Round 3 Irish Sea Zone
Rhiannon Wind Farm Limited

Preliminary Environmental Information
In support of Section 42 of the Planning Act 2008 – October 2012

The first Celtic Array offshore wind farm project within the Irish Sea Zone

www.celticarray.com

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Glossary of key terms

Abundance	Number of animals present per unit area.
Acoustic wave and current profiler	Survey equipment to measure current profiles and wave measurements.
Anthropogenic	Made by people or resulting from human activity.
Appropriate Assessment	Formal assessment by the Competent Authority of the impacts of a project on the integrity of a Natura 2000 site.
Baseline	Description of the existing conditions.
Bathymetry	The measurement of the depth of a water body.
Benthic	Relating to the deepest part of the ocean or sea bed.
Benthos	Animals living in the deepest part of the ocean or sea-bed.
Biogeographic region	Area of flora and fauna distribution having similar or shared characteristics throughout.
Biotope	Habitat and component species.
Cetacean	Whales, dolphins and porpoises.
Creel	A type of pot used in fishing for catching crab or lobster.
Crown Dependency	The Crown Dependencies are possessions of The Crown in Right of the United Kingdom, as opposed to overseas territories of the United Kingdom. They comprise the Channel Island Bailwicks of Jersey and Guernsey in the English Channel and the Isle of Man in the Irish Sea.
Cumulative and in combination impact assessment	Designed to address cumulative and in combination impacts at a suitable scale e.g. zone or project specific. Actual study area will depend on nature of receptor and the extent of its interaction with the environment. If done at a zonal scale, it will support EIA and HRA obligations to undertake cumulative and in combination impacts assessment.
Cumulative effects	The effects of one type of development (e.g. offshore wind) with other developments of the same type.
Development Consent Order	A legal order which provides consent for the project. It combines the grant of planning permission with a range of other consents.
Effect	An impact upon the receptor (individual, species or ecological system). Effects can be positive and negative.
Engineering Envelope	A series of worst realistic cases for which significant effects are assessed (see Section 5.9 for more information).
EIA Regulations	Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations (2012).
Elasmobranchs	Cartilaginous fish that comprise sharks, rays and skates.

Environmental Impact Assessment	A procedure for ensuring that the likely significant effects of new development on the environment are fully understood and taken into account before the development is allowed to go ahead.
Environmental Management Plan	A plan that ensures the project meets the requirements established by legislation, legal consents and environmental commitments.
Environmental Statement	This is the written record of an EIA study submitted to decision makers with project documentation.
Epibenthic	Relating to the surface of the seabed.
EU Renewable Energy Directive	This EU Directive sets targets for all Member States, such that the EU will reach a 20% share of energy from renewable sources by 2020.
European Protected Species	Animals and plants that receive protection under The Conservation of Habitats and Species Regulations 2010.
Fetch	The distance over which a wind of nearly constant direction has blown.
Food and Environmental Protection Act	Food and Environment Protection Act 1985 concerns the licensing and control of activities that could impact the environment. Part 2 of the act requires a Marine Licence to be granted for the deposit or removal of a substance or object below mean high water springs. It has been superseded by the Marine and Coastal Access Act.
Fluvial	Of or relating to or happening in a river.
Front	Transition zone between water masses with different physical characteristics.
Gyre	Ring-like system of currents.
Habitats Directive	The EC Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora). The aim of which is to promote the EU's biodiversity. Requiring Member States to maintain or restore natural habitats and wild species at a favourable conservation status.
Habitats Regulation Assessment	An assessment of the impacts of implementing a plan or policy on a Natura 2000 site.
Health and Safety at Work etc. Act	The Health and Safety at Work etc. Act 1974 is an Act of the Parliament of the United Kingdom that defines the fundamental structure and authority for the encouragement, regulation and enforcement of workplace health, safety and welfare within the United Kingdom.
In combination effects	The effects of one type of development (e.g. offshore wind) with different types of projects and activities (e.g. shipping, oil and gas).
Infauna	Benthic organisms that live within the sedimentary environment.
Intertidal	Shoreline areas between the high water spring tide mark and the low water spring tide mark.

Intra-array	Used in reference to cables connecting individual turbines within an array.
Impact	Response of the receptor (biophysical and socio economic) to the effect, be it adverse or beneficial effect.
Irish Sea Zone	Zone 9 of the third competitive leasing round for offshore wind in English and Welsh territorial seas and UK international waters.
Local Biodiversity Action Plan	Local Biodiversity Action Plan works on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets.
Localism Act	The Localism Act 2011 contains a wide range of measures to devolve more powers to councils and neighbourhoods and give local communities greater control over local decisions like housing and planning.
Low Carbon Transition Plan	The 2009 White Paper 'UK Low Carbon Transition Plan – National Strategy for Climate and Energy' sets out the UK's comprehensive, low carbon transition plan to 2020.
Lowest Astronomical Tide	The lowest sea level that can be predicted under normal meteorological and astronomical conditions. LAT is not an extreme level, as meteorological conditions can cause a lower level referred to as a storm surge.
Magnetometer	Survey equipment towed behind the vessel for the detection of ferrous objects.
Marine and Coastal Access Act	The Marine and Coastal Access Act 2009 introduces a new system of marine management. This includes a new marine planning system, marine plans, changes to the system for marine licensing and the designation of marine conservation zones. It also changes the way marine fisheries are managed and enables recreational access to the English and Welsh coast.
Marine License	The provision of licensing for the carrying on of activities in the marine environment.
Multibeam echo sounder	Survey equipment for acquiring bathymetry data in a swath with a width of up to ten times the water depth.
Mean High Water Springs	The highest level that spring tides reach on the average over a period of time.
Natura 2000 Network	A network of European sites protecting vulnerable habitats and species (Special Areas of Conservation) and birds (Special Protection Areas).
NERC Act	The Natural Environment and Rural Communities Act 2006 is primarily intended to implement key aspects of the Government's Rural Strategy published in July 2004. It also addresses a wider range of issues relating broadly to the natural environment.

Ornithology	The study of birds, including their physiology, classification, ecology and behaviour.
Planning Act	The Planning Act 2008 created a new system of development consent for nationally significant infrastructure projects.
Photomontage	Computer generated images of wind farm accurately located and overlaid onto scanned photographs of existing view, used to illustrate predicted view of proposed development.
Plankton/planktonic	Floating in the water column – the movements of planktonic plants/animals are almost entirely dictated by water currents.
Stage 1 Preliminary Environmental Information	A report describing the potential impacts of Rhiannon Wind Farm on the environment.
Stage 2 Preliminary Environmental Information	A report assessing the main effects which Rhiannon Wind Farm is likely to have on the environment.
Project	The offshore wind farm (Rhiannon Wind Farm) to be located at the Site including intra-array and export power cables, offshore substation(s) and onshore infrastructure.
Ramsar Convention	The Convention on Wetlands of International Importance (1971).
Realistic Worst Case Scenario	A scenario of the likely area, technology or process that would give rise to the maximum potential adverse impact of a project or projects. This scenario is intended to aid assessment of the maximum impacts as part of an Environmental Impact Assessment or Zonal Appraisal and Planning process. It includes consideration of cumulative and inter-related impacts.
Rochdale Envelope	Another name for an Engineering Envelope (see Sections 4.2 and 5.9 for more information).
Roll On Roll Off	Vessels designed to carry wheeled cargo such as automobiles, trucks, semi-trailer trucks, trailers or railroad cars that are driven on and off the ship on their own wheels.
Scoping	The process of identifying the content and extent of information to be submitted to the competent authority.
Scoping Opinion	A document identifying the content and extent of the information to be supplied by Celtic Array to the Planning Inspectorate.
Scour	Erosion holes around the foundations of wind turbines created by tidal currents.
Side-scan sonar	Survey equipment towed behind the vessel, which acoustically images the seabed.
Significance (Prediction of Impact)	Is the significance of an impact on a specific receptor and is derived in part from an analysis of the sensitivity and also considers timing, scale, size and duration of the specific impact.

Site	The offshore area encompassing Rhiannon Wind Farm located approximately 19km from Anglesey, 34km from the Isle of Man and 60km from the Cumbrian coast in the Irish Sea Zone. The Site does not include export cable and onshore infrastructure.
Strategic Environmental Assessment	A system of incorporating environmental considerations into policies, plans, programmes and strategies.
Substation	A facility that steps up or steps down the voltage in power cables/lines.
Territorial Seas	Defined by the 1982 United Nations Convention on the Law of the Sea and covering an area of sea extending 12 nautical miles from the coast, where a country or a region have rights.
Traffic Separation Scheme	A system of traffic management administered by the International Maritime Organization.
Wake loss	As a turbine extracts energy from the wind, it leaves behind it a wake characterized by reduced wind speeds and increased levels of turbulence. Another turbine operating in this wake, or deep inside a wind farm where the effects of a number of wakes may be felt simultaneously, will therefore produce less energy and suffer greater structural loading than a turbine operating in the free stream.
Wireframe	Computer generated perspectives of the topography and proposed development to illustrate the predicted views from each viewpoint.
ZAP Report	The 2012 report commissioned by Celtic Array as part of the Zonal Appraisal and Planning process.
Zone Development Agreement	A contractual arrangement for Round 3 wind farm development between an offshore wind developer and The Crown Estate.
Zonal Appraisal and Planning	A non-statutory planning process assessing a zone established for potential offshore wind farm development as a whole.

Abbreviations

A/S	Aktieselskab, the Danish name for a stock-based company
AA	Appropriate Assessment
ABP	Associated British Ports
AC	Alternating Current
ADD	Acoustic Deterrent Device
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALB	All Weather Lifeboat
AMSL	Above Mean Sea Level
ARPA	Automatic Radar Plotting Aid
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
ASMS	Active Safety Management System
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
ASSI	Areas of Specific Scientific Interest
ATC	Air Traffic Control
ATRS	Air Traffic Radar Services
AtoN	Aids to Navigation
AWAC	Acoustic wave and current profiler
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BMAPA	British Marine Aggregate Producers Association
BSI	British Standards Institution
BT	British Telecoms
BTO	British Trust for Ornithology
CA	Cruising Association
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CCS	Carbon Capture and Storage
CCW	Countryside Council for Wales
CDM	Construction (Design and Management)
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEH	Centre for Ecology and Hydrology
CFP	Common Fisheries Policy
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species
CMACS	Centre for Marine and Coastal Studies

CO_2	Carbon Dioxide
COLREGS	International Regulations for the Prevention of Collisions at Sea
CoS	Chamber of Shipping
COWRIE	Collaborative Offshore Wind Research into the Environment
CPA	Coastal Protection Act
CPRE	Campaign for the Protection of Rural England
CREL	Centrica Renewable Energy Ltd
cSAC	Candidate Special Area of Conservation
CHS	Committee for Health and Safety
CTA	Controlled Traffic Area
CTD	Conductivity Temperature Depth
DARDNI	Department of Agriculture and Rural Development Northern Ireland
DC	Direct Current
DCLG	Department of Communities and Local Government
DCO	Development Consent Order
DDV	Drop Down Video
DECC	Department of Energy and Climate Change
DEFA	Department of Environment Food and Agriculture (Isle of Man)
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DETI	Department of Enterprise, Trade and Investment (Northern Ireland)
DfT	Department for Transport (UK)
DIO	Defence Infrastructure Organisation (UK) (formerly Defence Estates)
DTLR	Department for Transport, Local Government and the Regions (Republic of Ireland)
DoE	Department of Environment (Northern Ireland)
DPPA	Drilling and Production Platform
DRDNI	Department of Regional Development Northern Ireland
DTI	Department of Trade and Industry (UK)
DVZ	Department voor Zeevisserij (Belgium)
EA	Environment Agency (England and Wales)
EC	European Commission
EEA	European Economic Area
EEC	European Economic Community
EIA	Environmental Impact Assessment
EH	English Heritage
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EPS	European Protected Species
ERCoP	Emergency Response Cooperation Plan
ES	Environmental Statement

EU	European Union
FAD	Fish Aggregating Device
FEPA	Food and Environmental Protection Act
FIR	Fishing Industry Representative
FLO	Fisheries Liaison Officer
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables
FPO	Fish Producers' Organisation
FSA	Formal Safety Assessment
GIS	Geographic Information System
GRT	Gross Tonnage
GW	Gigawatts
HAT	Highest Astronomical Tide
HMNB	Her Majesty's Naval Base
HPMCZ	Highly Protected Marine Conservation Zone
HRA	Habitats Regulations Assessment
HSWA	Health and Safety at Work etc. Act
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IACC	Isle of Anglesey County Council
IALA	International Association of Lighthouse Authorities
ICES	International Council for the Exploration of the Sea
ICZM	International Coastal Zone Management
IDB	Internal Drainage Board
IEEM	Institute of Ecology and Environmental Management
ILB	Inshore Lifeboat
IMO	International Maritime Organisation
IOMSPC	Isle of Man Steam Packet Company
IPC	Infrastructure Planning Commission
IPR	Infrastructure Planning Regulations
ISCZ	Irish Sea Conservation Zone
ISZ	Irish Sea Zone
IUCN	International Union for Conservation of Nature
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
km	Kilometres
kWh	Kilowatt hour
LAT	Lowest Astronomical Tide
LBAP	Local Biodiversity Action Plan
LGM	Last Glacial Maximum

LNG	Liquefied Natural Gas
LNR	Local Nature Reserve
LOS	Line of Sight
m	Metres
MAGIC	Multi-Agency Geographic Information for the Countryside
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MCCA	Marine and Coastal Access Act
MCU	Marine Consents Unit
MCZ	Marine Conservation Zone
MEHRA	Marine Environmental High Risk Area
MGN	Marine Guidance Notes
MHWS	Mean High Water Springs
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MOD	Ministry of Defence
mph	Miles per Hour
MRCC	Maritime Rescue Coordination Centre
MW	Megawatts
NA	Navigation Assessment
NATS	National Air Traffic Services Ltd
NE	Natural England
NERL	NATS (En Route) Limited
NFFO	National Federation of Fishermen's Organisations
NHS	National Health Service
NIEA	Northern Ireland Environment Agency
nm	Nautical Miles
NMR	National Monuments Register
NNR	National Nature Reserve
NPS	National Policy Statement
NPWS	National Parks and Wildlife Service
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Projects
NTM	Notice to Mariners
NUI	Normally Unattended Installation
NUC	Not Under Command (as per COLREGS)
NVQ	National Vocational Qualification
O&M	Operations and Maintenance
Ofgem	Office of the Gas and Electricity Markets

OREI	Offshore Renewable Energy Installation
OSPAR	Oslo/Paris convention for the Protection of the Marine Environment of the North-East Atlantic
PAM	Passive Acoustic Monitoring
PEI	Preliminary Environmental Information
PEXA	Practice and Exercise Areas
PPE	Personal Protective Equipment
PSA	Particle Size Analysis
pSPA	Potential SPA
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
QHSE	Quality, Health, Safety and Environment
RAF	Royal Air Force
RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
REZ	Renewable Energy Zone
rMCZ	Recommended Marine Conservation Zone
RNLI	Royal National Lifeboat Institution
ROFI	Region of Freshwater Influence
ROI	Republic of Ireland
Ro-Ro	Roll On Roll Off
RSL	Relative Sea Level
RUK	RenewableUK (formerly British Wind Energy Association (BWEA))
RWCS	Realistic Worst Case Scenario
RWF	Rhiannon Wind Farm
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SAR	Search and Rescue
SBL	Safe Biological Limits
SCI	Sites of Community Importance
SCOS	Special Committee on Seals
SEA	Strategic Environmental Assessment
SEAI	Sustainable Energy Authority of Ireland
SFF	Scottish Fisherman's Federations
SFPA	Sea Fisheries Protection Agency
SIC	Standard Industrial Classification
SLVIA	Seascape, Landscape and Visual Impact Assessment
SMAA	Surveillance Minimum Altitude Area
SMP	Shoreline Management Plan
SMPe	Seabird Monitoring Programme

SMRU	Sea Mammal Research Unit
SNH	Scottish National Heritage
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
SSSI	Sites of Special Scientific Interest
TAC	Total Allowable Catch
TAN 20	Technical Advice Note 20
TCE	The Crown Estate
TCPA	Town and Country Planning Act
TCPR	Town and Country Planning (EIA) Regulations
TEU	Twenty Foot Equivalent Unit
THLS	Trinity House Lighthouse Service
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift
UK	United Kingdom
UKCP	United Kingdom Climate Projections
UKCPC	United Kingdom Cable Protection Committee (now renamed Subsea Cables UK)
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UNCLOS	United Nations Convention on the Law of the Sea
VTS	Vessel Traffic Services
VMS	Vessel Monitoring System
WCA	Wildlife and Countryside Act
WDCS	Whale and Dolphin Conservation Society
WTG	Wind Turbine Generator
WWT	Wildfowl and Wetlands Trust
ZAP	Zonal Appraisal and Planning
ZDA	Zone Development Agreement
ZTV	Zones of Theoretical Visibility

EXECUTIVE SUMMARY

Celtic Array Limited (Celtic Array) is a joint venture between Centrica Renewable Energy Limited (CREL), a subsidiary of Centrica Plc (Centrica) and DONG Energy Wind Power Holdings A/S (DONG Energy).

Celtic Array is proposing to develop an offshore wind farm, called Rhiannon Wind Farm (RWF), in the Irish Sea and bring electricity to shore. At its closest point, RWF would be located approximately 19km from Anglesey, 34km from the Isle of Man and 60km from the Cumbrian coast. It could have a total generating capacity of up to 2.2 Gigawatts, which would comprise between 146 and 440 wind turbines.

What is being consulted on now and why?

This is the Stage 1 Preliminary Environmental Information (PEI) for RWF. Stage 1 PEI provides the information described in Part 1 of Schedule 2 of The Regulations where it is proposed to apply for a Development Consent Order (DCO) under the Planning Act 2008 ("the Act"). This report is one of a suite of documents which have been or will be published by Celtic Array as it prepares for the submission of applications for consents for RWF.

The primary purpose of the PEI is to provide sufficient information to inform consultation prior to the production of the Environmental Statement (ES).

Celtic Array plans to undertake two stages of public consultation. The first stage of consultation (Stage 1) sets out the initial proposal and describes the potential environmental effects associated with it. The second stage of consultation (Stage 2) will set out the detailed project design and include an assessment of the potential environmental effects of the application. Any responses received during Stage 1 consultation will be considered in the Stage 2 proposal. Following the Stage 2 consultation, an ES will be submitted (having considered the responses received to Stage 2 consultation) alongside the DCO in line with Regulation 6 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009.

In accordance with Section 42 of the Act, this Stage 1 PEI seeks to inform technical consultees about the proposed RWF and describe the potential impacts associated with the construction, operation and decommissioning phases of the project. All responses received during this consultation will be reviewed and analysed to:

- Help make sure the potential negative and positive aspects of the proposed project have been considered;
- Take on board opportunities for improving the project design, where appropriate; and
- Produce a consultation report to accompany an application for a DCO to the Planning Inspectorate. The Consultation Report will demonstrate how Celtic Array's application has given due consideration to the consultation responses.

How can I respond?

Technical consultees, stakeholders and Local Authorities are invited to comment before Thursday **20 of December 2012**. You can respond via:

Email: info@celticarray.com or

Mail: Celtic Array Limited
1st Floor, Churchill House
1 London Road
Slough
Berkshire SL3 7RL

This document, as well as the Community Consultation Document, will be on display at the libraries in North Wales and the Isle of Man. In Wales, copies of this report will available in Welsh and English. Annex 1 of this Report sets out the libraries where this document is available to view and public consultation events.

What has happened so far?

Celtic Array has completed a process of data collection, consultation and assessment known as Zonal Appraisal and Planning (ZAP). The ZAP process enabled Celtic Array to gain a better understanding of the unique physical, human and environmental constraints in the Irish Sea.

The ZAP process identified three Potential Development Areas. Celtic Array has decided to develop RWF in the south-east part of the Irish Sea Zone. RWF is the first project in the Irish Sea Zone. The ZAP surveys, report and consultation responses informed the offshore Scoping Report. Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6 July 2012 and obtained its opinion on the potential impacts that should be addressed in the Environmental Impact Assessment.

This Stage 1 PEI Report and the Community Consultation Document represents the latest documents to be published by Celtic Array. The documents have been issued to a number of technical and non-technical stakeholders to provide up to date information on RWF and to facilitate and inform the Stage 1 consultation process.

How does this report differ from the offshore Scoping Report?

Both the offshore Scoping Report and this Stage 1 PEI Report describe the potential impacts on the environment. The Planning Inspectorate issued the offshore Scoping Report to 42 consultation bodies and 15 responded. The Scoping Opinion is available on the Planning Inspectorate's website: http://infrastructure.planningportal.gov.uk/

The Scoping Opinion is based on the proposals set out on 6 July 2012 in the offshore Scoping Report. The scope of the EIA shall continue to evolve through stakeholder consultation and as result of surveys and site investigation. Celtic Array will continue to liaise with consultees throughout the pre-application process to ensure the EIA uses the best available evidence, the correct assessment methods and remains focused on potential impacts.

Celtic Array have used the offshore Scoping Report as the basis for this Stage 1 PEI, however there are key differences between the offshore Scoping Report and this Stage 1 PEI. The key differences between the offshore Scoping Report and the content of this Stage 1 PEI are outlined in the following reading guide:

<table>
<tr><th>Section</th><th>Key changes</th></tr>
<tr><td>1 Introduction</td><td>The introduction has undergone substantive changes to reflect that the purpose of this document differs from the offshore Scoping Report.

Celtic Array has signed an agreement with National Grid to take 2GW of power from the proposed wind farm to the National Grid transmission system. The connection is anticipated to be on Anglesey.</td></tr>
<tr><td>2 Planning Policy and Legislative Context</td><td>Outlines the consenting requirements for associated infrastructure in Wales.</td></tr>
<tr><td>3 Site Selection</td><td>Two sections have been added to reflect that the Scoping Opinion has been received and Stage 1 consultation is now underway.</td></tr>
<tr><td>4 Project Description</td><td>Additions include:
• Indicative turbine layouts for 5 and 15MW turbines;
• Summary of offshore design principles;
• Description of the offshore electrical transmission technology and infrastructure;
• Typical onshore infrastructure;
• Celtic Array’s philosophy for identifying and appraising possible onshore substation sites; and
• Typical onshore construction activities.</td></tr>
<tr><td>5 Environmental Impact Assessment Methodology</td><td>No change.</td></tr>
<tr><td>6 Physical Processes</td><td rowspan="3">Updated to:
• Incorporate the Scoping Opinion from the Planning Inspectorate;
• Describe the potential impacts (in light of the Scoping Opinion); and
• Outline surveys and study programme.</td></tr>
<tr><td>7 Biological Environment</td></tr>
<tr><td>8 Human Environment</td></tr>
<tr><td>9 Proposed Structure of the Environmental Statement</td><td>Amended to incorporate ES structure proposed in the Scoping Opinion.</td></tr>
<tr><td>10 Table of issues Scoped In/Out</td><td>Replaced with a table summarising the potential impacts associated with RWF which reflect matters raised in the Scoping Opinion.</td></tr>
</table>

What remains to be decided?

The environmental information currently available on the marine export cables and on the onshore grid connection is limited at this time because the process to identify options for suitable landfall points, onshore substation sites and cable routes has not yet concluded.

Offshore: The offshore export cable route is currently described as a search area, which will be further refined as more information is acquired, including completion of a geophysical survey currently underway to understand the seabed conditions. It is not possible to define the precise configuration and content of an offshore wind farm at the time that an application for consent is made, for example, full foundation designs or turbine types for RWF may not be available until after the project is consented, new products may enter the market or there may be legal requirements for competitive tendering for key components. An Engineering Envelope will provide a 'realistic worst case scenario' for the EIA. An Engineering Envelope approach will be applied to RWF in respect of a number of the works described in the project's ES, including turbine selection, an indicative export cable corridor and turbine foundation design.

Onshore: Celtic Array has a grid connection agreement with National Grid to connect 2GW of power from the proposed wind farm to the National Transmission System proposed to connect on Anglesey. The location of the onshore works required on Anglesey to connect to the existing transmission network, including cable landfall connection points, cable routes to an onshore substation and the location of the onshore substation are yet to be determined. The Act is devolution neutral so it enables consents to continue to be determined in Wales. Consequently, the cable landfall, onshore substation and connecting cables will require planning permission under the Town and Country Planning Act (1990) from the Isle of Anglesey County Council (IACC). Other consents may be required to connect the onshore substation to the existing transmission network.

At present, Celtic Array intends to submit an onshore Scoping Report for certain onshore infrastructure to the IACC in the spring of 2013, when there is greater clarity on the potential onshore substation sites, cable landfall sites, cable rating and connection scenarios. Informal consultation will also be undertaken in spring 2013 to provide an update on onshore elements of the Project.

In any event, the Stage 2 PEI will include sufficient detail on the onshore infrastructure to allow the consultees to understand the relationship between the offshore and onshore elements of RWF, including any potential cumulative effects and relevant onshore planning considerations.

If you have any queries about this Stage 1 PEI or this project, please visit our website www.celticarray.com or contact us at info@celticarray.com.

CRYNODEB GWEITHREDOL

Mae Celtic Array Cyfyngedig (Celtic Array) yn fenter ar y cyd rhwng Centrica Renewable Energy Cyfyngedig (CREL), is-gwmni i Centrica Ccc (Centrica) a DONG Energy Wind Power Holdings A/S (DONG Energy).

Mae Celtic Array'n cynnig datblygu fferm wynt ar y môr, dan enw Fferm Wynt Rhiannon, ym Môr Iwerddon a dod â thrydan i'r tir. Ar ei bwynt agosaf, byddai Fferm Wynt Rhiannon tua 19 cilomedr o Ynys Môn, 34 cilomedr o Ynys Manaw a 60 cilomedr o arfordir Cumbria. Gallai fod â chyfanswm gallu cynhyrchu o hyd at 2.2 Gigawatt, a fyddai'n cynnwys rhwng 146 a 440 o dyrbinau gwynt.

Beth yr ymgynghorir arno yn awr a pham?

Dyma Gam 1 Gwybodaeth Amgylcheddol Ragarweiniol Fferm Wynt Rhiannon. Mae Cam 1 yn rhoi'r wybodaeth a ddisgrifir yn Rhan 1 Atodlen 2 y Rheoliadau lle cynigir gwneud cais am Orchymyn Caniatâd Datblygu dan Ddeddf Cynllunio 2008 ("y Ddeddf"). Mae'r adroddiad yma'n un o gyfres o ddogfennau a gafodd neu a gaiff eu cyhoeddi gan Celtic Array wrth baratoi ar gyfer cyflwyno ceisiadau am ganiatâd ar gyfer Fferm Wynt Rhiannon.

Prif ddiben yr Wybodaeth Amgylcheddol Ragarweiniol yw rhoi digon o wybodaeth ar gyfer ymgynghoriad cyn cyflwyno'r Datganiad Amgylcheddol.

Mae Celtic Array yn bwriadu cynnal dau gam o ymgynghoriad cyhoeddus. Mae cam cyntaf yr ymgynghoriad (Cam 1) yn nodi'r cynnig dechreuol ac yn disgrifio'r effeithiau amgylcheddol posibl yn gysylltiedig gydag ef. Bydd ail gam yr ymgynghoriad (Cam 2) yn nodi dyluniad manwl y prosiect ac yn cynnwys asesiad o effeithiau amgylcheddol posibl y cais. Caiff unrhyw ymatebion a dderbynnir yn ystod Cam 1 yr ymgynghoriad eu hystyried yng nghynnig Cam 2. Yn dilyn yr ymgynghoriad Cam 2, cyflwynir Datganiad Amgylcheddol (ar ôl ystyried yr ymatebion a dderbyniwyd i ymgynghoriad Cam 2) ynghyd â'r Gorchymyn Caniatâd Datblygu yn unol gyda rheoliad 6 Rheoliadau Cynllunio Seilwaith (Asesiad Effaith Amgylcheddol) 2009.

Yn unol gydag Adran 42 y Ddeddf, mae Cam 1 yr Wybodaeth Amgylcheddol Arweiniol yma yn anelu i hysbysu ymgyngoreion technegol am y cynnig am Fferm Wynt Rhiannon a disgrifio'r effeithiau posibl yn gysylltiedig gyda chamau adeiladu, gweithredu a datgomisiynu'r prosiect. Caiff yr holl ymatebion a dderbyniwyd yn ystod yr ymgynghoriad eu hadolygu a'u dadansoddi i:

- Helpu i sicrhau y cafodd agweddau negyddol a chadarnhaol posibl y prosiect arfaethedig eu hystyried;
- Cynnwys cyfleoedd i wella dyluniad y prosiect, lle'n addas; a
- Cynhyrchu adroddiad ymgynghori i fynd gyda chais am Orchymyn Caniatâd Datblygu i'r Arolygiaeth Gynllunio. Bydd yr Adroddiad Ymgynghori yn dangos sut y rhoddodd cais Celtic Array ystyriaeth ddyladwy i'r ymatebion i'r ymgynghoriad.

Sut gallaf ymateb?

Gwahoddir ymgyngoreion technegol, rhanddeiliaid ac awdurdodau lleol i roi sylwadau erbyn dydd Iau **20 Rhagfyr 2012.** Gallwch ymateb drwy:

E-bost: info@celticarray.com neu

Post: Celtic Array Limited
1st Floor, Churchill House
1 London Road
Slough
Berkshire SL3 7RL

Caiff y ddogfen hon, yn ogystal â'r Ddogfen Ymgynghori Cymunedol, eu dangos mewn llyfrgelloedd yng Ngogledd Cymru ac Ynys Manaw. Yng Nghymru, bydd copïau o'r adroddiad hwn ar gael yn Gymraeg ac yn Saesneg. Mae Atodiad 1 yr Adroddiad hwn yn nodi ym mha lyfrgelloedd y mae'r ddogfen ar gael i'w gweld a digwyddiadau ymgynghori cyhoeddus.

Beth sydd wedi digwydd hyd yma?

Mae Celtic Array wedi cwblhau proses o gasglu data, ymgynghori ac asesu a elwir yn Werthusiad a Chynllunio Parth. Mae'r broses hon wedi galuogi Celtic Array i gael gwell dealltwriaeth o'r cyfyngiadau ffisegol, dynol ac amgylcheddol unigryw ym Môr Iwerddon.

Dynododd y broses Gwerthusiad a Chynllunio Parth dair Ardal Datblygu Bosibl. Penderfynodd Celtic Array ddatblygu Fferm Wynt Rhiannon yn rhan de-ddwyreiniol Parth Môr Iwerddon. Fferm Wynt Rhiannon yw'r prosiect cyntaf ym Mharth Môr Iwerddon. Mae arolygon Gwerthusiad a Chynllunio Parth, adroddiad ac ymatebion i'r ymgynghoriad yn sylfaen i Adroddiad Cwmpasu ar y môr. Cyflwynodd Celtic Array Adroddiad Cwmpasu i'r Arolygiaeth Gynllunio ar 6 Gorffennaf 2012 a chafodd ei farn ar yr effeithiau posibl y dylid eu hystyried yn yr Asesiad Effaith Amgylcheddol.

Yr Adroddiad Gwybodaeth Amgylcheddol Ragarweiniol a'r Ddogfen Ymgynghoriad Cymunedol yw'r dogfennau diweddaraf i'w cyhoeddi gan Celtic Array. Anfonwyd y dogfennau at nifer o randdeiliaid technegol a rhanddeiliaid eraill i roi'r wybodaeth ddiweddaraf ar Fferm Wynt Rhiannon ac i hwyluso a rhoi gwybodaeth ar gyfer proses ymgynghori Cam 1.

Beth yw'r gwahaniaeth rhwng yr adroddiad hwn a'r Adroddiad Cwmpasu ar y môr?

Mae'r Adroddiad Cwmpasu ar y môr a Cham 1 yr Adroddiad Gwybodaeth Amgylcheddol Ragarweiniol yn disgrifio'r effeithiau posibl ar yr amgylchedd. Dosbarthodd yr Arolygiaeth Gynllunio yr Adroddiad Cwmpasu i 42 o gyrff ymgynghori ac ymatebodd 15. Mae'r Farn Cwmpasu ar gael ar wefan yr Arolygiaeth Gynllunio: http://infrastructure.planningportal.gov.uk/

Mae Barn yr Arolygiaeth Gynllunio yn seiliedig ar y cynigion a nodwyd ar 6 Gorffennaf 2012 yn yr Adroddiad Cwmpasu. Bydd cwmpas yr Asesiad Effaith Amgylcheddol yn parhau i esblygu drwy ymgynghori gyda rhanddeiliaid ac fel canlyniad i arolygon ac ymchwiliad safle, bydd Celtic Array yn parhau i gydlynu gydag ymgyngoreion ar hyd y broses cyn gwneud cais i sicrhau bod yr Asesiad Effaith Amgylcheddol yn defnyddio'r wybodaeth orau sydd ar gael, y dulliau asesu cywir ac yn parhau gyda'i ffocws ar yr effeithiau arwyddocaol tebygol.

Defnyddiodd Celtic Array yr Adroddiad Cwmpasu ar y môr fel sail ar gyfer Cam 1 yr Wybodaeth Amgylcheddol Ragarweiniol, fodd bynnag mae gwahaniaethau allweddol rhwng yr Adroddiad Cwmpasu yn y môr a Cham 1 yr Wybodaeth Amgylcheddol Ragarweiniol. Caiff y gwahaniaethau allweddol rhwng yr Adroddiad Cwmpasu a chynnwys Cam 1 yr Wybodaeth Amgylcheddol Ragarweiniol eu hamlinellu yn y canllaw darllen dilynol:

<table>
<tr><th>Adran</th><th>Newidiadau allweddol</th></tr>
<tr><td>1 Cyflwyniad</td><td>Bu newidiadau sylweddol i'r cyflwyniad i ddangos fod gan y ddogfen hon ddiben gwahanol i ddiben yr Adroddiad Cwmpasu.

Mae Celtic Array wedi llofnodi cytundeb gyda National Grid i gymryd 2GW o bŵer o'r fferm wynt arfaethedig i system drawsyrru National Grid. Rhagwelir y bydd y cysylltiad hwnnw yn Ynys Môn.</td></tr>
<tr><td>2 Polisi Cynllunio a'r Cyd-destun Deddfwriaethol</td><td>Yn amlinellu'r gofynion caniatâd ar gyfer seilwaith cysylltiedig yng Nghymru.</td></tr>
<tr><td>3 Dewis Safle</td><td>Ychwanegwyd dwy adran i ddangos y derbyniwyd y Farn Cwmpasu a bod ymgynghoriad Cam 1 yn mynd rhagddo ar hyn o bryd.</td></tr>
<tr><td>4 Disgrifiad o'r Prosiect</td><td>Ychwanegiadau'n cynnwys:
Cynlluniau mynegol ar gyfer tyrbinau 5 a 15 MW;
Crynodeb o egwyddorion dylunio ar y môr;
Disgrifiad o dechnoleg a seilwaith trawsyrru trydan yn y môr;
Seilwaith nodweddiadol ar y tir;
Athroniaeth Celtic Array ar gyfer dynodi a gwerthuso safleoedd posibl ar gyfer is-orsafoedd ar y tir; a
Gweithgareddau adeiladu nodweddiadol ar y tir.</td></tr>
<tr><td>5 Methodoleg Asesu Effaith Amgylcheddol</td><td>Dim newid.</td></tr>
<tr><td>6 Prosesau Ffisegol</td><td rowspan="3">Diweddarir i:
Gynnwys y Farn Cwmpasu gan yr Arolygiaeth Gynllunio;
Disgrifio’r effeithiau posibl (yng ngoleuni'r Farn Cwmpasu); ac
Arolygon ar-lein a rhaglen astudio.</td></tr>
<tr><td>7 Amgylchedd Biolegol</td></tr>
<tr><td>8 Amgylchedd Dynol</td></tr>
<tr><td>9 Strwythur Arfaethedig y Datganiad Amgylcheddol</td><td>Newidiwyd i gynnwys strwythur Datganiad Amgylcheddol a gynigiwyd yn y Farn Cwmpasu.</td></tr>
</table>

Adran	Newidiadau allweddol
10 Tabl o faterion: Cwmpas Mewn/Allan	Newidiwyd am dabl yn crynhoi'r effeithiau posibl yn gysylltiedig gyda Fferm Wynt Rhiannon sy'n adlewyrchu materion a godwyd yn y Farn Cwmpasu.

Beth sydd ar ôl i gael ei benderfynu?

Mae'r wybodaeth amgylcheddol sydd ar gael ar hyn o bryd ar y ceblau allforio morol ac ar y cysylltiad grid ar y tir yn gyfyngedig ar hyn o bryd oherwydd na chafodd y broses i ddynodi opsiynau ar gyfer pwyntiau glanfa addas, safleoedd is-orsaf ar y môr a llwybrau ceblau eu cwblhau hyd yma.

Ar y Môr: Ar hyn o bryd disgrifir y llwybr cebl allforio ar y môr fel ardal chwilio, a gaiff ei fireinio ymhellach fel y ceir mwy o wybodaeth, yn cynnwys cwblhau arolwg geoffisegol sy'n mynd rhagddo ar hyn o bryd i ddeall cyflwr gwely'r môr. Ni fydd yn bosibl diffinio union gyfluniad a chynnwys fferm wynt ar y môr pryd adeg gwneud cais am ganiatâd, er enghraifft, efallai na fydd dyluniadau sylfaen llawn neu fathau tyrbin ar gyfer Fferm Wynt Rhiannon ar gael hyd ar ôl i'r prosiect gael caniatâd, gall cynnyrch newydd ddod i'r farchnad neu gall fod gofynion cyfreithiol ar gyfer tendro cystadleuol ar gyfer elfennau allweddol. Bydd Amlen Peirianneg yn rhoi 'sefyllfa achos gwaethaf realistig' ar gyfer yr Asesiad Effaith Amgylcheddol. Caiff dull gweithredu Amlen Peirianneg ei weithredu ar gyfer Fferm Wynt Rhiannon yng nghyswllt nifer y gweithiau a ddisgrifir yn Natganiad Amgylcheddol y prosiect, yn cynnwys dethol tyrbinau, arwydd o'r coridor cebl allforio a dyluniad sylfaen tyrbinau.

Ar y Tir: Mae gan Celtic Array gytundeb cysylltiad grid gyda National Grid i gysylltu 2GW o bŵer o'r fferm wynt arfaethedig i'r System Drawsyrru Genedlaethol y cynigir ei chysylltu ar Ynys Môn. Ni phenderfynwyd eto ar leoliad y gwaith ar y tir yn Ynys Môn i gysylltu â'r rhwydwaith trawsyrru presennol, yn cynnwys pwyntiau cysylltu glanfa cebl, llwybrau cebl i is-orsaf ar y tir a lleoliad yr is-orsaf ar y tir. Mae'r Ddeddf yn niwtral o ran datganoli felly bydd yn parhau'n bosibl i wneud penderfyniadau ar ganiatâd yng Nghymru. Fel canlyniad, bydd glanfa ceblau, is-orsaf ar y tir a cheblau cysylltu angen caniatâd cynllunio dan Ddeddf Cynllunio Tref a Gwlad (1990) gan Gyngor Sir Ynys Môn. Gall fod angen mathau eraill o ganiatâd i gysylltu'r is-orsaf ar y tir gyda'r rhwydwaith drawsyrru bresennol.

Ar hyn o bryd, mae Celtic Array'n bwriadu cyflwyno Adroddiad Cwmpasu ar y traeth ar gyfer rhai seilwaith ar y tir i Gyngor Sir Ynys Môn yng ngwanwyn 2013, pan fydd mwy o eglurder ar y safleoedd is-orsaf posibl ar y tir, safleoedd glanfa ceblau, graddiad ceblau a sefyllfaoedd cysylltu. Cynhelir ymgynghoriad ffurfiol yng ngwanwyn 2013 i roi diweddariad ar elfennau ar y tir y Prosiect.

Bydd Cam 2 yr Wybodaeth Amgylcheddol Ragarweiniol yn cynnwys digon o fanylion ar y seilwaith ar y tir i alluogi ymgyngoreion i ddeall y berthynas rhwng elfennau yn y môr ac ar y tir Fferm Wynt Rhiannon, yn cynnwys unrhyw effeithiau cronnus posibl ac ystyriaethau perthnasol cynllunio ar y tir.

Os oes gennych unrhyw ymholiadau am Gam 1 yr Wybodaeth Amgylcheddol Ragarweiniol neu'r prosiect hwn, ewch i'n gwefan www.celticarray.com neu gysylltu â ni ar info@celticarray.com os gwelwch yn dda.

1 INTRODUCTION

1.1 Celtic Array Limited (Celtic Array) is a joint venture between Centrica Renewable Energy Limited (CREL) and DONG Energy Wind Power Holdings A/S (DONG Energy). Celtic Array is proposing to develop an offshore wind farm, called Rhiannon Wind Farm (RWF), in the Irish Sea together with associated offshore infrastructure to bring electricity to shore on the Isle of Anglesey, Wales. Celtic Array is proposing to develop RWF through a subsidiary company Rhiannon Wind Farm Limited.

1.2 RWF is the first offshore wind farm to be proposed in the Irish Sea Zone (ISZ) and it is located approximately 19km north east from Anglesey, 34km south east from the Isle of Man and 60km south west of the Cumbrian coast. RWF will have a capacity of up to 2.2 Gigawatts (GW) and will comprise offshore wind turbines, foundations, intra-array cables and offshore transmission assets such as offshore substation(s) and the sub-sea export cables which will bring power to shore on the Isle of Anglesey, Wales.

1.3 Celtic Array has signed grid connection agreements with National Grid to connect 2GW of grid capacity from RWF to the electricity transmission network on the Isle of Anglesey. RWF shall have an installed capacity of up to 2.2GW which corresponds to a grid connection capacity of 2GW, such that up to 10% of additional installed capacity is provided, which is generally in keeping with industry practice to date (due to an optimisation of transmission costs and energy production allowing for Wind Turbine Generator downtime), and subject to optimisation during detailed design. Celtic Array is currently identifying potential offshore cable corridors, onshore cable landfall sites, onshore cable corridors and potential onshore substation sites on Anglesey. Celtic Array is in discussion with National Grid on how the connection will be made to the existing network. More information on the onshore infrastructure will be made available in the spring of 2013.

1.4 RWF is an offshore electricity generation station with a generation capacity of up to 2.2GW and is therefore defined as a ‘Nationally Significant Infrastructure Project (NSIP) by the Planning Act 2008. Section 14 of the Act sets out the area the Planning Inspectorate has jurisdiction over.

1.5 In England associated development can be made part of the application to the Planning Inspectorate whereas in Wales in most cases a separate application would have to be made to the Local Planning Authority. Consequently, Celtic Array intends to submit applications for, but not limited to:

- A Development Consent Order for the electricity generation station to the Planning Inspectorate which will include an application for a deemed Marine Licence (in consultation with the Marine Management Organisation (MMO)) for licensable activities, such as depositing turbines and cables outside the Welsh territorial seas;
- A Marine Licence for licensable activities, such as depositing turbines and cables inside the Welsh territorial seas to the Welsh Government (Marine Consents Unit); and
- Planning permission, for certain onshore infrastructure associated with RWF, in Wales, from the Isle of Anglesey County Council, once the location for the onshore grid connection is determined.

1.6 Figure 1.1 below shows the Site and indicative export cable corridor for RWF and the planning jurisdictions which apply to RWF. Chapter 4 describes the project in more detail.

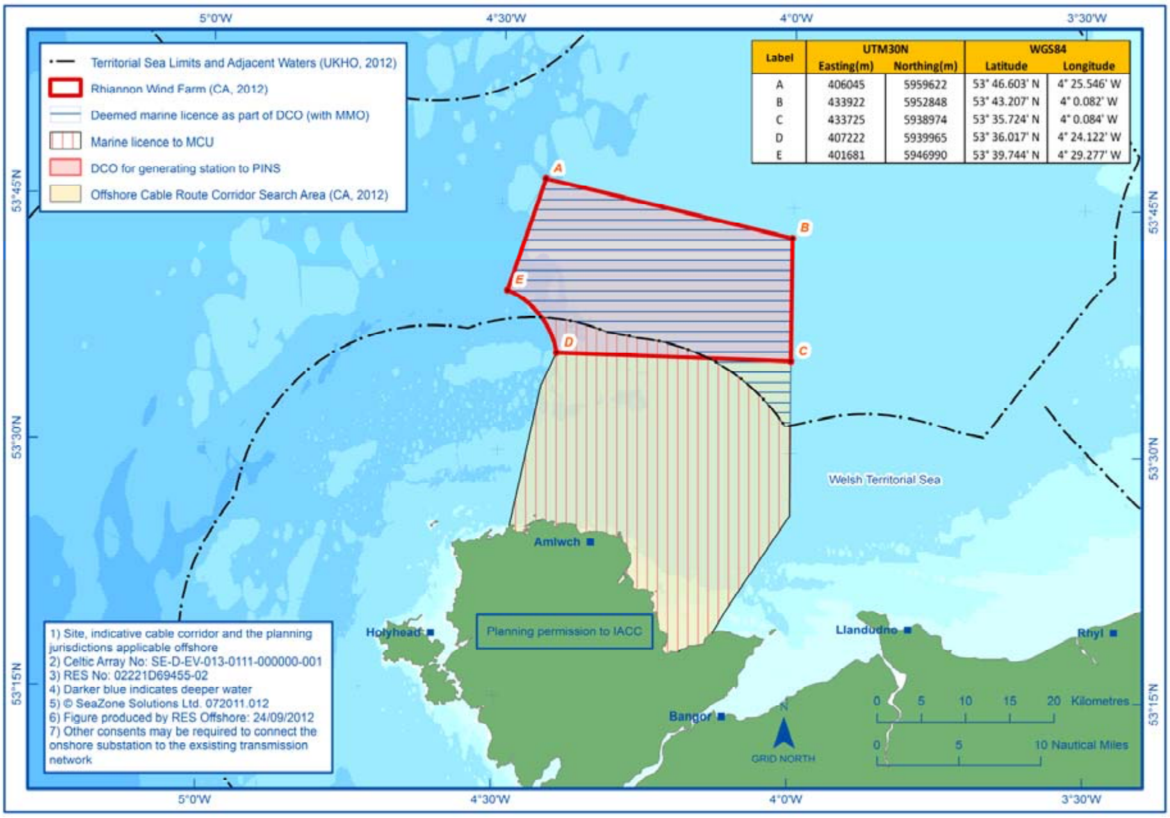

Figure 1.1 The Site, indicative cable corridor and the planning jurisdictions applicable to the project

The development team

1.7 RWF is being developed by Celtic Array which is a joint venture between CREL and DONG Energy.

1.8 CREL is a subsidiary of Centrica plc (Centrica), which is better known to customers through its market leading British Gas operations. Centrica supplies gas and electricity to millions of consumers across Britain and provides a wide range of energy-related services to homes and businesses. As part of a broader gas production and electricity generation portfolio, Centrica has a growing number of renewable assets. Centrica believes that wind power will deliver the majority of the required growth in renewable energy to enable the UK Government's current carbon reduction targets to be met by 2020.

1.9 Centrica's primary focus regarding renewable energy has been on the development of offshore wind farms. Centrica has developed, built and operated a number of offshore and onshore wind farms.

1.10 DONG Energy is one of the leading energy groups in Northern Europe specialising in procuring, producing, distributing and trading energy. The company employs approximately 6,000 employees across Northern Europe and the UK.

1.11 DONG Energy is the market leader in offshore wind and has more than 30 years experience in wind power and more than 20 years experience in developing, building and running wind farms. The majority of DONG Energy's wind power capacity is located in North West Europe, with an increasing amount being derived from offshore wind farms in Great Britain (Figure 1.2).

1.12 Renewable Energy Systems Ltd (RES) has been engaged by Celtic Array to develop projects in the ISZ.

1.13 RES is a member of the Sir Robert McAlpine Group and is one of the leading and broadest based companies in the wind energy industry worldwide. RES has been at the forefront of wind energy development in the UK since 1980 and has developed projects in America, Europe and worldwide. RES has a total portfolio of more than 5GW of installed wind capacity.

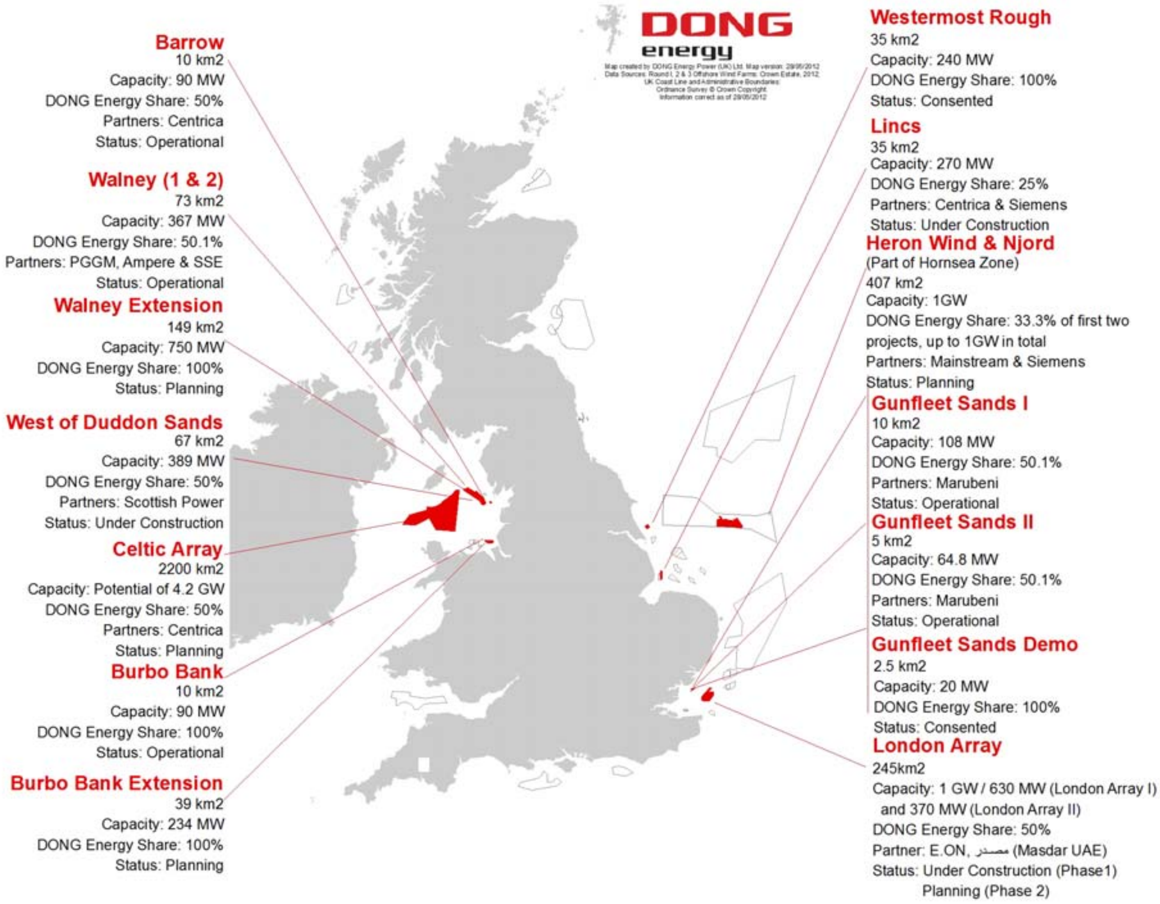

Figure 1.2 DONG Energy's wind farm projects

Preliminary Environmental Information – a staged approach

1.14 The primary purpose of the PEI is to provide sufficient information to inform consultation with a wide variety of technical (e.g. government agencies) and non-technical (e.g. marine users such as shipping operators or fishermen) prior to the production of the Environmental Statement (ES). An ES will be submitted alongside the DCO in line with Regulation 6 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended). The PEI will be consulted upon with a wide variety of Section 42 consultees both technical (e.g. government agencies) and non-technical (e.g. marine users such as fisherman or shipping operators).

1.15 Celtic Array intends to conduct public consultation in two stages, in line with Government guidance on pre-application consulation for Nationally Significant Infrastructure Projects (CLG 2009). The guidance encourages promoters to consider an interactive, phased consultation consisting of two or more stages (CLG 2009). This Stage 1 consultation is occurring early in the project development to present the options and the envelope that the EIA should use. Stage 1 provides consultees with an opportunity to influence the proposed RWF and identify any potential issues which will inform the scope of the EIA process. Given the early stage of developing the proposal for RWF, the Stage 1 PEI is at a high level, especially the preliminary impact assessment. Comments from technical consultees and the community will be of the greatest value at present, whilst the proposals are relatively flexible, followed up by a Stage 2 consultation as the proposal becomes firmer. Stage 2 PEI (Figure 2.1) will set out the preferred option and will include a full Environmental Impact Assessment for the RWF.

