore). In summary, this section discusses the following sites designated for nature conservation interest:

- Ramsar sites;
- Special Protection Areas (SPAs);
- Sites of Community Importance (SCIs)\(^\text{13}\) (including proposed)\(^\text{14}\);
- Special Areas of Conservation (SACs) (including possible, draft and candidate);
- Sites of Special Scientific Interest (SSSIs);
- National and Local Nature Reserves (NNRs and LNRs); and
- Recommended Marine Conservation Zones (rMCZs).

Environmental Baseline

International and European Designations

6.5.3 There are a number of sites designated as part of the Natura 2000 network within proximity to Project Two. These include offshore, coastal and estuarine SACs (and candidate SACs (cSACs)) to the north and south of Project Two, designated for Annex I habitats e.g. sandbanks, biogenic or geogenic reefs, intertidal mudflats, and/or for Annex II species e.g. marine mammals, migratory fish such as shads and lampreys.

6.5.4 Sites include the North Norfolk Sandbanks and Saturn Reef cSAC (9 km to the south of Subzone 2), Dogger Bank cSAC (31 km to the north of Subzone 2), Inner Dowsing, Race Bank and North Ridge cSAC (64 km to the southwest), Haisborough, Hammond and Winterton cSAC (89 km to the south), the Humber Estuary SAC (89 km to the southwest), Flamborough Head SAC (94 km to the northwest), the Wash and North Norfolk Coast SAC (93 km to the southwest) and the River Derwent SAC (144 km to the west) (Figure 6.21 and Figure 6.22). The offshore cable route and landfall for Project Two passes through the

\(^{13}\) SCIs are sites that have been adopted by the European Commission but not yet formally designated by the government of that respective country.

\(^{14}\) pSCIs and cSACs are sites that have been submitted to the European commission by a member state but not yet formally adopted.
coastal/estuarine Humber Estuary SAC. No terrestrial SACs (or features of) are in proximity to the onshore cable route and therefore no onshore SACs are included in this Scoping report.

6.5.5 Two coastal SACs further north along the east coast (the Firth of Tay and Eden Estuary SAC and the Moray Firth SAC) will also be considered in the Project Two EIA. Bottlenose dolphin *Tursiops truncatus* and harbour porpoise *Phocoena phocoena* are listed as reasons for designation or as qualifying features of these sites and have the potential to interact with the Project Two site based on known travelling distances.
Figure 6.20 UK Natura 2000 sites (offshore and coastal) in proximity (within 150 km) of Project Two.
Figure 6.21 European Special Protection Areas (SPAs) and Sites of Community Importance (SCIs).
Figure 6.22  European Special Areas of Conservation (SACs) and Sites of Community Importance (SCIs).
6.5.6 SPAs and/or Ramsar sites designated for bird species and for the protection of wetland habitats supporting waders and wildfowl also contribute to the Natura 2000 network. Included in Figure 6.22 and Table 6.7 are SPAs and/or Ramsar sites designated for bird species and interests within 150 km of Project Two. Sites include the Humber Estuary SPA/Ramsar site, Flamborough Head and Bempton Cliffs SPA, North Norfolk Coast SPA/Ramsar, Gibraltar Point Ramsar, Great Yarmouth SPA, the Wash SPA/Ramsar site and Broadland SPA.

6.5.7 Given the large foraging ranges of some bird species, other SPAs along the east coast may also need to be considered as part of the Project Two EIA process. SPAs within 750 km of Project Two are therefore shown in Figure 6.22.

6.5.8 Potential impacts on the interest features of these Natura 2000 sites will be assessed during the Project Two EIA process.

6.5.9 Along the coasts of Germany, Belgium, the Netherlands and Denmark there are also Natura 2000 sites comprising of SPAs and SCIs, and SACs and SCIs, as shown in Figure 6.22 and Table 6.7 respectively. Under Natura 2000, these designations are afforded protection, and any impact on the interest features of these sites are referred to as transboundary impacts, discussed further in Section 6.5.29. Table 6.7 lists the interest features for the nearest two offshore non-UK designated sites: the Klaversbank and Doggersbank SCIs.

Table 6.7 Onshore, coastal and offshore nature conservation designations.

<table>
<thead>
<tr>
<th>Importance</th>
<th>Name of Designation</th>
<th>Interest Features</th>
<th>Approximate Distance from Subzone 2 boundary (km)</th>
<th>Approximate Distance from Killingholme (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>International UK designations</td>
<td>North Norfolk Sandbanks and Saturn Reef cSAC</td>
<td>Habitats: sandbanks and reefs.</td>
<td>9</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Dogger Bank cSAC</td>
<td>Habitats: sandbanks which are slightly covered by seawater all of the time. Species: harbour porpoise <em>Phocoena phocoena</em>; common (harbour) seal <em>Phoca vitulina</em>; and grey seal <em>Halichoerus grypus</em>.</td>
<td>31</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>Inner Dowsing, Race Bank and North Ridges cSAC/pSCI</td>
<td>Habitats: sandbanks; and (biogenic) reefs. Species: harbour porpoise and grey seal.</td>
<td>64</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Haisborough, Hammond and Winterton</td>
<td>Habitats: sandbanks; and (biogenic) reefs. Species: harbour porpoise; and</td>
<td>89</td>
<td>140</td>
</tr>
<tr>
<td>Importance</td>
<td>Name of Designation</td>
<td>Interest Features</td>
<td>Approximate Distance from Subzone 2 boundary (km)</td>
<td>Approximate Distance from Killingholme (km)</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>cSAC/pSCI</td>
<td>grey seal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Humber Estuary SPA/Ramsar</td>
<td>Nationally or internationally important numbers of three breeding bird species and 21 wintering species; regularly supporting over 20,000 waterfowl.</td>
<td>89</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Humber Estuary SAC</td>
<td>Habitats: estuaries, mudflats and sandflats not covered by sea water at low tide; Atlantic salt meadows <em>Glauco-Puccinellietalia maritima</em>; sand dunes (embryonic shifting dunes, shifting dunes and fixed, and with sea buckthorn <em>Hippophae rhamnoides</em>); <em>Salicornia</em> and other annuals colonising mud and sand; <em>Spartina</em> swards; sandbanks; and coastal lagoons. Species: river lamprey <em>Lampetra fluviatilis</em>; sea lamprey <em>Petromyzon marinus</em>; allis and twaite shad <em>Alosa alosa</em> and <em>A. fallax</em>; common and grey seal.</td>
<td>89</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>The Wash and North Norfolk Coast SAC</td>
<td>Habitats: Atlantic salt meadows; large shallow inlets and bays; Mediterranean and thermo-Atlantic halophilous scrubs; mudflats and sandflats not covered by seawater at low tide; <em>Salicornia</em> and other annuals colonising mud and sand; reefs; and sandbanks which are slightly covered by sea water all the time. Species: common seal; and otter <em>Lutra lutra</em>.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flamborough Head SAC</td>
<td>Habitats: reefs; submerged or partly submerged sea caves; sandbanks; and vegetated sea cliffs of the Atlantic and Baltic coasts. Species: grey seal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flamborough Head Internationally important numbers</td>
<td></td>
<td>100</td>
<td>52</td>
</tr>
<tr>
<td>Importance</td>
<td>Name of Designation</td>
<td>Interest Features</td>
<td>Approximate Distance from Subzone 2 boundary (km)</td>
<td>Approximate Distance from Killingholme (km)</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>and Bempton Cliffs SPA</td>
<td>of breeding kittiwakes <em>Rissa tridactyla</em>; nationally important numbers of breeding guillemot <em>Uria aalge</em>, razorbill <em>Alca torda</em> and puffin <em>Fratercula arctica</em>.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>North Norfolk Coast SPA/Ramsar</td>
<td>Internationally important numbers of breeding terns <em>Sterna hirundo</em> and wintering wildfowl; nationally important numbers of breeding waders and wildfowl.</td>
<td>104</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Gibraltar Point Ramsar Site</td>
<td>Representative wetland; rare species; regularly supports 20,000 waterfowl and 1% of a waterfowl species population.</td>
<td>115</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Great Yarmouth SPA</td>
<td>Nationally important for breeding little terns.</td>
<td>118</td>
<td>161</td>
</tr>
<tr>
<td></td>
<td>Broadland SPA/Ramsar</td>
<td>Internationally important numbers of eight species of wintering wildfowl and two species during the breeding season; bittern <em>Botaurus stellaris</em> and marsh harrier <em>Circus aeruginosus</em>.</td>
<td>117</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td>The Wash SPA/Ramsar</td>
<td>Internationally important numbers of 13 species of wintering wildfowl; nationally important numbers of seven species of wintering wildfowl and one species of passerine; and regularly supports over 20,000 waterfowl.</td>
<td>121</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>River Derwent SAC</td>
<td>Habitats: water courses of plain to montane levels with the <em>Ranunculion fluitantis</em> and <em>Callitricho-Batrachion</em>. Species: river lamprey, sea lamprey, bullhead <em>Cottus gobio</em> and otter.</td>
<td>144</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Firth of Tay and Eden Estuary SAC</td>
<td>Habitats: estuaries, mudflats and sandflats and sandbanks. Species: common seal.</td>
<td>376</td>
<td>339</td>
</tr>
<tr>
<td></td>
<td>Moray Firth SAC</td>
<td>Habitats: sandbanks.</td>
<td>508</td>
<td>489</td>
</tr>
</tbody>
</table>
### Importance

<table>
<thead>
<tr>
<th>Name of Designation</th>
<th>Interest Features</th>
<th>Approximate Distance from Subzone 2 boundary (km)</th>
<th>Approximate Distance from Killingholme (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species: bottlenose dolphin Tursiops truncatus.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dutch Klaverbank SCI</td>
<td>Resident populations of harbour porpoise, bottlenose dolphin and grey seal</td>
<td>49</td>
<td>209</td>
</tr>
<tr>
<td>Dutch Doggersbank SCI</td>
<td>Resident populations of harbour porpoise, bottlenose dolphin and grey seal.</td>
<td>62</td>
<td>214</td>
</tr>
<tr>
<td>Donna Nook NNR/SSSI</td>
<td>Reserve of dunes, slacks, saltmarsh and inter-tidal areas, rich in bird life.</td>
<td>99</td>
<td>43</td>
</tr>
<tr>
<td>Humber Estuary SSSI</td>
<td>SSSIs are designated for their natural features, especially those of greatest value to wildlife conservation, are most highly concentrated or of highest quality.</td>
<td>88</td>
<td>1</td>
</tr>
<tr>
<td>Tetney Blow Wells SSSI</td>
<td></td>
<td>104</td>
<td>26</td>
</tr>
<tr>
<td>North Killingholme Haven Pit SSSI</td>
<td></td>
<td>114</td>
<td>2</td>
</tr>
<tr>
<td>Swallow Wold SSSI</td>
<td></td>
<td>115</td>
<td>14</td>
</tr>
</tbody>
</table>

### National and Local Designations

#### Sites of Special Scientific Interest

6.5.10 There are four SSSIs in proximity to the onshore cable route: Humber Estuary, North Killingholme Haven Pits, Tetney Blow Wells and Swallow Wold (Figure 6.20, Table 6.7).

#### National and Local Nature Reserves

6.5.11 There is a single NNR in the vicinity of the onshore cable route at Donna Nook (Table 6.7). No LNRs are located in proximity to the onshore cable route.
Figure 6.23 Sites of Special Scientific Interest and National Nature Reserves.
**Marine Conservation Zones**

6.5.12 Under the Marine and Coastal Access Act 2009, a new type of Marine Protected Area (MPA), called a Marine Conservation Zone (MCZ) can be designated in English inshore and UK offshore waters, to protect a range of nationally important marine wildlife, habitats, geology and geomorphology. MCZs are being identified through the Marine Conservation Zone Project by the Joint Nature Conservation Committee (JNCC) and Natural England to identify and recommend MCZs to Government.

6.5.13 Four regional projects were set up to work with sea users and interest groups to identify MCZs within their region. The ‘Net Gain’ regional project area spans two regional seas out to the median line; the southern portion of the northern North Sea (Scottish border to Flamborough Head) and the northern portion of the southern North Sea (Flamborough Head to Bawdsey) and includes Project Two.

6.5.14 Potential sites or recommended MCZs (rMCZs) have been identified by Net Gain through a process of stakeholder consultation and workshops (including attendance and correspondence by SMart Wind) and following national guidance issued from the JNCC and Natural England. The guidance specifies those features (referred to as ‘features of conservation interest’, or FOCI) that qualify an area for designation as a MCZ and the requirements for site connectivity and ecological coherence of the network. Management measures are yet to be defined for MCZs; however a proportion of MCZs in each region will be reference areas. Within these areas no extractive or depositional activities will be permitted. Submission of rMCZs to the UK Government for a formal consultation and designation process is expected in 2013.

6.5.15 Based on the final recommendations of the draft MCZ network in the Net Gain project area, there are five rMCZs that are within the region of Project Two and two that the Project Two offshore cable route crosses. A description of these rMCZs and their designated features are provided in Figure 6.24 and Table 6.8 below.

6.5.16 Site NG7 (Markham's Triangle) is 20 km from the eastern boundary of Project Two and the offshore cable route scoping boundary runs through NG5 (Lincs Belt), NG6 (Silver Pit), NG8 (Holderness Inshore) and NG9 (Holderness Offshore). There are no reference areas that fall within the vicinity of Project Two. Management measures for each individual rMCZ are proposed to be approved and designated in 2013.
### Table 6.8 Recommended Marine Conservation Zones in proximity to Project Two.

<table>
<thead>
<tr>
<th>Site</th>
<th>Name</th>
<th>Proposed Designated Feature</th>
<th>Distance to nearest part of Project Two (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG5</td>
<td>Lincs Belt</td>
<td>A5.1: Subtidal coarse sediment</td>
<td>Offshore Cable Route (0 km)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A5.2: Subtidal sand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A5.4: Subtidal mixed sediment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peat and clay exposures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtidal sands and gravels (modelled)</td>
<td></td>
</tr>
<tr>
<td>NG6</td>
<td>Silver Pit</td>
<td>A5.2: Subtidal sand</td>
<td>Offshore Cable Route (0 km)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A5.4: Subtidal mixed sediments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ross worm Sabellaria spinulosa reefs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtidal sands and gravels (modelled)</td>
<td></td>
</tr>
<tr>
<td>NG8</td>
<td>Holderness Inshore</td>
<td>A2.4: Intertidal mixed sediments</td>
<td>Offshore Cable Route (0 km)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A5.1: Subtidal coarse sediment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A5.2: Subtidal sand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peat and clay exposures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ross worm Sabellaria spinulosa reefs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtidal chalk (modelled)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtidal sands and gravels (modelled)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spurn Head geological feature</td>
<td></td>
</tr>
<tr>
<td>NG9</td>
<td>Holderness Offshore</td>
<td>A5.1: Subtidal coarse sediment</td>
<td>Offshore Cable Route (0 km)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A5.4: Subtidal mixed sediment</td>
<td></td>
</tr>
<tr>
<td>NG7</td>
<td>Markham’s Triangle</td>
<td>A5.1: Subtidal coarse sediment</td>
<td>Hornsea Zone (20 km)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A5.2: Subtidal sand</td>
<td></td>
</tr>
</tbody>
</table>

Source: Net Gain, 2011
Figure 6.24  Recommended Marine Conservation Zones in proximity to Project Two.
Other Habitats and Species of Conservation Value

6.5.17 The United Kingdom is also a signatory to the 1992 Convention of Biological Diversity, an international legally binding treaty that was signed at the 1992 Earth Summit in Rio de Janeiro, which provides a legal framework for biodiversity conservation. There are now 1150 Species Action Plans (SAPs) and 65 Habitats Action Plans (HAPs) for the UK’s most threatened (i.e. ‘priority’) species and habitats.

6.5.18 Certain UK priority habitats and species may exist in and around Subzone 2; the offshore and onshore cable routes corridors, landfall area locations and National Grid connection point. It is, therefore, important that the ES for Project Two fully assesses the existence of and potential impacts upon any such habitats and/or species.

6.5.19 Other designations of nature conservation interest include the International Union for Conservation of Nature (IUCN) Red List of Threatened Species and the OSPAR List of Threatened and Declining Species and Habitats.

Methods Supporting EIA

6.5.20 Potential impacts upon interest features of current and future nature conservation designations will be assessed through standard EIA methodologies outlined within Section 1 using criteria that have been agreed with the relevant competent authorities. Where the potential to impact nature conservation designations occurs, sufficient information will be provided in an appropriate section within the ES, and as a separate report, to enable the competent authority to undertake a Habitats Regulations Assessment (HRA), as described in Section 2.2.33.

6.5.21 In order to make an assessment for nature conservation designations, baseline characterisation surveys\(^\text{15}\) will be conducted to provide a robust understanding of the occurrence and extent of protected habitats and species (in particular Annex I habitats and Annex II species, but also BAP and OSPAR habitats and species) within proximity to Project Two, against which impacts from the project will be assessed. A comprehensive consultation with the relevant competent authorities will also be undertaken to inform this process and the following guidance documents will also be consulted:

- BWEA (2005). Consultation Response: Consultation on Nature Conservation Guidance to Developers of Offshore Wind farm Developments; and

\(^{15}\) See the Benthic Ecology, Birds and Marine Mammals sections for survey methodologies.
6.5.22 The species protected by the Birds Directive will be assessed according to the methodology in Section 6.3 and assessed within that chapter of the ES. Similarly, species and habitats protected under the Habitats Directive, or listed under a BAP or OSPAR will be assessed according to the methodology in Section 6.1 (Benthic and Epibenthic Ecology), Section 6.2 (Fish and Shellfish Ecology), Section 6.3 (Ornithology and Bat Ecology: for bats only) and Section 6.4 (Marine Mammals), and will be assessed within each of these ecology chapter of the ES.

6.5.23 Where these species and habitats are features of sites of conservation value that have potential to be affected by Project Two, an assessment of their importance/value to these sites, and potential to be effected will also be assessed. An assessment of potential for effects on site integrity will be included in the Nature Conversation ES chapter with appropriate cross referencing to the individual ecology chapters where appropriate.

Potential Project Impacts

6.5.24 Potential generic impacts on the interest features of nature conservation designations associated with Project Two are detailed below along with examples. Specific details on the potential impacts on individual receptors (habitats and species), for example, disturbance of marine mammals resulting from the noise and vibration caused by piling, are given in the relevant sections of this Scoping Report.

Construction Phase

6.5.25 Potential impacts on the interest features of nature conservation designations as a result of the construction phase of Project Two include:

- Temporary displacement of species, for example, through the presence of construction vessels, plant and associated personnel;
- Temporary disturbance of species as a result of noise and vibration, for example piling and ground works;
- Temporary reduction in food availability through the displacement / disturbance of prey species;
- Direct injury to species, for example, via piling noise and/or collision of marine mammals with construction vessels;
- Severance and habitat fragmentation, for example, through disruption to bat foraging routes caused by hedgerow removal as a result of cable trenching;
- Direct damage to or loss of habitats, for example, damage to biogenic (e.g. Sabellaria spinulosa) reef through vessel anchor damage and cable trenching and/or intertidal SAC habitat via landfall works; and
- Permanent displacement of species as a result of land-take or habitat loss, for example, through installation of scour protection.

**Operation and Maintenance Phase**

6.5.26 Potential impacts on the interest features of nature conservation designations as a result of the O&M phase of Project Two include:

- Displacement of species as a result of the presence of Project Two infrastructure, for example, through the presence of the turbines, resulting in the displacement of sea birds;
- Disturbance of species as a result of noise and vibration from operation and maintenance activities, for example offshore service and maintenance vessels;
- Reduction in food availability through the displacement / disturbance of prey species resulting from the presence of infrastructure or service and maintenance activities;
- Severance and habitat fragmentation, for example, through disruption to bird migration routes caused by the presence of the turbines; and
- Direct injury to species, for example, collision of seabirds or bats with the turbines.

** Decommissioning Phase**

6.5.27 Potential impacts on the interest features of nature conservation designations as a result of the decommissioning phase of Project Two will be the same as for the construction phase but in addition may include subsea noise impacts via use of explosives for cutting.

6.5.28 Sites, habitats and species of conservation value will be identified through desk based studies, interpretation of survey data and consultation. The potential for Project Two to affect these will be assessed as part of the EIA process.

**Potential Transboundary Impacts**

6.5.29 Certain species (e.g. fish, marine mammals and birds) are mobile and, therefore, may forage within and migrate through Project Two. These species are designated interest features of nature conservation designations outside of the UK EEZ. Any potential impact upon these species as a result of Project Two could affect the integrity of nature conservation designations beyond the UK EEZ and are, therefore, considered to be potential transboundary impacts which will be assessed during the Project Two EIA process.

**Potential Cumulative Impacts**

6.5.30 The assessment of potential cumulative impacts upon interest features of nature conservation designations will consider cumulative impacts between Project
One and Project Two, the Round 2 wind farms in The Greater Wash area and the Round 3 Dogger Bank and East Anglia Zone developments.

6.5.31 The assessment of potential cumulative impacts will also consider the impacts of Project Two with other projects, industries and activities e.g., commercial fishing, oil and gas, and shipping.

6.5.32 Potential cumulative impacts for specific individual receptors (habitats and species) will be assessed within each of the ecology chapters and are discussed in their relevant sections below.

Potential inter-related effects

6.5.33 Inter-relationships between effects on designated features will be considered for sites in isolation and collectively as part of the EIA process. Furthermore, inter-relationships between non designated ecological and human receptors, e.g. fish and shellfish, shipping, and designated features of protected sites will also be considered as part of the EIA process.

Potential Mitigation and Monitoring

6.5.34 Specific details on potential mitigation and monitoring for individual receptors are given in the relevant receptor specific sections of this Project Two Scoping report.

7 OFFSHORE HUMAN ENVIRONMENT

7.1 COMMERCIAL FISHERIES

7.1.1 This Section is relevant primarily to the offshore components of Project Two although some elements are also relevant to onshore components. Reference is therefore made to Subzone 2 (Figure 7.1) and the cable route corridor (offshore) as appropriate. Subzone 2 is located in the southwest portion of the International Council for the Exploration of the Sea (ICES) Division IVb (Central North Sea) statistical area; outside the 12 NM limit in UK EEZ waters. For the purpose of recording fisheries landings, ICES Division IVb is divided into statistic rectangles which are consistent across all Member States operating in the North Sea. From a commercial fisheries EIA perspective, the study area is defined by the ICES statistical rectangles that the Project Two boundary overlaps (Figure 7.1). The study areas for the EIA are defined as follows:

- Subzone 2 study area: ICES statistical rectangles 36F1 and 36F2; and
- Offshore cable route corridor study area: ICES statistical rectangles 35F0, 36F0 and 36F1; and

16 There is a small overlap of the Project Two boundary with ICES rectangle 37F1, however this area considered unlikely to be progressed, given known engineering constraints.
A regional study area: 14 ICES statistical rectangles to ensure adequate representation of surrounding activity.

Environmental baseline

Total landings and activity across Project Two

7.1.2 Project Two overlaps with ICES rectangles 35F0, 36F0, 36F1 and 36F2 which had a combined value of €16.9 million for UK, Dutch, Danish and German vessels in 2010 and Belgian vessels in 2009. The value of landings across the regional study area is presented in Figure 7.2 by country (to which vessels are registered). Within the regional study area the offshore ICES rectangles (35F1, 36F1, 37F1, 35F2, 36F2, 37F2, 35F3, 36F3 and 37F3) are dominated by Dutch and Danish landings, while the inshore ICES rectangles (36E9, 37E9, 35F0, 36F0 and 37F0) are predominately UK vessel landings, as expected. The ICES rectangles which overlap with Project Two represent 23% of the total value across the entire regional study area. It is also important to note that the Project Two development area occupies only a small portion of these ICES rectangles.
Figure 7.1 Hornsea Round 3 Zone and the Project Two boundary relative to ICES statistical Rectangles.
7.1.3 Vessel Monitoring System (VMS) data for UK and non-UK vessels indicate the importance of fishing grounds across the regional study area (Figure 7.3). UK vessels are colour coded to indicate gear type and non-UK vessels are shown as grey.

7.1.4 Demersal otter trawlers predominantly operate along the northern edge of Project Two and are also present in the eastern segment of the Hornsea Zone, near Markhams Hole. Consultation confirms that these vessels are targeting *Nephrops norvegicus* (known as langoustine, prawn and Norway lobster, referred to as *Nephrops*) as well as plaice and sole as part of a mixed demersal fishery.

7.1.5 Vessels are frequently present immediately east of Project Two (within the Hornsea Zone) with a number of different fishing methods being employed: demersal trawlers, beam trawlers, seiners and gillnetters. The target species across this area are likely to be plaice and sole. This area to the east of Project Two coincides with gas infrastructure which may act to attract fish due to the slight increase in temperature along the infrastructure. This may account for the higher level of activity across this area (OFLO, pers. comm. 2012).

7.1.6 UK beam trawlers, demersal trawlers and non-UK vessels (including Dutch beam trawlers, which are corroborated under the Dutch fisheries activity section) have been recorded fishing within Project Two. The majority of the effort occurs
to the north, east and west edges of Project Two and to the north of Project Two outside of the Hornsea Zone. A small amount of effort has been recorded for UK demersal trawlers and non-UK vessels along the portion of the offshore cable route corridor that overlaps ICES rectangle 36F1.

7.1.7 Significant levels of potting occur across the portion of the offshore cable route corridor that overlaps inshore waters, in particular across ICES rectangle 36F0, which is corroborated by both landing statistics and vessel surveillance data. Note that potting activity across the offshore cable route corridor is not well represented in Figure 7.3 as most potting is undertaken by vessel of < 15 m.
Figure 7.3  VMS data for vessels (≥ 15 m) in 2010 presenting actively fishing UK vessels by gear type (non-UK vessels are shown in grey). Source: MMO, 2011b.
Subzone 2

7.1.8 The Subzone 2 study area is dominated by landings of sole and plaice targeted principally by the Dutch fleet but also UK registered vessels (Figure 7.4). Landings of sole, recorded between 2006 and 2010 reached highest levels in 2010, with reductions in 2007 and 2008. Plaice is a retained by catch species within this fishery and historic trends have followed sole landings. In 2010 the combined sole, plaice and turbot *Psetta maxima* fishery was worth €5.7 million (not including Belgian landings since species specific data have not been available at the time of writing).

7.1.9 The industrial fisheries for sandeel *Ammodytes* spp. and sprat are more sporadic in nature. A sandeel fishery targeted by Danish vessels is recorded for 2006, 2008 and 2009, but no landings from the Subzone 2 study area were recorded in 2010. Sprat landings by Danish vessels have been small but notable in 2006 and 2008, and higher in 2010 (more than twice the value of 2008 landings) within the Subzone 2 study area.

![Figure 7.4](left) Left: Value (€) landed in 2010 from ICES rectangles 36F1 and 36F2 associated with Subzone 2 by UK, Dutch, Danish and German vessels. Right: Annual landings value (€) from ICES rectangles 36F1 and 36F2 associated with Subzone 2 by UK, Dutch, Danish and German vessels for top 10 species.

Sources: MMO, 2011a; IMARES, 2011a; Danish Fisheries Directorate, 2011a; BMELV, 2011a.

7.1.10 Herring *Clupea harengus* were landed from the Subzone 2 study area at the end of 2006 by UK and German fleets but have not appeared within statistics in notable volumes since then.
7.1.11 A detailed baseline assessment will be undertaken on a country by country basis as part of the EIA process for Project Two (Subzone 2 and the offshore cable route corridor). The following section provides a brief overview of this for each country (based on vessel registration) to briefly describe the fleet (gear type) and fisheries (species) targeted.

**United Kingdom**

7.1.12 Based on VMS data in 2010, whilst UK vessels show some effort within the Subzone 2 boundary, the majority of effort is focused east of Subzone 2 (still in the Hornsea Zone) where beam trawlers target sole and plaice and demersal trawlers target these species together with mixed whitefish (see above).

7.1.13 Project specific consultation undertaken for Project One indicates that Dutch owned UK registered vessels have operated within the Subzone 2 boundary more frequently in the past (circa five to 10 years ago). These beam trawl vessels target sole and plaice and effort is currently focused elsewhere (namely across Dogger Bank with focus on a plaice targeted fishery), although it is anticipated that grounds within the Subzone 2 area would be targeted in the future.

7.1.14 Consultation with the local UK potting fleet indicates that two to three vessels may target brown crab and lobster from within the wider Project Two study area. However, based on the key areas targeted by the UK potting fleet (inferred from VMS and consultation) the majority of the landings from the Project Two study area (ICES rectangles 36F1 and 36F2) are likely to be closer to shore within ICES rectangle 36F1.

**Netherlands**

7.1.15 Consultation undertaken to date indicates that up to 24 Dutch beam trawlers greater than 25 m in length, fish within the Subzone 2 boundary targeting sole and plaice. Other species taken as retained by catch include turbot, monkfish and cod. Within the Subzone 2 boundary fishing effort is greatest across the north-east.

7.1.16 Industry consultation indicates that approximately 25 to 30% of annual fishing effort of these vessels is spent within the Hornsea Zone and this has been as high as 50% in previous years.

**Denmark**

7.1.17 There are three distinct sandeel grounds targeted by the Danish trawl fleet in the Hornsea Zone (using demersal otter trawl and semi-pelagic otter trawl), across Subzone 1 and 2, in the east, and in the north-west of the Hornsea Zone. Herring and sprat are also occasionally targeted by pelagic trawl.

7.1.18 Approximately 20% of the Danish effort within the Hornsea Zone has focused on the sandeel ground that bisects Subzone 1 and 2, when this area is being
targeted, i.e. the majority of effort has focused on the other two sandeel grounds within the Zone. The majority of effort is currently focused on other North Sea sandeel grounds (namely Dogger Bank).

7.1.19 Industry consultation indicates that effort is currently focused elsewhere in the North Sea.

France

7.1.20 Based on VMS figures for French vessels the large majority of effort (>99%) is outside the Subzone 2 boundary mainly to the east of the Hornsea Zone.

Belgium

7.1.21 Belgian beam trawl and demersal otter trawl vessels operate within the Subzone 2 study area targeting plaice, sole, turbot, cod and monkfish. VMS data indicate that the large majority of effort is to the east of ICES rectangle 36F2 and outside the Subzone 2 boundary.

Germany

7.1.22 The majority of effort by German vessels is along the north edge of Subzone 2 (and Hornsea Zone) boundary, and as such, will need further consideration as part of the Project Two EIA.

Norway

7.1.23 Norwegian vessels are understood to target sandeel grounds throughout the North Sea. However, consultation indicates that this effort has not been focused on the Subzone 2 study area, which is corroborated by VMS and landings statistics data.

Offshore cable route corridor

7.1.24 The offshore cable route corridor study area is dominated by landings of lobster and brown crab targeted by the UK potting fleet. In 2010, the combined lobster and crab fishery was worth €6 million (£5.6 million). Brown crab landings have remained fairly consistent across a five year period (2006 to 2010), with peaks in 2007 and 2008, while lobster landings have dropped considerably in 2009 to 2010 compared to 2006 to 2008 quantities. Velvet crab *Necora puber* was also taken in notable volumes in 2006, but the volumes have dropped from 2007 onwards, likely due to a lack of market demand.

7.1.25 Three surveys have been undertaken relating to commercially important shellfish species across the offshore cable route to inform the assessment of natural fish and shellfish for Project One:

- Experimental potting surveys utilising three experimental strings along the cable corridor, sampled in June, October and November;
• Observational trip, accompanying a fishing vessel during their normal fishing operations in September; and
• Logbook data collection from a voluntary scheme whereby potting vessels in the Hornsea Zone provide a logbook of their fishing activity and landings over the 2011 fishing season.

7.1.26 Further surveys are planned as part of the Project Two EIA (see Chapter 6.3). Results will be used to provide data describing the community structure and composition of the commercially important shellfish population and presented as part of the natural fish and shellfish assessment for Project Two.

7.1.27 Potting survey results across the offshore cable route corridor to date show the most abundant species to be brown crab particularly in the western areas surveyed within inshore waters. On average at this inshore study area, 85% of the brown crab was undersize, suggesting the importance of this area as a nursery ground for brown crab. As expected, other commercially important species encountered during the surveys included European lobster, velvet crab and whelk *Buccinum undatum*.

7.1.28 Based on ICES landing data, large volumes of brown shrimp were also recorded, worth €1 million (£900k) in 2010 in the ICES rectangles through which the cable route passes. Whilst this fishery is targeted to the southwest of 35F0, it may occur across parts of the offshore cable route corridor. An emerging whelk fishery was also noted in 2010.

**Data and guidance to inform EIA**

**Data currently obtained**

7.1.29 The following data have been collated to inform the Scoping Phase of Project Two:

• **Landing statistics:** For the five year period 2006 to 2010 (2001 to 2010 for Dutch and Danish registered vessels) by EU Member States nationally registered vessels operating within the Project Two boundary and the regional area and landing to their home country ports including Netherlands, France, Belgian, Denmark and Germany;

• **VMS Data:** Data from 2010 on vessel position, course and speed (collected every 2 hours) for all >15 m EU Member States vessels. These VMS data do not include the large inshore fishing fleet, which predominately consists of vessels <15 m in length. VMS data may, therefore, appear to show these inshore areas as having lower (or no) fishing activity;

• **Surveillance Data:** Surveillance data have been provided by the MMO including data recorded from over flight and at sea patrols. These data includes all vessel sizes, nationalities and gear types; and
Consultation: Consultation was key throughout the Project One EIA process and the key findings from the Project One consultation will be used to inform Project Two.

Outstanding data requirements

7.1.30 As discussed, further data and information will be sourced to inform the commercial fisheries section of the Project Two EIA. These will include the following:

- **Landing statistics:** 2011 data to be added to the 2006 to 2010 dataset currently held;
- **VMS Data:** 2011 data to be added to the 2010 dataset used for the Project One EIA;
- **Surveillance Data:** 2011 data to be added to the 2010 dataset used for the Project One EIA; and
- **Consultation:** Consultation with the commercial fisheries industry is vital throughout the EIA process. SMart Wind has appointed an Onshore Fisheries Liaison Representative (OFLR) and consultation with the OFLR and National Federation of Fishermens Organisations (NFFO) has informed this section of the Scoping Report, which in turn is based on content from the Project One Scoping Report. A list of those consulted to date is provided in Section 7.1.3. Close consultation with the OFLR, NFFO, North eastern Inshore Fisheries and Conservation Agency and UK and European fishing industry will continue throughout the EIA process for Project Two, continuing the close consultation carried out to date with the fishing industry and SMart Wind.

7.1.31 All other relevant published data and site specific studies will be utilised in order to describe the fishing activity occurring within the Project Two boundary and inform the EIA process. To explore the fisheries resources of the North Sea as defined in separate stocks by ICES area (as opposed to the just the fishing activity), ICES reports on key commercial species will be reviewed, as will other fish trawl survey reports such as those by CEFAS and previous developers in and around the subject area. Other reports of note that will be used to inform the EIA include:

- Options and opportunities for marine fisheries mitigation associated with wind farms (Ichthys Marine, 2009); and

Methods supporting EIA

Baseline environment

7.1.32 The various data sources listed above will be assessed together to enable a robust assessment of baseline fishing activity (gear types, nationalities, spatial
and temporal trends, target species etc.) in and around the Project Two study area. Landings data will be used to determine volume and value of landings from the study area. These data will be ground-truthed against responses from the fisheries consultation to be undertaken for the Project Two EIA.

7.1.33 VMS data will be processed and interpreted in a way that enables an assessment to be made of vessel activity (fishing/steaming) within the study area. This will inform the assessment of fishing activity (and potential impacts) within the Project Two site boundary.

7.1.34 Offshore boat-based surveys being undertaken for marine mammal and bird observation and geophysical surveying within the Hornsea Zone, including the Project Two area, have been issued with a standard log template, and when possible will record fishing activity seen during these surveys.

7.1.35 No specific fisheries surveys in the form of observation trips on-board fishing vessels were identified for Project One and none are currently planned for the Project Two area.

7.1.36 The impacts of Project Two on the fish and shellfish ecology and therefore fisheries resource, can have an indirect impact on the commercial fisheries interests. These will be informed through the studies and assessment as described in Section 6.2 and will include impacts to nursery and spawning grounds.