1.16 This is the Stage 1 PEI for RWF. Stage 1 PEI provides the information described in Part 1 of Schedule 2 of The Regulations where it is proposed to apply for a DCO under the Planning Act 2008. This report is one of a suite of documents which have been or will be published by Celtic Array as it prepares for the submission of applications for consents for RWF.

1.17 While the statutory PEI only applies under the Planning Act 2008 Celtic Array will, for clarity and consistency, use Stage 1 PEI to record information about applications for a Marine Licence from the Welsh Government and for planning permission for onshore works from the Isle of Anglesey County Council.

1.18 Stage 1 PEI and Stage 2 PEI will contain non-statutory project and environmental information on:

- The marine export cables from the outer boundary of the Welsh territorial seas as far as mean high water, for which an application for a Marine Licence will be made to the Welsh Ministers under Section 65 of the Marine and Coastal Access Act 2009; and
- Onshore infrastructure above mean low water springs, for which an application for planning permission from the Isle of Anglesey County Council or relevant examining authority will be made under the Town and Country Planning Act 1990 or the Planning Act 2008.

1.19 The environmental information currently available on the marine export cables and on the onshore grid connection works is limited at this time as the process to identify suitable onshore cable landfall points, onshore substation sites and onshore cable routes has not yet concluded. More information on the onshore works will be available when Celtic Array issues the onshore Scoping Report in the spring of 2013, which will be the subject of consultation. Figure 2.1 sets out the proposed approach to consultation.

1.20 Stage 1 PEI is broken down into the following sections:

Chapters 1, 2 and 3 introduce the development team, RWF, how it was selected, progress to date and the consenting strategy;

Chapter 4 describes RWF and the likely methods of construction, operation and decommissioning;

Chapter 5 outlines the EIA methodology;

Chapters 6, 7 and 8 describe the physical, biological and human environment in which RWF is located; identify the potential impacts of the project; and explain how it is intended to analyse any significant effects during EIA; and

Chapter 9 outlines the contents of the ES that will be submitted alongside the DCO.

2 PLANNING POLICY AND LEGISLATIVE CONTEXT

UK energy policy and the need for renewable energy

2.1 The energy demand of the UK has historically been met by fossil fuels and nuclear energy. Increasing international scientific concerns over climate change and other environmental impacts of burning fossil fuels, together with a desire to minimise dependence on overseas energy sources has led the UK Government to pursue energy policies which increase the amount of electricity generated by renewable sources.

2.2 The UK Government's policy was set out in the first Annual Energy Statement made to the UK Parliament in July 2010. UK energy policy aims to:

- Reduce greenhouse gas emissions to tackle climate change;
- Increase security of supply; and
- Reduce fuel poverty.

2.3 The UK Government is committed, through the Climate Change Act (2008), to reducing UK carbon dioxide emissions by at least 34% by 2020 and at least 80% by 2050 (as compared with 1990 levels).

2.4 Under the EU Renewable Energy Directive, there is a requirement for the UK to produce 15% of all its energy from renewable sources by 2020. In July 2009, the UK Government published the UK Renewable Energy Strategy, setting out the means by which it intended to meet this target. Given the difficulties of increasing the proportion of heating and transportation fuel that is made up from renewable sources, the 'lead scenario' identified in this strategy is for over 30% of the UK's electricity to come from renewable sources by 2020, over two-thirds of which is expected to come from wind power.

2.5 The 2009 White Paper 'UK Low Carbon Transition Plan – National Strategy for Climate and Energy' sets out the UK's first ever, comprehensive, low carbon transition plan to 2020. The plan sets out the UK's approach to becoming a low carbon country by cutting emissions, maintaining secure energy supplies, maximising economic opportunities and protecting the most vulnerable. The Low Carbon Transition Plan is expected to deliver carbon dioxide emission cuts of 18% on 2008 levels by 2020 (and over a one-third reduction on 1990 levels).

2.6 The targets for the lead scenario within the UK Renewable Energy Strategy have effect within Wales since they reflect UK energy policy. The Welsh Government issued an energy policy statement in March 2010 which aims to promote the optimum use of offshore wind around the coast of Wales in order to deliver a further 15kWh of capacity per day and per person, by 2016. The Welsh Government has outlined their approach to energy and climate change in a number of policy documents, including the Energy Strategy published in March 2012.

The Planning Act

2.7 The Planning Act (2008) introduced a new consenting regime for NSIPs in England and Wales. Under the Planning Act, applications for development consent to build NSIPs were originally dealt with by the Infrastructure Planning Commission (IPC).

However, under the Localism Act, the IPC was abolished on 1 April 2012 and the Planning Inspectorate took over its work.

2.8 The Planning Inspectorate is responsible for examining applications for development consent and applies the provisions of the Planning Act relating to pre-application procedures. At the end of the examination of an application, which will still be completed within a maximum of six months, the Planning Inspectorate will have three months to make a recommendation to the Secretary of State for Energy and Climate Change. The Secretary of State will make the decision whether to grant or refuse a Development Consent. This decision is expected within three months of receipt of a recommendation from the Planning Inspectorate.

2.9 The Planning Act placed a duty on the UK Government to create a series of National Policy Statements (NPSs) that set out national policy in relation to NSIP. The UK Government published six energy NPSs in July 2011, following two periods of public consultation. The Planning Act requires that the Planning Inspectorate must decide an application for an NSIP in accordance with the relevant NPS. The energy NPSs relevant to RWF are listed below. These energy NPSs establish and confirm the need for energy infrastructure in the UK, including the development of offshore wind farms:

- Overarching NPS for Energy (EN-1);
- NPS for Renewable Energy Infrastructure (EN-3); and
- NPS for Electricity Networks Infrastructure (EN-5).

2.10 The need for all types of electricity generation is outlined in EN-1. EN-1 notes that large scale deployment of renewable energy will help the UK tackle climate change, reducing the UK's emissions of carbon dioxide by over 750 million tonnes by 2030. Such deployment is estimated to bring business opportunities and provide around £100 billion of new investment with the potential to create 500,000 new jobs in the UK. EN-1 states that the Planning Inspectorate should examine all applications for infrastructure covered by the energy NPSs on the basis that the need for NSIP has been demonstrated by the UK Government and that this need is urgent. EN-1, EN-3 and EN-5 set out the assessment principles for the Planning Inspectorate including the assessment of relevant environmental impacts for each project.

2.11 Section 33 of the Planning Act enables certain other consents to be granted within the DCO in addition to the granting of consent to construct and operate a generating station, such as a deemed Marine Licence. A DCO can also confer 'statutory authority' for carrying out development and has the scope to apply, modify or exclude legislation, where necessary.

2.12 Special provisions apply in Wales, where devolved powers exist relating to development that is associated with an NSIP. These devolved provisions are set out in paragraphs 2.18 and 2.21 below.

Consultation milestones

2.13 Under sections 42, 47 and 48 of Part 5 of the Planning Act, there are statutory requirements for promoters of a DCO application to engage in pre-application consultation with local communities, local authorities and those who would be directly affected by the proposals.

2.14 The Infrastructure Planning (Applications and Procedure) Regulations (2009) set out the detailed procedures which must be followed for submitting, publicising and consulting on NSIPs.

2.15 Pre-application, consultation and engagement occurs before and during the preparation of the ES, before the DCO application is submitted. Relevant local authorities with coastal and landward jurisdictions within which the potential development footprint falls will also be included. Celtic Array is planning on carrying out formal pre-application consultation in two stages in addition to ongoing engagement with relevant stakeholders.

2.16 Figure 2.1 below summarises the planned approach to DCO pre-application consultation.

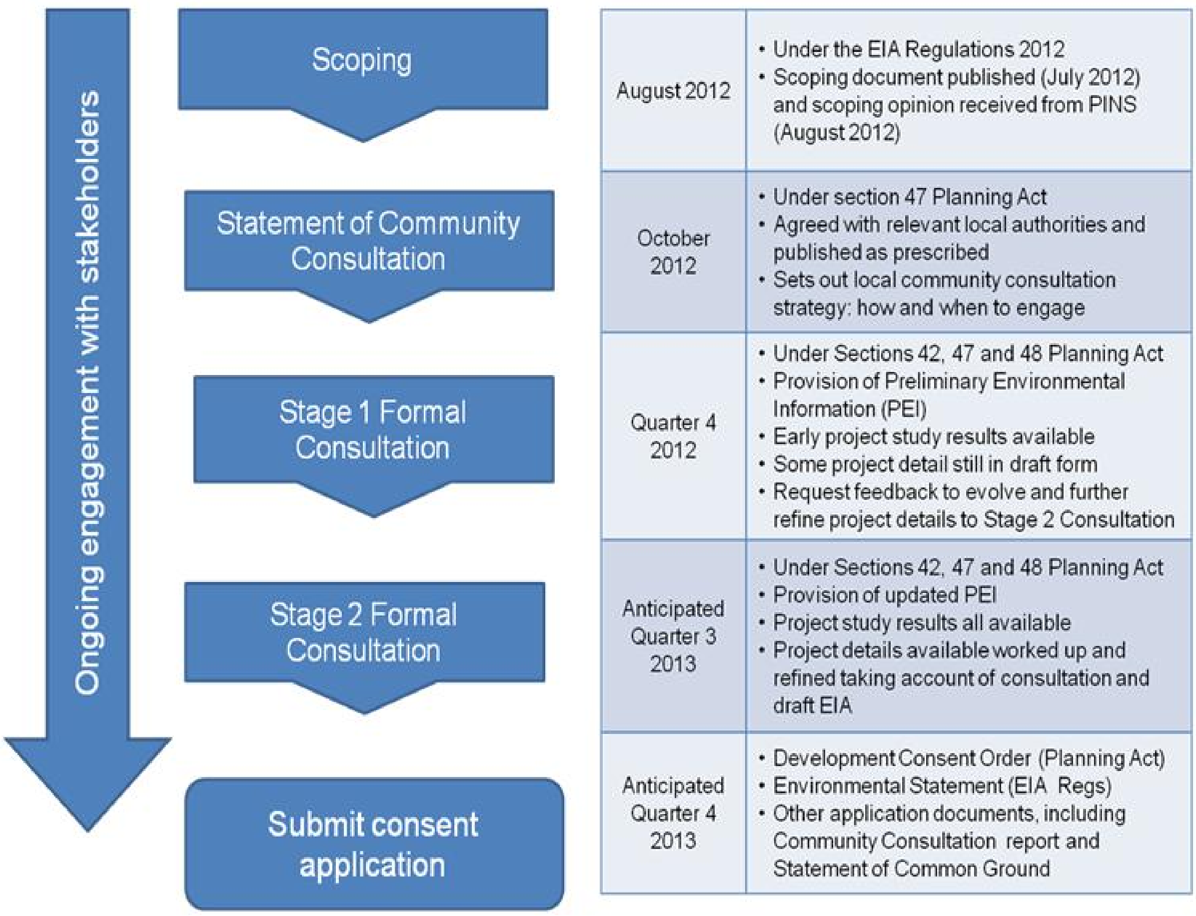

Figure 2.1 Planned approach to pre-application consultation

The Marine and Coastal Access Act

2.17 Under the Marine and Coastal Access Act (2009), a Marine Licence is required for the construction and operation of all parts of the Project below MHWS. In cases where applications are made to the Planning Inspectorate for an offshore wind farm (projects over 100MW), a deemed Marine Licence may be granted as part of the DCO. The Planning Inspectorate retains responsibility for the review of the application and the

Planning Inspectorate retains responsibility for the review of the application and the MMO acts as a statutory consultee in defining the conditions relating to the deemed Marine Licence. This regime will apply to all works outside the Welsh territorial seas.

2.18 For all licensable activities within Welsh territorial seas, an application for a Marine Licence will be made to the Welsh Government (through the Marine Consents Unit (MCU)), since this Marine Licence cannot be deemed within the DCO. It is anticipated that applications for Marine Licences to both the MMO and MCU will be aligned with the DCO application and onshore consents as far as possible, both in timing and consultation with the MCU and the MMO.

Associated infrastructure

2.19 Although the statutory PEI only applies under the Planning Act 2008 to the DCO area (see Figure 1.1) for clarity and consistency, the PEI also provides information about infrastructure that is consented as part of a Marine Licence from the Welsh Government and for planning permission for onshore works from the Isle of Anglesey County Council (or other planning body under the Town and Country Planning Act 1990 or Planning Act 2008).

2.20 Celtic Array examined potential grid connection options in the North West region. Celtic Array agreed with National Grid to connect 2GW of grid capacity from RWF to the electricity transmission network on the Isle of Anglesey. Celtic Array is currently identifying options for potential offshore cable corridors, cable landfall sites, onshore cable corridors and onshore substation sites on Anglesey. Celtic Array is in discussion with National Grid on how the connection will be made to its existing network. More information on the connection will be available in spring 2013, when Celtic Array intends to submit the onshore Scoping Report to the Isle of Anglesey County Council and carry out an additional stage of informal consultation.

2.21 Certain onshore infrastructure in Wales (such as underground cables and a substation) is outside the jurisdiction of the Planning Inspectorate and will be determined by the Isle of Anglesey County Council by way of an application for planning permission under Section 57 of the Town and Country Planning Act (TCPA) 1990. The TCPA application will be accompanied by an EIA under the Town and Country Planning (EIA) Regulations for the onshore infrastructure. The offshore ES will include sufficient detail on the onshore infrastructure to allow the Planning Inspectorate and stakeholders to understand the relationship between the offshore and onshore elements of the Project, including any potential cumulative effects and relevant onshore planning considerations. Other consents may be required to connect the onshore substation to the existing transmission network.

2.22 The offshore export cable route is described in a corridor, which will be further refined as more information is known. The section of the export cable that is within the Welsh territorial seas will require a Marine Licence from the Welsh Government Marine Consents Unit.

Welsh language impact assessment

2.23 Technical Advice Note 20 (TAN 20) emphasises that the Welsh language is part of the social fabric of Wales. In recognising the importance of language to people and communities, Celtic Array will conduct a language impact assessment as part of the planning process. The language impact assessment will examine whether RWF could cause any changes to the language patterns of the surrounding communities. Celtic Array will continue to work with the relevant local planning authorities and follow any guidance such authorities have produced on how best to perform the language assessment.

Habitats Regulations

2.24 There is a network of protected sites which aim to conserve natural habitats and species that are rare, endangered, vulnerable or endemic within the EU. This network, known as 'Natura 2000', includes Special Areas of Conservation (SAC) designated under the Habitats Directive for their habitats and/or species of European importance and Special Protection Areas (SPA) classified under the Birds Directive for rare, vulnerable and regularly occurring migratory bird species and internationally important wetlands.

2.25 The requirements of the Habitats Directive are transposed in England and Wales and their respective territorial seas, by means of the Conservation of Habitats and Species Regulations 2010 (as amended) (the Habitats Regulations). The Offshore Marine Conservation (Natural Habitats, &c) (Amendment) Regulations 2010 transpose the Habitats Directive in the UK offshore marine area (beyond 12 nautical miles). Candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Importance (SCIs) should be subject to the same considerations. In addition, sites designated under the 1971 Ramsar Convention for their internationally important wetlands should also be addressed. While Ramsar sites are not European sites for the purposes of the Habitats Directive, they will nonetheless be considered in any subsequent Habitats Regulations Assessment (HRA) for the Project.

2.26 Under the Habitats Regulations, development that is considered by a Competent Authority to have the potential to have a likely significant effect on a European site cannot be consented until an Appropriate Assessment undertaken by the Competent Authority has ascertained that the Project will have no adverse effect on the integrity of those sites.

2.27 For the purposes of the DCO, the Competent Authority will be the Secretary of State for Energy and Climate Change. For the purposes of the application for a Marine Licence for works within the Welsh territorial sea, the Competent Authority will be the Welsh Ministers. However, the Habitats Regulations recognise the need to avoid duplication where more than one Competent Authority is involved. This legal duty can be discharged through a single Appropriate Assessment, made by the most appropriate Competent Authority. No decision has yet been reached on whether the Secretary of State or the Welsh Ministers would be the most appropriate competent authority.

2.28 The NPS (EN-1) states that, before recommending development consent, the Planning Inspectorate must consider the application of the Habitats Regulations to it. Information is provided to developers on where the requirements of the Habitats Regulations can be found, which statutory bodies should be consulted and what developers must provide to the Planning Inspectorate, including avoidance and/or mitigation measures.

2.29 Under the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009 (Regulation 5(2) (g)), the applicant must submit a report considering the effect of the proposed development, alone or in combination with other plans or projects, on the integrity of any relevant European site.

2.30 The Planning Inspectorate's Advice Note 10 in the HRA explains the obligations placed on both the decision maker and developer under the Habitats Regulations, clarifies the information to be provided with an application for a DCO and highlights the relevant bodies that should be consulted throughout the HRA process.

2.31 The ES will be accompanied by a separate HRA document. The outcome of any Appropriate Assessment would be determined by the Competent Authority and would be produced once a DCO has been granted.

2.32 The HRA will be screened independently from this PEI Report when more information from surveys and further analysis is available.

3 SITE SELECTION

The Crown Estate leasing process

3.1 The Crown Estate owns the seabed in UK territorial waters (out to 12 nautical miles (nm)) and manages the rights to renewable energy resources for the continental shelf out to a maximum distance of 200nm. In 2008, The Crown Estate launched a third leasing round of offshore wind (Round 3). Round 3 was a competitive tender performed for nine zones around the UK coast (Figure 3.1).

3.2 CREL was successful in obtaining the development rights to the Irish Sea Zone (ISZ) in January 2010 (the ISZ is sometimes also referred to as Zone 9, which was the title used during The Crown Estate's tender exercise). These development rights allow the holder to identify and seek consent for offshore wind projects within the ISZ. When CREL and DONG Energy formed Celtic Array in March 2012 and following approval by The Crown Estate, the development rights to the ISZ were transferred to Celtic Array.

3.3 The ISZ covers an area of 2,200km^2 and is approximately 15km from Anglesey, 20km from the Isle of Man and over 60km to the Cumbrian coast. Celtic Array expects the ISZ to deliver up to 4.2GW of capacity of offshore wind. The boundary of the ISZ is shown in Figure 3.2.

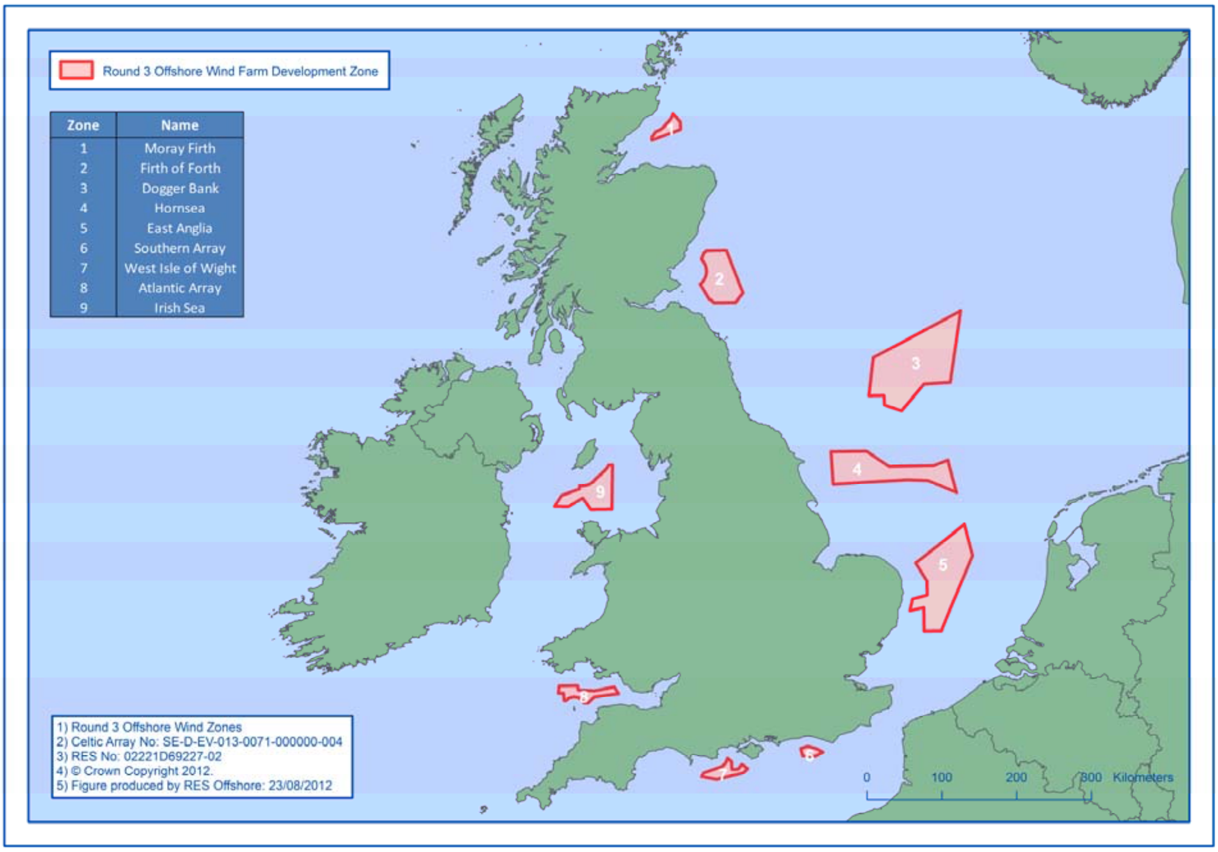

Figure 3.1 Round 3 offshore wind zones

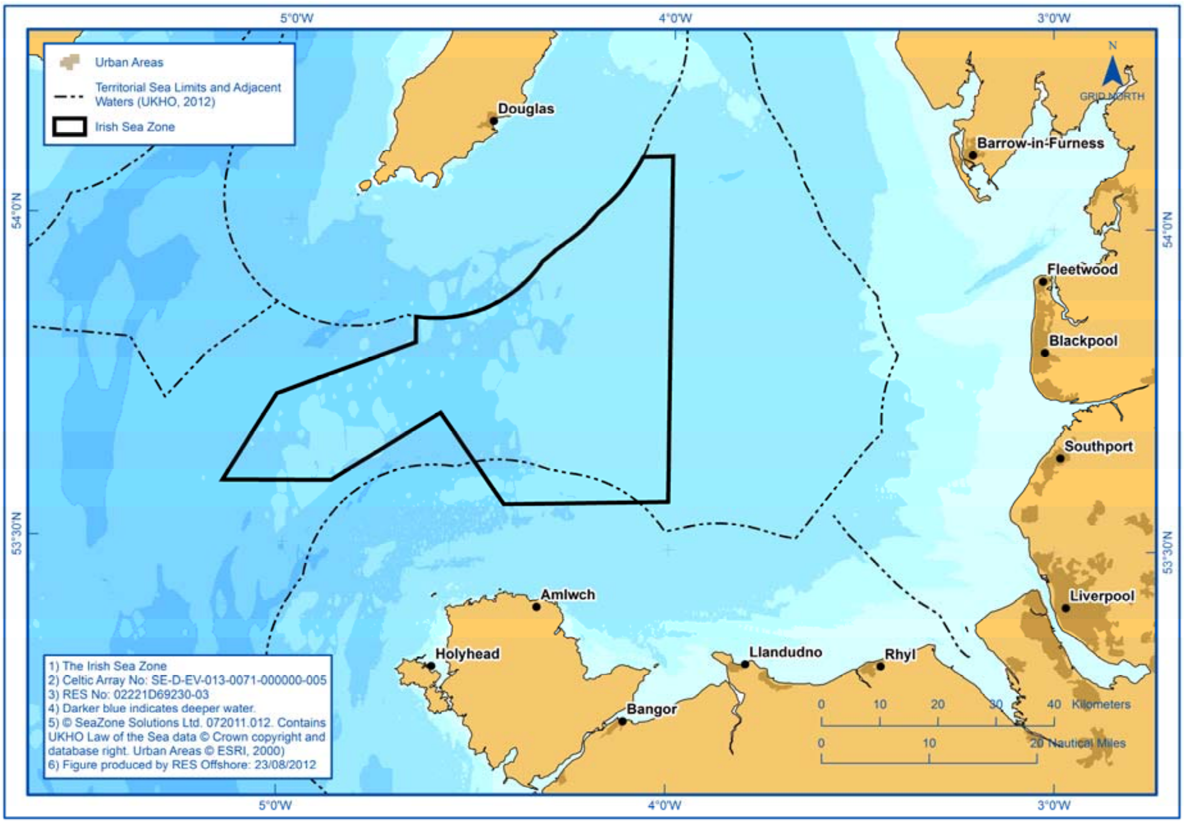

Figure 3.2 The Irish Sea Zone

Zone Appraisal and Planning

3.4 In order to allow a more strategic approach to the development of offshore wind and the accompanying consultation, The Crown Estate suggested that each zone should go through the Zonal Appraisal and Planning (ZAP) process. Celtic Array completed the ZAP process to gain a better understanding of the unique physical, human and environmental constraints and opportunities in the ISZ. The ISZ ZAP process was a non-statutory, strategic programme extending over two years, involving data collection, consultation and assessment.

3.5 The ZAP process represents a new approach to project development and has allowed RWF to be advanced on the basis of a large body of data and views collected specifically to inform any proposals. This reduces the need to rely on desk-based studies only and forms a strong foundation for project specific consultation and assessment. The ZAP assessment assumed that either 5MW or 7MW turbines would be used as these represented the largest turbines either in use or on the market at that time. The engineering envelope has changed since ZAP; further details are set out in Section 4. ZAP focused on identifying key constraints within the ISZ in respect to the main infrastructure i.e. turbines and foundations. Impacts associated with onshore infrastructure and marine cables could not be assessed until Potential Development Areas were identified within the ISZ.

3.6 The ZAP process culminated in the Celtic Array ZAP Report that identified three Potential Development Areas in the ISZ which may host offshore wind farms. While the ZAP process is not provided for in any regulations, the data collection, consultation and assessment can be viewed as preliminary work informing and, to some extent, underpinning the EIA.

3.7 Celtic Array published the ZAP Report on its website on the 3 April 2012 and invited comments, via email, from more than 700 stakeholders. Stakeholder responses to the ZAP Report have informed this Stage1 PEI Report and will be considered as the EIA progresses. The ZAP Report is available for download at: www.celticarray.com

Potential Development Areas

3.8 The ZAP process identified three Potential Development Areas (Figure 3.3) on the basis of water depth, ground conditions, shipping routes and stakeholder responses. Consultation during the ZAP process helped identify strategic corridors which will be left undeveloped to assist other sea users and manage the environmental impacts associated with multiple offshore wind farms.

3.9 The ZAP process also recommended that the South East Potential Development Area should be amended to provide a buffer of 5nm from the entrance / exit to the Anglesey Traffic Separation Scheme (TSS) and a buffer of 1nm from a line drawn between northern most limit of the Anglesey TSS and Liverpool Bay TSS (Figure 3.3 below).

3.10 The two years of data collection and consultation collated via ZAP has informed this PEI Report by outlining key issues which will need to be addressed as part of the project level EIA.

3.11 Celtic Array decided to develop its first project, RWF, in the South East Potential Development Area because of its proximity to grid connection(s) on Anglesey.

3.12 The North East Potential Development Area and South West Potential Development Area will separately be examined to identify future projects. Any future projects will go through their own process of consultation and assessment, including the consideration of cumulative and in combination effects.

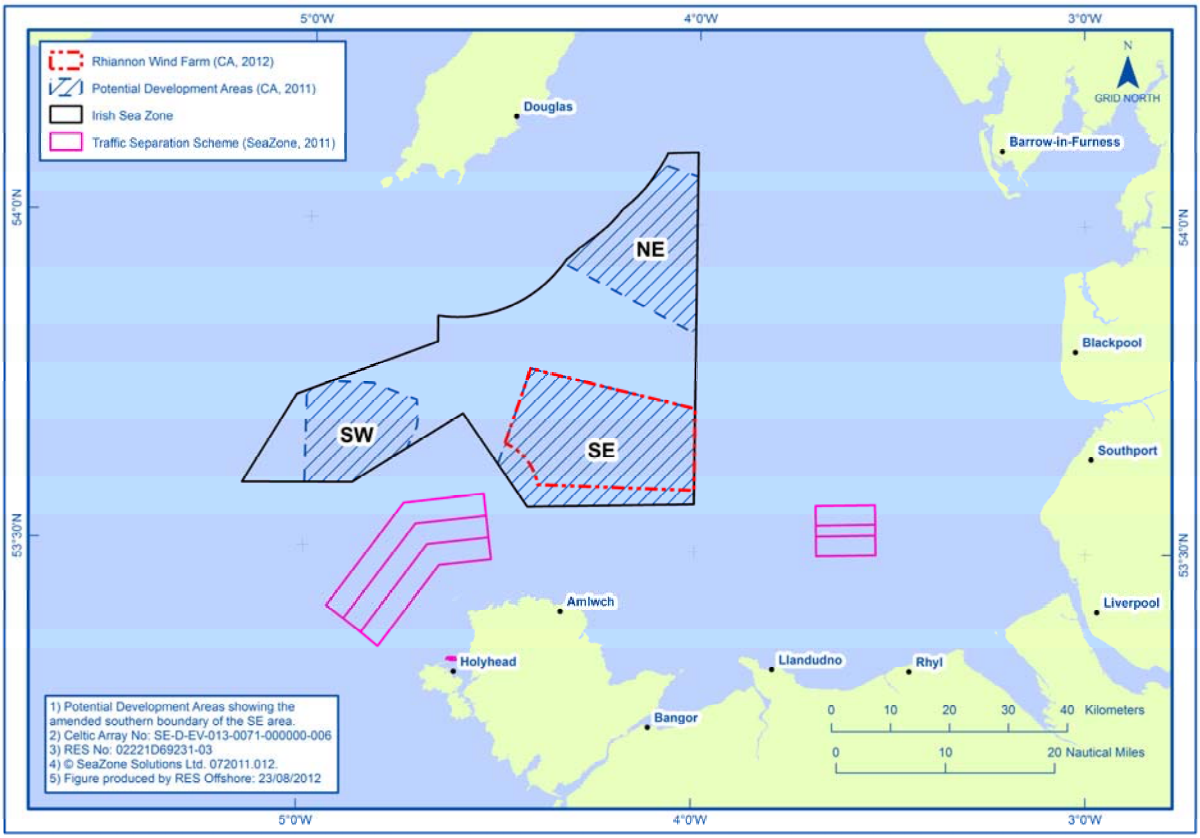

Figure 3.3 Amended southern boundary of the South East Potential Development Area

Scoping

3.13 The DCO application will be accompanied by one ES prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended) and supporting documents. The EIA Regulations enable an applicant to ask the Planning Inspectorate to state in writing its formal opinion (a Scoping Opinion) on the information required to be provided in an ES.

3.14 On 6 July 2012, the Planning Inspectorate received an offshore Scoping Report submitted by Celtic Array under Regulation 8 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended) in order to request a Scoping Opinion for the proposed RWF. The offshore Scoping Report set out the proposed content, key issues and methodologies for the EIA; the results of which would be included in the offshore ES to be submitted with the application for a DCO and Marine Licences. The Planning Inspectorate consulted with 42 consultation bodies and received 14 responses before issuing its Scoping Opinion on 19 August 2012. The Planning Inspectorate's Scoping Opinion and all responses are available on the Planning Inspectorate's website: http://infrastructure.planningportal.gov.uk/

3.15 The Scoping Opinion is based on the proposals set out on 6 July 2012 in the offshore Scoping Report. Celtic Array will continue to liaise with consultees throughout the pre-application process to ensure the EIA uses the best available evidence, the correct assessment methods and remains focused on potential impacts of the Project.

Preliminary Environmental Information

3.16 The primary purpose of the PEI is to provide sufficient information to inform consultation prior to the production of the ES. An ES will be submitted alongside the DCO in line with Regulation 6 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended).

3.17 Celtic Array plans to consult twice. The first stage of consultation (Stage 1) sets out our initial proposal and describes the potential impacts associated with it. The second stage of consultation (Stage 2) will set out our detailed project design and include an assessment of the potential environmental effects of our application. Any responses received during Stage 1 consultation will be considered in the Stage 2 proposal, this also includes responses received from the Scoping Opinion. Following the Stage 2 consultation, an ES will be submitted (having considered the responses received to Stage 2 consultation) alongside the DCO in line with Regulation 6 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009.

3.18 In accordance with Section 42 of the Planning Act 2008, this Stage 1 PEI seeks to inform technical consultees about the proposed RWF and describe the potential impacts associated with the construction, operation and decommissioning phases of the project. All responses received during this consultation will be reviewed and analysed to:

- Help make sure the potential negative and positive aspects of the proposal have been considered;
- Take on board opportunities for improving the project design, where appropriate; and
- Produce a Consultation Report to accompany an application for a DCO to the Planning Inspectorate. The Consultation Report will show how Celtic Array has given due consideration to consultation responses within the application.

4 PROJECT DESCRIPTION

4.1 RWF is the first offshore wind farm to be proposed in the ISZ. The key offshore and onshore components are outlined below. At this stage, the RWF description remains indicative but it will be refined following ongoing surveys, engineering studies and discussions with stakeholders as part of the EIA process. However, it is essential that a range of engineering and construction options remain available to Celtic Array following the issue of a DCO and a Marine Licence. Stage 2 PEI will set out Celtic Array's detailed project design and include an assessment of the potential environmental effects of the proposal.

4.2 As discussed in Chapter 5 of this Stage 1 PEI Report, the RWF description in the ES will include a clearly defined Engineering Envelope (also known as a Rochdale Envelope[1]) upon which the assessment of environmental impacts will be based. This topic is further explored in paragraphs 5.9 to 5.11.

Project objective

4.3 The principal objective of the project is to secure domestic supplies of renewable electricity from offshore wind, in line with the UK Government's energy policy (see Chapter 2 of this Stage 1 PEI Report).

Site location and layout

4.4 The Site is located in the ISZ approximately 60km south west of the Cumbrian coast, 19km north east of Anglesey and 34km south east of the Isle of Man at its closest boundaries to shore. The maximum area of the Site is about 497km^2. The Site and indicative cable corridor is shown in Figure 4.1 which includes the co-ordinates of the verticies of the Site's boundary.

4.5 The offshore export cable route falls within a wide corridor (Figure 4.1) which will be refined once a grid connection is finalised, landfalls have been defined and geophysical surveys have identified potential constraints within the export cable corridor. The DCO application and ES will be focussed on a narrower cable corridor. Further details will be provided when the grid connection point is agreed and the relevant technical studies have been completed. The connection is anticipated to be on Anglesey, though the exact location is yet to be determined.

4.6 The main offshore components are likely to include:

- Offshore wind turbines and associated foundations;
- Multiple offshore substations (High Voltage Alternating Current (HVAC);

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[1] Case law (for example Rochdale MBC Ex. Parte C Tew 1999) has affirmed the legal principle that the content of any consent for development requiring EIA cannot exceed the scope of EIA. However, an enduring difficulty for the promoters of complex infrastructure projects such as offshore wind farms is that it is not possible to be precise about each element of a development at the time of the submission of a consent application. As recognised by the Planning Inspectorate in its Advice Note 9, a valid approach to this issue is to define an engineering envelope (known as a Rochdale envelope) comprising a series of realistic worst cases for individual environmental or technical disciplines, which will define the scope of EIA and in turn the scope of a consent.

- One or more offshore High Voltage Direct Current (HVDC) converter stations (if DC voltage is selected for the offshore transmission);
- Intra-array subsea cables between the turbines and offshore substations;
- Export sub-sea cables linking the offshore HVAC substations, or HVDC converter stations to the onshore electricity system, allowing the energy generated by the turbines to be used onshore;
- Offshore platforms for operation, maintenance and accommodation; and
- Scour protection for turbine foundations and cable protection.

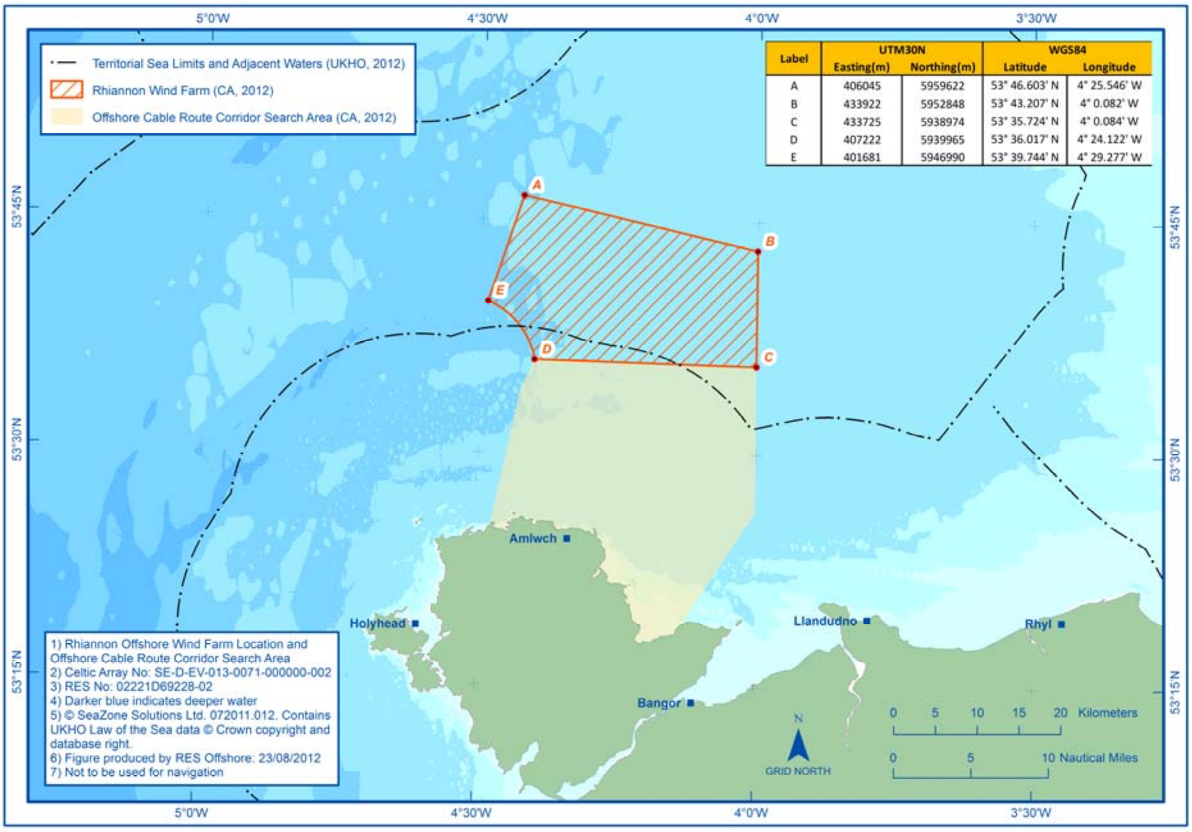


Figure 4.1 Project location and offshore cable route study area

4.7 The section of the cable route within the Welsh territorial seas will be the subject of a separate Marine Licence application because a Marine Licence from the Welsh Government cannot be deemed within a DCO.

4.8 Certain onshore infrastructure associated with the RWF Project will be the subject of a separate application for planning permission to the Isle of Anglesey County Council under the Town and Country Planning Act (1990), because it is not possible to include deemed planning permission for onshore works associated with an offshore NSIP in Wales within a DCO. Although the onshore infrastructure associated with RWF Project will be outside the scope of the DCO application, the ES will include sufficient detail on the onshore infrastructure to allow the Planning Inspectorate and stakeholders to understand the relationship between the offshore and onshore elements of the project, including any potential cumulative effects and relevant onshore planning considerations. The application for planning permission will also be subject to a full EIA and will be accompanied by an ES. Other consents may be required to connect the onshore substation to the existing transmission network.

Meteorological mast

4.9 Celtic Array will apply for a Marine Licence to install a meteorological mast within RWF. Subject to obtaining a lease from The Crown Estate and a Marine Licence from either the MMO or the MCU, Celtic Array intends to install the met mast in 2014.

Turbine options

4.10 Offshore wind turbines ranging in size from about 5MW to 15MW will be considered for RWF. Figure 4.2 below shows an indicative wind turbine generator structure.

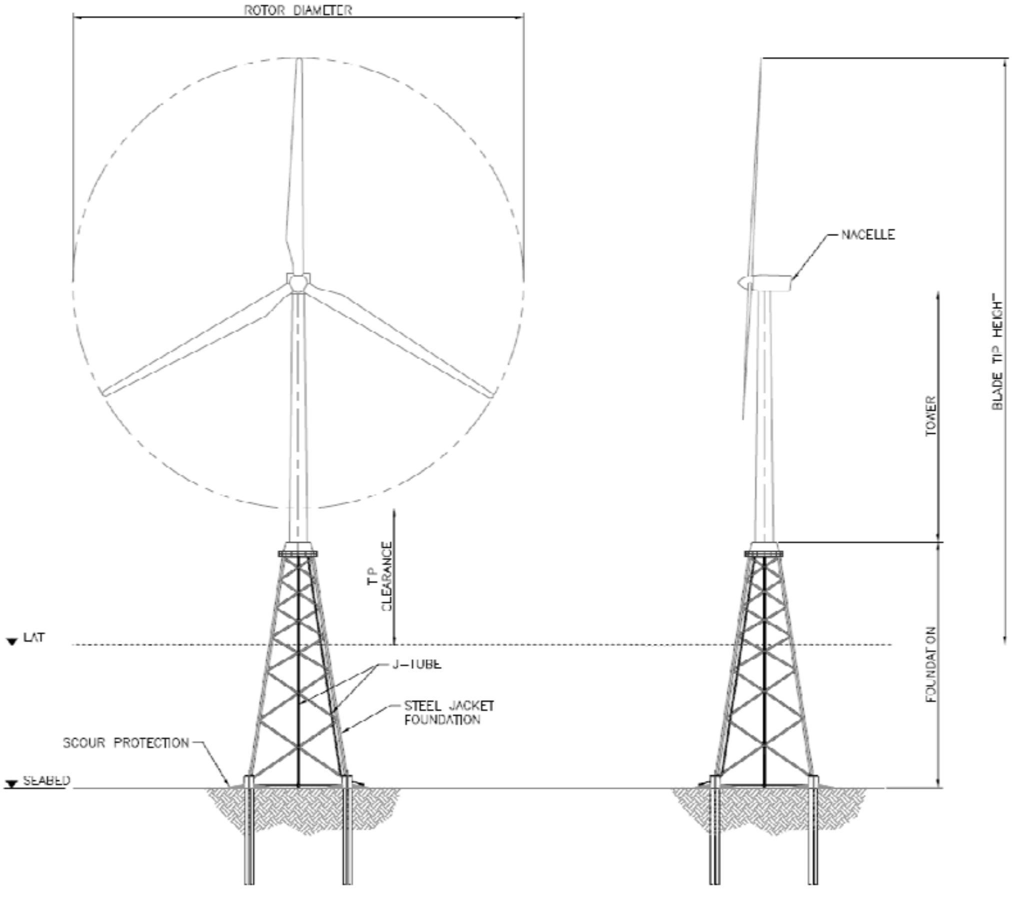


Figure 4.2 Indicative wind turbine generator structure (Celtic Array 2012. Drawing No: 02221 D2209-01)

4.11 Table 4.1 provides indicative turbine numbers and dimensions for RWF.

Table 4.1 Indicative turbine options and maximum potential dimensions

Rating	Max. no. of turbines	Max. rotor diameter (m)	Max. hub height (m LAT)	Max. rotor tip height (m LAT)
5MW	440	142	109	180
6MW	366	155	117	195
7MW	314	172	127	213
12MW	183	220	156	266
15MW	146	250	175	300

4.12 The average spacing of the turbines in the final layout for RWF could range between 7 and 10 rotor diameters (about 800m and 2,500m). The spacing between turbines within the array may also vary with direction because of factors such as wind climate, micro-siting and navigational safety requirements which may result in the turbines being spaced closer or further apart than the average range provided above. The layout of turbines across the Site is yet to be confirmed and, depending on the outcome of wind resource studies and wake modelling, could be a regular grid, a radial array or an irregular arrangement of turbines. Figures 4.3 and 4.4 show potential layouts for 5MW and 15MW turbines, as an indication of what could be proposed. There are spaces within the array which may be used for offshore substations and that take account of existing infrastructure within the Site.

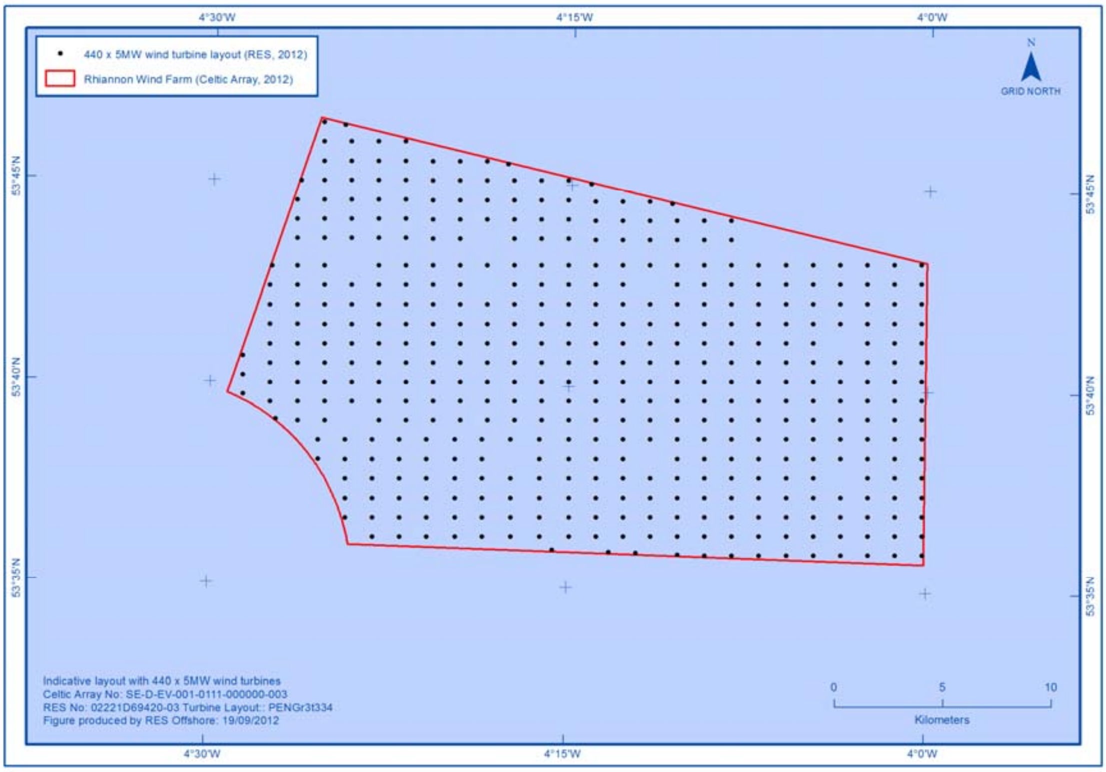


Figure 4.3 Indicative turbine layout with 440 x 5MW wind turbines

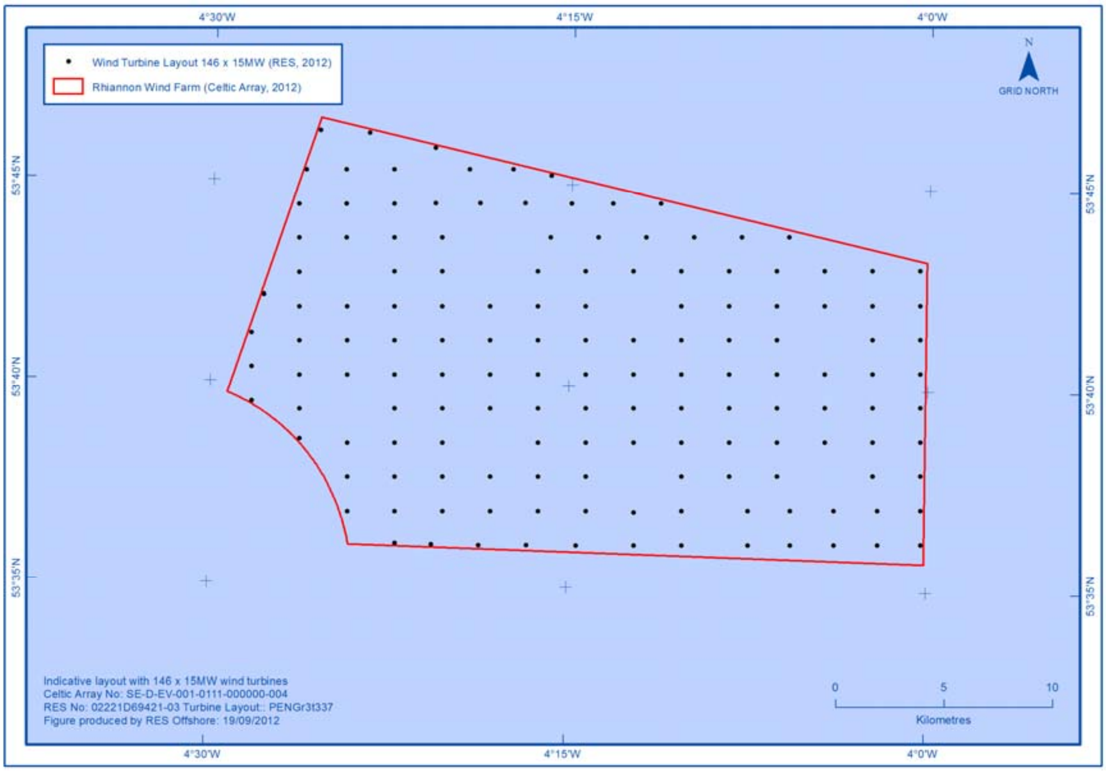


Figure 4.4 Indicative turbine layout with 146 x 15MW wind turbines

4.13 It should be noted that the exact wind turbine specifications for RWF have yet to be determined. The chosen wind turbines are likely to be of proven technology, likely to incorporate tapered tubular or steel lattice towers and two or three blades attached to a nacelle which will contain equipment such as the generator, gearbox and other operating equipment.

4.14 In summary, RWF would have an installed capacity of up to 2.2GW. A range of turbine models could be used for the project.

4.15 Table 4.2 below summarises design principles for the offshore elements of the project.

Table 4.2 Summary of offshore design principles

Design principle	Reason
Flexibility in turbine size	Ensure that the most suitable technology is deployed at time of construction to provide lowest cost of energy
Flexibility in turbine layout design	Facilitate flexibility of turbine selection and to enable appropriate siting of turbines to allow for foundation costs and energy production to provide lowest cost of energy
Regular turbine layout where geotechnical conditions and other constraints allow	To aid navigation through the Site
Straight boundary edges in turbine layout where geotechnical conditions and other constraints allow	To aid navigation through and around the Site
Minimum blade tip clearance of 22m above mean high water springs (MHWS)	To conform to industry guidance to avoid conflict with sailing vessels
Turbines not located too close to existing cables	To mitigate potential conflict with cable owners and operators
Turbines not located within 5 nautical miles (nm) of the entrance to a Traffic Separation Scheme	To increase the safety of vessels using the Traffic Separation Scheme
Turbines not located within 1nm of ships passing between two Traffic Separation Schemes	To increase the safety of vessel traffic

Foundation options

4.16 Water depths within the Site range from approximately 36m LAT in the east to 83m LAT in the west, with a tidal range of between about 6m and 8.5m. The mean water depth across the Site is about 46m LAT.

4.17 Piled steel jacket structures, gravity base foundations may suit these conditions but alternative foundation options, such as but not limited to a ‘hybrid’ concept, monopile foundations or suction caisson foundations, may be specified and assessed in the ES. The final engineering solution will be determined following the completion of the detailed geotechnical campaign and in response to environmental constraints identified during the consultation and EIA process. It is possible that more than one type of foundation may be used across the Site. Figure 4.5 outlines some of the potential foundation options.

4.18 It may be possible to deploy monopiles in the shallower parts of the Site, although it is considered unlikely that simple monopile foundation concept would be technically viable across the whole area. In addition, monopiles are unlikely to be feasible for larger MW capacity turbines. Variants of the monopile, for example braced or guyed monopiles, could extend the range of conditions for which such foundations could be utilised. Further studies shall confirm the spatial extent of the area within the Site over which monopile foundations may be deployed.