**Impact assessment**

7.1.37 A design envelope approach, using the combination of design parameters that constitute the worst case scenario for effects on commercial fisheries, will be determined based on reviewing the Project Design Statement for Project Two. Impact assessments will be divided as below into construction, operation and maintenance, decommissioning, and transboundary. Cumulative impacts, and the inter-relationship between impacts and with other receptors, will also be assessed. Impacts on commercial fisheries in Subzone 2 and the offshore cable route will be assessed separately if/as appropriate. Impacts on commercial fisheries of the potential impacts identified under each of the project phases identified below will be assessed for each of the commercial fisheries receptor groups identified during the Project Two EIA process.

7.1.38 Based on our understanding of Project One, it is currently envisaged that these receptor groups would include the following:

- UK demersal otter trawls;
- UK potting vessels;
- UK brown shrimp beam trawlers;
- UK (Dutch) beam trawlers;
- Dutch beam trawlers;
- Danish sandeel trawlers;
- Danish pelagic trawlers;
- French demersal and pelagic trawlers;
- Belgian beam and demersal trawlers;
- German beam and otter trawlers; and
- Norwegian demersal and pelagic trawlers.

7.1.39 Standard EIA methodologies for assessing impacts would apply, as described in Section 1.

**Potential project impacts**

**Construction phase**

- Temporary displacement of UK and European fishing vessels from established fishing grounds within Project Two due to existence of construction Safety Zones;
- Loss or damage to fishing gear and/or vessels due to seabed debris, anchor wires, construction vessel movements etc.;
- Displacement or disruption of commercial important fish and shellfish resources (including from marine noise impacts (see Section 5.3 Underwater Noise)); and
- Longer steaming distances to alternative fishing grounds to avoid construction Safety Zones.

**Operation and maintenance phase**

- Exclusion of UK and European fishing vessels from established grounds;
- Displacement or disruption of commercial important fish and shellfish resources (including EMF effects on elasmobranchs (see Section 6.1 Fish and Shellfish Ecology));
- Beneficial impact on potting fishery due to creation of refuge habitat from foundations and/or scour protection for selected shellfish species;
- Increased safety risk to vessels from presence of wind farm structures;
- Loss or damage to fishing gear (including snagging risk of cable); and
- Longer steaming distances to alternative fishing grounds.

**Decommissioning phase**

7.1.40 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.
Potential transboundary impacts

7.1.41 Due to the possible constraints that Project Two may have on demersal trawling, beam trawling, demersal seining and other gears, fishing effort may be displaced to other fishing grounds including into the Dutch EEZ. Other EU member state fishing fleets may also be displaced from the Project Two area.

Potential cumulative impacts

7.1.42 Cumulative impacts, particularly assessment of the different timing scenarios between Project Two (i.e. concurrent; phased-continuous; phased-discontinuous with reinstatement in between phases) and Project One in the Hornsea Zone, will be assessed.

7.1.43 As for Project One, the proximity of Project Two to the Dogger Bank and East Anglia Round 3 Zones, together with consented Round 2 wind farms (some of which are currently being constructed) and operational Round 1 wind farms, will require consideration of the potential for cumulative impacts to occur as part of the Project Two EIA process.

7.1.44 The cumulative impacts of Project Two combined with other industry sectors, stakeholders and activities e.g. oil and gas infrastructure, aggregate extraction areas and offshore cables (see Section 7.8) and sites designated for conservation value, e.g. MCZs (see Section 6.1) will also be given consideration as part of the EIA process.

Potential inter-related effects

7.1.45 Inter-relationships between impacts on commercial fisheries considered in isolation (e.g. loss or damage to fishing gear) will also be considered together as part of the EIA process. Furthermore, inter-relationships with other receptors i.e. all of the impacts of Project Two on commercial fisheries, and the potential for secondary effects on other receptors (e.g. benthic ecology, fish and shellfish ecology, shipping and navigation etc.) will also be considered as part of the EIA process.

Potential mitigation and monitoring

7.1.46 Early and efficient consultation with the commercial fishing sector is vital to the identification, qualification and resolution of the issues of displacement or disturbance. SMart Wind has appointed an OFLR who is based within the NFFO. Close cooperation and consultation with the fishing industry via the OFLR throughout the EIA process will be undertaken. Consultation with the industry will be vital to ground truth existing data and establish the true extent of commercial fishing within the Project Two boundary.

7.1.47 NPS EN-3 states at paragraph 2.6.13 that “mitigation should be designed to enhance where reasonably possible any potential medium and long-term positive benefits to the fishing industry and commercial fish stocks”.

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Consideration will be given to this advice in the design of any mitigation measures for Project Two.

7.1.48 Specific mitigation measures relevant to the commercial fishing sector will include, but not be limited to:

- Burial of cables to appropriate depths to avoid interaction with fishing gears/anchors;
- Use of appropriate cable protection where suitable burial not achieved;
- Cable awareness campaign via KISCA charts and Notice to Mariners;
- Use of FLO’s aboard construction vessels; and
- Ongoing consultation with the fishing industry.

7.1.49 Further mitigation and monitoring will be informed by the recent Ichthys Marine (2009) report on options and opportunities for marine fisheries mitigation associated with offshore wind farms.

7.1.50 A decommissioning plan will be developed that will be approved by the regulator and will ensure that any hazards to fishing activities are identified and either removed or marked on charts and reported in the relevant fisheries media.

7.2 SHIPPING AND NAVIGATION

Environmental baseline

7.2.1 The main ports and harbours in the vicinity of Project Two are shown in Figure 7.5 below. The main shipping routes in the vicinity of the Project Two and cable route corridor run parallel to the Holderness coast, west of the project area, or enter the Humber Estuary to use the ports of Hull, Immingham and Grimsby.
Figure 7.5  Ports, harbours and navigational features in vicinity of Project Two.
7.2.2 Entry to the Humber is through the International Maritime Organisation (IMO) routing Traffic Separation Scheme (TSS) known as Rosse Reach, which runs along the northern edge of the proposed cable route corridor envelope at the estuary mouth as shown in Figure 7.5. There are no other TSS’s in the project area with the nearest being approximately 30 NM south east of the Project Two area orientated south west to north east.

7.2.3 There is an Anchor zone just north of the proposed export cable route corridor as shown in Figure 7.5.

7.2.4 There is a Marine Environmental High Risk Area (MEHRA), the Spurn Point MEHRA which lies within the proposed export cable route envelope as shown in Figure 7.5. MEHRAs are defined as areas having high environmental sensitivities and being at risk from shipping activity. The Government expects mariners to take note of MEHRAs and either to keep well clear or, where this is not practicable, to exercise an even higher degree of care than usual when passing through a MEHRA (MCA 2006).

7.2.5 There are several gas surface platforms within the wider cable route study area which are discussed further in Section 7.8.

7.2.6 DECC (2009c) recommended that at least six port locations distributed around the UK would need to be available for the development of offshore wind farms from 2014 onwards. The Humber is one area that has been targeted for this development.

7.2.7 Automatic Identification System (AIS) shipping data has been collected to inform the Hornsea Zone ZAP from tracking equipment installed on the Southern Star, Victor Hensen and Ocean Discovery (bird and marine mammal, geophysical and geotechnical survey vessels respectively) which were operating within the Hornsea Zone during May to August 2010. Additional data specific for Project Two and the proposed cable route will be collected from the Southern Star (Feb 2012 to Feb 2013) and from Ocean Discovery (June to July 2012) and used to inform the Project Two Navigational Risk Assessment (NRA).

7.2.8 These data will also be supplemented using data available from coastal locations (East Yorkshire) and offshore vessels to provide coverage across the entire Project Two area (including a 10 NM buffer) and the proposed cable route (with a 5 NM buffer). The AIS density data for the entire Hornsea Zone (SMart Wind, 2012) shows that the majority of the area has a medium to high level of shipping based on indicative national ranges for the UK. These data are shown in Figure 7.6 where each line represents an individual vessel track.

7.2.9 The cable route corridor is crossed by a number of dense traffic routes including north south coastal traffic and traffic bound to and from the River Humber.

7.2.10 As context for Project Two, the NRA for Project One identified an average of 29 to 30 vessel movements per day passing within 10 NM of Project One recorded on AIS and Radar and an additional 12 vessels per day intersecting the Project One boundary.
Figure 7.6  **AIS data (25 May- 6 August 2010, 28 days) by ship type excluding non-routine traffic.**

Figure 7.7  **AIS density (ship per year per nm² (25 May- 6 August 2010) represented on a 1 x 1 NM Grid.**
7.2.11 Shipping in the region ranges in size from small general cargo vessels to large container ships, bulk carriers and crude oil tankers. Intersecting vessels mainly comprise of medium sized cargo ships, moderate to large tankers and passenger ferries operated by DFDS Seaways on route between Ijmuiden and Newcastle.

7.2.12 A medium density shipping lane bisects Project Two, northwest to southeast, as shown in Figure 7.7. This lane sees approximately 2 to 4 ships per day headed mostly between Forth and Tees Ports in the UK, and Benelux in the Netherlands. This route includes a mix of both tanker and cargo vessels. The definition of what constitutes a major shipping lane has been based primarily on traffic volume and the importance of the lane, for example, if it is the only route available when approaching a port or a route through a channel where sea room is not available for the route to deviate without a significant impact.

7.2.13 Where such a route is identified then generally the 90 % shipping lane has been defined as unsuitable for offshore wind farm development, i.e., the part of the route, either side of the centreline, containing 90 % of the traffic. The width required for the shipping lane should be largely dictated by the vessels using the lane and the water depth. Further simulation and modelling of the vessels using this main shipping lane will be undertaken and will inform the EIA for Project Two.

7.2.14 A Newcastle to Amsterdam DFDS operated cruise is identified on its own route, immediately to the west of the main route (again running northwest to southeast), and bisecting the Project Two area. A further shipping route is shown crossing the Project Two area from southwest to northeast, approximately two vessels a day transit this route between Immingham, UK and Esbjerg, Denmark.

7.2.15 Following analysis of shipping and navigational data sources alongside other key constraints, a channel and routing scenario has been defined by SMart Wind to allow vessel movements to continue through the Hornsea Zone and safely bypass both Project One and Project Two. This channel and routing scenario has been drawn up under the work of the Southern North Sea Offshore Wind Forum (SNSOWF) which produced the navigational assessment for the scenario. These proposed routing options are shown in Figure 7.9 in relation to Project Two. The scenario is still under consideration as part of the ongoing ZAP process which includes consultation with the navigation and shipping industries.

7.2.16 The export cable route from Project Two ashore will cross areas of high shipping activity. The HVAC transmission option requires a reactive compensation substation to be sited within the cable corridor at a defined optimal position between Subzone 2 and cable landfall. A detailed study is being undertaken at the present time to define the optimum location of the proposed reactive compensation substation, along this route. This will involve an assessment being made of the no go zones, followed by consultation with Trinity House and the Maritime and Coastguard Agency (MCA) to fix the location. This will then be
followed by a detailed NRA of the selected site location. This study shall be used to inform the EIA.

7.2.17 Fishing vessel activity has been identified and included within the Project One NRA and showed highest activity in the north eastern portion of Project Two extending northwards. Commercial fishing is discussed in more detail in Section 7.1.

7.2.18 With regard to recreational sailing, the Royal Yachting Association’s UK Coastal Atlas of Recreational Boating (RYA, 2008) shows that there are no routes or sailing areas intersecting the proposed Project Two project area. Cruising routes bisect the cable route corridor headed between north eastern UK and Holland as shown in Figure 7.10 below.
Figure 7.8  Shipping lanes (90% boundaries) colour-coded by number of ships.
Figure 7.9: Routing scenario showing proposed shipping lanes.
Figure 7.10  Recreational activity relative to Project Two.
Data and guidance to inform EIA

Data currently obtained

7.2.19 A NRA was undertaken for Project One of the Hornsea Zone (EMU, 2011 Appendix A2.9.1). This NRA covered the Project One area, including a 10 NM buffer. Applying a 10 NM buffer around Project Two and including the cable route corridor with a 5 NM buffer, changes the project footprint. In addition new information is available on shipping densities for 2011. Therefore, it is proposed that the Project One NRA shall be used to inform the Project Two NRA, but a separate Project Two NRA shall be undertaken for Project Two EIA.

7.2.20 The following data will be used to support the Project Two NRA:

- Admiralty Charts;
- Admiralty Sailing Directions – North Sea (West) Pilot, NP 54, 6th Edition, (UKHO, 2003);
- AIS data (from Hornsea Zone ZAP);
- Cruising Association;
- DECC online GIS (www.maritimatedata.co.uk);
- Department for Transport, Maritime Statistics (http://www.dft.gov.uk/pgr/statistics/datatablespublications/maritime/);
- DTI (2005a) Methodology for assessing the marine navigational safety risks of offshore wind farms;
- International Maritime Organisation (IMO) (2002). Guidelines for formal safety assessment (FSA) for use in the IMO rule making process (as amended);
- Local port and harbour authorities;
Outstanding data requirements

7.2.21 Additional AIS and radar data specific for Project Two and the proposed cable route will be collected from the Southern Star (Feb 2012 to Feb 2013) and from Ocean Discovery (June to July 2012) and used to inform the Project Two Navigational Risk Assessment (NRA).

7.2.22 Other data sources that shall be updated include:

- DECC online GIS (www.maritimatedata.co.uk);
- Department for Transport, Maritime Statistics (http://www.dft.gov.uk/pgr/statistics/datatablespublications/maritime/);
- Local port and harbour authorities;
- Marine Management Organisation (MMO) (Fisheries data); and
- SeaZone (UKHO Marine data).

Methods supporting EIA

Navigational risk assessment

7.2.23 A NRA shall be undertaken for Project Two EIA which will be informed by the Project One NRA. Guidance notes published by the MCA (MGN 371); DECC and Trinity House will be taken into account (MCA 2008).

7.2.24 An NRA shall be undertaken for both the Project Two turbine array, the cable route, and for the reactive compensation substation along the cable route.

7.2.25 The NRA will assess the potential impacts of Project Two on shipping by using AIS and radar data for the area to identify the exact routes of vessels, the types of vessels, and the timings (e.g., whether there are more vessels seen in the area during different times of the year, or how long transit times are and therefore how specific vessels would be affected by the development of Project Two). The assessment will also consider non-routine vessels such as fishing vessels and leisure craft, through consultation with the NFFO, the Royal Yachting Association (RYA) and the Cruising Association (CA).
7.2.26 Consultation will also include the MCA, Trinity House, RNLI, RYA ports and harbours (e.g. ABP Hull) ship operators (e.g. ferries) and associations. The results of these consultations will inform the NRA.

7.2.27 SSmart Wind have joined East Anglia and Dogger Bank developers in forming the Southern North Sea Offshore Wind Forum (SNSOWF) which provides an ongoing forum to consult with the stakeholders mentioned above particularly in regard to potential cumulative impacts from the proposed developments on navigation and shipping. The NRA will be informed by discussions and meetings of this group.

**Vessel based AIS and radar data**

7.2.28 The additional AIS and radar data collected from the Aquarius (Feb 2012 to Feb 2013) and from Ocean Discovery (June to July 2012) will be used to supplement existing studies within the Hornsea Zone and shall be used to define the following:

- The distance from any major shipping routes, as identified from the AIS data, to allow the application of the MCA shipping template;
- The type of traffic using Project Two and surrounding area;
- The non-transit uses of the area e.g., fishing, diving, offshore surveys, exploration drilling and recreation;
- Prescribed routeing schemes or precautionary areas;
- The proximity of Project Two to areas used for anchorage, safe haven, port approaches and pilot boarding or landing areas;
- The proximity of Project Two to offshore firing/bombing ranges and areas used for any maritime military purposes;
- The proximity of Project Two to existing or proposed wind farms, offshore oil/gas platforms, marine aggregate dredging, marine archaeological sites or wrecks, or other exploration/exploitation sites;
- The proximity of Project Two relative to any designated areas for the disposal of dredging spoil;
- The proximity of Project Two to navigation aids and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impacts thereon; and
- Provide input into the proposed channel and rerouting scenario (see Section 7.2.15 above) further identifying where existing traffic could be displaced to and whether there is potential for choke points/conflicts to be created.

**Impacts on navigation of auxiliary infrastructure**

7.2.29 The impact assessment will also describe:

- The implication of tidal regimes on shipping in and around Project Two;
• Whether current maritime traffic flows and operations in the general area are affected by the depth of water;
• The set and rate of the tidal stream, at any state of the tide;
• Whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream;
• The implication of adverse weather conditions on shipping in and around Project Two; and
• Whether in bad weather and/or restricted visibility conditions the turbines within Project Two could present difficulties or dangers to craft including sailing vessels.

**Visual navigation and collision avoidance**

7.2.30 The impact assessment will study whether:

• Structures could block or hinder the view of other vessels under way on any route; and
• Structures could block or hinder the view of the coastline.
• The assessment will consider both the marking of project structures and requirement for additional navigational aids and the potential impact of the proposed project on existing markings of structures and navigational aids, in consultation with Trinity House.

**Communication, radar and positioning systems**

7.2.31 The assessment will identify:

• The potential for the structures to produce radar reflections, blind spots, shadow areas or adverse impacts;
• The potential for communications to be adversely affected; and
• Whether sound signals could be masked by the structures.

7.2.32 The potential impacts with regard to radar and communication are discussed in more detail in Section 7.4.

**Emergency response**

7.2.33 The assessment will consider whether there would be potential navigational or communication difficulties caused to any mariners or emergency services using the area.

**Cable routes**

7.2.34 The assessment will also consider the potential effect of the Project Two cable corridor route on navigation in terms of planned anchoring, emergency anchoring and fishing activities.
Increased construction vessels

7.2.35 The assessment will also include information regarding increased vessel movements resulting from the Project Two construction activities and routine maintenance.

Additional studies

7.2.36 The following additional studies have been identified which will inform the Project Two EIA:

- A simulation and modelling exercise of the main shipping lane bisecting Project Two;
- A channel and routing scenario for the whole of Hornsea Zone;
- A Navigational Risk Assessment (NRA) for Project Two;
- A location assessment for the HVAC reactive compensation substation.
- Cumulative 90th percentile lands are being reviewed by the SNSOWF to assess cumulative impacts throughout the southern North Sea. This will provide a long term collaborative approach to marine traffic data collection for wind farm development within the southern North Sea area. As this information becomes available it shall be used to inform the EIA accordingly; and
- a burial protection index study and an anchor penetration study of the export cable route shall be carried out on the section of the route which are required following a geophysical survey of the route and in consultation with the MCA.

Potential project impacts

Construction phase

7.2.37 The project activities that have a potential to impact on the ports shipping and navigation include:

- Construction and decommissioning related vessel movements (including cable-laying vessels and activities related to cables at the time of decommissioning);
- Associated increased vessel activity in the area; and
- Increased activity will influence the rate of vessel-to-vessel encounters and hence the collision risk.

7.2.38 Receptors will include commercial vessel, recreational users, commercial fishing and other marine users including wind farm operators and oil and gas activities.

7.2.39 The impact on ports, shipping and navigation from construction activities, including those arising from cable-laying and additional vessel traffic operating within, and transiting to and from, Project Two, will be assessed within the EIA.
process. This will include detail of vessel movements during construction as far as practicable.

**Operation and maintenance phase**

7.2.40 The identified potential impacts resulting from the operation and maintenance of Project Two are as follows:

- Collision risk between vessels and structures;
- Potential for the structures to produce radar reflections, blind spots, shadow areas or adverse impacts;
- Potential for structures to block or hinder the view of other vessels under way on any route;
- Potential for structures to block or hinder the view of the coastline from vessels;
- The distances travelled by merchant vessels could be affected by Project Two requiring vessels to travel greater distances;
- The cable route may impact on merchant ships dragging anchor or emergency anchoring in the vicinity of the cable(s);
- Potential compass deviation from the magnetic fields generated by the cables;
- Vessel-to-vessel encounters and hence the collision risk as a result of the potential displacement of fishing activity outside of Project Two during operation;
- Potential for gear interaction from fishing vessels including increased snagging risk;
- Potential for diminished search and rescue capabilities and pollution and salvage response for all sea users; and
- The potential impacts on ports shipping and navigation during operation and maintenance shall be assessed further in the EIA.

7.2.41 It is considered unlikely that there will be any significant recreational activities within Project Two due to the distance offshore.

**Decommissioning phase**

7.2.42 Impacts arising during decommissioning can generally be considered to be similar to those experienced during the construction phase in particular related to vessel movements. Additional considerations that shall require assessment shall include anchoring hazards with cables left in situ, and the impacts of navigational marking or obstructions that cannot be removed during decommissioning.
7.2.43 Potential impacts to ports, shipping and navigation during decommissioning shall be assessed further in the EIA.

**Potential transboundary impacts**

7.2.44 The traffic passing through Project Two is mainly trading between UK east coast ports, such as Teesport and Immingham and European ports, such as Esbjerg, Rotterdam and Amsterdam. Offshore support vessels may also pass through Project Two area coming from European ports.

7.2.45 There is the potential for transboundary impacts relating to ports, shipping and navigation which shall be assessed further in the EIA.

**Potential cumulative impacts**

7.2.46 There is the potential for cumulative impacts during all phases of the project (construction, operation and decommissioning) to occur between Project Two and the other wind farm developments in the area. These include the Dogger Bank and East Anglia Round 3 Zones, other Hornsea Zone developments, the consented Round 2 wind farms (some of which are currently being constructed) and operational Round 1 wind farms. Other cumulative impacts may occur from oil and gas operators in the region (see Section 7.8).

7.2.47 Cumulative impacts from ports, shipping and navigation shall be assessed further in the EIA.

**Potential inter-related effects**

7.2.48 Potential inter-related effects exist between impacts to navigation and shipping (this Section), disturbance from noise and vibration (Section 5.2), impacts to radar and communication (Section 7.4) impacts to commercial fishing (Section 7.1) and impacts to other marine users, primarily oil and gas operations (see Section 7.8)

7.2.49 The potential for impacts from these and other parameters to interact with navigation and shipping impacts to produce new or increased significance impacts will be assessed during the EIA.

**Potential mitigation and monitoring**

7.2.50 There are a range of measures that can be applied to mitigate the potential impacts of Project Two such as through layout design, which are identified in MGN 371 (MCA, 2008a). The following list includes measures identified in MGN371 and other proposed mitigation measures that could be applied to the project as appropriate to the level and type of risk determined during the EIA:

- Distribution of information and warnings through notices to mariners and other appropriate media;
- Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC);
▪ Application for and use of safety zones of appropriate configuration, extent and application to specified vessels;

▪ 500 m rolling safety zone around each wind turbine during construction and decommissioning and 50 m fixed safety zone during operation.

▪ Use of additional aids to navigation;

▪ 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 a Search and Rescue and Emergency Response Co-operation plan with the relevant Maritime Rescue Co-ordination Centre and Active Safety Management System including development of emergency resources to respond to vessels before a collision is inevitable; to be implemented from construction phase onwards.

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

▪ Marking and lighting the site in accordance with General Lighthouse Authority requirements (Recommendation 0-139 on the marking of offshore structures (IALA 2008)), 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 wind farm;

▪ Wind turbine rotor blade tip clearance at a minimum 22 m above Mean High Water Springs; and

▪ Vessel nominated as guard vessel during construction/decommissioning (and operations and maintenance) activities.

7.2.52 Mitigation for Project Two will be identified during the Marine Navigation Risk Assessment and may include, in addition to the points listed above, measures such as the channel and routing scenario (see Section 7.11 above) and an IMO adopted traffic routing system.

7.2.53 Due to the importance of the region for shipping there is significant navigational infrastructure present within the Study Area including shipping channels, anchorage areas, buoys, precautionary areas and pilot boarding areas. Where possible and practicable, cable routes will be designed to avoid navigational infrastructure.
7.3 **CIVIL AVIATION AND MILITARY ACTIVITIES**

**Environmental baseline**

7.3.1 Project Two is situated entirely within the UK Flight Information Region (FIR) and in an area of Class G uncontrolled airspace, which is established from the sea surface up to Flight level (FL) 195 (approximately 19,500 feet). Class C controlled airspace is established above FL195. Under these classifications of airspace the following applies:

- Class G uncontrolled airspace: any aircraft can operate in this area without any mandatory requirement to be in communication with any Air Traffic Control (ATC) unit; and

- Class C controlled airspace: all aircraft operating in this airspace must be in receipt of an air traffic service from National Air Traffic Services (NATS) En-Route Ltd (NERL).

7.3.2 In Project Two the Class G uncontrolled airspace is subdivided into areas with the following aviation stakeholder responsibility:

- Anglia Radar: based at Aberdeen Airport and employing the NERL Primary Surveillance Radar (PSR) at Claxby, has its area of responsibility established for the provision of ATC services from the surface up to FL65 (approximately 6,500 feet) as detailed in NATS (2010a); and

- Air Surveillance and Control Systems (ASACS) uses its PSR resources in support of operational flights within UK airspace and for training exercises. Two Managed Danger Areas (MDAs) are established over the North Sea (Northern and Southern MDA). The Southern MDA is located above Project Two and when active operates from FL50 up to FL 660. When activated Anglia Radar operations are restricted to FL40 and below. When the Southern MDA is not activated the airspace reverts to class G uncontrolled airspace.

7.3.3 There are aerodromes and air traffic control zones located onshore from Project Two. Aerodromes are safeguarded against inappropriate developments in their vicinity, as outlined in CAP 738 (CAA, 2006), Chapter 1, and CAP 764 (CAA, 2010a) Chapter 3, where proposed wind farms should be notified to the Defence Geographic Centre (DGC). Objections may be raised to proposed wind farms that are situated under the protected surfaces of an aerodrome based on the potential for physical obstruction to aircraft and instrument approach procedures and interference with Communications, Navigation and Surveillance (CNS) infrastructure, as discussed in Section 7.4. A protected surface as defined in CAP 168 (CAA, 2010b), Chapter 4, has a radius of 15,000 m extending at a height of 150 m outwards from the Aerodrome Reference Point (ARP). Project Two is more than 15,000 m from any airfield and does not therefore have the potential to penetrate any aerodrome protected surface.
7.3.4 CAP 168 (CAA, 2010b), Chapter 5, provides generic criteria for safeguarding distances from aerodromes. Safeguarding distances are limited to the vicinity of the aerodrome, which can be a 3, 4, 5, 17 or 30 km radius depending upon the aerodrome status (licensed or unlicensed), equipment (radar or non-radar) and instrument approach procedures. The location of Project Two is not affected by such constraints due to their distance from shore. Potential interference with Radar is discussed in Section 7.4.

7.3.5 The upper airways (which exist at FL195 and above) that cross the Hornsea Zone as detailed in NATS (2010b) are UL975, UN97, UM982, UM981 and UM79. The upper airways which are located above the cable route corridor are: UL975, UM79, UL602, UL46 and UL90. The turbines within Project Two and the cable laying vessel(s) or other cable laying associated activities are not considered to have potential to cause an impact on the Upper Airways.

7.3.6 There are no low level airways which exist at FL195 (19,500 ft.) and below crossing Project Two as detailed in NATS (2010c).

7.3.7 A network of helicopter main routes is established to serve oil and gas platforms, rigs, accommodation blocks as well as Floating Production, Storage and Offloading vessels (FPSO’s).
Figure 7.11 Proposed helicopter main routes and 9 NM buffer for consultation around oil and gas platforms.
7.3.8 The CAA Helicopter Main Routes (HMR) are defined in NATS (2010a). The routes are changed every year to reflect current operational needs. The most recent proposed routing is shown in Figure 7.11 which is now under consideration by the operators, developers and NATs. No HMR fully dissects the location of the proposed Project Two turbine array. Once agreement has been reached it will go to the Directorate of Airspace Policy (DAP) for approval. The figure shows HMR3 partially crosses the eastern edge of Project Two. It is used predominantly for transit from both Norwich International Airport and the Great Yarmouth (North Denes) Heliport to offshore installations. Helicopter operators include Bristow, CHC Scotia, Bond and NHV Helicopters. The HMRs have no defined lateral dimensions although 2 NM either side of the route centreline should ideally be kept obstacle free. The purpose of the HMRs is to facilitate safe helicopter flights, particularly in Instrument Flight Rules conditions (when flight cannot be completed in visual conditions). It is not mandatory however for helicopters to use HMRs and a large number of the offshore installations are located outside of direct HMR routing and therefore it is likely that there will be “off route” helicopter traffic flying across the Project Two area.

7.3.9 Helicopters are height banded so that those outbound to North Sea installations fly at 2,000 ft. and 3,000 feet whilst those inbound fly at 1,500 feet and 2,500 feet. This allows for 500 feet vertical separation between helicopters travelling in opposite directions. A large number of turbines beneath an HMR could force aircraft to fly higher in order to maintain a safe vertical separation from wind turbines. This may not be possible when flying through low cloud on days when the zero degree isotherm (icing level) is below 2,000 ft. as defined in CAP 764 (CAA, 2010a), Chapter 3, Page 5, Para. 8. In addition, when the Southern MDA is activated helicopters are restricted to FL40 unless clearance to fly above this level is given by Anglia Radar.

7.3.10 CAP 764 (CAA, 2010a), Chapter 3, Section 8, states that “From a regulatory perspective, whilst in an ideal world, the area 2 NM either side of a HMR should be obstacle free, providing one side of the route was obstacle free, some wind turbine development within 2 NM could be manageable”. Further assessment is being undertaken in consultation with NATS to ascertain the optimum width requirements for HMR3 and the potential to reroute HMR3 with respect to the navigation channel rerouting scenario (see Section 7.2). In addition a collaborative approach to helicopter routing requirements is being undertaken through SNSOWF/SAG group.

7.3.11 A two nautical mile radius Helicopter Traffic Zone (HTZ) and a nine nautical mile Obstacle Free Zone (OFZ) consultation radius is established around offshore platforms that have helicopter operations (CAA, 2011). No two nautical mile zones overlay the Project Two boundaries, however the nine nautical mile consultation zone around two platforms overlap the project boundaries as can be seen in Figure 7.11 above. The Mimas platforms consultation zone extends into the south western portion of Project Two and the Schooner consultation zone extends into the north east of the project area. The purpose of the zones
provide is to safe entry and exit for helicopters from the respective platforms. The physical presence of infrastructure in the zone has the potential to affect the installations instrument flight and missed approach procedures and may affect the integrity of emergency evacuation procedures.

7.3.12 Consultation with the oil and gas operators is ongoing to look at the optimum OFZ requirements around each platform (see Paragraph 7.3.10).

7.3.13 Helicopter based Search and Rescue (SAR) operations are operated by HM Coastguard, Ministry of Defence (MOD), and the USAF (United States Air Force). Onshore from Project Two, Royal Air Force (RAF) Sea King helicopters operate from RAF Boulmer and RAF Leconfield, with an operating range of approximately 250 nm. US helicopters may operate in a SAR capacity from RAF Mildenhall when requested by the UK Rescue Co-ordination Centre at RAF Kinloss. SAR operations are unplanned events and thus can occur anywhere over land or sea.

Military aviation

7.3.14 The MOD uses all uncontrolled UK airspace (surface to FL 195) and waters for Army, Air Force, and Navy training.

7.3.15 Project Two is located in uncontrolled airspace and beneath a Practice and Exercise Area (PEXA). A PEXA is a designated offshore area which can be used by the Army, Air Force or Navy for firing practice and exercises.

7.3.16 Project Two lies beneath PEXA D323C as shown in Figure 7.12. Within D323C, air combat training, high energy manoeuvres and supersonic flight can be expected between altitudes of FL50 (5,000 ft.) and FL660 (66,000 ft.). Control of this area is managed by the Air Defence Operations Centre at RAF Boulmer. Typical aircraft that can be expected to use these areas are Typhoon, Tornado, Harrier, Tanker aircraft or Airborne Warning and Control System (AWACS) Sentry Aircraft. New aircraft joining the RAF inventory would also be expected to utilise these areas.

7.3.17 D323C does not represent a significant risk to wind turbine siting, cable routing and landfall decisions, though subsurface and surface exercises shall be considered during turbine and cable laying installation and operations through consultation with the Defence Infrastructure Organisation (DIO).

7.3.18 All operational military airfields are inland and a considerable distance from Project Two. Radar interference from these airfields is discussed in Section 7.4.

7.3.19 The London Military Air Traffic Control Centre, based at Swanwick, provides a Middle Airspace Radar Service over the whole area, as illustrated in NATS (2010d). When the MDA’s are not operational, this service is used by civil aircraft wishing to route directly from the UK Flight Information Region (FIR) boundary at Airways Reporting Point BODSO to Humberside, Durham Tees Valley or Newcastle Airport as detailed in NATS (2010c). London Military use the NERL Claxby PSR to provide this service which is discussed in Section 7.4.
7.3.20 There is a regular military low flying area that is directly adjacent to Low Flying Area (LFA) 11. It runs south from Flamborough Head to the Wash area. LFA 11 could be considered to include the offshore low flying area indicated in Figure 7.12. LFA 11 is used regularly by aircraft based elsewhere transiting to and from the RAF Air Weapons Ranges on the Wash, and training areas in LFA 5. The whole of LFA 11 allows military fixed wing aircraft to fly as low as 250 feet Minimum Separation Distance (MSD) from obstacles. LFA 11 is not designated as a tactical training area. As a result of this, with the exception of helicopters no aircraft is permitted to fly below 250 feet (MSD).

7.3.21 Depending on the height of the equipment on the cable laying vessel(s), there may be potential for the vessel to be considered to be a moving physical obstruction. As long as the vessel(s) is displaying the appropriate maritime light signals for the task, it is considered unlikely that it will create an aviation hazard (see Section 7.4).

7.3.22 Project Two is not considered to have the ability to impact on the two submarine exercise areas lying to the north-east and north-west of the project.

7.3.23 Donna Nook Danger Area (D307) is located within the cable route corridor near the landfall point. Activities in this area include live firing, bombing and demolition. Consultation with the DIO has indicated that DIO need to be briefed on the nature of and the timing of any cable laying operations that will occur within the extent of D307.

7.3.24 Military radar issues are discussed in Section 7.4
Figure 7.12  Military Practice and Exercise Areas.
Data and guidance to Inform EIA

Data currently obtained

7.3.25 Radar performance and propagation modelling has been carried out for the wider Hornsea Zone (ZoC Chapter 15.1) and an aviation impact assessment has been carried out for the Hornsea Zone Project One (EMU, 2012 Appendix A2.10.2). These studies have highlighted the following sources of information to inform the Project Two EIA:

7.3.26 The CAA and NATS UK Integrated Aeronautical Information Publication (AIP) (CAA and NATS, 2010) and relevant CAA CAPs, including:

- CAP 764 CAA Policy and Guidelines on Wind Turbines (CAA, 2010a);
- CAP 437 Standards for Offshore Helicopter Landing Areas Guidance (CAA, 2010);
- CAP 670 Air Traffic Services Safety Requirements (CAA, 2010d);
- CAP 738 Safeguarding of Aerodromes (CAA, 2006);
- CAP 793 Safe Operating Practices at Unlicensed Aerodromes (Including Helicopter Landing Sites);
- CAP 393. Air Navigation: The order and regulations (CAA, 2010c);
- CAP 168 Licensing Of Aerodromes (CAA, 2010b); Lower Airspace charts South;
- Lower Airspace charts North;
- Upper Airspace charts South;
- Upper Airspace charts North;
- DECC (2011a) Overarching National Policy Statement for Energy (En-1) Chapter 5.4 Civil and Military Aviation and Defence Interests;
- EUROCONTROL (2010). EUROCONTROL Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors ;
▪ MCA (2008a) MGN 371 (M+F): Offshore renewable energy installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response issues;

▪ MCA (2011) Offshore renewable energy installations, emergency response co-operation plans (ERCoP) for construction and operations phase, and requirements for emergency response and SAR helicopter operations;


▪ UK Hydrographic Office (UKHO) PEXA charts Q6401 and Q6405, as amended by Notice to Mariners 0455/2010, 4915/2006 and 5194/2005; and


**Outstanding data requirements**

▪ The data sources provided in the section above shall be checked for any updated information from 2011/2012; and

▪ General enquiries and ongoing consultation will be carried out with CAA, NATS En Route Ltd and MOD, DAP, Humberside International Airport, and Helicopter operators.

**Method Supporting EIA**

7.3.27 Radar performance and propagation modelling has been carried out for the wider Hornsea Zone (ZoC Chapter 15.1) and an aviation impact assessment has been carried out for the Hornsea Zone Project One ES (EMU, 2012 Appendix A2.10.2) which shall be used where applicable, to inform Project Two.

7.3.28 These studies have shown that there may be the potential for the project to impact on the following aviation stakeholders:

▪ Civil en-route operations;

▪ MOD Air defence operations and training;

▪ Helicopter support to offshore operations; and

▪ Helicopter provision of search and rescue.

7.3.29 Project design parameters which may give rise to an impact on civil aviation and military activities include:

▪ Physical presence of above sea level structures including:
  ▪ meteorological mast (115 m height);
accommodation platforms (x2) 60 m height;
offshore HVAC collector substation stations (x2) 60 m height;
offshore convertor station 63 m height;
reactive compensation substation (60 m height).

- Physical height of wind turbines (maximum height of 272 m); and
- Turbulence caused to the surrounding air from the rotation of the turbines (maximum of 360 turbines).

7.3.30 Potential impacts have been identified as being from physical obstruction of airspace, restriction on helicopter movement to offshore oil and gas platforms and for Search and Rescue, and to safety hazards caused by turbulence. Impacts to radar and communication are discussed in Section 7.4.

7.3.31 Using appropriate data sources as listed above, the following steps will be undertaken for the Project Two assessment:

- Conduct / review use of controlled and uncontrolled airspace in Project Two footprint and along cable corridor
- Conduct radio propagation analysis to determine radars which may be affected (further discussed in Section 7.4);
- Identify both radar and non-radar stakeholders;
- Identify the potential radar performance impacts (Section 7.4);
- Identify the potential operational impacts;
- Identify the potential impact on Navigational Aids;
- Through consultation with the identified stakeholders, determine the potential for Project Two to affect their operations;
- Potential mitigation options will be discussed with stakeholders if appropriate;
- At the present time consultation on HMR route optimisation is ongoing with NRA (Paragraph 7.3.10);
- Consultation is also on going regarding navigational markings of wind farm and associated infrastructure with the MCA;
- Consultation with gas platform operators is on-going to ascertain optimum helicopter zone requirements around neighbouring platforms (Paragraph 7.3.10); and
- Ongoing consultation regarding radar performance impacts is discussed in Section 7.4.
**Potential project impacts**

**Construction phase**

7.3.32 There is the potential for construction vessels to be considered a moving physical obstruction, depending on the height of the equipment on the vessels. As long as the vessel(s) is displaying the appropriate maritime light signals for the task, it is considered unlikely that it will create an aviation hazard.

7.3.33 The cable route shall pass through the Donna Nook Danger Area. DIO have indicated that they should be briefed on this activity during construction.

7.3.34 Construction related impacts on civil aviation and military activities shall be further assessed in the EIA.

**Operation and maintenance phase**

7.3.35 The identified potential impacts on civil aviation and military activities resulting from the operation and maintenance of Project Two are as follows:

- Physical obstruction to aircraft;
- Wake turbulence on aircraft; and
- Restriction on helicopter operations affecting integrity of offshore safety requirements and search and rescue operations.

7.3.36 Further assessment will be made on the potential impact of the project on civil aviation and military activities to inform the EIA.

7.3.37 Consultation will continue with the relevant stakeholders to inform the EIA, including in particular NATS and the helicopter operators (for HMRs siting) and the offshore oil and gas operators and search and rescue bodies for exclusion zone requirements.

**Decommissioning phase**

7.3.38 Impacts on civil aviation and military activities during the decommissioning phase of Project Two are anticipated to be similar to those identified during the construction phase.

**Transboundary impacts**

7.3.39 The Project Two area lies entirely within the UK FIR and therefore there are no anticipated transboundary impacts to routine aviation and military activities. It should be noted that Search and Rescue teams could be sent in to the area from other North Sea countries and so further consideration to this potential impact shall be considered within the EIA.

**Cumulative impacts**

7.3.40 Project Two along with the presence of existing wind farms (from Round 1, Round 2 and Round 2.5) as well as future planned wind farms in the wider North
Sea could have a significant cumulative impact for civil aviation and military activities. Identified wind farms include Dogger Bank, Humber Gateway and Triton Knoll, Project One in the Hornsea Zone and future subzones, which could have an extensive impact on helicopter offshore operations in the area. Cumulative impacts shall also arise with ongoing oil and gas activities within the area and any new activities that are planned in the wider area (see Section 7.8).

7.3.41 Consultation shall be continued with the relevant helicopter operators and NATS to inform the applicability of some measure of turbine development within the 2 NM of the centreline of the subject HMRs and the 9 NM of any platform OFZ.

7.3.42 Further assessment of cumulative impacts from civil aviation and military activities shall be considered in the EIA.

Inter-related impacts

7.3.43 There is considered to be inter-relationship impacts from civil aviation and military activities with radar and communication (Section 7.4) and shipping and navigation (Section 7.2), affecting other marine users primarily oil and gas operations within the wider area. There are also potential inter-relationship impacts between the lightings and marking requirements for aviation with visual assessment. These inter-relationship impacts shall be assessed within the EIA.

Potential mitigation and monitoring

7.3.44 Some or all of the wind turbines shall be required to be equipped with aviation warning lights. Reference shall be made to the legal requirement for aviation obstruction lighting on offshore wind turbines which is documented within the UK Navigation Order 2009 (Article 220). Furthermore the DAP has published a policy on offshore lighting requirements which highlight the latest developments in this area including lighting to support helicopter operations within the wind farm if applicable, which shall be referenced.

7.3.45 Consultation with CAA shall be sought to ensure that wind turbine colour scheme and markings will be in line with international aviation regulatory requirements.

7.3.46 The physical presence of all wind turbines and other related offshore infrastructure shall be charted for aviation purposes in regard to DfT/ODPM Circular 1/2003 Annex 2.

7.3.47 The DIO will be kept informed of cable laying operations with information regarding the nature and duration of the works, vessels used and project timing. This will enable cable laying activities and the firing range activities to be coordinated.

7.3.48 A collaborative approach to helicopter routing requirements is being undertaken through SNSOWF/SAG group where more detail can be found in the consultation report.

7.3.49 Further mitigation measures that will be considered include:
- In consultation with DAP the establishment of temporary aviation exclusion zones; and
- In-fill radar to mitigate radar interference (see Section 7.4).

7.4 RADAR AND COMMUNICATIONS

Environmental baseline

7.4.1 The Hornsea Zone is located within the operational range of the NERL Claxby and Cromer Primary Surveillance Radar (PSRs) and the Humberside International Airport (HIA) terminal radar, as shown in Figure 7.13. The NERL PSRs are used by NERL, NATS Aberdeen and “London Military” to provide an en-route service to aircraft. The HIA supports the provision of air traffic services for aircraft including helicopters servicing North Sea oil and gas platforms.

7.4.2 The Hornsea Zone is also within the operational range of the MODs Air Surveillance and Control System (ASACS) Air defence PSRs located at Staxton Wold and Trimingham. There is also temporarily stationed Air Defence Radar at RAF Kirton in Lindsey. The location of these radar installations is provided in Figure 7.13. The meteorological radar stations within proximity to the Hornsea Zone is also shown in Figure 7.13.

7.4.3 Wind farm construction and operation has the potential to interfere with radar systems i.e. turbines may affect radar waves through back-scatter or shadows in coverage. Potential interference associated with civil and military radar, meteorological radar and maritime communications is discussed in this Section. Further reference is made to civil and military radar in Section 7.3 (civil and military aviation). Further reference is made to maritime communications in Section 7.2 (Shipping and navigation). Further reference is made to the potential impacts with other marine users particularly oil and gas industry in Section 7.8.

Civil radar

7.4.4 Civil airspace and air traffic surveillance and management infrastructure is comprised of the following systems which may be affected by wind farms:

- Primary Surveillance Radar (PSR);
- Secondary Surveillance Radar (SSR); and
- Aeronautical Navigation Aids (Nav aids).

7.4.5 Radar Performance and Propagation modelling will be carried out on the wider Hornsea Zone assuming turbine heights of 200 m and 325 m). The maximum turbine height for Project Two is 272 m which is well within this range. The results of the model will be used to predict any potential impact on:

- The Claxby PSR;
- The Cromer PSR;
The HIA terminal radar is predicted to have visibility over a very small portion of the South West of the Hornsea Zone, but not Project Two. Modelling for the HIA terminal radar has, however, only been run for 200 m turbines and it is recognised this will need to be repeated for 272 m height for Project Two; and

- The critical range for Secondary Surveillance Radar (SSR) is 24 km as stated in CAP 413 (CAA, 2011). Project Two lies outside this range (at 89 km from the shore) and so there are no potential impacts to the SSR.

### 7.4.6 Helicopter Operations

A network of helicopter main routes are established to facilitate safe helicopter flights. These routes are discussed in Section 7.3. In addition consultation zones are established around offshore oil and gas platforms to assist the safe entry and exist of helicopters to the respective platforms. These are discussed in Section 7.3.
Figure 7.13  NERL air defence PSRs and meteorological radar installations.
Military air traffic management

7.4.8 All operational military airfields are inland and a considerable distance from Project Two. The closest RAF flying station RAF Leconfield is a Search and Rescue (SAR) helicopter station and is not equipped with radar.

7.4.9 Military Air traffic management is supported by Military ATC radars. These are typically standard terminal area ATC radars with instrumental range of 60 nm. Military Air Traffic Management is also supported by military Precision Approach Radars (PARs) at certain airfields. These have a much shorter instrumental range and are only safeguarded out to 20 NM in certain directions.

7.4.10 Radar performance and radio propagation modelling was run assuming 200m turbines for the Hornsea Zone (SMart Wind 2012). The modelling predicted that no turbines of this height in the Project Two area would be detectable to military PSR, ATC radars or military landing aids at any of the military airfields so equipped. This modelling will be rerun for 272 m turbine height to inform the EIA.

Military air defence radars

7.4.11 Military Air Defence systems are typically more complex than civil CNS systems. The MOD has a role to provide unimpeded airspace surveillance and early warning of air attack and intrusion into UK airspace. The MOD assesses the impacts of wind farms on their CNS on a case-by-case basis and therefore consultation with Defence Estates will be undertaken as part of the EIA process.

7.4.12 Air Defence radars generally have an operational range of over 400 km. However turbines may not be detectable by Air Defence radar if there are significant obstacles e.g. screening by terrain features. Radar performance and propagation modelling that takes this screening effect into account, will be run for the Hornsea Zone to assess:

- The Air Defence Radar at RAF Staxton Wold;
- The Air Defence Radar at RAF Trimingham; and
- The temporary Air Defence Radar at RAF Kirton in Lindsey.

Meteorological radar

7.4.13 The Met Office is part of the MOD and maintains 15 out of a total network of 18 meteorological radars across Britain in support of its meteorological monitoring and forecasting role. The locations of relevant meteorological radar installations are presented in Figure 7.13.

7.4.14 The meteorological radars have an operational range of up to 255 km (Met office, 2011). The safeguarding guidelines adopted by the Met Office (OPERA, 2006) indicate that wind turbines in Project Two area will not impact their meteorological radar provided that they are a) below the existing (radio) horizon, and b) they are not within the beam of the radar.
7.4.15 Defence Estates shall be consulted to determine the potential impact from Project Two with regard to Met Office radar safeguarding. In addition, the Met Office submitted an invitation to tender for a Weather Radar Network Renewal process in June 2010 in order to increase data resolution (Met Office, 2010). Any technical improvements resulting from this will be considered during the EIA process.

**Maritime communications**

7.4.16 Military and civil aviation rely on CNS infrastructure to support airspace and air traffic management. Military CNS has a crucial role in providing air defence surveillance for UK and the North Atlantic Treaty Organization (NATO). Shipping and offshore infrastructure also depends on communication systems for safe operation.

7.4.17 Maritime communication devices include cellular telephones, satellite communications, VHF radio television and offshore microwave fixed links.

7.4.18 Cellular telephone service providers do not provide coverage for users located in Project Two area which means there is unlikely to be any interference to services.

7.4.19 Satellite communications users include surface vessels or offshore rigs or platforms. The Ofcom Tall Structures guidance document (Ofcom, 2009c) indicates that the principal impact of new structures, such as wind turbines, on satellite television is potential blocking between the receiver and the satellite in the sky. Satellite signals are generally received from a high elevation, meaning that disruption to satellite reception is usually limited only to cases where a receiver is very close to a tall structure (e.g. a ship passing very close to a wind turbine).

7.4.20 Trials undertaken for North Hoyle wind farm tested Global Positioning System (GPS) performance in the vicinity of the North Hoyle wind turbines and found no significant impact to GPS performance (DfT, 2004).

7.4.21 VHF radio is used by large commercial container ships, offshore service vessels, fishing boats and pleasure craft in the marine band (approx. 156 – 174 MHz) for ship to ship, ship to platform and ship to shore, voice communication for the purpose of communication and navigation. Trials at North Hoyle wind farm also indicated that wind turbines had no noticeable effects on any voice communication system, vessel to vessel or vessel to shore station (DfT, 2006). These included ship borne, shore based and handheld VHF transceivers and mobile telephones. Digital selective calling (DSC) was also satisfactorily tested. However the VHF Direction Finding equipment carried in the lifeboats did not function correctly when very close to wind turbines (within 50 m).

7.4.22 Onshore terrestrial television viewers are beyond the maximum extent of area that may be affected by turbines in Project Two.
7.4.23 The offshore microwave links in the vicinity of Project Two have been identified as shown in Figure 7.14. The microwave link between the ConocoPhillips Mimas and ConocoPhillips Saturn platform is approximately 8.8 km from the southern boundary of the Project Two area. The microwave link between the ConocoPhillips Caister and the Shell Schooner platform is approximately 6.4 km from the Project Two. The potential interference with microwave links is calculated based on distance and frequency of the particular link. Further calculations, in consultation with Ofcom and the microwave link operators, will be run during the EIA.
Figure 7.14     Microwave fixed links in vicinity of Project Two.
Data and guidance to inform EIA

7.4.24 Radar performance and propagation modelling has been carried out for the wider Hornsea Zone (SMart Wind (2012), Chapter 15.1) and an aviation impact assessment has been carried out for the Hornsea Zone Project One (EMU, 2011 Appendix A2.10.2). These studies have highlighted the following sources of information to inform the Project Two EIA:

- The CAA (2011) list of airspace publications including:
  - CAA (2010c) CAP 393 Air Navigation: The Order and the Regulations;
  - CAA (2010a) CAP 764 CAA Policy and Guidelines on Wind Turbines;
  - CAA (2011) CAP 413 Radio Telephony Manual;
  - CAA (2011d) CAP 670 Air Traffic Services Safety Requirements including RTF Frequency Allocations for mobile installations in the UK Areas under concession; and NDB Frequency Allocations for mobile installations in the UK Areas under concession.

- Television transmitter locations, which can be determined by using the following link (OFCOM, 2009a):

- The BBC wind farm assessment tool which provides guidance as to the potential impact of wind farms on TV reception can be found here (BBC, 2010);

- Data for fixed links will be identified through consultation with OFCOM as well as the relevant operators in the vicinity of Project Two;

- Bacon, D.F. (2002) Fixed-link wind-turbine exclusion zone method: A proposed method for establishing an exclusion zone around a terrestrial fixed radio link outside of which a wind turbine will cause negligible degradation of the radio link performance;


- DECC (2011a) Overarching National Policy Statement for Energy (EN-1) Chapter 5.4 Civil and Military Aviation and Defence Interests;

- Maritime and Coastguard Agency (MCA) (2004) the effects of offshore wind farms on marine radar, navigation and communication systems, MNA 53/10/366;

- Maritime and Coastguard Agency (MCA) (2005) Offshore wind farm Helicopter search and rescue trials undertaken at the north Hoyle Wind Farm MSA 10/6/239;
• OFCOM (2009a) Television Transmitter location maps;
• OFCOM, (2009b) RF Measurement Assessment of Potential Wind Farm Interference to Fixed Links and Scanning Telemetry Devices, ERA Technology, March 2009;
• OFCOM (2009c). Tall structures and their impact on broadcast and other wireless services; and

Outstanding data requirements

7.4.25 The data sources identified above will be reviewed for any relevant updates for 2011/2012. In addition the following data sources will be obtained:

• Data for fixed links will be identified through consultation with OFCOM as well as the relevant operators in the vicinity of Project Two; and
• Consultation with regard to radar and communications is required across several stakeholder groups including, Humberside International Airport, and unlicensed aerodromes within the onshore study area including Garton Field, Humbleton, North Coates and Cuxwold, with NERL, the CAA, MODod, with the helicopter operators, and with the MCA and SAR operators search and rescue.

Methods supporting EIA

Radar

7.4.26 Radar performance and propagation modelling has been carried out for the wider Hornsea Zone (SMart Wind (2012) Chapter 15.1) and an aviation impact assessment has been carried out for the Hornsea Zone Project One (EMU 2011,
Appendix A2.10.2). This data shall be reviewed and a further assessment carried out for Project Two.

7.4.27 The project design parameters which may give rise to an impact on radar and communication include:

- Physical presence of above sea level structures including
  - meteorological mast (115 m height);
  - accommodation platforms (x2) 60 m height;
  - offshore HVAC collector substation stations (x2) 60 m height;
  - offshore converter station 63 m height;
  - reactive compensation substation (60 m height).
- Physical height of wind turbines (maximum height of 272 m); and
- Physical footprint of wind turbine array (maximum 360 turbines).

7.4.28 Potential impacts include physical interference with the radar signal and screening effects, causing the radar to not be able to monitor the true air picture.

7.4.29 To undertake the radar and aviation assessment, using appropriate data sources as listed above, the following steps will be taken:

- Identify HIA Terminal radars, Civil Air Traffic Control (ATC) radars, Military Air Defence radars and Meteorological radars:
  - Conduct/Review radio propagation analysis to determine radars which may be affected;
  - Identify radar stakeholders;
  - Determine the types of radar used and the Controllers’ situation display characteristics;
  - Identify the potential radar performance impact; and
  - Consult with the identified stakeholders to determine the potential for Project Two to affect their operations.

Communications

7.4.30 To undertake the assessment of effect upon communications the following steps will be taken:

- Consultation with regard to radar and communications is required across several stakeholder groups including, Humberside International Airport, and unlicensed aerodromes within the onshore study area including Garton Field, Humbleton, North Coates and Cuxwold, with NERL, the CAA, Mod, with the helicopter operators, and with the MCA and search and rescue;
- Through consultation with the identified stakeholders, determine the potential for Project Two to affect their operations; and
Where available, use an appropriate assessment method or trials reports for each communication type to identify the potential technical impact.

Potential project impacts

Construction phase

7.4.31 There are no anticipated impacts on radar and communications resulting from the construction phase of Project Two.

7.4.32 It is proposed that the construction phase is scoped out of the EIA.

Operation and maintenance phase

7.4.33 The identified potential impacts on radar and communications resulting from the operation and maintenance of Project Two are as follows:

- Civil HIA Terminal radar interference;
- Aeronautical Navaids;
- Military PSC and ATC radar;
- Military Air defence radars;
- Meteorological radars;
- VHF communications interference;
- Satellite communications interference; and
- Offshore microwave fixed links.

7.4.34 It will be necessary to use appropriate assessment methods and consultation with the identified stakeholders to determine the potential for Project Two to affect their operations which will be undertaken in the EIA.

7.4.35 Consultation to date with NERL indicates that the turbines of 272 m within Project Two are unlikely to be detectable by NERLs Claxby and Cromer PSRs. Therefore, it is unlikely that there will be an effect on NERL operations. Furthermore their analysis concludes that there is unlikely to be an effect on the provision of ATC services by NERL, Anglia Radar and Military ATC Units based at NERL Control Centres that would be attributed to Project Two.

7.4.36 Consultation with the MOD indicate that turbines of 272 m may be detected by the MODs ASACS PSRs and may therefore shield the radar from genuine aircraft targets and/or hide genuine aircraft targets from the ASACS controller. Further assessment is required in Project Two EIA. Any of these issues would impact on the controller's ability to provide a safe service to aircraft and use the radar data to monitor the air picture.

7.4.37 The Lockheed Martin TPS-77 Air Defence Radar is the only current mitigation accepted by MOD for mitigating the effects of wind turbines on air defence PSRs, and this radar is currently being installed at Trimingham and there are plans to install the radar at Staxton Wold in 2012.
7.4.38 At the present time consultation on HMR route optimisation is ongoing with NRA (Paragraph 7.3.10).

7.4.39 Consultation with gas platform operators is ongoing to ascertain optimum helicopter zone requirements around neighbouring platforms (see Paragraph 7.3.10).

**Decommissioning phase**

7.4.40 There are no anticipated impacts on radar and communications during the decommissioning phase of Project Two.

7.4.41 It is proposed that decommissioning phase is scoped out the EIA.

**Potential transboundary impacts**

7.4.42 There are no anticipated transboundary impacts on radar and communications from Project Two.

7.4.43 It is proposed that potential transboundary impacts are scoped out the EIA.

**Potential cumulative impacts**

7.4.44 Cumulative impacts can only arise if the wind farm is detectable by a radar. There are not anticipated to be cumulative impacts on the NERL PSR.

7.4.45 There is the potential for cumulative impacts on the MOD ASACS PSRs with other projects in the area including other developments within the Hornsea Zone, the Dogger Bank and East Anglia Round 3 Zones, together with the consented Round 2 wind farms and operational Round 1 wind farms.

7.4.46 Cumulative impacts will be assessed further in the EIA.

**Potential inter-related effects**

7.4.47 There is the potential for inter-related impacts to result from radar and communications with shipping and navigation (Section 7.2) and civil and military aviation (Section 7.3) and other marine users particularly the oil and gas industry (Section 7.8). Further assessment will be undertaken during the EIA.

**Potential mitigation and monitoring**

7.4.48 There are a number of mitigation techniques which can reduce or remove the impact of wind farm interference on Air Defence radar including the use of new radar technology. Consultation is ongoing with the Defence Estates. The TPS-77 PSR manufacturer (Lockheed Martin) is engaged to determine if the replacement radars might mitigate all or some of the proposed future turbines in the Hornsea Zone including Project Two, which would be detectable by the Staxton Wold andTrimingham PSRs. It is understood that the Lockheed Martin radar mitigation may have a limitation due to the number of times that Non-Auto Initiation Zones can be applied within the radar systems.
7.4.49 Consultation is ongoing with the helicopter operators to optimise the helicopter routes and turbine development options (see Paragraph 7.3.10).

7.4.50 Consultation is ongoing with the offshore oil and gas operators to look at the required OFZ around each platform (see Paragraph 7.3.10).

7.4.51 The requirements for further potential mitigation and monitoring will be determined during the consultation stage with the stakeholders.

7.5 ORDNANCE

Environmental baseline

7.5.1 There is the potential for unexploded ordnance (UXO) to be present within the Project Two boundary, due to the level of activity in this part of the North Sea during both World Wars. There is the potential for mines, torpedoes high explosives bombs and other munitions as discussed below, however high resolution geophysical site specific surveys will be required and undertaken to determine the exact location of any UXO.

7.5.2 The Project Two boundary is out of range of coastal batteries, however projectiles fired from naval vessels may be encountered but not in any great numbers.

7.5.3 The cable route corridor has the potential to pass through areas historically utilised for armaments training. Consequently, it is likely that related munitions will be present within the cable route corridor. It is also likely that many such munitions may have migrated in and out of this area given the strong currents.

7.5.4 Several potential sources of explosive ordnance contamination have been identified in this east coast offshore region including British and German sea mines, unexploded air-delivered bombs and anti-aircraft projectiles, historic Naval firing ranges (in the potential cable route area), ship wrecks, torpedoes and depth charges, and ammunition dumping grounds.

7.5.5 The North Sea is known to have been mined during both WWI and WWII by the UK and Germany, and it is likely that unrecorded German mine laying activities also took place, delivered either by air, submarines or E-Boats. Mines are still encountered by dredgers and fishermen around the British coastline (BACTEC, 2010).

7.5.6 Defensive minefields were typically deployed around UK coastal waters by British forces with the East Coast Mine Barrage of 1939 comprising up to 100,000 mines along the entire eastern coast of the UK. There is the potential for mines within Project Two as it lies within the East Coast Mine Barrage as shown in Figure 7.15. It is likely that the boundary depicted is only indicative of where the mines may have been laid. Site specific survey results will be required to determine the exact location of any UXO.

7.5.7 Secondary sources also detail extensive German mining of the Humber estuary and deeper waters from 1939 and a wreck recorded within the Hornsea Zone is
detailed to have been sunk by a mine in March 1941. The magnitude of mine laying off the east coast is further supported by the find of 200 loose enemy mines washed up on south Yorkshire beaches, attributed to the autumn gales of 1939 ripping them from their moorings and also the mine related sinking of eleven recorded vessels.

7.5.8 Establishing the locations of all mines at a research stage is not wholly possible since offensively laid mines, in particular, were not generally laid in declared barrages and sometimes singly or in very small numbers. Therefore it has not been possible to accurately determine numbers and types of mines within the Project Two boundary.

7.5.9 While some air delivered bombing of east coast cities took place during WWI the threat from air delivered bombs of this period is low. However during WWII bombing raids were carried out on towns, cities, infrastructure, and key military installations, including RAF airfields and Royal Navy bases. Aerial attacks on shipping (both naval and armed merchant) were also carried out in the North Sea with high concentrations of attacks in the Humber estuary and coastal areas by both the German and Allied air forces. A proportion of the bombs would have failed to function as designed (the typical failure rate was 10%) and may be encountered on the seabed within the Project Two boundary. However, the total quantity of weapons dropped within the Project Two boundary would not have been high.

7.5.10 Unexploded high explosive bombs are occasionally encountered at sea off the UK coastline and if present within the project area could pose a significant threat to works. A recent example is a 500 kg high explosive bomb which washed up on a beach at Felixstowe and another bomb which washed up on Humber coastline (BACTEC, 2010).
Figure 7.15  Map showing WWII minefields near the Hornsea Zone.
7.5.11 Records also indicate that if a Luftwaffe pilot did not find his intended target or came under fighter or Anti-Aircraft Artillery (AAA) attack, he would often drop his bomb load before returning to base – an occurrence known as a ‘tip and run’. The area of the North Sea, within which Project Two is located, was in close proximity to the flight paths for bombers aiming for industrial targets further to the west such as Hull, Manchester and Liverpool and it is possible that the Project Two area could have been at risk from such ‘tip and run’ incidents.

7.5.12 No naval firing range areas are in close proximity to the project area however six overlapping firing areas were located in the Humber estuary and may impact on the cable route corridor. Unexploded munitions from these ranges which come to rest on the seabed can migrate significant distances due to currents, tides and fishing activities. As a consequence, it is conceivable that items of ordnance from these ranges and Naval training activities may have moved offshore into the Project Two area.

7.5.13 Many vessels (both Military and Merchant Navy/civilian) were sunk during WWI and WWII, predominantly as a result of U-boat activity and offensive/defensive mining. Many of these vessels, particularly those in use by the military and responsible for the transportation of ordnance and live explosives, can still pose a threat to modern-day intrusive works. In general, the risk of munitions contamination is lower in the vicinity of military related wrecks than for dump sites and weapons ranges, since the munitions tend to be enclosed and immobile within the wrecks, and typically unfused during transportation.

7.5.14 Eleven wrecks within the wider Hornsea Zone are labelled ‘dangerous’; of which one is listed as an aircraft. Three submarines are listed and described as ‘non-dangerous’. However, it is possible that these vessels contained UXO when they sank. Two of these submarines were mined in 1915 and are therefore WWI era vessels. There is also one trawler wreck that is recorded sunk by German bombing on 1 June 1940.

7.5.15 Both torpedoes and depth charges were deployed around the UK during WWI and WWII, however not in high numbers. Torpedoes that failed to detonate would sink to the seabed with their warheads intact when they ran out of fuel and several have been recovered from the waters around the UK in recent years. Such devices have the potential to be present within Project Two, however, the risk of encountering unexploded torpedo warheads is not considered to be high as they were commonly deployed in relatively small numbers. Typically, the warheads would contain up to 300 kg of explosives. Depth charges were also used off the coast of England during WWII, but to a much lesser extent than torpedoes.

7.5.16 There are two submarine exercise areas in close proximity to Project Two at the north-east and north-west corners of the wider Hornsea Zone. It is possible that live or inert ordnance related to submarine exercises in these areas could have been fired or migrated into the Project Two boundary. There is also a small naval depth charge exercise area within 3 km of the east edge of the Hornsea
Zone and again the possibility that live depth charges were deployed and have subsequently migrated into the Project Two boundary cannot be discounted.

7.5.17 Following the end of WWII large quantities of surplus munitions needed to be disposed of quickly and safely and, at the time, sea dumping was the only practical method. No charted ammunition dumping grounds were identified within or in close proximity to the Project Two boundary.

7.5.18 The Explosive Risk Assessment for Project One Hornsea Zone (EMU 2012 A2.11.2) concluded that there is a potential risk that the wider Hornsea Zone (including Project Two area) is contaminated with UXO for, the known minefields laid in the area during WWI and WWII and the deployment of torpedoes and depth charges in the area, the historic losses of vessels to mines in the area and the historic modern Army/navy firing ranges in the vicinity of the cable route landfall.

**Data and guidance to inform EIA**

**Data currently obtained**

7.5.19 An Explosive Risk Assessment was conducted for the Hornsea Zone, Project One and the cable route corridor (EMU 2011 A2.11.2 Ordnance). Detailed historical research was carried out to inform this assessment including accessing military records and archived material held in the public domain and in the MoD. Material from the following sources was consulted as part of this study:

- The National Archives, Kew;
- United Kingdom Hydrographic Office (UKHO), Taunton; and
- Open sources such as published books, local historical records and the internet.

7.5.20 This report shall be reviewed and supplemented to ensure full coverage of the revised cable route corridor and project footprint for the Ordnance risk assessment for Project Two.

7.5.21 In addition geophysical surveys have been conducted of the wider Hornsea Zone and cable route corridor which will be supplemented with additional surveys for the revised cable route corridor. The findings of the geophysical surveys shall be used to inform the Explosive Risk Assessment.

7.5.22 There is no specific legislation in the UK regarding the management of UXO with regard to construction activities, however the associated health and safety risks are covered in the following pieces of legislation:

- Health and Safety at Work etc. Act (1974);
- Construction (Design and Management) Regulations 2007;
- Management of Health and Safety at Work Regulations 1999 (as amended); and
7.5.23 Guidance shall also be sought from the following:


**Outstanding data requirements**

7.5.24 The data sources identified above shall be reviewed for any new relevant information for 2011/2012.

7.5.25 Additional geophysical surveys are to be run on the revised cable route corridor in 2012. The exact dates are not known but the data source shall be used to inform the Ordnance assessment for Project Two.

7.5.26 Consultation regarding ordnance shall be conducted with the MOD. In any event that Ordnance UXO is encountered during the Project Two it will be reported to the MCA and managed according to the procedures of the military authorities or the Joint Services Explosive Ordnance Disposal Operation Centre.

**Methods supporting EIA**

7.5.27 An Explosive Risk Assessment was conducted for the Hornsea Zone, Project One; and

7.5.28 An Explosives Risk Assessment shall be carried out for the revised cable route corridor and Project Two footprint. This shall draw on the wealth of information provided in the Project One assessment further desk based research and the geophysical surveys.

7.5.29 The risk assessment methodology will address the following issues:

- The risk that Project Two is contaminated with unexploded ordnance;
- The risk that unexploded ordnance remains on site within Project Two;
- The risk that ordnance may be encountered during the construction, operation and decommissioning of Project Two;
- The risk that ordnance may be initiated; and
- The consequences of initiating or encountering ordnance.

7.5.30 General and, as far as possible, site specific factors will be considered including:

- Military history of the region;
- Official and unofficial munitions dumping sites;
- Official and unofficial weapon ranges;
- Wrecks of Military warships/submarines;
- Wrecks of merchant ships possibly carrying munitions as cargo;
- Defensive or offensive minefields;
- Evidence of aerial bombing; and
• Torpedoes and depth charges.

7.5.31 Since the assessment is based on historical evidence, the accuracy and comprehensiveness of the wartime records is difficult or impossible to verify. As a result conclusions as to the exact location, quantity and nature of the ordnance threat can never be definitive but must be based on the accumulation and careful analysis of all accessible evidence.

7.5.32 The risk assessment and findings there from will be undertaken in consultation with the Ministry of Defence (MoD).

**Potential project impacts**

7.5.33 Typically the impact of the development on the receptor (in this case the ordnance) is assessed. With regards ordnance this would simply be identification of UXO and its removal by detonation. In this case, however, the potential impact of the receptor on the development also needs to be identified.

**Construction phase**

7.5.34 The identified potential impacts of UXO on the construction of Project Two are as follows:

• There is the potential that construction activities could disturb unknown UXO, especially within the cable route corridor. Such an occurrence could lead to significant impacts to the health and safety of construction workers and for damage to construction equipment and vessels.

• With regard to the impacts of encountering or initiating UXO, the initiation of a small item of ordnance such as a small calibre projectile at depth during intrusive works is likely to result in damage to plant and potentially injury to personnel. The initiation of a larger weapon such as a high explosive bomb or sea mine during borehole or piling works could have severe consequences in terms of both damage and loss of life.

• Unlike borehole or piling operations where the initiation of an item of ordnance is likely to be at depth and at distance from operatives, the initiation of even a small item of ordnance during dredging operations for cabling has the potential to be severe

• Potential Impacts from ordnance during construction phase shall be further assessed during the EIA.

**Operation and maintenance phase**

7.5.35 The identified potential impacts of UXO on the operation and maintenance of Project Two are as follows:

• Changes in hydrodynamic regime as a result of the wind turbine foundations and scour protection within Project Two could result in the exposure and remobilisation of previously covered ordnance; and
Potential impacts from ordnance during operation and maintenance phase shall be further assessed during the EIA.

**Decommissioning phase**

7.5.36 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.

7.5.37 Potential Impacts from ordnance during decommissioning phase shall be further assessed during the EIA.

**Potential transboundary impacts**

7.5.38 Potential transboundary impacts resulting from ordnance are unlikely; however the interaction between changes in physical processes and this receptor will be considered within the EIA.

**Potential cumulative impacts**

7.5.39 Potential cumulative impacts resulting from UXO are unlikely.

**Potential inter-related effects**

7.5.40 Potential inter-related effects resulting from ordnance are unlikely; however the interaction between changes in physical processes and this receptor will be considered within the EIA process.

**Potential mitigation and monitoring**

7.5.41 Explosive Ordnance Safety and Awareness Briefings shall be given to all personnel. A specialised briefing is an essential component of the Health & Safety Plan for Project Two and conforms to requirements of CDM Regulations 2007. All personnel working on Project Two shall be instructed on the identification of UXO, actions to be taken to alert site management and to keep people and equipment away from the hazard. Posters and information of a general nature on the UXO threat shall be held in the site office for reference and as a reminder.

7.5.42 The Provision of UXO Site Safety Instructions shall be written instructions containing information detailing actions to be taken in the event that unexploded ordnance is discovered. They are to be retained and will both assist in making a preliminary assessment of a suspect object and provide guidance on the immediate steps to be taken in the event that UXO is believed to have been found.

7.5.43 Prior to installation of project components (piles, foundations cable etc.) a high resolution non-intrusive geophysical survey will be considered to locate seabed anomalies which may be UXO related (such as sea mines and torpedoes) and therefore cause a significant threat to intrusive works associated with the
installation of the wind turbines. Micro-siting of turbines would be considered should UXO be located coincident with proposed turbine locations.

7.6 MARITIME ARCHAEOLOGY AND CULTURAL HERITAGE

Environmental baseline

7.6.1 Project Two lies in an area of potentially high archaeological value within which archaeological and palaeoenvironmental evidence may be preserved, potentially covering the full span of human occupation of the UK from circa 850,000 years ago to the present day.

7.6.2 The archaeological record of the area consists of both known sites that have been identified and/or located, and sites that are thought likely to exist on the basis of current understanding of the history (and prehistory) of the UK.