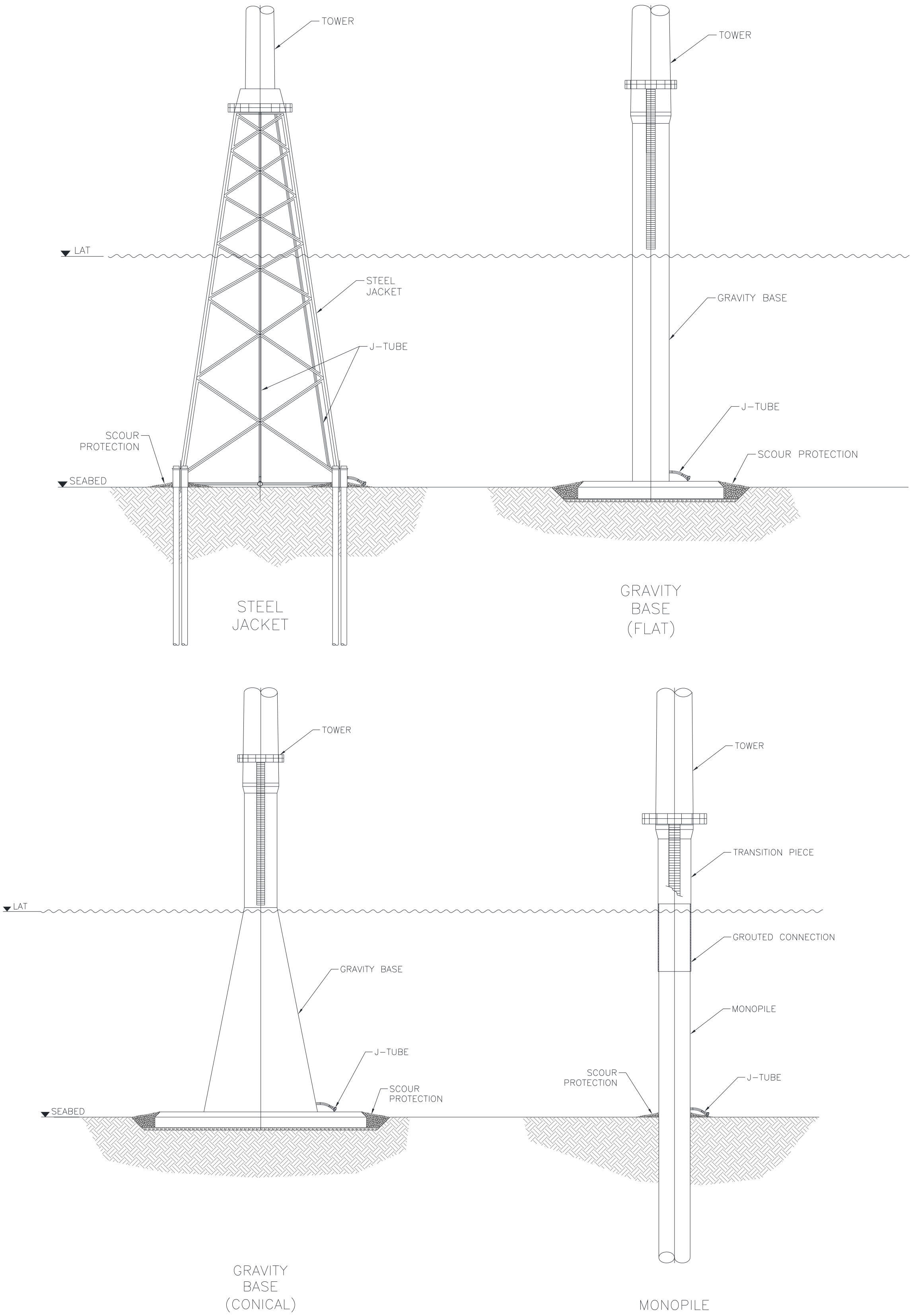


Figure 4.5 Indicative foundation options (Celtic Array 2012. Drawing No: 02221 D2210-03)

Monopile

4.19 Monopile foundations consist of a steel tubular foundation that is piled or drilled into the seabed and have been deployed extensively within UK Round 1 and Round 2 projects to date. The tubular diameter may be up to, or potentially greater than, 10m in diameter. Variants on a simple monopile design will also be considered.

4.20 Generally, there is little or no requirement for seabed preparation. Installation of the monopile involves the transportation of the prefabricated foundation to the Site for positioning on the seabed, before being piled or drilled into position. A 'transition piece' is then lifted and grouted or fixed by other means onto the installed monopile and then the tower and wind turbine generator can be installed onto the transition piece.

Jacket

4.21 Steel jacket structures typically consist of three or four main legs, supported by cross-bracing. Indicative dimensions for large multi-pile foundations include main tubular diameters of up to, or potentially greater than, 3m and a width of base at seabed of about 40m, depending on water depth and ground conditions.

4.22 Generally, there is little or no requirement for seabed preparation. Installation of the steel jacket involves the transportation of the prefabricated foundation to the Site for positioning on the seabed. Each of the main legs is usually secured by pin piles (typically one pile per leg, but two or more piles per leg shall be considered). The piles would be up to approximately 3m in diameter, depending on water depth and seabed conditions at the Site. The pin piles would be driven or drilled into the seabed and grouted or swaged into a sleeve, but this can also be achieved using other techniques, such as suction caissons as described below.

Gravity base

4.23 Gravity base foundations typically consist of heavy steel, concrete or a combination of concrete and steel, sometimes including additional ballast materials which sit on the seabed. The structure is constructed such that it protrudes well above the sea level to support the turbine tower. Gravity bases vary in shape and include conical, as well as cylindrical, hexagonal or cruciform sections, with indicative base diameters of approximately 50m, depending on water depths and ground conditions.

4.24 In most cases, the gravity base structure is placed on a pre-prepared area of seabed. Seabed preparation may involve dredging (to remove soft material) and/or backfilling with material such as rock, hardcore and/or gravel to provide a firm and flat surface. Dredged material may be disposed of on-site, or off-site at a licensed disposal area. Any seabed preparation and/or dredge disposal would be subject to assessment and licensing, as appropriate.

Hybrid (jacket and gravity base)

4.25 A hybrid structure would consist of a flat base, typically constructed of heavy steel, concrete, or a combination of concrete and steel, sometimes including additional ballast materials which sit on the seabed. A steel jacket structure would be attached to the base and protrude well above the sea level to support the turbine tower.

4.26 In most cases, the base is placed on a pre-prepared area of seabed. Seabed preparation may involve dredging (to remove soft material) and/or backfilling to provide a flat surface. Dredged material may be disposed of on-site, or off-site at a licensed disposal area. Any seabed preparation and/or dredge disposal would be subject to assessment and licensing, as appropriate. Installation of the steel jacket involves the transportation of the prefabricated foundation to the Site for positioning and securing to the base. The steel jacket structure would be lifted into position using a heavy-lift vessel and secured to base structure by grouting or swaging.

Suction caisson

4.27 The suction caisson is comparable to an upturned bucket lowered to penetrate into a pre-prepared (levelled) seabed. For larger turbine classes, the use of suction caisson foundations may form part of a jacket structure and may be considered in conjunction with the options above. The use of such structures is highly dependent on the seabed conditions at the Site.

Scour protection

4.28 Scour protection may be required around offshore structures and marine cables. The options available depend on the final foundation or structural design, ground conditions, scour assessments and environmental assessment. Typical options include:

- Protective aprons;
- Mattresses;
- Flow energy dissipation devices (such as frond mattresses); and
- Rock placement.

Electrical transmission technology

4.29 It has not yet been determined whether the electricity will be transmitted via High Voltage Alternating Current (HVAC) or High Voltage Direct Current (HVDC). Both connection technologies are under consideration, but the eventual transmission technology will be decided on the basis of economics and other technical factors. A decision on the electrical system is expected in the summer of 2013.

Intra-array cables

4.30 The wind turbines will be connected to multiple offshore substations, potentially with a minimum capacity of 250MW, via a network of intra-array cables. The total length of this network will depend on the chosen capacity of the wind turbines, their location and the outcomes of an intra-array cable optimisation study, based on minimisation of costs and transmission losses. It is common practice to use sea-armoured, three-core copper cables for this installation. Where feasible the cables are likely to be buried under the seabed either by ploughing, jetting or trenching.

Offshore substations

4.31 Offshore substations will be installed within the wind farm and will collect the electricity generated by the wind turbines via the intra-array cables transmitting power to shore via the export cables. The offshore substations will be steel-framed structures housing electrical equipment. The topside structures will be manufactured onshore and then installed offshore on to pre-installed foundations, which are likely to be jacket-type structures (see Figure 9). The total height of the substations is likely to be up to 45m above Lowest Astronomical Tide (LAT). The substations will be within the boundaries of the Site and are expected to be marked for navigational purposes in a similar way to the wind turbines.

Offshore HVDC converter stations

4.32 Depending on the grid connection technology selected, one or more offshore HVDC converter stations may be required. These will be of a similar size to the offshore substations described above and will be housed in a similar manner.

Export cables

4.33 Between 4 and 16 subsea export cables will transfer energy from the offshore substation platform(s) to the onshore substation(s). Like intra-array cables, the export cables will be buried under the seabed, where feasible.

4.34 The offshore export cable routes will fall within a wide corridor (as shown in Figure 4.1) in which the cables may be located. The cable corridor will be refined once the environmental and technical surveys are completed and a grid connection agreed. It is likely that consent will be requested for a smaller cable corridor than that shown in Figure 4.1 above. It is likely that consent will be requested for a cable corridor rather than a single route to allow for minor route realignments.

Other offshore infrastructure

4.35 An operations and maintenance platform potentially including accommodation platforms may be included within the turbine array. This could be temporary or permanent and either attached to the sea-bed or a fixed floating structure.

Typical offshore construction activities

4.36 Potential construction activities for RWF will fall into the following generalised categories (note that some of these activities will happen in parallel):

- Seabed preparation;
- Transport of foundations to the Site;
- Foundation installation by installation vessel;
- Installation of tower, nacelle, hub and blades of the wind turbine generators;
- Transport of offshore substation module(s), as well as O&M structures, to Site and installed from an installation vessel or by self installation techniques;
- Installation of subsea intra-array cables;
- Installation of export cable(s);
- Testing and commissioning of systems; and
- Demobilisation of vessels and personnel.

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

- Pile driving, drilling or grouting into the seabed;
- Grouted connections (e.g. connecting piles to jacket);
- Sea bed levelling (for gravity base structures); and
- Ballasting (for gravity base structures).

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

4.39 Prior to or aligned with the turbine installation process, the onshore works, offshore substation and sub-sea cables will be installed. This will be followed by the connection of the cables to all the turbines and performing electrical commissioning to ensure RWF is ready to generate.

4.40 The environmental management of construction activities will be carried out under the provisions of an environmental management plan (EMP) which will be agreed with key stakeholders before construction begins. The provisions of an EMP usually include issues such as fuel and chemical handling, pollution prevention and control and storage of waste and effluent.

Typical offshore operational activities

4.41 Once operational, RWF will require regular inspections, servicing and maintenance throughout its lifetime. This may require a dedicated team of technicians and support staff. Given the distance of the project from shore, it is assumed that one or more offshore operations hubs will also be required. The offshore hub may be either a fixed platform at the Site or a vessel which steams between port and the project.

4.42 Operations and maintenance activities will be defined within the Engineering Envelope and addressed in the relevant technical sections of the ES.

Indicative programme

4.43 The offshore construction of RWF is likely to begin in 2017 and will contribute to the UK Government's 2020 targets. To enable this programme to be met, pre-application stages are anticipated through 2012 and 2013 with an aim to submit relevant consent applications at the end of 2013. Approximate dates are provided in Figure 2.1.

Repowering/decommissioning

4.44 The Crown Estate Lease(s) for RWF, which will be signed if RWF has achieved consent, is anticipated to last for fifty years. The design life of the turbines and other components of the project are likely to be twenty to twenty-five years and therefore it is possible that re-powering (the replacement of turbines and, potentially, foundations) may occur. The relevant consents or licences required to re-power the Site would be applied for at that time.

4.45 It is a condition of The Crown Estate Leases that projects are decommissioned at the end of the lease period. In addition, the Energy Act (2004) requires Celtic Array to provide a decommissioning plan, supported by appropriate financial security, prior to constructing RWF. Decommissioning activities will need to comply with all relevant UK legislation at the time.

Onshore infrastructure

Onshore site selection and search area

4.46 Celtic Array is currently carrying out detailed cable landfall, onshore substation/converter station site and onshore cable route identification and appraisal studies.

4.47 At present, possible landfall sites between Wylfa and Red Wharf Bay are being investigated. Possible corridors for underground cables between potential onshore substation/converter station and cable landfall sites are also being identified.

4.48 Although it cannot be confirmed until detailed surveys and studies of the ground conditions have been completed, Celtic Array will aim to keep all cables between the cable landfall and new onshore substation underground wherever possible.

4.49 Celtic Array's philosophy for identifying and appraising possible onshore substation sites is as follows:

- Follow industry good practice guidance, including National Grid Horlock 'rules', which establish a set of seven key criteria to assist those responsible for the siting and design of new substations, or substation extensions, in order to mitigate the environmental effects of such developments;
- Where possible, avoid and keep reasonable distance from National Parks, Areas of Outstanding Natural Beauty (AONB), Heritage Coasts, World Heritage Sites, Ramsar Sites, Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Protection Areas (SPA) and Special Areas of Conservation SAC);
- Aim to avoid areas at risk of flooding;
- Aim to avoid Ancient Monuments, Listed Buildings, ancient woodlands, ancient hedgerows, important habitats, local level designations;
- Aim to avoid re-routing of Public Rights of Way;
- Utilise existing screening opportunities;
- Consider topography;
- Utilise existing man-made features in landscape (for example electricity pylons, wind turbines, industrial sites), if appropriate;
- Aim to utilise sites in proximity to existing access;
- Consider any proposals within local development plans which may restrict development; and
- Consider constraints (environmental & technical) to incoming cables from landfall and outgoing circuits to the National Grid interface point (Wylfa or the existing Wylfa to Pentir overhead line).

4.50 Celtic Array's philosophy for onshore cable routing is to aim to:

- Reduce cable route length to minimise cost and related environmental impacts;
- Avoid protected landscapes and habitats and sites of historic importance;
- Minimise road, river and railway crossings;
- Keep a reasonable distance from residential properties; and
- Avoid difficult ground conditions such as rocky areas which would make cable trenching difficult.

4.51 Over the coming months, Celtic Array will continue to identify and appraise possible locations on Anglesey for the onshore works for the RWF Project. As part of this process the Isle of Anglesey County Council and other stakeholders, including the public will be consulted. The onshore works will need to be subject to their own full Environmental Impact Assessment. The onshore Scoping Report will be submitted to the Isle of Anglesey County Council in spring 2013, with a request for a Scoping Opinion. The onshore Scoping Report will contain more information on the possible options being considered for the onshore works. The onshore Scoping Report will be the subject of informal consultation.

Typical onshore construction activities

4.52 Potential onshore construction activities will fall into the following generalised categories for landfall and substation activities (note that some activities may occur in parallel):

Cable landfall

- HDD at the landfall;
- Opening of the trench;
- Preparation of cable pulling;
- Laying of the pipes for fibre cable;
- Laying of selected land fill;
- Possible laying of ducts for later installation of cables;
- Backfilling and compaction of soil; and
- Reinstatement, where necessary.

Substation

- Erect site fencing;
- Clearing, levelling and landscaping the site;
- Installation of foundations;
- Construction of building(s);
- Installation of sub/converter station equipment; and
- Reinstatement, where necessary.

Health and safety

4.53 Development, construction, operation, re-powering and decommissioning of the Project will be undertaken within the framework of CREL's health and safety policies and in accordance with the requirements of the Health and Safety at Work etc. Act (1974) and subordinate legislation. Health, safety and environmental risks will be identified and arrangements implemented throughout the project's lifecycle to ensure that all potential health, safety and environmental issues are managed, as required by legislation and in accordance with the principle of ALARP (as low as reasonably practicable).

5 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

General approach

5.1 An ES will be prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended) and, in particular, the requirements of Schedule 4, parts 1 and 2 of the EIA Regulations.

5.2 The development teams at Celtic Array have gained substantial experience of EIA from previous projects as described in Chapter 1 of this Stage 1 PEI Report. Celtic Array will continue to apply best practice in EIA and will, in particular, take into account the following guidance:

- The Planning Inspectorate guidance on the EIA process associated with the Planning Act 2008 including:
  - *Advice note three: Consultation and notification undertaken by the Planning Inspectorate explaining the approach to identifying parties to be consulted on the scope of the environmental statement under regulation 8 of the EIA Regulations;*
  - *Advice note six: Preparation and submission of application documents*;
  - *Advice note nine: Rochdale Envelope*;
  - *Advice note ten: Habitat Regulations Assessment*; and
  - *Advice note twelve: Development with significant transboundary impacts consultation.*
- Centre of Environment, Fisheries and Aquaculture Science (Cefas) guidance note for EIA in respect of FEPA and CPA requirements (2005);
- Nature conservation guidance on offshore wind farm development (Defra 2005); and
- Guidance on the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (BERR 2000).

5.3 Additional topic specific, technical guidance will also be followed where applicable following consultation with statutory bodies, for example Civil Aviation Authority (CAA) guidance, Maritime and Coastguard Agency (MCA) and DECC guidelines for the assessment of shipping traffic and Joint Nature Conservation Committee (JNCC) guidance on European Protected Species (EPS) licensing.

5.4 As discussed below, EIA will also be carried out to inform HRA including Appropriate Assessment, if required, under The Conservation of Habitats and Species Regulations 2010 and/or The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010.

Alternatives

5.5 The Infrastructure Planning (Environmental Impact Assessment) Regulations require for inclusion in an ES:

> *"An outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for his choice, taking into account environmental effects"*

5.6 The Strategic Environmental Assessment (SEA) undertaken by the Department of Energy and Climate Change (2009) assessed a plan for an additional 25GW of offshore wind development within UK waters less than 60m deep. The SEA referenced the indicative Round 3 Development Zones which were then under development by The Crown Estate; these zones were designed through a process of constraint and opportunity mapping at national level to determine the location of the most appropriate sites for offshore wind farm development (The Crown Estate 2012).

5.7 The Round 3 zones were designed to be large enough to give developers flexibility in the location of wind farms within these zones. As detailed in Chapter 3 of this Report, the ZAP process aided the strategic decision to choose the South East Potential Development Area to host RWF. The ZAP process considered alternatives within the ISZ; The Crown Estate granted Celtic Array the exclusive right to identify and develop offshore wind projects within the ISZ.

5.8 It will not be the purpose of the alternatives section to justify Celtic Array's decision to bring forward RWF because the conditions which have led Celtic Array to do so have been established by the UK Government, in the Overarching NPS for Energy (EN-1) (See Paragraph 2.10).

Engineering envelope

5.9 As noted in the footnote to paragraph 4.2, it is not possible to define the precise configuration and content of an offshore wind farm at the time that an application for consent is made. For example, full foundation designs or turbine types for RWF may not be available until after the project is consented, new products may enter the market or there may be legal requirements for competitive tendering for key components.

5.10 Notwithstanding this uncertainty, the EIA Regulations require a project's potential impact to be assessed. Within the EIA, this requirement can be addressed by adopting an Engineering Envelope approach, as discussed in paragraph 4.2. The Engineering Envelope (also known as Rochdale Envelope) approach has been adopted in most environmental assessments of Round 2 offshore wind farms and other major infrastructure projects. Where multiple options exist for any element of the Project, the Engineering Envelope provides a 'realistic worst case scenario' for the EIA process to consider. An Engineering Envelope approach will be applied to the RWF Project in respect of a number of the works described in the project's ES, including turbine selection, an indicative export cable corridor and turbine foundation design.

5.11 The Planning Inspectorate's 'Advice note 9: Rochdale Envelope' will be taken into account in respect of the drafting of the ES and the Engineering Envelope will be clearly defined in each relevant chapter to ensure that specialist and non-specialist readers are able to understand the parameters under assessment. Those parameters will also be clearly captured in the draft DCO accompanying the application for consent, so as to ensure the scope of the EIA matches the scope of the draft DCO and Marine Licence.

Assessing significance

5.12 Impact assessments can be complex, requiring a variety of different approaches to handle data limitations, spatial and temporal scales and differences associated with receptor sensitivities. For this reason, a number of analytical methods will be used in the ES to support decisions made on the assessment. In particular, in the application to determine and quantify 'magnitude of effect' and 'sensitivity of receptor'. These will include professional judgement, consultation, matrices, historical analysis, GIS spatial analysis, modelling, field data and observations. In any case, clear, unambiguous measures of significance for each technical chapter will be developed in consultation with the relevant statutory agencies. Such criteria for significance will be clearly 'signposted' at the start of each relevant chapter in the ES.

5.13 In general, the sensitivity and magnitude of potential impacts of RWF will be determined to establish significance. For the EIA, it is normal practice to state what the threshold of significance is, such as 'no impact/negligible', 'minor', 'moderate' and 'major', which are defined by how acceptable the impact is judged to be. Table 5.1 below sets out a matrix to determine impact significance.

Table 5.1 Matrix to determine impact significance

		Degree of change (magnitude)			
		Very low	Low	Medium	High
Degree of vulnerability to change (sensitivity)	High	Minor significance	Moderate significance	Major significance	Major significance
	Medium	Not significant	Minor significance	Moderate significance	Major significance
	Low	Not significant	Not significant	Minor significance	Moderate significance

Mitigation measures

5.14 Mitigation is defined in the EIA Directive as "measures envisaged in order to avoid, reduce and, if possible remedy significant adverse effects" (EC 85/337 1985). The offshore wind industry has developed, in conjunction with regulators, advisors and stakeholders, a range of potential mitigation measures to avoid, reduce or offset the potential impacts associated with the construction and operation of offshore wind farms. Mitigation measures for which there is a firm commitment and which can be delivered, will be identified within each chapter in the ES. The mitigation measures proposed will be cross-referred to any relevant provisions of the DCO that are dependent on those measures.

5.15 In keeping with good environmental practice, outline environmental management plans will be discussed in the ES. However, in keeping with the Engineering Envelope approach, full details may not be available for inclusion in the ES.

5.16 Celtic Array will propose appropriate mitigation measures to address any significant adverse effects identified through the Environmental Impact Assessment process and in consultation with the regulators, advisors and stakeholders, as appropriate.

Inter-relationships

5.17 Celtic Array acknowledges that an ES cannot be regarded as a collection of unrelated topic chapters. The inter-relationships between relevant receptors will be considered in the ES where potential pathways exist between topic areas. The key inter-relationships during the construction and operation of RWF that will be considered in the ES are summarised in Table 5.2 below. Going forward into the EIA, further inter-relationships will be identified and clearly stated in each chapter of the ES.

5.18 Where indicated by yellow or red shading, the chapters listed in the top row of the Table 5.2 below will draw upon information and impact assessment conclusions provided in the chapters listed in the first column. Red shading indicates the requirement for significant cross referencing because of the nature of the relationships and dependencies between the receptors in question, with the yellow shading indicating that only limited cross-referencing will be required. These cross referencing requirements are discussed in greater detail in each of the chapters below.

Table 5.2 Inter-relationships to be considered in the Environmental Statement

	Physical processes	Benthic ecology	Fish ecology	Ornithology	Marine mammals, basking sharks and turtles	Nature Conservation	Commercial Fisheries	Shipping and navigation	Aviation	Other marine users	Marine archaeology and cultural heritage	Landscape, seascape and visual impacts	Socio-economics
Physical processes													
Benthic ecology													
Fish Ecology													
Ornithology													
Marine mammals													

	Physical processes	Benthic ecology	Fish ecology	Ornithology	Marine mammals, basking sharks and turtles	Nature Conservation	Commercial Fisheries	Shipping and navigation	Aviation	Other marine users	Marine archaeology and cultural heritage	Landscape, seascape and visual impacts	Socio-economics
Nature conservation													
Commercial fisheries													
Shipping and navigation													
Aviation													
Other marine users													
Marine archaeology and cultural heritage													
Landscape, seascape and visual impacts													
Socioeconomics													

Significant cross-referencing required   Limited cross-referencing required

Cumulative impact

5.19 The potential for cumulative impacts will be assessed during the EIA process. The EIA will consider the effects of the construction, operation and decommissioning of RWF cumulatively with other offshore wind farm projects as well as with other non-wind farm related activities and onshore projects. Consideration will be given to existing or reasonably foreseeable future developments.

5.20 The ES will use the term 'cumulative effects' to describe effects of RWF that have the potential to overlap with similar effects arising from any existing, planned and reasonably foreseeable plan or project (other wind farms or non-related human activity). Within the ES such cumulative effects may either arise solely from within

RWF (effects occurring between different elements of the project) or externally (effects arising from the project and another plan or project).

5.21 The term 'in combination effect' will be used solely to describe the effects of RWF in the context of a Habitats Regulation Assessment (HRA) (i.e. the effects of the project, in combination with any other plans or projects, on European sites).

5.22 The identities of relevant projects to be taken into consideration as part of the cumulative impact assessment (CIA) process will vary from receptor to receptor and will be considered within each of the relevant chapters of the ES. The projects in Table 5.3 below are indicative of the type of projects that will be included within the scope of the cumulative impact assessment for at least one receptor. Celtic Array will continue to consult with local planning authorities and other stakeholders to discuss other major developments which should be considered in the EIA.

Table 5.3 Other projects to be considered as part of cumulative impact assessment

Project	Type of development and status	Primary receptors
Onshore infrastructure	Substation and onshore cable connection	Land/seascape and visual, intertidal ecology
Wylfa Nuclear Power Station	New nuclear power station. Decommissioning of existing plant	Intertidal ecology, socio-economics, land/seascape, visual, physical environment, shipping and navigation (marine elements only), seascape
Onshore wind farms	Twenty-eight undetermined planning applications for onshore wind turbines on Anglesey	Land/seascape and visual
Other foreseeable ISZ projects	Other offshore wind farm projects in the ISZ, in planning (i.e. those for which a Scoping Opinion has been requested at the time of EIA submission)	Physical environment, birds, marine mammals, shipping and navigation, commercial fisheries, benthic environment, fish and shellfish ecology
Walney Extension	Offshore wind farm, in planning	Physical environment, birds, marine mammals, shipping and navigation, commercial fisheries, benthic environment, fish and shellfish ecology
Walney I	Offshore wind farm, operational	Physical environment, birds, shipping and navigation, commercial fisheries
Walney II	Offshore wind farm, operational	Physical environment, birds, shipping and navigation, commercial fisheries
West of Duddon Sands	Offshore wind farm, consented	Physical environment, birds, shipping and navigation, commercial fisheries
Ormonde	Offshore wind farm, constructed	Birds

Project	Type of development and status	Primary receptors
Barrow	Offshore wind farm, operational	Birds
Burbo Bank	Offshore wind farm, operational	Birds
Burbo Bank Extension	Offshore wind farm, in planning	Birds, marine mammals
North Hoyle	Offshore wind farm, operational	Birds
Gwynt y Môr	Offshore wind farm, in construction	Birds
Rhyl Flats	Offshore wind farm, operational	Birds
Atlantic Array	Offshore wind farm, Round 3 development, in planning	Manx Shearwater only
Robin Rigg	Scottish offshore wind farm, operational	Birds
Oriel Wind Farm	Irish offshore wind farm, in planning	Birds, marine mammals
Dublin Array	Irish offshore wind farm, in planning	Birds, marine mammals
Codling Bank	Irish offshore wind farm, consented	Birds, marine mammals
Codling Wind Park extension	Irish offshore wind farm, in planning	Birds, marine mammals
Arklow Bank	Irish offshore wind farm, operational	Birds
Seagen Skerries Tidal Array	Tidal energy scheme, in planning	Marine mammals, shipping, commercial fisheries, seascape, socio-economics
Licence Area 331	Aggregate / sand extraction	Physical environment, benthic ecology
Licence Area 457	Aggregate / sand extraction	Physical environment, benthic ecology
Licence Area 392	Aggregate / sand extraction	Physical environment, benthic ecology
Licence Area 393	Aggregate / sand extraction	Physical environment, benthic ecology
Conwy Bay (IS055)	Dredge disposal sites	Physical environment, benthic ecology
Holyhead Deep (IS040)	Dredge disposal sites	Physical environment, benthic ecology
Site Y (IS150)	Dredge disposal sites	Physical environment, benthic ecology
Barrow D (IS205)	Dredge disposal sites	Physical environment, benthic ecology

Project	Type of development and status	Primary receptors
Hilbre Swash dredging area	Licensed area for disposal of dredging of Mersey	Physical environment
SIRIUS South	Blackpool-Dublin telecoms cable, operational	Commercial fisheries
EirGrid East West Interconnector	Electricity interconnector – Co. Dublin to North Wales, under construction	Commercial fisheries
Port Meridian	Offshore Liquefied Natural Gas port facility	Shipping and navigation, commercial fisheries
Gateway gas storage	Offshore gas storage in salt caverns	Shipping and navigation, commercial fisheries
Douglas field	Oil and gas field with platforms and associated pipelines	Shipping and navigation, aviation, commercial fisheries
Hamilton	Oil field with platform and associated pipelines	Shipping and navigation, aviation, commercial fisheries
Hamilton North	Gas field with platform and associated pipelines	Shipping and navigation, aviation, commercial fisheries
Lennox	Gas field with platform and associated pipelines	Shipping and navigation, aviation, commercial fisheries
North Morecambe	Gas field with platform and associated pipelines	Shipping and navigation, aviation, commercial fisheries
South Morecambe	Gas field with platforms and associated pipelines	Shipping and navigation, aviation, commercial fisheries
Bains	Gas field, no platform, pipeline	Commercial fisheries
Millom	Gas field with platform and associated pipelines	Shipping and navigation, aviation, commercial fisheries
Dalton	Gas field, no platform, pipeline	Commercial fisheries
Calder	Gas field with platform and associated pipelines	Shipping and navigation, aviation
Darwen, Crossens, Asland	Consented gas field, not developed. No surface infrastructure, tied back to Calder	Commercial fisheries

5.23 Previous IPC advice identified the requirement to consider projects "*identified in the relevant development plan*" and "*identified in other plans and programmes*" as being "*reasonably foreseeable*". At present it is considered that there is no other project likely to fall within this definition although a competitive tender for a future wind farm in the Northern Irish territorial seas is underway. Celtic Array will continue to monitor developments in this respect.

Transboundary effects

5.24 The Planning Inspectorate 'Advice note 12: Development with significant transboundary impacts consultation' describes issues for developers to take into account in respect of consultation on potential transboundary effects.

5.25 While most potential environmental effects arising from RWF are unlikely to cross international boundaries (i.e. outside UK waters), the ZAP process identified the potential for effects to occur on receptors within areas administered by the Republic of Ireland (RoI), the Isle of Man (IoM) and possibly with Belgium (as well as some effects in other parts of the UK). The ZAP process concluded that potential transboundary impacts are expected to include those associated with the following receptors:

Table 5.4 Potential transboundary effects

Receptor	UK	IoM	RoI	Belgium
Birds (primarily Manx Shearwater)	✔	✔	✔	
Marine Mammals (primarily seal species)	✔	✔	✔	
European sites	✔	✔	✔	
Shipping	✔	✔	✔	
Civil aviation	✔	✔	✔	
Commercial fisheries	✔	✔	✔	✔

5.26 It has been noted from the Scoping Opinion that the Secretary of State requires at an appropriately early stage any additional available information about potential significant transboundary effects on European state(s) (including the Isle of Man). In addition the Scoping Opinion also stated that transboundary impacts on migratory species should also be considered. Analysis of transboundary effects during ZAP has not identified additional concerns and therefore it is not proposed that other transboundary issues will be addressed in the ES. As discussed in the ZAP Report, impacts on physical processes, fish ecology, benthic ecology and marine archaeology are unlikely to occur outside of the ISZ boundary and, in many cases, will only occur within the Site boundary.

5.27 In addition, the ES will consider potential impacts on relevant receptors in those parts of the UK (Scotland and Northern Ireland) not subject to the Planning Act (2008) and the Planning Inspectorate processes. The ES will consider potential impacts on relevant receptors on the Isle of Man and in the waters surrounding the Crown Dependency.

5.28 Celtic Array will continue to consult with relevant stakeholders in the Republic of Ireland, the Isle of Man and (as a matter of protocol) Belgium, although potential transboundary effects are anticipated to be limited to Belgian commercial fishing interests.

Export cable corridor

5.29 As discussed in Chapter 3 of this Stage 1 PEI Report, Celtic Array is in discussion with National Grid about potential connection points to the UK electricity transmission system on the UK mainland. The connection is likely to be on Anglesey although the exact location is yet to be determined. It has not yet been possible to characterise the environment of the cable route corridor. Additional surveys along the cable route will be required and, where relevant, these are discussed in the relevant technical chapter below.

5.30 Additionally, surveys and studies will be required to inform the EIA of the landfall locations up to MHWS including the intertidal environment. These surveys will include consideration of beach topography, sensitive intertidal habitats, sites designated for nature conservation and temporary construction impacts on local amenity. Once greater certainty is reached on the onshore substation site and potential export landfall sites, intertidal surveys will be commissioned. The scope and methodologies for this EIA work will be agreed in consultation with key stakeholders.

5.31 Consultation with key stakeholders to determine the scope of the EIA in respect of the export cable corridor will be required once the grid connection has been progressed further.

Description of potential environmental impacts

5.32 The following chapters of this Stage 1 PEI Report describe the potential environmental effects in respect of:

- The physical environment (Chapter 6);
- The biological environment (Chapter 7); and
- The human environment (Chapter 8).

5.33 In these Chapters, the following structure has been adopted:

- Studies and surveys carried out to date;
- Description of the offshore environment relevant to that topic;
- Overview of potential impacts which might arise should RWF be developed; and
- Proposed surveys and studies.

5.34 Potentially significant impacts are described within each of the chapters. As suggested by the Institute of Ecology and Environmental Management (IEEM) guidelines (IEEM 2009), it is based on consideration of relevant literature, the findings based on two years of surveys and assessment (the ZAP Report) and specialist consultants' understanding of the environmental conditions likely to be encountered at the Site.

5.35 As discussed above, consultation with key stakeholders to determine the scope of the EIA in respect of the export cable corridor will be required once the onshore site selection has been progressed further. For this reason, consideration of issues associated with the export cable and landfall in this report is limited. In particular there is no dedicated chapter dealing with intertidal ecology, though it is intended that this topic will be consulted on with stakeholders and addressed in a dedicated chapter of the ES.

6 PHYSICAL PROCESSES

Introduction

6.1 This chapter briefly characterises the physical environment in and around the Site, describes the potential impacts of wind farm development on that environment and outlines the issues that will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees (e.g. Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the Countryside Council for Wales (CCW)), which will inform the EIA as well as the Scoping Opinion received from the Planning Inspectorate on 17th August 2012.

6.2 The physical environment is defined as the hydrodynamic and sedimentary regimes that operate within the Site and the broader area. Not only are these important receptors in their own right, they also affect the distribution and behaviour of other potential receptors such as birds and commercial fisheries.

6.3 Offshore wind farm development has the potential to affect the hydrodynamic and sedimentary regime in a number of ways. These effects may be temporary, such as those potentially occurring during the construction phase, or longer-term, such as a response to the presence of foundations.

Surveys and studies carried out to date

6.4 The ZAP Report (see Chapter 3 of this Stage 1 PEI Report) included a full zonal characterisation of the physical processes and developed a regional physical processes model. This work, which has informed the contents of this chapter, included characterisation of the hydrodynamic, morphological and sedimentary regimes as well as frontal behaviour in the Irish Sea (Celtic Array 2012). The ZAP Report drew upon the survey data collected by Celtic Array as part of zone-wide surveys listed in Table 6.1 below.

Table 6.1 ZAP Report physical process surveys

Survey/study	Date of survey	Description
Geophysical surveys	February to June 2010	High-resolution multibeam bathymetric data (100% coverage of ISZ)
		High-resolution sidescan sonar data (100% coverage of ISZ) used to characterise seabed morphology
		Seismic data utilising Chirp and Sparkler systems to identify shallow geology
Benthic survey	August to September 2010	Baseline information on the benthic communities in and adjacent to the proposed wind farm application Site has been collected. 109 grab samples are available from the ISZ, which have been used for particle size analysis, providing a good indication of the surficial sediment distribution across the ISZ

Survey/study	Date of survey	Description
Metocean surveys	October 2010 to October 2011	A twelve month survey campaign comprising twelve deployment locations across the ISZ. Dataset includes current speed, water levels, wave heights/directions, surface temperature, salinity and turbidity
Prince Madog surface water sampling (during boat-based bird and mammal surveys)	July 2010 to September 2010	Surface water samples collected during three months of the 24 month bird and mammal survey campaign have been used to derive surface temperature and surface salinity distributions. A larger surface water dataset (i.e. >three months) will be available for EIA

Stakeholder consultation

6.5 As part of the ZAP process consultation took place with Joint Nature Conservation Committee (JNCC), Marine Management Organisation (MMO), Marine Consents Unit of the Welsh Government (MCU), Cefas, CCW and Natural England (NE). Consultation focussed on agreeing the scope of ZAP surveys and studies and presentation of the results of the zonal assessment. Following feedback on the ZAP Report a further stakeholder meeting was held on 27th July 2012 to discuss some of the key conclusions and findings of the zonal assessment. The purpose of the July meeting was to clarify some of the reasoning behind the conclusions of the physical processes assessment – particularly in relation to the calibration and validation of the regional wave and hydrodynamic model and sediment transport assumptions. In addition, relevant stakeholders were consulted on the scope of the RWF EIA by the Planning Inspectorate. Conclusions of the July 2012 meeting and the Scoping Opinion are discussed further below.

Description of current environment

6.6 This section briefly describes the current physical environment in the vicinity of the Site and draws upon the zone-level assessment carried out in the ZAP Report.

Bathymetry and morphology

6.7 The Site has been surveyed as part of a zone-wide geophysical investigation. To facilitate survey logistics and data processing the ISZ was divided into six segments (A-F), as shown in Figure 6.1. The Site is located predominantly over segments B and D with some overlap with segments C and E.

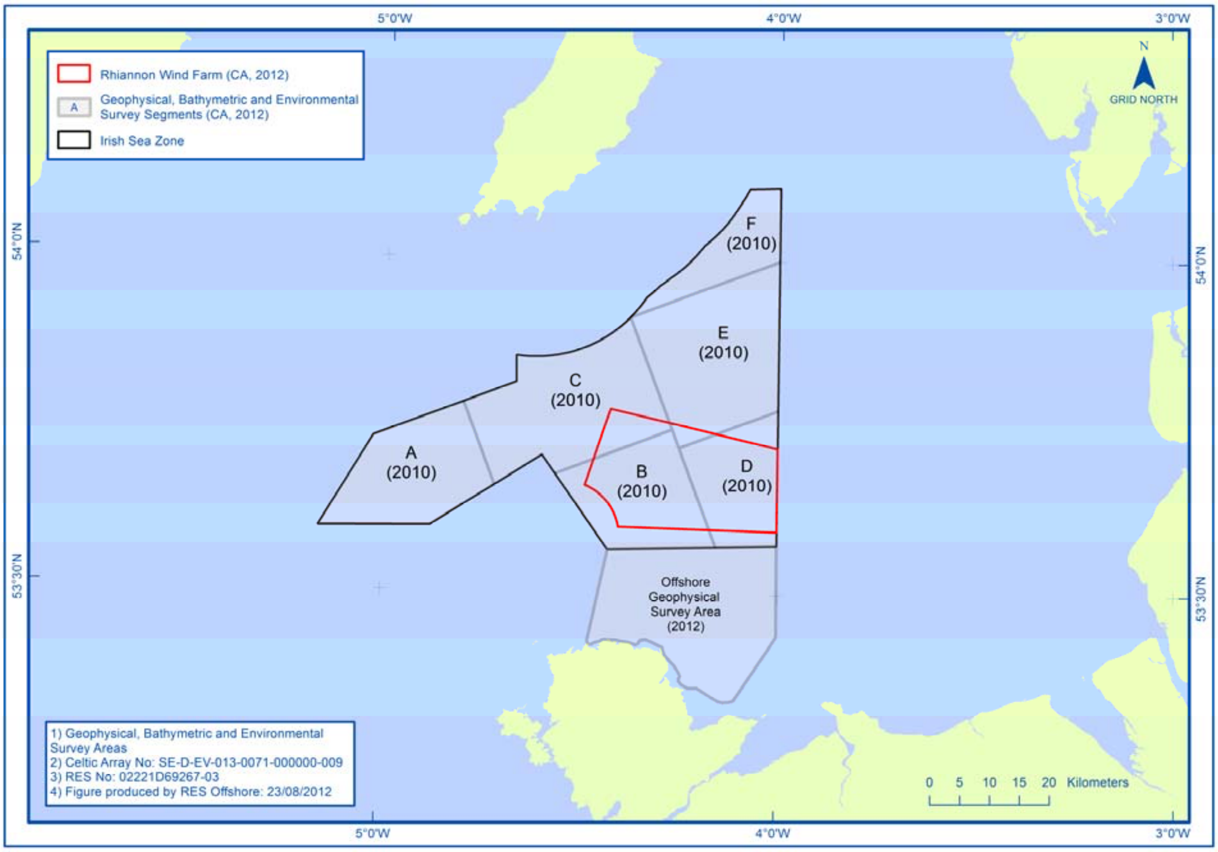


Figure 6.1 Bathymetry survey areas

6.8 In general, water depths increase from east to west across the Site. Water depths range between 36m and 83m Lowest Astronomical Tide (LAT) with an average depth of 46m (LAT). Figure 6.2 shows the approximate bathymetry across the Site.

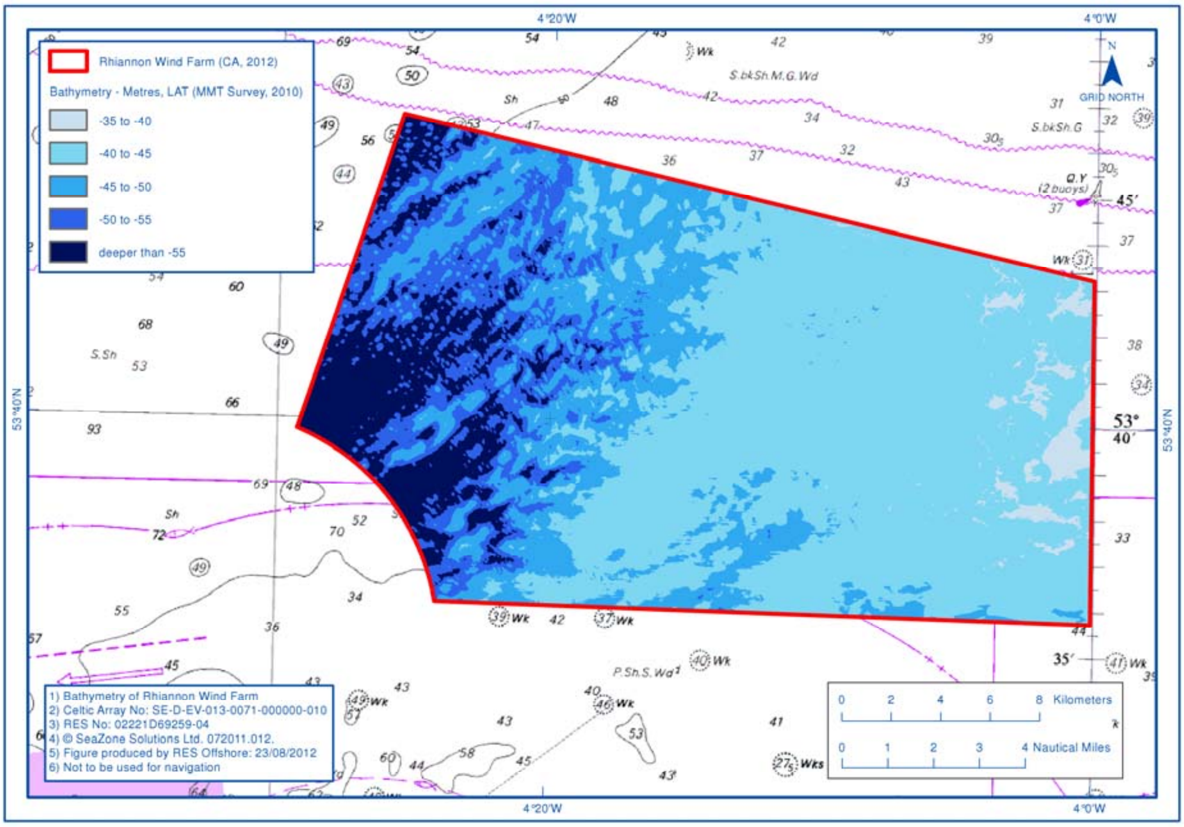


Figure 6.2 Bathymetry of the Site

6.9 A more complex seabed morphology exists in the western part of the Site, consisting of glacial features which include drumlins, iceberg scars and meandering channels, contributes to the deeper water experienced here.

6.10 Mobile bedforms are prevalent in the north eastern part of the ISZ. These include barchan (arc shaped) dunes and sandwaves of up to 10m high, with wavelengths of between 500m and 1km and smaller scale megaripples. Mobile bedforms are also found within the Site, albeit significantly smaller than those in the north eastern part of the ISZ.

6.11 The bathymetry in the eastern part of the Site is fairly flat with a gently undulating bed that increases in depth towards the south of the Site. Minimum depths are observed on dune features which occur regularly throughout the central and eastern parts of the Site.

Seabed sediments

6.12 The Site and its vicinity is characterised by outcrops of glacial till, sand and gravel and gravel deposits. The general direction of suspended sediment transport is aligned with the dominant flood tide which is north east and east across the Site.

6.13 In the Irish Sea, the combination of topographic, hydrographic and meteorological conditions, along with abundant sediment sources makes suspended particulate matter an integral and important part of the marine ecosystem. Its distribution in the water column influences the plankton primary production by regulating the light penetration depth in seawater (Reid *et al*. 1990).

6.14 The influence of tidal current on sediment movement was assessed as part of the ZAP Report. Current speeds suggest that coarse sand is mobilised during all but the lowest flow periods experienced during neap tides.

6.15 The ability of wave conditions to mobilise sediments was also assessed as part of the ZAP Report. In the Site, none of the waves recorded during the deployment periods were sufficient to mobilise the bed sediments.

6.16 The ZAP Report found that:

- Sediment suspension occurs mainly due to tidal energy with studies indicating a strong correlation between turbidity and tidal stirring. There are lower suspended sediment levels in summer;
- Consideration of seasonal surface suspended sediment maps indicate that surface suspended sediment concentrations within the ISZ are typically low with winter surface Suspended Sediment Concentration (SSC) values in the range 3 to 8mg/l; and summer surface SSC values generally between 0.5 and 2mg/l;
- There is a clear north south gradient in surface SSC across the ISZ, both in winter and summer, with higher concentrations in the south of the ISZ where the Site is located;
- Analysis of optical backscatter data from the metocean studies indicates that tidal currents are the predominant mechanism driving suspended sediment transport although there are a number of occasions where large wave events are shown to coincide with increased SSC concentrations;
- From the limited data, there is little evidence of spatial variability in vertical SSC in the ISZ;
- The general direction of suspended sediment transport will be towards the north east and east across the ISZ; and
- In respect of bedload sediment transport, progressive vector analysis and study of wave crests is indicative of a net north easterly and easterly transport pathway across the ISZ and into Liverpool Bay. For the most part, the bedforms are aligned with the flood dominant flow pathway.

Hydrodynamic regime

6.17 The ZAP Report characterised the baseline hydrodynamics in the ISZ in terms of:

- Water levels (due to the astronomical tidal regime, non-tidal influences and sea-level rise);
- Currents (due to both tidal and non-tidal influences); and
- Waves.

Water levels

6.18 The Site is subject to tidal influences from both the north and the south with two tidal waves entering the Irish Sea through the North Channel and St George's Channel and converging in the vicinity of the Isle of Man. Propagation into the Irish Sea by both channels is virtually simultaneous and this creates a standing wave that travels in an easterly direction into Liverpool Bay (Myres 1993). The tidal range increases with distance from west to east across the ISZ with the mean spring tidal range across the Site varying between 5m and >6.5m.

6.19 Measurement data from the ZAP Report metocean survey shows a clear spatial variability with the tidal range increasing from west to east across the ISZ, largely as a result of an increase in high water levels at the eastern-most deployment locations.

6.20 Surges can cause water levels to fluctuate considerably above or below the predicted tidal level. Positive surges may have implications for structural design and the assessment of impacts on coastal processes.

6.21 The ZAP Report considered six surge events (three positive and three negative) with analysis suggesting that, in common with water levels, surge severity is likely to increase from west to east. Within the ISZ, an estimate of the one in fifty year storm surge height is given as 1.5m above the expected tidal level (HSE 2001).

6.22 Changes in sea level arising from climate change and land movement were also considered in the ZAP Report which applied the medium emission scenario provided in the UK Climate Projections (UKCIP) resource as defined in UKCP09 (Lowe *et al*. 2009). This scenario predicts an exponential increase in the changes to sea level over the 21st century with a maximum increase of about 0.65m by the end of the century. UKCP09 also predicts a 0.40mm and 0.73mm a year increase in the fifty year return period surge level within the ISZ.

Currents

6.23 The ZAP Report derived tidal ellipses from measured and modelled current data, indicating a strongly rectilinear current both to the west of and within the ISZ. Currents across the Site were shown to be orientated along a 90°N to 270°N axis roughly parallel to the North Wales coast.

6.24 The tidal current data collected as part of the metocean survey campaign shows a marked asymmetry in the tidal flows. There is also recognisable rotation in the dominant direction from survey sites in the west to those in the east of the ISZ. In the vicinity of the Site, the currents are strongly east northeast (flood tide) to west southwest (ebb tide).

6.25 The ZAP Report found that the flood tide propagates across the ISZ in a north easterly direction and the ebb flows travel in a south westerly direction with a degree of asymmetry between the flood and ebb tide. Peak flood flows exceed 1m/s over much of the ISZ while the ebb speeds are typically lower, indicating a flood dominant tidal regime. This apparent tidal asymmetry has important implications for bedload sediment transport across the ISZ.

Waves

6.26 The Irish Sea is sheltered in the main from long period Atlantic swell seas and is mostly influenced by locally generated wind seas. Exposure to swell seas is limited to waves moving through the narrow northerly entrance (North Channel) and the wider southerly entrance (St George's Channel). The proximity of adjacent coastlines relative to the ISZ provides some shelter and leads to locally fetch limited conditions over which wind-seas can develop. Fetches typically increase over the western part of the ISZ, which is also most exposed to swell from either the North Channel or St George's Channel. This variability in exposure conditions to both swell and local winds is the basis of spatial variability in waves across the ISZ.

6.27 Since waves originate from meteorological forcing, the wave regime can be described as highly episodic but also with a degree of anticipated seasonal variation. Typically, larger waves are expected during winter periods and smaller waves during summer periods. The magnitude and frequency of waves will also tend to exhibit year to year variations, a phenomenon which is typically linked to the North Atlantic Oscillation. In general, wave conditions for the semi-enclosed area of sea will correlate to the direction and magnitude of the local winds and their associated fetch distances.

6.28 Wave data were collected as part of the ZAP process. A comparison between westerly and easterly sites within the ISZ suggests waves to the west of the ISZ are likely to have a slightly longer period (more exposure to swell) and higher wave height (longer fetches to the south) relative to those recorded in the vicinity of the Site.

6.29 Figure 6.3 below presents monthly average significant wave heights over the period 2001 to 2010. Variance around the monthly mean wave height is shown as single standard deviation around the mean for each year. The monthly mean wave heights clearly demonstrate a seasonal pattern and the scale of the standard deviation provides an indication of the inter-annual variation of the mean value. Across the full year, the standard deviation around the monthly mean varies in value between ±0.17 and 0.43m.