7.6.3 The marine archaeology of the Project Two area can be divided into three broad categories:

- Submerged prehistoric archaeology;
- Maritime or shipwreck archaeology; and
- Aviation or aircraft archaeology.

7.6.4 Further information is provided regarding the potential for military shipwrecks and military aviation wrecks in Section 7.5.

7.6.5 Archaeological sites and materials can be expected to be more or less randomly spread across the entire project area with the potential for concentrations of sites and materials at locations of more intensive past human activity.
Figure 7.16  Palaeolandsapes.
**Prehistoric archaeology and landscapes**

7.6.6 The seabed of the southern North Sea basin, which encompasses the Project Two footprint, is an important palaeolandscape within north-west Europe (Figure 7.16). As a landscape which at a number of times in the past has been exposed as dry land due to sea level falls driven by climate change, the region probably acted not just as a land bridge between the UK and mainland Europe, but was also inhabited at various stages by hominin\(^\text{17}\) settlers, most recently during the Mesolithic period.

7.6.7 Information provided by sea level change and current archaeological hypotheses suggest that there is the potential for archaeological sites and material in the Project Two area dating to the:

- Lower Palaeolithic during the Cromerian period (circa 700,000 to 478,000 BP);
- Lower Palaeolithic during the Wolstonian period (circa 350,000 to 170,000 BP);
- Middle and Upper Palaeolithic during the Devensian period (circa 40,000 BP to 24,000 BP); and
- Late Upper Palaeolithic and Mesolithic during the Devensian late-glacial and early Holocene periods (circa 13,000 BP to 5,500 BP).

7.6.8 Although no prehistoric remains are currently known from this area, the Offshore Energy SEA (DECC, 2009a) suggests that Mesolithic material, for example, should be expected in and around a large relict lagoon which filled the Outer Silver Pit. The Outer Silver Pit would in the past have dominated the landscape of the southern north sea featuring a significant drainage basin, resources including a lake or marine outlet with an extensive coastline, numerous estuaries and salt marsh (Gaffney et al. 2007). It is a prime location for archaeology and the study of possible maritime resource use.

**Maritime or shipwreck archaeology**

7.6.9 The estimates of the number of maritime losses around the UK coast vary substantially, with an approximate range of between 100,000 and 500,000 wrecks, suggesting the potential for an average of between 8 and 40 wrecks for every mile of coastline. The majority of these wrecks are likely to be located close to the coast with fewer, in relative terms, likely to be found as far out as Project Two.

7.6.10 Any boat remains and shipwrecks within the Project Two area may be expected to range in date from late Mesolithic (circa 8,000 BP), when the area was undergoing marine transgression, to the present. Since the mid-Holocene

\(^{17}\) ‘Hominin’ is used to describe what used to be called a hominid; a creature that is human or a human ancestor. This includes all of the Homo species (Homo sapiens, H. ergaster, H. rudolfensis), all of the Australopithecines (Australopithecus africanus, A. boisei, etc) and other ancient forms like Paranthropus and Ardipithecus.
marine transgression, all human activity in the Project Two area has been
maritime in nature, and any shipwrecks found would reflect the commercial use
(trade and fisheries) and naval importance of the North Sea within the context of
north-western Europe, particularly since the early medieval period.
Figure 7.17  Wrecks within the Project Two area.
Aircraft losses

7.6.11 Thousands of military and civilian aircraft have been lost in UK waters since the advent of powered human flight in the early 20th century. The bulk of these losses occurred during WWII, but aircraft losses at sea span the entire period of aviation history.

7.6.12 Although records of aircraft losses at sea are extensive, they are seldom tied to accurate positions. Aircraft remains on the seabed are also not easily discernible in geophysical surveys. Recently, numerous aircraft wrecks have been discovered during aggregate dredging operations and survey work associated with offshore renewable energy development around the UK (Wessex Archaeology, 2008), and it is increasingly clear that these remains not only survive on the seabed, but are widespread.

7.6.13 All military aircraft crash sites are automatically protected under the Protection of Military Remains Act 1986, and may not be disturbed without a licence; those within the Project Two boundary will be identified and considered during the EIA process.

Data and guidance to inform EIA

7.6.14 An archaeological assessment has been undertaken of the area covered by the maximum extent of the Hornsea Subzone 1 geophysical survey and the cable route corridor (EMU, 2011 Appendix A2.11.1). The geophysical survey of the Hornsea Subzone 1 and the cable route corridor has been completed and has been used to inform this assessment.

7.6.15 The archaeological assessment for the Hornsea Subzone 1 shall be reviewed and referenced where applicable. The assessment shall be undertaken in the following way:

7.6.16 A systematic search will be undertaken of all readily available and relevant historic environment sources and archives. This will include:

- The UKHO Wrecks Database (record of wrecks and obstructions), and a review of cartography, historic charts and sailing directions held by the UKHO;
- Information held by English Heritage on wrecks designated under the terms of the Protection of Wrecks Act 1973;
- Marine archaeological records held in the English Heritage National Monuments Record;
- Ministry of Defence (MOD) - information on protected wreck remains and military losses;
- Records held with the Receiver of Wreck (RoW) (MCA);
- Relevant reports (UK Offshore Energy SEA (DECC, 2009a) and Archaeological Baseline; SEA 5 (DECC, 2009e));
▪ Information and collections held in national and local museums;
▪ Records held with the Archaeology Data Service (ADS);
▪ Marine Environment Data information Network (MEDIN); and
▪ British Geological Survey (BGS) regional guide and previous work in the area.

7.6.17 Other sources will include accessible published sources and grey literature, external marine historic environment specialists, and local dive groups in the area.

7.6.18 Data collected in site specific geophysical and geotechnical surveys will also be used.

7.6.19 In addition to the data sources above, the following stakeholders/bodies will also be consulted:
▪ English Heritage Maritime Team;
▪ Humber Archaeology Partnership;
▪ North East Lincolnshire Council Archaeologist;
▪ Lincolnshire County Archaeologist;
▪ MOD (protected remains and military losses); and
▪ Receiver of Wreck (MCA);

7.6.20 The assessment will be conducted in line with industry best practice and the relevant offshore renewables and marine historic environment guidance, this includes:
▪ DECC (2011) NPS EN-1 Chapter 5.8 Historic Environment;
▪ DECC (2011) NPS En-3 Section 2.6.137 Historic Environment;
▪ COWRIE (2007b) Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore renewable Energy;
▪ Institute for Archaeologists (IfA) (2008) Code of Practice and Standard and Guidance for Archaeological Desk-based Assessment; and


Outstanding data requirements

7.6.21 All of the above data sources shall be reviewed for relevant data updates for 2011/2012.

7.6.22 Geotechnical core log data has been collected from the geotechnical surveys and this will be reviewed for samples collected along the cable route. A further geophysical survey along the cable route has been undertaken in 2012 and this shall be subject to archaeological review in order to confirm the presence of known sites and features and to identify any previously unknown sites, features and artefacts of archaeological interest. The exact data of the survey is not known but the information so obtained shall be used to inform the archaeological baseline for Project Two.

7.6.23 Consultation will continue with English Heritage and the relevant county archaeologists.

Methods supporting EIA

7.6.24 An archaeological assessment has been undertaken of the area covered by the maximum extent of the Hornsea Subzone 1 geophysical survey and the cable route corridor (EMU, 2011 Appendix A2.11.1). This assessment shall be reviewed and referenced where applicable. A further assessment shall be undertaken for Project Two to include those areas outside the Project One boundary.

7.6.25 The archaeological assessment of the potential impacts on the marine historic environment of the development of Project Two will comprise the following elements, which will be used to inform the EIA process:

▪ An archaeological baseline study;
▪ An archaeological review of geophysical data; and
▪ An archaeological review of geotechnical data.

7.6.26 This work will reflect best practice and will be carried out in accordance with the guidance listed above and shall be informed by consultation with English Heritage.

7.6.27 The archaeological baseline study aims to identify all known sites and features of cultural heritage interest within the Project Two boundary. In addition, the baseline study will consider broader regional histories and data to aid in establishing the potential for presence of currently unrecorded archaeological
sites and materials, such as relict submerged landscapes and associated deposits.

7.6.28 The baseline study will consist of a literature review of the available archaeological data sources. The baseline review will include consultation with the stakeholders listed above.

7.6.29 In addition, the geophysical Subzone survey and the geophysical Cable Route Surveys undertaken in 2010 and 2011 have been subject to archaeological review in order to confirm the presence of known sites and features and to identify any previously unknown sites, features and artefacts of archaeological interest. These data will be reviewed and used to inform the EIA for Project Two. Geotechnical core log data has been collected and this will also be reviewed for samples collected along the cable route. A further geophysical survey along the cable route has been undertaken in 2012 and this shall be subject to archaeological review in order to confirm the presence of known sites and features and to identify any previously unknown sites, features and artefacts of archaeological interest.

7.6.30 Drop-down video survey data may also provide information about the nature and extent of targets of cultural heritage interest identified during the geophysical marine survey and review of geotechnical data.

7.6.31 The archaeological baseline study will be used as the basis for the assessment of impacts. Together the project elements outlined above will be used to compile the archaeological EIA for Project Two and propose measures to mitigate any adverse impacts of the development on the archaeological record, including currently unknown sites and material within the area.

7.6.32 The archaeological assessment of impacts will consider the impacts of the direct, indirect, cumulative and inter-relationship impacts of the development on known and potential archaeological receptors. Known sites, features and artefacts will be categorised according to their importance, and thus sensitivity and the magnitude of impacts on these sites and features will be assessed.

7.6.33 Consultation will continue with English Heritage and the relevant county archaeologists regarding the potential impacts within the Hornsea Zone and the most appropriate mitigation measures for Project Two.

Potential project impacts

Construction phase

7.6.34 Construction will have the potential to result in impacts on archaeology and cultural heritage including through:

- Foundation piling and/or drilling;
- Seabed preparation for foundation placement;
- Prelay cable route grapnel runs;
- Ploughing or jetting for cable installation;
- Deployment of jack-up vessel spud feet; and
- Deployment of moorings.

7.6.35 Indirect effects may also arise from post construction seabed scour and deposition of sediment on the seabed arising from foundation drilling and/or seabed dredging.

7.6.36 The potential impacts include damage to archaeological sites, features and artefacts.

7.6.37 Construction related impacts shall be assessed for the footprint of Project Two further during the EIA.

**Operation and maintenance phase**

7.6.38 The identified operational and maintenance activities which have the potential to impact archaeology and cultural heritage include:

- Potential seabed scour around turbine foundations and remedial works on inter-array and export cables; and
- Related changes to the sediment regime within the area resulting from the Project Two development.

7.6.39 Potential impacts shall arise from increased exposure of artefacts. There may also be beneficial impacts, for instance the burial of sites and features by increased sedimentation.

7.6.40 Impacts from operation and maintenance phase shall be assessed further during the EIA.

**Decommissioning phase**

7.6.41 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase but may be reduced in the instance that cables or foundations are left in situ.

**Potential transboundary impacts**

7.6.42 As the Project Two footprint is entirely within UK territorial waters there are no potential transboundary impacts to archaeology and cultural heritage from the Project.

7.6.43 It is proposed that potential Transboundary impacts shall be scoped out of the EIA.

**Potential cumulative impacts**

7.6.44 The greatest cumulative impacts are likely to be associated with Project One and any future projects within the Hornsea Zone, and Humber Gateway and Triton Knoll, being the closest developments to the cable route corridor.
Cumulative impacts will also be considered for those wind farms in the wider area including Westermost Rough, Race Bank, Lincs, Lynn & Inner Dowsing, Docking Shoal, Sheringham Shoal and Dudgeon.

- Cumulative impacts shall also be considered from;
- Future oil and gas exploration (see Section 7.8);
- Cable and pipelines laying (see Section 7.8);
- Commercial fishing (see Section 7.1); and
- Aggregate extraction and dredging (see Section 7.8).

7.6.45 Potential impacts within the Project Two footprint may include the effect of multiple piles through a relict prehistoric landscape surface or deposit. Potential impacts outside the project boundary may include the effects of several developments within the same region on the archaeological record.

7.6.46 Potential cumulative impacts will be assessed during the EIA process.

Potential inter-related effects

7.6.47 There is the potential for the visual impact of the wind farm development (see Section 7.7) to impact on coastal historic assets though this is very unlikely to be significant due to the distance of the development from the shore. This will be assessed during the EIA.

7.6.48 The potential inter-relationship impact between changes in physical processes (Section 1) and marine archaeology (this section) will also be assessed during the EIA.

Potential mitigation and monitoring

7.6.49 There are various mechanisms for mitigating development impacts on the archaeological record. In line with both international and national policies which dictate a presumption in favour of preservation in situ, sites and features of cultural heritage interest within the Project Two area should be subject to as little disturbance as possible. The aim of mitigation measures will thus be to minimise the impact on cultural heritage assets through the appropriate siting of infrastructure and works.

7.6.50 Mitigation measures usually involve avoidance (the implementation of exclusion zones and design alterations), reduction (the introduction of measures to deal with unexpected discoveries during works), or offsetting (excavation and recording of a site before an impact occurs). When a site is excavated and recorded it shall be done according to professional standards to include compilation and deposit of the project archive and publication of results. This process shall be laid out in the ES including the requirement for the developer to produce an OASIS (Online Access to the Index of archaeological investigations) form for any completed and agreed archaeological reports to be deposited with
English Heritage National Monuments Record; along with other opportunities for publication and public dissemination of new information.

7.6.51 The preferred mitigation for archaeological sites is avoidance. To achieve this wind turbines and cables may be micro-sited to avoid identified sites and exclusion zones implemented, within which no construction activities may take place. The implementation of mitigation measures may be managed and monitored through a formal archaeological mitigation strategy, agreed with English Heritage and the relevant Local Authority Archaeologist, and often referred to as a Written Scheme of Investigation (WSI).

7.6.52 The procedures for reporting and dealing with unexpected archaeological discoveries made during construction will be set out in an appropriate protocol as part of the development of mitigation measures for the project.

7.7 LANDSCAPE, SEASCAPE AND VISUAL AMENITY

Environmental baseline

7.7.1 The Project Two boundary lies approximately 89 km from the coastline at its closest point. In the area of the North Sea around Project Two, there are limited existing features at or above the sea’s surface, and these are mainly limited to offshore gas platforms. However, for the purposes of the Project Two assessment we would adopt a future baseline scenario which assumes that the Project One array has already been constructed.

Data and Information to Inform EIA

7.7.2 The following data sources will be used to inform the offshore assessment of seascape and visual impacts:

- Admiralty Chart data;
- Information about weather conditions from the Met Office;
- Zone of theoretical visibility (ZTV) maps plotted for the proposed development;
- English Heritage Historic Seascape Broad Character Types (http://www.english-heritage.org.uk/professional/research/landscapes-and-areas/characterisation/historic-seascape-character/);
- National planning policy, in terms of policies which are relevant to seascape or visual impacts; and
- Information about the proposed development and the construction process which can be made available.

Relevant Guidance

7.7.3 Relevant guidance, which will be followed, is listed below:

- Landscape Institute:
• Landscape Institute (2009) Advice Note 01/11. Photography and Photomontage in Landscape and Visual Impact Assessment; and

• Landscape Institute and the Institute of Environmental Management and Assessment (2002). Guidelines for Landscape and Visual Impact Assessment. The third edition of this guidance is due to be published in 2012/2013, and depending on actual publication date relative to the planning submission date, this would be substituted for the second edition;

• Department of Energy and Climate Change (DECC) and Department of Trade and Industry (DTI):
  • DTI (2000). Cumulative Effects of Wind Turbines; A Guide to Assessing the Cumulative Effects of Wind Energy Development; and

• Natural England:
  • Countryside Agency and SNH (2003). Landscape Character Assessment Series Topic Paper 9: Climate change and natural forces, the consequences for landscape character;
  • Countryside Agency and SNH (2002). Landscape Character Assessment Guidance for England and Scotland; and

• Scottish Natural Heritage:
  • University of Newcastle (2002). Visual Assessment of Wind Farms Best Practice;
  • SNH (2005). Cumulative Effects of Wind Farms;
  • SNH (2006). Visual Representation of Wind Farms Good Practice Guidance; and
  • SNH (2009). Siting and Designing Wind Farms in the Landscape.

• Countryside Council for Wales:
Methods supporting EIA

7.7.4 To assess the impact of the proposed turbines and offshore infrastructure for Project Two on seascapes and views, a study area with a radius of 50 km from the edge of the proposed turbines would be considered due to the proposed height of the turbines. This SVIA study area is considered to be the maximum radius within which a significant effect could occur given the height of the proposed wind turbines. The study area is not intended to provide a boundary beyond which the operational Project Two cannot be seen, but rather to define the area within which Project Two may have a significant seascape or visual effect.

7.7.5 The location of Project Two is approximately 89 km from the nearest coastline. At this distance, due to the curvature of the earth, the turbines and associated offshore substations would not be visible from the vast majority of the coastline and inland locations (see Figure 7.18).

7.7.6 However, the preliminary ZTV of the blade tip height also indicates that there would be discrete areas of higher land onshore from where there would be theoretical views of the blade tips (but not of the hubs and turbine towers). Typically these limited areas are more than 100km from the closest turbines. At this distance, it is considered that the blade tips are likely to be barely perceptible, if at all.

7.7.7 The SNH Visual Representation of Wind Farms Good Practice Guidance (2006) states the following:

7.7.8 “... it is important to understand that visibility of turbine blades and turbine towers differs. At close distances, turbine blades often seem more noticeable than the towers due to their movement; while at far distances, the turbine towers are usually more prominent because of their greater mass, and may actually be the only element visible at very great distances. ...” (Paragraph 62).

7.7.9 The DTI Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report (2005) states the following:

7.7.10 “…For an observer on the beach, turbine blades theoretically become visible at distances of 45 – 53 km, although in reality the acuity of the human eye to distinguish blade tips at this distance is highly debatable. It is more likely that as nacelles, tops of towers and full rotor blades of turbines become visible over the horizon at distances of around 30-35 km, that there is potential for significant effects on visual amenity to occur. This is considered to be the outer limit of potentially significant effects. ....” (Section 7.5)

7.7.11 Given the substantial distances (more than 100 km) between the onshore locations from where there are theoretical views of the blade tips only, the assessment of impacts on landscape character, designated landscapes and onshore views resulting from the Project Two turbines can be scoped out of the offshore SVIA.
7.7.12 An HVAC reactive compensation substation may be located at a yet undefined point along the proposed cable corridor. Depending on its final location and dimensions, it may be appropriate to define a separate study area for the HVAC reactive compensation substation.

7.7.13 The ES would consider the potential for onshore views of the HVAC reactive compensation substation, depending on its final location and dimensions.

7.7.14 The construction impacts of near shore cable laying and landing would be considered as part of the Onshore LVIA. Both the onshore LVIA and the offshore SVIA would be based on similar methodologies to ensure a consistency of approach to assessment.

7.7.15 The impact of proposed turbines and associated offshore substations within Project Two on seascapes and offshore views will be assessed using a 50 km radius study area as significant seascape and visual effects are considered to be unlikely to occur beyond this distance. Locations within this study area will be assessed to examine impacts on seascape and visual receptors. Existing seascape infrastructure and development which may be already present, such as gas platforms, will be considered as part of the existing baseline conditions. Ferry routes, shipping lanes and inhabited rigs will be taken into consideration as potential visual receptors.

**Current Seascape Character**

7.7.16 English Heritage commissioned the Museum of London Archaeological Service (MoLAS) to prepare a pilot study Historic Seascape Characterisation for an area between Withernsea in Yorkshire and Skegness in Lincolnshire, which was published in 2009 [Museum of London Archaeology June 2009]. The study area extended into open sea as far as the median line between the UK and the Netherlands. The Historic Seascapes project looked extensively at many different factors before deriving its Broad Character Types and its more detailed Historic Seascape Character Areas. These factors included historic subsea features (such as palaeo-landscapes, wrecks and other historic features) as well as present day activities (such as fishing, the oil and gas industries and military activities). These subsea historic features are not considered to be relevant to an assessment of the current seascape character effects of Project Two experienced at or above sea level. It is therefore proposed that the seascape assessment for Project Two would consider only the effects at or above sea level on the Present Day Form, Sea Use: Present and Character Perceptions of the Broad Character Type level. It would also include changes to broad seascape character due to Project One. Consideration of the effects on the subsea components would be provided in the Historic Environment chapter.

**Visual Effects**

7.7.17 Climatic and atmospheric conditions will be taken into account within the assessment of likely visual impacts. The approach will consider the visual
significance limits recommended to apply to offshore wind farms. The distances quoted in the DTI (2005b). Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report, together with the predicted level of significance of visual impacts, are:

- <13 km – possible major visual impact;
- 13-24 km – possible moderate visual impact, and
- >24 km – possible minor visual impact.

7.7.18 It is recognised that this varies according to the nature of the proposed site, the weather conditions, and to the technology proposed, in particular the height and size of the turbines.

7.7.19 The potential for night time effects of proposed aviation and navigation lighting will be considered as part of the ES.


7.7.21 The work will be informed and illustrated through the preparation of Zones of Theoretical Visibility (ZTVs), noting that the curvature of the earth is taken to be the limit of the ZTV for the purpose of the modelling exercise, and that it is recognised that atmospheric haze and the diminishing of visibility due to distance will reduce this to about 50 km radius from the nearest turbine. ZTVs will be modelled to show the extent of theoretical visibility of both the tips and hubs of the proposed turbines across the 50 km radius study area. Separate ZTVs would be prepared for the HVAC reactive compensation substation, depending on final location and dimensions. These ZTVs will be produced in accordance with SNH (2006) Visual Representation of Wind Farms Good Practice Guidance.

7.7.22 Alongside the ZTVs, a series of maps will be produced showing the distribution of Broad Seascape Character Types (English Heritage), and the location of viewpoints and other sensitive receptors in relation to the ZTV. These maps will inform the assessment of potential impacts upon these areas.

7.7.23 Key visual receptors are likely to include:

- People following the cruising routes identified by the Royal Yachting Association (RYA);
- Passengers and workers on board commercial ferries or cruise liners;
- People at their place of work on passing cargo, tanker or other commercial vessels;
- People at their place of work on static gas platforms or travelling to the platforms;
- People at their place of work on commercial fishing vessels;
- People at their place of work on aggregate dredging vessels;
- Military personnel using identified Military Practice Areas; and,
- Other marine users (e.g. ecologists).

7.7.24 The visual effects will be illustrated by generating wireframes of proposed turbines for Project Two from each sample viewpoint. These viewpoints will be used as an assessment tool in order to inform examination and description of impacts upon offshore visual amenity and views. Up to five locations will be examined.

7.7.25 Potential viewpoint locations would include:

- Newcastle Upon Tyne to Amsterdam cruise ferry and other ferry routes if they fall within the study area;
- Royal Yachting Association cruising routes;
- Shipping routes; and
- Offshore rigs.

Potential project impacts

7.7.26 As discussed the distance of Project Two from the British coastline means that there will be no significant impact due to the turbines on onshore landscape or visual receptors. As such the assessment of impacts on landscapes, designated areas and onshore views resulting from the offshore components of Project Two can be scoped out.

Construction Phase

7.7.27 The identified potential impacts on seascapes and visual amenity resulting from the construction of Project Two are as follows:

- During construction there will be short term seascape and visual impacts within the 50km study area from machinery/equipment and activities including assembly of turbines and installation of infrastructure; and,
- Consideration of any onshore/near shore visual effects due to cable laying will be considered as part of the Onshore LV assessment.
Figure 7.18  Zone of Theoretical Visibility of an indicative wind turbine array within the Project Two Subzone area (based on a 325 m turbine blade tip height).
**Operation and Maintenance Phase**

7.7.28 The identified potential impacts on seascapes and visual amenity resulting from the operation and maintenance of Project Two are as follows:

- Visual receptors on passenger ferries, shipping channel routes and other marine uses are likely to experience a change in view for a short period of time. Impacts can be adverse or beneficial, and in some cases may be considered to be neutral; and
- The seascape is likely to experience direct, adverse impacts in Broad Character Types within which the turbines and substations for Project Two are located.

**Decommissioning Phase**

7.7.29 The identified potential impacts on seascapes and visual amenity resulting from the decommissioning of Project Two are likely to reverse those impacts identified for the operation and maintenance phase.

7.7.30 Other impacts are likely to be similar to those reported during construction.

**Potential Transboundary Impacts**

7.7.31 Visual receptors on passenger ferries and shipping channel routes between the UK and non-UK EEZ are likely to experience a change in view for a short period of time. Impacts can be adverse or beneficial, and in some cases may be considered to be neutral.

**Potential Cumulative Impacts**

7.7.32 The potential cumulative effects of Project Two would be considered within the 50 km study area radius for Project Two plus a buffer zone (of varying radius depending on turbine height) for existing and proposed wind farms. The future baseline would already include Project One within the Hornsea Zone. Subsequent Hornsea Zone projects will be considered if/when locations have been determined and are known. Other existing or proposed wind farms within this area of the North Sea include: Dogger Bank Project One; Triton Knoll; Race Bank; Dudgeon; and Sheringham Shoal. The potential for cumulative effects with these wind farms would be considered as part of the SVIA.

**In-combination impacts**

7.7.33 For the in-combination assessment a study area of 50 km from the edge Project Two plus appropriate buffer zones for the structures will be considered. The visual and seascape impacts arising from Project Two will be considered in-combination with other industrial sector developments within the study area, including, the oil and gas industry.
Potential Mitigation and Monitoring

7.7.34 The main form of mitigation available is the layout of the turbines within the array, as well as their extent across Subzone Two. The orientation and design of the layout may reduce the level of significance of impacts, although it is recognised that seabed conditions, shipping routes and physical process such as tidal currents, wave and wind climate will be a key consideration in determining the layout.

7.7.35 The proposed colour and lighting of the turbines and any ancillary structures are subject to international navigation and aviation standards, and as such cannot form part of proposed mitigation measures.

7.8 INFRASTRUCTURE AND OTHER MARINE USERS

Environmental baseline

7.8.1 This section presents the existing marine infrastructure and other marine users with the potential to interact with Project Two. The topics considered include:

- Recreational activities (including sailing and motor cruising, kite surfing, windsurfing, sea/surf kayaking and canoeing, diving and recreational fishing);
- Other offshore wind farms;
- Other marine renewable energy projects;
- Offshore cables (including telecommunications);
- Oil and gas (including pipelines);
- Carbon capture and storage;
- Natural gas storage;
- Coal gasification;
- Marine Aggregate Extraction Areas; and
- Waste disposal and dumping sites.

Recreational activities

7.8.2 Sailing and motor cruising - Offshore sailing is considered in the shipping and navigation section (Section 7.2). This Section considers near shore sailing. The landward end of the cable route corridor overlaps with an RYA listed sailing area and racing area as shown in Figure 7.19. These areas cover the final 16 km of the cable corridor as it approaches landfall. There is one RYA affiliated club Saltfleet Haven Boat Club located 12 km south of the cable route. The Humber Mouth Yacht Club and Humber Mouth Sailing School are located 3.6 km north of the cable landfall. Figure 7.19 shows that RYA cruising routes cross the cable route corridor in eight locations.
7.8.3 **Kite surfing** - Cleethorpes Kite surf club is located 2 km north of the location where the cable makes landfall (kitebeaches.com 2011). It is likely that some kite surfers will venture down into the proposed cable route corridor area.

7.8.4 **Surfing** - Surfing may only take place near shore in the surf zone, and is therefore only potentially able to occur at the very near shore end of the cable route. A Lincolnshire surf club uses surfing locations to the south of the cable route at Sandilands near Sutton (Extreme Horizon ltd).

7.8.5 **Windsurfing** - Windsurfing is confined to the near shore surf zone. Cleethorpes windsurfing club operates from facilities 5 km north of the cable route corridor and it is possible that windsurfers could venture into the near shore cable corridor.

7.8.6 **Sea kayaking and canoeing** - There are no kayaking or canoeing clubs in the vicinity registered with Canoe England or the British Canoe Union. Sea kayaking or canoeing may take place in the inshore region of the cable route corridor.

7.8.7 **Diving** - Diving in the area is mainly associated with wreck diving. There are several popular dive sites in the vicinity of Project Two however none are within the Project Two footprint or along the cable route as shown in Figure 7.20.

7.8.8 **Recreational fishing** - There is the potential for interaction with recreational fishing, including both beach angling and charter vessel activity within the cable route corridor. Therefore, and further assessment will be undertaken made in the EIA.
Figure 7.19    RYA UK sailing areas, racing areas and cruising routes.
Figure 7.20  Dive sites in the vicinity of Project Two.
Offshore wind farms

7.8.9 Wind farms in the region surrounding Project Two are shown in Figure 7.21 and listed in Table 7.1. The status of the wind farms is as of May 2012. The closest wind farm to Project Two is the Project One Hornsea Zone wind farm which is in development.

Table 7.1 UK offshore wind farms in the southern North Sea.

<table>
<thead>
<tr>
<th>Offshore Wind Farm Site Name</th>
<th>The Crown Estate Leasing Round</th>
<th>Capacity (MW)</th>
<th>Status (October 2012)</th>
<th>Distance to Hornsea Zone (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogger Bank Zone Tranche A / Project One</td>
<td>3</td>
<td>9000</td>
<td>In development</td>
<td>31</td>
</tr>
<tr>
<td>East Anglia Zone (East Anglia ONE)</td>
<td>3</td>
<td>7200</td>
<td>In development</td>
<td>102</td>
</tr>
<tr>
<td>Hornsea Zone (Project One)</td>
<td>3</td>
<td>4000</td>
<td>In development</td>
<td>0</td>
</tr>
<tr>
<td>Triton Knoll</td>
<td>2</td>
<td>1200</td>
<td>Submitted</td>
<td>49</td>
</tr>
<tr>
<td>Galloper</td>
<td>2.5</td>
<td>504</td>
<td>Submitted</td>
<td>205</td>
</tr>
<tr>
<td>Blythe Demonstration site</td>
<td>Demo</td>
<td>99.9</td>
<td>Submitted</td>
<td>217</td>
</tr>
<tr>
<td>Dudgeon</td>
<td>2</td>
<td>560</td>
<td>Submitted</td>
<td>62</td>
</tr>
<tr>
<td>Race Bank</td>
<td>2</td>
<td>620</td>
<td>Approved</td>
<td>78</td>
</tr>
<tr>
<td>Westernmost Rough</td>
<td>2</td>
<td>240</td>
<td>Approved</td>
<td>81</td>
</tr>
<tr>
<td>Humber Gateway</td>
<td>2</td>
<td>219</td>
<td>Approved</td>
<td>75</td>
</tr>
<tr>
<td>Greater Gabbard</td>
<td>2</td>
<td>504</td>
<td>Operational</td>
<td>207</td>
</tr>
<tr>
<td>Sheringham Shoal</td>
<td>2</td>
<td>316.8</td>
<td>Under Construction</td>
<td>78</td>
</tr>
<tr>
<td>Lincs</td>
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<td>270</td>
<td>Under Construction</td>
<td>90</td>
</tr>
<tr>
<td>Lynn &amp; Inner Dowsing</td>
<td>1</td>
<td>194.4</td>
<td>Operational</td>
<td>95</td>
</tr>
<tr>
<td>Scroby Sands</td>
<td>1</td>
<td>60</td>
<td>Operational</td>
<td>130</td>
</tr>
<tr>
<td>Blyth offshore</td>
<td>Pilot</td>
<td>4</td>
<td>Operational</td>
<td>227</td>
</tr>
</tbody>
</table>
Figure 7.21 Offshore wind farms within the vicinity of Project Two.
Figure 7.22  Offshore cable routes both active and out of service in the vicinity of Project Two.
Other marine renewable installations

7.8.10 There are no marine renewable energy installations within the Project Two main site or cable corridor. The closest development is the Pulse Tidal Scheme located on the south bank of the Humber estuary.

Offshore cables

7.8.11 There are no offshore cables (both active or out of service) within the boundaries of Project Two. The nearest cable to the project area is NorSea Com 1 telecommunications cable which runs north south over 8 km east of the project area (see Figure 7.22).

7.8.12 The Project Two cable route corridor crosses one cable which is a power line connecting two offshore platforms, Amethyst B1d to Amethyst A2d approximately 55 km from the landfall. The power line sites approximately 50 m west of several gas pipelines that connect two offshore gas installations the Amethyst field (operated by BP Exploration Operation Company Ltd) (see Figure 7.22).

Future offshore cable routes

7.8.13 Future possible cable routes in the North Sea and potentially within the Hornsea Zone include those created as part of a European offshore supergrid. This will consist of an integrated cross border grid network creating a flexible network that bypasses existing grid bottlenecks. No formal plans or cable routes have been submitted as yet but progress on these projects shall be followed during the EIA as they could result in both constraints and connection opportunities with Project Two.

Oil and gas

7.8.14 Typical of the southern North Sea, the Project Two encompasses areas of gas exploration and development rather than oil developments.

Gas fields

7.8.15 There are 23 gas fields within the wider Hornsea Zone however no gas fields directly within the footprint of Project Two as shown in Figure 7.23. The proposed cable route passes through a number of gas fields, which are listed in Table 7.2 below.
Figure 7.23  Hydrocarbon fields within and surrounding Project Two.
### Table 7.2 Hydrocarbon fields within proximity of Project Two.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Type</th>
<th>Status</th>
<th>Discovery date</th>
<th>Discovery well</th>
<th>Production date</th>
<th>Determined status</th>
<th>Operator</th>
<th>Licence</th>
</tr>
</thead>
<tbody>
<tr>
<td>47/15b-5</td>
<td>Gas</td>
<td>Discovery</td>
<td>2001/03</td>
<td>47/15b-5</td>
<td>N/A</td>
<td>Not determined</td>
<td>Hydrocarbon Resources Ltd (subsidiary of Centrica plc.)</td>
<td>P776</td>
</tr>
<tr>
<td>Amethyst east</td>
<td>Gas</td>
<td>Producing</td>
<td>1972/10</td>
<td>47/14a-1</td>
<td>1990/09</td>
<td>Determined</td>
<td>BP Exploration Operating Company Ltd</td>
<td>P003</td>
</tr>
<tr>
<td>Amethyst west</td>
<td>Gas</td>
<td>Producing</td>
<td>1970/04</td>
<td>47/13-1</td>
<td>1992/07</td>
<td>Determined</td>
<td>BP Exploration Operating Company Ltd</td>
<td>P005</td>
</tr>
<tr>
<td>Mimas</td>
<td>Gas</td>
<td>Producing</td>
<td>1989/05</td>
<td>48/09-2</td>
<td>2007/06</td>
<td>Determined</td>
<td>ConocoPhillips (UK) Ltd</td>
<td>P459</td>
</tr>
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<td>Newsham</td>
<td>Gas</td>
<td>Producing</td>
<td>1989/10</td>
<td>48/07a-9</td>
<td>1996/09</td>
<td>Determined</td>
<td>BP Exploration Operating Company Ltd</td>
<td>P001</td>
</tr>
<tr>
<td>Rose</td>
<td>Gas</td>
<td>Production Suspended</td>
<td>1998/03</td>
<td>47/10-6</td>
<td>2004/01</td>
<td>Determined</td>
<td>Hydrocarbon Resources Ltd (subsidiary of Centrica plc.)</td>
<td>P776</td>
</tr>
<tr>
<td>Juliet</td>
<td>Gas</td>
<td>Discovery</td>
<td>2008</td>
<td>47/14b-10</td>
<td>N/A</td>
<td>Not determined</td>
<td>GdF Suez E&amp;P UK Ltd</td>
<td>P614</td>
</tr>
<tr>
<td>Pickerill</td>
<td>Gas</td>
<td>Producing</td>
<td>1984/12</td>
<td>48/11b-4</td>
<td>1992/08</td>
<td>Determined</td>
<td>Perenco UK Ltd</td>
<td>P037</td>
</tr>
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<td>Hoton</td>
<td>Gas</td>
<td>Producing</td>
<td>1989/10</td>
<td>48/07b-8</td>
<td>2001/12</td>
<td>Determined</td>
<td>BP Exploration Operating Company Ltd</td>
<td>P001</td>
</tr>
<tr>
<td>Seven Seas</td>
<td>Gas</td>
<td>Under development</td>
<td>1991/05</td>
<td>48/7c-11</td>
<td>N/A</td>
<td>Determined</td>
<td>Hydrocarbon Resources Ltd (subsidiary of Centrica plc)</td>
<td>P1354</td>
</tr>
<tr>
<td>West sole</td>
<td>Gas</td>
<td>Producing</td>
<td>1965/12</td>
<td>48/06-1</td>
<td>1967/03</td>
<td>Determined</td>
<td>BP Exploration Operating Company Ltd</td>
<td>P001</td>
</tr>
</tbody>
</table>

**Subsurface and surface infrastructure**

7.8.16 The recovery of oil and gas from the subsea environment involves the use of many seabed structures including protective structures, pipe junctions, manifolds, wellheads, tress and values. Subsurface gas infrastructure is shown in Figure 7.24.
Figure 7.24   Subsurface and surface structures in the Project Two study area.
7.8.17 There are no identified surface or subsurface structures within the Project Two site boundary. There are a total of eight identified subsurface structures along the cable route corridor. The exact identification of each will be investigated further during the EIA. Several surface structures do occur in the vicinity of Project Two including both manned and unmanned platforms and four unmanned platforms along the pipeline/cable corridor.

**Pipelines**

7.8.18 Pipelines in the project area are shown in Figure 7.25. There are four pipelines which cross the Project Two area including:

- PL1570 Shearwater to Bacton (Seal)" - 34 inch Gas Line;
- “PL253 Esmond to Bacton” – 24 inch Gas Export Line;
- PL929 “Theddlethorpe to Murdoch MD” - 26 inch Gas Line; and
- PL9230 “Theddlethorpe to Murdoch MD MEOH Line – 4 inch methanol line bundled to PL929.

7.8.19 A detailed assessment of the pipelines that are crossed by the cable route will be included in the EIA.

**Wells**

7.8.20 Wells are classified into 4 categories, which include:

- Completed wells. These are wells that have been drilled and completed and are ready for production (or injection).
- Drilling wells. These are wells which are in the process of being drilled for exploration, appraisal or production purposes.
- Plugged and abandoned wells. These are wells which are or have become, non-commercially viable and are closed by plugging with a cement plug and recoverable equipment removed.
- Suspended wells. These are wells which are temporarily abandoned, in that they may be used again at a later date. They are plugged but a guide base is left on the sea bed to facilitate re-entry.

7.8.21 The location of various types of wells (completed, drilling, abandoned and suspended) in and around Project Two is shown in Figure 7.26.

**Licence blocks**

7.8.22 Licences for the exploration and extraction of oil and gas in the UK are granted by DECC for identified quadrant blocks in consecutive licensing rounds, the most recent being the 27th licensing round (submissions 1 May 2012). The outcome of this round will not be known until November 2012. The current licences in blocks within Project Two are shown in Table 7.3 and Figure 7.27. The licence blocks under offer for the 27th round are also shown in Figure 7.27.
Figure 7.25 Pipelines located within the study area.
Figure 7.26  Wells located within Project Two area.
Figure 7.27  Hydrocarbon license blocks within Zone area.
Table 7.3  
Showing licence holders (extant) in blocks within the Project Two area.

<table>
<thead>
<tr>
<th>Block</th>
<th>Licence</th>
<th>Operator</th>
<th>Date</th>
<th>Acreage (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48/3</td>
<td>P1245 Production – Promote</td>
<td>Venture North Sea Gas Ltd</td>
<td>2004-2030</td>
<td>422.6</td>
</tr>
<tr>
<td>48/3</td>
<td>P1595 Production – Traditional</td>
<td>E.ON Ruhrgas UK EU Ltd</td>
<td>2009-2035</td>
<td>211.3</td>
</tr>
<tr>
<td>48/4</td>
<td>P25 Production</td>
<td>Perenco UK Ltd</td>
<td>1964-</td>
<td>1727.6</td>
</tr>
<tr>
<td>48/4</td>
<td>P1245 (as above)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48/5</td>
<td>P25 (as above)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49/1</td>
<td>P520 Production</td>
<td>RWE DEA UK SNS Ltd</td>
<td>2085-2021</td>
<td>243.8</td>
</tr>
</tbody>
</table>

**Current activity**

7.8.23 Activities that may potentially occur in the Project Two and cable route corridor include seismic surveying exploration and appraisal drilling, production operations and decommissioning activities. The location and timing of any such programmes need to be understood in detail and further assessment shall be undertaken as part of the EIA. This shall be achieved through consultation with the Crown Estates, DECC, and through consultation with the relevant operators.

7.8.24 The potential interactions with oil and gas activities and Project Two that will be considered within the EIA include construction activities temporarily blocking access to subsea pipelines and cables, the physical presence of the project reducing areas available for exploratory and development activities, and under water noise disturbing seismic data acquisition, (discussed in Section 5.3) and interaction with support service requirements from both vessels (see Section 7.2) and helicopters (see Section 7.3).

**Carbon capture and storage**

7.8.25 At the present time there is no proposed carbon capture and storage (CCS) development with the Project Two area. As CCS could use the same infrastructure and locations as existing gas extraction there is the potential for similar interactions with CCS in the Hornsea Zone as there is for gas extraction. Discussions have taken place between SMart Wind and developers with an interest in potential aquifer lease areas in the wider zone. This consultation will continue and will be assessed regarding the potential interaction with Project Two and to inform the EIA.

**Natural gas storage**

7.8.26 At the present time there is no proposed natural gas storage within the Project Two area. Natural gas storage is likely to utilise the same infrastructure as oil
and gas and therefore the interaction with offshore wind is considered to be similar. Any further developments within this area with regard to Project Two area will be addressed within the EIA.

**Coal gasification**

7.8.27 There is currently one Underground Coal Gasification (UCG) licence in the Humber held by clean coal and two UCG applications areas onshore from the Hornsea Zone as shown in Figure 7.28. BGS (2006) shows there to be extensive coal at a depth of over 1200 m within the Hornsea Zone however this depth was previously considered too deep for UCG by the DTI (2004). However with future technological developments this area of UCG could become commercially viable and developments in this area will continue to be assessed during the EIA.
Figure 7.28 Underground coal gasification in the licence process.
Figure 7.29  Location of aggregate extraction areas within the vicinity of Project Two.
Figure 7.30 Waste disposal sites in the vicinity of Project Two.
Marine aggregate extraction areas

7.8.28 There are no marine aggregate licences or application areas within the proposed offshore footprint of Project Two although there are several within close proximity to the cable corridor as shown in Figure 7.29.

7.8.29 Licence Area 105, operated by CEMEX, is the only active marine aggregate area that the cable route corridor intersects. The proposed route passes through the south east corner of Area 105. The total size of Area 105 is approximately 164 km squared and the area of the corridor that overlaps with this is 1.5 km squared, representing under 1% of the total size of the area. There is no overlap with the existing active dredge zones (ADZ) within Area 105 which are located approximately 9.2 km and 14.4 km to the north west of the corridor.

7.8.30 There are a number of indicative dredger routes that intersect with Project Two (offshore area and cable route) as shown in Figure 7.29. The dredger routes shall be considered further within the EIA as part of Shipping and Navigation assessment.

Waste disposal and dumping grounds

7.8.31 There are no known waste disposal sites within Project Two as shown in Figure 7.30. There is one historic disposal site, Spurn Head, which overlaps with the cable route corridor. Spurn Head (HU100) is a closed disposal site which lies 21 km from the coast and 31 km from the cable landfall along the cable route corridor. The site was closed in 1997 following the disposal of 1,401,000 tonnes of sewage sludge.

7.8.32 Since 1994, the dumping at sea of most forms of industrial waste has been prohibited, with the disposal of sewage sludge phased out in 1998. Dredged waste from excavated ports and navigation channels now forms the majority of the remaining material eligible for disposal at sea.

7.8.33 The Bull Sand Fort (HU111) and Bull Sand Fort Extension (HU109) are two of six approved dump sites for dredged material. The material is being extracted from seven locations around the Humber estuary. The sites lie within the cable corridor as shown in Figure 7.30.

7.8.34 Chemical weapons and munitions have been dumped at sea since the end of WWI. The UK Offshore Energy SEA does not report any chemical munitions disposal sites in the Regional Sea encompassing the Hornsea Zone and the Project Two boundary. Admiralty charts 1187, 1190 and 1191 were also consulted as part of this report and do not indicate any charted ammunition dumping grounds within or in close proximity to the Project Two Boundary. UXO is discussed further in Section 7.5.
Data and guidance to inform EIA

Data currently obtained

7.8.35 The following list identifies key guidance, information and data sources that will inform the assessment of infrastructure and other marine users assessment within the EIA:

- The Crown Estate - various data on marine aggregate extraction activity in UK waters). Available online at: http://www.thecrownestate.co.uk/dredge_areas_statistics;
- The RYAs Position on offshore renewable energy developments: Paper 1 (of 3) (RYA, 2012);
- DTI (2002a). Human Activities in the SEA 3 Area;
- SeaZone (2010). GIS PEXA areas and offshore munitions disposal sites;
- The UK Cable Protection Committee (UKCPC) guidelines for proximity of wind farm developments and offshore cables (UKCPC, 2010);
- DECC website (http://www.decc.gov.uk/);
- Oil and Gas UK website (http://www.oilandgasuk.co.uk/); and
- UKDEAL website (https://www.ukdeal.co.uk/dp/jsp/PleaseLoginDeal.jsp).

Outstanding data requirements

7.8.36 The above data sources shall be reviewed for relevant up to date data from 2011/2012.

Methods supporting EIA

7.8.37 Key to the assessment of impacts on other marine users will be detailed consultation with relevant stakeholders to inform the EIA. Consultation will include the RYA, CA and the local sailing clubs as identified; Associated Petroleum terminals Ltd (ATP), British Dredging Ltd (CEMEX), British Marine Aggregates Producers Association, British Marine Federation, British Pipelines
Potential project impacts

7.8.38 A significant portion of impacts associated with infrastructure and other marine users are in regard to vessel movements. All such related impacts are discussed in Section 7.8.

Construction phase

7.8.39 The identified potential impacts on infrastructure and other marine users resulting from the construction of Project Two are as follows:

- Cable installation activities along the export cable route may impact on recreational activities, via increased collision risk between leisure and water sports craft and construction vessels / plant and the temporary displacement of activities from areas during the construction phase; and
- Cable installation resulting in impacts on existing oil and gas pipelines and infrastructure (mainly via cable crossings).

Operation and maintenance phase

7.8.40 The identified potential impacts on infrastructure and other marine users resulting from the operation and maintenance of Project Two are as follows:

- Potential changes to seabed composition, bathymetry and hydrodynamics by increased scour from presence of the wind turbine foundations, leading to potential effects on marine aggregate extraction;
- The physical presence of Project Two may impact on the future exploration for oil and gas within its footprint by restricting future seismic surveys, exploration drilling and development activities; and
- The physical presence of Project Two and the effect cable corridor may have on the future exploitation of gas fields or other underground resources and have implications for the possible future use of depleted gas fields for natural gas storage or CCS projects.

Decommissioning phase

7.8.41 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.
Potential transboundary impacts

7.8.42 There are no transboundary impacts anticipated for infrastructure and other marine users.

Potential cumulative impacts

7.8.43 Given the proximity of Project Two with the Hornsea, Dogger Bank and East Anglia Round 3 Zones, together with a number of Round 1 and 2 wind farms in the area (operation, in construction or due to be constructed) there is the potential for cumulative impacts to occur. These will be assessed during the EIA process. Particular attention will be given to impacts on recreational sailing including loss of recreational areas, wind effects from the turbines on racing, dredging and use of ports and harbours for construction, operation and maintenance works.

Potential inter-related effects

7.8.44 Inter-related impacts that will be assessed during the EIA include those between infrastructure and other marine users including the inter relationship between navigation and shipping (Section 7.2) aviation (Section 7.3) radar (Section 7.4) commercial fishing (Section) underwater noise (Section 7.8) and socioeconomic impacts (Section 8.10).

Potential mitigation and monitoring

7.8.45 Potential mitigation measures to reduce significance of impacts of Project Two on other marine users and infrastructure include use of formal legal agreements for cable crossings, use of NTM’s to advice other users of construction activity, use of rolling Safety Zones rather than fixed exclusion zones and on-going consultation and liaison with other users potentially affected during the construction and operational phases of Project Two.
8  ONSHORE ENVIRONMENT

8.1  INTRODUCTION

8.1.1 The locations of the onshore components of Project Two are largely determined by the locations of the Project One components. Routing the cable for Project Two adjacent to that for Project One will minimise overall environmental impacts. However, there is scope for minor deviations between the Project One and Project Two routes. These will be determined through the EIA and consultation processes commencing with this scoping exercise. The location of the onshore grid connection point is fixed by the connection agreement entered into with NGET. The onshore environment is defined for the purposes of this scoping report as all land and foreshore above the Mean High Water Spring (MHWS) mark. The onshore boundary of Project Two is shown in Figure 8.1.

8.1.2 The key constraints pertaining to the Onshore Environment include:

- Geology, soils, agriculture and land use;
- Water resources;
- Air quality and health;
- Ecology and nature conservation;
- Historic Environment;
- Landscape and visual resources;
- Flood risk;
- Traffic and transport;
- Noise and vibration; and
- Socioeconomics, recreation and tourism.

8.1.3 These issues are discussed in the following sections.

8.1.4 Specific impacts have been scoped out of the environmental assessment for Project Two. These are presented, along with the justification for their omission, in a table in Section 11.

8.1.5 No transboundary impacts are anticipated onshore and it is therefore proposed that these should be scoped out of the onshore assessment.
Figure 8.1  Key onshore environmental constraints.
8.2 GEOLOGY, SOILS, AGRICULTURE AND LAND USE

Environmental baseline

8.2.1 Agricultural land quality south of the Humber is dominated by Grade 3 land, with some bands of Grade 2 agricultural land. An area of Grade 1 agricultural land is situated close to the mouth of the Humber, to the north of the village of North Somercotes. The large urban area of Grimsby lies on the edge of the Humber Estuary, to the north of which is the industrialised area of Immingham Docks.

8.2.2 Kirmington Pits, a geological SSSI, lies approximately 8 km to the southwest of Grimsby. The site, one of the most important Quaternary sites in eastern England, contains a complex sequence of glacial and interglacial deposits up to 30 m thick within a buried channel.

8.2.3 The bedrock underlying the project is chalk, overlain by superficial deposits. The chalk is a principal groundwater aquifer, while perched groundwater may be present in the superficial deposits along parts of the cable route.

Data and guidance to Inform EIA

Data currently obtained

8.2.4 The following data sources have been reviewed to inform the assessment process:

- Ordnance Survey (Southampton, 1983) Soil Survey of England and Wales;
- Agricultural Land Classification of England 1:250,000 (Defra, accessed via www.magic.gov.uk);
- Ordnance survey maps;
- British Geological Survey 1:50,000 scale geological map (England and Wales, Bedrock and Superficial Deposits); and
- Details of Geological Sites of Special Scientific Interest and Regionally Important Geological and Geomorphological Sites (Natural England).

Outstanding data requirements

8.2.5 The data identified above shall be reviewed for relevant new data.

Method supporting EIA

8.2.6 The presence of best and most versatile land (including soil resource issues) is important when considering the sustainability of development proposals as set out in paragraph 28 of Planning Policy Statement 7 (Office of the Deputy Prime Minister, now Communities and Local Government, 2004). This accords with the Government’s expectation that a “high level of protection” is to be afforded to all natural resources as evidenced by the guidance in Planning Policy Statement...
1 on sustainable development (Office of the Deputy Prime Minister, now Communities and Local Government, 2005).

8.2.7 A desk-based study of agricultural land affected by the development has been undertaken, supplemented by field survey where appropriate to determine the agricultural land classification of the areas affected. The characteristics of each soil association (type) affected by the development will be established and interpreted for the assessment of construction impacts and suitable soil handling techniques.

8.2.8 Agri-environment schemes affected by the onshore components of Project Two will be reviewed, alongside relevant planning policy providing protection to agricultural land.

8.2.9 Potentially affected Geological SSSIs and Regionally Important Geological and Geomorphological Sites have been identified through desk-based study.

8.2.10 The assessment methodology focuses on impacts on farming and geological SSSIs to concentrate on potentially significant impacts.

Potential project impacts

Construction phase

8.2.11 Potential impacts could include:

- The majority of land which would potentially be affected by Project Two is under arable cultivation, potential impacts include:
  - Soil loss or structural damage;
  - Changes to soil composition and structure;
  - Changes to existing land quality and agricultural productivity of soils;
  - Temporary disruption to farming operations, including sterilisation of land and consequent economic implications during construction;
  - Temporary disruption to land drainage systems during construction;
  - Permanent loss of agricultural land from the farming framework; and
  - Potential for transmission of agricultural pests and diseases.

- Damage to, or severance of, access to designated geological sites (geological Sites of Special Scientific Interest (SSSI) and regionally important geological and geomorphological sites (RIGS)) is not likely to occur as there are none within the route corridor and therefore this assessment has been scoped out of the EIA;

- The risk of exposure to contaminated soils is negligible as there are no known contamination sources crossed by the route corridor; and
• Effects on geology and soils would be temporary and are anticipated to be negligible to minor adverse (bedrock geology and superficial deposits) or minor adverse (ground conditions and groundwater quality).

**Operation and maintenance phase**

8.2.12 During operation, the onshore cable system and HVAC substation or HVDC converter station(s) are not anticipated to have an adverse impact on soils, farming or other land use. This topic has therefore been scoped out of the EIA.

8.2.13 The potential impacts during maintenance are considered to be similar to those previously described during construction phase.

**Decommissioning phase**

8.2.14 The potential impacts during decommissioning are considered to be similar to those previously described during construction phase.

**Potential transboundary impacts**

8.2.15 No transboundary impacts are anticipated and it is therefore suggested that it is scoped out of the EIA process.

**Potential cumulative impacts**

8.2.16 The cumulative assessment will consider impacts arising from the construction, operation and maintenance and decommissioning of the onshore components of Project Two alongside other coastal development (e.g., related to other wind farms, ports, oil and gas industries, industrial development). The impacts would be similar to the potential project impacts identified above: damage or loss of soil resources and geological sites, temporary disruption to farming practices and land drainage, alterations to land quality and an increased risk of the transmission of agricultural pests and diseases.

8.2.17 The cumulative impact assessment will consider impacts from the onshore components of Project Two alongside the construction, operation and maintenance and decommissioning of other grid connection works in the surrounding area. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the grid connection agreement for Project Two will be taken into consideration and mitigation measures will be recommended to avoid or reduce impacts. The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
2. Project One in construction with an overlap with Project Two construction;
3. Project One operational, or;
4. No change (no Project One).

8.2.18 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.2.19 For geology, soils, agriculture and land use it is considered that the worst case scenario would be the longest duration of disturbance, hence scenario 2 or 3, as the potential for soil damage, crop losses and farm disruption would extend over a longer period of time.

**Potential inter-related effects**

8.2.20 Impacts on agriculture and land use have potential inter relationships with impacts on socio-economics (in that the viability of farming enterprises may be affected, either permanently or during construction) and recreation (in that recreational resources may be affected, either permanently or during construction).

**Potential mitigation and monitoring**

Mitigation measures for impacts on geology, soils, land use and agriculture may include:

- Pollution control plan for cable route activities;
- Where possible, areas of best and most versatile land will be avoided during identification of the cable route;
- Minimising any risk to the integrity of soil resources and land quality during the construction and reinstatement process, handling soils in accordance with best practice; and
- Avoiding designated geological and geomorphological sites.

### 8.3 WATER RESOURCES

**Environmental baseline**

8.3.1 Water resources comprise a number of potentially sensitive receptors, namely:

- Surface waters, including rivers, streams and drainage ditches;
- Groundwater aquifers and springs;
- Abstractions of surface water or groundwater;
- Ecological receptors directly and indirectly associated with water features; and
- Other users of the identified water features, such as recreational users.

8.3.2 Flood risk associated with Project Two is considered in a separate section below.
8.3.3 The only large water body lying within the study area south of the Humber is Covenham Reservoir, providing potable water to Grimsby. Louth Canal runs to the east of the reservoir, linking Louth to the south with Tetney Lock in the north. A number of small rivers flow south west to north east through the area, draining the agricultural land.

8.3.4 Most of the cable route is within a groundwater source protection zone, with only the two ends outside the designation. The whole area lies over a principal bedrock aquifer and contains a small number of Secondary A superficial deposit aquifers.

8.3.5 The cable route lies within a nitrate vulnerable zone.

Data and guidance to inform EIA

Data currently obtained

8.3.6 The following data sources will be reviewed to inform the assessment process:

- Groundwater Source Protection Zones (Environment Agency, 2010d);
- Principal and secondary aquifers (superficial deposits and bedrock) (Environment Agency, 2010e);
- British Geological Survey 1:50,000 scale geological map (England and Wales, Bedrock and Superficial Deposits);
- British Geological Survey Borehole Records;
- Environment Agency records on licensed abstractions (surface and groundwater);
- Local Authority records on private water supplies (surface and groundwater); and
- Current Ordnance Survey 1:10,000, 1:25,000 and 1:50,000 scale mapping.

Outstanding data requirements

8.3.7 The above data shall be reviewed for relevant new data.

Method Supporting EIA

8.3.8 The onshore study area for Project Two will comprise the landfall point, HVAC substation or HVDC converter station(s), cable route corridor and surrounding areas as appropriate. It will also include any surface water features and groundwater resources elsewhere, which are hydraulically connected to the development area and may, therefore, be potentially affected. The extent of the onshore study area will be refined once specific landfall and cable route options are identified and will consider the nature of the water environment and the associated receptors potentially affected by the development.

8.3.9 A detailed baseline study has been carried out to establish the current conditions of the water environment. Information has been drawn from a variety
of sources, including published information, maps relating to hydrology, water quality, and hydrogeology, and consultation.

8.3.10 The assessment of impacts on water resources will be undertaken using a source-pathway-receptor model and a risk based assessment. This will be based on combining assessments of both the likelihood and consequence of any potential impact in line with the Institute of Environmental Management and Assessment (IEMA) approach, together with consideration of sensitivity based on the Design Manual for Roads and Bridges (DMRB) (Highways Agency et al. 2008, 2009) together with consideration of sensitivity based on the Design Manual for Roads and Bridges (DMRB) (Highways Agency et al. 2008, 2009). This approach embraces principles of Directive 2000/60/EC establishing a framework for the Community action in the field of water policy (the Water Framework Directive (WFD)).

8.3.11 The evaluation of the significance of potential impacts on the water environment will be in accordance with the EIA methodology set out in Section 1 Criteria such as the Environment Agency’s water quality ratings, ecological designations and groundwater vulnerability will be drawn upon in order to define the sensitivity of the water environment.

**Potential project impacts**

**Construction phase**

8.3.12 The identified potential impacts on water resources resulting from the construction of Project Two are as follows:

- Sediment mobilisation in surface runoff from exposed soil surfaces during construction;
- Contamination of surface water features or groundwater by oils, lubricants and fuels originating from construction vehicles or store areas;
- Impacts on the quality of private water supplies;
- Changes to groundwater movement; and
- Longer term impacts on abstraction for private water supplies, particularly any supplies dependent on groundwater.

**Operation and maintenance phase**

8.3.13 Maintenance activities will be controlled through best practice site management. The potential for surface water and groundwater contamination during operation is considered to be very low and as such this topic is proposed for scoping out of the EIA.

**Decommissioning phase**

8.3.14 The potential impacts during decommissioning are considered to be similar to those during the construction phase.
Potential transboundary impacts

8.3.15 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.

Potential cumulative impacts

8.3.16 The cumulative assessment will consider impacts arising from the construction and operation of the onshore components of Project Two alongside the construction, operation and maintenance and decommissioning of other coastal development e.g. related to ports, oil and gas industries and industrial development. The impacts would be similar to the potential project impacts identified above: sediment mobilisation, contamination, alteration of groundwater flows and impacts on private water supplies.

8.3.17 The cumulative impact assessment will consider impacts from the onshore components of Project Two alongside the construction, operation and maintenance and decommissioning of other grid connection works in the surrounding area. SMart Wind are working closely with NGET to ensure that any upgrading works required by NGET specific to the grid connection agreement for Project Two will be taken into consideration and mitigation measures will be recommended to avoid or reduce impacts.

8.3.18 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

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3. Project One operational, or;
4. No change (no Project One).

8.3.19 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.3.20 For water resources it is considered that the worst case scenario would be the longest duration of disturbance and water management, hence scenario 2 or 3. However, building both substations simultaneously could increase the magnitude of accidental contamination.

Potential inter-related effects

8.3.21 Impacts on water resources have potential inter relationships with impacts on ecology (in that many flora and fauna are dependent on surface water) and flood risk.
Potential mitigation and monitoring

8.3.22 The cable route will be located at least 20 m from watercourses where possible.

8.3.23 Pollution control measures will be put into place during the construction phase of the development in order to minimise the risk posed to receiving surface water features. Details of appropriate actions are contained in the Environment Agency’s Pollution Prevention Guidance notes 1 and 5, General Guide to the prevention of pollution and Works in, near, or liable to affect watercourses, respectively. Measures that will be considered include:

- Minimising areas of exposed soil;
- Temporary storm water management system;
- Provision of specific bunded storage area; and
- Development of pollution incident reaction plan.

8.4 AIR QUALITY AND HEALTH

Environmental baseline

8.4.1 Air quality in East and West Lindsey is generally very good and East Lindsey District Council and West Lindsey District Council have not designated any Air Quality Management Areas (AQMAs) as concentrations of all pollutants are below the relevant objectives and limit values.

8.4.2 AQMAs have been designated by North East Lincolnshire Council and North Lincolnshire Council. The nearest AQMA to the study area is approximately 3 km to the north east, located at Immingham. The Immingham AQMA is designated due to high levels of particulates (PM$_{10}$) associated with HGV movements to and from the port. There are no AQMAs within the study area.

8.4.3 Electromagnetic fields (EMF) and the electromagnetic forces they represent are a fundamental part of the physical world. Electromagnetic forces are partly responsible for the cohesion of material substances and they mediate all the processes of chemistry. EMF occur naturally within the human body (through nerve and muscle activity) and also arise from the magnetic field created by Earth and electric fields in the atmosphere.

8.4.4 The Earth’s natural static magnetic field varies in strength between approximately 30 µT at the equator and 60 µT at the poles, being approximately 50 µT in England. AC (time-varying) EMF is localised to sources (e.g. household appliances, power lines) and no generally-established background level would be applicable.
Data and information to inform EIA

Data currently obtained

8.4.5 Air quality data in the UK are available from a range of sources including national monitoring networks, monitoring and modelling undertaken by local authorities (as part of their requirements set out under Part IV of the Environment Act 1995), and national modelling reported in the National Air Quality Information Archive.

Outstanding data requirements

8.4.6 The data sources above shall be reviewed for relevant new data.

Method supporting EIA

8.4.7 No statutory or official air quality criterion for dust annoyance has been set at a UK, European or World Health Organisation (WHO) level and therefore by convention, a risk based approach is usually employed to assess dust impacts. An assessment will be undertaken using the well-established source-pathway-receptor approach. This will focus on the key issue in relation to local air quality effects; the potential for nuisance to be caused by the deposition of dust.

8.4.8 Strong electric or magnetic fields have the potential to cause adverse human health impacts. Public exposure guideline limits have been adopted in the UK which are set to protect health. For EMF, a conservative (worst case) prediction of potential changes in EMF exposure arising from Project Two will be presented. Predicted changes will be compared with the health protection guidelines for public exposure given in the DECC Voluntary Code of Practice for demonstrating compliance with EMF public exposure guidelines, which are based on recommendations from the Health Protection Agency (HPA) and publications of the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Potential project impacts

Construction phase

8.4.9 During the construction phase of the proposed redevelopment, the major influences on air quality are likely to be dust-generating activities, such as movement of plant and vehicles both on and around the site. Potentially, nuisance can be caused by the deposition of construction dust, including the impact of dust on the footpath and road network and on nature conservation sites in the locality.

8.4.10 Construction of the Project Two will have associated construction traffic, comprising contractors’ vehicles and Heavy Goods Vehicles (HGVs), diggers,

18 National Air Quality Information Archive, available at www.airquality.co.uk
and other diesel-powered vehicles. This will result in emissions of nitrogen oxides (NO$_x$), particles and other combustion-related pollutants. The operation of these vehicles will be localised and temporary. The guidance issued by Environmental Protection UK recommends that the air quality assessment should include construction traffic for those large, long-term construction sites that will generate large HGV flows (> 200 movements per day) over a period of a year or more, or will affect annual average daily traffic flows (> 5 - 10%). Emissions from construction traffic will only be considered if these criteria are exceeded. Nevertheless, emissions of pollutants from construction-related vehicles on the local footpath and road network and on local nature conservation sites will be considered to the extent that they are included within the risk assessment.

8.4.11 The underground cable and substation would not be energised during construction (no electricity transmitted) and there would be no electric or magnetic field generated. There is therefore no need to assess EMF effects during this phase.

**Operation and maintenance phase**

8.4.12 During the operational and maintenance phase, there will be no significant sources of atmospheric emissions. Consequently, an air quality assessment of effects using the operational and maintenance phase will not be undertaken.

8.4.13 EMF will be generated by the operation of underground cables and the onshore HVDC converter station(s)/HVAC substation. The calculated field strength will be assessed in accordance with the DECC Code of Practice, against the relevant guideline public exposure limits.

**Decommissioning phase**

8.4.14 The proposed development has the potential to affect local air quality during the decommissioning phases through the generation of dust and emissions of combustion related pollutants from on-site plant/vehicles and off-site road traffic. It is likely that traffic levels during decommissioning would be similar to or less than those during construction.

8.4.15 The underground cable and substation would be de-energised during decommissioning (no electricity transmitted) and there would be no electric or magnetic field generated. There is therefore no need to assess EMF effects during this phase.

**Potential transboundary impacts**

8.4.16 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.
Potential cumulative impacts

8.4.17 Cumulative impacts arising from the proposed development alongside other projects within the area from other industries/activities e.g. other wind farms, port development, industrial development, and other coastal infrastructure associated with oil and gas activities are considered unlikely. However, the potential for inter-related effects to occur will be assessed as part of the EIA process.

8.4.18 Additional impacts are only likely to result in significant effects if construction activities at other development sites take place within a distance of 1000m of the onshore infrastructure scheme during the same period. Dust mitigation is best achieved at source. Mitigating measures should be developed appropriate to each development site in accordance with best practice. SMart Wind are working closely with NGET to ensure that any upgrading works required by NGET specific to the grid connection agreement for Project Two will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.4.19 EMF strength drops rapidly with the distance from its source, and any potential for effects is therefore localised to such sources. Depending on the interaction between fields from sources in close proximity, the combined strength can be greater or lesser than that from each single source. The Project Two underground cables are anticipated to closely parallel the route of Project One cables, and the cumulative impact of EMF when both sets of cables are energised will be assessed. The cumulative effect of a static magnetic field from DC cables, if applicable, with the Earth’s natural static magnetic field, will also be assessed.

8.4.20 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
2. Project One in construction with an overlap with Project Two construction;
3. Project One operational, or;
4. No change (no Project One).

8.4.21 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.4.22 For air quality, namely dust effects, the larger the construction area the higher the level of dust impact. Therefore, simultaneous construction may be the worst case scenario for dust effects as this scenario is likely to result in a larger surface area of construction at any one time. In terms of vehicle emissions the
worst case scenario would be that which would result in the highest levels of HGV movements. Simultaneous construction is likely to result in the highest level of HGV movements. However, assessment of the effects from vehicle emissions may be scoped out should there be fewer than 200 HGV movements per day (averaged over one year). For EMF the construction phasing is wholly irrelevant as there are no construction related effects.

**Potential inter-related effects**

8.4.23 Impacts on air quality are likely to affect the same receptors as impacts arising from noise and vibration and traffic and transport.

**Potential mitigation and monitoring**

8.4.24 Best practice guidance provides mitigation measures based on the level of risk identified at construction sites (APPLE, 2006). Mitigation measures will be considered, appropriate to the level of risk established by the assessment; however, these are likely to include:

- Minimise dust generating activities;
- Machinery and dust causing activities to be located away from sensitive receptors;
- Site personnel to be fully trained;
- Trained and responsible manager on site during working times to maintain logbook and carry out site inspections;
- Use water as dust suppressant where applicable;
- Re-vegetate earthworks and exposed areas;
- All vehicles to switch off engines when not in operation – no idling vehicles;
- Effective vehicle cleaning;
- Any loads entering and leaving site to be covered;
- Control site runoff of water / mud;
- On-road vehicles to comply to set emission standards; and
- Non Road Mobile Machinery (NRMM) to use ultra-low sulphur diesel (ULSD) where available.

19 This guidance has been produced by the Mayor of London, in association with the Air Pollution Planning and the Local Environment (APPLE) working group, comprising participants from the Greater London Authority and the Association of London. The BPG is designed to inform the planning process within London boroughs and assist developers in understanding the methods to control dust and emissions from construction and demolition activities. Although the proposed scheme is not located within London, the approach described in the BPG is considered to be appropriate for assessment of dust emissions.
8.4.25 In terms of EMF, Project Two is expected to comply with the public exposure guideline limits in the DECC Code of Practice, and as such no EMF mitigation measures would be required.

8.5 TERRESTRIAL ECOLOGY AND NATURE CONSERVATION

Environmental baseline

8.5.1 For scoping purposes, terrestrial ecology is characterised through the main nature conservation designations.

8.5.2 The designated sites of primary ecology and nature conservation importance, located within approximately 5km of the proposed onshore components of Project Two are the Humber Estuary Special Protection Area (SPA), Special Area of Conservation (SAC), Ramsar Site, and Site of Special Scientific Interest (SSSI), and Donna Nook and Saltfleet by Theddlethorpe National Nature Reserves (NNRs). They extend along the coastline including Horseshoe Point.

8.5.3 Further inland lies Tetney Blow Wells SSSI, a site managed as a Nature Reserve by Lincolnshire Wildlife Trust.

8.5.4 Small pockets of ancient woodland to the southwest of Grimsby and Immingham and three Local Nature Reserves (LNRs) lie within 1 km of the outskirts of Grimsby (Bradley and Dixon Woods LNR, Cleethorpes LNR and Cleethorpes Country Park LNR).

8.5.5 There are no proposed SPAs or candidate SACs which may be affected by the onshore elements of Project Two.

8.5.6 Natural England will be consulted to determine whether any candidate or potential sites are to be identified during the Ecological Impact Assessment (EcIA).

Data and guidance to inform EIA

Data currently obtained

8.5.7 International, national and local designated sites information for landfall and cable route corridors and a surrounding area has been obtained to support this scoping phase and inform the EcIA process. Data sources include:

- Site notifications and further details of SACs, SPAs, Ramsar Sites, SSSIs, NNRs and Ancient Woodland provided by Natural England (2010); and

- Details of Local Nature Reserves, Sites of Nature Conservation Importance, Local Wildlife Sites and BAP habitats, also provided by Natural England (2010).

8.5.8 In addition, biological records from the following data sources have been obtained:

- Lincolnshire Environmental Records Centre.
Lincolnshire Biodiversity Partnership;
Lincolnshire Wildlife Trust;
Humber Industrial Nature Conservation Association;
British Trust for Ornithology;
Botanical Society of the British Isles;
Royal Society for the Protection of Birds;
Ordnance survey map data; and
National and local planning policy, where relevant to terrestrial ecology.

Outstanding data requirements

8.5.9 The data sources above shall be reviewed for relevant new data.

Methods supporting EIA

8.5.10 A detailed ecology desk study has been undertaken, drawing on the data sources highlighted above, together with other published and unpublished information sources, to establish the existing terrestrial ecological baseline that would potentially be affected by the onshore components of Project Two. The desk study also included consultation with relevant stakeholders and key groups, including Natural England, the RSPB and the Lincolnshire Wildlife Trust. The onshore desk study area considered extends up to approximately 5 km from the onshore elements of the project.

8.5.11 An extended Phase 1 habitat survey of the landfall and HVAC substation or HVDC converter station sites, the preferred cable route corridor and a surrounding buffer zone of approximately 250 m in width, has been undertaken in accordance with standard methodology (JNCC, 2003). The Phase 1 habitat survey provides a nationally recognised means of classifying and mapping habitats, and highlighting areas and aspects requiring additional detailed survey. Sightings of protected species, signs of such species, and habitats that could support such species were noted.