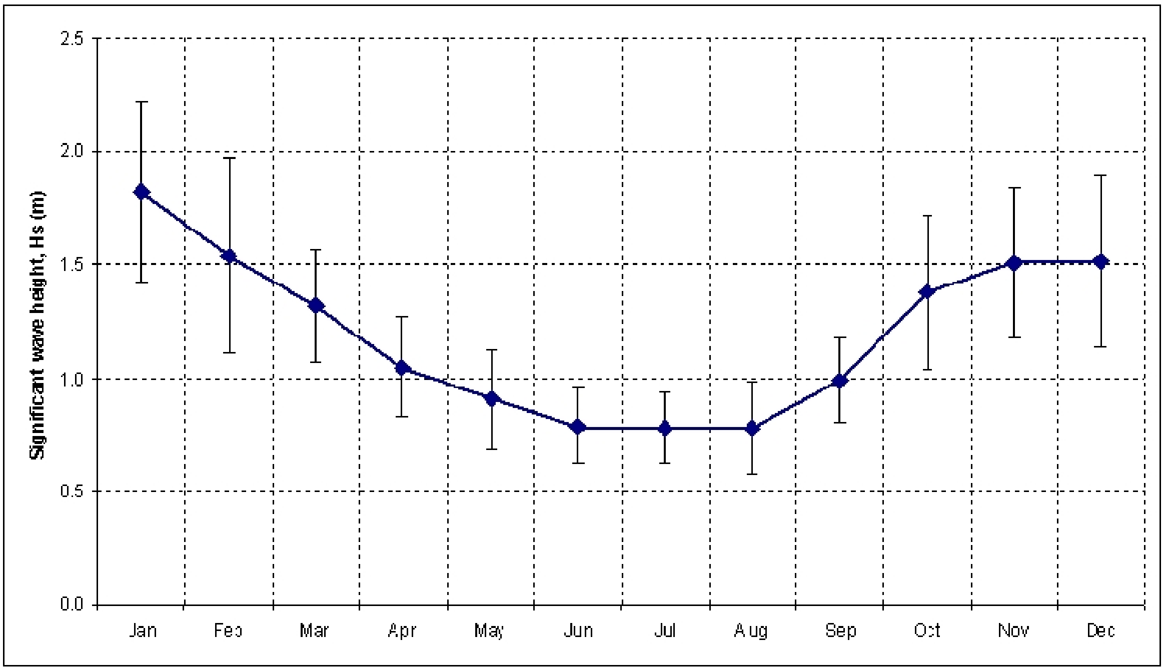


Figure 6.3 Monthly average significant wave heights (2001 to 2010)

6.30 Due to the water depth across the ISZ, it is likely that the majority of waves will not exert any influence on the local seabed and the orbital motion of the waves will expire higher in the water column or be at a magnitude too small to stir local seabed sediments.

6.31 For waves arriving along the coastlines of Ireland, the Isle of Man, Anglesey, North Wales and the East Coast of England it can be assumed that the (upstream) pathway for these waves involves crossing the ISZ. Hence, potential developments within the ISZ have the potential to interfere with the passage of these waves before they reach the coast.

Coastline

6.32 The ZAP Report presented a high level description of the coastlines listed below and identified the coastal morphology and local hydrodynamic and sediment transport processes in order to determine their potential sensitivity to changes in physical processes. These coastlines are either in sufficiently close proximity to the ISZ, or their prevailing hydrodynamic influences cross the ISZ and are therefore potential receptors for development at the Site. These coastlines are:

- Anglesey;
- North Wales;
- Point of Ayr to Morecambe Bay;

- Morecambe Bay to the Solway Firth; and
- The Isle of Man.

6.33 The initial characterisation of the physical environment demonstrates that there are no hydrodynamic or sedimentary pathways between the ISZ and the east coast of Ireland (ABPmer 2010). Equally, the distance between this coast and the large water depths to the west of the ISZ provide a further indication that there are no direct links between the two locations. Consequently, it was concluded that the east coast of Ireland is not a receptor for development within the ISZ and it was not included in the baseline characterisation or the subsequent assessment in the ZAP Report.

6.34 Modelling of changes to the wave and tidal regime on the coastlines described previously, concluded that impacts are considered to be insignificant.

Frontal systems

6.35 Tidal mixing fronts form the boundary between vertically mixed and summer-stratified waters in shelf seas. It is necessary to consider the potential impacts of the proposed development upon these systems to ensure that the development and maintenance (both seasonally and permanently) of these features are not compromised. Lateral fronts (known as tidal fronts) can also develop, separating bodies of water with differing vertical thermohaline properties and stratification.

6.36 Since their discovery, tidal fronts have been the focus of considerable attention for their potential role as sites of enhanced biomass production (Hill *et al*. 1993). Indeed, the frontal features greatly influence the availability of light and nutrients to plankton, driving both primary and secondary productivity which in turn attract fish, birds and cetaceans. Figure 6.4 depicts the location of frontal systems in the Irish Sea.

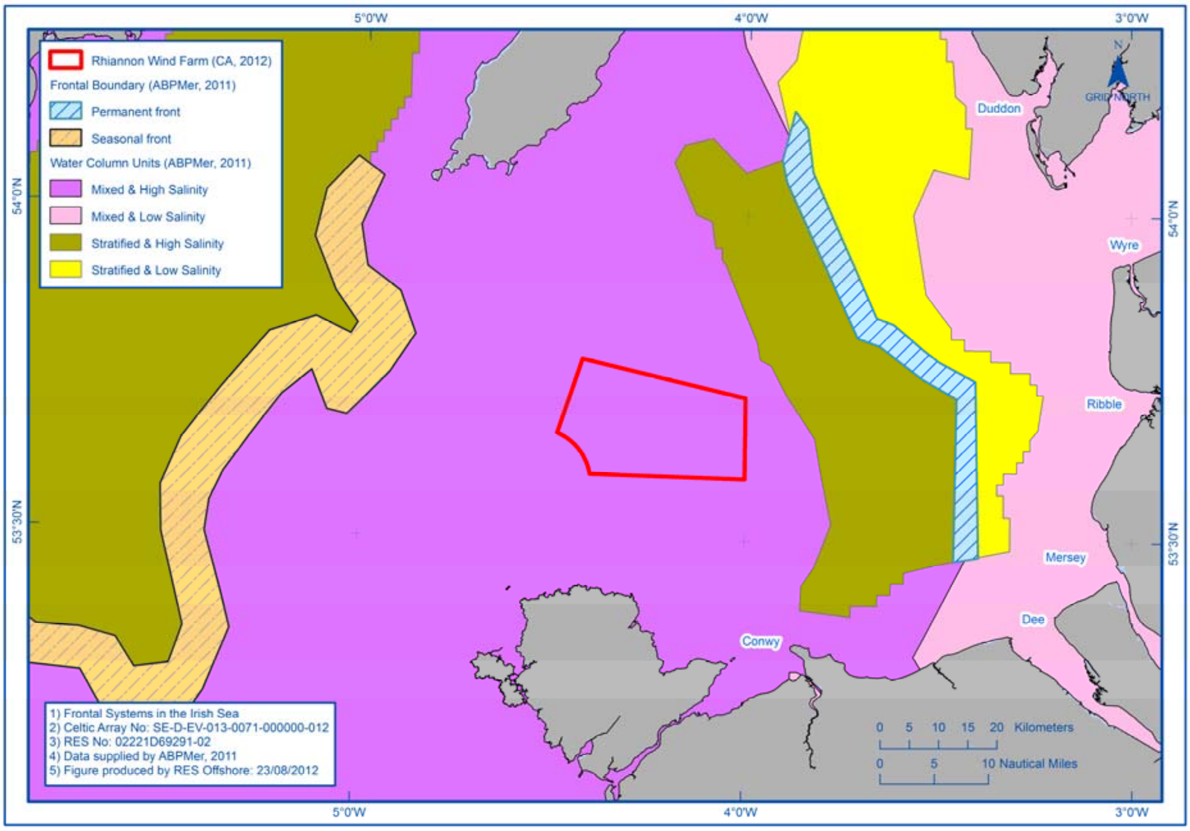


Figure 6.4 Frontal systems in the Irish Sea

6.37 There are two distinct frontal systems that could potentially be affected by developments in the ISZ. These are:

- A permanent haloclinic frontal system located within Liverpool Bay. This feature is also known as a Region of Freshwater Influence (ROFI). The ROFI is a permanent feature within Liverpool Bay and has developed as a result of the large freshwater inputs that are derived principally from the Dee, Mersey and Ribble; and
- A seasonal area of vertical thermoclinic stratification to the west of the ISZ that forms as a result of deep water and small tidal currents.

6.38 Based on the regional characterisation of the hydrodynamic regime, it was considered that development in the ISZ would be less likely to affect the seasonal temperature front to the west than the ROFI to the east. This was based on an initial assessment which looked at changes in flow speeds and then residual flow patterns. It showed that there was no change to flow patterns and combined with the no change to tidal currents it was concluded that there would be no change in tidal mixing and hence seasonal stratification. Consequently, only the salinity frontal system was subject to dedicated modelling as part of the ZAP Report.

6.39 The ZAP Report concluded that, at a zonal level, there was little potential for a significant alteration of the existing hydrodynamic, wave or sediment regimes or to frontal systems.

Water and sediment quality

6.40 In general, water quality in the Irish Sea is good. Most designated testing sites in the North West of England and North Wales regularly pass ‘bathing water’ quality requirements with many achieving compliance with more stringent standards. Sediment contaminant analysis undertaken for the ZAP process showed that all heavy metals analysed were below Cefas Action level 1. However, three of the samples were just over the action level for arsenic. The higher levels of arsenic may be caused by a number of anthropogenic or natural sources. Radionuclides will be investigated as part of the EIA.

Potential impacts

6.41 The regional scale modelling performed as part of the ZAP process indicated that changes to the hydrodynamic regime would be confined to within the ISZ or, where they are further afield, they would be insufficient to significantly impact physical processes. Cumulative assessments in the ZAP Report identified a potential physical processes interaction between the ISZ and the Walney offshore wind farm, Hilbre Swash aggregate dredging area and the Wylfa power station outfall. However, the ZAP Report concluded that the predicted size of the changes is likely to be either insignificant or potentially insignificant. The extent of potential impacts caused by the Skerries Tidal Array and the distance from RWF suggests that there are no cumulative impact 'overlaps' potentially leading to a greater magnitude of change, overall. As a result of the ZAP findings, the potential impacts scoped into the EIA are generally restricted to those operating on seabed morphology and sediments.

6.42 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction / decommissioning	
Geology	Project construction will not change the geology of the Site other than to a shallow depth in the localised areas directly affected by the foundations. This also applies to operational effects.
Hydrodynamic regime - Wave and tidal climate	Construction activities, most notably the presence of vessels and the installation of foundations may give rise to small localised short-term changes in the prevailing hydrodynamic conditions. These are not considered to be likely to have any significant effect on the current wave and tide climate.
Morphology	Short term increases in suspended sediment levels may occur as a result of ground preparation, cable laying and foundation installation with the quantities and type of sediment brought into suspension being dependent on the construction methods used. It is anticipated that increased levels of suspended sediments

	would remain localised. Localised morphology may be directly affected by construction vessel activity; for example through anchoring or positioning of jack-up vessels. Dredging and seabed preparation associated with gravity bases may also give rise to localised impacts on seabed morphology. Anticipated volumes of material to be dredged will be assessed, as appropriate, as part of the EIA.
Water quality	Water quality may be affected by the suspension of sediment, including the re-suspension of contaminated sediments. Inadvertent release of chemicals used in the construction process into the water column may occur although this risk can be managed by the adoption of good environmental working practices.
Sediment quality	Heavy metal concentrations were shown to be below Cefas action levels for the ZAP surveys. Contamination levels of sediments will be considered further as part of EIA.
Potential impacts during operation	
Hydrodynamic regime - Wave and tidal climate	Studies carried out by Cefas (2005) and site specific modelling at many wind farm sites have shown that wave diffraction associated with foundations is not likely to give rise to a significant effect on wave regime. Similarly, wave driven effects on sediment transport are also considered to be insignificant, with only a small and highly localised reduction in sediment transport being likely (Cefas 2005). This was also confirmed by the results of the ZAP assessment (Celtic Array 2012). As a result of these studies developers are no longer required to monitor waves for such effects under current FEPA licences. The results of the ZAP assessment also support this. Effects on the frontal systems were deemed to be insignificant in the ZAP Report.
Morphology	Tidal currents may give rise to scour impacts around foundation structures, although studies indicate the impacts of scour pits are generally localised (e.g. Cefas 2006). Impacts from operation and maintenance activities are likely to be localised and negligible but these impacts will be assessed, as appropriate, as part of the EIA.
Sediment transport regime	A number of studies on changes to sediment transport, e.g. Cefas (2006), have concluded that near and far field impacts on sediment transport can be expected to be minimal provided that foundations are adequately spaced so that scour pits do not interact with each other. These findings are supported by the conclusions of the ZAP Report.

Potential cumulative impacts	
Hydrodynamic regime – Wave and Tidal regime	The ZAP Report concluded that cumulative effects on the hydrodynamic regime may occur with Walney, Walney extension and West of Duddon Sands although these are unlikely to be significant. This conclusion was also reached in respect of other studies (e.g. Cefas 2004). The ZAP Report concluded that interaction between the ISZ and the offshore wind farms along the North Wales coast (Gwynt y Môr, Rhyl Flats, North Hoyle, Burbo Bank and Burbo Bank extension) was unlikely to give rise to an effect. Similarly, the ZAP Report concluded that cumulative impacts between the Potential Development Areas were considered to be insignificant. In addition, the ZAP Report concluded that given the distance of proposed wind farm projects in the territorial waters of Northern Ireland and the Republic of Ireland it was very unlikely that impacts with respect to physical processes will occur as a result of development within the ISZ.
Aggregate and outfall interactions	The ZAP Report identified a potential physical processes interaction between the ISZ and Hilbre Swash aggregate dredging area and Wylfa power station outfall and recommended further consideration at the project EIA stage. The findings of the ZAP Report were that the effects would be either 'insignificant' or 'potentially insignificant' and so, the likelihood of environmental effects is low and this potential effect is not anticipated to be a focal issue for the EIA.
Suspended sediment levels	The findings of the ZAP Report concluded that suspended sediment levels were unlikely to be significantly raised other than in respect of short term and localised (within the Site boundary) impacts.

Scoping Opinion from the Planning Inspectorate

6.43 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6 July 2012 to establish and agree the scope of the EIA for RWF. Their Scoping Opinion was received on the 17 August 2012. Based on the conclusions of the ISZ ZAP, it was the Planning Inspectorate's view that the following issues can be scoped out of the RWF EIA:

- Construction and operation impacts on the wave and tidal climate; and
- Cumulative effects on suspended sediment level.

6.44 A meeting was also held with CCW, Cefas and the MMO on 27 July 2012 to discuss certain ZAP conclusions. A technical note was produced and submitted to the attendees prior to the meeting, providing more information on the calibration and validation of the wave and tidal regional model which formed the basis of the ZAP conclusions. The attendees were satisfied that provided the RWCS assessed within the ZAP remains appropriate to assess impacts on physical process receptors at EIA then the justification for scoping out construction and operational impacts on the wave and tidal climate was valid. In addition, it was agreed to provide more information in the EIA on the confidence in the sediment transport assessment.

6.45 In addition, it was the opinion of the Planning Inspectorate that impacts on geology and water quality should be considered as part of the EIA. As detailed in the offshore Scoping Report (Celtic Array 2012) other issues that are scoped into the RWF EIA (and agreed by the Planning Inspectorate) include the following:

- Morphology;
- Sediment quality; and
- Sediment transport regime.

Approach to address Scoping Opinion

6.46 The level of detail as to how these issues will be addressed will be determined following the completion of baseline studies and surveys. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA survey and study programme

6.47 EIA surveys will build upon the extensive survey data already collected (Table 6.1). There are currently two wave buoys and an acoustic wave and current profiler (AWAC) deployed on the Site.

6.48 One AWAC and one wave buoy will be deployed for periods of approximately three months at one of the locations shown in Figure 6.5, while the other wave buoy (B10 in Figure 6.5) will remain in one location until at least the end of December 2012.

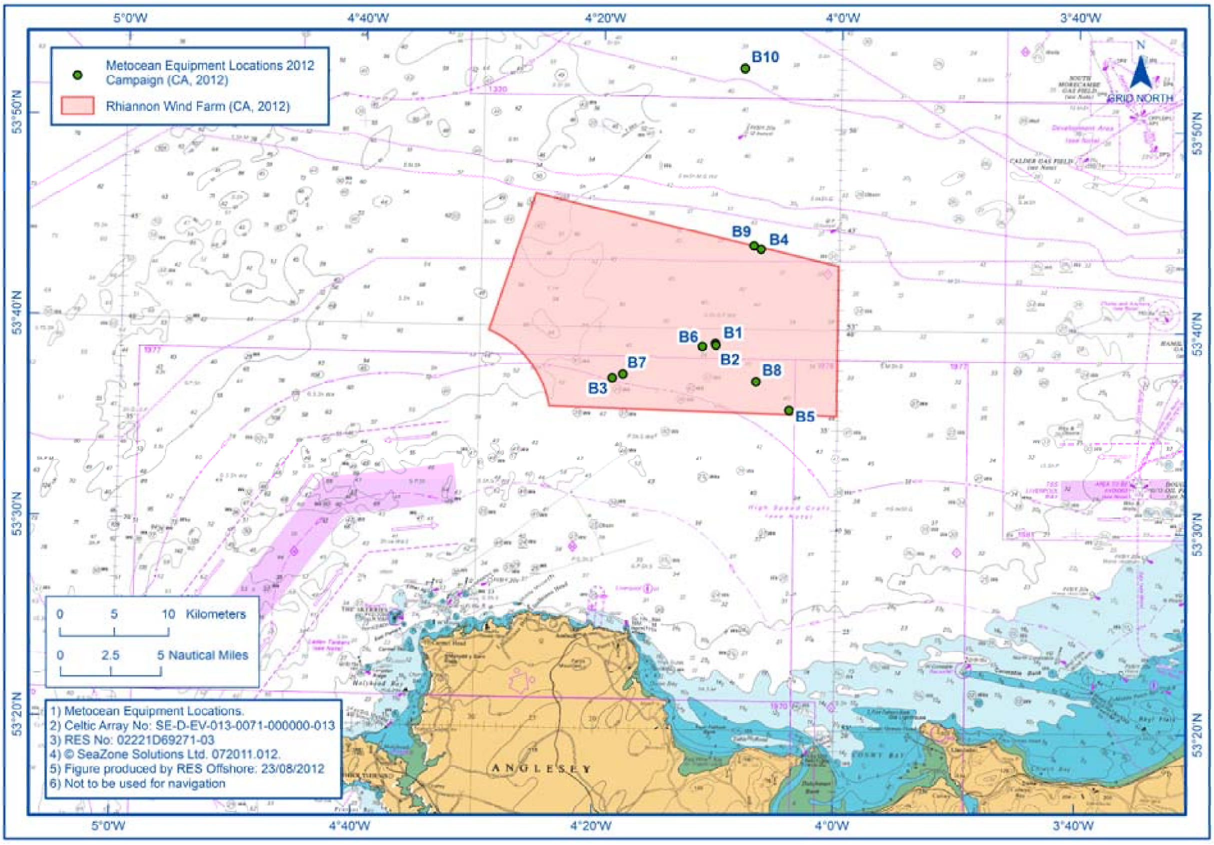


Figure 6.5 Metocean equipment locations

6.49 The assessment and analysis will build on the ZAP Report modelling and surveys already performed, with the Zone scale model being used as a framework to support the RWF ES.

6.50 A combined geophysical and environmental survey to characterise the indicative cable corridor area (see Figure 1.1) commenced in July 2012. The results of this survey will help inform potential impacts on physical processes in this area.

6.51 Information collected as part of the geotechnical survey in the Site and potential sediment grabs collected as part of further benthic habitat baseline surveys will also be considered.

Future consultation

6.52 This Stage 1 PEI Report represents the first formal stage in the consultation process for RWF with respect to the requirements under the Planning Act (2008). A second formal stage of consultation will be undertaken in the autumn of 2013 where opinions will be sought on a more detailed Stage 2 PEI. As well as the formal stages of consultation, informal discussions with respect to physical processes will be undertaken with JNCC, MMO, Cefas, Natural England, the Environment Agency and the Isle of Man Department of Environment Food and Agriculture (DEFA) throughout the pre-application phase.

7 BIOLOGICAL ENVIRONMENT

7-1 Biological environment – benthic ecology

Introduction

7.1 This section characterises the benthos (the flora and fauna of the seabed and its sediments) in and around the Site, describes the potential impacts of wind farm development on that environment and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees which will be used to inform the EIA. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees, which will inform the EIA as well as the Scoping Opinion received from the Planning Inspectorate on 17th August 2012.

Surveys and studies carried out to date

7.2 As part of the ZAP process described in Chapter 3 of this Stage 1 PEI Report, Celtic Array commissioned a marine ecology study (Celtic Array 2012). The ZAP Report included full zonal characterisation of the benthic environment based around the collection of survey data and consultation.

Benthic survey

7.3 The primary source of data informing this section was derived from around six months of sidescan and multibeam surveys. This survey data was ground truthed during August and September 2010 using still and video camera footage and day grab samples. Figure 7.1 shows the location of the video, drop down camera and sediment grabs. The dedicated 4m beam trawl surveys carried out in November 2010 and March 2011 also provided some additional information on the main epibenthos. Figure 7.4 shows the location of the demersal fish surveys where information on epibenthic communities was collected.

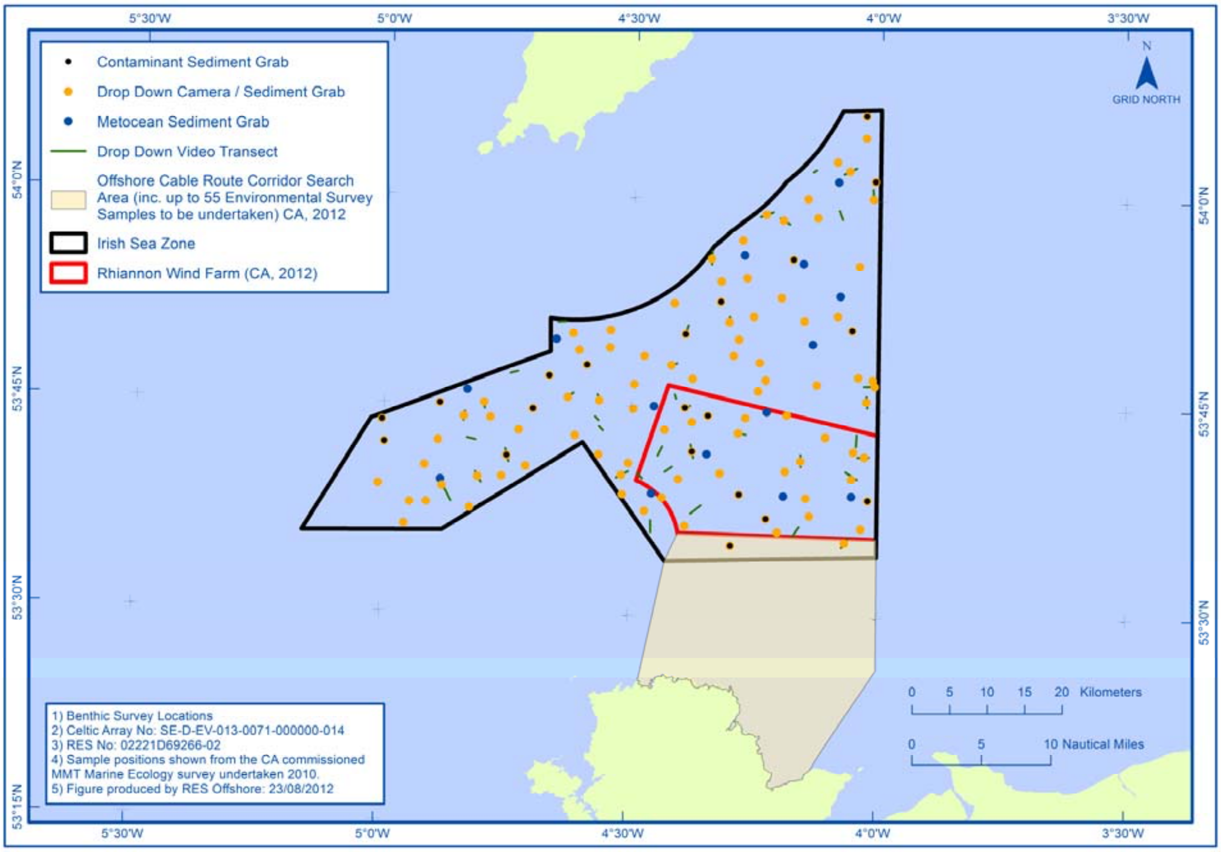


Figure 7.1 Benthic survey locations

7.4 Several months of data analysis were then undertaken resulting in a comprehensive description of the main seabed habitats and communities. Seabed communities were identified to biotope level where possible, or alternatively to biotope complex level or habitat complex level, after the JNCC biotope classification (Connor *et al.* 2004).

Other sources of information

7.5 Other sources of data informing this section include that from the HabMap and UKSeamap projects (JNCC 2010) and third party survey data from the Irish Sea.

7.6 HabMap represents the most up to date and comprehensive data source and largely confirms the outputs of the benthic survey described above. HabMap uses a combination of survey and modelled data, applying physical parameters to predict what biotopes are most likely to be present in areas where there is no existing biotope data.

7.7 UKSeamap (JNCC 2010) also provides broadscale habitat mapping information but this differs from HabMap in that it does not incorporate biological records. HabMap data has been used in preference to UKSeamap data to inform the baseline.

7.8 For selected communities, notably *Modiolus* beds and reefs, additional survey data provided by CCW has also been collated.

7.9 For context, data from offshore areas off the coast of the Isle of Man have been sourced from a draft report summarising a broadscale camera and grab survey of Manx waters (Hinz *et al.* 2009).

7.10 Other data sources include general descriptions of the seabed, including *Modiolus* communities, around the south of the Isle of Man (Jones 1951) and more recent historical surveys in connection with oil and gas exploration off the north and east coasts of the island (Holt *et al.* 1997a, Holt *et al.* 1997b, Holt and Shalla 1996).

Stakeholder consultation

7.11 As part of the ZAP Report consultation has taken place with CCW, JNCC, Natural England, MMO, Cefas, The Crown Estate, Northern Ireland Environment Agency (NIEA) and Isle of Man DEFA. Consultation with these parties will continue as the EIA progresses. In addition, responses on the offshore Scoping Report, submitted to the Planning Inspectorate in July 2012, were received in August 2012. The Scoping Opinion is discussed further below.

Description of the current environment

7.12 An outline biotope map can be found at Figure 7.2 below.

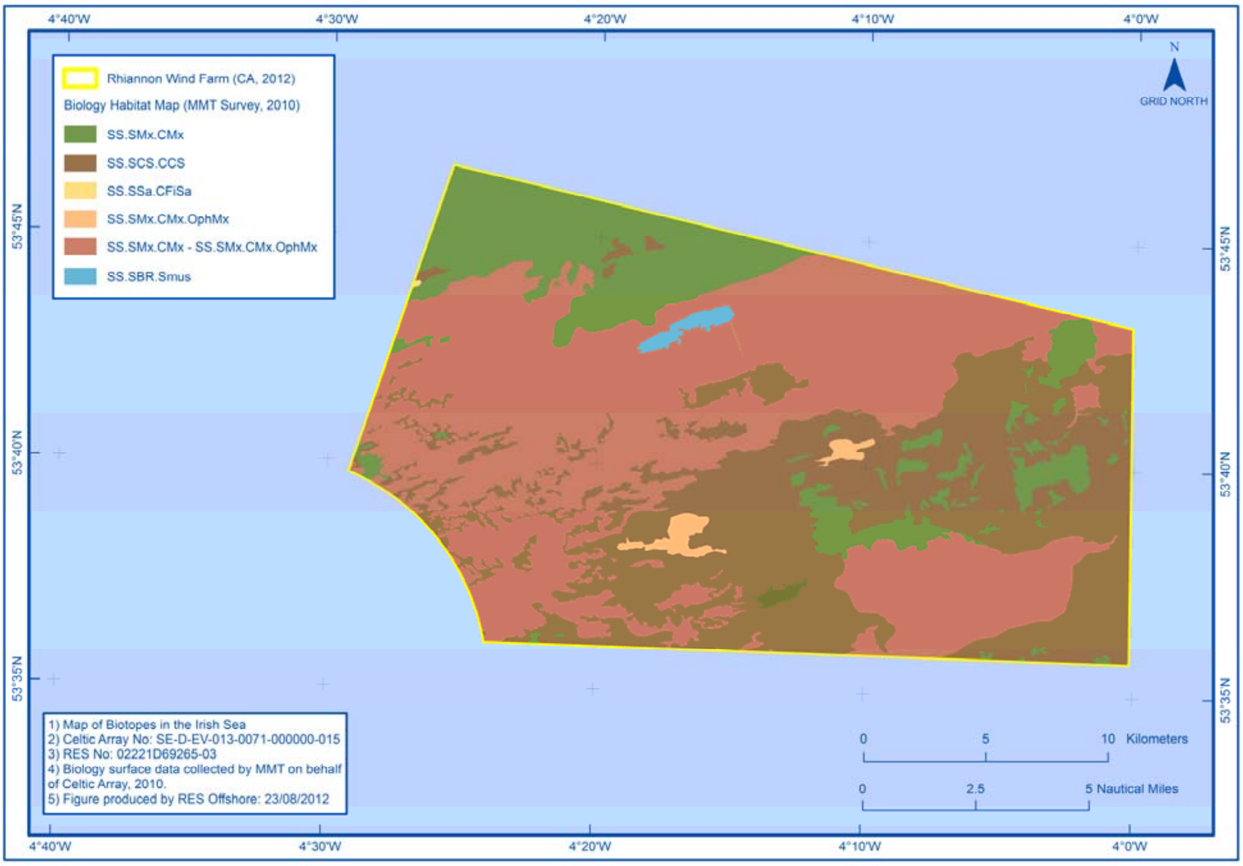


Figure 7.2 Map of biotopes in the Site

7.13 A number of sedimentary biotope complexes were found in the Site. Of these complexes, two were particularly dominant; Circalittoral coarse sediments (SS.SCS.CCS) and a mosaic of Circalittoral mixed sediment and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (SS.SMx.CMx-SS.SMx.CMx.OphMx). Further information on these communities is provided below:

- SS.SCS.CCS Circalittoral coarse sediments - Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20m. This habitat, as with shallower coarse sediments, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves, often forming a rich and diverse community; and
- Mosaic habitat of SS.SMx.CMx Circalittoral mixed sediment and SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment.

7.14 SS.SMx.CMx are mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15-20m), including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. Because of the variable nature of the seabed a variety of communities can develop which are often very diverse. The combination of epifauna and infauna can lead to species rich communities. SS.SMx.CMx.OphMx is a component biotope of SS.SMx.CMx. and consists of circalittoral sediments dominated by brittlestars (hundreds or thousands per m^2) forming dense beds, living epifaunally on boulder, gravel or sedimentary substrata. Such beds can act as important feeding grounds for benthic feeding fish such as cod. This was classified as a mosaic habitat due to the complexity of the habitat which did not allow areas of seabed to be unequivocally assigned to a single biotope or biotope complex.

7.15 In addition, the following biotope complexes/biotopes were shown to be present in the Site:

- SS.SMx.CMx – Circalittoral mixed sediment;
- SS.SMx.CMx.OphMx – *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment;
- SS.SCS.CCS.Blan – *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel;
- SS.SSa.CfiSa – Circalittoral fine sand; and
- SS.SBR.Smus – Sublittoral mussel beds (discussed further under *Modiolus modiolus* below).

Potential Annex I communities

7.16 The following communities have the potential, under appropriate circumstances, to qualify as features listed within Annex I of the Habitats Directive. Habitats listed in this Annex are those which EU member states are required to protect, for example by the designation of Special Areas of Conservation (SACs).

Modiolus reefs

7.17 *Modiolus modiolus* beds may qualify as biogenic reef under Annex I of the Habitats Directive where reef features are pronounced.

7.18 *Modiolus* reef was found in only one location within the Site (Figure 7.3) which appears to be sparse in comparison to good examples of *Modiolus* reefs. According to a single grab sample densities of *Modiolus* themselves were up to around 40 per m^2 but lower in evidence from camera survey, at typically around 1 to 12 per m^2, with the animals almost completely buried in the sediment and difficult to spot amongst the large amount of sediment and dead shell that was also present. Mounds typical of many offshore *Modiolus* reefs were seen on acoustic images of this area while on board the survey vessel, although these were not wholly distinct.

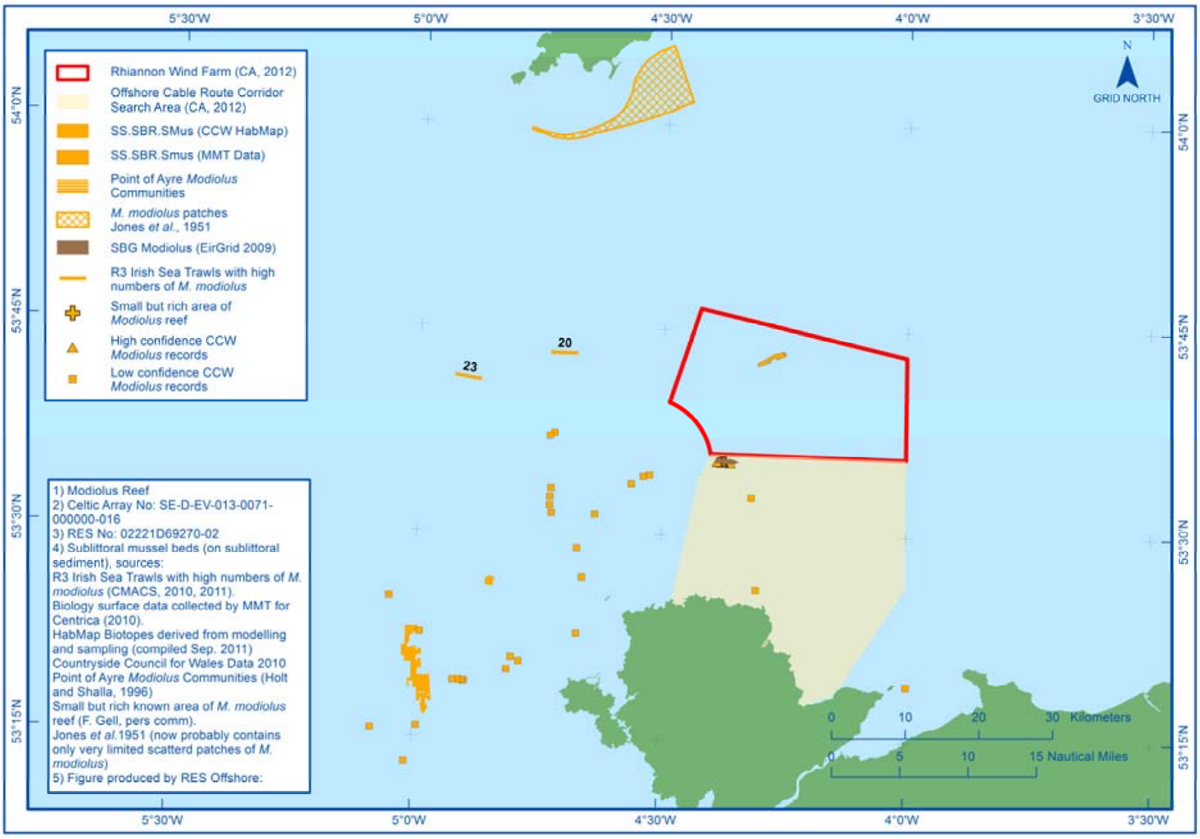


Figure 7.3 Modiolus reef near to the Site

7.19 One other *Modiolus* reef area has been historically recorded within the Site. This was mapped during benthic surveys for a proposed subsea cable project but it was not detected during the ZAP survey.

7.20 Additionally, large numbers of *Modiolus* were found in two of the 4m beam trawls carried out as part of the surveys for the ZAP Report described above. Because the trawls were several kilometres long and hence covered large areas of seabed, it is impossible to know whether these finds represent significant areas of potential reef and if so where exactly these would be.

7.21 Historically, there have frequently been other reports of *Modiolus* dominated communities between Anglesey and the Isle of Man, although many are anecdotal and have not been documented in published reports.

7.22 A benthic community sampling protocol has been developed in consultation with the relevant statutory advisors, utilising additional ground-truthing in the form of targeted benthic grabs/drop-down video to build upon and improve the value of the extensive ZAP dataset. This will include further work focusing on the potential Annex I habitats previously identified within the Site to establish the quality and extent of these habitats.

Rocky reef

7.23 An area of potential Annex I of the Habitats Directive rocky reef composed of bedrock occurs within the Site. The survey suggests that it forms a bathymetric high approximately 2,500m in diameter and 10m above the surrounding seabed level and would therefore appear to be of high 'reefiness'. The associated community appears to have relatively sparse epifauna dominated by starfish, with some dense patches of brittle stars *O. fragilis* and to be broadly similar to much of the stony (boulder) reef (see below). The community appears to match well with the biotope complex CR.MCR.EcCr Echinoderms and crustose communities on moderately exposed circalittoral rock.

7.24 The majority of the areas described in the ZAP Report as potential Annex I of the Habitats Directive reef areas are composed of a very mixed seabed with variable amounts of stones and boulders of differing sizes. They are mostly circalittoral mixed sediment, including mosaic with brittle star beds, but also in some places circalittoral coarse sediment, presumably reflecting the low proportion of rock habitat occurring.

7.25 The protocol for the survey required the interpretation of any potential Annex I of the Habitats Directive rocky reef against the reefiness index described in Irving (2009) and redescribed for cobble reef in Limpenny *et al.* (2010). Both authors note that, in relation to Annex 1 definitions, such reefs can include both bedrock and stony areas including cobble and boulders. However, in the case of such patchy and widespread habitats, such an interpretation is largely unfeasible except to say that in at least some areas where large boulders are present, the habitat clearly reaches a medium level of reefiness. The ZAP Report concludes that the majority of the Annex I of the Habitats Directive stony reef areas are of low or medium reefiness.

7.26 There are likely to be additional, possibly very numerous, smaller areas of boulder and stones that may technically qualify as Annex I of the Habitats Directive rocky reef elsewhere in the Site. This seems most likely in those areas adjacent to the mapped stony reefs that are mapped as being predominantly coarser, such as the circalittoral mixed sediment areas (SS.SMx.CMx and SS.SMx.CMx–SS.SMx.CMx.OphMx mosaic) and offshore mixed sediment areas, both within the Site and outside it, particularly to the north.

Authigenic carbonate communities

7.27 Authigenic carbonate communities are based on unusual solid carbonate deposits that can occur as a result of natural methane seepage through seabed sediments. No authigenic carbonate communities were found within the Site or the ISZ during the survey. However, there are extensive areas in the Northern Irish Sea that represent the majority of the known resource of this habitat in UK waters, notably the Croker Carbonate slabs well to the south west of the ISZ, some 30km to the west of Anglesey, which are part of both a proposed SAC (JNCC 2011f) and a proposed MCZ area (ISCZ 2011). The slabs are described as ‘low relief’ (elevation of up to 20cm above the surrounding seabed) or ‘high relief’ (elevation over 20cm and often up to 2m). A cliff feature up to 8m in elevation and 500m long has also been recorded (Whomersley *et al*. 2010, Judd 2005).

7.28 With the exception of the potential Annex 1 communities discussed above, the ZAP Report noted that sedimentary seabed communities mapped within the ISZ are mostly common and widespread communities, with abundant areas both within the ISZ but outside of the Potential Development Areas and in most cases a strong likelihood of existing widely outside the ISZ. The ZAP Report further noted that none of these habitats are considered likely to be sufficiently rare, important or sensitive enough to warrant protection from the direct loss of a small percentage of seabed habitats. It should be noted however that the ZAP assessment was restricted to the potential impact associated with the direct loss of habitat from operation of wind farms in the ISZ.

7.29 Table 7.1 below sets out the extent of the main seabed communities within the Site. It describes the total area of each biotope mapped within the ISZ and states the percentage of that biotope area found within the Site.

Table 7.1 Main seabed communities mapped within the Site and the ISZ with summary information on extent calculated

Biotope or habitat code	Biotope or habitat name	Total extent within the ISZ (km^2)	Proportion of total extent within the Site (%)	Likely extent outside ISZ
CR.MCR	Moderately exposed circalittoral rock	1.72	100.0	Area not known but extensive to south and west
SS.SBR.Smus	Sublittoral mussel beds	2.40	100.0	Area not known – widespread but probably few areas of high quality
SS.SCS.CCS	Circalittoral coarse sediment	435.53	56.2	Area not known but extensive
SS.SCS.CCS.Blan	*Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel	1.19	100.0	Unknown – *B lanceolatum* may be widespread in low numbers but the biotope is likely to be limited in extent
SS.SMx.CMx	Circalittoral mixed sediment	903.25	10.6	Area not known but probably extensive
SS.SMx.CMx - SS.SMx.CMx.OphMx	A mosaic of: Circalittoral mixed sediment and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	314.04	85.0	Area not known but both constituents probably extensive
SS.SMx.CMx.OphMx	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	6.38	67.5	Area not known but probably extensive at least to north of ISZ
SS.SSa.CFiSa	Circalittoral fine sand	206.24	0.1	Area not known but probably extensive

Biotope or habitat code	Biotope or habitat name	Total extent within the ISZ (km^2)	Proportion of total extent within the Site (%)	Likely extent outside ISZ
Stony Reef	Stony reef areas mapped by the benthic survey (MMT 2011) as an additional layer on top of all of the above biotopes, see text for descriptions (excludes the CR.MCR which was mapped separately as an area of bedrock). Reefs are very patchy and only occupy part of this measured area	89.20	30.1	Area not known but appears extensive to south and west of ISZ

Export cable route

7.30 The ZAP Report did not characterise the benthic ecology of the cable route corridor, due to uncertainties over the grid connection location. At the time of writing the ZAP Report, possible grid connection points included a number of areas in the north west of England and north Wales. On agreement of a connection point in Anglesey a combined geophysical and environmental survey was commissioned in July 2012, of which further details are provided in the EIA surveys and studies section below.

Potential impacts

7.31 The geophysical survey and associated groundtruthing undertaken as part of the ZAP assessment provides a detailed map of benthic communities across the Site. The ZAP Report notes that the majority of these communities are mostly common and widespread, with abundant areas both within the ISZ but outside of the Potential Development Areas and in most cases with a strong likelihood of existing widely outside the ISZ. The ZAP Report further noted that none of these habitats are considered likely to be sufficiently rare, important or sensitive enough to warrant protection from the direct loss of a small percentage of seabed habitats. However, the ZAP Report also highlighted a number of discrete areas supporting potential Annex I habitats that are likely to be focal issues in the EIA.

7.32 Within the Site, no areas of potential Annex 1 *Sabellaria* reef were reported and elsewhere within the ISZ there have only been limited areas of low reefiness. No evidence of authigenic carbonate reefs were found in the ISZ and the expectation that such reefs exist within the Site is again low. An area of potential Annex I rocky reef is present in the western part of the Site.

7.33 As well as rocky reefs, a single area of *Modiolus* bed that may represent Annex 1 reef was detected within the Site, but not elsewhere in the ISZ. An additional area of *Modiolus* bed that may represent reef was reported as part of the EirGrid East West Interconnector studies immediately to the south of the Site (Metoc 2009), but was not detected during the ZAP survey. Both surveys mapped and described Annex I features based upon a combination of sidescan and multibeam information and groundtruthed using towed video. A detailed survey protocol (as described in the EIA survey and study section below) has been developed and agreed to ensure that *Modiolus* coverage within the Site and export cable area is adequately covered.

7.34 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction	
Physical disturbance to sedimentary communities	The primary impacts on the benthic environment from construction is likely to arise from direct and indirect physical disturbance from jack-up legs, anchor placement, piling and intra-array and export cable installation. These activities are likely to result in short-term localised changes to the marine environment such as increased turbidity, changes to suspended sediment levels and direct disturbance. As concluded in the ZAP Report, none of these habitats are considered likely to be sufficiently rare, important or sensitive enough to warrant protection from the direct loss of a small percentage of seabed habitat (with the exception of Annex 1 habitats, discussed below) and so, the likelihood of environmental effects is low and this potential effect is not anticipated to be a focal issue for the EIA.
Loss or alteration of habitat	Habitat loss or alteration may occur during construction from a number of sources including the installation of foundations and intra-array and export cables. However, this potential impact is not anticipated to be a focal issue for the same reasons given for the 'potential disturbance to sedimentary communities' above.
Smothering	Benthic communities may be affected by smothering when sediment is mobilised by construction activities such as the laying of intra-array and export cables, foundation ground work preparation etc. The level of sediment mobilised during construction will be dependent on the sediment characteristics with finer sediments (such as silts and clays) likely to remain in suspension for a greater period of time than coarser sands. The potential issue of smothering of benthic communities has been identified and scoped into the EIA; the potential for such effects will be fully addressed as part of the assessment process and will be reported on in the ES.
Re-mobilisation of contaminated sediments	As discussed in Chapter 6 of this Stage 1 PEI Report, the likelihood of environmental effects arising from contaminated sediment disturbance is extremely low and this potential effect is not anticipated to be a focal issue for the EIA.
Annex 1 Habitats	*Modiolus* reef structures and their attendant fauna are sensitive to physical damage and may take very long periods to recover. The limited known areas of *Modiolus* reef can be relatively easily avoided by careful siting of turbines and routeing of cables. The likelihood of environmental effects is low and this potential effect is not anticipated to be a focal issue for the EIA. In respect of rocky reef, the worst case permanent losses would amount to approximately 0.33% of the total amount of this habitat in the ISZ with significant larger areas of similar habitat outside the zone, including within proposed areas for MCZs. It is therefore considered that this potential impact is not anticipated to be a focal issue for the EIA.

Potential impacts during operation	
Loss or alteration of habitat	Loss of habitat during operation is most likely to occur from indirect effects such as scour or from changes to physical processes (direct loss resulting from installation of turbine foundations and cables is classed as a 'construction phase' impact). As discussed in Chapter 6 of this Stage 1 PEI Report, such impacts are likely to be limited in extent and magnitude and would only occur within small areas of the wind farm footprint and not anticipated to be a focal issue for the EIA.
Change in benthic communities	Changes to the composition of benthic communities within the Site may occur, either from the colonisation of hard foundation and scour protection surface or through changes in fishing activity arising from the use of safety zones around turbines. The impact of the potential to introduce or spread non-native species during construction and operation activities will be considered as part of the EIA.
Potential impacts during decommissioning	
Potential impacts during the decommissioning phase are expected to be similar to those arising during the construction phase. Following removal of structures opportunities for habitat recovery in the former location of foundations may arise. Other impacts may include the loss of biodiversity/habitats that have built up in colonised sub-sea structures during the operational lifetime of the project.	
Potential cumulative impacts	
Chapter 5 discusses the projects and activities which may act cumulatively or in combination with RWF. Based on the results of the marine ecology and physical processes assessments presented in the ZAP Report, the potential for cumulative and, or in combination impacts with benthic communities in the Site is not anticipated. However, this position will be reconsidered should this consultation or future consultations identify additional activities that Celtic Array is not aware of. However, there is the potential for cumulative impacts and/or in combination effects to arise within the export cable corridor(s), which are therefore, scoped in.	

Scoping Opinion from the Planning Inspectorate

7.35 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the offshore EIA for RWF. The impacts considered in the table above were all scoped into the EIA. The following represents the Planning Inspectorate's opinion in respect to benthic ecology.

- The Secretary of State welcomed the benthic surveys to be carried out as part of the data collection exercise for the ES. The terms of reference for these surveys should be agreed with the relevant statutory bodies;
- The assessment of environmental impacts on the benthic and epibenthic communities should include all aspects of the proposed wind farm in the construction, operation and decommissioning phases of the development. Direct

loss of habitat through the installation of, amongst other items, foundations, intra-array cables, substations and stabilisation materials should also be investigated;

- The ES should include an assessment of the possible introduction of non-native species via vessels and/or equipment which would be used during construction and maintenance of the project. Furthermore, the possibility of colonisation of foundations and scour protection (stepping stones) should also be assessed;
- Consideration should be given to the total loss of seabed area resulting from the offshore wind farm array and associated works; and
- The Secretary of State considers that the Applicant should assess disturbance and loss of habitat from the installation phase of the development and furthermore, from the operational phase of the development.

Approach to address Scoping Opinion

7.36 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA survey and study programme

7.37 Project specific survey requirements will be developed in consultation with key stakeholders, namely MMO, MCU, JNCC, CCW and Cefas. The results of the surveys will be made available for Stage 2 PEI consultation anticipated to take place in the autumn of 2013.

7.38 Surveys within the wind farm area and cable route area are anticipated to be undertaken in September/October 2012 and will be designed to build on the extensive dataset collected during the ZAP process.

7.39 Any surveys proposed will be designed in line with the approach described in the DTLR publication Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites, 2nd Edition, March 2011.

7.40 A benthic community sampling protocol will be developed in consultation with key statutory advisors, for the collection of epibenthic and macrobenthic community data. Information on species diversity, numbers, habitat classification and community structure will be used to characterise the area in terms of the local marine ecology. Although the focus is on identifying potential Annex 1 habitats, other species and habitats of importance such as those listed under Section 42 of the NERC Act 2006, or OSPAR will also be identified and assessed. Intertidal surveys will utilise existing datasets such as CCW's Intertidal Biotope Mapping Survey (Brazier *et al*. 2007). Guidance documents such as the *Guidelines for Ecological Impact Assessment for Britain and Ireland: Marine and Coastal* (IEEM 2010) will also be used and referred to as appropriate.

7.41 Sediments samples will be collected for analysis of particle size distribution and contaminant concentrations, as well as providing information on the spatial distribution of sediments. This information will help explain benthic community patterns and will inform the physical processes assessment as described in Chapter 6.

7.42 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, consultation derived data and information. This description will include analysis of the survey data described above;
- A review and summary of consultation activities including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative impacts;
- A review and summary of physical processes surveys and studies incorporating any identified key issues specifically regarding benthic ecology, such as any identified smothering or sediment regime change implications. Cross-referencing to the relevant chapters of the ES will be included; and
- Proposals for mitigation measures and monitoring, if required.

7-2 Biological environment – fish ecology

Introduction

7.43 This section characterises the fish ecology in and around the Site, describes the potential impacts of wind farm development on the relevant fish ecology receptors and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees which will be used to inform the project level EIA process.

7.44 Commercial fisheries are considered separately in Section 8-1. However, the ES will cross-refer to relevant issues in each of these sections.

7.45 For the purposes of this report, Basking sharks *Cetorhinus maximus* are considered to have more in common with other large marine megafauna such as marine mammals than with the fish ecology issues dealt with here. They are therefore considered in Section 7-3 on marine mammals, turtles and basking shark.

Surveys and studies carried out to date

7.46 As part of the ZAP process described in Chapter 3 of this Stage 1 PEI Report, Celtic Array commissioned a marine ecology study (Celtic Array 2012). The ZAP Report included full zonal characterisation of the fish ecology of the ISZ, based around the collection of survey data and consultation.

7.47 The primary data sources for fish communities within the Site used in this report are the dedicated 4m beam trawl surveys carried out in autumn 2010 (November) and spring 2011 (March) by CMACS Ltd (CMACS Ltd 2010, CMACS Ltd 2011) to inform the ZAP Report.

7.48 These surveys were designed to provide information on fish and epifauna abundance and distribution and in order to allow direct comparison with the Cefas autumn fish surveys. Sampling was carried out using a 4m commercial beam trawls with a 40mm mesh cod-end insert at the locations shown in Figure 7.4. A full methodology and results of these two trawl surveys are available within reports CMACS (2010) and CMACS (2011).

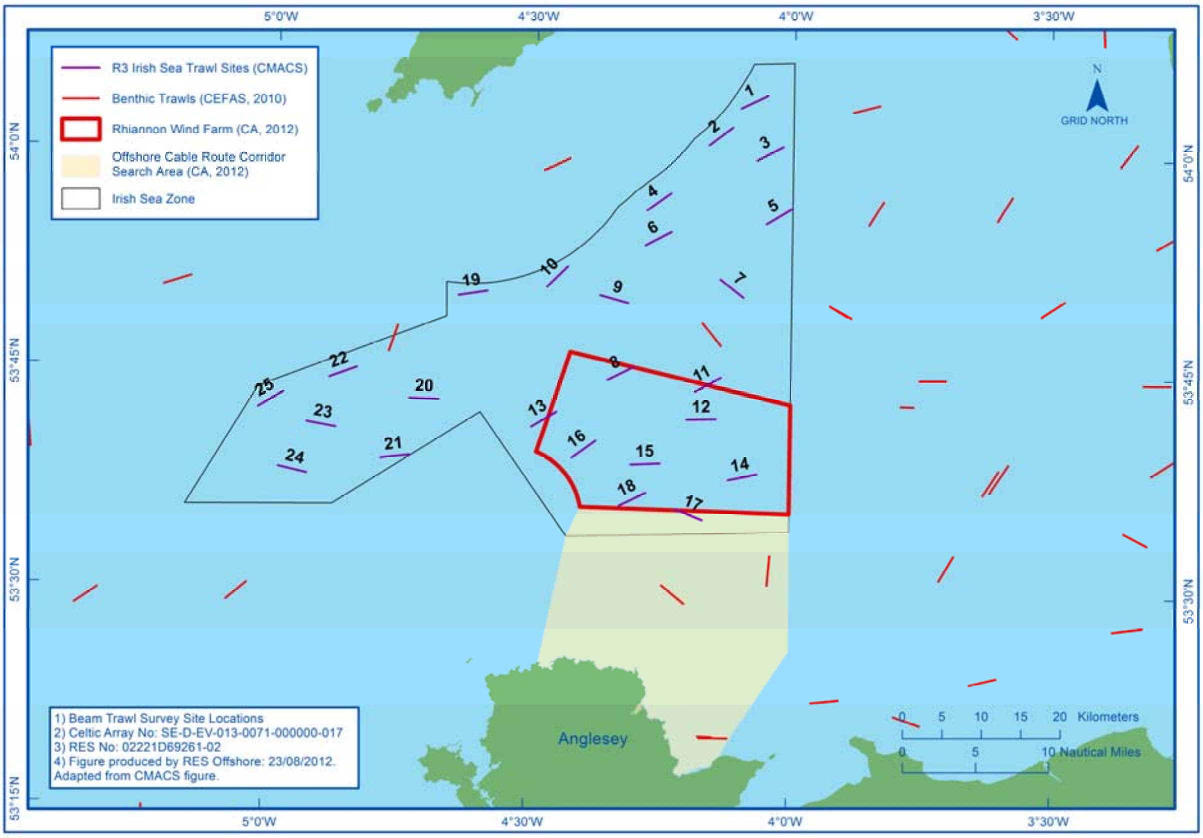


Figure 7.4 Beam trawl survey site locations

7.49 Since 1992, Cefas has maintained a series of trawl surveys undertaken during autumn throughout the greater part of the Irish Sea (Parker-Humpreys 2004), with sampling carried out from the Cefas research vessel 'Corystes' towing a commercial-pattern 4m beam trawl fitted with a fine mesh cod-end liner (Ellis *et al*. 2000, Parker-Humphreys 2004). Analyses of these data have been published by Ellis *et al*. (2000) and Parker-Humphreys (2004) with further analysis by Ellis and Parker-Humphreys (2004).

Stakeholder consultation

7.50 As part of the ZAP Report, consultation has taken place with the CCW, JNCC, NE, MMO, Cefas and the Isle of Man DEFA. In addition, the Planning Inspectorate has undertaken consultation with these parties to formulate their scoping response on the offshore Scoping Report. Consultation with these bodies will continue throughout the pre-application stage.

Description of current environment

Summary

7.51 No unusual fish communities or rare fish species were found during the ZAP surveys. In the main, fish communities and individual fish species are wide ranging within and around the Site and the ISZ and there is no indication of especially important areas, either for individual species or for communities. Fish spawning and nursery areas occur in proximity to the Site for a number of species but in all cases the areas involved are part of much wider spawning/nursery areas that also include large areas outside of the ISZ. Spawning areas for herring, *Clupea harengus*, which are likely to be more sensitive to disturbance by noise than most fish species, are thought to occur exclusively outside the ISZ, the nearest area being well to the north of the Site, off the east coast of the Isle of Man, where according to Bowers (1969) they were found to spawn around 5-10 miles from the coast.

Fish communities

7.52 The most abundant species recorded in the ZAP surveys differed for the two seasons in which the surveys were conducted. It was found that there was marginally higher species diversity in spring (47 species) than the autumn (43 species), with the autumn fish community being dominated by Poor cod, *Trisopterus minutus* and spring recording the Thickback Sole, *Microchirus variegatus* as the most abundant fish species across the ISZ as a whole. Total abundance of fish was very similar between autumn and spring.

7.53 The proportion in each catch of the ten most common species, sampled as part of the autumn 2010 survey, is displayed in Figure 7.5. Numbers in black denote site numbers. The most common species recorded across the ISZ was Poor cod (838 individuals from 20 trawls). The largest single catch of Poor cod (121 individuals) was at site 8, to the north of the Site, where the species comprised 73% of the haul. Poor cod are found mainly on muddy or sandy sea beds. Although they may be commercially harvested for fish meal, they are not actively fished in this area of the Irish Sea.

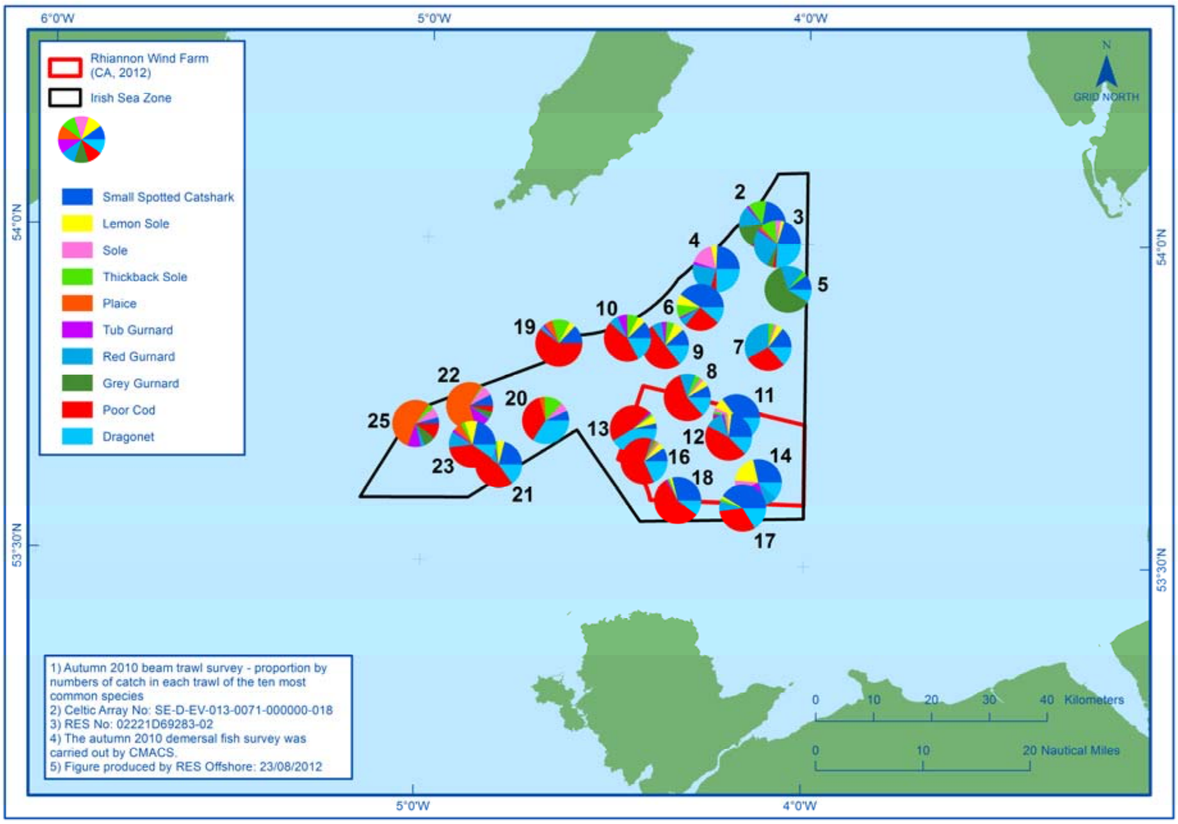


Figure 7.5 Proportion by numbers of catch in each trawl of the ten most common species in the autumn 2010 survey

7.54 The results from the site specific surveys showed a similarity to the assemblages identified in the central Irish Sea by Ellis *et al.* (2000).

Shellfish

7.55 The Cefas beam-trawl survey is not designed to sample commercial shellfish but each of the principal species for which there are fisheries in the Irish Sea were recorded in the catches. These are: king scallop, *Pecten maximus* and queen scallop, *Chlamys opercularis*, whelks, *Buccinum undatum*, brown crab, *Cancer pagurus*, lobster, *Homarus gammarus* and brown shrimp, *Crangon crangon*. Brown shrimps are most abundant in very shallow water, particularly adjacent to the major estuaries in the eastern Irish Sea such as Dee and Morecambe Bay. The relatively few brown crab and lobsters that were recorded were widespread. Nephrops, *Nephrops norvegicus,* were not recorded in the trawl survey but they are an important shellfish resource within the Irish Sea between the Isle of Man and the Cumbria coast.

7.56 None of the shellfish species recorded from the Cefas surveys are classified as being 'rare' or 'endangered' and none are subject to non-fishery management conservation measures.

Spawning and nursery ground usage

7.57 Spawning and nursery areas within the central and eastern Irish Sea and within and around the ISZ have been identified using Coull *et al.* (1998) 'Fisheries sensitivity maps in British waters'. The data from these maps are compiled from surveys conducted over a number of years (1991-1996) and are taken as a recent representation of the present fish population distributions, which are likely to vary spatially and temporarily in both the short term (seasonally) and longer term (over several years).

7.58 More recently, Cefas scientists have undertaken additional analyses to complement and update the Coull *et al*. data. GIS information from the results regarding spatial and intensity of use of the different areas has also been referred to here.

7.59 Table 7.2 shows species which spawn within the ISZ. Table 7.2 is based on the more recent Cefas (2011) data. The spawning periods for the area are shown in Table 7.3.

7.60 Information from Coull *et al.* (1998) also shows that herring (*Clupea harengus*) utilise the east coast of the Isle of Man as a spawning ground over August to September (well to the north of the Site). This is a well-known and important historical spawning area and its continued use was confirmed by consultation with Isle of Man DEFA as part of the ZAP Report (Celtic Array 2012). Herring require areas of clean gravel into which they lay their eggs to spawn (Haegele and Schweigert 1985), the provision of which can be largely determined by changing environmental conditions. The Site, however, is well to the south of this spawning area.

Table 7.2 Spawning areas as defined from Cefas egg surveys (Cefas 2011) for the main commercial fish species likely to spawn in the ISZ

Species	Area and Intensity
Cod	Spawn at low intensity throughout the eastern Irish Sea with a high intensity in the east of the ISZ which is part of an area of high intensity spawning which runs from the mouth of the Solway Firth down to the North Wales coastline.
Hake	Low intensity spawning area around the Isle of Man with the southern part of this area including the western part of the ISZ.
Ling	Ubiquitous low intensity spawning throughout the central Irish Sea (including most of the ISZ).
Horse Mackerel	Low intensity spawning ground includes most of the ISZ and extends across the central part of the Irish Sea.
Mackerel	Low intensity spawning across all of the central and eastern Irish Sea (to include the ISZ).
Plaice	High intensity spawning occurs off the east coast of Ireland and in an area extending from the Solway Firth down to the Welsh coastline (to include the eastern edge of the ISZ). Low intensity spawning occurs throughout the eastern and central Irish Sea.
Sole	Low intensity spawning occurs throughout the Irish Sea and therefore includes the ISZ. High intensity spawning occurs from the Solway Firth down to the North Wales coastline but occurs inshore of the Site.
Sand eel	Spawns at low intensity throughout the eastern and central Irish Sea. High intensity spawning area located inshore from the Site within Liverpool Bay and stretching along the North Wales coastline and the Fylde coast.

Table 7.3 Spawning periods for the main commercial species in the Irish Sea

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cod		*	*									
Whiting												
Plaice	*	*										
Sprat					*	*						
Lemon sole												
Sole				*								
Nephrops				*	*	*						

* peak spawning intensity

Nursery grounds

7.61 As summarised in the ZAP Report, in addition to spawning areas, the Irish Sea also provides important nursery ground habitat for a variety of fish (including commercial) species. The majority of the main nursery grounds are found in the shallower sandier coastal areas inshore from the Site. However, lemon sole (*Microstomus kitt*), nephrops (*Nephrops norvegicus*) and cod (*Gadus morhua*) all have nursery grounds within the ISZ and a herring and whiting (*Merlangius merlangus*) nursery area are also present in close proximity to the zone (Coull *et al*. 1998).

7.62 A number of factors affect the suitability of benthic habitats as nursery grounds such as water depth; coastal or deeper offshore areas, food abundance, habitat type, i.e. rocky reef or sandbank and the prevailing water conditions, i.e. salinity and water temperature (Pawson and Robson 1996, Coull *et al*. 1998). For these reasons, it is expected that the exact boundaries of nursery grounds will vary much in the same way as for spawning grounds, resulting in the locations to be indications only. Spawning and nursery ground areas for the same species are not always in the same geographical areas.

7.63 Nursery ground information for the Irish Sea has also been updated by Cefas. GIS information related to this update has been considered in this report.

7.64 From this data, it appears that cod, whiting and mackerel (*Scomber scombrus*) use the ISZ (as part of much wider areas across the Irish Sea) for nursery areas and the usage is assessed as being low. Spurdog and tope have a high usage of the ISZ for a nursery area but this high usage area includes much of the northern Irish Sea and extends across from the Solway Firth to the Irish coast. Thornback ray *(Raja clavata)*, sole (*Solea solea*), spotted ray *(Raja montagui)*, sand eel (*Ammodytes* sp.) and plaice (*Pleuronectes platessa*) all use inshore sandier areas in other parts of the Irish Sea located outside the Site boundary.

Elasmobranch species

7.65 Elasmobranchs are a potentially vulnerable group as many of the species in this group have lifestyle traits characterised by slow maturation, small brood numbers and low recruitment rates. Such traits can make them vulnerable to the negative effects of habitat destruction and removal, direct overexploitation and high mortality from by-catch and, as a result, elasmobranch abundance in the Irish Sea has declined in recent years. In order to combat this, IUCN enforced protection measures of zero total allowable catch (TAC) have been applied to some key UK species to prevent potential localised extinctions. This restriction aims to allow population numbers to recover through prohibiting landings of these species and also gather data in the way of location of catch, size, species, sex and physical state of the returned fish (Cefas 1999).

7.66 In excess of thirty species of elasmobranch have been recorded in the Irish Sea (Irish Sea Conservations Zones 2011). During the ISZ trawl surveys (2010/11); seven species of elasmobranch were recorded from across the ISZ. From these surveys, the small-spotted Catshark *(Scyliorhinus canicula)* was found to be the most abundant across the ISZ and in the Site, followed by spotted ray *(Raja montagui)*, cuckoo ray *(Raja naevus)*, nursehound *(Scyliorhinus stellaris)*, thornback ray *(Raja clavata)*, blonde ray *(Raja brachyuran)* and smoothhound *(Mustelus asterias)*.

7.67 No rare or endangered elasmobranch species were recorded, although some such as the thornback ray and nursehound are designated as near threatened in UK waters (Ellis 2005). This designation means that the species does not currently qualify for a threatened category, but is close to qualifying as one in the future should current population trends continue (IUCN 2001).

7.68 The overall number of elasmobranchs within the ISZ appears to be lower in spring than in autumn, suggesting a seasonal variation in population abundance.

Migratory species

7.69 The migratory species considered here are diadromous fish. Either they spawn in freshwater and feed at sea (anadromous) or feed in freshwater and spawn at sea (catadromous). As a result of the high number of major rivers terminating into the Irish Sea, a number of diadromous fish species would be expected to traverse the Site or the ISZ area.

7.70 Commercially or recreationally fished species include the Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta*) and European eel (*Anguilla anguilla*). All three are found in virtually all the rivers draining into the Irish Sea.

7.71 Non-commercial anadromous species recorded from rivers and estuaries (Dee, Morecambe Bay, Conwy and Solway Firth) in the eastern Irish Sea include allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*) and the sea lamprey (*Petromyzon marinus*) and the catadromous river lamprey (*Lampetra fluivatilis)*. Each of these species is listed in Annex II of the EC Habitats Directive (1992) as negative human impacts from pollution, overfishing and river obstructions to migration have led to large reductions in numbers making them uncommon in UK waters (JNCC 2011a, JNCC 2011b, JNCC 2011c, JNCC 2011d).

Species of nature conservation interest

7.72 None of the fish species recorded from the ZAP surveys are protected individually under any national or international legislation although commercial marine fish are listed under a grouped species biodiversity action plan (www.ukbap.org.uk). The priority species listed under this action plan are those for which the International Council for the Exploration of the Seas (ICES) scientists' assessment is that they are below Safe Biological Limits (SBL). These include species such as cod, plaice and sole. These fish taxa are protected under the regulations underpinning the Common Fisheries Policy.

7.73 In addition to the European and national legislation that covers the exploitation of marine fish (e.g. Common Fisheries Policy) and migratory species (e.g. UK *Salmon and Freshwater Fisheries Act* 1975), a number of fish species are also subject to a range of national and international conservation measures. Species afforded protection under such national or international conventions which have been previously recorded within the Irish Sea are listed in Table 7.4 alongside the relevant legislative protection.

7.74 Local Biodiversity Action Plans (LBAPs), which are based on administrative counties are applicable to coastal inshore waters, are in place for all skate and ray species in the North Wales counties of Flintshire, Denbighshire, Conwy, Gwynedd and Anglesey and specifically highlight thornback ray, blonde ray and skate (*Raja batis*), as being particularly vulnerable (or in the case of skate, extinct in Irish Sea).

Table 7.4 Protection measures afforded particularly to Irish Sea species (data from Pawson and Robson 1996, Pinnegar *et al*. 2010)

Species	Protection
Allis shad	Appendix II and Appendix III of the Bern Convention Annexes II and V of the Habitats Directive UK BAP species
Twaite shad	Appendix III of the Bern Convention Recommended for addition to Schedule 5 of the Wildlife and Countryside Act 1981 under section 9-(4) (a). Annexes II and V of the Habitats Directive UK BAP species
Sea lamprey	Appendix III of the Bern Convention Annex II of the Habitats Directive
River lamprey	Appendix III of the Bern Convention Annex II of the Habitats Directive
Sturgeon (records from the Dee Estuary)	Appendix III of the Bern Convention CITES species Schedule 5 of the Wildlife and Countryside Act 1981 Annex II of the Habitats Directive
Smelt	Appendix III of the Bern Convention Annexes II and V of the Habitats Directive
Salmon	Appendix III of the Bern Convention but only protected under Annex II of the Habitats Directive when in freshwater.

Export cable route

7.75 The ZAP Report did not characterise the fish and shellfish ecology of the cable route corridor. The EIA, however, will address fish and shellfish ecology of the cable route corridor and local area.

Potential impacts

7.76 Extensive demersal fishing surveys were undertaken across the ISZ in autumn 2010 and spring 2011 and combined with desk-based data and the results of other survey programmes to provide a comprehensive description of the natural fish communities of the ISZ and wider Irish Sea.

7.77 No unusual fish communities or rare fish species were found during the ZAP surveys. In the main, fish communities and individual fish species are wide ranging within and around the Site and the ISZ and there is no indication of especially important areas, either for individual species or for communities. Fish spawning and nursery areas occur in proximity to the Site and the ISZ for a number of species but in all cases the areas involved are part of much wider spawning/nursery areas that also include large areas outside of the ISZ. Spawning areas for herring, which are likely to be more sensitive to disturbance by noise than most fish species, are thought to occur exclusively outside the ISZ, the nearest area being well to the north of the Site, off the east coast of the Isle of Man.

7.78 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction / decommissioning	
Loss of, or disturbance to, fish and shellfish habitat	Direct disturbance to fish and shellfish habitat may occur during construction from foundation installation, anchoring (if used) by installation vessels and cable laying activities. The area affected is likely to be very small compared to the available habitat in the Site and the ISZ and so, whilst it is not possible to confidently scope out this potential issue, the likelihood of environmental effects is low and not anticipated to be a focal issue for the EIA.
Noise disturbance	Noise from underwater piling has the potential to affect noise sensitive fish species such as herring. While injury to individuals is highly unlikely to arise (Nedwell *et al*. 2007) potential disturbance behaviour may arise which may disrupt spawning activity. Although some distance away, potential impacts on herring spawning grounds in the Manx territorial seas will be considered and this is likely to be a focal issue for natural fish communities in the EIA. The significance of noise impacts and the extent to which species will be affected will be dependent on a large number of factors including foundation type and installation method, local conditions and their effect on noise attenuation and fish distribution.
Suspended sediments	Wind farm construction activities, including cable installation, have the potential to generate suspended sediments. High suspended sediment levels may lead to impacts on fish such as the impairment of respiratory or reproductive functions or the disruption of migration/spawning activity. Juvenile and larval stages may be likely to be more susceptible to these effects due to their lower mobility and higher sensitivity to such effects. Given the relatively coarse nature of the sediments and the relatively high background suspended sediment concentration levels associated with the Site it is not anticipated that adverse effects will occur. This issue is also discussed in respect of benthic communities (Section 7.1) and physical processes (Chapter 6).

Potential impacts during operation	
Effects of electromagnetic fields (EMF)	Intra-array and export cables create electromagnetic fields. Elasmobranchs are considered to be sensitive to the effects of EMF, although research undertaken to date has not been conclusive as to the nature of potential impacts. Recent mesocosm studies (Gill *et al.* 2009) showed little conclusive evidence to suggest any effect on elasmobranch species. The impacts associated with EMF at the Site and on the export cable route on elasmobranch species are not anticipated to be significant, particularly given that cables will be buried, where feasible (thereby reducing potential impacts) and that EMF only extend to very low distances (a few metres) from cables.
Changes in community composition or biomass	The presence of foundations and associated scour protection is likely to lead to colonisation by benthic invertebrates. This may increase fish and shellfish diversity. Increased biomass and diversity has been associated with offshore wind farm development although, to date, the effect of the structures' role as fish aggregation devices (the 'Reef Effect') has not been distinguished from the possible effect of safety zones around structures reducing fishing effort within wind farm footprints.
Operational noise	Operational noise impacts are considered highly unlikely to cause physical damage to fish species (Thomsen *et al.* 2006). Studies in the UK in operating wind farms (Nedwell *et al.* 2007) suggest that operational noise is higher than background noise levels within the wind farm footprint but is not discernible further afield. Studies at Nysted and Horns Rev offshore wind farms do not show diminished fish or shellfish diversity or biomass suggesting that any effects of operational noise or vibration is unlikely to be biologically significant.
Potential cumulative impacts	
Construction noise	The offshore construction programme for RWF commences in 2017 (see Chapter 4). It is anticipated that construction of Gwynt y Môr, Walney extension and Burbo Bank extension will all be completed by 2016 and so there is no potential for cumulative construction noise impacts with those projects. However as was undertaken for the ZAP noise assessment for marine mammals a one year overlap in construction will be considered as part of the EIA.
Electromagnetic Fields (EMF)	As discussed above, the potential impacts resulting from electromagnetic fields (EMF) are currently poorly understood with studies having been largely inconclusive. The intra-array and export cables associated with other wind farms may, subject to the findings of ongoing monitoring studies, have the potential to give rise to cumulative impacts on elasmobranch species.

Suspended sediments	Based on the results of the marine ecology and physical processes assessments presented in the ZAP Report, the potential for cumulative and/or in combination impacts on natural fish communities in the Site is not anticipated. However, this position will be reconsidered should this consultation or future consultations identify additional activities that Celtic Array is not aware of. However, there is the potential for cumulative and/or in combination impacts to arise within the export cable corridor(s).

Scoping Opinion from the Planning Inspectorate

7.79 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to fish ecology:

- The Secretary of State welcomed the fact that there had been engagement with relevant bodies as part of the Zonal Appraisal Planning Report and supports ongoing engagement with these parties (i.e. CCW, JNCC, NE, MMO, Cefas and the Isle of Man DEFA);
- The potential noise and vibration impacts on possible spawning grounds should be considered in the ES and potential mitigation measures should be investigated;
- Operational noise on fish ecology should be scoped into the EIA;
- The Secretary of State considers that the ES should include an assessment of the effect of EMF on fish, shellfish and elasmobranch ecology; and
- The Secretary of State welcomes the intention to cross refer fish ecology to relevant matters regarding commercial fisheries in the ES.

7.80 With respect to operational noise the Planning Inspectorate opined that operational noise on fish ecology should be scoped in to the EIA. As detailed in the table above operational noise impacts are considered unlikely to cause physical damage and monitoring results from operational wind farms suggest no impact. However, this issue will be considered further at EIA.

7.81 The potential for changes to community composition and biomass during the operation of the wind farm will be considered as part of the EIA.

Approach to address Scoping Opinion

7.82 The level of detail as to how these issues will be addressed will be determined following Stage 1 consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA survey and study programme

7.83 As a result of the extensive data collected as part of the ZAP process, Celtic Array does not anticipate a need to collect further data on demersal fish communities for the purposes of EIA.

7.84 The EIA for RWF will build on the extensive desk-based and demersal trawl survey data collected as part of the ZAP process and update the data described above as necessary. Celtic Array intends to make use of long-term datasets held for the Irish Sea area, such as the annual Cefas trawl surveys, in order to ensure that an accurate baseline and longer-term trends in natural fisheries communities are captured.

7.85 The scope and extent of studies will be agreed with relevant stakeholders, including MMO, MCU, JNCC, CCW, Cefas and Isle of Man DEFA. This will include assessment of the cable route corridor. Potential indirect effects on other receptors, such as marine mammals and bird predators, will be assessed as part of the EIA and reported in the ES.

Noise modelling

7.86 The potential for impacts from noise on noise-sensitive fish species and fish at vulnerable life stages will be addressed through modelling of the noise propagation associated with the construction of RWF via the Engineering Envelope described in Chapter 5 above. The scope of this modelling and relevant fish species to be included for assessment of noise impacts will be agreed with relevant stakeholders.

Fish spawning survey

7.87 The requirement for fish spawning studies and impact assessment work is being established and agreed with the relevant statutory organisations. The potential for cumulative effects to arise with other activities taking place in the Irish Sea will also be addressed.

7.88 The EIA will also draw on information obtained from the benthic surveys (see Section 7.1) and consultation with the fishing industry (see Section 8.1).

7.89 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, consultation derived data and information. This description will include analysis of the survey data described above;
- A review and summary of consultation activities including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative impacts;
- A review and summary of physical processes surveys and studies incorporating any identified key issues specifically regarding fish and shellfish habitat, such as any identified smothering or sediment regime change implications. Cross-referencing to the relevant chapters of the ES will be included (see Chapter 5);
- A review and summary of other relevant information contained in ES chapters including cross-referencing to commercial fisheries (see Section 8.1) and benthic ecology (see Section 7.1) issues; and
- Proposals for mitigation measures and monitoring, if required.

7-3 Biological environment – marine mammals, turtles and basking shark

Introduction

7.90 This section describes the distribution and abundance of marine mammals, turtles and basking sharks in and around the Site and the potential impacts of wind farm development on those species and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees which will be used to inform the RWF EIA.

7.91 For the purposes of this report, basking sharks, by reason of their size and reproductive ecology, are considered to have more in common with other large marine megafauna such as marine mammals and turtles than with other fish, which are considered in Section 7.2, Fish and Shellfish Ecology.

Surveys and studies carried out to date

7.92 As described in Chapter 4, Celtic Array commissioned monthly boat-based surveys over a two year period (Celtic Array 2012). The ZAP Report included full zonal characterisation using the marine mammal and basking shark survey data and consultation responses.

7.93 Data informing the ZAP Report and this Stage 1 PEI Report included:

- Aerial survey data (The Crown Estate 2009);
- Atlas of cetacean distribution in Northwest European waters (Reid *et al*. 2003) ;
- Marine Conservation Society basking shark watch 20-year report (1987-2006), (Bloomfield and Solandt 2008);
- Atlas of the marine mammals of Wales (Baines and Evans 2009);
- Irish Cetacean Review (2000-2009) (Berrow *et al*. 2010);
- Manx Wildlife Trust database;
- Manx Basking Shark Watch website - sightings collated around the Isle of Man from 2004 to date (www.manxbaskingsharkwatch.com);
- National Biodiversity Network, NBN (2011) - accessed for information on turtles to determine presence and utilisation of the Irish Sea waters;
- Small cetacean abundance in the North Sea (SCANS I) (Hammond *et al*. 1995, 2002);
- Small cetaceans in the European Atlantic and the North Sea (SCANSII 2008);
- Special Committee on Seals (SCOS) reports (SCOS 2010);
- Strategic Environmental Assessment (SEA) technical report (Hammond *et al*. 2005);
- Sea Mammal Research Unit (SMRU) telemetry data (Matthiopoulos *et al*. 2004, Hammond *et al*. 2005, Thompson *et al*. 2011);
- The West Wales grey seal census (Baines *et al*. 1995); and
- TURTLE database, (Pierpoint 2000), TURTLE database (2011) - records (published and unpublished) of turtle strandings and sightings around the UK and the Republic of Ireland.

7.94 Boat-based surveys were carried out on a monthly basis between March 2010 and April 2012 according to a methodology agreed with CCW, NE and JNCC. The objective of the survey programme was to collect data on the distribution, activity and behaviour of marine mammals (and other large marine megafauna) throughout the ISZ. The surveys comprised both visual surveys using Marine Mammal Observers and passive acoustic monitoring (PAM) using a towed hydrophone array.

7.95 A total of seventeen transects, orientated north east/south west across the ISZ were traversed during twenty-seven surveys between March 2010 and April 2012 (Figure 7.6).

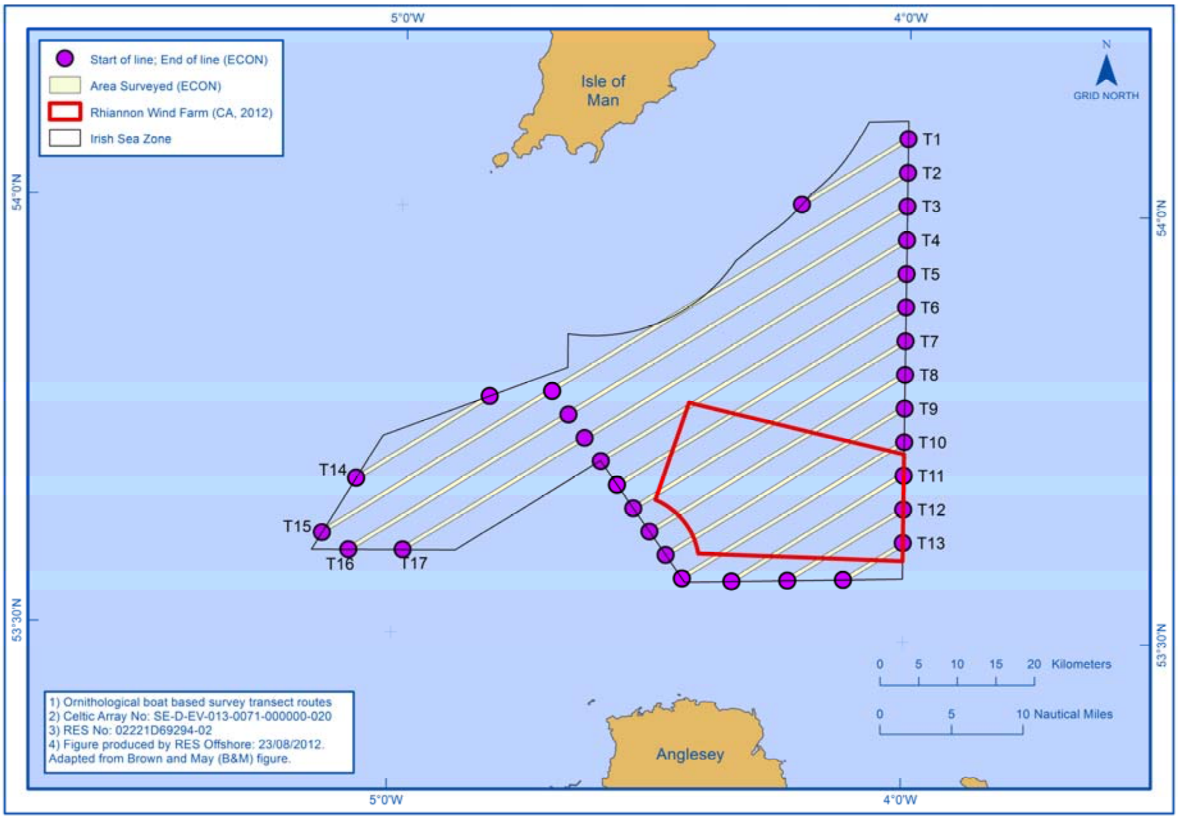


Figure 7.6 Location of survey transects within the Irish Sea Zone

Stakeholder consultation

7.96 As part of the ZAP Report consultation has taken place with CCW, JNCC, NE, MMO, Cefas and Isle of Man DEFA and a number of non-statutory conservation organisations such as the Manx Wildlife Trust, Whale and Dolphin Conservation Society (WDCS) and Sea Watch Foundation. Consultation with these parties will continue as the EIA progresses. In addition a number of consultees have been consulted on the scope of the EIA by the Planning Inspectorate, as detailed in the Scoping Opinion. Consultation with these parties will continue as the EIA progresses.

Description of current environment

7.97 Published data has identified a total of twenty cetacean and two pinniped species which have been recorded in the Irish Sea. Of these, many are considered to be only rare, scarce or occasional visitors, or are documented only from strandings (especially deep-water species such as beaked whales). Generally, the northern half of the Irish Sea (north of Anglesey) in which the ISZ is located has a lower sightings rate and species diversity for cetaceans, in comparison with the southern Irish Sea (Evans and Shepherd 2001, Hammond *et al*. 2002, Baines and Evans 2012, Evans 2012). This is likely a result of its shallow depth and its location away from the majority of migration routes and the deeper waters off the shelf edge. However, in the Irish Sea region there are specific areas of high species diversity and high sightings rates for marine mammals such as north of Colwyn Bay and south of the Isle of Man for grey seals (*Halichoerus grypus*) and just off the north coast of Anglesey and Llŷn Peninsula for Risso's dolphins (*Grampus griseus*). Cardigan Bay and the north coast of Anglesey has high sighting rates for bottlenose dolphin (*Tursiops truncates*), indeed Cardigan Bay has the largest population of bottlenose dolphins in Europe and is internationally designated.

7.98 Seven marine mammal species are known to occur regularly and on a year round basis (or on an annual seasonal basis) in Irish Sea waters, comprising two species of pinniped (common (*Phoca vitulina)* and grey seal) and five cetacean species (common minke whale, *Balaenoptera acutorostrata*; Risso's dolphin; bottlenose dolphin; short-beaked common dolphin, *Delphinus delphis* and harbour porpoise, *Phocoena phocoena*) (Reid *et al*. 2003, Hammond *et al.* 2005, Baines and Evans 2012, Berrow *et al.* 2010).

7.99 The basking shark (*Cetorhinus maximus*) is regularly recorded around the Isle of Man, with the highest densities to the south and south west around the Calf of Man and along the western coast. The north east coast is the area of lowest density, while scattered records occur in the ISZ.

7.100 Of the seven marine turtle species in the world five have been recorded in UK. Of these only one is frequently reported in UK waters, the leatherback turtle *Dermochelys coriacea*, with other recorded species likely to be vagrants. Leatherback turtles are known to frequent the Irish Sea with significant numbers of sightings recorded off Anglesey and the Isle of Man (TURTLE database).

7.101 All of these species may occur within the Site. A summary of the conservation status and occurrence of these species is provided in Table 7.5.

Table 7.5 Conservation status and occurrence of marine mammals, basking shark and turtle species encountered regularly within the Irish Sea region

Common name	Scientific name	Habitats Directive Annex[2]	UK BAP species	Seasonality in Irish Sea	Distribution	Irish Sea population (derived from SCANS II unless stated otherwise)	European population (unless stated otherwise)
Common minke whale	*Balaenoptera acutorostrata*	IV	Yes	Seasonal	Coastal and offshore	**1,073**	SCANS II: **18,614** [95% CI = 10,445-33,171] CODA: **6,765** [95% CI = 1,239-36,925]
Risso's dolphin	*Grampus griseus*	IV	Yes	Year round	Offshore	No estimate	JNCC *et al* (2010): Estimated at **100s, 1000s**
Bottlenose dolphin	*Tursiops truncatus*	II & IV	Yes	Year round	Coastal	**235**	SCANS II: **12,645** [95% CI = 7,504-21,307] CODA: **19,295** [95% CI = 11,842-31,440]

[2] II: Species requiring designation of Special Areas of Conservation; IV: Species in need of strict protection; V: Species whose taking from the wild can be restricted by European law.

Common name	Scientific name	Habitats Directive Annex[2]	UK BAP species	Seasonality in Irish Sea	Distribution	Irish Sea population (derived from SCANS II unless stated otherwise)	European population (unless stated otherwise)
Common dolphin	*Delphinus delphis*	IV	Yes	Year round	Coastal and offshore	**366**	SCANS II: **63,366** [95% CI = 26,973-148,865] CODA: **162,266** [95% CI = 65,990-399,001]
Harbour porpoise	*Phocoena phocoena*	II & IV	Yes	Year round	Coastal and offshore	**15,230**	SCANS II: **385,617** [95% CI = 261,266-569,153]
Grey seal	*Halichoerus grypus*	II & V	n/a	Year round	Coastal and offshore	2009 pup production (SCOS 2010): Wales: **1,650** Northern Ireland: **100** Population estimates: **5,198-6,976** (Irish and Celtic Seas) (Kiely *et al*. 2000) **~ 5,000** (Baines *et al*. 1995)	2009 UK pup production (SCOS 2010): **47,540** 2009 UK population estimate (SCOS 2010): **106,200** [95% CI= 82,00 – 138,700]

Common name	Scientific name	Habitats Directive Annex[2]	UK BAP species	Seasonality in Irish Sea	Distribution	Irish Sea population (derived from SCANS II unless stated otherwise)	European population (unless stated otherwise)
Common (harbour) seal	*Phoca vitulina*	II & V	Yes	Year round	Coastal and offshore	**~1,300** (Duck 2006)	UK population estimate (2009): **40,000 – 46,000** (SCOS 2010)
Basking shark	*Cetorhinus maximus*	Not relevant[3]	Yes	Seasonal	Coastal and offshore	No estimate	No estimate
Leatherback turtle	*Dermochelys coriacea*	IV	Yes	Largely seasonal	Coastal and offshore	No estimate	No estimate

[3] Protected under Schedule 5 of the Wildlife and Countryside Act 1981 out to 12nm

7.102 Field data gathered during the boat transect surveys of the ISZ indicate that harbour porpoise and grey seal are the most frequently encountered marine mammal species in the ISZ. Three dolphin species were recorded in low numbers.

7.103 Boat-based visual surveys recorded a total of 298 cetacean and 66 pinniped sightings within the ISZ (Table 7.6). A single basking shark sighting was also recorded. Five species of cetacean and one pinniped species were identified, all of which are known to occur in the wider Irish Sea region regularly. The harbour porpoise dominated the marine mammal observations, with 265 sightings recorded. The minke whale was the only baleen whale species recorded, with 17 sightings (one other baleen sighting was unidentified). Only three dolphin species were recorded. The grey seal was the only pinniped species recorded and the many unidentified seals were also most likely to have been this species. No marine turtles were recorded.

7.104 There were 310 acoustic detection events recorded during acoustic surveys. The vast majority of these detections comprised harbour porpoise click trains. However, there were also five detections of dolphins.

Table 7.6 Summary of marine mammals recorded during visual and acoustic surveys of the ISZ carried out from March 2010 to September 2011

Species	Total visual sightings	Total visual individuals	Total acoustic detections †
Harbour porpoise	**265**	**467**	**305**
Bottlenose dolphin	4	13	
Common dolphin	1	8	
Risso's dolphin	3	18	
Dolphin species	6	10	5
All dolphins	**14**	**49**	**5**
Minke whale	17	19	
Baleen species	1	1	
All baleen whales	**18**	**20**	
Cetacean species	1	1	
All cetaceans	**298**	**537**	**310**
Grey seal	53	53	
Seal species	13	13	
All seals	**66**	**66**	
All marine mammals	**364**	**603**	
Leatherback turtles	0	0	
Hardback turtle species	0	0	
Turtle species	0	0	
All turtles	**0**	**0**	

Species	Total visual sightings	Total visual individuals	Total acoustic detections †
Sunfish	0	0	
Basking shark	1	1	
Other sharks	0	0	
All large fish	**1**	**1**	

† Few porpoise detections could be extracted from click files recorded between March and July 2010 (surveys 1-6) due to technical problems with the vessel's high-frequency echo-sounder (all detections are included in this Table).

7.105 Harbour porpoise occur in the ISZ throughout the year but particularly during the period from spring to autumn. They are widely distributed across the entire ISZ but densities appear to be highest in the west, where there is an offshore bank and bathymetry is more variable. Both visual and acoustic data suggested that the Site (and the south east area of the ISZ in general) was generally the lowest used area by porpoises in the ISZ. The data also indicate that during the winter, as well as the summer, relatively high proportions of calves/juveniles may be present within the ISZ.

7.106 Grey seals are numerous within the Irish Sea, with the Welsh territorial seas holding 90% of the breeding population for the region. Haul-out counts at sites adjacent to the ISZ, such as the Isle of Man and West Hoyle sandbank, sometimes number over 400 and 500 animals respectively. Seasonal fluctuations in the peak haul-out counts at these sites may be suggestive of movements of animals between sites. At least some of the large number of animals using these haul-out sites would certainly be expected to forage within the Site at times. The ZAP surveys suggest that these animals' use of the Site as a foraging ground is likely to be year round, but with peak densities during April and May following the moulting season. Telemetry data confirm the wide-ranging nature of seal foraging although the identity of prey species and their presence or absence in different areas, could not be ascertained by the fish ecology surveys described in Section 7.2.

7.107 The importance of the Irish Sea region for basking sharks remains unclear, although it is certainly apparent that significant numbers of sharks occur locally in the waters around the Isle of Man during the summer (MWDW 2011). Seasonal data from the Isle of Man indicate an expected presence near, if not within, the Site between May and August. Their use of the area during other seasons remains unclear although recent tagging studies (Stéphan *et al*. 2011) suggest that sharks may be present at greater depths than previously understood and therefore detection may be challenging. The same study confirms an association between sharks and areas of sea associated with the Manx West Coast front and the Western Irish Sea front (Stéphan *et al*. 2011).

7.108 There are relatively few sightings of marine turtles in the ISZ or broader Irish Sea area (TURTLE Database). None were recorded during surveys associated with the ZAP Report.

Protected areas

7.109 Within the Irish Sea region there are five SACs for which marine mammals are qualifying features (Table 7.7). The most important of these based on their grading are the Cardigan Bay SAC for bottlenose dolphins (one of the primary features for the selection of this site) in Wales and the Lambay Island SAC for grey seals in Ireland. Additionally, there are two marine mammal SACs located just outside of the Irish Sea region, both of which are of European importance for grey seals.

Table 7.7 Special Areas of Conservation within and adjacent to, the Irish Sea where marine mammals are grade A-C qualifying features*

SAC site	Country	Species
Within the Irish Sea		
Cardigan Bay/Bae Ceredigion	Wales	Bottlenose dolphin, grey seal
Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau	Wales	Bottlenose dolphin, grey seal
Lambay Island	Ireland	Grey seal
Murlough	Northern Ireland	Common seal
Strangford Lough	Northern Ireland	Common seal
In close proximity to the Irish Sea		
Pembrokeshire Marine	Wales	Grey seal
Saltee Islands	Ireland	Grey seal

**Further details on these sites are included in the nature conservation Section 7.5.*

Potential impacts

7.110 The collection and assessment of data collected as part of ZAP has provided a clear focus for the RWF EIA. Information collected as part of an extensive monthly boat-based survey was supplemented with available desk-based data to estimate density and usage of the Site and the ISZ by marine mammals and other large megafauna. The subsequent assessment of this baseline data has identified the potential impacts that should focus attention for the RWF EIA.

7.111 Published data identified a total of 20 cetacean and two pinniped species in the Irish Sea although only five species of cetacean, one pinniped and a single basking shark individual was sampled as part of the dedicated ZAP ISZ surveys. Harbour porpoise was by far the most numerically dominant cetacean species and grey seal the most numerically dominant pinniped.

7.112 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction/decommissioning	
Impacts of construction noise on marine mammals	Many species of marine mammal use sound for prey detection, communication and navigation. High levels of anthropogenic noise which falls within the audible range of a marine mammal has the potential to give rise to the masking of vocalisations used to communicate and forage or invoke behavioural responses, auditory injury (either permanent or temporary) and, in extreme cases, severe injury or even death. In recent years, the potential ecological impacts of underwater noise associated with the construction of offshore wind farms has been a subject of substantial research (e.g. Bailey *et al*. 2010, Nedwell *et al*. 2004, Nedwell *et al.* 2007a and 2007b, Thomsen *et al*. 2006 and Tougaard *et al*. 2003a and 2003b). It is widely accepted that impact piling operations can give rise to levels of noise with the potential to affect marine mammals within and close to offshore wind farm development areas. Lethal effects may arise in close proximity (tens of metres) to piling operations although such risks can be effectively managed through mitigation involving postponement of the commencement of piling operations until a monitored area is clear of marine mammals. Upon commencement of piling, 'soft start' procedures are also likely to provide effective mitigation. At greater distances, effects may include permanent damage to hearing (permanent threshold shift (PTS)), temporary effects on hearing (temporary threshold shifts (TTS)) and behavioural effects which may include aversion to high noise levels resulting in displacement from an area.
Indirect effect of construction noise on prey species of marine mammals	As discussed in Section 7.2, the prey species of marine mammals (fish) can also be affected by high levels of underwater noise, particularly 'hearing specialists' such as herring. Noise modelling and measurements at a number of wind farm projects has suggested that displacement of noise sensitive fish species is likely to occur over smaller distances than analogous effects on marine mammals (Thomsen *et al* 2006), suggesting that prey species in the vicinity of displaced marine mammals will be less affected by underwater noise. However, longer term impacts associated with spawning etc. will be discussed as part of the fish ecology chapter of the ES and cross-referenced appropriately.
Impacts of construction noise on basking shark and turtles	Noise impacts on basking shark and turtle are poorly understood. It is not thought that they rely significantly on sound for prey detection, communication or navigation. However, the ES will consider the potential for impacts using available data.

Risk of collision with vessels	There is the risk that vessels associated with construction activities and particularly faster moving crew transfer vessels, may collide with marine mammals, basking shark or turtles. Such impacts, if assessed to be likely, can be mitigated through appropriate safeguards in environmental management plans associated with the construction activities. The incidence of 'cork screw' injuries on seals has been linked by some parties to ducted propeller systems on vessels (SMRU 2010). However, there is currently no conclusive scientific evidence on this matter. As part of the ongoing consultation process, Celtic Array will discuss this issue with MMO, CCW, NE and JNCC to ensure that, if necessary, it is appropriately addressed in the ES.
Potential impacts during operation	
Effects of turbine on physical processes – basking shark and tidal fronts	Analysis of the distributional and behavioural information on basking shark, together with advice from stakeholder consultation, suggests that consideration may be required in respect of potential impacts on tidal fronts and associated effects on the feeding and migration patterns of individuals. A recent study involving the tagging of basking shark confirms an association between sharks and areas of sea associated with the Manx West Coast front and the Western Irish Sea front (Stéphan *et al*. 2011). Any changes affecting tidal fronts could give rise to alteration in mixing and primary productivity with resulting changes in levels of the plankton on which the sharks depend. Studies associated with offshore wind farms (e.g. Cefas 2005) and project environmental statements have concluded that impacts associated with marine processes (currents and tides) are generally only minor in scale and 'near-field' (i.e. occurring within or close to individual wind farm footprints). The ZAP physical process studies concluded that any effects on the frontal systems would be insignificant.
Risk of collision with vessels	There is the risk that vessels associated with operation and maintenance (O&M) activities and particularly faster moving crew transfer vessels, may collide with marine mammals, basking shark or turtles. Such impacts, if assessed to be likely, can be mitigated through appropriate safeguards in environmental management plans associated with the construction activities.
Effects of operational noise	Studies in the UK in operating wind farms (Nedwell *et al.* 2006) suggest that operational noise is higher than background noise levels within the wind farm footprint but is not discernible further afield. Studies at Nysted and Horns Rev offshore wind farms and monitoring at other projects suggest that marine mammals are not inhibited from entering a wind farm footprint, either by reason of operational noise or otherwise. In respect of seals, studies did not

	indicate a difference in the use of the wind farm area when compared to surrounding areas at Horns Rev (Teilmann *et al.* 2006). Similarly at Horns Rev, no effects were observed for harbour porpoise during normal operation, although at Nysted the picture is more complicated with porpoise abundance at a lower level after two years than before construction, possibly as a result of the strong negative reactions to construction (Teilmann *et al*. 2006).
Effects of electromagnetic fields (EMF)	As discussed in Section 7.2 (fish and shellfish ecology), EMF may affect certain sensitive species. The sensitivity of basking shark to EMF is not well understood but will be considered in the ES.
Potential cumulative effects	
Cumulative impacts may arise with all of the projects discussed in Chapter 5. These may arise in respect of other wind farm developments where there is the potential for cumulative underwater noise impacts to affect marine mammals, basking shark and turtles. The most likely significant impact will, if driven piles are utilised, relate to potential behavioural responses in marine mammals. Such effects could arise as a result of two or more projects undertaking piling simultaneously (spatial cumulative impacts) or piling on different projects taking place over consecutive spawning periods (temporal cumulative impacts). As discussed above and in Section 7.2, the potential impacts resulting from EMF are currently poorly understood with studies having been largely inconclusive. The intra-array and export cables associated with other wind farms may, subject to the findings of ongoing monitoring studies, have the potential to give rise to operational cumulative impacts on basking shark. Other relevant activities may include increases in vessel traffic and increased collision risk with marine mammals, basking shark and turtles, associated with activities in the Irish Sea and Liverpool Bay area including crew transfer vessels from wind farms and oil and gas facilities.	

7.113 In addition to the above Celtic Array recognise the potential for disturbance to marine mammals under the European Protected Species (EPS) process. Dialogue with JNCC, Welsh Government, CCW and Natural England will continue throughout the pre-application stage on this subject.

Scoping Opinion from the Planning Inspectorate

7.114 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. With the exception of the effects of turbines on tidal fronts and operational noise, all issues in the table above were scoped in the EIA. The following represents the Planning Inspectorate's opinion in respect to marine mammals, turtles and basking shark:

- The Secretary of State welcomed the level of engagement which had occurred with relevant bodies and recommends an ongoing involvement with these bodies;

- The Secretary of State considers that there was a need to further consider the impacts of the proposals on protected species such as the Risso's Dolphin;
- The Secretary of State recommended that the assessment of impacts of the proposal on all protected species found in the study area were comprehensive and up to date;
- The Secretary of State welcomed the inclusion of potential offshore noise on marine mammals and their prey species. There is potential for noise impacts particularly during the construction stage which should be assessed;
- The ES should set out in full the potential risk to any European Protected Species (EPS) and confirm whether any EPS Licence is required. Celtic Array will take into account any recent changes in legislation with regard to EPS Licence procedure;
- The Secretary of State suggested that consideration was given to whether any further assessments or surveys would be deemed necessary upon reviewing the baseline assessment for species;
- The Secretary of State did not agree that the impacts of operational noise on marine mammals should be scoped out as there is currently a lack of information available to demonstrate that marine mammals are not adversely affected by operational noise of wind; and
- The Secretary of State recommended that the effect of vibration from construction on marine mammals is considered as part of the ES.

Approach to address Scoping Opinion

7.115 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. All types of piling and other noisy activities will be scoped into the assessment including timescales of activity. Effects associated with decommissioning are expected to be similar to those experienced under construction. As required under the Energy Act 2004 a decommissioning programme will be agreed and will need to comply with all relevant UK legislation at the time.

EIA survey and study programme

7.116 The EIA for RWF will build on the data collected as part of the ZAP process and update the data described above as necessary. In particular, following consultation with the MMO, CCW, NE, the Manx Wildlife Trust and JNCC, a number of technical scopes, surveys and studies have been commissioned as described below.

Project specific aerial surveys

7.117 A high-definition camera aerial survey is currently underway to further record the distribution and abundance of marine mammals within and adjacent to the Site (see Section 7-4 Ornithology). Aerial surveys have achieved a good detection rate for marine mammals (Scheidat *et al.* 2012) and have been used to collect data to inform designation of protected areas (e.g. ASCOBANS 2012). The approach and methodology for the aerial surveys was agreed with key stakeholders.

Noise modelling

7.118 The potential for impacts from noise will be addressed through modelling the noise propagation associated with the construction of the project 'Engineering envelope' described in Chapter 5 above. The scope of this modelling will be agreed with relevant stakeholders but is likely to include calculation of thresholds for injury, PTS, TTS and behavioural responses for harbour porpoise and grey seal. The appropriate metrics to be applied when establishing thresholds will be agreed with relevant statutory consultees.

Further studies and surveys

7.119 As concluded by the ZAP Report following the outcome of the noise modelling further data on how marine mammals, basking shark (and turtles) use the Site may be required. Such matters would need to be discussed in more detail with consultees. This may be particularly relevant to HRA issues where assessment of effects on designated sites and their features is required.

7.120 As discussed above, marine mammal surveys of the export cable corridor have not taken place. Given that (from experience of other wind farm projects) other than in respect of EMF impacts on basking shark, any effects are likely to be temporary and unlikely to give rise to a significant effect on marine mammals, turtles and basking shark, it is proposed that assessment of such impacts in the ES will be based on currently available distribution data and, therefore, that further surveys will not be required.