8.5.12 Further field surveys have been undertaken as a result of the findings of these surveys. These surveys have been completed in accordance with methodologies agreed with Natural England, and include:
- Hedgerow surveys, undertaken with regard to the Hedgerows Regulations 1997;
- Micro-habitat assessments of sensitive areas including sand dune habitats, which include an assessment of elements such as species assemblage, structure and substrate stability;
- Bird surveys – breeding and wintering bird surveys as required;
- Reptile surveys – undertaken between April and June and during September;
• Great crested newt surveys undertaken between mid-March and mid-June (with two survey visits completed between mid-April and mid-May); and
• Mammal surveys – including water vole, otter, badger and bat surveys.

8.5.13 The need for any other surveys will be agreed with Natural England.

8.5.14 Data gathered through the ecology desk-based study and subsequent field surveys will be used to support the EcIA. The EcIA will be carried out in accordance with the Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the United Kingdom (2006) and other relevant guidance as appropriate.

Potential project impacts

8.5.15 A number of potential ecology and nature conservation impacts have been identified from activities involving cable trenching, construction of HVAC substation or HVDC converter station foundations, the operations phase, and decommissioning of above ground infrastructure.

Construction phase

8.5.16 The potential impacts on terrestrial features of ecology and nature conservation importance resulting from the construction of Project Two would include:

• Disturbance to habitats and/or species as a result of expected increases in noise, vibration, lighting and activities associated with onshore construction;
• Habitat severance and fragmentation as a result of cable trenching, which could result in disturbance to species utilising these habitats, such as bats;
• Temporary displacement of species as a result of construction activities and land-take;
• Potential habitat and species loss as a result of land-take for the new HVAC substation or HVDC converter station(s);
• Temporary discharge of pollutants, which may have adverse impacts on habitats and species during construction; and
• Habitat reinstatement would be undertaken following construction wherever practicable.

Operation and maintenance phase

8.5.17 The identified potential impacts on terrestrial features of ecology and nature conservation importance resulting from the operation and maintenance of Project Two would include:

• Permanent displacement of species as a result of land-take for the new HVAC substation or HVDC converter station(s); and
• Disturbance to habitats and/or species as a result of noise and increased human activities during maintenance operations.
Decommissioning phase

8.5.18 The identified potential impacts on terrestrial features of ecology and nature conservation importance resulting from the decommissioning of Project Two are considered to be similar to those previously described during construction, however cables are likely to be left buried.

8.5.19 There may be subsequent potential for reinstatement of habitats and species, habitat management and enhancement.

Potential transboundary impacts

8.5.20 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.

Potential cumulative impacts

8.5.21 Construction and operation of the onshore components of Project Two, alongside the construction, operation and decommissioning of other coastal development in the area (for example, Tetney to Saltfleetby sea defences and any works related to other wind farms, ports, oil and gas industries and industrial development) could result in cumulative impacts. Inter-related are likely to be similar to the potential project impacts identified above and will be assessed through the EIA process.

8.5.22 The onshore components of Project Two alongside the construction, operation, maintenance and decommissioning of other grid connection works within 10 km of the grid connection route may result in cumulative impacts on terrestrial ecology.

8.5.23 SMart Wind are working closely with NGET to ensure that any upgrading works required by NGET specific to the grid connection agreement for Project Two will be taken into consideration and mitigation measures will be recommended to avoid or reduce impacts. Such impacts are likely to be similar to the potential Project Two impacts identified above: habitat loss, loss of plant or animal species, disturbance, severance and fragmentation. These will be assessed through the EIA process.

8.5.24 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
2. Project One in construction with an overlap with Project Two construction;
3. Project One operational, or;
4. No change (no Project One).

8.5.25 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.5.26 The worst case scenario for ecological receptors is very much dependant on the area of the route and the habitats and species affected. However, the worst case is considered to be scenarios 2 or 3 as more breeding seasons would be affected compared to the other scenarios due to disturbance over a longer duration. Species would be displaced from areas for a longer period and hence put increased pressure on adjacent habitats for a longer period.

**Potential inter-related effects**

8.5.27 Impacts on ecology have potential inter-relationships with impacts on water resources and these will be considered in the EIA.

**Potential mitigation and monitoring**

8.5.28 Appropriate mitigation measures that could be built into the design of the development will be identified, avoiding or reducing adverse impacts where possible. In addition, measures to enhance terrestrial ecology will also be identified.

8.5.29 Mitigation measures would include:

- Avoidance of designated nature conservation sites and where practicable, other features identified as of ecology and nature conservation importance, during scheme design;
- Seasonal constraints to construction operations designed to minimise likely impacts on protected or otherwise notable species;
- Methods of construction designed to minimise likely impacts on protected or otherwise notable species. All works to be carried out taking full account of legislative requirements and Environment Agency guidance;
- Implementation of pollution prevention measures to avoid pollution of watercourses and other habitats;
- Construction access tracks to be located and fabricated using materials to minimise generation of run-off and/or drainage requirements, particularly during heavy rain;
- Sediment traps to avoid sediment-laden run-off from exposed ground polluting local watercourses;
- Measures to be set in place to ensure the appropriate storage of soils, and restoration of reinstated areas of land;
- Appointment of a site-based environmental clerk of works, in consultation with the determining authority, to oversee the construction phase; and
- Regular monitoring on site to ensure effectiveness of mitigation measures.
8.5.30 Species and habitat specific mitigation would be informed by findings of the ecology surveys.

8.6 HISTORIC ENVIRONMENT

Environmental baseline

8.6.1 The archaeological evidence for the earliest periods of human occupation in the project area was destroyed by the last Devensian ice sheet and only a few finds dating from the Palaeolithic are known within the region.

8.6.2 However, since the early Holocene the area around the modern Humber Estuary has been a focus of human activity and settlement. The Humber region is well known for its early Mesolithic sites such as Starr Carr in the Vale of Pickering, dating from around 9,500 to 6,300 BC. This was followed by the Neolithic, which saw the appearance of the first farmers in Lincolnshire.

8.6.3 Sea level reached roughly its current stand c. 3,500 BP and resulted in the accretion of alluvium from this time onwards in the Humber estuary. Much of the alluvium visible today was deposited during the Roman period (43 – 410AD).

8.6.4 The pollen record for the region shows a thinning of the woodland canopy, which is indicative of clearances for farming and settlements from as early as the Bronze Age and Iron Age. This evidence for an increasing human population is supported by the discovery of several Bronze Age logboats (at North Ferriby, Appleby and Brigg), which also suggests that the Humber Estuary was an important transport artery for the region.

8.6.5 Archaeological sites can be expected to range in date from the Mesolithic to the modern era. Rapid erosion and cliff collapse in the region eroded out many archaeological materials from the Bronze and Iron Ages to modern monuments (largely deposited on the beach and in the intertidal zone).

8.6.6 There are scattered Listed Buildings located within small settlements. For example, St Mary’s Church in Covenham St Mary, a farmhouse at North Thoresby and the Church of St Edmund in Rilby. Grimsby’s industrial heritage is also reflected in features such as the listed West Lock to Royal Dock. Key archaeological features include Thornton Abbey Augustinian monastery and the site of a medieval nunnery near Brocklesbury.

Data and information to inform EIA

Data currently obtained

8.6.7 Review of the main heritage designations, including nationally designated sites, listed buildings and Conservation Areas used data sources such as:

- Details of Listed Buildings, Scheduled Ancient Monuments, Battlefields, Registered Parks and Gardens, World Heritage Sites and historical air photographs from the National Monument Record;
Historic Environment Records and Conservation Areas from Lincolnshire County Council, North Lincolnshire Council, North East Lincolnshire Council and the Humber Archaeological Partnership; and

Historic mapping including tithe maps and 1st addition Ordinance Survey maps and historic charts held by the United Kingdom Hydrographic Office.

**Outstanding data requirements**

8.6.8 The data sources above shall be reviewed for relevant new data.

**Methods supporting EIA**

8.6.9 A detailed desk-based archaeological assessment has been carried out in accordance with the Institute of Archaeologists’ Standards and Guidelines for desk-based assessments. The desk-based study includes:

- A review of information from the National Monument Record, Historic Environment Record, descriptions for every listed building and MAGIC (www.magic.gov.uk);
- Conservation area character appraisals, where available; and
- Primary and secondary documentary resources from the British Library, the County Records office, the Archaeology Data Service website (www.ads.ahds.ac.uk) and historic maps of the area.

8.6.10 The desk-based study considers:

- Grade I and II listed buildings, conservation areas, Scheduled Ancient Monuments and Registered Parks and Gardens within 5 km of the proposed HVAC substation or HVDC converter station(s) and within 500 m of the centre of the route corridor;
- Grade II listed buildings within 2.5 km of the proposed HVAC substation or HVDC converter station(s) and within 500 m of the centre of the cable route corridor; and
- Below ground archaeological remains within a 1 km radius of the proposed HVAC substation or HVDC converter station(s) and within 500 m of the centre of the cable route corridor.

8.6.11 Field surveys include:

- A walk-over by a suitably qualified and experienced archaeologist, including all designated historic assets within the Project Two study area;
- Geophysical survey; and
- Trial trenching. Please note that the geophysical survey and trial trenching undertaken in July 2012 for Project One has now been agreed by the curators to also be valid for Project Two.
8.6.12 The significance of potential impacts will be assessed by taking into account the potential magnitude of impacts (e.g. a high magnitude impact could involve the total loss of a heritage asset) and the sensitivity of heritage assets. The sensitivity of heritage assets will depend on factors such as the condition of the site and the perceived heritage value/importance of the site. The sensitivity of the receptor (heritage asset) is defined by its importance in terms of national, regional or local statutory or non-statutory protection and grading of the asset.

8.6.13 The sensitivity of heritage assets, together with the magnitude of change, defines the significance of the impact. A matrix led approach will be used to identify impact significance.

**Potential project impacts**

**Construction phase**

8.6.14 The identified potential impacts on archaeology and cultural heritage resulting from the construction of Project Two are as follows:

- Direct impacts involving physical alteration or destruction of heritage assets as a result of cable trenching or construction of HVAC substation or HVDC converter station(s) foundations and any potential cable infrastructure;
- Potential temporary impacts on historic monuments and buildings from noise and vibration during construction; and
- Indirect impacts resulting in an effect on the setting of a heritage asset, such as a scheduled ancient monument, listed building or a conservation area from above ground HVAC substation or HVDC converter station(s) and/or any potential cable infrastructure.

**Operation and maintenance phase**

8.6.15 No permanent impacts are anticipated on archaeology and cultural heritage during operation and maintenance activities.

**Decommissioning phase**

8.6.16 The potential impacts during decommissioning are considered to be similar to the temporary impacts described during the construction phase; no additional permanent impacts are anticipated.

**Potential transboundary impacts**

8.6.17 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.

**Potential cumulative impacts**

8.6.18 The assessment of cumulative impacts will consider impacts of the onshore infrastructure alongside other projects within the area from other
industries/activities e.g., port development, industrial development, other coastal infrastructure for example associated with oil and gas activities.

8.6.19 There is no set guidance on the assessment of cumulative impacts on heritage assets. The cumulative assessment will consider cumulative impacts with other grid connection infrastructure projects. The visual impact of multiple projects will be assessed within the Landscape and Visual Chapter.

8.6.20 Smart Wind are working closely with NGET to ensure that any upgrading works required by NGET specific to the grid connection agreement for Project Two will be taken into consideration and mitigation measures will be recommended to avoid or reduce impacts.

8.6.21 Cumulative ZTVs will be used in order to gain a theoretical picture of visibility of the above ground elements of relevant projects on designated historic assets. Impacts could arise where a substantial percentage of a view, considered to represent the ‘setting’ of a heritage feature, is affected by a number of projects.

8.6.22 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
2. Project One in construction with an overlap with Project Two construction;
3. Project One operational, or;
4. No change (no Project One).

8.6.23 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.6.24 Effects on buried archaeology would not be heightened or lessened by construction timing. Simultaneous construction would result in a higher magnitude of change in terms of historic setting and would therefore represent the worst case in this instance. Although the end result is the same the interim baseline is different thus the level of effect may be slightly higher with simultaneous construction.

**Potential inter-related effects**

8.6.25 There are inter-relationships between impacts on the historic environment and those on the landscape, particularly insofar as the setting of historic features may be affected.
Potential mitigation and monitoring

8.6.26 Direct impacts on the historic environment have been avoided where possible in the identification of a preferred cable route corridor. If features are present in close proximity, adoption of construction practices to minimise the width of disturbance or to avoid surface disturbance may be employed.

8.6.27 Where archaeological remains cannot be avoided, detailed investigations may be needed prior to construction, or at the start of the construction period to record any remains.

8.7 LANDSCAPE AND VISUAL RESOURCES

Environmental baseline

8.7.1 Figure 8.2 indicates national landscape character areas, which reflect the type of features present. Areas designated for their landscape importance are shown in Figure 8.1.

Landscape Character Assessment of North Lincolnshire

8.7.2 Much of the North Lincolnshire coastline is relatively low lying, character which extends further inland towards the Lincolnshire Wolds which morph slowly into gently undulating but more hilly topography. The south estuary edge is a landscape of flat topography, the coastal industrial area is to be found at the town of Barton upon Humber with farmland further inland.

Landscape Character Assessment of North East Lincolnshire

8.7.3 The topography of North East Lincolnshire is predominantly low lying at the coast which gently rises further inland towards the hills of the Lincolnshire Wolds. The south estuary edge is a landscape of flat topography, the coastal industrial areas are to be found at the towns of Immingham, Grimsby and Cleethorpes. Key features and locations in this area include:

- Industrial development is present at Killingholme, Immingham and Great Coates (Pyewipe Industrial Estate);
- Settlements comprise the town of Grimsby and clustered villages set back from the estuary edge;
- National Cycle Network Route 1;
- Public footpaths throughout the area; and
- Cleethorpes.

Landscape Character Assessment of East Lindsey

8.7.4 The mouth of Humber Estuary is characterised by its wide areas of sand flats that extend along the East Lindsey Coastline. Inland, topography is relatively
flat consisting of a farmed landscape with little woodland cover that is interlaced with numerous canals, dykes, drains and streams. Settlements consist of regular small villages and individual properties. Wind farms are present at Mablethorpe and Conisholme Fen. Key features and locations in this area include:

- Lincolnshire Wolds Area of Outstanding Natural Beauty;
- Public footpaths throughout the area;
- Villages including Saltfleetby; and
- Public viewpoints and parking areas along the coast.
Figure 8.2  National Character Areas.
Data and guidance to inform EIA

Data currently obtained

8.7.5 The following data sources have been used to inform the assessment of landscape and visual impacts:

▪ Ordnance Survey map data (including the location of key tourist destinations and concentrations of visual receptors);
▪ Landscape designations across the area (see Figure 8.1);
▪ Information about weather conditions from the local meteorological office;
▪ Aerial photography;
▪ Natural England’s National Character Areas, the online Database of Landscape Character Assessments in England and other regional and local landscape character assessments;
▪ National, regional and local planning policy, in terms of policies which are relevant to landscape and seascape character or visual impacts; Information about the proposed development and the construction process which can be made available; and
▪ Photomontages.

Relevant Guidance

8.7.6 Relevant guidance from the Landscape Institute and Natural England will be followed:

▪ Landscape Institute (2009) Advice Note 01/09. Use of Photography and Photomontage in Landscape and Visual Assessment;
▪ Countryside Agency/Scottish Natural Heritage (2003). Landscape Character Assessment Series Topic Paper 9: Climate change and natural forces, the consequences for landscape character; and

Outstanding data requirements

8.7.7 The data sources above shall be reviewed for relevant new data.
Method supporting EIA

8.7.8 Key viewpoints have been agreed with the local authorities and Natural England for Project One. These viewpoints will be used as an assessment tool in order to inform examination and description of impacts upon visual amenity and visual receptors for Project Two. The viewpoints proposed for Project Two are the same as those for Project One. This will be consulted upon and agreed prior to commencement of assessment.

8.7.9 A number of viewpoint locations will be considered, focussing on the HVAC substation or HVDC converter station(s) (with a radius of 5 km from the HVAC substation or HVDC converter station(s)), the underground grid connection route (1 km radius and along the length of the route) and any sensitive visitor destinations. Photomontages will be undertaken from some locations. Night time photomontages have been scoped out as the location for the HVDC converter station / HVAC substation is immediately adjacent to a well-lit industrial area, with flare stacks.

8.7.10 The significance of onshore landscape and visual impacts will be judged by considering the nature and sensitivity of the existing landscape, and visual receptors, against the proposed magnitude of change (e.g. nature, scale, layout and proximity of the proposed project).

8.7.11 Impacts will be assessed in accordance with the Landscape Institute and the Institute of Environmental Management and Assessment (Second Edition 2002) Guidelines for Landscape and Visual Impact Assessment.

8.7.12 The work will be informed and illustrated through the preparation of Zones of Theoretical Visibility (ZTVs) for the proposed HVAC substation or HVDC converter station. ZTVs will be modelled to show the extent of theoretical visibility across the study area. Impacts across the onshore study area will be reported, focusing on significant impacts.

8.7.13 A series of maps will be produced, including those showing landscape character areas, designated landscapes and the location of viewpoints and other sensitive receptors within a 10km study area. These maps will inform the assessment of potential impacts upon landscape character.

Potential project impacts

Construction phase

8.7.14 The identified potential impacts on landscape, seascape and visual amenity resulting from the construction of Project Two are as follows:

- The jointing pit will be underground and as such is not likely to give rise to any permanent impacts unless landscape features are displaced and not mitigated. During construction there are likely to be visual impacts;
- Underground sections of the grid connection are not likely to give rise to any permanent impacts unless trees and other landscape features are lost or
displaced and not mitigated. During construction there may be direct landscape and visual impacts on local receptors such as Public Rights of Way, due to the displacement of landscape features, temporary diversion or stopping up of routes and the presence of construction activity in views; and

- The HVAC substation or HVDC converter station(s) at Killingholme is adjacent to an existing industrial area and as such is not likely to give rise to any permanent significant impacts. During construction there are unlikely to be significant impacts due to the industrial nature of the area and screening provided by existing structures.

**Operation and maintenance phase**

8.7.15 The identified potential impacts on landscape, seascape and visual amenity resulting from the operation and maintenance of Project Two are as follows:

- The HVAC substation or HVDC converter station(s) at Killingholme will be within an existing industrial area and as such is not likely to give rise to any significant visual impacts. No impacts are anticipated during this phase of the project; and
- The installation of the cables will have a permanent effect on trees over on the line of the cable route, shrubs will be replaced.

**Decommissioning phase**

8.7.16 The identified potential impacts on landscape, seascape and visual amenity resulting from the decommissioning of Project Two are as follows:

- At the time of decommissioning, onshore infrastructure will be retained if it can be used for another purpose. If this is not possible then above ground features will be removed. The underground cable system would be isolated and left in place to avoid unnecessary environmental disturbance. It is assumed at this stage that HVAC substation or HVDC converter station(s) plant will be dismantled, with any buildings demolished and removed from site and any landscaping works remaining in place;
- During decommissioning there will be short term landscape and visual impacts from machinery/equipment and activities on the site including dismantling of plant, demolition of buildings and removal from site. Impacts are likely to be less adverse than those reported during construction as the underground cable is likely to remain in place; and
- Following decommissioning there is unlikely to be any residual impact on the landscape or visual receptors.

**Potential transboundary impacts**

8.7.17 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.
Potential cumulative impacts

8.7.18 Construction, operation and maintenance and decommissioning of the onshore components of Project Two including other similar development in the area (for example, related to ports, oil and gas industries and industrial development) could result in cumulative impacts. These are only likely to occur for the HVAC substation or HVDC converter station(s), and will be assessed within the study areas as per the cumulative methodology.

8.7.19 Construction, operation, maintenance and decommissioning of the onshore components including other grid connection works of Project Two could result in cumulative impacts. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the grid connection agreement for Project Two will be taken into consideration and mitigation measures will be recommended to avoid or reduce impacts.

8.7.20 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
2. Project One in construction with an overlap with Project Two construction;
3. Project One operational, or;
4. No change (no Project One).

8.7.21 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.7.22 As with historic setting, simultaneous construction of two HVAC substations or HVDC converter stations on the site would result in a higher magnitude of change than building one and then another. Although the end result is the same the interim baseline is different thus the level of effect may be slightly higher with simultaneous construction.

8.7.23 The Landscape and Visual Impact Assessment (LVIA) will assess cumulative impacts within a corridor centred on the cable corridor (the corridor would be 2 km wide) and within the HVAC substation or HVDC converter station study area (a 10 km radius around the HVAC substation or HVDC converter station(s)).

8.7.24 Cumulative landscape and visual impacts from operational underground cables are unlikely to occur and it is proposed that this element is to be scoped out of the cumulative assessment.
Potential inter-related effects

8.7.25 There are inter-relationships between impacts on landscape and those on the historic environment, particularly insofar as the landscape setting of historic features may be affected. There are also inter-relationships with changes in land use and impacts on ecology, for example where trees and hedgerows are to be removed.

Potential mitigation and monitoring

8.7.26 Mitigation measures will include avoidance of sensitive features through siting and design, and considering planting to replace any vegetation which may need to be removed. Typical good construction practice to reduce adverse impacts (hoarding, maintaining a tidy site, topsoil stripping and storage etc.) will also be employed as appropriate.

8.7.27 Mitigation may be monitored on site by an environmental clerk of works.

8.7.28 Specific mitigation for the grid connection route may include:

- Avoidance of sensitive landscape features including historic features, historic parks and gardens, woodlands and river corridors; and

- Restoration of displaced landscape features including woodland, hedgerows, fences and walls.

8.7.29 Specific mitigation for the HVAC substation or HVDC converter station(s) may include tree planting and earthworks to provide screening and sensitive choice of materials for the HVAC substation or HVDC converter station building.

8.8 FLOOD RISK

Environmental baseline

8.8.1 The Environment Agency’s flood risk map (2010a) indicates that a large proportion of the area around Grimsby is at risk of flooding from rivers or sea, with only some areas protected by defences. The HVAC substation or HVDC converter station(s) location at the Killingholme Power Station lies outside the areas identified as being at risk from flooding depicted on the Environment Agency’s flood zone map (2010a); therefore this area has a low probability of flooding.

Data and guidance to inform EIA

Data currently obtained

8.8.2 The following data sources have been reviewed:

- Environment Agency flood zone maps (2010a);
- Environment Agency Historical Flood Records;
- Environment Agency Flood Defence Data Base;
- Environment Agency Catchment Management Plans
- Local Authority Strategic Flood Risk Assessments;
- Previous flood risk assessments or reports in the area;
- Ordnance survey maps; and

**Outstanding data requirements**

8.8.3 The data sources above shall be reviewed for relevant new data.

**Method supporting EIA**

8.8.4 Flood risk will be assessed through desk-based collection of baseline data (maps and published information), consultation with the Environment Agency and local water authorities and a walkover survey.

8.8.5 A Flood Risk Assessment (FRA) for the proposed HVAC substation or HVDC converter station(s) will be prepared, to take into account the impact that increasing the area of hard standing may have on the surface water run-off regime. As noted above, the site falls outside of those areas identified as being at risk from flooding. However, if the development footprint exceeds 1 ha a FRA will be required in line with the National Planning Policy Framework (NPPF) and associated Technical Guidance for Flood Risk,(2012), the Government's spatial planning policy on assessing the appropriateness of developments in the context of flood risk. This will look at vulnerability to flooding from other sources as well as from river and sea flooding and the potential to increase flooding risk elsewhere.

8.8.6 The impact of the cable route corridor on flood risk, as a result of cable crossings of watercourses (including potential impacts on the functional floodplain), will also be assessed.

**Potential project impacts**

**Construction phase**

8.8.7 The identified potential impacts on flood risk resulting from the construction of Project Two are temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding on, or arising from construction of above ground infrastructure.

**Operation and maintenance phase**

8.8.8 The identified potential impacts on flood risk resulting from the operation and maintenance of Project Two are as follows:
- Permanent increase in surface run-off as a result of increased impermeable surface areas, and resultant potential for flooding on, or arising from above ground infrastructure; and
- Temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding on, or arising from maintenance of above ground infrastructure.

**Decommissioning phase**

8.8.9 The identified potential impacts on flood risk resulting from the decommissioning of Project Two are temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding on, or arising from the decommissioning of above ground infrastructure.

**Potential transboundary impacts**

8.8.10 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.

**Potential cumulative impacts**

8.8.11 The cumulative assessment will consider impacts arising from the construction, operation and maintenance and decommissioning of the onshore component of Project Two alongside other coastal development (e.g., related to other wind farms, ports, oil and gas industries, industrial development). The impacts would be similar to the potential project impacts identified above, namely temporary and permanent alterations to surface run-off and water drainage patterns, resulting in changes to flood risk.

8.8.12 The cumulative impact assessment will consider impacts from the onshore component of Project Two alongside the construction, operation and maintenance and decommissioning of other grid connection works in the surrounding area. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the grid connection agreement for Project Two will be taken into consideration and mitigation measures will be recommended to avoid or reduce impacts.

8.8.13 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
2. Project One in construction with an overlap with Project Two construction;
3. Project One operational, or;
4. No change (no Project One).

8.8.14 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.8.15 In terms of impacts on flood risk there is no clear worst case between scenario 1, 2 and 3 as adequate attenuation would be applied.

**Potential inter-related effects**

8.8.16 There are inter relationships between impacts on flood risk and the water environment more generally and these will be addressed by the EIA.

**Potential mitigation and monitoring**

8.8.17 Appropriate measures will be put in place to mitigate potential adverse impacts on flood risk. These may include use of sustainable drainage techniques, ensuring that the development will not lead to an increased risk of flooding, either onsite or downstream.

**8.9 TRAFFIC AND TRANSPORT**

**Environmental baseline**

8.9.1 The area to the south of the Humber contains a number of road and rail transport links. The main road artery into the area is the M18 that connects with the M18 and the A1(M) and M1 to the west. The M180 connects with the dual carriageway A180 between Scunthorpe and Immingham at the A18 junction. The A18 runs south from the A180 and provides opportunities to connect to areas to the east, through which the cable route passes. The A180 runs via Immingham to Grimsby. Extending out from Grimsby to the south east, south and south west are single carriageway A roads, the A1031, A16 and A46 respectively. The A1031 follows the coast from Grimsby to Mablethorpe. The main railway line also runs from Scunthorpe to Grimsby, with branch lines serving the Immingham Docks and a number of small villages in the northern part of the area. The railway line does not extend to the south of Grimsby.

**Data and guidance to inform EIA**

**Data currently obtained**

8.9.2 Baseline data have been obtained from site visits, existing traffic flow data supplemented with new surveys undertaken in 2011, records of personal injury accidents and information relating to public transport services.

8.9.3 Baseline data on railway lines and services will be obtained from OS mapping, Network Rail and Train Operating Companies.
Outstanding data requirements

8.9.4 In areas where data do not currently exist, information will be supplemented by further traffic surveys.

Method supporting EIA

8.9.5 Baseline studies will identify potential road network constraints and inform potential routes for delivery and construction and decommissioning vehicles (types and numbers). The Local Highway Authorities (LHAs) and the Highways Agency (HA) will be consulted during this period to ascertain any potential issues with the proposed access routes. The location of railway lines and potential disruption to rail services as a result of cable route construction under railway lines will be assessed.

8.9.6 Transport movements associated with the onshore works will be identified, followed by a desk-top review to identify the key locations where transport issues may be raised. A site visit of access routes and key locations may be carried out if required and the LHAs and HA will be consulted.

8.9.7 A desk-top study has been undertaken to ascertain the likely potential disruption to rail services as a result of cable route construction under railway lines.

8.9.8 The assessment of impacts on the local road network will assess the flows predicted as a result of construction of Project Two against existing baseline flows. The scope and duration of predicted impacts will be quantified in terms of phases of delivery, construction and operation.

8.9.9 The assessment will be based on the following guidance:

- The Department for Transport (March 2007). Guidelines on Transport Assessments;
- Institute of Environmental Management and Assessment (1993). Guidelines for the Environmental Assessment of Road Traffic; and
- The Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment (Highways Agency et al. 2008).

8.9.10 The impact assessment methodology will be agreed in consultation with the LHAs and HA and will determine the criteria by which impact on the road network, highway users and local residents will be assessed and measured.

8.9.11 An assessment of the potential impact of disruption to rail services as a result of cable route construction under railway lines will be undertaken in consultation with Network Rail.

Potential project impacts

Construction phase

8.9.12 The identified potential impacts on traffic and transport resulting from the construction of Project Two are as follows:
- The proposed development has the potential to affect the local road network during the construction phase through delivery of machinery, concrete, cabling, aggregate and sand, and through the arrival and departure of construction workers;

- Wastes generated from construction offshore would come ashore and need to be transferred. There would also be waste generated from the onshore works. The types and likely volumes of waste will be identified within a Site Waste Management Plan (SWMP). Traffic movements generated as a result of waste transfer will be predicted. Depending upon the change in traffic flows predicted to occur as a result of the proposed development, potential impacts that will be assessed are: severance, driver delay, pedestrian delay, pedestrian amenity, fear and intimidation, accidents and safety; and unusual loads; and

- Project Two also has the potential to result in temporary delays to public transport services as a result of cable route construction under railway lines or impacts on road networks.

**Operation and maintenance phase**

8.9.13 Although routine maintenance visits will require vehicles to access the landfall site and HVAC substation or HVDC converter station(s) during operation, it is not anticipated that these will have a significant impact on the local traffic or transport during the operation of the onshore project infrastructure. It is suggested that no further assessment is therefore required.

**Decommissioning phase**

8.9.14 The potential impacts during decommissioning are considered to be similar to those previously described during construction.

8.9.15 Traffic will be generated during the decommissioning stages, although to a lesser extent than during the construction phase.

**Potential transboundary impacts**

8.9.16 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.

**Potential cumulative impacts**

8.9.17 Cumulative impacts on traffic arising from the proposed development alongside other projects within the area from other industries/activities e.g. port development, industrial development, other coastal infrastructure (e.g. associated with oil and gas activities) are considered to be unlikely. However, the potential for Inter-related impacts to occur will be assessed as part of the EIA process.
8.9.18 Smart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the grid connection agreement for Project Two will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.9.19 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
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3. Project One operational, or;
4. No change (no Project One).

8.9.20 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.9.21 For traffic and transport the worst case scenario would be that which results in the highest levels of HGV movements, particularly at sensitive locations. The highest peaks in traffic movements are likely to occur with simultaneous construction. However there are sections of the HGV route through areas which do not experience even low levels of HGV traffic. In such locations in particular it may be that a longer period of medium level HGV movements would be considered equally worst case as a shorter period of much higher numbers of HGVs. This will be considered in more detail in the traffic and transport CIA to define a worst case, or several if there is more than one equal worst case scenario.

Potential inter-related effects

8.9.22 Impacts on traffic have inter-relationships with impacts from noise. These will be covered in the noise and vibration section of the EIA.

Potential mitigation and monitoring

8.9.23 A Construction Management Plan (CMP) will be prepared for the construction phase and a Logistics Management Plan (LMP) will be prepared for the decommissioning phase of the onshore development. The CMP and LMP will include mitigation measures aimed at controlling environmental impacts that could occur during construction and decommissioning, for example:

- Co-ordinated timing of HGV movements to ensure that disruption to local residents and other highway users is reasonably minimised;
- HGVs and site personnel will be instructed to use only the approved access routes to the site; and
Following discussion and agreement with the local highway authority, appropriate information and signs will be provided on the approaches to the proposed site access.

Where practicable, measures will be implemented to minimise delays to rail services as a result of cable route construction under railway lines such as timing construction work to avoid peak travel times.

8.10 NOISE AND VIBRATION

8.10.1 The rural parts of the study area rank highly in terms of tranquillity according to the Campaign for the Protection of Rural England (CPRE) tranquillity maps of England. However, the urban and industrial nature of the Humber Estuary means that areas around Immingham, Cleethorpes and Grimsby are rated as less tranquil.

Data and Information to Inform EIA

8.10.2 CPRE tranquillity maps provide a high level indication of the noise environment.

Method Supporting EIA

8.10.3 Site surveys have identified key groups of sensitive receptors in the areas around the proposed landfall, substation/converter station and cable route corridor.

8.10.4 In assessing the impact of construction and decommissioning noise and vibration, it is usual to accept that the associated works are of a temporary nature. The principal UK guidance on construction noise is contained in BS5288:2009 ‘Code of practice for noise and vibration control on construction and open sites’. Predictions of construction and decommissioning noise will be made referencing typical activity emission levels and likely variations in noise levels at surrounding receiver locations within 300 m of the cable route, using the methodology set out in BS5228:2009. This assessment will identify if and when predicted noise levels may be above standard guideline limits, particularly taking into account the rural character of much of the cable routes and the different construction activities used throughout the construction programme. Construction noise management procedures will also be determined. Consideration will also be given to the potential impact of construction traffic on sensitive receptors in the area where a significant change in flow is predicted during construction.

Potential Project Impacts

Construction Phase

8.10.5 The identified potential impacts of noise and vibration resulting from the construction of Project Two are as follows:
Noise and vibration from activities carried out on the surface along the cable route (mainly moving and excavation);

Noise and vibration from construction activities at the substation/converter station site including landscaping;

Noise and vibration from directional drilling and/or tunnelling activities;

Noise and vibration from off-site vehicle and plant equipment movement on the public road network; and

Noise and vibration from the operation of mobile and static plant equipment and heavy goods vehicles servicing the cable construction corridor and substation/converter station, delivering or removing materials (including spoil and fill) and plant.

**Operation and Maintenance Phase**

8.10.6 There are unlikely to be any noise and vibration effects relating to operational or maintenance traffic but operational noise effects may arise from the operation of the substation/converter station. Should the substation/converter station site be located in proximity to residential properties (which is unlikely given the proposed connection location at Killingholme power station), an assessment would be required to determine whether operational noise emissions would be likely to have significant environmental effects including potentially audible transformer ‘hum’ at a frequency of 100 Hz.

**Decommissioning Phase**

8.10.7 The potential impacts during decommissioning are considered to be similar to those previously described during the construction phase.

**Potential Transboundary Impacts**

8.10.8 No transboundary impacts are anticipated and it is therefore proposed that these should be scoped out of the EIA process.

**Potential Cumulative Impacts**

8.10.9 Cumulative impacts arising from the proposed development alongside other projects within the area from other industries/activities e.g. port development, industrial development, other coastal infrastructure (e.g. associated with oil and gas activities) are considered to be unlikely. However, the potential for Inter-related impacts to occur will be assessed as part of the EIA process.

8.10.10 SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the grid connection agreement for Project Two will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.
8.10.11 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

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3. Project One operational, or;
4. No change (no Project One).

8.10.12 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.10.13 Although further analysis is required it is considered that simultaneous construction could be marginally worse than the other scenarios.

Potential inter-related effects

8.10.14 Impacts from noise relate in part to impacts from traffic and these will be addressed by the EIA.

Potential Mitigation and Monitoring

8.10.15 The following best practicable means of noise and vibration control will be utilised where appropriate:

- Selection of the most appropriate methods and plant to minimise the level and duration of noise and vibration generated;
- Sensitive location of static plant items;
- Screening and/or enclosure of temporary generators and other noisy plant items;
- Adequate maintenance/lubrication of plant items;
- Shut down of engines when not in use;
- Specification of appropriate access points, haul routes and vehicle standing areas to minimise waiting times and the use of reversing alarms;
- Restriction of vehicle movements to acceptable times;
- Monitoring of noise and vibration; and
- Careful routeing and speed limits for HGVs: and
- Monitoring any noise complaints.

8.10.16 The need for mitigation associated with the substation/converter station will be considered and options could include bunding or screening.
8.11 SOcioeconomics, recreation and tourism

General description

Socioeconomics

8.11.1 This section considers the socio-economic environment of the ‘socio-economic hinterland’ which is referred to as the ‘study area’. The study area includes those Local Authority (LA) areas which are most likely to be affected by Project Two in relation to socio-economics and tourism:

- North Lincolnshire (population (2009 estimate) 160,000);
- North East Lincolnshire (population (2010 estimate) 157,000);
- East Lindsey (population (2010 estimate) 141,600); and
- West Lindsey (population (2010 estimate) 89,400).