7.121 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, consultation derived data and information. This description will include analysis of the survey data described above;
- A review and summary of consultation activities including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative impacts;
- A review and summary of fish ecology surveys and studies incorporating any identified issues regarding underwater noise impacts on the fish prey of marine mammals. Cross-referencing to the relevant chapters of the ES will be included;
- A review and summary of physical processes surveys and studies incorporating any identified issues which may adversely affect basking shark distribution. Cross-referencing to the relevant chapters of the ES will be included; and
- Proposals for mitigation measures and monitoring, if required.

7.122 The following guidance documents will be used to inform the impact assessment for marine mammals:

- Guidance on the Assessment of Effects on the Environment and Cultural Heritage from Marine Renewable Developments. Produced by: MMO, JNCC, NE, CCW and Cefas (In draft 2011);
- Approaches to Marine Mammal Monitoring at Marine Renewable Energy Developments Final Report. Report by The Sea Mammal Research Unit on behalf of The Crown Estate. August 2010;
- The Protection of Marine European Protected Species (EPS) From Injury and Disturbance: Guidance for the Marine Area in England and Wales and the UK Offshore Marine Area, draft (JNCC *et al*. 2010);

- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects. Draft for Consultation. (Cefas 2011); and
- Statutory Nature Conservation Agency Protocol for Minimising the Risk of Injury to Marine Mammals from Piling Noise (JNCC 2010).

European protected species

7.123 Under Article 12 of the EU Habitats Directive, Member States are required to take the requisite measures to establish a system of strict protection for EPS in their natural range prohibiting (a) all forms of deliberate capture or killing of specimens of these species in the wild, (b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration and (c) deterioration or destruction of breeding sites or resting places.

7.124 EPS are species which are listed in Annex IV of the Habitats Directive and include all cetaceans (such as harbour porpoise).

7.125 The JNCC, NE and CCW have produced draft guidance (JNCC *et al.* 2010) concerning the protection of marine EPS from injury and disturbance, which provide an interpretation of requirements under the Habitats Directive and associated UK regulations, particularly in respect of the potential impacts of underwater noise.

7.126 The guidance proposes that:

- *"A permanent shift in the hearing thresholds (PTS) of an EPS would constitute an injury offence. The Southall et al. (2007) precautionary criteria for injury are based on quantitative sound level and exposure thresholds over which PTS-onset could occur. If it is likely that an EPS could become exposed to sound at or above the levels proposed by Southall et al. (2007) then there is a risk that an injury offence could occur. The risk of an injury offence will be higher in areas where EPS occur frequently and/or in high densities.";* and
- *"The disturbance offence catches disturbance which is significant in that it is likely to be detrimental to the animals of an EPS or significantly affect their local abundance or distribution. Such disturbance could therefore be likely to increase the risk of a negative impact to a population of an EPS at Favourable Conservation Status (FCS) in their natural range. Sporadic disturbances without any likely negative impact on the species, i.e. trivial disturbances such as that resulting in short term behavioural reactions, are not likely to result in an offence being committed...The risk of a disturbance offence being committed will therefore exist if there is sustained noise in an area and/or chronic noise exposure, as a result of an activity. The risk is likely to be higher in regions where there are semi-resident populations or where animals of a species occur frequently and in high densities."*

7.127 The marine EPS guidance (JNCC *et al*. 2010) states: *"for most populations of marine EPS in UK waters, the removal of tens, hundreds and even thousands of animals for the most abundant species (e.g. harbour porpoise), would not result in detriment to the population at FCS".* However, this is not interpreted to mean that efforts and mitigation measures would not be used to prevent disturbance or injury.

7.128 Potential implications for EPS licensing (primarily in respect of harbour porpoise) will be discussed in the ES. Information to support the assessment of whether a licence is required or not will also be provided.

Habitats Regulations Assessment

7.129 The Round 3 AA concluded that developing offshore wind in the ISZ will not adversely affect the integrity of European sites provided that wind farm projects within the ISZ adhere to either:

- ‘General Environmental Measures’; or
- Specific, project-level mitigation to avoid, reduce and offset significant impacts.

7.130 In the absence of detailed project information, the Round 3 Appropriate Assessment noted that the positive conclusion relied on the ability of developers to demonstrate no adverse effect at a project level.

7.131 The ZAP Report concluded that HRA may be required in respect of grey seals associated with a number of SACs, most notably from the Lleyn Peninsula and the Sarnau SAC. Individuals from these sites may be found within the RWF Site. The modelling carried out for the ZAP Report suggested that individuals in foraging areas may be affected by piling noise although the number of individuals affected and the biological significance of such impacts cannot be assessed at this time. Further study may be required in this respect and HRA screening will assist with this process. This is discussed further in Section 7.5, Nature Conservation Designations.

7.132 It is not anticipated that HRA will be required in respect of the Harbour porpoise. Although individuals that frequent the locality of SACs in Cardigan Bay and Pembrokeshire may visit the Site, the species is categorised by the JNCC in respect of those SACs as "*non-qualifying features (non-significant presence)*". Potential impacts on the porpoise population of the wider Irish Sea area will be considered as part of the EIA process, following consultation with CCW and JNCC.

7.133 Given the small number of bottlenose dolphin recorded during visual surveys and acoustic dolphin detections, it is not anticipated that HRA will be required in respect of the status of this species as a qualifying features of the Cardigan Bay and Pen Llŷn a'r Sarnau SACs (Table 7.6). The largely coastal distribution of bottlenose dolphin (Reid *et al.* SCANS II) suggest that offshore areas such as the Site are not of particular importance for the species, although areas closer inshore to the north Anglesey coast are used by bottlenose dolphins from Cardigan Bay (Pesante *et al*. 2008). It is proposed that this issue be further discussed with CCW as part of the EIA process.

7-4 Biological environment – ornithology

Introduction

7.134 This chapter characterises the ornithology of the Site and surrounding area, describes the potential impacts of wind farm development on birds and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees which will be used to inform the RWF EIA process.

Surveys and studies carried out to date

7.135 As part of the ZAP Report, issues associated with the features of nature conservation sites listed below were considered. The main designations considered were Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs), or, in Northern Ireland, Areas of Special Scientific Interest (ASSIs) and Marine Conservation Zones (MCZs).

- Benthic ecology – SACs, SSSIs, MCZs;
- Fish ecology – SACs;
- Ornithology – SPAs, SSSIs/ASSIs; and
- Marine mammals – SACs.

7.136 Potentially significant impacts on features afforded protection by these designations are considered in the relevant chapters, namely those relating to benthic ecology (Section 7.1), fish and shellfish ecology (Section 7.2), marine mammals (Section 7.3) and birds (this section).

7.137 As part of the ZAP process described in Chapter 4, Celtic Array commissioned an ornithological study (Celtic Array 2012). The ZAP Report included full zonal characterisation of the main bird species in the ISZ based around the collection of survey data and consultation.

Boat-based survey programme

7.138 The primary data source used to inform this report and the ZAP Report is the boat-based survey programme commissioned by Celtic Array to characterise the ornithology of the ISZ.

7.139 These surveys commenced in March 2010 and finished in April 2012, with a survey frequency of broadly one survey per month. Additional surveys were undertaken in key periods in the summer months.

7.140 The survey methodology, which was agreed with the statutory advisors JNCC, CCW and NE in April 2011, was based on COWRIE recommendations (Camphuysen *et al*. 2004). As shown in Figure 7.7, the sampling design for the ISZ incorporated seventeen line transects orientated from north east to south west, with a line spacing of 3.7km (i.e. within the 2nm recommended by COWRIE).

7.141 Six out of 28 surveys (25%) were not fully completed due to poor weather conditions. Other than one instance in May 2011, such conditions were encountered in the late autumn and winter. This means that the focus of the ZAP Report on summer visiting Manx shearwater has not been adversely affected.

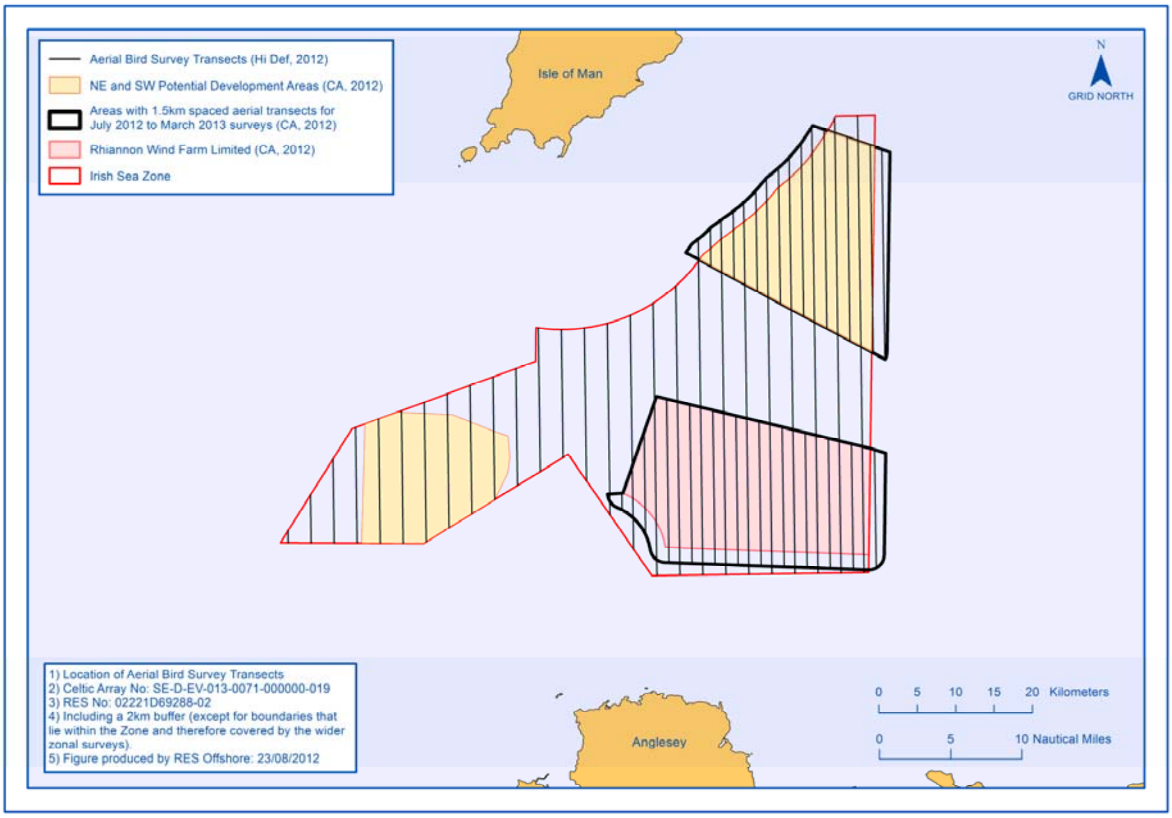


Figure 7.7 Aerial bird survey transects across the RWF Site and the ISZ

Additional survey data and sources of information

7.142 In addition to the boat-based, surveys the following sources of information have also been considered in this report:

- Aerial surveys undertaken by WWT Consulting (2009) commissioned by DECC. Five surveys of blocks covering the ISZ area were undertaken from November 2007 to July 2008 covering mid-winter (pre New Year), mid-winter (post New Year), late winter, breeding-incubation and breeding-chick rearing periods;
- A further five surveys were commissioned by The Crown Estate in 2009 in relation to the development of the ISZ;
- An Atlas of Seabird Distribution in north west European Waters (Stone *et al*. 1995);
- Seabird populations of Britain and Ireland: Results of the Seabird 2000 Census 1998-2002. (Mitchell *et al*. 2004);
- An Atlas of Breeding and Wintering Birds on the Isle of Man (Sharpe *et al*. 2007);
- The Birds of Lancashire and North Merseyside (White *et al*. 2008);
- Seabird Monitoring Programme (SMP) Online Database (http://www.jncc.gov.uk/smp/);

- Information on SPAs from JNCC for UK (including Northern Ireland) (http://jncc.defra.gov.uk) and from the National Parks and Wildlife Service (NPWS) for Ireland (http://www.npws);
- Information on SSSIs from NE for England (http://naturalengland.org.uk), CCW for Wales (http://ccw.gov.uk), Northern Ireland Environment Agency in Northern Ireland (http://www.ni-environment.gov.uk) and Scottish Natural Heritage (SNH) in Scotland (http://snh.gov.uk);
- Information on ASSIs in Ireland from the NPWS;
- Information on seabird foraging range undertaken by Thaxter *et al*. (2012);
- The tracking studies of Manx Shearwater breeding at Skomer, Pembrokeshire by Guilford *et al*. (2008); and
- Votier *et al*. (2010, 2011) on the foraging movements of immature and adult Gannets associated with Grassholm.

Stakeholder consultation

7.143 As part of the ZAP Report consultation has taken place with CCW, JNCC, NE, RSPB, NIEA, Cefas, Isle of Man DEFA and MMO. Consultation with these parties, as well as other stakeholders such as the Manx Wildlife Trust, will continue as the EIA progresses. In addition, relevant stakeholders were consulted on the scope of the RWF EIA by the Planning Inspectorate.

Description of the current environment

Introduction

7.144 The Irish Sea and bordering coastlines of England, Scotland, Wales, Northern Ireland, Isle of Man and the Republic of Ireland are known to be nationally and internationally important for a variety of breeding and wintering seabirds, as well as for migrant and wintering wildfowl and wading birds associated with a number of large estuaries and embayments (e.g. River Ribble and Morecambe Bay, Rivers Mersey and Dee and Liverpool Bay). As a consequence of large numbers of birds, there are numerous localities around the Irish Sea basin that are designated as SPAs of international importance and SSSIs or ASSIs of national importance in the UK and Ireland respectively for their ornithological interest (Figure 7.8). In addition, Liverpool Bay is one of the few offshore SPAs in the UK, the designation of which was partly informed by extensive seabird surveys associated with the Round 2 offshore wind farm developments.

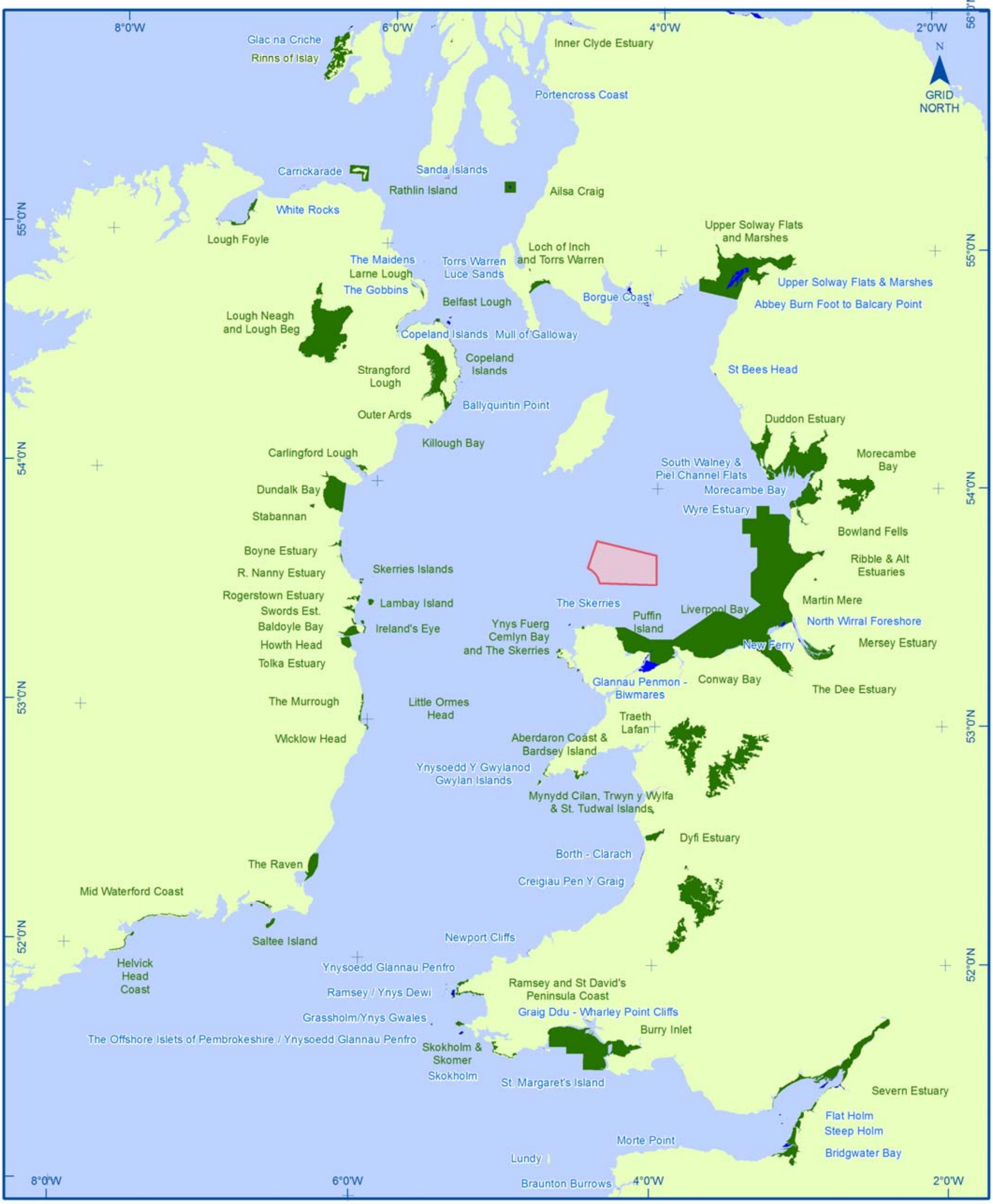
Breeding populations of seabirds

7.145 A number of colonies of breeding seabirds border the Irish Sea. These include colonies on the coasts of North Wales, West Wales, Cumbria, Lancashire, the Isle of Man and the eastern coast of Ireland. Colonies in closest proximity to the Site include those on the Isle of Man which support breeding northern fulmar *Fulmarus glacialis*, Manx shearwater *Puffinus puffinus*, common guillemot *Uria aalge*, razorbill *Alca torda* and black-legged kittiwake *Rissa tridactyla* amongst five other species of gulls, with herring gull *Larus argentatus* and great black-backed gull *Larus marinus* the most numerous (Sharpe *et al*. 2007).

7.146 Seabird breeding colonies along the North Wales, East of Ireland and North West England coasts are also likely to be easily within reach of the Site for certain species due to the long distance foraging trips undertaken by many seabirds. Manx shearwater, northern gannet *Morus bassanus* and fulmar in particular are known to forage over distances of several hundred kilometres. For example, a review of seabird foraging ranges suggests that the mean maximum foraging range for Manx shearwater is 330km (Thaxter *et al*. 2012). Tracking studies at the University of Oxford (Guildford *et al*. 2008) have shown that Manx shearwaters from the super colony of the islands of Skomer (101,800 pairs[4]), Skokholm (46,200 pairs) and Middleholm (3,000 pairs) off the western tip of South Wales (over 200km from the Site), are known to forage within or pass through the Irish Sea. The colonies constituting the largest breeding aggregation of this species in the world (Mitchell *et al.* 2004) are collectively embraced within the Skokholm and Skomer SPA.

7.147 The potential for birds from this SPA to use the Site highlights the consideration of Manx shearwater as the focus of the ornithological elements of the ZAP Report (Celtic Array 2012).

[4] Numbers of breeding shearwaters are measured in terms of apparently occupied sites or AOS, which equates to pairs.



Rhiannon Wind Farm (CA, 2012)

Special Protected Areas (SPA's) [Multiple Sources]

Sites of Special Scientific Interest (SSSI's) & Areas of Special Scientific Interest (ASSI's) [Multiple Sources]

Note:
Some sites are too small to see at this scale

Figure 7.8

This drawing was compiled using the most current data at the time of publication. Please contact Celtic Array Ltd for the latest information: info@celticarray.com

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ISSUE	DATE	DRN	CHK	APR	ISSUE NOTE
03	10/10/12	JD	SM	EF	Project title revised
02	20/08/12	AM	SW	EF	Symbology Changed
01	01/05/12	JD	PM	EF	First Issue

PROJECTION	DATUM	PAGE SIZE	SCALE
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0 20 40 60 80 Kilometers

0 10 20 30 40 Nautical Miles

ROUND 3: IRISH SEA ZONE

RHIANNON WIND FARM

Location of Special Protection Areas, Sites of Special Scientific Interest and Areas of Special Scientific Interest in relation to Rhiannon Wind Farm

CELTIC ARRAY NO: SE-D-EV-013-0071-000000-021

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Overwintering and passage seabirds

7.148 Seabirds breeding outside of foraging range from the Site may also traverse the area to and from breeding colonies and wintering grounds, or even spend some time within the area of the Site outside of the breeding season. This may include species such as gannet, kittiwake and auks (mostly guillemot and razorbill) that breed in large numbers to the north and north west of the Site along the Scottish west coast and associated islands and in Northern Ireland. For example Rathlin Island in Northern Ireland is one of the most important sites for common guillemot and razorbill in the UK with 63,728 and 13,976 pairs respectively (Mitchell *et al*. 2004). Rathlin Island also supports the largest colony of kittiwake in the whole of Ireland (9,917 pairs). In relation to gannet, Ailsa Craig in south Ayrshire was recorded as the third largest colony in the UK and Ireland with 35,825 pairs in the Seabird 2000 surveys (Mitchell *et al*. 2004).

7.149 The Irish Sea also contains one of the few marine SPAs in the UK, the Liverpool Bay SPA which stretches from the coast of Anglesey in North Wales to the Lancashire coast in NW England. The 1,702km^2 area supports 5.4% of the UK overwintering population of red-throated diver, *Gavia stellata* and 3.4% of the European population of overwintering common scoter, *Melanitta nigra,* (Webb *et al*. 2006, Natural England and Countryside Council for Wales 2009). However, the Site (and the whole of the ISZ) lies outside the SPA and lies in deeper water (over 25m) than is suitable for divers and scoters. It was therefore expected that these species would not be a feature of surveys.

Migratory wetland and terrestrial birds

7.150 A whole suite of passerines, waders and wildfowl may potentially cross the Irish Sea during the autumn and spring migration. Some birds will traverse the Irish Sea on their annual migration route. For example, barn swallows *Hirundo rustica* breeding in Northern Ireland are known to pass through the Irish Sea on their way to their wintering grounds in South Africa (Wernham *et al*. 2002). Greenland white fronted geese *Anser albifrons flavirostris* that over winter in the Dyfi Estuary migrate to and from Greenland crossing the Irish Sea.

7.151 The saltmarshes and intertidal sand and mud flats of Morecambe Bay and Ribble Estuary SPAs in Merseyside, Lancashire, Dyfi Estuary and Burry Inlet SPAs in Wales to name but a few support internationally important concentrations of waders and wildfowl (White *et al*. 2008). The habitat provides vital overwintering or stopover feeding grounds for thousands of waders such as oystercatcher *Haematopus ostralegus*, dunlin *Calidris alpina*, sanderling *Calidris alba*, knot *Calidris canutus*, curlew *Numenius arquata*, redshank *Tringa totanus*; and wildfowl such as pink-footed goose *Anser brachyrhynchus*, shelduck *Tadorna tadorna* and wigeon *Anas penelope*. Whooper *Cygnus cygnus* and Bewick's swan *C. columbianus bewickii* are species for which the nearby Martin Mere SPA is designated.

7.152 Many of these birds may cross the Irish Sea once or twice per year on annual migration, although more frequent exchange of waterfowl and waders between the east and west coast of the Irish Sea may also occur, perhaps in response to short-term environmental conditions. Birds may migrate over a broad front (Wernham *et al*. 2002), but may also tend to take a more typical narrow flight path, perhaps structured by landforms. In either case, the principal routes may be rather direct from their source. Tracking studies on whooper swans to and from Martin Mere and Iceland by the Wildfowl and Wetlands Trust (WWT) showed that swans typically and successfully crossed one or more offshore and/or onshore wind farm sites in the north west of the

UK (Figure 7.8), but that this did not include the Site which lies to the west of the typical routes (Griffin *et al.* 2011).

Survey results

7.153 A total of 77,265 individual birds from 71 species and 14 unidentified taxa were recorded in the 21 boat-based surveys between March 2010 and August 2011[5]. The species assemblage was primarily composed of a range of seabirds such as petrels, shearwaters, gannet, skuas, gulls, terns and auks. Additionally, a few individuals of species that spend part of their life cycle at sea (e.g. divers and seaduck) were recorded alongside a variety of migrant species such as waders, waterfowl, raptors and passerines that were encountered in spring and autumn passage (Figure 7.9). The ZAP Report (Celtic Array 2012) describes how the population estimates depicted in Figure 7.9 were calculated. The dominance of seabirds is in keeping with the location of the ISZ, extending to a considerable distance from shore (42km) from relatively close to shore (16km from the coast of North Wales).

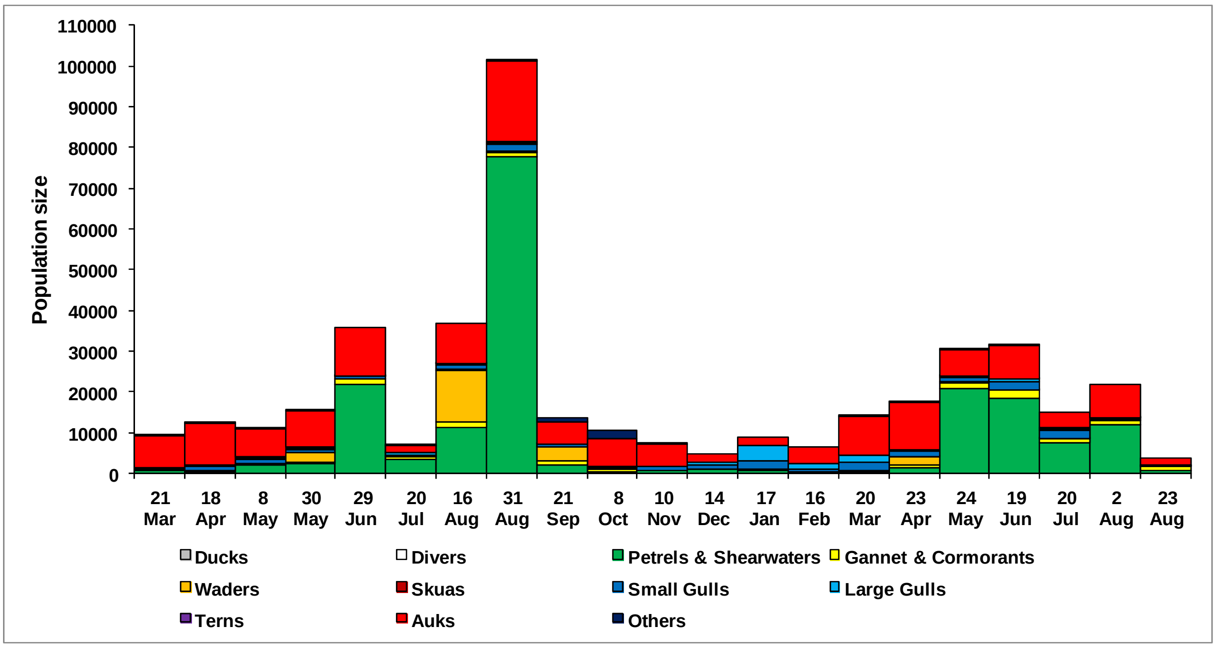

Figure 7.9 Seasonal variation of bird species group population size in the ISZ from data collected in the first 21 boat-based surveys (March 2010 to August 2011)

7.154 Manx shearwater dominated the assemblage present with 44.8% of all the ISZ records. The auk species guillemot and razorbill were the second and third most common encountered species with 16.5% and 8.2% respectively. Together, these three species comprised 68.7% of all records clearly illustrating the dominance of the assemblage by just a few species of seabirds. Other taxa supplying approximately 6% of records were kittiwake (6.1%) and gannet (5.9%), followed by fulmar (4.5%). Puffin and herring gull accounted for approximately 2% of all records, with 2.1% and 1.6% respectively.

[5] Boat based data collected after August 2011 will be fully assessed as part of the EIA.

Lesser black-backed gull and great black-backed gull both accounted for 0.9% of all records, of which many of these birds will have been over wintering in the Irish Sea.

7.155 The ISZ exhibits seasonal variation in the abundance of particular bird species or groups, with many of the more numerous species present in higher numbers throughout the spring and summer months according to the occupancy of breeding colonies (Figure 7.9). For example, the summer-visiting Manx shearwater was present from March through to September, alongside other important groups such as the auks, comprised of guillemot, razorbill and puffin. Around 30,000 to 40,000 birds were estimated to be present in the ISZ during the summer months equating to a density of around 20 birds km^{-2}. At peak however, just after the breeding season and before dispersal, up to around 100,000 birds were estimated at a density of 50 birds km^{-2}. During autumn and winter, many birds disperse widely; for example, puffins spend the winter months hundreds of miles offshore in the Atlantic but with different individuals exhibiting different patterns (Guilford *et al*. 2011).

7.156 Much lower numbers of birds were present during the winter months with around 10,000 birds at a density of ~5 birds km^{-2}. At this time, auks were generally the most numerous group, although the contribution of large gulls including herring gull, lesser black-backed gull and great black-backed gull increased as their numbers reached a peak. Common gull *Larus canus* was solely recorded in the winter months, between November and February.

Potentially sensitive species

7.157 The ES will consider all relevant species recorded during surveys. It should be noted that the ZAP Report highlights 11 bird species that may occur in important numbers within the ISZ (see Table 7.8 below). Comparison with known populations suggests that Manx shearwater and great black-backed gull occur within the ISZ in what appear to be internationally important numbers, with razorbill occurring in what appears to be nationally important numbers (highlighted in red and amber respectively in Table 7.8). It should be noted that these numbers relate to the ISZ, rather than the Site and other species may be regionally important; however, some combination of these species is likely to constitute the sensitive receptors to be considered in the RWF ES, although not all may occur in important numbers within the Site.

Table 7.8 Numbers seen, pattern of occurrence and estimated density and population sizes of important bird species recorded in the ISZ

Species	Number seen	Peak numbers present	Maximum density (ind. km^{-2})	Maximum population size	1% criterion international population[1]	1% criterion of national population[2,3]
Manx shearwater	33,904	May – August	34.38	74,672	7,400	5,902[2]
Guillemot	12,781	March – October	4.89	10,619	47,000	13,224[2]
Razorbill	6,363	March – August	3.89	8,443	12,000	1,645[2]
Kittiwake	4,693	All year	0.98	2,137	51,000	7,337[2]

Species	Number seen	Peak numbers present	Maximum density (ind. km^{-2})	Maximum population size	1% criterion international population[1]	1% criterion of national population[2,3]
Gannet	4,538	April – October	0.97	2,104	6,100	4,371[2]
Fulmar	3,460	All year	2.33	5,065	72,000	9,975[2]
Puffin	1,634	April – August	1.96	4,260	130,000	11,584[2]
Herring gull	893	December – February	0.69	1,494	8,000	7,300[3]
Lesser black-backed gull	747	March – August	0.48	1,043	6,500	2,202[2]
Great black-backed gull	674	January – February	0.92	1,997	1,500	760[3]
Arctic tern	425	May – August	0.23	492	14,000	1,052[2]

[1] Birdlife International 2004 [2] Baker *et al*. 2006 [3] Musgrove *et al*. 2011

Population appears to be in internationally important numbers

Population appears to be in nationally important numbers

Manx shearwater

7.158 Manx shearwaters were present in internationally important numbers in the Site as well as the ISZ as a whole. Manx shearwater population estimates were highest in the Site compared with the other Potential Development Areas identified in the ZAP Report. A relatively high proportion of feeding/foraging birds (>30%) was strongly indicative of the Site being an important foraging area, presumably as it attracts fish, although it is not yet clear which species these may be.

7.159 Begg and Reid (1997) have previously shown that Manx shearwater (among other species) was associated with the Western Irish Sea Front. The transition from stratified cooler, deeper, waters to shallower and warmer mixed waters may prove to be especially important in determining the distribution of the species.

7.160 The consistent presence of Manx shearwater in the Site and ISZ in large numbers throughout the breeding season could indicate that they originate from nearby colonies. However, the closest colony on the Calf of Man is very small and many birds must come from further afield. Manx shearwater has one of the longest foraging ranges of UK breeding seabirds, with a mean maximum foraging range of 330km (Thaxter *et al*. 2012). The Site is therefore well within reach of the super-colony of Skomer, Skokholm and Middleholm (within the Skokholm and Skomer SPA) as shown in Figure 7.10.

Rhiannon Wind Farm (CA, 2012)

330km Buffer from Rhiannon Wind Farm (based on mean maximum foraging range)

Special Protected Area colonies (ECON)

Other protected sites (ECON)

This drawing was compiled using the most current data at the time of publication. Please contact Celtic Array Ltd for the latest information: info@celticarray.com

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0 25 50 75 100 Kilometers

0 10 20 30 40 50 Nautical Miles

ISSUE	DATE	DRN	CHK	APR	ISSUE NOTE
04	10/10/12	JD	SM	EF	Project title revised
03	22-08-12	DB	JF	EF	Ammended border
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ROUND 3: IRISH SEA ZONE

RHIANNON WIND FARM

Location of all designated breeding colonies for Manx Shearwater

CELTIC ARRAY DOC NO: SE-D-EV-013-0071-000000-023

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Figure 7.10

7.161 Other colonies within reach of the Site include Bardsey Island, Ramsey Island and Offshore Islets of Pembrokeshire in Wales; Lighthouse Island and Big Copeland in the Copeland Islands in Northern Ireland; the islands of Lambay, Great Saltee and Little Saltee in the Republic of Ireland; the Sanda Islands in Scotland; and Lundy (1,081 pairs by 2008 from 297 pairs in 2001 after rat eradication - Brown *et al*. 2011) in the Bristol Channel off the coast of Devon, England. Although not within the mean maximum foraging range it is possible that Manx shearwater colonies Rhum and St Kilda are within reach on migration.

7.162 Although birds recorded in the Site could originate from any of these colonies supporting a total of 352,728 individuals (176,364 pairs) given the relative size of the different colonies and the number of birds involved in observations, the majority of birds seen in the Irish Sea could possibly originate from the super-colony of Skokholm and Skomer SPA, perhaps supplemented by numbers of birds from Bardsey Island (within the Aberdaron Coast and Bardsey Island/Glannau Aberdaron and Ynys Enlli SPA) and Aberdaron SPA and the Copeland Islands SPA (Figure 7.8). Evidence that birds from Skomer reach the ISZ was provided by Guildford *et al*. (2008) who discovered that tagged Manx shearwaters from Skomer were utilising foraging grounds as far north as the Mull of Galloway, traversing the length of the Irish Sea to do so.

Great black-backed gull

7.163 Population estimates indicated that great black-backed gull occurred in internationally important numbers in the ISZ in the winter months, although this was just on one occasion in late winter in January 2011. The recorded density generating this peak was 0.92 individuals km^{-2}, which is higher than the maximum value of 0.34 individuals km^{-2} recorded by Stone *et al*. (1995) for the Irish Sea. Other densities in the rest of the winter were, however, similar and the presence of fishing boats from which this species regularly scavenges (Mitchell *et al*. 2004) may be an important factor. Apart from this peak, great black-backed gull did not otherwise occur in even nationally important numbers.

7.164 Additionally, great black-backed gulls were observed throughout the breeding season, with birds potentially originating from breeding colonies in relative close proximity to the ISZ, most notably on the Isle of Man (405 pairs – Sharpe *et al*. 2007) and Gwynedd on the coast of North Wales (101 pairs - Mitchell *et al*. 2004).

Razorbills

7.165 There are at least 20 breeding colonies situated on the Welsh, Irish, English and Isle of Man coasts, consisting of over 17,000 breeding pairs (Mitchell *et al*. 2004). Around 1,021 pairs breed on the Isle of Man alone (Mitchell *et al*. 2004). The occurrence of razorbill in nationally important numbers in the ISZ was therefore not unexpected.

7.166 Higher numbers were consistently present early in the breeding season (April and May) as colonies were occupied and eggs laid. Thereafter, numbers decreased, presumably as adults provisioned chicks from waters closer to the colonies. This is a typical pattern for many seabirds (see Ojowski *et al*. 2001). Razorbill is a relatively short ranging species with a mean maximum foraging range of 58km (Thaxter *et al*. 2012) and thus in the latter season, only birds from the Isle of Man and North Wales would be expected to reach the Site.

Potential impacts

7.167 Information on bird distribution and use of the Site and the ISZ was collected through an extensive monthly boat-based survey programme over a period of two years. The surveys were supplemented with existing aerial survey data and desk-based data.

7.168 The results of these surveys have shown that 11 species occur in numbers that are important at regional, national and international scales within the ISZ. Of these species, Manx Shearwater was shown to be the most sensitive receptor as a result of its occurrence in internationally important numbers in the ISZ. The results of the ZAP surveys therefore, provide a clear focus for the RWF EIA. Due to the conservation importance and protection afforded to a number of the species recorded, surveys are proposed to continue to inform the EIA. However, the existing data provides a sound baseline for comparison and will allow for better consideration and identification of temporal and spatial trends to be extracted from the data.

7.169 The NPS for Renewable Energy Infrastructure (EN-3) issued by DECC (2011), lists five possible impacts of offshore wind farms upon birds, which are considered below in further detail below: collisions with rotating blades, direct habitat loss, disturbance from construction activities, displacement during the operational phase and impacts on bird flight lines (i.e. barrier effects).

7.170 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are identified in the proceeding sections).

Potential impacts during construction/decommissioning	
Disturbance	The presence of construction vessels and associated activities, including the creation of noise, may disturb and displace birds using the Site for feeding, resting and passage. Such effects may occur for the duration of installation activities with most species likely to return thereafter (NERI 2004). Sensitivities of individual species to disturbance will vary, with species being most sensitive to the presence of vessels more likely to be displaced (Garthe and Hüppop 2004, NERI 2004).
Indirect effects - prey species	As discussed in Section 7.2 (fish and shellfish ecology) noise associated with construction activities (most notably pile driving) may cause temporary, localised displacement of prey species, such as fish.
Potential impacts during operation	
Disturbance and displacement	Certain species may be disturbed by operational wind farms, either by operation and maintenance vessels or by the presence of turbines themselves. This disturbance may give rise to displacement from an area of former use. Displacement will affect different species in different ways and its biological consequences will largely be dependent upon the availability of suitable alternative feeding habitat in the wider area to which species are displaced. Species with specific habitat requirements may be more vulnerable to the effects of displacement

	than habitat generalists such as gulls, auks, skuas and fulmar (Garthe and Hüppop 2004, Maclean *et al.* 2009).
Collision	Different species vary in their behaviour around wind turbines, thereby affecting their susceptibility to collision. Many of the species recorded in the ISZ surveys and discussed in the ZAP Report were observed flying below blade height and are therefore considered to be at low risk of fatality through collision. Manx shearwater, gannet, kittiwake, lesser black-backed gull, herring gull and great black-backed gull were evaluated in the ZAP Report in relation to collision. For most species the zone level assessment concluded there was negligible risk of an impact at the national population scale apart from the national wintering population of great black-backed gull.
Barrier effect	Birds may change their flight path to avoid flight through an operating wind farm. In such cases the wind farm may act as a barrier to movement, either to migrants or to individuals' diurnal movements, for examples between colonies and foraging areas. This can result in increased energetic costs of daily movements and migration (DECC 2009). Any impact arising from any barrier effect will be both species and movement specific. Large bulky species with high wing loadings, which have to repeatedly avoid the wind farm, will be the most affected. In relation to the latter, research has shown that the energetic costs of minor deviations of even a few kilometres as a result of barrier effects of offshore wind farms were inconsequential compared to the overall distance travelled for migrating waterfowl (Masden *et al*. 2009). Moreover, while there is potential for barrier effects to be important for birds regularly commuting from colonies for example, the costs of any deviation were anticipated to be lower than those imposed by low food abundance or adverse weather (Masden *et al*. 2010). Overall, there is a general sense that barrier effects are less important than initially thought.
Changes in habitat or prey supply	As discussed in Sections 7.1 (benthic ecology) and 7.2 (fish and shellfish ecology), the presence of turbines may give rise to changes in habitat or local marine ecology. There is increasing recognition of the possibility of indirect effects upon habitat and prey resources such as fish following construction and during operation, which subsequently impact upon individual birds and thence perhaps to a population scale (Perrow *et al*. 2011). While indirect effects may have a negative impact, positive impacts may also accrue through the reef effect (Linley *et al*. 2007), whereby turbine bases are colonised by flora and fauna that form a resource for fish and thereby birds. Certain species, such as gulls, which are not prone to displacement, may feed within the Site preferentially, such as recorded during monitoring studies of the operational Horns

	Rev offshore wind farm (NERI 2005).
Potential cumulative impacts	
As discussed below in respect of Habitats Regulation Assessment, COWRIE guidance on assessing cumulative impacts on birds (King *et al.* 2009) has been referred to in drafting this report. The potential impacts described above may arise cumulatively with the wind farm projects listed in Chapter 5 (EIA methodology). Table 7.9 provides a summary of ornithological issues considered in the environmental statements available for current UK and Irish projects.	

7.171 Potential cumulative impacts could be caused by other wind farms in the region. Table 7.9 lists the other projects in the Irish Sea where there is a potential for cumulative impacts to occur and key species that may be affected by each wind farm. This list of bird species was compared to the species identified in the ISZ as part of the ZAP surveys, to determine if there is the potential for cumulative impact. The scale of the assessment of cumulative impacts for the ES will be informed by the population scale under consideration and therefore other developments may need to be considered.

7.172 The analysis of species that may be affected by potential cumulative impacts was collated into a table adapted from those provided in the COWRIE guidance (King *et al.* 2009). Table 7.10 lists the species that were sighted ten or more times during the ZAP surveys and the numbers seen. Those species that may be affected by potential cumulative impacts as they are also key species at other wind farms in the area are indicated. Table 7.10 also shows which species benefit from protection from SPAs in the region and lists the SPAs for each species in the region. A more detailed analysis will be undertaken for the ES. All species and SPAs that could be affected will be assessed and due to the far ranging distribution of many seabird species it is recognised that there may be a number of designated sites beyond the Irish Sea region that will need to be considered, including in other member states. The ES will include presentation of abundance and density estimates (derived using Distance sampling techniques and stating if mean peak or cumulative) with associated confidence intervals.

7.173 This initial analysis will be used to inform the RWF ES and HRA. Detailed cumulative and in combination assessment will be undertaken as part of the RWF ES and HRA following the COWRIE guidance (King *et al*. 2009). Further discussion on the methodology applied to Table 7.10 in respect of SPAs is provided at Section 7.5 (Nature conservation designations).

Table 7.9 Details of key bird species at other wind farm projects in the Irish Sea area

Wind farm project	Location	Region	Bird monitoring activities	Important bird species
Robin Rigg	9.5km off Maryport/ 8.5km off Rock Cliffe	North West England	Twice monthly boat-based surveys (pre-construction) and aerial surveys.	Red-throated diver (plus ‘divers’), Manx shearwater, storm petrel, gannet, cormorant, scaup, common scoter, kittiwake, guillemot and razorbill (plus ‘auks’).
Barrow	7km off Walney Island	North West England	Pre-construction surveys: ferry based surveys, two aerial surveys and one site specific boat-based surveys, during and post-construction boat-based, aerial and land-based surveys.	Gannet, auks, Manx shearwater, lesser black-backed gull, common scoter, red-throated diver, whooper swan and pink-footed goose.
Burbo Bank	5.2km off Crosby	North West England	Ornithological surveys were conducted pre-construction. Land, boat and aerial surveys.	Common scoter, red-throated diver, common tern, cormorant, red-breasted merganser, guillemot, razorbill and little gull.
North Hoyle	7.5km off Prestatyn and Rhyl	North Wales	Monthly boat-based surveys (Pre-construction). Aerial surveys used to assess Site usage by common scoter and red-throated diver.	Common scoter, red-throated diver with suggestions that other bird species may also use the Site.
Rhyl Flats	8km off Abergele	North Wales	Monthly boat-based surveys pre-construction, during construction and operation. Use of radar in March 2006. Aerial surveys.	Red-throated diver, fulmar, cormorant, shag, common scoter, kittiwake, common tern, sandwich tern, little tern, guillemot and razorbill.
Ormonde	Off Walney Island	North West England	Ornithological surveys were conducted pre-construction. Land, boat and aerial surveys.	No specific detail in the non-tech EIA, apart from pink-footed goose and general mention of gulls and migratory wildfowl.

Wind farm project	Location	Region	Bird monitoring activities	Important bird species
Walney Phase 1 & 2	14 -15km off Walney Island	North West England	Ornithological surveys were conducted pre-construction. Land, boat, radar and aerial surveys.	Common scoter, herring gull, lesser black-backed gull, manx shearwater, pink-footed goose, red-throated diver, sandwich tern and whooper swan.
West of Duddon Sands	North Irish Sea	North West England	Ornithological surveys were conducted pre-construction. Land, boat, radar and aerial surveys.	Herring gull, lesser black-backed gull, guillemot, Manx shearwater, gannet, pink-footed goose and whooper swan.
Gwynt y Môr	13km off North Wales coast	North Wales	Boat-based surveys; aerial surveys. One boat-based radar survey in Feb 2005 for dawn and dusk movements of common scoter.	Red-throated diver, Manx shearwater, fulmar, gannet, cormorant, shag, common scoter, kittiwake, 'other gulls', sandwich tern, common tern, guillemot, razorbill. Note common scoter and red-throated diver.
Arklow Bank	10km off Wicklow coast, Ireland	East Ireland	Boat-based surveys twice per month July-September, once per month from October.	Red-throated diver, fulmar, Manx shearwater, gannet, shag, little gull, kittiwake, common tern, Arctic tern, guillemot and razorbill.
Codling Wind Park	13km off Wicklow coast, Ireland	East Ireland	Monthly boat-based surveys from April 2001 - ongoing aerial surveys.	Manx shearwater, guillemot, razorbill, shag, gannet, kittiwake.
Oriel Windfarm	5.5km off Cooley Point, Ireland	East Ireland	Boat-based surveys within the Site and a 5km buffer.	Red-throated diver, great northern diver, Manx shearwater, gannet, kittiwake, sandwich, common and roseate terns, guillemot and razorbill. Wildfowl, waders and passerines selected as 'key groups'.

Table 7.10 Identification of potential for cumulative impact for SPA and other species (based on guidelines in King *et al.* 2009)

Species	Number seen[6]	Potential for cumulative impact?	SPA feature?	SPA sites for species within the region with potential cumulative impact
Manx shearwater	33904	Y	Y	Skokholm & Skomer Copeland Islands Glannau Aberdaron and Ynys Enlli/Aberdaron Coast and Bardsey Island
Guillemot - corrected	12781	Y	Y	Rathlin Island Lambay Island Saltee Islands Ireland's Eye
Razorbill - corrected	6363	Y	Y	Saltee Islands Lambay Island Ireland's Eye Skokholm & Skomer Rathlin Island
Kittiwake	4693	Y	Y	Rathlin Island Saltee Islands Lambay Island Ireland's Eye Howth Head Coast Helvick Head to Ballyquin Wicklow Head
Gannet	4538	Y	Y	Ailsa Craig Grassholm Saltee Islands
Fulmar	3460	Y	Y	Lambay Island Saltee Islands
Puffin - corrected	1634	Y	Y	Rathlin Island Lambay Island Saltee Islands Skokholm & Skomer
Herring gull	893	Y	Y	Skerries Island Saltee Islands Lambay Island Ireland's Eye Helvick Head to Ballyquin Mid -Waterford Coast
Lesser black-backed gull	747	Y	Y	Ailsa Craig Bowland Fells Ribble and Alt Estuaries Saltee Islands Lambay Island
Great black-backed gull	674	Y	N	

[6] Numbers seen have been derived from the number of birds observed as sampled in twenty one boat-based surveys between March 2010 to August 2011 across the ISZ.

Species	Number seen[6]	Potential for cumulative impact?	SPA feature?	SPA sites for species within the region with potential cumulative impact
Arctic tern	425	**Y**	**Y**	Ynys Feurig, Cemlyn Bay & the Skerries Outer Ards Strangford Lough Copeland Islands
Dunlin	81	N	**Y**	Burry Inlet Severn Estuary
Common scoter	70	**Y**	**Y**	Rinns of Islay Ribble and Alt Estuaries Liverpool Bay / Bae Lerpwl Bae Caerfyrddin/ Carmarthen Bay
Black-tailed godwit	70	N	**Y**	
Great skua	68	N	N	
Storm petrel	55	N	**Y**	
Common tern	51	**Y**	**Y**	Ribble and Alt Estuaries Dee Estuary Ynys Feurig, Cemlyn Bay & the Skerries Lough Neagh & Loch Beg Larne Lough Strangford Lough Carlingford Lough
Curlew	40	N	**Y**	Traeth Lafan/ Lavan Sands, Conway Bay Burry Inlet
Common gull	28	N	**Y**	
Black-headed gull	23	N	**Y**	
Whooper swan	19	**Y**	**Y**	Rinns of Islay Upper Solway Flats & Marshes Ribble and Alt Estuaries Martin Mere Lough Neagh & Loch Beg Lough Foyle Black Cart
Whimbrel	18	N	**Y**	
Oystercatcher	16	N	**Y**	Traeth Lafan/ Lavan Sands, Conway Bay Burry Inlet
Golden plover	13	N	**Y**	
Leach's storm petrel	12	N	N	

Species with potential cumulative impact (light blue)

Species is an SPA feature in the region (pink)

7.174 This analysis suggests that 14 species may require further consideration in respect of cumulative impact, 13 of them are species found in SPAs in the region.

7.175 Most notably, the wide range of Manx shearwater introduces potential for cumulative impacts with a number of other wind farms. The close proximity of the Atlantic Array (Round 3, Zone 8) to the Skokholm and Skomer SPA may mean that potential impacts upon this population from wind farms may be largely shared between the Site, other projects in the ISZ and the Atlantic Array. Many of the environmental statements for Round 1 and Round 2 sites in the Irish Sea have generally not raised Manx shearwater as a particular issue. The proximity of these sites to the coast outside the offshore pelagic realm of Manx shearwater when away from breeding colonies may be the fundamental reason for this difference. The exception appears to be Walney, with particular consideration of the possible impact upon Manx shearwater within scoping of the Walney Extension (DONG Energy 2010). The likely origin of birds on this site, however, currently remains unknown.

7.176 Additionally a number of other human activities occur within or in close proximity to the Site, which could result in cumulative impacts on birds. These are detailed in Chapter 5 (EIA methodology) and include aggregate extraction areas and oil and gas projects.

Scoping Opinion from the Planning Inspectorate

7.177 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. Within the report all the issues identified in Section 7.174 were scoped into the assessment. The following represents the Planning Inspectorate's opinion in respect to ornithology:

- The Secretary of State welcomed the surveys which took place from March 2010 until April 2012. Celtic Array acknowledged that due to poor weather conditions, 6 of the 28 surveys were not completed, though it was acknowledged that this would not have an adverse impact on surveying for Manx shearwater. Celtic Array are required to ensure that the assessment is robust and that the information used to inform the assessment is comprehensive;
- The Secretary of State welcomed the fact that collision risk modelling will take place alongside consultation with key stakeholders; and
- The Secretary of State recommended that there should be assessment of the impacts that the proposal may have on Greenland white fronted geese which migrate through the proposal zone.

Approach to address Scoping Opinion

7.178 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA survey and study programme

7.179 The EIA for RWF will build on the data collected as part of the ZAP process and update the data described above as necessary. Consultation has been undertaken with CCW, NE, RSPB, the Manx Wildlife Trust, JNCC and Isle of Man DEFA on the scope of the aerial surveys discussed below:

Project specific aerial surveys

7.180 In addition to the ZAP data collected as part of the boat-based surveys, the distribution and abundance of birds within the Site is currently being collected as part of a high-definition camera aerial survey. The survey conforms to standards approved by JNCC and is of a sufficiently high resolution to provide key species abundance and density estimates (with associated confidence levels). The detailed methodology has been distributed to statutory nature conservation bodies.

7.181 Given the temporary nature of export cable installation effects and the absence of any pathway to give rise to a significant impact on birds during export cable operation, the export cable corridor has not been included within the aerial survey programme. Instead, the assessment of impact in the ES will be based on currently available distribution data for the area.

Collision risk modelling

7.182 The selection of species for which collision risk modelling will take place in consultation with the main stakeholders.

7.183 The level of impact calculated through the modelling of collision risk is highly dependent upon the selection of relevant notional avoidance rates. It is proposed that avoidance rates will also be agreed with key stakeholders.

7.184 The following guidance documents will be used to inform the impact assessment for ornithology:

- Nature conservation guidance on offshore wind farm development: A Guidance Note on the implications of the EC Wild Birds and Habitats Directives for Developers (DEFRA 2005);
- Developing Guidance on Ornithological Cumulative Impact Assessment for Offshore Wind Farm Developers (King *et al.* 2009);
- A review of methods to monitor collisions or micro-avoidance of birds with offshore wind turbines. Strategic Ornithological Support Services Project SOSS-03A (Collier *et al.* 2011);
- Using a collision risk model to assess bird collision risks for offshore wind farms. Strategic Ornithological Support Services Project SOSS-02 (Band 2011); and
- Report: Developing guidelines on the use of Population Viability Analysis for investigating bird impacts due to offshore wind farms (SOSS 2012).

7.185 In addition, ongoing work being carried out by other parties in relation to Manx shearwater will be considered as part of the EIA process and will be discussed with statutory consultees.

7.186 As discussed in the introductory sections of this report, intertidal surveys will be required in respect of the landfall site for the export cables. Such surveys will also include consideration of important coastal habitats for birds, including protected sites, foraging areas etc. The scope of these surveys will be agreed with statutory nature conservation bodies and the RSPB.

7.187 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, consultation derived data and information. This description will include analysis of the survey data described above;
- A review and summary of consultation activities including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative impacts;
- A review and summary of fish ecology surveys and studies incorporating any identified issues regarding underwater noise impacts on the fish prey of birds. Cross-referencing to the relevant chapters of the ES will be included;
- A review and summary of benthic and fish ecology surveys and studies incorporating any identified issues regarding potential impacts habitat change which may positively or adversely affect bird species. Cross-referencing to the relevant chapters of the ES will be included; and
- Proposals for mitigation measures and monitoring, if required.

Habitats regulations assessment

7.188 As discussed above, birds likely to have originated from protected areas have been recorded within the Site. Further study may be required in this respect and a HRA screening will assist with this process. HRA is discussed further in Chapter 2. Summaries of relevant sites and species to which HRA screening may apply have been provided in Section 7.5 in the format similar to that provided by King *et al*. (2009). Consultation with key stakeholders will be undertaken to discuss and agree the scope of the HRA.

7-5 Biological environment – nature conservation designations

Introduction

7.189 This section considers sites designated for their nature conservation importance which may be affected by the development of RWF.

7.190 Chapters 2 (legislation and policy) and 5 (EIA methodology) provide outline details of the treatment of these sites within the DCO process.

7.191 It should be noted that this section does not constitute screening for the purposes of HRA. A separate screening exercise for HRA will be carried out following consultation with key stakeholders.

Surveys and studies carried out to date

7.192 As part of the ZAP Report (Celtic Array 2012), issues associated with the features of nature conservation sites listed below were considered. The main designations considered were SACs, SPAs, SSSIs and MCZs.

- Benthic ecology – SACs, SSSIs, MCZs;

- Fish ecology – SACs;
- Ornithology – SPAs, SSSIs; and
- Marine mammals – SACs.

7.193 Potentially significant impacts on features afforded protection by these designations are considered in the relevant sections, namely those relating to benthic ecology (Section 7.1), fish and shellfish ecology (Section 7.2), marine mammals (Section 7.3) and birds (Section 7.4).

Description of current environment

7.194 This section considers sites of nature conservation interest in the UK. Potential impacts on sites in Ireland are discussed briefly below (see transboundary issues).

7.195 A large number of nature conservation sites are located in or around the Irish Sea region. UK sites are shown in Figure 7.11.

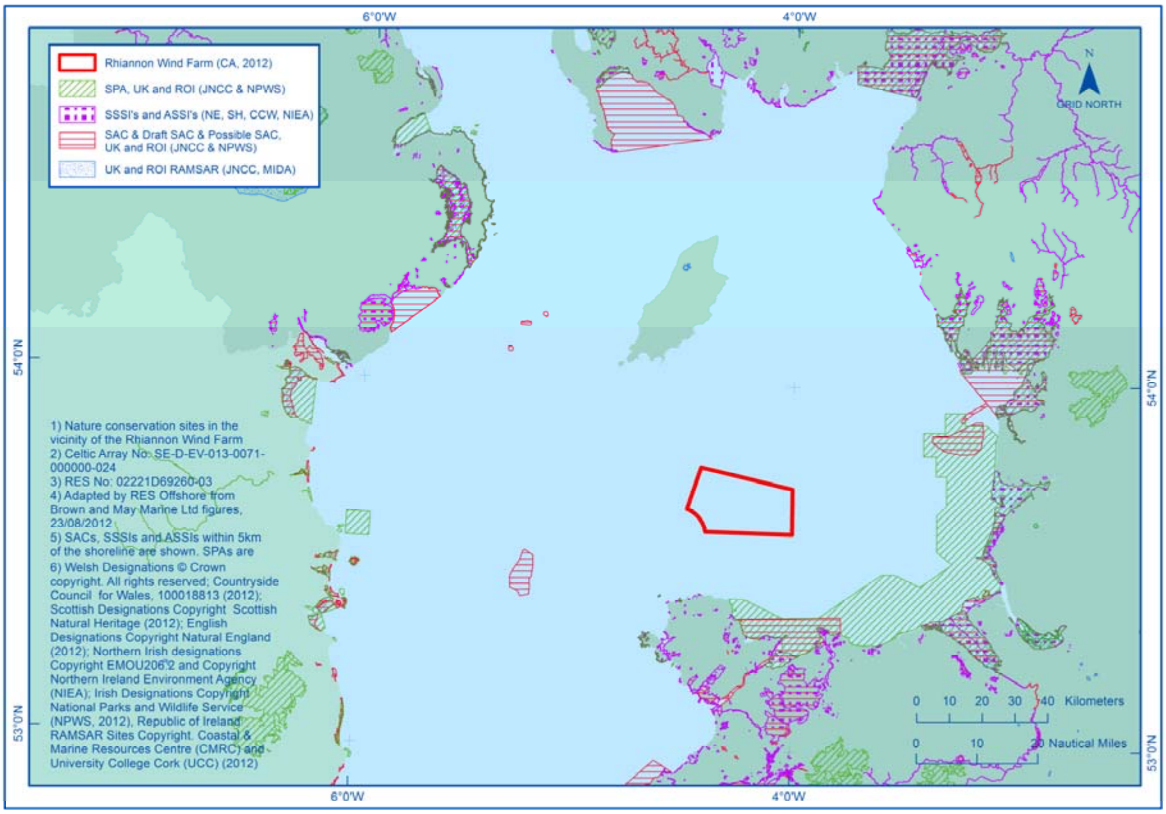


Figure 7.11 Nature conservation sites in the vicinity of the project

Special Areas of Conservation (SAC)

7.196 There are a number of SACs in the vicinity of the Site; these are listed in Table 7.11. Annex I habitats outside of SACs are discussed in detail in 7-1 Benthic Ecology.

Table 7.11 UK SACs and their proximity to the Site

Site name	Site number	Marine qualifying feature	Distance from Site (km)
Scotland			
Luce Bay and Sands	UK0013039	Sandbanks which are slightly covered by sea water all the time Reefs Mudflats and sandflats not covered by seawater at low tide	96.7
Solway Firth	UK0013025	Sandbanks which are slightly covered by sea water all the time Mudflats and sandflats not covered by seawater at low tide Reefs Sea lamprey River lamprey	126.2
River Bladnoch	UK0030249	Atlantic salmon	120.1
England			
River Derwent and Bassenthwaite Lake	UK0030032	Sea lamprey River lamprey Atlantic salmon	103.7
River Ehen	UK0030057	Atlantic salmon	92.4
River Eden	UK0012643	Sea lamprey River lamprey Atlantic salmon	112.7
Drigg Coast	UK0013031	Mudflats and sandflats not covered by seawater at low tide	77.4

Site name	Site number	Marine qualifying feature	Distance from Site (km)
Morecambe Bay	UK0013027	Mudflats and sandflats not covered by seawater at low tide Sandbanks which are slightly covered by sea water all the time	62.5
Shell Flat and Lune Deep	UK0030376	Sandbanks which are slightly covered by sea water all the time Reefs Mudflats and sandflats not covered by seawater at low tide	45.0
River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid	UK0030252	Atlantic salmon Sea lamprey River lamprey	74.0
Northern Ireland			
Murlough	UK0016612	Common seal	95.0
Strangford Lough	UK0016618	Mudflats and sandflats not covered by seawater at low tide Reefs Common seal	93.8
Wales			
Afon Eden – Cors Goch Trawsfynydd	UK0030075	Atlantic salmon	78.0
Afon Gwyrfai a Llyn Cwellyn	UK0030046	Atlantic salmon	54.7
Bae Cemlyn / Cemlyn Bay	UK0030114	Coastal lagoons	21.6

Site name	Site number	Marine qualifying feature	Distance from Site (km)
Dee Estuary/ Aber Dyfrdwy	UK0030131	Mudflats and sandflats not covered by seawater at low tide Sea lamprey River lamprey	48.0
Y Fenai a Bae Conwy / Menai Strait and Conwy Bay	UK0030202	Sandbanks which are slightly covered by sea water all the time Mudflats and sandflats not covered by seawater at low tide Reefs Large shallow inlets and bays Submerged or partially submerged sea caves	25.8
Pen Llŷn a`r Sarnau / Lleyn Peninsula and the Sarnau	UK0013117	Bottlenose dolphin Grey seal	71.3
Cardigan Bay / Bae Ceredigion	UK0012712	Bottlenose dolphin Grey seal	132.2

7.197 It is anticipated that many of the sites listed in Table 7.11 will not be affected by the development of RWF because impact pathways for the qualifying features are not present.

7.198 For example, given the findings of the ZAP Report on physical processes (see Chapter 6 of this report) impacts on the Annex I features within and out with coastal SACs are unlikely to arise, other than in respect of works within the export cable corridor. All the sites in Table 7.11 and Annex I habitats and species outside of designated sites will be the subject of HRA screening at a later date; however, it is presently anticipated that in terms of SACs, only the sites listed in Table 7.12 may require consideration in the ES as they may be at potential risk of effects from construction, operation and decommissioning.

Table 7.12 UK SAC features and potential impacts likely to be considered in the Environmental Statement (subject to HRA screening)

Site name	Qualifying feature
River Bladnoch	Atlantic salmon
River Derwent and Bassenthwaite Lake	Atlantic salmon
River Ehen	Atlantic salmon
River Eden	Atlantic salmon
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid	Atlantic salmon Sea lamprey River lamprey
Murlough	Common seal
Strangford Lough	Common seal
Afon Eden – Cors Goch Trawsfynydd	Atlantic salmon
Afon Gwyrfai a Llyn Cwellyn	Atlantic salmon
Bae Cemlyn / Cemlyn Bay	Coastal lagoons
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay	Sandbanks which are slightly covered by sea water all the time Mudflats and sandflats not covered by seawater at low tide, including eelgrass Reefs Large shallow inlets and bays Submerged or partially submerged sea caves
Pen Llŷn a`r Sarnau / Lleyn Peninsula and the Sarnau	Bottlenose dolphin and Grey seal
Cardigan Bay / Bae Ceredigion	Bottlenose dolphin and Grey seal

Special Protection Areas (SPA)

7.199 Section 7.4 (ornithology) identifies in Table 7.10 those bird species for which SPAs are designated in the Irish Sea area. During surveys, 22 SPA species were identified as having been observed within the ISZ in sufficient numbers (greater than ten individuals in total) to require further consideration. Three species, great black-backed gull, great skua and Leach's storm petrel are not qualifying species for any of the SPAs within the Irish Sea or wider area.

7.200 Table 7.13 lists the SPAs within the Irish Sea and wider area that have these species listed in the designation order, including if they are mentioned as part of the assemblages. However, many of the SPAs are situated beyond the mean maximum foraging range for each species (Thaxter *et al.* 2012). The ZAP Report identified Manx shearwater as the focus for assessment because of its occurrence in the ISZ at internationally important numbers, with great black-backed gull the only other species found in the ISZ at internationally important numbers. For most species assessed there was a negligible risk of a collision impact at the national population scale apart from the great black-backed gull. The great black-backed gull is predominantly a wintering species in the Irish Sea and there are no SPAs where the species is a designated feature within the ISZ. The HRA screening is likely to include (but not necessarily be limited to) the following species as they are located within the mean maximum foraging range and listed as a qualifying species of an SPA:

- Manx shearwater;
- Gannet;
- Fulmar;
- Lesser black-backed gull; and
- Arctic tern.

7.201 As with the SACs outlined above, all relevant sites will be the subject of HRA screening at a later date. However, Table 7.10 and Table 7.13 suggest that 22 bird species at 31 SPA sites may require consideration within the ES.

Table 7.13 SPAs in the Irish Sea area where identified key species from ZAP surveys are present as a qualifying feature[7]

Site name	Site number	Distance from RWF Site (km)
Rinns of Islay	UK9003057	250.4
Ailsa Craig	UK9003091	167.0
Upper Solway Flats and Marshes	UK9005012	126.2
Duddon Estuary	UK9005031	65.2
Bowland Fells	UK9005151	88.3
Morecambe Bay	UK9005081	66.4
Ribble and Alt Estuaries	UK9005103	62.4
Martin Mere	UK9005111	73.7

[7] Includes species listed as forming part of an SPA assemblage.

Site name	Site number	Distance from RWF Site (km)
Mersey Estuary	UK9005131	71.0
Mersey Narrows and North Wirral Foreshore	UK9020287	68.5
Dee Estuary	UK9013011	52.7
Traeth Lafan / Lavan Sands, Conway Bay	UK9013031	35.2
Ynys Feurig, Cemlyn Bay and the Skerries	UK9013061	22.1
Glannau Aberdaron and Ynys Enlli	UK9013121	87.6
Liverpool Bay / Bae Lerpwl	UK9020294	20.4
Grassholm	UK9014041	216.1
Skokholm and Skomer	UK9014051	216.1
Rathlin Island	UK9020011	199.2
Belfast Lough	UK9020101	132.0
Lough Neag and Loch Beg	UK9020091	148.7
Lame Lough	UK9020042	139.2
Outer Ards	UK9020271	94.3
Strangford Lough	UK9020111	93.5
Carlingford Lough	UK9020161	114.4
Copeland Islands	UK9020291	122.5
Saltee Islands	004002	132.0
Lambay Island	004069	114.4
Ireland's Eye	004117	122.5
Skerries Island	004122	94.5
Howth Head Coast	004113	139.2
Helvick Head to Ballyquin	004192	148.7

Ramsar sites

7.202 Table 7.14 lists the Ramsar sites that border the Irish Sea. Ramsar sites are designated under The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention or Wetlands Convention) 1971 convention in Ramsar, Iran. These Ramsar sites are designated for their important habitats such as fens, sand dunes and mudflats and/or their rare species and important populations of wetland birds. Many of these Ramsar sites are also SPAs classified under the Birds Directive.

Table 7.14 Ramsar sites and features within the region

Site name	Qualifying feature
Anglesey and Llŷn Fens	Calcareous fens and diverse flora and fauna with associated rare species.
Ballaugh Curragh	Peatland habitat, corncrake *Crex crex* and hen harrier *Circus cyaneus.*
Castle Loch, Lochmaben	Species/populations occurring at levels of international importance.
Dee Estuary	Intertidal mud and sand flats and saltmarsh, Natterjack Toad, *Epidalea calamita*, assemblages of international importance of waterbirds and species/populations occurring at levels of international importance.
Duddon Estuary	Natterjack toad *Epidalea calamita,* supports a rich assemblage and scarce wetland plants and invertebrates, nationally important numbers of waterfowl during spring and autumn passage, assemblages of international importance of waterfowl and species/populations occurring at levels of international importance.
Leighton Moss	Reedbed habitat, great bittern *Botaurus stellaris*, Eurasian marsh harrier *Circus aeruginosus* and bearded tit *Panurus biarmicus,* species occurring in nationally important numbers outside the breeding season include northern shoveler *Anas clypeata* and water rail *Rallus aquaticus.*
Loch of Inch & Torrs Warren	Sand dune and dune slack habitats and species/populations occurring at levels of international importance.
Mersey Estuary	Assemblages of international importance of waterfowl and species/populations occurring at levels of international importance.
Morecambe Bay	Migratory waterfowl, assemblages of international importance of waterfowl and species/populations occurring at levels of international importance.
Ribble and Alt Estuary	Natterjack toads *Epidalea calamita*, assemblages of international importance of waterfowl and species/populations occurring at levels of international importance.
Upper Solway Flats & Marshes	Natterjack toad *Epidalea calamita,* assemblages of international importance of waterfowl and bird species/populations occurring at levels of international importance.

Sites of Special Scientific Interest (SSSI)/Areas of Special Scientific Interest (ASSI)

7.203 As shown in Figure 7.11 above, there are a large number of SSSIs/ASSIs in the Irish Sea area. The vast majority relate to terrestrial features above the high water mark and therefore, as discussed in Chapter 5, will be considered as part of the EIA of the onshore infrastructure associated with the RWF Project.

7.204 A number of SSSIs/ASSIs also benefit from designation as SPAs, SACs or Ramsar sites and these are subject to the HRA considerations outlined above.

7.205 A smaller number of SSSIs designated for coastal features such as dunes and wetlands are present along the Welsh and English coasts. Given the findings of the

ZAP Report on physical processes (see Chapter 6 of this report), impacts on such sites are unlikely to arise other than in respect of works within the export cable corridor.

7.206 The export cable corridor encompasses the eight SSSIs listed in Table 7.15 below. These include designations for geological features as well as nature conservation interests.

Table 7.15 SSSIs within the offshore cable route study area

Site name	Reason for SSSI designation
Carmel Head	Geological features
Henborth	Geological features
Cemlyn Bay	Coastal lagoon, shingle bank
Llanbadrig-Dinas Gynfor	Geological features
Traeth Lligwy	Geological features
Trwyn Dwlban	Geological features
Arfordir Gogleddol Penmon	Geological, botanical, ornithological and marine biological features.
Puffin Island	Seabirds (cormorant)

7.207 Additionally, as shown in Figure 7.11 in Section 7.4 (ornithology), there are a number of other SSSIs/ASSIs which incorporate ornithological interests in their designations.

Marine Conservation Zones (MCZs)

7.208 The Marine and Coastal Access Act 2009 provides the framework for the establishment of a network of marine protected areas, known as MCZs in English, Welsh (0-12nm) and UK waters (12-200nm).

7.209 The MCZ project considers English inshore waters and offshore waters around England, Wales and Northern Ireland. A body known as Irish Sea Conservation Zones (ISCZ) was formed as one of four regional projects set up to recommend MCZs to the UK Government. ISCZ, informed by a regional stakeholder group, made recommendations in 2011 to UK Government on the establishment of the 13 MCZs, three estuarine MCZs and associated 'reference' areas shown in Figure 7.12. On 18th July 2012 JNCC and NE have formally advised Defra on recommended MCZs. Defra will continue evaluating all the evidence before the public consultation in December 2012. After having analysed the results of the consultation and other evidence, Ministers will make their decisions on which sites to designate. Defra should be designating the first tranche of sites in summer 2013, while other sites will follow at a later stage.

7.210 In Welsh inshore waters the relevant Devolved Administration has the responsibility to designate a small number of Highly Protected Marine Conservation Zones (HPMCZ) identified through the Marine Conservation Project Wales. In April 2012 the Welsh Government began their first round of consultation on potential HPMCZ site options for the Welsh territorial seas.

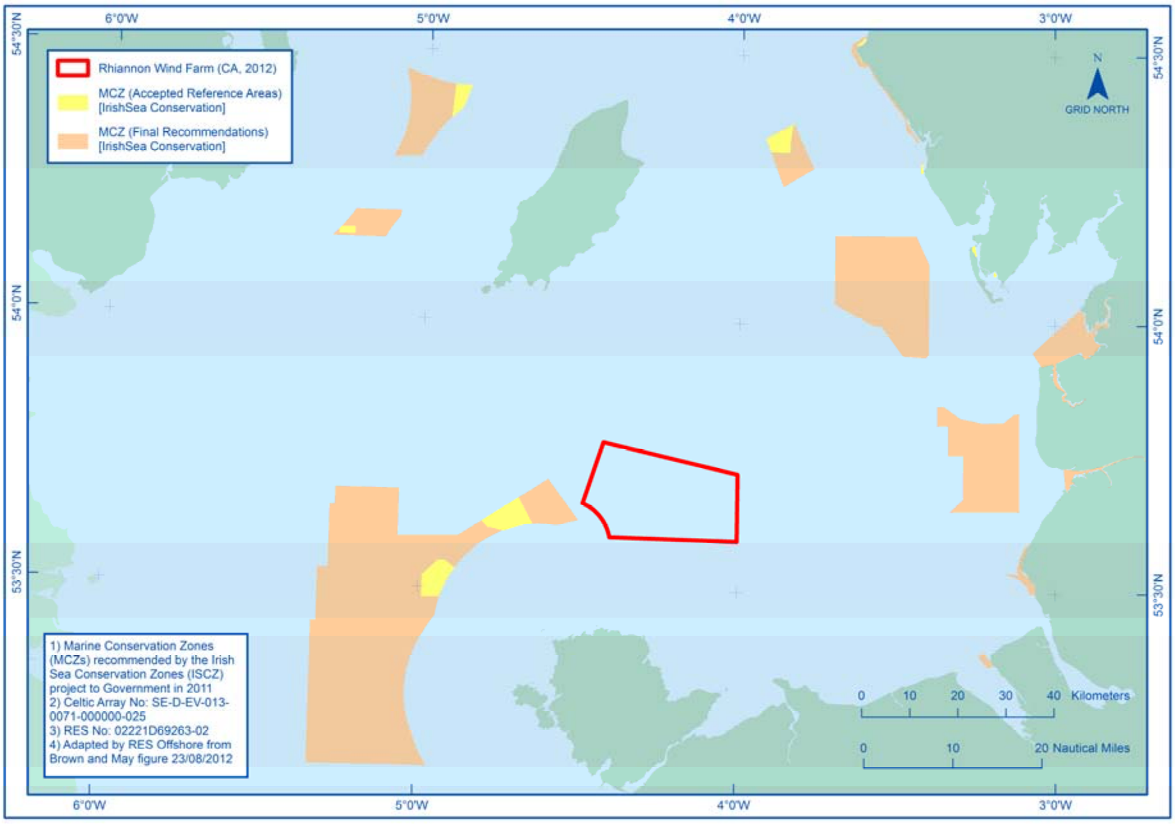


Figure 7.12 MCZs recommended by ISCZ to the UK Government in 2011

7.211 Three of the recommended MCZ (rMCZ) are in relatively close proximity to the Site, although none overlap with the Site or the potential export cable corridor.

7.212 Alongside the four projects looking at English and offshore waters, the Welsh Government, between April to July 2012, consulted on a suite of potential highly protected Marine Conservation Zones (HPMCZs) in the Welsh territorial seas. The aim of the MCZ Welsh programme is to designate 3-4 sites by 2014. Out of the 10 potential site options put forward (all located along the west of Wales and Anglesey coastline), the potential HPMCZs Puffin Island and North East Menai Strait are closest to the Site.

Transboundary issues

7.213 As discussed above, there are a number of designated sites in the Republic of Ireland which will require consideration in the ES. The findings of the chapter on physical processes (Chapter 6) suggest that coastal sites are unlikely to be directly affected by the development of the Site. However, such designations may cover bird and marine mammal species which have been recorded within the ISZ and so may be considered further in RWF's EIA. This is particularly relevant in respect of Manx shearwater.

Other protected area designations

7.214 Other nature conservation designations such as National Nature Reserves (NNR) and Local Nature Reserves (LNR) may be affected by the development of onshore infrastructure. As described in Chapter 5 (EIA methodology), potential impacts on these designations will be considered in the onshore ES produced in support of the application for planning permission for onshore infrastructure.

Potential impacts

7.215 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction / decommissioning	
Installation of export cables	The installation of the export cables within the export cable corridor has the potential to affect features protected by SSSI and SAC designations. Such impacts are considered in Section 7.1 (benthic ecology). Such impacts can largely be mitigated through careful route selection.
Construction noise impacts on fish and marine mammals – SAC species	As discussed in Section 7.2 (fish and shellfish ecology) and 7.3 (marine mammals) construction noise and particularly the use of driven piles, has the potential to affect marine mammals (seals and cetaceans) and fish (Atlantic salmon, river and sea lamprey) which may be qualifying features of SACs.
Displacement of SPA bird species	As discussed in Section 7.4 birds may be disturbed or displaced by construction activity at the Site. Such birds may be qualifying species of SPAs.
Impacts on MCZs and coastal SSSIs and SACs	The findings of the ZAP Report on physical processes (see Chapter 6) concludes that significant indirect effects arising from construction (suspended sediments, changes to tidal regime) are unlikely to arise.
Potential impacts during operation	
Collision risk, displacement and barrier effect - SPA species	As discussed in Section 7.4, birds may be disturbed or displaced by the operation of a wind farm either through the presence of turbines or though maintenance vessel traffic. The presence of the turbines may give rise to the risk of collision between birds and rotating blades. The wind farm may act as a barrier to daily or seasonal movements of birds. In all these cases, such birds may be qualifying species of SPAs.
Operational noise – SAC species	As discussed in Sections 7.2 (fish and shellfish ecology) and 7.3 (marine mammals), it is proposed, that the effects of operational noise be scoped out of the ES.

Physical processes – impacts on MCZs and coastal SACs and SSSIs	The findings of the ZAP Report on physical processes (see Chapter 6) concluded that significant indirect effects arising from the operation or presence of the turbines (suspended sediments, changes to tidal or wave regime) are unlikely to occur outside of the near-field. Given that the relevant MCZs, SACs and SSSIs are at some distance from the Site (see Figures 7.11 and 7.12 above), it is proposed that impacts on MCZs, coastal SSSIs and SACs arising from changes to physical processes during the operation of RWF be scoped out of the ES.
Potential cumulative impacts	
Installation of export cables	The installation of multiple export cables from different wind farms (either within the ISZ or over a wider area) has the potential to cumulatively affect features protected by SSSI and SAC designations. Such impacts are considered in Section 7.1 (benthic ecology).
Construction noise impacts on SAC species	As discussed in Section 7.2 (fish and shellfish ecology) and 7.3 (marine mammals), construction noise from multiple projects (either simultaneously or consecutively) has the potential to effect qualifying features of SACs.
Collision risk, displacement and barrier effect - SPA species	As discussed in Section 7.4, birds may be disturbed or displaced by the construction and operation of multiple wind farms either through the presence of turbines or though maintenance vessel traffic. The presence of the turbines in multiple projects may give rise to an increased risk of collision between birds and rotating blades. A group of wind farms may collectively act as barriers to daily or seasonal movements of birds. In all these cases, such birds may be qualifying species of SPAs. Table 7.10 identifies SPA species for which cumulative impact risks may arise.

Scoping Opinion from the Planning Inspectorate

7.216 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to nature conservation:

- The Secretary of State noted that there were a number of statutory designations in the vicinity of the proposed site; and
- The Secretary of State advised that the ES should contain relevant information regarding potential impacts of the proposal on both relevant offshore and terrestrial nature conservation designations.

Approach to address Scoping Opinion

7.217 The level of detail as to how these issues will be addressed will be determined following Stage 1 consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA survey and study programme

7.218 The EIA for RWF will build on the data collected as part of the ZAP process and update the data described above as necessary. In particular, the surveys outlined in Sections 7.1 (benthic ecology), 7.2 (fish and shellfish ecology), 7.3 (marine mammals) and 7.4 (ornithology) will be used to inform the assessment of impacts on areas of nature conservation importance.

7.219 As discussed in Chapter 5, further surveys in respect of the intertidal zone may be required to assess the impacts of the installation of export cables. Such surveys will be particularly relevant in respect of the Y Fenai a Bae Conwy SAC and the eight SSSIs identified in Table 7.13 above.

7.220 The ES will include:

- A description of the nature conservation designations outlined above, including their current status and the relevant populations or features they support. Reference will be made to the information described above and, in particular, consultation derived data and information;
- This description will include analysis of the survey data described above;
- A review and summary of consultation activities including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative impacts. Much of this assessment will draw upon specialist technical chapters in the ES relating to benthic ecology, fish and shellfish ecology, marine mammals and birds. Cross-referencing to the relevant chapters of the ES will be included;
- A review and summary of physical processes surveys and studies incorporating any identified key issues specifically regarding benthic, intertidal and beach/dune ecology. Cross-referencing to the relevant chapters of the ES will be included; and
- Proposals for mitigation measures and monitoring, if required.

8 HUMAN ENVIRONMENT

8-1 Human environment – commercial fisheries

Introduction

8.1 This chapter characterises commercial fishing activities in and around the Site, describes the potential impacts of wind farm development on those activities and outlines the issues which will be considered in the ES. It also outlines the scope of surveys and studies that have been agreed with relevant consultees.

Surveys and studies carried out to date

8.2 As part of the ZAP process described in Chapter 3, Celtic Array commissioned a commercial fisheries study. The ZAP Report included full zonal characterisation based around the collection of fisheries data and consultation.

8.3 The principal sources of data and information used for the production of the ZAP Report and this Stage 1 PEI Report are:

- Results of consultation with fishermen and their representatives;
- Round 3 ISZ Commercial Fisheries Consultation Report (RSS Marine Ltd);
- International Council for the Exploration of the Seas (ICES);
- MMO;
- The Scallop Association;
- Sea Fisheries Protection Agency (SFPA) (Republic of Ireland);
- Vlaamse Overheid Fisheries Department (Belgium); and
- Isle of Man DEFA.

8.4 As part of the ZAP Report and the preparation of this chapter, the following reports were reviewed and relevant information included in the description of the current environment:

- ICES Stock Assessment Reports and other ICES publications of relevance;
- EC/National and Local Fisheries Legislation;
- Oil and Gas UK publications;
- Cefas publications; and
- Other relevant publications.

8.5 The following statistical datasets were utilised in preparing the ZAP Report and this chapter:

- MMO fisheries statistics;
- MMO UK satellite tracking (VMS) data;
- MMO surveillance sightings;
- Vlaamse Overheid Fisheries Department fisheries statistics (supplied by the Institute for Agricultural and Fisheries Research - ILVO);
- Vlaamse Overheid Fisheries Department Belgian satellite tracking (VMS) data (supplied by ILVO);

- SFPA fisheries statistics;
- SFPA Irish satellite tracking (VMS) data;
- Isle of Man DEFA fisheries statistics;
- Isle of Man DEFA satellite tracking (VMS) data; and
- Fishery specific information (information provided by fishermen and their representatives).

8.6 Additional survey data was collected by Celtic Array as follows:

- Radar data on fishing vessel movement was collected from a geophysical survey vessel across the ISZ between March and August 2010; and
- Fish community surveys to characterise the ground fish assemblage of the zone. Using 4m beam trawls, a survey of 25 locations across the zone was undertaken in two surveys in late autumn 2010 and March 2011. The methodology adopted allows for comparability with autumn surveys of the wider Irish Sea by Cefas.

8.7 Celtic Array has consulted a number of organisations and individuals to date, namely:

- The MMO District fisheries Officer – Blackpool and Whitehaven;
- The relevant IFCAs;
- The National federation of Fisheries Organisations (NFFO);
- The Scottish Fishermen's Federation (SFF);
- Redercentrale (Belgian Fishermen's Federation);
- Manx Fish Producers Organisation (MFPO);
- New Under Ten Fishermen's Association;
- The Scallop Association;
- Relevant UK Producer Organisations;
- Regional and Local Fishermen's Associations; and
- Individual skippers and vessel owners with vessels fishing in the area of the ISZ.

8.8 A meeting was held on 9 August 2011 with the main UK fishing industry bodies including the NFFO, Anglo-North Irish Fish Producers Organisation (ANIFPO), Northern Ireland Fish Producers' Organisation (NIFPO), SFF and representatives of The Scallop Association. A subsequent meeting was held on 30th September 2011 with the Fisheries Industry Representatives (FIRs) described below. More recently meetings have taken place in August 2012 with the major associations including ANIFPO, NIFPO, The Scallop Association, MFPO and the North Wales Fishermans Association. The purpose of these meetings was to provide the various industry bodies with an update to the project and possible data collection requirements. Further meetings are planned with members of the Belgian Producers Organisation.

8.9 In addition to meetings with the industry bodies, statutory regulators have also been consulted and updated on Celtic Array's overall progress, approach to consultation and communication with the industry. The ZAP Scoping Report was sent out to all relevant statutory regulators in August 2010 and all relevant statutory regulators we consulted on the approach to the ZAP process commercial fisheries assessment process.

8.10 Fisheries newsletters and Notice to Mariners (NTMs) have been distributed by Celtic Array's Fisheries Liaison Officer (FLO) to keep the industry updated on the overall ZAP process and informing the industry about survey timings.

8.11 Celtic Array's Fisheries Liaison Officer (FLO), prepared and distributed a standard questionnaire to obtain further information from individual stakeholders. 172 questionnaires have been issued and 18 questionnaires had been returned representing 63 vessels. Consultation has also been undertaken with a large number of site-based operators as part of RSS Marine's fisheries liaison role. Consultation is ongoing and further meetings have been held with Celtic Array's FIRs and the ISZ working group in August and September 2012. Informal consultation will continue with these groups including statutory stakeholders throughout EIA process.

8.12 A fisheries working group has been established, the members of which represent the various fisheries sectors which could be potentially impacted by developments within the ISZ. The aim of the working group is to provide a forum for:

- Discussion of issues, concerns and clarification of facts relating to Celtic Array's offshore wind farm activities in the ISZ, including development of RWF;
- Providing a means by which the FLO and Celtic Array can address and discuss issues and concerns raised directly with representatives of the local fishing community;
- Consideration of mitigation measures; and
- An alternative means of liaising and communicating with Celtic Array.

8.13 In addition, four FIRs from the principal categories of fishing vessels operating within the ISZ area have been appointed to:

- Act as a principal point of contact within the fishing community;
- Liaise with fishermen with a view to informing Celtic Array and the FLO of any particular issues;
- Disseminate information; and
- Provide Celtic Array and its consultants with specialised fishing advice.

Description of current environment

8.14 The description of the current environment is based on the findings of the ZAP Report. Due to the relatively coarse nature of much of the fisheries data references are made predominantly to the ISZ rather than the Site itself.

8.15 The ZAP Report described the regional study area as the area that encompasses those ICES rectangles in the immediate surrounding area of the ISZ. The local study area is defined by the ICES rectangles in which the Potential Development Areas are located (36E5 and to a lesser extent 37E5), ICES rectangles being the smallest spatial units currently used for the collation of fisheries statistics.

8.16 The Site is located in an area which sustains comparatively low levels of activity in the national and regional contexts. The activity which does occur is predominantly by UK vessels.

8.17 In terms of landings values, trawling for nephrops is the most important fishery within the Irish Sea. It is worth noting, however, that the main nephrops grounds are located some distance from the ISZ, off the Irish and Cumbrian coasts, with comparatively low levels of fishing occurring within the ISZ.

8.18 Beam trawling for flatfish, predominantly sole, is also an important fishery, with the highest levels of activity recorded by Belgian vessels. As with the nephrops fishery, however, the ISZ sustains only low levels of beam trawling activity as the main grounds are located to the east and west of the ISZ.

8.19 Potting for whelks, crab and lobster have become increasingly important fisheries in the Irish Sea with some limited activity occurring within the ISZ.

8.20 In terms of value and potential impacts, scallop fishing is the most significant activity occurring within the ISZ. The data and information obtained to date suggest that the highest concentration of scallop dredging activity occurs in the north east of the ISZ.

8.21 King scallop fishing is cyclical with vessels generally targeting grounds intensively for a period after which they are then left to recover, often for a number of years. King scallop grounds are extensive, being located in the Irish Sea, off the Scottish east and west coasts and in the English Channel.

8.22 The queen scallop fishery in the Irish Sea is one of the largest in the UK and mainly targeted in the waters around the Isle of Man, but some activity occurs within the ISZ. On a national scale, queen scallop fisheries are declining, although the Isle of Man fishery is considered to be environmentally sustainable, possibly in part because of the management measures introduced in 2010.

National and regional fisheries statistics

National MMO fisheries statistics

8.23 The regional study area considered in this report comprises the 12 ICES rectangles outlined in Figure 8.1. Figure 8.1 shows the average landings values by species in the regional study area (2001 to 2010), which records significant landings values for nephrops, king scallops, sole, queen scallops and whelks (MMO 2012).

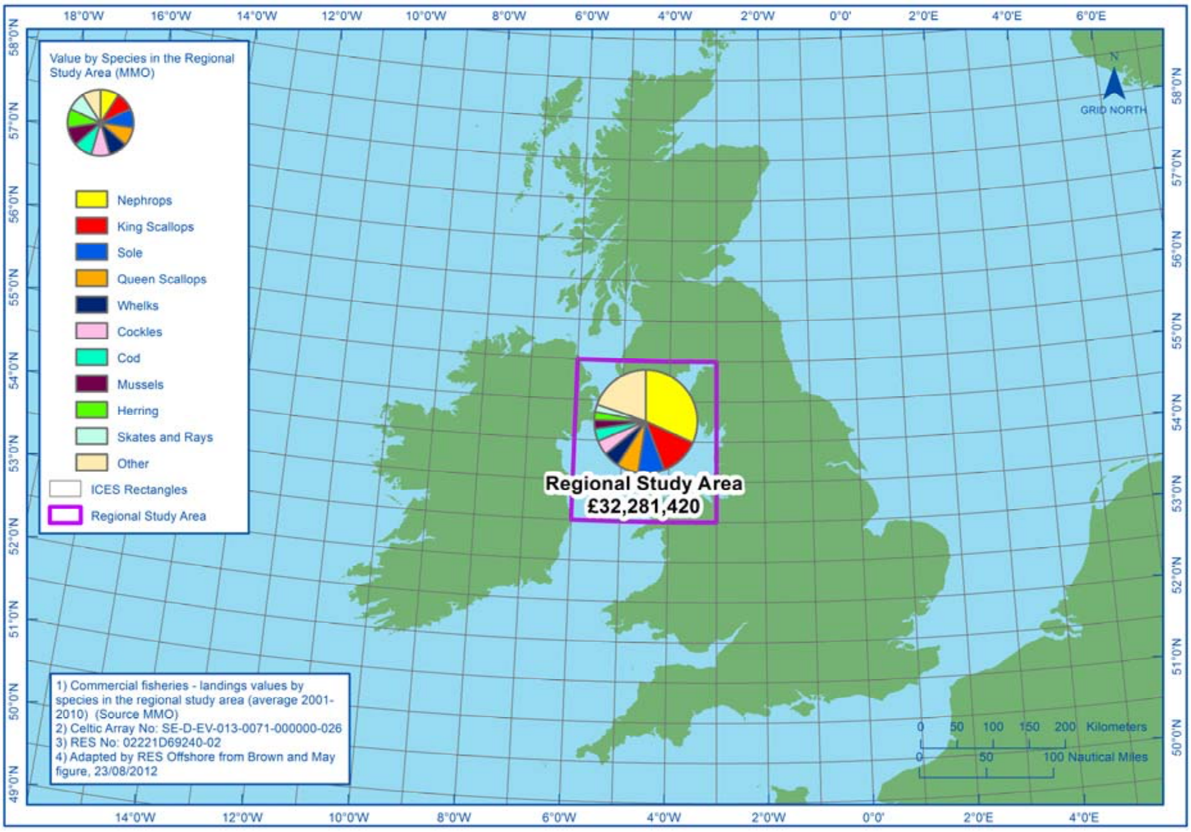


Figure 8.1 Landings values by species in the regional study area in the regional study area (Source MMO)

8.24 The total national landings values by year in comparison to the total landings values in the regional and local study areas (for UK registered vessels only) are shown in Table 8.1. It can be seen that the regional study area records landings values which represent between 4% and 6% of the national value. The local study area records landings values which represent approximately 1% of the national value and this has increased slightly over the ten year period. Regional and local landings weights are broadly commensurate with landings values, indicating that values are directly proportional to weights landed.

Table 8.1 Landings values by year in the national, regional and local study areas of all species

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total national landings values* (£ million)	574.4	545.6	528.3	513.0	574.6	614.3	646.3	635.6	674.4	719.3
Total regional landings values (£ million)	31.6	28.1	32.7	21.6	22.2	28.1	29.6	32.2	27.5	31.1
Percentage of the national area values that the regional study area values represent	5.5%	5.2%	6.2%	4.2%	3.9%	4.6%	4.6%	5.1%	4.1%	4.3%
Total local landings values (£ million)	5.4	4.4	4.4	3.2	5.8	5.9	6.1	7.0	8.3	9.8
Percentage of the national area values that the local study area values represent	0.9%	0.8%	0.8%	0.6%	1.0%	1.0%	0.9%	1.1%	1.2%	1.4%

*Source: Summary of UK fishing industry: 2001 to 2010 (MMO statistics).

8.25 Trawling for nephrops comprises the majority of the landings values in the regional study area. ICES rectangles to the west of the regional study area record the highest landings values which are of national importance as they are comparable to nephrops landings values recorded elsewhere in the UK. Nephrops landings values in the local area are considerably lower. The key nephrops grounds are located in the Irish Sea, off the east and west coasts of Scotland and off the north east coast of England.

8.26 Fishing for king and queen scallops are important fisheries in the Irish Sea with landings values that are important on a national scale. King scallop fisheries are located around the UK, with key grounds found in the English Channel, Irish Sea and west and east coasts of Scotland. Queen scallops are principally targeted in the Irish Sea, which records the highest landings values for this species. There are also grounds off the coasts of Northern Ireland and Wales.

8.27 Beam trawling for sole is also an important fishery in the Irish Sea targeted by both UK and foreign vessels. The grounds in the local area are of low to moderate importance on a national scale, although grounds in the east of the regional study area record moderate to high landings values. The main sole grounds targeted by beam trawlers are located off the coasts of Cornwall and Devon as well as in the English Channel and in the southern North Sea.

8.28 Whelks have become an increasingly important fishery in the Irish Sea, targeted in the main by vessels setting pots. ICES rectangles in the north and south of the regional study area record landings values of national importance whereas the local study area records landings of moderate importance on a national scale. The principal UK whelk grounds are located in the Irish Sea, around the coast of Wales, off the southern coast of England and off the Yorkshire coast. There are also smaller whelk fisheries targeted in northern Scotland and the Orkneys.

Regional MMO fisheries statistics

8.29 The local study area considered in the ZAP Report is comprised of two rectangles, 36E5 and 37E5, shown edged orange in Figures 8.2 and 8.3. The Site is situated within 36E5. Figures 8.2 and 8.3 show the landings values recorded in the regional study area, by species and method, respectively (MMO 2012). It can be seen that rectangles 36E5 and 37E5 record landings values of moderate importance in the regional study area.

8.30 Dredging for king and queen scallops occurs in the central rectangles, with beam trawling for sole in the west and south east of the regional study area. Landings values for nephrops are high in the south west of the regional study area as well as in grounds inshore to the north east, targeted by nephrops trawlers and bottom otter trawlers (the same method under different categorisation). Potting for whelks occurs in inshore areas to the south of the study area. Herring comprises a significant proportion of the landings values of ICES rectangle 37E5 to the north, targeted in the main by mid-water pair trawlers. Vessels operating otter trawls also record significant proportions of landings values in the regional area, targeting species such as cod, haddock and spurdog.

8.31 The majority of activity in the regional study area is undertaken by vessels of over 15 metres in length. Activity by non-UK vessels is recorded to the south west and east of the study area. A moderate amount of activity is recorded by the under 10 metre fleet in inshore areas, with the 10 to 15 metre fleet recording lower levels.

8.32 The regional statistics record Irish, Isle of Man and Belgian landings weights in the regional study area.

8.33 The main species targeted by the Irish fleet is nephrops, recording high landings weights in ICES rectangle 36E4 to the west of the regional study area. There is also some potting for whelks and dredging for mussels in areas to the south west of the regional study area. Landings weights in the local study area are considerably lower with scallops the principal species targeted in ICES rectangle 36E5 and herring in 37E5.

8.34 Manx landings weights records show that queen and king scallops record the highest landings weights in the central rectangles, including the local study area. Rectangles inside the local study area record the highest weights with rectangles outside the local study area record considerably lower landings weights.

8.35 For Belgian landings the main species targeted is sole, followed by plaice and rays. The largest landings weights are recorded in the east and south west of the regional study area, with landings in the local study area recording relatively lower weights.

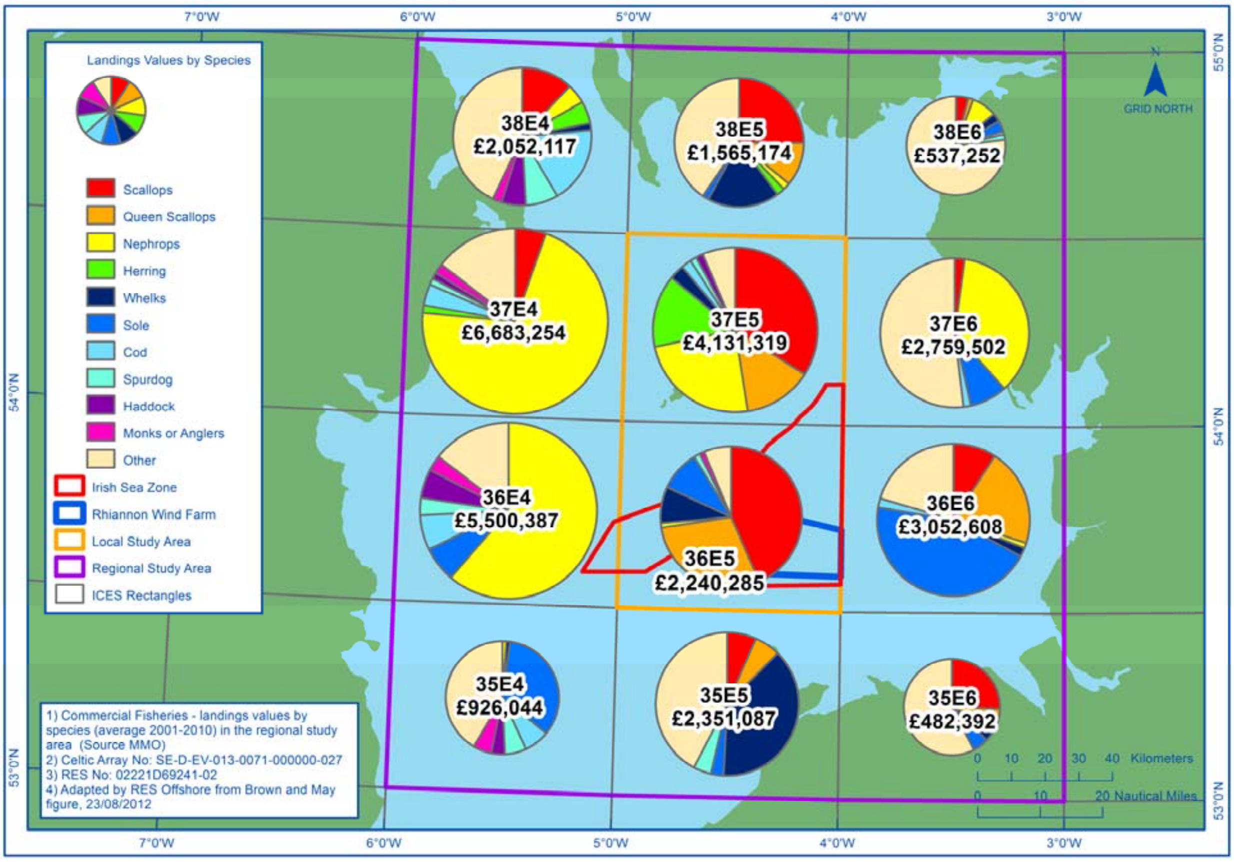


Figure 8.2 Landings values by species (average value 2001-2010) in the regional study area

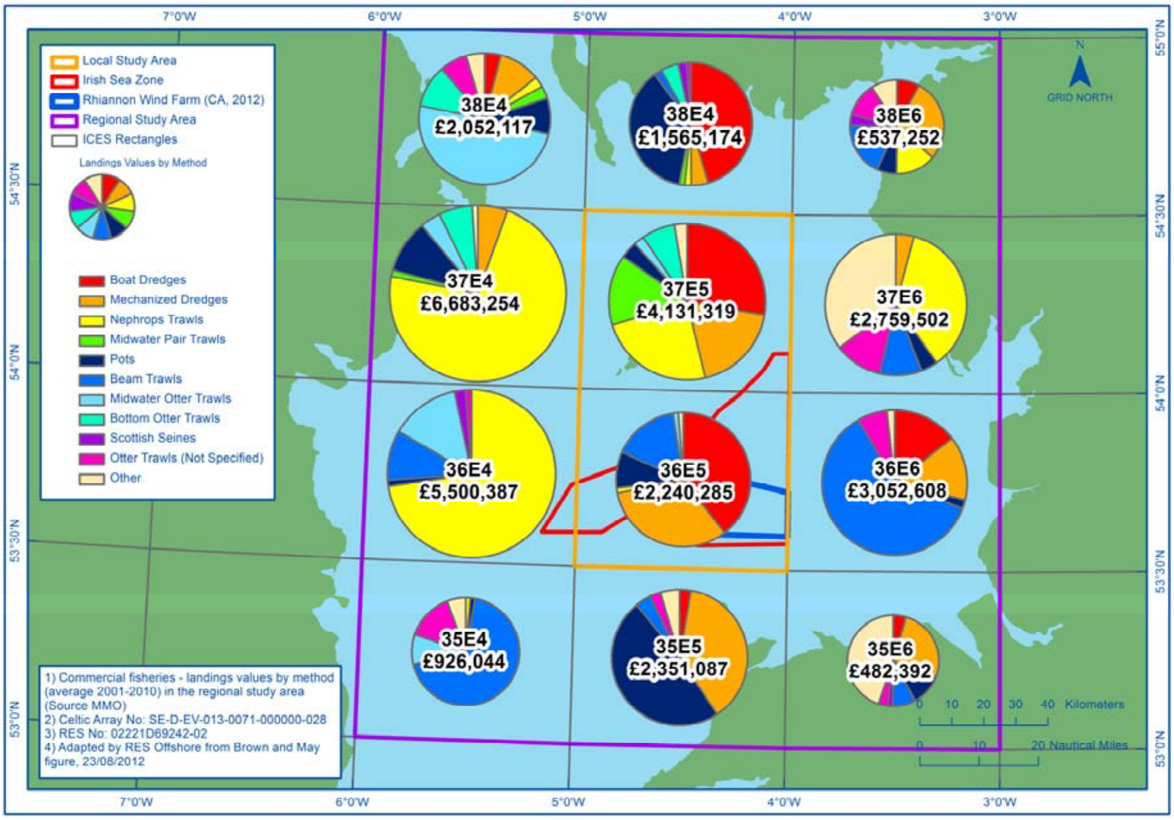


Figure 8.3 Landings values by method (average value 2001-2010) in the regional study area

Satellite tracking - regional overview (2007-2010 data)

8.36 Figures 8.4 and 8.5 show the satellite density of all UK vessels over-15 metres by landings values in the regional study area by mobile and static gears, respectively (total value 2007 to 2010) (MMO 2012). Relatively high densities of mobile gear values are recorded in the west, east and central areas of the regional study area. High levels of mobile values are recorded in the north east of the ISZ, with moderate values recorded in the south east and negligible mobile values recorded in the south west.

8.37 There are two relatively high value areas for static gear in the Irish Sea: one to the north of the Isle of Man and another small area to the west of Anglesey. Areas in the north east and south west of the ISZ record low static gear values.

Belgian VMS data

8.38 Belgian VMS data from 2009 have been considered which show Belgian beam trawling activity in the east, outside of the ISZ and to a lesser extent in the west, including areas of the south western ISZ. The remainder of the ISZ records negligible activity. Consultation with Redercentrale supports this assessment of the distribution of Belgian beam trawling activity (BMM November 2011). The data suggest that negligible levels of demersal otter trawling occur from Belgian vessels within the ISZ.

Irish VMS data

8.39 Irish VMS data (averaged from 2005 to 2007) shows that the majority of Irish activity occurs in the west of the Irish Sea, with moderate activity occurring in the east outside the ISZ. Very low levels of activity are recorded in the north east and south west of the zone.