8.11.2 Within the study area, population growth rates have varied considerably; East and West Lindsay have seen growth of more than 15% since 1989 whereas North East Lincolnshire has experienced very low or negative population growth.

8.11.3 A slightly lower proportion of the working age population within the study area are economically active compared to England as a whole. In particular, East Lindsay has higher numbers of economically inactive people than the study area or England average.

8.11.4 The largest sources of employment in the study area mirror the sources found at an English level - the public sector, retail, business activities and tourism related activities. However, there are a number of sectors which are more important for the study area compared to their importance to England as a whole. Such industries include heavy manufacturing of metals, chemicals products and oil and gas. Other sectors which are over-represented include food and drink manufacturing and fishing.

8.11.5 There are a number of important elements of the study area’s infrastructure which are likely to be directly affected by the development of Project Two, such as the ports of Grimsby and Immingham. The Port of Immingham’s master plan (ABP, 2010) recognises that “the South Humber Bank provides excellent opportunities to site manufacturing and assembly services and the existing port facilities have capacity to service the associated shipping requirements”. These port facilities are well placed to potentially benefit from the Project Two development.

Recreation and tourism

8.11.6 Cleethorpes is a significant tourist area. It is a traditional and popular seaside town, with hotel accommodation and several caravan and holiday parks. Attractions include the seafront, pier and beaches. Along the coast to the south of Cleethorpes, there are several National Nature Reserves, with visitor
information, parking and beach access, including Donna Nook and Saltfleetby Theddlethorpe.

8.11.7 A Public Right of Way (PROW) runs along the southern bank of the Humber Estuary from Goxhill Haven south along the Estuary shoreline as far as Killingholme. A further footpath continues from Immingham Dock as far as the northern developed edge of Grimsby. The coast to the south of Cleethorpes also has good access, with a footpath running from the southern edge along stretches of the coast to the south.

8.11.8 To the west of the study area is the eastern edge of the Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB). The countryside, villages and market towns of the AONB attract visitors for walking and sight-seeing. The Wanderlust Way is located within the eastern edge of the AONB. It is a 20 mile walking route passing through the small villages, woods and farmland of the AONB.

Data and guidance to inform EIA

Data currently obtained

8.11.9 There is no specific guidance for assessing the impact of offshore wind farms on socio-economics or tourism. However, the socio-economic and tourism impact assessments will draw on a range of sources. Table 8.1 lists the key socio-economic and tourism topics which will be covered by the baseline assessment, the measures used to assess the topics and the data sources which will be used.

Table 8.1 Socio-economic and tourism baseline measures and data source.

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<tr>
<td>Occupational breakdown</td>
<td>Annual Population Survey</td>
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<tr>
<td>Earnings per employee</td>
<td>Annual Survey of Hours and Earnings</td>
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<tr>
<td>GVA per employee</td>
<td>Online National Statistics/Scottish Annual Business Statistics</td>
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</tbody>
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<thead>
<tr>
<th>Transport and commuting</th>
<th>Review of transport infrastructure</th>
<th>Desk research and consultations (to be identified as study progresses)</th>
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<tbody>
<tr>
<td>Commuting and travel patterns</td>
<td>2001 Census</td>
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<tr>
<td>Ferry operators</td>
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<thead>
<tr>
<th>Tourism and leisure</th>
<th>Review of existing attractions</th>
<th>Desk research and consultations (to be identified as study progresses)</th>
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</thead>
<tbody>
<tr>
<td>Tourist numbers</td>
<td>Visitor Attraction Monitor data, RDAs, Visit England.</td>
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<tr>
<td>Value of tourism</td>
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</table>

8.11.10 In addition to the baseline sources, a number of regional level and national level resources will be used in assessing the potential socio-economic and tourism impacts of Project Two:

- National level reports and resources:
  - BWEA (2009). UK Offshore Wind: Charting the Right Course: Building the Offshore Wind Supply Chain;
  - The Crown Estate (2010g). A Guide to an Offshore Wind Farm;

Renewables East (2005). Scroby Sands Supply Chain Analysis;


Scottish Government (2008). The economic impacts of wind farms on Scottish tourism; and

Scottish Renewables and British Wind Energy Association (2002). Tourist Attitude Towards Wind Farms.

Regional resources include:


East Lindsey District Council (2010). Core Strategy Options Paper;


East Midlands Regional Assembly. The East Midlands Energy Challenge – Regional Energy Strategy;

Global Gateway (2005). Hull and Humber Ports City Region Development Programme;

North East Lincolnshire Council (2010). Revised Core Strategy Preferred Options;

North Lincolnshire Council (2010b). Draft Core Strategy submission;

North Lincolnshire and North East Lincolnshire Councils (2010). Evidence base for Northern Lincolnshire Economic Assessment;


Yorkshire Forward (2008). Visitor Economy Strategy; and


8.11.11 Further information including PROWs, bathing beaches, Country Parks and tourist infrastructure such as caravan parks will be considered within the EIA process.
Outstanding data requirements

8.11.12 All data sources above shall be reviewed for relevant new data.

Methods supporting EIA

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

- Socio-economic baseline assessment for areas affected;
- A review of the socio-economic impact literature, existing evidence and relevant regional and national reports;
- Consultation with project developers and other relevant stakeholders; and
- Development of an economic impact model.

8.11.14 The socio-economic baseline assessment will cover:

- Population;
- Employment and economic activity;
- Industry;
- Infrastructure;
- Quality of life;
- Income and wealth;
- Tourism and leisure;
- Fishing; and
- Commercial shipping.

8.11.15 The baseline provided in the socio-economics and tourism ES chapter will identify and assess the existing socio-economic characteristics of the study area. This will include an assessment of the level of tourism activity and also a review of the existing facilities and services which will be directly relevant to the development, for instance the port facilities in the study area. Alongside the baseline, the ES chapter will also include an assessment of the economic benefits which are likely to accrue to the area in terms of employment and Gross Value Added (GVA).

8.11.16 Key local industry representatives, ports and harbours and the developers themselves will also be consulted to explore how any adverse impacts can be minimised while ensuring that any positive effects are maximised.

8.11.17 In addition to the sources listed above, the individual Commercial Fisheries, Ports, Shipping and Navigation and Landscape, Seascape and Visual Amenity assessments will also provide important inputs to the socio-economics baseline assessment.

8.11.18 Following this, the potential socio-economic impacts will be identified and assessed. The key output will be an estimate of the number of net jobs
associated with Project Two and the economic contribution that Project Two makes to the local economy, as measured by its net GVA impact. The economic impact model will consider the impacts associated with the different stages of the development (construction, operation, maintenance and decommissioning) and make an assessment of the direct and indirect employment and GVA generated by each stage of the project.

8.11.19 In addition to the direct and indirect employment and GVA associated with Project Two, an assessment of the impact that Project Two has on tourism (both onshore and offshore), oil and gas industry commercial fishing and shipping will be undertaken. This will be undertaken through examining the results from other EIA baseline reports and consultation with stakeholders. The results will be mainly qualitative and reported in terms of their potential significance of impact.

Potential project impacts

8.11.20 The potential impacts of the construction, operation and maintenance of a project of this size are potentially significant at both a local and national scale.

Construction phase

8.11.21 The identified potential impacts on the socio-economics of the study area resulting from the construction of Project Two are as follows:

- Increased direct employment of local people and associated GVA;
- Increased expenditure through local businesses involved in the project’s supply chain may generate indirect employment and GVA through economic multiplier effects;
- Disruption to tourism and other businesses, particularly during the construction phase;
- Potential upgrades to port infrastructure may allow for new business opportunities;
- Effects on housing, local services and infrastructure associated with any large scale influx of new workers;
- Temporary disruption to the recreational use of publicly accessible spaces (e.g. beaches), recreational facilities and businesses which may be temporarily disrupted through access route diversions, as a result of construction work;
- Temporary disruption to public rights of way (PROW) closures and diversions may be necessary in which case they will be undertaken in consultation with the Council’s Rights of Way department; and

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20 See definition described in Section 1.
• Indirect impacts arising from changes in amenity, for example from noise, dust or changes in views.

8.11.22 Offshore impacts may accrue to commercial fisheries, ferries, other commercial shipping and leisure yachts. The assessment of these impacts will build upon the individual Commercial Fisheries, Ports, Shipping and Navigation and Landscape, Seascape and Visual Amenity assessments being undertaken in parallel with the socio-economic assessment. Potential impacts could include:
  ▪ Increased steaming time for vessels;
  ▪ Loss of access to fishing grounds; and
  ▪ Disruption to traditional shipping routes.

**Operation and maintenance phase**

8.11.23 Impacts arising during operation and maintenance phase are expected to be similar to those experienced during the construction phase.

**Decommissioning phase**

8.11.24 Impacts arising during the decommissioning phase are expected to be similar to those experienced during the construction phase.

**Potential transboundary impacts**

8.11.25 There is potential for transboundary impacts to occur given the scale of Project Two. Examples of potential transboundary impacts include the impacts on foreign ships and fishing fleets and the potential impact on overseas economies through the purchase of key Project Two inputs from companies based outside the UK. Reference will be made to the commercial fisheries section of the EIA in assessing transboundary impacts with regard to socio-economics. These effects will be captured in the economic impact assessment.

**Potential cumulative impacts**

8.11.26 Cumulative impacts may arise from different industry sectors within the same region or Zone on sensitive receptors.\(^{21}\)

8.11.27 The predicted socio-economic and tourism impacts resulting from the construction, operation and maintenance and decommissioning of Project Two could, alongside the presence of the future potential projects within the Hornsea Zone as well as other Round 3 Zones in the North Sea, generate potential for a cumulative impact.

8.11.28 Cumulative impacts may arise in relation to employment and local supply chain involvement in the industry. If sufficient offshore wind farms are brought forward

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\(^{21}\) The Crown Estate (2010), Round 3 zone appraisal and planning A strategic approach to zone design, project identification and consent
and consented, this will present a strong business case for local businesses to invest in the skills or capital needed to become involved in the market. For example, local boat owners diversifying to provide trips to the wind farm for service and maintenance. This is unlikely to occur for one opportunity (i.e. Project Two) but with more developments in the pipeline, there may be sufficient scale to allow businesses to make the necessary investments.

8.11.29 The most likely cumulative impacts relate to Hornsea Project One, the landfall, cable route and HVDC converter station(s) or HVAC substation of which are expected to be closely adjacent to those of Project Two. Project One is not included in the baseline for Project Two, but fully assessed in the CIA using one of four possible scenarios. These are:

1. Project One in construction at the same time as Project Two (simultaneous);
2. Project One in construction with an overlap with Project Two construction;
3. Project One operational, or;
4. No change (no Project One).

8.11.30 A realistic worst case scenario for construction phasing will be agreed and used for assessment.

8.11.31 Although further analysis is required it is considered that simultaneous construction could be marginally worse in terms of socio-economic effects as the duration of the project’s job creation would be shorter term. Conversely, for recreation and tourism the longer term construction involved in scenarios 2 and 3 could result in longer term disruption to public rights of way.

**Potential inter-related effects**

8.11.32 Impact on socio-economics and recreation relate partly to impacts on land use and soils, in that farming and recreational facilities may be affected by the project.

8.11.33 The assessment of both cumulative and inter-related effects will be a ‘live’ and ongoing process, incorporating information from other EIA surveys and monitoring surveys and input from stakeholders. The potential for inter-related impacts to occur will be assessed as part of the EIA process.

**Potential mitigation and monitoring**

8.11.34 Potential mitigation strategies may include:

- Making use of local facilities such as ports and harbours, maximising the involvement of local businesses in the supply chain for Project Two and employing and/or training local people to work at various project stages;
- Directional drilling and/or tunnelling and other good construction practices to avoid disruption to coastal areas used for recreation;
- Temporary diversions of PROW; and
- Good construction practices, including working hours, along the cable route to avoid disruption of tourism and recreation e.g. measures to control noise, dust and traffic (described further in relation to these topic-specific assessments).

8.12 WASTE

8.12.1 The type, volume and transport of onshore waste will be considered in a waste management strategy, appended to ES Volume 1, Chapter 3 Project Design Statement.
9 ENVIRONMENTAL STATEMENT CONTENTS

9.1.1 This section sets out the proposed structure of the ES. The ES will include a clear description of all the aspects of the proposed development, including, onshore and offshore elements, timescales at the construction, operation and decommissioning stages.

9.1.2 It is anticipated that detailed specialist reports will be made available as a separate technical appendices. A separate Non-Technical Summary (NTS) of the information contained within the ES will be produced.

9.1.3 It is proposed that the contents 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: Consultation
  - Section 1.6: Report Structure
- Section 2: Legislative Context
- Section 3: Description of the Proposed Development
- Section 4: Assessment Methodology
- Section 5: Offshore Baseline Environment, Potential and Predicted Impacts and Mitigation
  - Section 5.1: Introduction
  - Section 5.2: Physical Environment
    - Section 5.2.1: Marine Geology, Physical Processes and Water Quality
    - Section 5.2.2: Airborne Noise
  - Section 5.3: Biological Environment
    - Section 5.3.1: Nature Conservation Designations
    - Section 5.3.2: Benthic and Epibenthic Ecology
    - Section 5.3.3: Fish and Shellfish Ecology
    - Section 5.3.4: Ornithology
    - Section 5.3.5: Marine Mammals
  - Section 5.4: Human Environment
• Section 5.4.1: Commercial Fisheries
• Section 5.4.2: Ports, Shipping and Navigation
• Section 5.4.3: Civil Aviation and Military Activities
• Section 5.4.4: Radar and Communications
• Section 5.4.5: Ordnance
• Section 5.4.6: Maritime Archaeology and Cultural Heritage
• Section 5.4.7: Seascape and Visual Amenity
• Section 5.4.8: Infrastructure and Other Marine Users

• Section 6: Onshore Baseline Environment, Potential and Predicted Impacts and Mitigation
  o Section 6.1: Introduction
  o Section 6.2: Physical Environment
    • Section 6.2.1: Geology and Ground Conditions
    • Section 6.2.2: Hydrology and Flood Risk
  o Section 6.3: Biological Environment
    • Section 6.3.1: Ecology and Nature Conservation
  o Section 6.4: Human Environment
    • Section 6.4.1: Landscape and Visual Resources
    • Section 6.4.2: Historic Environment
    • Section 6.4.3: Land Use, Agriculture and Recreation
    • Section 6.4.4: Traffic and Transport
    • Section 6.4.5: Noise and Vibration
    • Section 6.4.6: Socioeconomics

• Section 7: Summary of Impacts and Mitigation Measures
• Section 8: Summary of Effect
• Section 9: Information to Support Appropriate Assessment
• References
• Technical Appendices
## 10 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

### 10.1 OFFSHORE ENVIRONMENT

<table>
<thead>
<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
<th>Justification</th>
</tr>
</thead>
</table>
| Offshore Physical Environment                            | Geology - Construction and Decommission Phase | Temporary increase in suspended sediment could change sediment composition (locally); Changes to, removal of, or creation of large-scale seabed features such as sandwaves and mega ripples; and Changes in sediment transport pathways and deposition could change bathymetry, locally affecting navigation. | • Data from Zonal level geophysical and geotechnical surveys, including grab samples for PSA  
• Site-specific data from Hornsea metocean buoy system (7 locations)  
• PSA data from Project Two grab sampling survey (59 x 0.1 m² Hamon grab sample stations)  
• Outputs from physical process modelling undertaken for ZAP and Project Two specific numerical modelling |
| Offshore Physical Environment                            | Geology - Operation and Maintenance Phase | Changes to hydrodynamics as a result of turbine structures have the potential to impact bathymetry, seabed features and sediment distribution; and There are no anticipated significant impacts to geology. |                                                                                                                         |
| Offshore Physical Environment                            | Physical Processes - Construction and Decommissioning Phase | Temporary disturbance to sediments caused by jack-up barge legs or vessel anchor  
Temporary interference with seabed morphology caused by jack-up barge spud cans (base of the legs);  
Temporary disruption to flow around jack-up barge legs;  
Increased suspended sediment dependent on method of installing foundations;  
Scour around foundations causing increased |                                                                                                                         |
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<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
<th>Justification</th>
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</thead>
<tbody>
<tr>
<td>Offshore Physical Environment</td>
<td>Physical Processes - Operation and Maintenance Phase</td>
<td>suspended sediment concentrations; Suspension and deposition of sediment plumes, which may cause a change in sediment composition locally; Interference with seabed morphology; and Increased suspended sediment during cable laying and trenching.</td>
<td></td>
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<tr>
<td>Relevant ES section</td>
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<td>Project Two – Specific impact</td>
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<td>processes at the coast, including deposition and erosion, due to changes in wave regime; Potential changes to barrier beach features within the North Norfolk Coast Special Area of Conservation, which may require Habitats Regulations Assessment; Interference with seabed morphology (potential impact on navigation channels); Exposure of cable if laid within sand wave fields; and Interference with seabed morphology.</td>
<td>Site-specific data from Hornsea metocean buoy system (7 locations) Data from grab samples from Zonal-level surveys and also Project Two specific grab surveys (which will include 18 x 0.04 m² Shipek grab sampling stations for seabed sediment contaminants analysis</td>
</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Water Quality – Construction and Decommissioning</td>
<td>Potential to release of contaminants bound in sediments; Increased suspended sediment concentrations; Increased turbidity leads to a reduction in light penetration, which can affect primary production; Increased turbidity could interfere with the hunting and feeding efficiency of a wide range of animals including fish, birds and marine mammals; and Potential for the accidental release of contaminants into marine environment during construction activities through spillage or leakage of contaminants from vessels and/or other plant*.</td>
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<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact</td>
<td>Justification</td>
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</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Water Quality – Operation and Maintenance</td>
<td>Changes in seabed scour and deposition, affecting turbidity; and Potential for the accidental release of contaminants into marine environment during maintenance activities through spillage or leakage of contaminants.</td>
<td>Airborne Noise Assessment undertaken for Project One (will be reviewed and referenced as appropriate for the Project Two EIA)</td>
</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Airborne Noise and Vibration - Construction, Operational and Decommissioning Phases</td>
<td>Airborne noise is unlikely to result in significant impacts during either the construction or operational phase.</td>
<td>Project Two specific noise study that shall comprise an assessment and noise modelling exercise</td>
</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Underwater Noise - Construction and Decommissioning Phase</td>
<td>Potential adverse impacts on fish and marine mammals via piling operations and vessel noise.</td>
<td>Noise modelling undertaken for Project One and the wider Hornsea Zone shall be reviewed and used where applicable to inform the noise modelling for Project Two</td>
</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Underwater Noise - Operation and Maintenance Phase</td>
<td>Potential adverse impacts on fish and marine mammals via O&amp;M vessel noise.</td>
<td>Data from Rd2 piling noise monitoring</td>
</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Offshore and Onshore Nature Conservation Designations - Construction and Decommissioning Phase</td>
<td>Temporary displacement/disturbance of species; Temporary reduction in food availability through the displacement / disturbance of prey species; Direct injury to species; Severance and habitat fragmentation</td>
<td>Data from boat-based bird and marine mammal surveys across Subzone 2 (visual counts of bird and marine mammals plus data from towed hydrophone array deployed from survey vessel)</td>
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<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact</td>
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<tr>
<td>Offshore Biological Environment</td>
<td>Offshore and Onshore Nature Conservation Designations - Operation and Maintenance Phase</td>
<td>Direct damage to or loss of habitats, for example, damage to biogenic (e.g. S. spinulosa) reef through vessel anchor damage and cable trenching; and Permanent displacement of species as a result of land-take or habitat loss. (All leading to potential adverse effects on integrity of SAC/SPAs)</td>
<td>• Wider regional data from range of data sources (SCANS-II) • Data from aerial bird surveys across Hornsea Zone undertaken by The Crown Estate • Seabed habitat (Annex I) data from grab/DDV/trawl surveys and geophysical surveys over Subzone 2 area</td>
</tr>
<tr>
<td>Offshore Biological Environment</td>
<td>Benthic and Epibenthic Ecology - Construction and Decommissioning Phase</td>
<td>Displacement/displacement of species; Reduction in food availability through the displacement / disturbance of prey species Severance and habitat fragmentation; and Direct injury to species.</td>
<td>• Data from grab and 2m beam trawl surveys of wider zone and Subzone 1 undertaken in 2010/11 • Additional data from 40 x grab samples, 30 x DDV stations, 30 x 2m beam trawl sites and 18 x sediment contaminant analysis sites in Project Two study area • Geophysical (sidescan sonar) data from Project Two geophysical survey (for Annex I habitat mapping)</td>
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Offshore Benthic and Long term loss of existing seabed habitats under
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<th>Relevant ES section</th>
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<th>Project Two – Specific impact</th>
<th>Justification</th>
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<tbody>
<tr>
<td><strong>Biological Environment</strong></td>
<td>Epibenthic Ecology - Operation and Maintenance Phase</td>
<td>foundations, scour protection and as a result of scour around the structures; Deployment and presence of artificial hard substrate structures and associated increase in colonisation of benthic species adapted to hard surfaces; Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures; Increased suspended sediments and smothering from re-suspension of sediments during cable trenching, vessel anchoring, piling and or drilling; Change to water quality from accidental release of contaminants; and Re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance.</td>
<td></td>
</tr>
<tr>
<td><strong>Offshore Biological Environment</strong></td>
<td>Fish &amp; Shellfish Ecology - Construction and Decommissioning Phase</td>
<td>Temporary loss of habitats and subsequent impacts on spawning stocks, nursery areas and recruitment; Seabed disturbance and associated increased suspended sediments leading temporary disruption to migratory pathways and feeding activity; Change to water quality from accidental release of contaminants; Noise and vibration disturbance from piling and vessel movements having physiological and behavioural impacts on fish and shellfish species,</td>
<td>• Data from Zonal level and cable corridor otter trawl surveys (April and September/October 2011) • Data from intertidal fisheries surveys (April and September 2011) • Data from experimental and observational potting surveys along cable route (June and October 2011) • Additional data from continued experimental and observational potting surveys (May, Oct, Nov 2012)</td>
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<td>Relevant ES section</td>
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<td>Project Two – Specific impact</td>
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|                     |           | including disturbance to early life stages, and temporary disruption to migratory pathways of salmonids, lamprey and other migratory fish and shellfish species; Acoustic surveys that are conducted in the pre-construction phase may disturb fish and shellfish spawning; Changes in sediment transport and deposition patterns impacting on seabed spawning habitat; Changes to water quality; and Habitat modification due to introduction of hard substrate in the form of foundations and scour | • Data from EIA fisheries consultation  
• Data from CEFAS fisheries spawning sensitivity maps (Ellis et al, 2012) |
<table>
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<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
<th>Justification</th>
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</table>
|                     | Phase     | from construction activities, the presence of construction vessels and other associated plant; and Reduction in prey availability through the disturbance and displacement of fish and other prey from the Subzone 2 area resulting from the presence of construction vessels and other associated plant. | in March 2010)  
  • Data from site-specific monthly boat-based seabird surveys for Subzone 2 Study Area, covering Subzone 2 and a 4 km buffer at 2 km transect spacing also running north to south (commenced in April 2012 – due to end March 2013).  
  • Regional bird count data from various literature sources including aerial bird survey data collected by The Crown Estate over Hornsea Zone. |
<p>| Offshore Biological Environment | Ornithology - Operation and Maintenance Phase | Displacement of birds resulting from the presence of turbines; Direct collision of birds using study area for feeding and migration with the turbines; Barrier to daily movements and migration as a result of the turbines disrupting the flight-lines of birds which may cause an increase in the energetic costs; Disturbance and displacement of birds resulting from the presence of O&amp;M vessels, leading to a physical loss of foraging habitat; and Reduction in prey availability through the disturbance and displacement of fish and other prey resulting from the presence of O&amp;M vessels. | |
| Offshore Biological Environment | Marine Mammals - Construction and Decommissioning Phase | Potential mortality, injury and/or behavioural responses to individual marine mammals due to noise emission from foundation piling; Temporary disturbance and displacement of marine mammals; Temporary effects on the distribution and availability through the disturbance and displacement of fish and other prey from the presence of O&amp;M vessels. | • Data from boat-based marine mammal surveys up to a distance of 4km from Subzone 2 and 10 km from the wider Hornsea Zone (visual counts of marine mammals plus data from towed hydrophone array) |</p>
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<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
<th>Justification</th>
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</table>
| Offshore Biological Environment | Marine Mammals - Operation and Maintenance Phase | Disturbance and displacement of marine mammals resulting from the noise and vibration from O&M vessels; Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance; Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from O&M vessels; and Potential physical damage, masking effects, and disturbance resulting from the noise and vibration and/or collision from O&M vessels. | deployed from survey vessel)  
• Wider regional data from range of data sources (SCANS-II)  
• Any marine mammal sighting data from aerial bird surveys across Hornsea Zone undertaken by The Crown Estate |
| Offshore Human Environment | Commercial Fisheries - Construction and Decommissioning Phase | Temporary displacement of UK and European fishing vessels from established fishing grounds within Project Two due to existence of construction (500m) Safety Zones; Increased pressure on adjacent fishing grounds due to displacement from fishing grounds affected | • Landing statistics from ICES rectangles within which Project Two lies (2006-2011)  
• VMS data for 2010 and 2011 for Project Two study area |
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<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
<th>Justification</th>
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<tr>
<td></td>
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<td>by construction Safety Zones;</td>
<td>• Surveillance data from MMO for area covered by Project Two</td>
</tr>
<tr>
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<td>Loss or damage to fishing gear and/or vessels due to seabed debris, anchor wires, construction vessel movements etc.;</td>
<td>• Detailed consultation with key fishing organisations (UK and EU) – continued from process initiated via Project One</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Displacement or disruption of commercial important fish and shellfish resources (including from marine noise impacts; and</td>
<td>• Ecological data from trawl and potting surveys over main site and cable corridor</td>
</tr>
<tr>
<td></td>
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<td>Longer steaming distances to alternative fishing grounds to avoid construction Safety Zones.</td>
<td></td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Commercial Fisheries - Operation and Maintenance Phase</td>
<td>Exclusion of UK and European fishing vessels from established grounds; Increased pressure on adjacent fishing grounds; Displacement or disruption of commercial important fish and shellfish resources (including EMF effects on elasmobranchs; Beneficial impact on potting fishery due to creation of refuge habitat from foundations and/or scour protection for selected shellfish species Increased safety risk to vessels from presence of wind farm structures; Loss or damage to fishing gear (including snagging risk of cable); and Longer steaming distances to alternative fishing grounds.</td>
<td></td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Shipping &amp; Navigation - Construction and Decommissioning</td>
<td>Increased collision risk to commercial shipping due to increased construction traffic within Project Two main site and cable corridor; and</td>
<td>• Outputs of the formal Navigation Risk Assessment (NRA) undertake for Project One (including a 10 km</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact</td>
<td>Justification</td>
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<td></td>
<td>Phase</td>
<td>Increased disruption to routine ports operations and traffic due to presence of construction vessels</td>
<td>buffer zone).</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Shipping &amp; Navigation - Operation and Maintenance Phase</td>
<td>Increased collision risk between vessels and structures; Potential for the structures to produce radar reflections, blind spots, shadow areas or adverse effects; Potential for structures to block or hinder the view of other vessels under way on any route; Potential for structures to block or hinder the view of the coastline from vessels; The distances travelled by merchant vessels could be affected, requiring vessels to travel greater distances; The cable route may impact on merchant ships dragging anchor or emergency anchoring in the vicinity of the cable(s); Potential compass deviation effects of the magnetic fields generated by the cables; It is considered unlikely that there will be any significant recreational activities within Subzone 2 due the distance offshore; and Potential for fishing activity to be displaced to outside of Subzone 2 during operation, this will influence the rate of vessel-to-vessel encounters and hence the collision risk</td>
<td>Outputs of new NRA for Project Two incorporating up-to-date shipping density data for 2011 (obtained via radar and AIS sources) Consultation with commercial shipping operators</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact</td>
<td>Justification</td>
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</table>
| Offshore Human Environment | Civil Aviation and Military Activities - Construction and Decommissioning Phase | Depending on the height of the equipment on the various installation vessel(s), there may be potential for the vessel to be considered to be a moving physical obstruction. As long as the vessel(s) is displaying the appropriate maritime light signals for the task, it is considered unlikely that it will create an aviation hazard. | • Consultation with MoD and civil aviation bodies and organisations  
• Radar performance and propagation modelling has been carried out for the wider Hornsea Zone and an aviation impact assessment has been carried out for the Hornsea Zone Project One) which shall be used where applicable, to inform the EIA for Project Two |
<p>| Offshore Human Environment | Civil Aviation and Military Activities - Operation and Maintenance Phase | Physical obstruction to aircraft; Wake turbulence on aircraft; Restriction on helicopter operations affecting integrity of offshore safety requirements and search and rescue operations; and Disruption to military activities | |
| Offshore Human Environment | Radar and Communications - Construction and Decommissioning Phase | There are no anticipated impacts on civil aviation and military activities during the construction phase. | |
| Offshore Human Environment | Radar and Communications - Operation and Maintenance Phase | Civil HIA Terminal radar interference; Aeronautical navigation aids (Navaids); Military PSC and ATC radar; Military Air defence radars; Meteorological radars; VHF communications interference; Satellite communications interference; and | |</p>
<table>
<thead>
<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
<th>Justification</th>
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<tbody>
<tr>
<td>Offshore Human Environment</td>
<td>Offshore microwave fixed links</td>
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<tr>
<td>Offshore Human Environment</td>
<td>Ordnance (UXO) - Construction and Decommissioning Phase</td>
<td>Potential for construction activities to disturb unknown UXO, especially within the cable route corridor. Such an occurrence could lead to significant impacts to the health and safety of construction workers and for damage to construction equipment and vessels.</td>
<td>• The Project One Explosive Risk Assessment shall be reviewed and supplemented to ensure full coverage of the cable route corridor and project footprint for the Ordnance risk assessment for Project Two.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Ordnance (UXO) - Operation and Maintenance Phase</td>
<td>Changes in hydrodynamic regime as a result of the turbine foundations and scour protection within Project Two could result in the exposure and remobilisation of previously covered ordnance.</td>
<td>• In addition geophysical surveys have been conducted of the wider Hornsea Zone and cable route corridor which will be supplemented with additional surveys for the cable route corridor. The findings of the geophysical surveys shall be used to inform the Explosive Risk Assessment.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Maritime Archaeology and Cultural Heritage - Construction and Decommissioning Phase</td>
<td>Damage to archaeological sites, features and artefacts resulting from construction activities.</td>
<td>• Project One Archaeological Assessment (covering the cable route corridor)</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Maritime Archaeology and Cultural Heritage - Operation and Maintenance Phase</td>
<td>Potential changes to the sediment regime resulting in burial or exposure of archaeological sites, features and artefacts.</td>
<td>• Data from additional geophysical surveys of the cable route corridor.</td>
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<td>• Data from any geotechnical studies within the Zone</td>
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<td>• Project Two specific Archaeological Assessment (incorporating geophysical and geotechnical data from Project One and Zonal studies)</td>
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<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact</td>
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<tr>
<td>Offshore Human Environment</td>
<td>Landscape, Seascape and Visual Amenity - Construction and Decommissioning Phase</td>
<td>Short term seascape and visual impacts from machinery/equipment and activities including assembly of turbines and installation of infrastructure.</td>
<td>- Desk-based records</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Landscape, Seascape and Visual Amenity - Operation and Maintenance Phase</td>
<td>Visual receptors on passenger ferries and shipping channel routes are likely to experience a change in view for a short period of time*. Impacts can be adverse or beneficial, and in some cases may be considered to be neutral; and The seascape is likely to experience direct, adverse impacts in character areas within the Subzone.</td>
<td>- Admiralty Chart data</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Infrastructure and Other Marine Users - Construction and Decommissioning Phase</td>
<td>Cable installation activities along the export cable route may impact on recreational activities, via increased collision risk between leisure and water sports craft and construction vessels / plant and/or the temporary displacement of activities from areas during the construction phase; Potential of contaminated sediment being disturbed during cable installation and reintroduced into the water column should the cable route pass through previously closed disposal sites; and Cable installation resulting in impacts on existing oil and gas pipelines and infrastructure (mainly via cable crossings)</td>
<td>- Data from Hornsea ZAP</td>
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<td>- Various websites of key marine users, e.g. BMAPA, RYA, UK DEAL etc.</td>
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<td>- Consultation with other marine users via EIA process (continuation of ongoing consultation initiated for ZAP and Project One EIA process)</td>
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<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact</td>
<td>Justification</td>
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<tr>
<td>Offshore Human Environment</td>
<td>Infrastructure and Other Marine Users - Operation and Maintenance Phase</td>
<td>Potential impacts on the marine aggregate extraction dredging industry if the size of sediment particles within an aggregate licence area alters as a result of the construction of Project Two; Physical presence of Project Two may impact on the future exploration for oil and gas within its footprint by restricting future seismic surveys, exploration drilling and development activities; and Physical presence of Project Two and the cable corridor may impact on the future exploitation of gas fields and have implications for the possible future use of depleted fields for natural gas storage or Carbon Capture and Storage (CCS) projects.</td>
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</tbody>
</table>
### 10.2 ONSHORE ENVIRONMENT

<table>
<thead>
<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
<th>Justification</th>
</tr>
</thead>
</table>
| Onshore Physical Environment | Geology, Soils, Agriculture and Land-Use - Construction and Decommissioning Phase | Soil loss or structural damage; Changes to soil composition and structure; Changes to existing land quality and agricultural productivity of soils; Temporary disruption to farming operations during construction; Temporary disruption to land drainage systems during construction; and Potential for transmission of agricultural pests and diseases. | • Citations and descriptions of geological sites  
• British Geological Survey (BGS) mapping  
• BGS borehole records for locations in the vicinity  
• Ground investigations at the cable landfall point  
• GroundSure EnviroInsight database reports |
| Onshore Physical Environment | Geology, Soils, Agriculture and Land-Use - Operation and Maintenance Phase | The potential impacts during maintenance are considered to be similar to but smaller than those for the construction phase. | • GroundSure GeoInsight database reports  
• Landmark Envirocheck database reports  
• Defra agricultural land quality maps |
| Onshore Physical Environment | Water Resources - Construction and Decommissioning Phase | Sediment mobilisation in site runoff from exposed soil surfaces during construction; Contamination of surface water features or groundwater by oils, lubricant and fuels originating from construction vehicles or store areas; Impacts on the quality of private water supplies; Changes to groundwater movement; and Longer term impacts on abstraction for private | • British Geological Survey (BGS) Geology Plans  
• British Geological Survey (BGS) Groundwater Vulnerability Map  
• The Centre for Ecology and Hydrology (CEH)  
• Envirocheck Report  
• Environment Agency, River Basin |
<table>
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<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact</th>
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</thead>
<tbody>
<tr>
<td>Onshore Physical Environment</td>
<td>Water Resources - Operation and Maintenance Phase</td>
<td>Contamination of surface water features or groundwater by oils, lubricant and fuels originating from operational and maintenance vehicles or store areas; and Risk of contaminated water run-off from hard-standing areas entering nearby watercourses and potentially impacting the quality of private water supplies.</td>
<td>Management Plan Humber River Basin District, December 2009 • Fisher German Priestner asset mapping • GroundSure EnviroInsight Report • GroundSure GeoInsight Report • Met Office • Environment Agency information on groundwater vulnerability, source protection zones and bedrock/superficial deposit aquifer status</td>
</tr>
<tr>
<td>Onshore Physical Environment</td>
<td>Air Quality and Health - Construction and Decommissioning Phase</td>
<td>Potential to affect local air quality during the construction phases through the generation of dust and emissions of combustion related pollutants from on-site plant/vehicles and off-site road traffic.</td>
<td>• The National Air Quality Information Archive (NAQIA); and • Air Quality Review and Assessment Documents prepared by ELDC, NELC, WLDC and NLC.</td>
</tr>
<tr>
<td>Onshore Physical Environment</td>
<td>Air Quality and Health Resources - Operation and Maintenance Phase</td>
<td>No potentially significant sources of emissions to air will exist during the operation of the proposed development. HVAC substations and HVDC converter stations do not give off emissions and, as such, no direct impact would be anticipated. It is proposed that this issue is scoped out of the EIA process.</td>
<td></td>
</tr>
<tr>
<td>Onshore Biological Environment</td>
<td>Ecology and Nature Conservation - Construction and Decommissioning</td>
<td>Disturbance to habitats and/or species as a result of expected increases in noise, vibration, lighting and activities associated with onshore construction.</td>
<td>• Citations and descriptions of biological sites; • Humber Environmental Data Centre</td>
</tr>
<tr>
<td>Relevant ES section</td>
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<tr>
<td>Phase</td>
<td>Habitat severance and fragmentation as a result of cable trenching, which could result in disturbance to species utilising these habitats, such as bats. Temporary displacement of species as a result of construction activities and land-take. Potential habitat and species loss as a result of land-take for the new HVAC substation or HVDC converter station(s). Temporary discharge of pollutants, which may have adverse impacts on habitats and species during construction. Habitat reinstatement would be undertaken following construction wherever practicable.</td>
<td>(Humber INCA); • Lincolnshire Wildlife Trust; • Lincolnshire Biodiversity Partnership; • Lincolnshire Biodiversity Action Plan; • British Trust for Ornithology; • RSPB; • Lincolnshire Badger Group; • Buglife; • Botanical Society of the British Isles (BSBI); • English Heritage (National Monuments Record)</td>
<td></td>
</tr>
<tr>
<td>Onshore Biological Environment Ecology and Nature Conservation - Construction and Decommissioning Phase</td>
<td>Permanent displacement of species as a result of land-take for the new HVAC substation or HVDC converter station(s). Disturbance to habitats and/or species as a result of noise and increased human activities during maintenance operations.</td>
<td>• Lincolnshire Bat Group; • Lincolnshire Bird Club; • Lincolnshire Reptile and Amphibian Group; • Butterfly Conservation; • Field surveys for Project One and Project Two.</td>
<td></td>
</tr>
<tr>
<td>Onshore Human Environment Historic Environment - Construction and Decommissioning Phase</td>
<td>Direct impacts involving physical alteration or destruction of heritage assets as a result of cable trenching or construction of HVAC substation or HVDC converter station(s) foundations and any cable infrastructure; Potential temporary impacts on historic monuments and buildings from noise and</td>
<td>• The Lincolnshire Historic Environment Record; • The North-East Lincolnshire Historic</td>
<td></td>
</tr>
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</table>
## SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

<table>
<thead>
<tr>
<th>Relevant ES section</th>
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<th>Project Two – Specific impact</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore Human Environment</td>
<td>Historic Environment - Operation and Maintenance Phase</td>
<td>No permanent impacts are anticipated on archaeology and cultural heritage during operation and maintenance activities.</td>
<td>Environment Record;</td>
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<td>vibration during construction; and</td>
<td>• The North Lincolnshire Historic Environment Record;</td>
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<td></td>
<td>Indirect impacts involving an effect on the setting of a heritage asset, such as a scheduled ancient monument, listed building or a conservation area from above ground HVAC substation or HVDC converter station(s) and/or any potential cable infrastructure</td>
<td>• The Lincolnshire Archives</td>
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<td></td>
<td>Lanscape and Visual Resources - Construction Phase</td>
<td>During construction there are likely to be minor visual impacts; During construction there may be direct landscape and visual impacts due to the displacement of landscape features and the presence of construction activity in views; and During construction there are unlikely to be significant impacts due to the industrial nature of the area and screening provided by existing structures.</td>
<td>• Landscape Character Assessments for East Lindsey, West Lindsey, North Lincolnshire and North-East Lincolnshire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No impacts are anticipated to result from the</td>
<td>• Landscape Character Assessment for East Midlands</td>
</tr>
<tr>
<td></td>
<td>Lanscape and Visual Resources - Construction Phase</td>
<td></td>
<td>• Ordnance Survey maps</td>
</tr>
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<td></td>
<td>Lanscape and Visual Resources - Construction Phase</td>
<td></td>
<td>• Landscape designations</td>
</tr>
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<td></td>
<td>Lanscape and Visual Resources - Construction Phase</td>
<td></td>
<td>• Meteorological office</td>
</tr>
</tbody>
</table>

- Environment Record;
- The North Lincolnshire Historic Environment Record;
- The Lincolnshire Archives;
- Grimsby Public Library;
- The Bodleian Library, Oxford;
- ArchSearch (data held by the Archaeology Data Service);
- The National Monuments Record, Swindon;
- Google Earth;
- English Heritage database of designated historic assets;
- Geophysical surveys undertaken for Project One and Project Two.
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</thead>
</table>
| Environment         | Resources - Operation and Maintenance Phase | HVAC substation or HVDC converter station(s) during this phase of the project. | • Aerial photography  
• Natural England’s National Character Areas  
• Database of Landscape Character Assessments in England;  
• National, regional and local planning policy |
| Onshore Human Environment | Landscape and Visual Resources - Decommissioning Phase | Short term landscape and visual impacts from machinery/equipment and activities on the site. Impacts are likely to be smaller than those reported during construction as the underground cable is likely to remain in place; and Following decommissioning there is unlikely to be any residual impact on the landscape or visual receptors. | |
| Onshore Human Environment | Flood Risk - Construction and Decommissioning Phase | Temporary changes to natural surface water drainage patterns and run-off rates, and resultant potential for flooding on, or arising from construction of above ground infrastructure. | • East Lindsey District Council Strategic Flood Risk Assessment  
• Environment Agency Flood Hazard Mapping;  
• Fisher German Priestner asset mapping;  
• Humber Flood Risk Management Strategy, March 2008;  
• Lindsey Marsh Internal Drainage Board Asset Mapping;  
• Met Office;  
• North East Lincolnshire & North Lincolnshire Strategic Flood Risk |
<p>| Onshore Human Environment | Flood Risk - Operation and Maintenance Phase | Permanent increase in surface run-off from as a result of increased impermeable surface areas, and resultant potential for flooding on, or arising from above ground infrastructure.; and Temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding on, or arising from maintenance of above ground infrastructure. | |</p>
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<tr>
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<th>Project Two – Specific impact</th>
<th>Justification</th>
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<tbody>
<tr>
<td>Onshore Human Environment</td>
<td>Traffic and Transport - Construction and Decommissioning Phase</td>
<td>Potential to affect the local road network during the construction phase through delivery of machinery, concrete, cabling, aggregate and sand, and through the arrival and departure of construction workers; Depending upon the change in traffic flows predicted to occur as a result of the proposed development, potential impacts that will be assessed are: severance, driver delay, pedestrian delay, pedestrian amenity, fear and intimidation, and accidents and safety; and Potential to result in temporary delays to public transport services as a result of cable route construction under railway lines or impacts on road networks</td>
<td>Site visit; Existing traffic flow information from Lincolnshire County Council, North-East Lincolnshire Council and North Lincolnshire Council within the study area; Traffic surveys for Projects One and Two; Records of personal injury road traffic accidents for the study area; Bus timetables.</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Traffic and Transport - Operation and Maintenance Phase</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Noise and Vibration - Construction and Decommissioning Phase</td>
<td>Noise and vibration from construction activities including: earth moving, excavation, landscaping, directional drilling and/or tunnelling, site vehicle and plant equipment movement on the public road network and mobile and static plant equipment and heavy goods vehicles servicing</td>
<td>Ordnance Survey mapping; Aerial photography; Baseline noise surveys for Projects One and Two;</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact</td>
<td>Justification</td>
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<tr>
<td>Onshore Human Environment</td>
<td>Noise and Vibration - Operation and Maintenance Phase</td>
<td>Operational noise effects may arise from the operation of the HVAC substation or HVDC converter station(s).</td>
<td>• Baseline data from other EIAs in the project area;</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Socio-Economics Recreation and Tourism - Construction and Decommissioning Phase</td>
<td>Increased direct employment of local people and associated GVA; Increased expenditure through local businesses involved in the project’s supply chain may generate indirect employment and GVA through economic multiplier effects; Disruption to tourism and other businesses, particularly during the construction phase; Potential upgrades to port infrastructure may allow for new business opportunities; Effects on housing, local services and infrastructure associated with any large scale influx of new workers; Temporary disruption to the recreational use of publicly accessible spaces (e.g. beaches), recreational facilities and businesses which may be temporarily disrupted through access route diversions, as a result of construction work; Temporary disruption to public rights of way (PROW) closures and diversions may be necessary in which case they will be undertaken</td>
<td>• OS mapping; • Definitive maps of Public Rights of Way; • Tourist information; • Local authorities; • Site visits.</td>
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</table>
## SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

### Relevant ES section
### Parameter
### Project Two – Specific impact
### Justification

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<tr>
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</thead>
<tbody>
<tr>
<td>Onshore Human Environment</td>
<td>Socio-Economics Recreation and Tourism - Operation and Maintenance Phase</td>
<td>Impacts arising during operation and maintenance phase are expected to be small.</td>
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</tr>
</tbody>
</table>

- in consultation with the Council’s Rights of Way department; and
- Indirect impacts arising from changes in amenity, for example from noise, dust or changes in views.
## 11 POTENTIAL TRANSBOUNDARY IMPACTS

### 11.1 OFFSHORE ENVIRONMENT

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<tr>
<th>Relevant ES section</th>
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<th>Potential Transboundary Impact</th>
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</thead>
<tbody>
<tr>
<td>Offshore Physical Environment</td>
<td>Geology, Physical Processes and Water Quality</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Airborne Noise and Vibration</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Physical Environment</td>
<td>Underwater Noise</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Biological Environment</td>
<td>Offshore and Onshore Nature Conservation Designations</td>
<td>Potential for transboundary effects through highly mobile designated species. Full assessment of impacts will be undertaken during the EIA and DCO application process.</td>
</tr>
<tr>
<td>Offshore Biological Environment</td>
<td>Benthic and Epibenthic Ecology</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Biological Environment</td>
<td>Fish &amp; Shellfish Ecology</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Biological Environment</td>
<td>Ornithology</td>
<td>Potential for transboundary impacts through highly mobile species. Full assessment of impacts will be undertaken during the EIA and DCO application process.</td>
</tr>
<tr>
<td>Offshore Biological Environment</td>
<td>Marine Mammals</td>
<td>Potential for transboundary impacts through highly mobile species. Full assessment of impacts will be undertaken during the EIA and DCO application process.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Commercial Fisheries</td>
<td>Potential for transboundary impacts upon foreign fishing fleets.</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Potential Transboundary Impact</td>
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<tr>
<td>Offshore Human Environment</td>
<td>Shipping &amp; Navigation</td>
<td>Potential for transboundary impacts upon international shipping. Full assessment of impacts will be undertaken during the EIA and DCO application process.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Civil Aviation and Military Activities</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Radar and Communications</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Ordnance (UXO)</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Maritime Archaeology and Cultural Heritage</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Landscape, Seascape and Visual Amenity</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Infrastructure and Other Marine Users</td>
<td>No potential transboundary impact predicted.</td>
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## 11.2 ONSHORE ENVIRONMENT

<table>
<thead>
<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Potential Transboundary Impact</th>
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<tbody>
<tr>
<td>Onshore Physical Environment</td>
<td>Geology, Soils, Agriculture and Land-Use</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Onshore Physical Environment</td>
<td>Water Resources</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Onshore Physical Environment</td>
<td>Air Quality and Health</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Onshore Biological Environment</td>
<td>Ecology and Nature Conservation</td>
<td>No potential transboundary impact predicted.</td>
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<tr>
<td>Onshore Human Environment</td>
<td>Historic Environment</td>
<td>No potential transboundary impact predicted.</td>
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<tr>
<td>Onshore Human Environment</td>
<td>Landscape and Visual Resources</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Landscape and Visual Resources</td>
<td>No potential transboundary impact predicted.</td>
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<tr>
<td>Onshore Human Environment</td>
<td>Flood Risk</td>
<td>No potential transboundary impact predicted.</td>
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<tr>
<td>Onshore Human Environment</td>
<td>Traffic and Transport</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Noise and Vibration</td>
<td>No potential transboundary impact predicted.</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Socio-Economics Recreation and Tourism</td>
<td>There is potential for transboundary impacts to occur given the scale of Project Two. Examples of potential transboundary impacts include the impacts on foreign ships and fishing fleets and the potential impact on overseas economies through the purchase of key Project...</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Potential Transboundary Impact</td>
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<td></td>
<td>Two inputs from companies based outside the UK. Reference will be made to the commercial fisheries section of the EIA in assessing transboundary impacts with regard to socio-economics. These effects will be captured in the economic impact assessment.</td>
</tr>
</tbody>
</table>
12 TOPICS PROPOSED TO BE SCOPED OUT OF THE ASSESSMENT FOR PROJECT TWO

12.1.1 Detail on the items that have been specifically scoped out of this assessment, and the justification for these, is indicated below.

12.2 OFFSHORE ENVIRONMENT

<table>
<thead>
<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact scoped out of this assessment</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore Physical Environment</td>
<td>Air Quality</td>
<td>The impact of the project on local and regional air quality is to be scoped out of this assessment.</td>
<td>Atmospheric emissions from Subzone 2 will be from the fuel used to power vessels used in the construction, operation, and maintenance and decommissioning of the wind farms. The pollutants of concern from these sources are oxides of nitrogen (NOX), which represents the total of nitrogen dioxide (NO2) and nitrogen oxide (NO), sulphur dioxide (SO2) and carbon dioxide (CO2), however all vessels used during the Project development will comply with the Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008. Given the dispersive nature of the offshore environment (strong winds and flat topography) and the distance of Subzone 2 from considerable static sources of pollutants, it is not considered likely that existing concentrations are at levels of environmental concern within Subzone 2. An air quality assessment was undertaken using the DEFRA shipping data for the region and the magnitude of impact at a local, regional and global level from maintenance activities was considered to be negligible due to short durations, and a dispersive environment. Receptor sensitivity was considered to be negligible due to</td>
</tr>
</tbody>
</table>
### Relevant ES section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project Two – Specific impact scoped out of this assessment</th>
<th>Justification</th>
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</thead>
<tbody>
<tr>
<td><strong>Offshore Physical Environment</strong></td>
<td>Airborne Noise and Vibration</td>
<td>The effects of airborne noise impacts from the operational project are to be scoped out of the assessment.</td>
</tr>
</tbody>
</table>
| **Bat Ecology**            | Impacts upon bat ecology through all phases of the project are to be scoped out.                                                                 | Species that may occur in the Project Two development Area  
Species that may occur in the Project Two development Area  
The Nathusius’ pipistrelle is probably a regular                            |
<table>
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<tr>
<th>Relevant ES section</th>
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<th>Project Two – Specific impact scoped out of this assessment</th>
<th>Justification</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>but scarce migrant and could occur within the proposed development area. The UK also has a summer breeding population of Nathusius' pipistrelles, though only a handful of maternity roosts are known. Although this species is widespread across the UK, it is considered nationally rare. There is the potential for the Nathusius' pipistrelle to occur in the area of the proposed development during the migration periods, which mainly occur in September. Nathusius’ pipistrelle is the most frequently recorded bat on offshore platforms, with 26 out of 34 records from the Dutch sector being of this species, and the most frequently recorded species from the Northern Isles. There are few records along the east coast with none in North Yorkshire and few in Lincolnshire (Simpkin, 2006; NYBG, 2011; NBN, 2011). The species was also frequently recorded during offshore studies undertaken in Sweden where it was detected foraging and migrating (Ahlén et al., 2009). Studies undertaken in Sweden recorded the flight heights of Nathusius’ pipistrelle and other species. The majority of records were of bats flying less than 10 metres above the sea surface with only occasional sightings at rotor height (Ahlén et al., 2009). Consequently, the risk of collision with the turbines by Nathusius’ pipistrelle is very low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Conclusion</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact scoped out of this assessment</td>
<td>Justification</td>
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<td></td>
<td></td>
<td>The Nathusius pipistrelle is the only species of bat considered likely to occur within the Project One development area. Based on the relative scarcity of Nathusius’ pipistrelle in the UK and the low flight heights recorded offshore it was considered that there will not be a significant environmental impact from the proposed Project One on the Nathusius’ pipistrelle. The noctule and Leisler’s bats are scarce in the North Sea and there are few, if any, sightings of migrants along the east coast of England. They are therefore not at risk of any significant environmental impact from the proposed Project One development. Based on the available data, the desk based study concluded that the proposed development of will not have a significant environmental impact on bats.</td>
</tr>
<tr>
<td>Offshore Human Environment</td>
<td>Waste Management</td>
<td>Impacts of offshore waste management are proposed to be scope out of the assessment.</td>
<td>Solid waste generated offshore includes food and general waste and special waste including oil and oily rags from the construction vessels and rigs. All solid waste will be handled in accordance with the MARPOL convention (as relevant to the North Sea). The MARPOL convention prohibits discharge of any solid wastes into the North Sea as a Special Sea Area. All waste will therefore be bought ashore to port reception facilities where it will be managed, handled and disposed as per legislative requirements. The onshore transportation of waste will be assessed in the onshore transport of the ES. Due to the small</td>
</tr>
</tbody>
</table>
### Relevant ES section | Parameter | Project Two – Specific impact scoped out of this assessment | Justification
--- | --- | --- | ---
 |  |  |  | quantities of solid waste generated and the fact that all waste will be brought to the shore it is proposed that offshore solid waste will be scoped out of the assessment.
### 12.3 ONSHORE ENVIRONMENT

<table>
<thead>
<tr>
<th>Relevant ES section</th>
<th>Parameter</th>
<th>Project Two – Specific impact scoped out of this assessment</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore Physical Environment</td>
<td>Geology, Soils, Agriculture and Land-Use - Construction and Decommissioning Phases</td>
<td>No anticipated damage to or severance of access to designated geological sites – where geological receptors comprise geological Sites of Special Scientific Interest (SSSI) and regionally important geological and geomorphological sites. Transboundary effects have been scoped out of this assessment.</td>
<td>There are no sites designated for geological reasons within 1 km of the construction works.</td>
</tr>
<tr>
<td>Onshore Physical Environment</td>
<td>Geology, Soils, Agriculture and Land-Use - Operation and Maintenance Phase</td>
<td>No anticipated impacts on groundwater quality as a result of maintenance activities. No anticipated impacts on soils, the farming framework or other land use resulting from the operation of the HVAC substation or HVDC converter station(s) or cable route.</td>
<td>Maintenance activities would be controlled through best practice site management. Following the successful reclamation of soils during the construction phase, there would be no further effects on agricultural land quality and soils arising during the operation of the project. The permanent loss of agricultural land associated with the development will be assessed as part of the construction phase.</td>
</tr>
<tr>
<td>Onshore Physical Environment</td>
<td>Water Resources - Construction and Decommissioning Phases</td>
<td>No specific impacts identified for scoping out of this assessment.</td>
<td>Maintenance activities would be controlled through best practice site management.</td>
</tr>
<tr>
<td>Onshore Physical Environment</td>
<td>Water Resources - Operation and Maintenance Phase</td>
<td>No anticipated impacts on ground water or surface water quality as a result of operational or maintenance activities. Transboundary effects have been scoped out of this assessment.</td>
<td>Maintenance activities would be controlled through best practice site management. Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td>Onshore Physical</td>
<td>Air Quality and Health</td>
<td>Effects on local air quality from vehicle</td>
<td>The guidance issued by Environmental Protection</td>
</tr>
</tbody>
</table>
### TOPICS PROPOSED TO BE SCOPED OUT OF THE ASSESSMENT FOR PROJECT TWO

<table>
<thead>
<tr>
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<th>Parameter</th>
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<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environment</strong></td>
<td>- Construction and Decommissioning Phases</td>
<td>Emissions would be scoped out should the HGV movements be less than an average of 200 movements per day.</td>
<td>UK recommends that the air quality assessment should include construction traffic for those large, long-term construction sites that will generate large HGV flows (&gt; 200 movements per day) over a period of a year or more, or will affect annual average daily traffic flows (&gt; 5 - 10%). Emissions from construction traffic will only be considered if these criteria are exceeded.</td>
</tr>
<tr>
<td><strong>Onshore Physical Environment</strong></td>
<td>Air Quality and Health - Operation and Maintenance Phase</td>
<td>No potentially significant sources of emissions to air will exist during the operation of the proposed development. Transboundary effects have been scoped out of this assessment.</td>
<td>Substations and converter stations do not give off emissions and, as such, no direct impact would be anticipated. It is proposed that this issue is scoped out of the EIA process. Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td><strong>Onshore Biological Environment</strong></td>
<td>Ecology and Nature Conservation</td>
<td>Transboundary effects have been scoped out of this assessment.</td>
<td>Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td><strong>Onshore Human Environment</strong></td>
<td>Historic Environment</td>
<td>Transboundary effects have been scoped out of this assessment.</td>
<td>Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td><strong>Onshore Human Environment</strong></td>
<td>Landscape and Visual Resources - Construction and Decommissioning Phases</td>
<td>No specific impacts identified for scoping out of this assessment.</td>
<td>Cumulative landscape and visual impacts from operational underground cables are very unlikely to occur once the land is reinstated.</td>
</tr>
<tr>
<td><strong>Onshore Human Environment</strong></td>
<td>Landscape and Visual Resources - Operation and Maintenance Phase</td>
<td>No anticipated cumulative landscape and visual impacts from operational underground cables. Transboundary effects have been scoped out of this assessment.</td>
<td>Cumulative landscape and visual impacts from operational underground cables are very unlikely to occur once the land is reinstated. Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact scoped out of this assessment</td>
<td>Justification</td>
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<td>scoped out of this assessment.</td>
<td>to other states.</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Flood Risk</td>
<td>Transboundary effects have been scoped out of this assessment.</td>
<td>Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Traffic and Transport - Construction and Decommissioning Phases</td>
<td>No specific impacts identified for scoping out of this assessment.</td>
<td>N/A</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Traffic and Transport - Operation and Maintenance Phase</td>
<td>Transboundary effects have been scoped out of this assessment.</td>
<td>The operation of the cable route would generate negligible levels of traffic movements. Traffic associated with the operation of the onshore HVDC converter/HVAC substation would be minimal and below the thresholds for requiring more detailed assessment of transport environmental impacts. Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Noise and Vibration - Construction and Decommissioning Phases</td>
<td>No specific impacts identified for scoping out of this assessment.</td>
<td></td>
</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Noise and Vibration - Operation and Maintenance Phase</td>
<td>No anticipated noise and vibration effects relating to operational or maintenance traffic. No anticipated noise or vibration impact during operation of the cable route. Transboundary effects have been scoped out of this assessment.</td>
<td>There are unlikely to be any noise and vibration effects relating to operational or maintenance traffic as the traffic volumes would be minimal. The cable, once operational, would not produce any noise emissions. Onshore impacts for this topic have no pathway to other states.</td>
</tr>
<tr>
<td>Relevant ES section</td>
<td>Parameter</td>
<td>Project Two – Specific impact scoped out of this assessment</td>
<td>Justification</td>
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<tr>
<td>---------------------</td>
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</tr>
<tr>
<td>Onshore Human Environment</td>
<td>Socioeconomics, Recreation and Tourism</td>
<td>No specific impacts identified for scoping out of this assessment.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Justification:

Onshore Human Environment:
No specific impacts identified for scoping out of this assessment. N/A
13 CONSULTATION

13.1 OVERVIEW

13.1.1 Consultation is a fundamental principle underpinning the development and assessment process for NSIPs under the Planning Act 2008.

13.1.2 The process by which formal consultation will be conducted with relevant statutory and non-statutory stakeholders and other interested parties on the project development will be described in the forthcoming Statement of Community Consultation (SoCC). Regular communications and meetings will be sought with relevant stakeholders throughout the pre-application period.

13.1.3 The consultation process for Project Two has been designed to ensure that:

- The groups and individuals interested in or affected by the proposed development are identified;
- Information issued is accurate, understandable, issued at the appropriate time and does not overwhelm recipients;
- Dialogue is held between those affected by the decisions and those responsible for making the decisions;
- The information provided by the public and consultees is incorporated within the final decision making process and final decision; and
- Feedback is provided to all consultees, including the public, explaining the actions taken and how the final decision has been influenced by the process.

13.1.4 This Scoping Report includes the required material for submission to PINS for the purposes of requesting a Scoping Opinion under Regulation 8(3) of the EIA Regulations. Before adopting an opinion the Commission must (under Regulation 8(6)) consult the consultation bodies, meaning a body prescribed under Section 42(a) of the Planning Act 2008 and listed in column 1 of the table set out at Schedule 1 to the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the APFP Regulations) where the circumstances set out in column 2 are satisfied and each authority that is within Section 43 of the Planning Act 2008 (local authorities for the purposes of Section 42(b)).

13.1.5 The SMart Wind development strategy of the Hornsea Zone through a series of staggered projects has established a level of awareness of the wider development prospects within the Zone and provided the opportunity for dialogue with stakeholders over time at the both the project and Zonal level.

13.1.6 Throughout the EIA process for Project One, SMart Wind has engaged with a list of statutory and non-statutory consultees for Project One through a variety of
means including; meetings, local consultation events, drop in sessions, workshops, a telephone advice line, citizen panels, internet, media (radio, newspapers, brochures and pamphlets); and consultation with parish, town and community councils.

13.1.7 It is considered appropriate to maintain open dialogue with this established consultation community during the pre-application consultation for Project Two. It is also recognised that the consultation community built up during pre-application consultation for Project One is not definitive or binding and other organisations will be added as they are brought to SMart Wind’s attention.

13.2 SUMMARY OF CONSULTATION TO DATE

13.2.1 The programme of pre-application consultation with local communities, businesses and organisations for Project One has been organised into four phases. Phases 1, 2 and 3 have been completed. Whilst consultation material available throughout these phases of consultation has not been presented as Project Two data or information, there is direct relevance to parts of the development of the Project Two scoping area that this scoping report describes.

Phase 1 (completed)

13.2.2 Phase 1 consultation took place in March and April 2011 on the overall project and the broad onshore cable route study area. Phase 1 consisted of 11 Consultation Events which were open to the members of the public and included information boards and presentations by the development team outlining the options that were considered for the onshore cable route.

13.2.3 The venues and dates for the Phase 1 Consultation Events were published in the local press, specifically the Hull Daily Mail, Fishing News, Holderness Gazette, Scunthorpe Telegraph, Link Up (North East Lincolnshire Council News Paper) and the Grimsby Telegraph. Information was also broadcast on local radio stations such as BBC Radio Humberside, Viking FM, KCFM, Yorkshire Coast Radio and Lincs FM.

Phase 2 (completed)

13.2.4 Following analysis of the feedback from Phase 1, a preferred onshore cable route was selected which triggered a targeted Phase 2 consultation with those near the chosen cable route corridor and other associated onshore development. This Phase consisted of questionnaires and information leaflets distributed by post to the following parties:

- Local residents, businesses and organisations with postcodes within 400m of the preferred cable route corridor and landing point and 1.5km from the boundaries of the four candidate substation sites;
- Members of British and European Parliaments with local constituencies wholly or partly within the consultation boundary.
District and county councillors with wards/divisions wholly or partly within the consultation boundary.

13.2.5 Phase 2 included eight consultation events held at those venues used in Phase 1 in closest proximity to the preferred onshore cable route corridor and other associated onshore development. Throughout the consultation phases for Project One stakeholders have been able to send SMart Wind comments or questions through either: the SMart Wind website, email, or the post as set out in the contacting us section. SMart Wind continues to monitor these communications, and where contact details are provided, a direct response will be provided.

13.2.6 Phase 3 consultation for Project One was undertaken by correspondence only to all parties previously invited to comment on the Phase 2 Consultation. The Preliminary Environmental Impact Report (PEIR) formed the basis for this consultation and all stakeholders were given 42 days to comment on the material presented. The Phase 3 consultation phase concluded on 12 September 2012. The Phase 3 PEI described the pre-application development of Project One including a detailed description of the project, a description of the alternatives considered and the environmental impact assessment to date.

13.2.7 Phase 4 consultation will be the final phase of consultation and will consist of a number of consultation events along the chosen onshore cable route and other associated onshore development. Confirmation of the venues and dates for Phase 4 consultation events will be publicised when known, but it is anticipated that this will be early 2013. This will provide the last opportunity for all stakeholders to review the draft application documentation and draft Environmental Statement for Project One and work plans prior to submission to the Planning Inspectorate.

13.2.8 The timing of Phase 4 consultation on Project One is currently planned to overlap the provision of data and information describing the assessment and development of Project Two.

13.3 SUMMARY OF CONSULTATION PLANNED FOR PROJECT TWO

13.3.1 There are two phases of consultation planned for Project Two:

- Phase 1 of Project Two is currently planned to coincide with the timing of Phase 4 for Project One in winter 2012/13; and
- Phase 2 of Project Two is likely to be in the summer of 2013 and will be based upon the draft ES for the project. The project team aim to submit a full application to PINS in autumn 2013.
14 CONTACT DETAILS

13.1 The contact address for SMart Wind is:

Chris Jenner
SMart Wind
11th Floor
140 London Wall
EC2Y 5DN

Email: info@SMartWind.co.uk
15 REFERENCES


British Oceanographic Date Centre, including projects such as Land-Ocean Interaction Study (LOIS).

BSI (British Standards Institute) (2005) BS7445: Description and measurement of environmental noise. Part 1: Guide to environmental quantities and procedures;


BMELV (German Federal Ministry for Food, Agriculture and Consumer Protection), 2011a. Landing statistics data for German registered vessels from 2006-2010 with data query attributes for: landing year; landing month; vessel length category; ICES rectangle; vessel/gear type; port of landing; species; live weight (tonnes); and value.
REFERENCES


CAA (Civil Aviation Authority) (2010) Civil Aviation Publication (CAP) 437 Standard for Offshore Helicopter Landing Areas Guidance on Standards;

CAA (Civil Aviation Authority) (2005) CAP 452 Aeronautical Radio Station Operators Guide;

CAA (Civil Aviation Authority) (2011) CAP 413 Radio Telephony Manual;


Central Lincolnshire District Council (2012) Joint Core Strategy DPD Draft 2012


Clean North Sea Shipping Project (CNSS) website: www.CNSS.no/


Countryside Agency and Scottish Natural Heritage (2002). Landscape Character Assessment Guidance for England and Scotland

Countryside Agency and Scottish Natural Heritage (2003). Landscape Character Assessment Series Topic Paper 9: Climate change and natural forces, the consequences for landscape character. Countryside Agency and Scottish Natural Heritage


Danish Fisheries Directorate, 2011a. Landing statistics data for Danish registered vessels from 2006-2010 with data query attributes for: landing year; landing month;
vessel length category; ICES rectangle; vessel/gear type; port of landing; species; live weight (tonnes); and value.

Danish Fisheries Directorate, 2011b. Vessel Monitoring System data for Danish registered vessels recorded in 2009 and 2011 with data query attributes for: sighting date; ICES rectangle; ICES subsquare; latitude; longitude; vessel/gear type; course; speed; and number of sightings.

Danish Fishermen’s Association, 2011 Maps of key sandeel grounds based on vessel tracking plots from Danish registered vessels.


DECC (Department for Energy and Climate Change) (2011) The Offshore Energy Strategic Environmental Assessment 2


DfT (Department of Transport) (2004) Results of the electromagnetic investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle wind farm by QinetiQ and the Maritime and Coastguard Agency. Martin Howard and Colin Brown, QINETIQ/03/00297/1.1 MCA MNA 53/10/366.


REFERENCES

Harwood). Sea Mammal Research Unit, Gatty Marine Laboratory University of St Andrews, St Andrews, Fife KY16 8LB


DTI (Department of Trade and Industry), 2004. Review of the Feasibility of Underground Coal. Cleaner fossil fuel programme. DTI/Pub URN 04/1643


EMU (2012) Project One Hornsea Zone Environmental Statement

EMU (2011) SMartwind, Hornsea Project One, Offshore Wind Farm Environmental Statement.


Environment Agency (no date). Pollution Prevention Guidance Note 5 Works in, near, or liable to affect watercourses. Environment Agency.


FLOW (Fisheries Liaison with Offshore Wind), 2006. Fisheries Liaison with Offshore Wind group Framework for dialogue between the fishing and wind farm industries on how to assess the value of fishing activities and any disruption or displacement caused to them by wind farm developments. February 2006.[online] Available at: <http://www.bwea.com/pdf/offshore/fisheries_framework.pdf>


Global Gateway (2005). Hull and Humber Ports City Region Development Programme


Health and safety at Work etc Act (1974)


IfA (Institute for Archaeologists) Code of Practice and Standard and Guidance for Archaeological Desk-based Assessment (IfA 2008);

IMARES (Institute for Marine Resources and Ecosystem Studies), 2011a. Landing statistics data for Dutch registered vessels from 2006-2010 with data query attributes for: landing year; landing month; vessel length category; ICES rectangle; vessel/gear type; port of landing; species; live weight (tonnes); and value.

IMARES (Institute for Marine Resources and Ecosystem Studies), 2011b. Vessel Monitoring System data for Dutch registered vessels recorded in 2009 and 2011 with
data attributes presented graphically for: year; month; vessel/gear type; and vessel size category.


Institute of Petroleum guidelines (2000) Guidelines for the calculation of estimates of energy use and gaseous missions in the decommissioning of offshore structures


Joint Nature Conservation Committee (JNCC) (2010a) Haisborough, Hammond and Winterton cSAC. Available [online] at: http://www.jncc.gov.uk/page-4534#Haisborough


Joint Nature Conservation Committee (JNCC), (2010c) North Norfolk Sandbanks and Saturn Reef cSAC. Available [online] at: http://www.jncc.gov.uk/page-4534#NorthNorfolkSandbanks
REFERENCES


MCA (2011) Offshore renewable energy installations, emergency response cooperation plans (ERCoP) for construction and operations phase, and requirements for emergency response and SAR helicopter operations


MMO (Marine Management Organisation), 2011a. Landing statistics data for UK registered vessels from 2006-2010 with data query attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; port of landing; species; live weight (tonnes); and value.

MMO, JNCC, NE, CCW (2010). Guidance on the assessment of effects on the environment and cultural heritage from marine renewable developments.


REFERENCES


North Lincolnshire Council (2010a), North Lincolnshire Council Infrastructure Delivery Plan, North Lincolnshire Council, available [online] at: http://www.planning.northlincs.gov.uk/PlanningReports/Evidencebase/Local/NorLincsInfPlan.pdf
North Lincolnshire Council (2010 Housing and Employment Land Allocations DPD Submission Draft November 2010
North Sea Demersal Regional Advisory Council, pers. comm., 2011
Oil and Gas UK website (2010). Website Front Page. Available [online] at: http://www.oilandgasuk.co.uk/


PINS (Planning Inspectorate) (2012b). Advice Note Ten: Habitat Regulations Assessment relevant to nationally significant infrastructure projects (version 2).
PINS (Planning Inspectorate) (2012c). Advice Note Twelve: Development with significant transboundary impacts consultation (version 3)


REFERENCES


Scottish Natural Heritage (2001). Guidelines on the Environmental Impacts of Wind Farms and Small Scale Hydro-electric Schemes. SNH

Scottish Natural Heritage (2005). Cumulative Effects of Wind Farms. SNH


Scottish Natural Heritage (2009). Siting and Designing Wind Farms in the Landscape. SNH.


SeaZone (2010). GIS PEXA areas and offshore munitions disposal sites


SMRU (Sea Mammal Research Unit), 2011. Summary of SMRU seal count and telemetry data from the Humber area.


(The Crown Estate, 2009).Habitats Regulations Assessment of the Round 3 Plan


REFERENCES


The international cable protection committee (ICPC) (2007a) ICPC Recommendatino No 2. Recommended routing and reporting criteria for cables in proximity to others

The international cable protection committee (ICPC) (2007b) ICPC Recommendation NO 3 Criteria to be applied to proposed crossing between submarine telecommunications cables and pipelines/power cables.

UN Framework Convention on Climate Change (Earth Summit). Available at: http://unfccc.int/key_documents/the_convention/items/2853.php


UKDEAL website (2010) Front Page Log in. Available [online] at: https://www.ukdeal.co.uk/dp/jsp/PleaseLoginDeal.jsp


REFERENCES


United Kingdom Hydrographic Office (UKHO) PEXA charts Q6401 and Q6405, as amended by Notice to Mariners 0455/2010, 4915/2006 and 5194/2005


National Oceanographic Data Centre (1994) World Ocean Atlas Climatology data