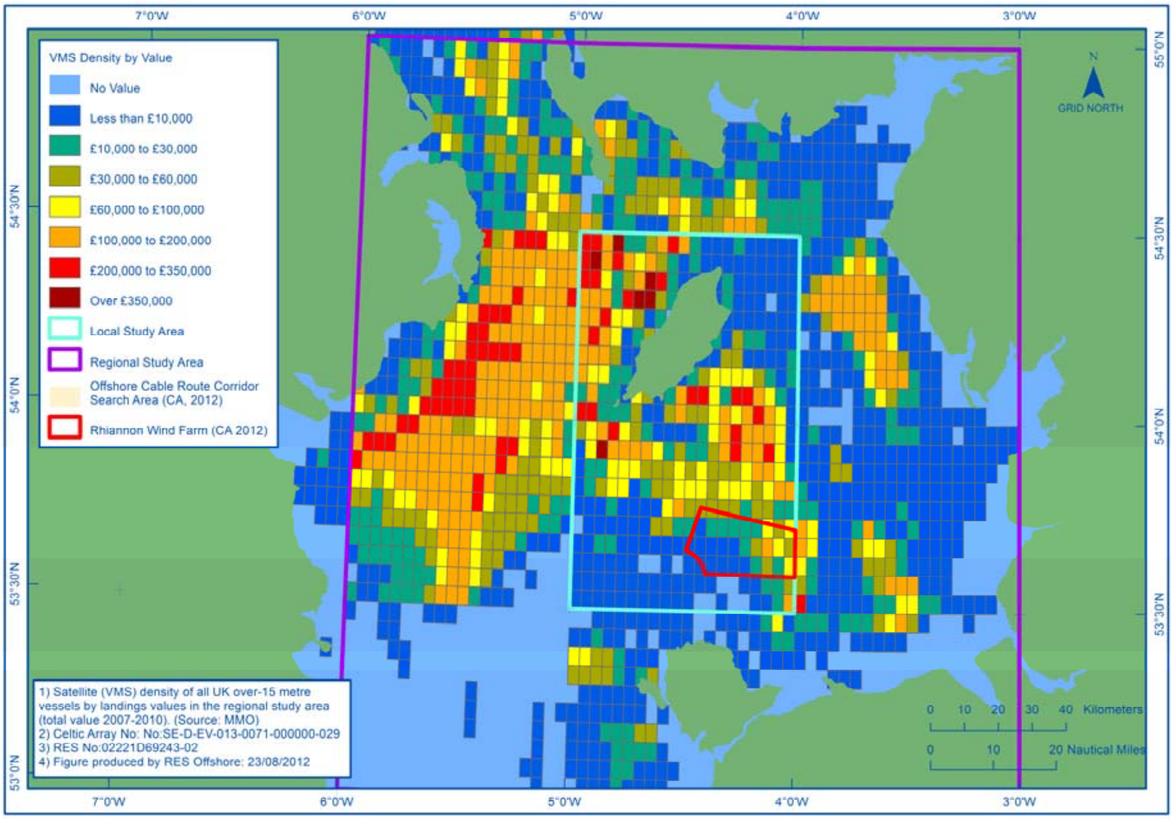


Figure 8.4 Satellite (VMS) density of all UK over-15 metre vessels by landings values in the regional study area (average value 2007-2010)

centrica energy DONG energy

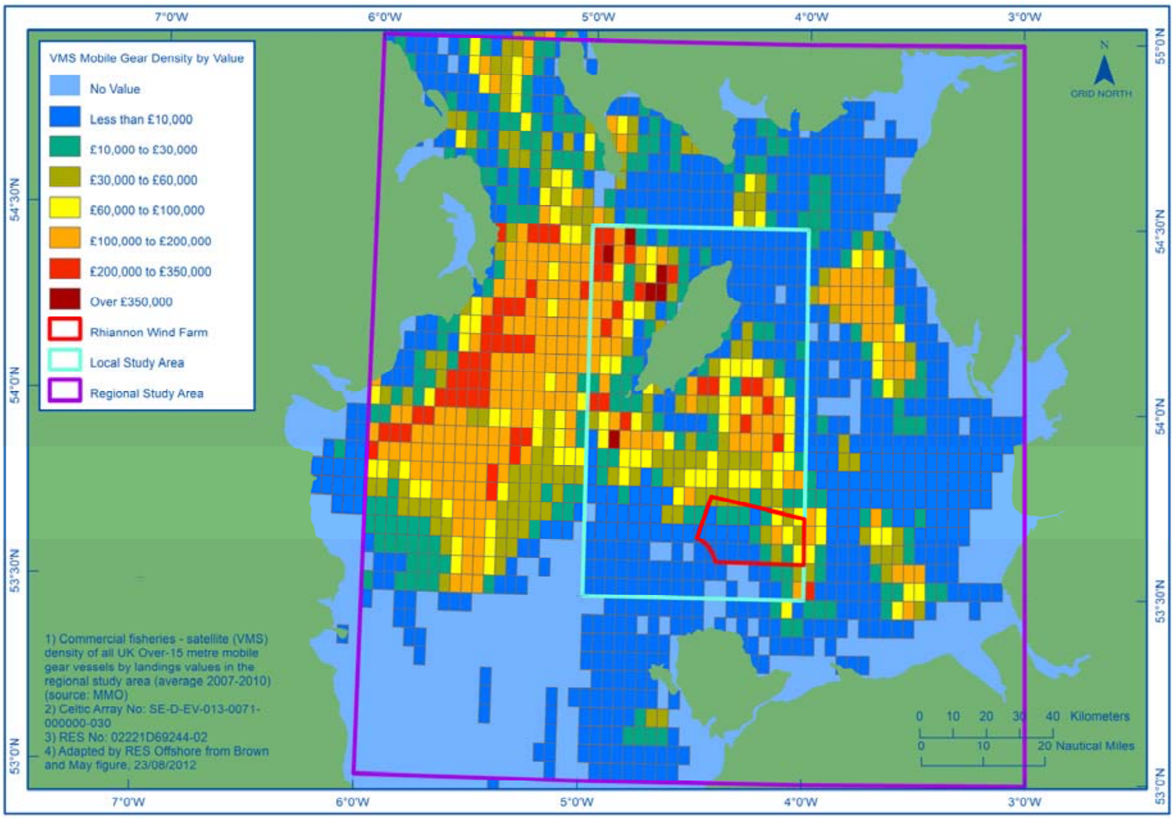


Figure 8.5 Satellite (VMS) density of all UK over - 15 metre mobile gear vessels by landings values in the regional study area (average value 2007-2010)

Fisheries surveillance sightings

8.40 Figures 8.6 and 8.7 show the positions of vessels identified by fisheries surveillance officers in the regional study area by nationality and method respectively (2001 to 2010) (MMO 2012). Table 8.2 gives the percentage of the total sightings within the ISZ by nationality and method.

8.41 It can be seen that vessels using trawl gear to target nephrops in the Irish Sea are the most abundant, with sightings broadly corroborating the analysis of the MMO fisheries statistics and satellite (VMS) density data, with the highest densities located in the west and north east of the regional study area. Trawl activity is, however, comparatively low to moderate in the local study area and low in the ISZ, including the Site, with the highest sightings located in the north east of the ISZ, followed by the areas to the south east of the zone. Very low numbers are recorded in the south west of the ISZ. Over the ten year period, 215 vessels using trawl gear were recorded in the ISZ, 1.4% of the total trawl vessels recorded in the regional area.

8.42 Vessels from the UK account for 69.0% of the recorded sightings in the ISZ for the period 2001 to 2010. Over one third (34.7%) of the sightings within the ISZ are beam trawlers. Scallop dredgers have the second highest numbers of sightings in the zone (28.9%).

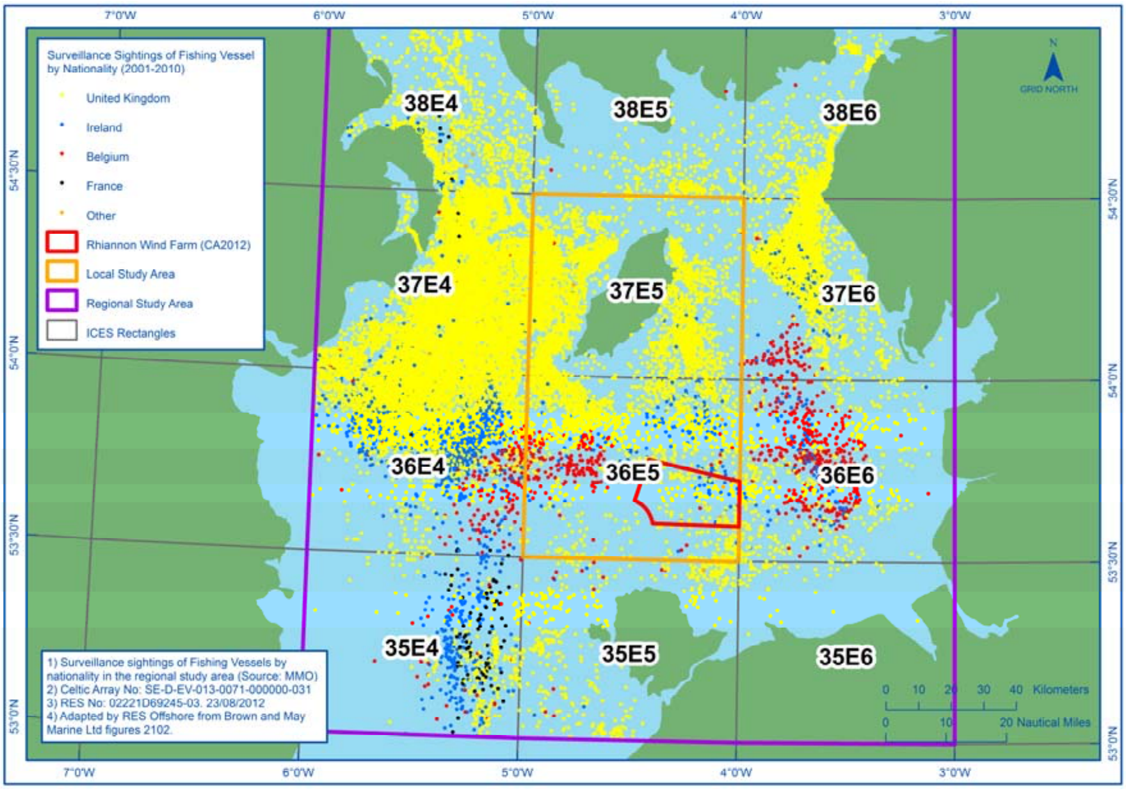


Figure 8.6 Surveillance sightings by nationality in the regional study area

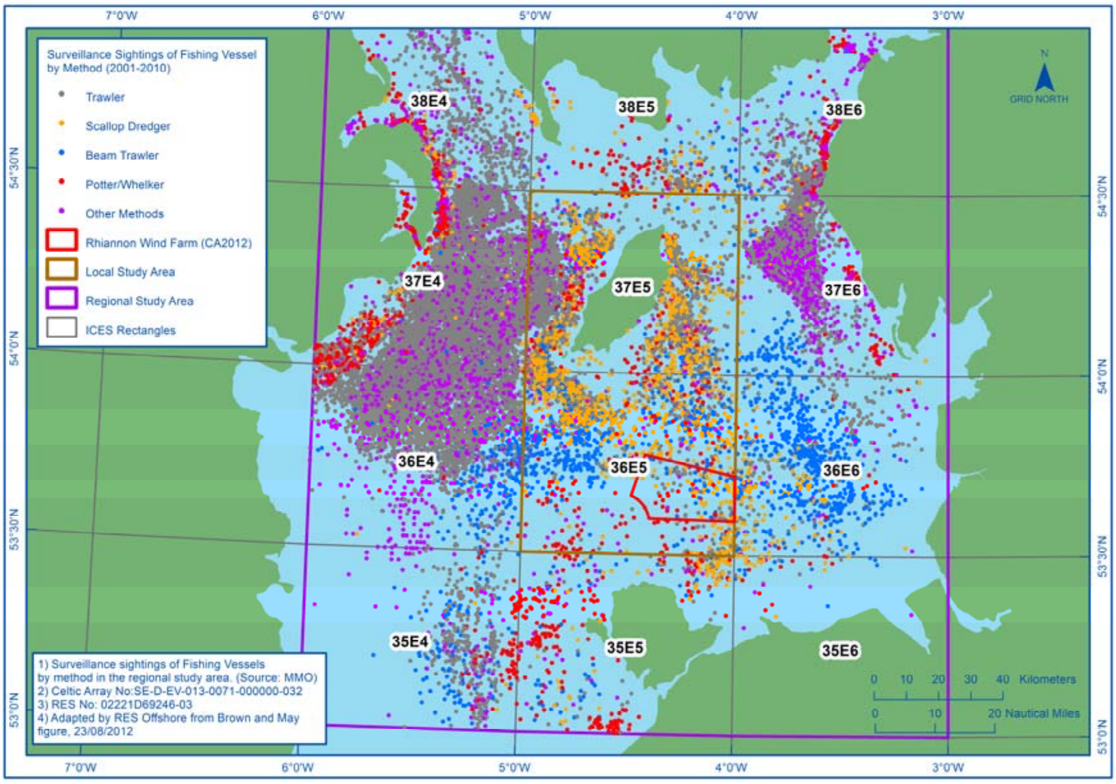


Figure 8.7 Surveillance sightings by method in the regional study area

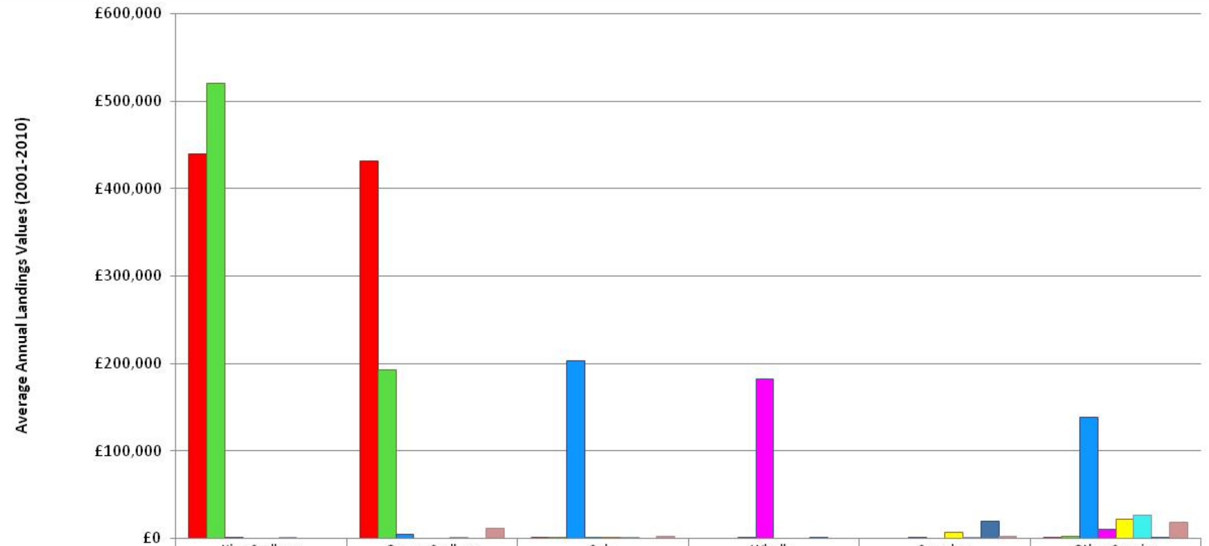
Table 8.2 Percentage of sightings within the ISZ by nationality and method (MMO 2012)

Nationality	Method	Percentage
United Kingdom	Scallop Dredgers	24.5%
	Trawler	20.3%
	Beam Trawler	10.4%
	Potter/Whelker	8.9%
	Pair Trawler	1.4%
	Stern Trawler	1.1%
	Demersal Stern Trawler	0.8%
	Demersal Side Trawler	0.6%
	Long Liner	0.4%
	Gill Netter	0.3%
	Side Trawler	0.3%
	Unknown	0.1%
	United Kingdom Total	69.0%
Belgium	Beam Trawler	16.1%
	Scallop Dredger	0.2%
	Demersal Side Trawler	0.2%
	Belgium Total	16.5%
Ireland	Beam Trawler	8.2%
	Scallop Dredger	4.1%
	Trawler	1.2%
	Potter/Whelker	0.5%
	Ireland Total	14.0%
Netherlands	Beam Trawler	0.1%
	Trawler	0.1%
	Scallop Dredger	0.1%
	Netherlands Total	0.3%
France	Stern Trawler	0.2%
	France Total	0.2%

Fishing methods in the local study area

8.43 Figure 8.8 highlights the key fisheries in ICES rectangle 36E5 (within which the Site is located) and the methods which are used to target those species (MMO 2012). It can be seen that the main fisheries in the ICES rectangle 36E5 are, in decreasing order of magnitude:

- Dredging for king and queen scallops;
- Beam trawling for sole;
- Potting for whelks; and
- Long-lining for spurdog (not considered in this report as a current fishery. A directed fishery for spurdog was effectively prohibited in 2010 as no quota was issued due to declining populations. Recorded landings values are post 2007).



	King Scallops	Queen Scallops	Sole	Whelks	Spurdog	Other Species
Boat dredges	£439,050	£431,472	£775	£0	£0	£1,449
Mechanized dredges	£520,021	£192,601	£159	£0	£0	£2,514
Beam trawls	£1,568	£4,003	£203,230	£565	£604	£138,228
Pots	£0	£0	£4	£182,227	£0	£9,714
Midwater otter trawls	£0	£0	£81	£0	£7,346	£21,833
Nephrops trawls	£41	£544	£156	£0	£44	£26,449
Longlines	£0	£0	£0	£82	£19,579	£1,500
Other Methods	£0	£11,672	£2,149	£0	£2,730	£17,895

Species

Figure 8.8 Average annual landings values (average 2001-2010) by species and method in ICES rectangle 36E5

Scallop dredging

8.44 Both king and queen scallops are targeted by vessels in rectangle 36E5 operating dredges.

King scallops

8.45 By virtue of their activity, a number of scallop vessels are nomadic, fishing one location before moving to another and returning to grounds when they have recovered. In this way, most of the suitable grounds around the UK are fished. Visiting vessels from Scotland, Ireland and Belgium periodically fish scallop grounds in the Irish Sea and, in addition, there are locally based vessels which tend to concentrate their scallop dredging activities in the regional area.

Queen scallops

8.46 Queen scallop fisheries are mainly concentrated in the Irish Sea and off the west coast of Scotland. Visiting vessels from Belgium, Ireland and Scotland will seasonally target the Irish Sea fishery, generally landing their catch into Liverpool. There are also a number of locally based vessels, especially based on the Isle of Man, who target queen scallops.

8.47 Vessels targeting king and queen scallops in the Irish Sea are either local or visiting vessels. Local vessels are based at ports within the Irish Sea area and will generally undertake day trips, landing their catch each day. Visiting vessels are vessels based at ports outside of the regional study area (generally Ireland, Scotland or Belgium) which will seasonally visit the area to target the species, landing their catch into local ports.

8.48 The ports and number of scallopers operating out of each port are identified below. Consultation with fishermen has also identified the general grounds in the Irish Sea where these vessels will target scallops.

8.49 Table 8.3 lists the ports in the regional area into which vessels that are targeting king and queen scallops in the vicinity of the ISZ will land their catch.

Table 8.3 Ports into which vessels targeting king and queen scallops will land their catch

Port	Vessels
England	
Whitehaven	Whitehaven records the second highest landings values for king and queen scallops from ICES rectangles 36E5 and 37E5. These landings are generally made by visiting UK vessels which have home ports elsewhere (MMO statistics).
Liverpool	Although there is no permanently based fishing fleet at Liverpool, a number of Scottish scallop dredgers will land their catch into the port (RSS Marine Consultation Report). Liverpool records the fourth highest landings values of king scallops and seventh highest landings values of queen scallops from the local study area (MMO statistics).
Maryport	There are between eight and ten scallopers identified to be operating out of Maryport and targeting scallops in Manx waters and on the outskirts of the ISZ (RSS Marine Consultation Report).
Wales	
Holyhead	There are between five and six scallopers based at Holyhead which are between 10 and 15 metres in length. These vessels target both king and queen scallops, although this is generally in inshore areas outside of the zone. There is one identified scalloper which targets scallop grounds in the vicinity of the ISZ (RSS Marine Consultation Report).
Amlwch	There is one identified scallop dredger based at Amlwch targeting both king and queen scallops in inshore areas outwith of the ISZ (RSS Marine Consultation Report).

Port	Vessels
Scotland	
Kirkcudbright	There are approximately 30 vessels based in Scottish ports such as Kirkcudbright and Isle of Whithorn which will seasonally target both king and queen scallops throughout the ISZ (RSS Marine Consultation Report). Vessels landing scallops into Kirkcudbright record the highest values from ICES rectangles 36E5 and 37E5 (MMO statistics).
Isle of Whithorn	
Northern Ireland	
Kilkeel	There are about five to eight Northern Irish vessels based at ports such as Kilkeel, Portavogie and Ardglass, which will target scallops in inshore areas and within the ISZ; however, activity in the ISZ is limited (RSS Marine Consultation Report).
Portavogie	
Ardglass	
Isle of Man	
There are five identified scallopers based on the Isle of Man who target both king and queen scallops within the ISZ (RSS Marine Consultation Report).	

Fishing grounds

8.50 Figures 8.9 and 8.10 show, respectively, king and queen scallop grounds identified through direct consultation with fishermen and generic grounds identified through the analysis of the datasets previously mentioned (VMS, surveillance sightings etc.). It can be seen that the king scallop grounds are located throughout the ISZ, including within the Site. Queen scallop grounds are generally located outside the ISZ in the waters surrounding the Isle of Man, although some grounds have been identified in the north and south east of the ISZ.

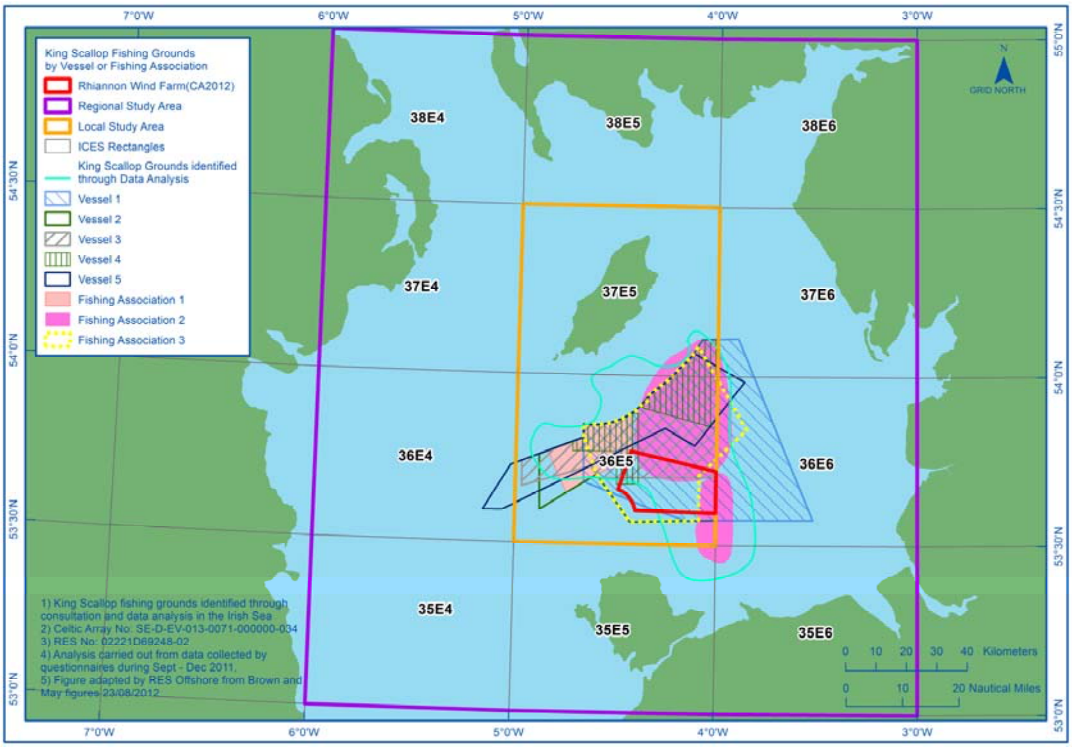


Figure 8.9 King scallop grounds identified through consultation and data analysis in the Irish Sea

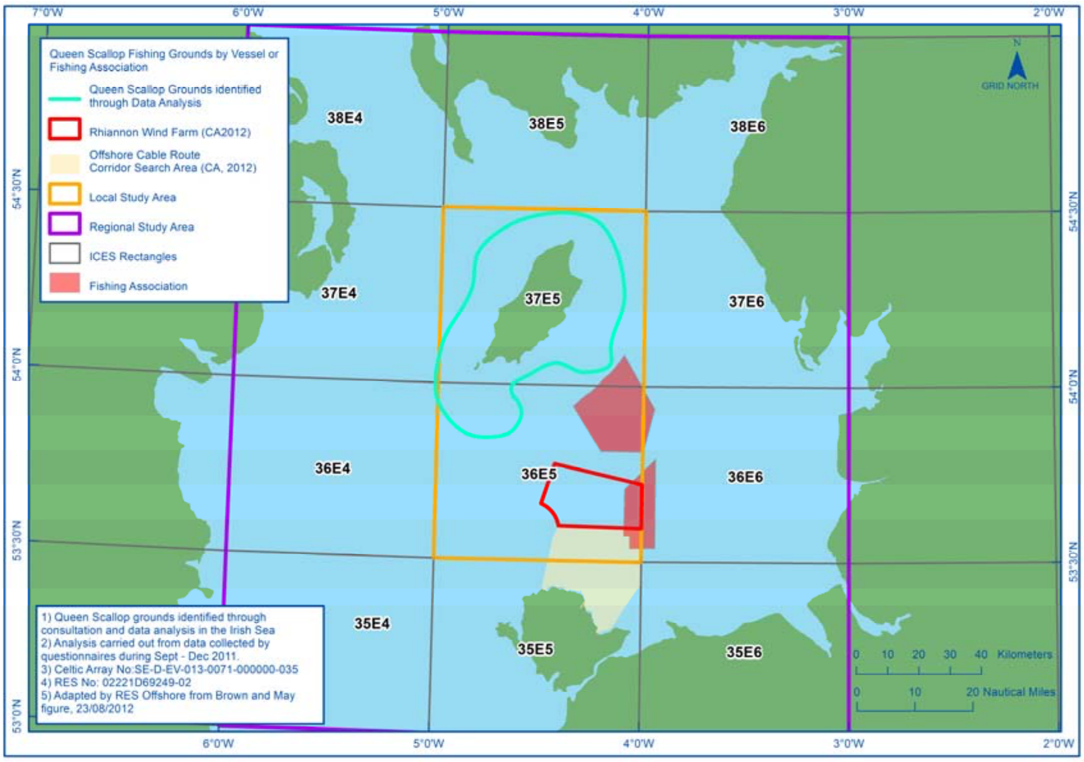


Figure 8.10 Queen scallop grounds identified through consultation and data analysis in the Irish Sea

Beam trawling

8.51 Some beam trawling principally for sole occurs in ICES rectangle 36E5, in which the Site is located.

8.52 Vessels targeting sole in the Irish Sea are both local and visiting vessels. The highest proportion of vessels targeting sole are Belgian registered which generally land their catches into Liverpool. The numbers of vessels operating out of the main ports are identified below. Consultation with fishermen has also identified the general grounds in the Irish Sea where the vessels target sole.

8.53 Table 8.4 lists the ports in the regional area into which vessels that are beam trawling for sole in the vicinity of the ISZ land their catch.

Table 8.4 Ports into which vessels beam trawling for sole will land their catch

<table>
<tr><th>Port</th><th>Vessels</th></tr>
<tr><td colspan="2">England</td></tr>
<tr><td>Liverpool</td><td>Liverpool records the highest landings values of sole from the local study area. The vessels landing sole into Liverpool are generally Belgian registered (MMO statistics).</td></tr>
<tr><td>Fleetwood</td><td>There are four Fleetwood based vessels identified which are able to target sole in the Irish Sea. These vessels target grounds in inshore and offshore areas, outside the ISZ (RSS Marine Consultation Report).</td></tr>
<tr><td>Barrow</td><td>One full time vessel has been identified as operating from Barrow and targeting sole. The activity of this vessel is confined to near shore areas outside the ISZ (RSS Marine Consultation Report).</td></tr>
<tr><td colspan="2">Wales</td></tr>
<tr><td>Milford Haven</td><td rowspan="3">The ports of Milford Haven, Holyhead and Swansea record significant landings values of sole from ICES rectangle 36E5. The vessels landing sole into these ports are either foreign vessels (Belgian or Irish) or UK visiting vessels that have home ports elsewhere (MMO statistics).</td></tr>
<tr><td>Holyhead</td></tr>
<tr><td>Swansea</td></tr>
</table>

8.54 Table 8.5 lists the visiting vessels that seasonally beam trawl for sole in the Irish Sea.

Table 8.5 Visiting vessels seasonally beam trawling for sole in the Irish Sea

Country	Vessels
Belgium	There are approximately four to six Belgian beam trawlers targeting sole in inshore areas and along the western edge of the ISZ (RSS Marine Consultation Report). These vessels land their catches into Liverpool which records the highest landings values of sole from ICES rectangle 36E5 (MMO statistics).
Ireland	There are estimated to be up to 15 vessels targeting sole using beam trawls in inshore areas and central areas of the ISZ (RSS Marine Consultation Report).

8.55 Figure 8.11 below shows generic beam trawl grounds identified through the analysis of the datasets previously mentioned (VMS, surveillance sightings etc.).

8.56 It can be seen that the main fishery for sole is located on the eastern side of the Irish Sea in the relatively shallow coastal waters of England and Wales. The largest catches have been recorded in Liverpool Bay, Morecambe Bay, Cardigan Bay and off Anglesey. Belgian beam trawlers are also known to target sole to the south of the Isle of Man (Cefas 2009).

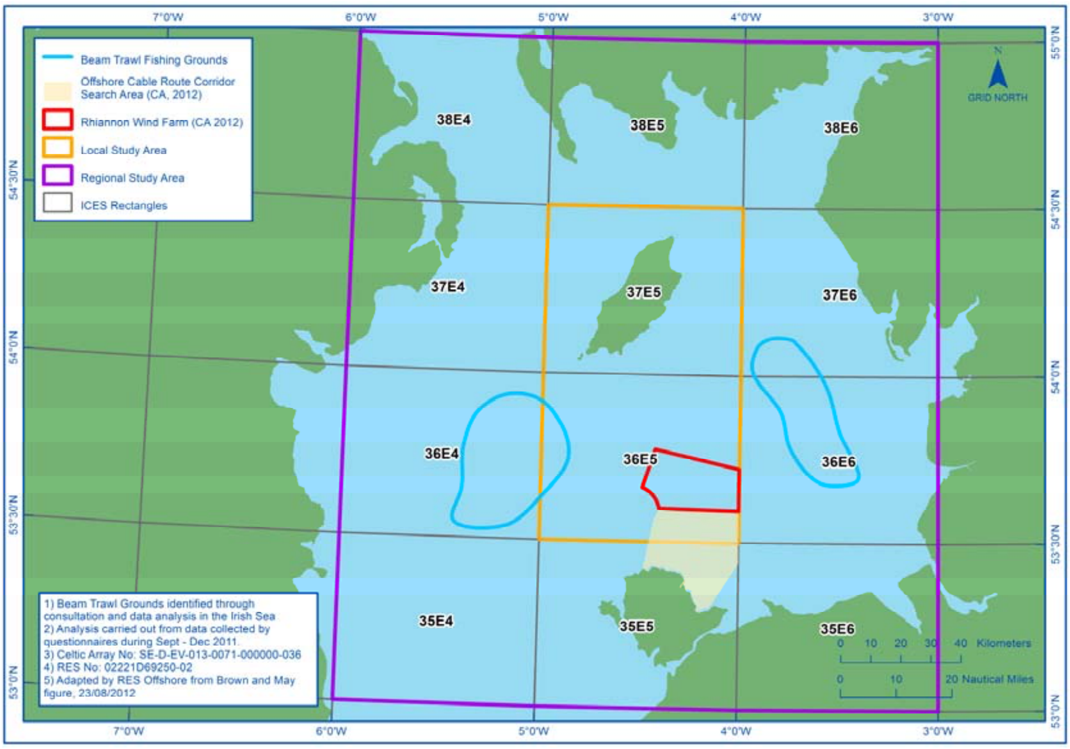


Figure 8.11 Beam trawl grounds identified through consultation and data analysis in the Irish Sea

Potting for whelks

8.57 Whelks are targeted in ICES rectangles 36E5 by potting vessels. The majority of these vessels are English and Jersey registered landing their catch into local ports (MMO statistics).

8.58 Whelks are targeted by vessels setting baited whelk pots (usually with fish or crab) and left for a period of time. A number of whelk pots are set on a main line which is deployed on the seabed for an average soak time of one to two days, although this can be extended during periods of bad weather.

8.59 In addition to full time whelk potting vessels, a number of vessels are part time, including a number of scallop fishermen who fish for whelks to supplement their income (Kaiser *et al*. 2008). The UK market for whelks is relatively small scale and the majority of the catch is exported to South Korea and Japan (Fahy *et al*. 2000).

8.60 Vessels targeting whelks in the Irish Sea will generally be local vessels which will land their catch daily at the ports in the local area. The ports and number of whelk fishermen operating out of each port are identified below. Consultation with fishermen has also identified the general grounds in the Irish Sea where these vessels will target whelks.

8.61 Table 8.6 lists the ports in the regional area into which vessels that are targeting whelks in the vicinity of the Site will land their catch.

Table 8.6 Ports into which vessels targeting whelks will land their catch

Port	Vessels
England	
Whitehaven	There are two to three potting vessels based at Whitehaven (RSS Marine Consultation Report). Whitehaven records the highest landing of whelks from ICES rectangle 37E5 (MMO statistics).
Wales	
Holyhead	There are about five to six identified potting vessels based at Holyhead, which will target whelks in addition to crustaceans. These vessels generally target grounds outside the ISZ in inshore areas (RSS Marine Consultation Report). Vessels landing into Holyhead record the highest values of whelks from 36E5 (MMO statistics).
Amlwch	There are approximately five to six identified potting vessels based at Amlwch, which will target whelks in addition to crustaceans. The vessels generally target grounds outwith of the ISZ in inshore areas, although there are two static gear vessels which target principal whelk grounds within the ISZ (RSS Marine Consultation Report).

8.62 Figure 8.12 below illustrates the Irish Sea whelks grounds identified through consultation with fishermen, showing potting occurring in the south east of the ISZ, including within the Site boundary.

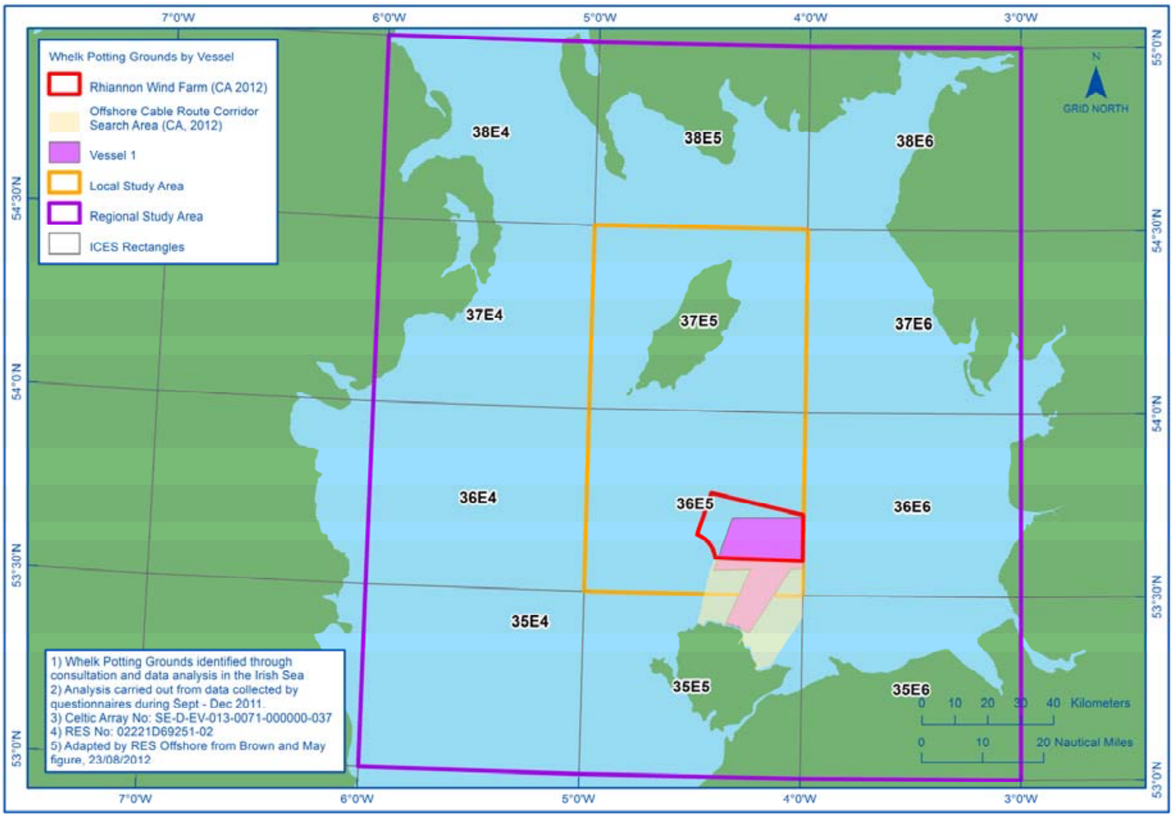


Figure 8.12 Whelk potting grounds identified through consultation in the Irish Sea

Nephrops trawling

8.63 In ICES rectangle 37E5, nephrops are targeted by vessels operating demersal otter trawls. The majority of these vessels are UK registered, although some Irish registered vessels also target the fishery. These vessels generally employ single or twin rig demersal trawl gears.

8.64 Vessels targeting nephrops in the Irish Sea will generally be local vessels which will land their catch daily at the ports in the local area. The ports and number of nephrops fishermen operating out of each one are identified below. Consultation with fishermen has also identified the general grounds in the Irish Sea where these vessels will target nephrops.

8.65 Table 8.7 lists the ports in the regional area into which vessels that are targeting nephrops in the vicinity of the ISZ will land their catch.

Table 8.7 Ports into which vessels targeting nephrops will land their catch

Port	Vessels
England	
Whitehaven	There are 12 identified trawlers based at Whitehaven which target nephrops in the Irish Sea, however this activity generally occurs outside the ISZ. Northern Irish vessels will also land their catch at Whitehaven when targeting nephrops in fishing grounds off the coast of Barrow (RSS Marine Consultation Report).
Fleetwood	Four trawlers have been identified as operating from Fleetwood to target nephrops in offshore and inshore areas outside the ISZ. Effort made by these vessels varies, but the vessels are restricted by quota availability and days at sea restrictions (RSS Marine Consultation Report).
Maryport	There are between eight and ten small trawlers identified to be targeting nephrops in the Irish Sea and landing their catch into Maryport. These vessels will generally target nephrops grounds in close proximity to their home port (RSS Marine Consultation Report).
Northern Ireland	
Portavogie	Northern Irish ports such as Portavogie, Ardglass and Kilkeel record the highest landings values of nephrops from ICES rectangle 37E5 (MMO statistics).
Ardglass	
Kilkeel	

8.66 Figure 8.13 below shows the Irish Sea specific nephrops grounds identified through consultation with fishermen conducted by RSS Marine ltd and generic grounds identified through the analysis of the datasets previously mentioned (VMS, surveillance sightings etc.). It can be seen that the main nephrops grounds are located in the east and west of the Irish Sea, in areas outside of the Site, however consultation has identified one fishing association whose vessels target nephrops within central areas of the ISZ.

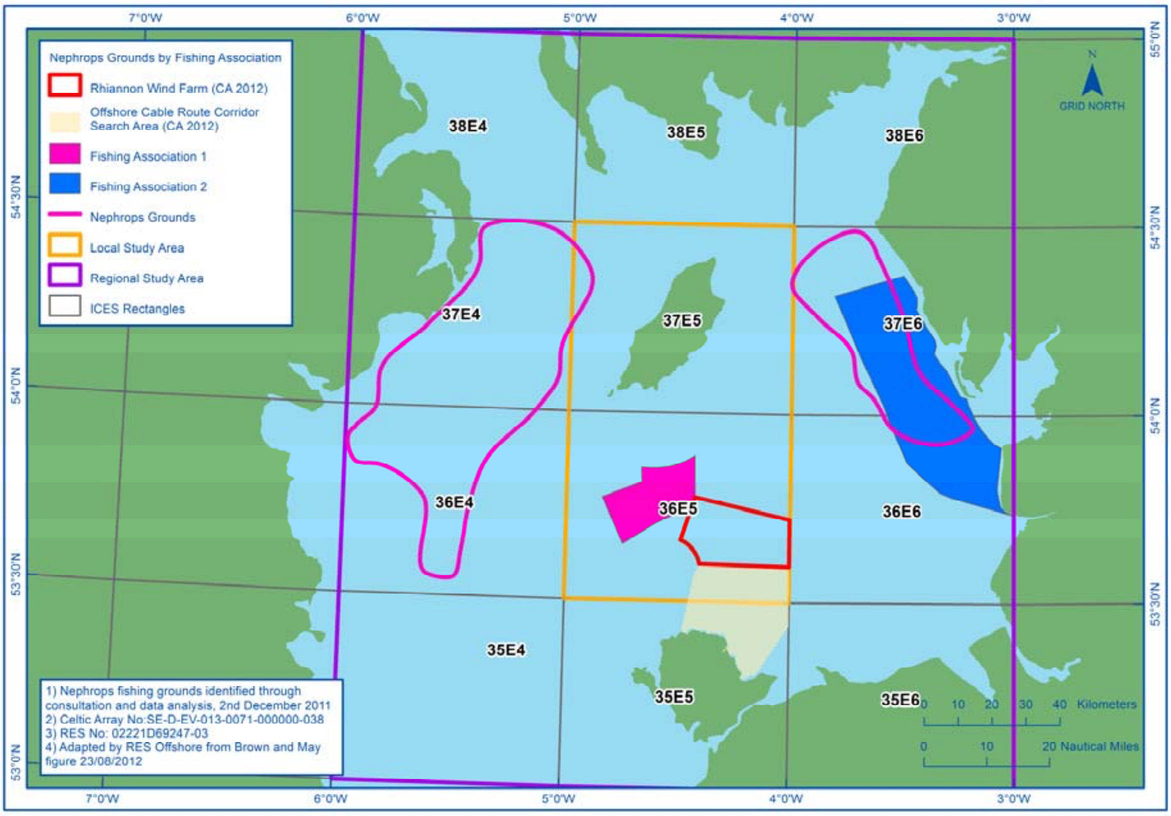


Figure 8.13 Nephrops fishing grounds identified through consultation and data analysis in the Irish Sea

Mid-water pair trawling

8.67 In ICES rectangle 37E5, herring are targeted by vessels working mid-water pair trawls. These vessels are either Northern Ireland or Scotland registered.

8.68 The herring fishery in the Irish Sea is relatively small scale compared with fisheries elsewhere in UK waters. All landings have been by vessels landing into Northern Irish ports (Gibson 2011). Ardglass is the principal port for landing herring, although Londonderry, Rathmullen, Belfast and Portavogie also record landings values for the period 2001 to 2010 (MMO statistics).

8.69 Two Northern Irish vessels seasonally target herring in the waters adjacent to the Isle of Man (Gibson 2011). In addition, consultation has identified one fishing association whose vessels target herring within central areas of the ISZ (Figure 8.14), though outside of the Site boundary.

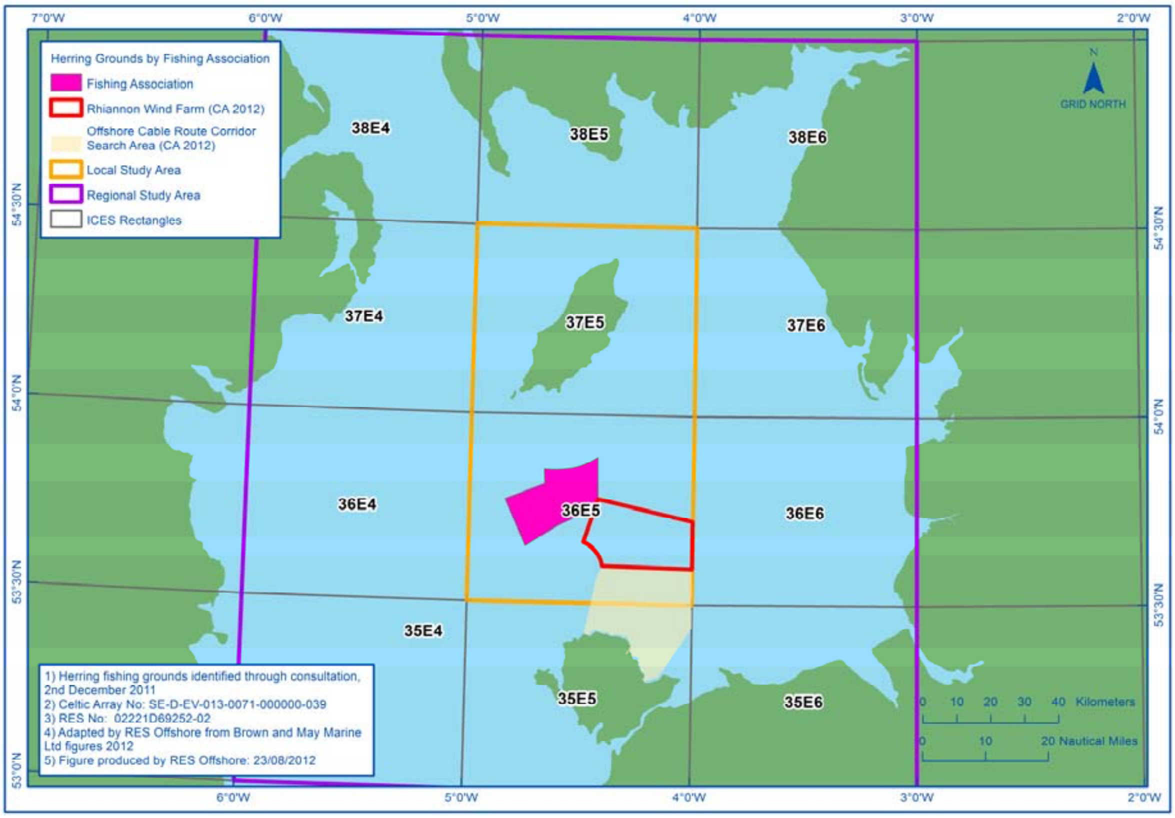


Figure 8.14 Herring fishing grounds identified through consultation in the Irish Sea

Potting for crabs and lobster

8.70 Potting for edible crab and lobster generally occurs in inshore areas, although there is some limited activity occurring in the vicinity of the ISZ. Potting is an increasingly important fishery in the Irish Sea due to the restrictions on other fisheries.

8.71 Because of the limited operational range of small, inshore vessels, potting vessels generally deploy their creels closer to the coast and in areas which are unsuitable for trawling.

8.72 The majority of potting vessels are under 10 metres in length, but the scale of the activity can range from a ‘hobbyist’ fisherman setting around 20 pots to a vivier crabber which may set more than 3000 pots at a time. Smaller vessels may keep their catch alive in cages on the seabed, while larger vessels will use purpose-built onboard vivier tanks.

8.73 There are a number of potting vessels operating on a part-time basis. Generally, these vessels only operate during the summer months.

8.74 All landings are made by vessels operating in close proximity to their home ports. Table 8.8 lists the ports in the regional area into which vessels that are targeting crab and lobster will land their catch.

Table 8.8 Ports into which vessels targeting crabs and lobster will land their catch

Port	Vessels
England	
Barrow	There are two potting vessels based at Barrow who will seasonally target lobster in addition to netting for bass. This activity occurs in inshore areas outwith of the ISZ (RSS Marine Consultation Report).
Ravenglass	There are four to five potting vessels based at Ravenglass which will target crab and lobster in inshore areas. The lobster grounds are found within 1.5 miles of the coast (RSS Marine Consultation Report).
Workington	There are 15 potting vessels based at Workington who will target set pots in the summer months and operate gill nets for the remainder of the year. This activity occurs outside the ISZ (RSS Marine Consultation Report).
Whitehaven	There are two to three potting vessels operating out of Whitehaven which target crab and lobster in areas outside the ISZ (RSS Marine Consultation Report).
Maryport	There are eight to ten potting vessels based at Maryport which will target crab and lobster (RSS Marine Consultation Report).
Wales	
Cemaes Bay	There are two potting vessels based at Cemaes Bay which will target crab and lobster in areas coastal outside the ISZ (RSS Marine Consultation Report).
Holyhead	There are five to six potting vessels based at Holyhead which will target crab and lobster in coastal areas outside the ISZ (RSS Marine Consultation Report).
Amlwch	There are five to six potting vessels based at Amlwch which will target crab and lobster in coastal areas outside the ISZ (RSS Marine Consultation Report).
Beaumaris to River Dee	There are up to 35 vessels operating from ports between Beaumaris and the River Dee. These vessels are both full and part time and a number will target lobster in areas inshore areas outside the ISZ (RSS Marine Consultation Report).

8.75 Consultation with potting fishermen has identified fishing grounds in inshore areas (Figure 8.15).

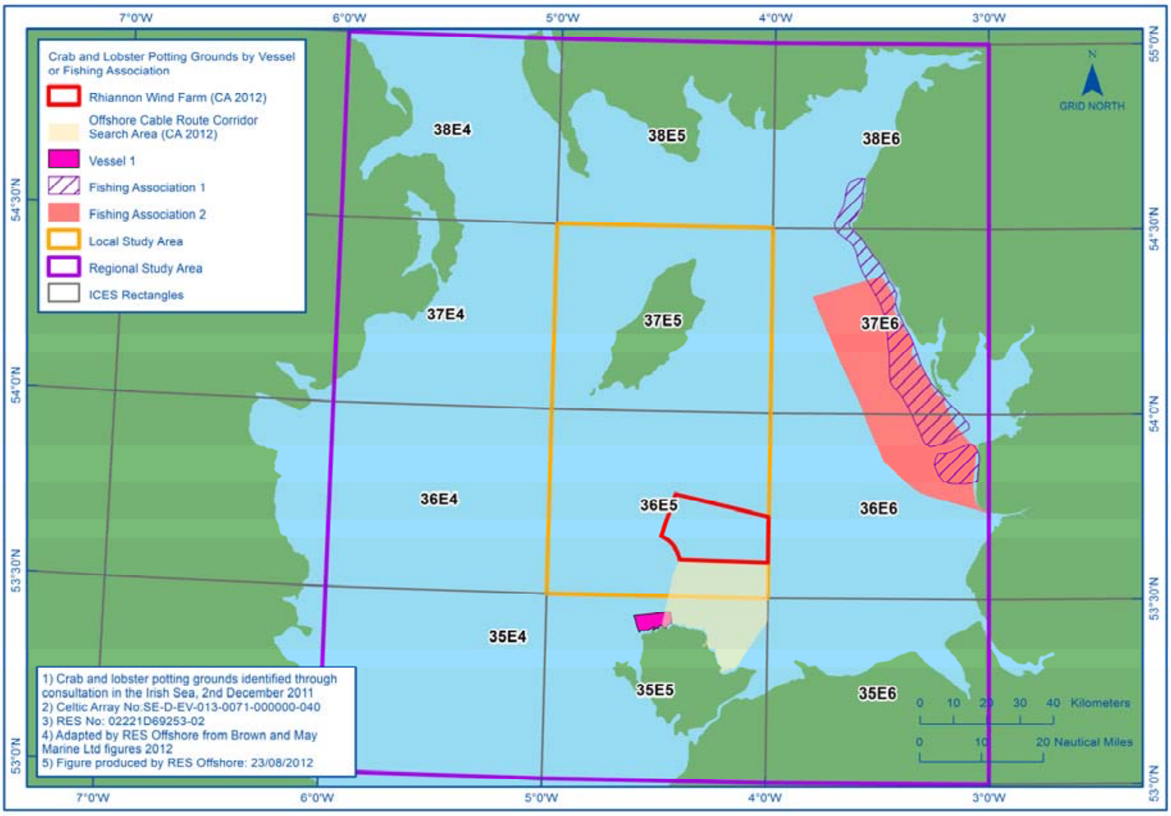


Figure 8.15 Crab and lobster potting grounds identified through consultation in the Irish Sea

Other methods

8.76 In addition to the methods outlined above, there are a number of additional methods used in the Irish Sea which target species of regional importance. These include dredging for cockles and mussels in inshore areas and mid-water otter trawling for whitefish species (cod and haddock).

8.77 Dredging for cockles is a relatively recent fishery in the Irish Sea, with landings values recording for 2008 and 2010 only, targeted in October and November in ICES rectangles in the waters around Northern Ireland and the Isle of Man. Hand fishing for cockles has occurred in previous years (2001 to 2003) between August and November in coastal areas off the English coast.

8.78 Dredging for mussels has occurred in previous years (2001 to 2004) generally in the winter months (October to February) in coastal areas.

8.79 Consultation with fishermen has identified some inshore cockling and whelking areas. None of these are close to the Site.

8.80 Mid-water otter trawling for whitefish generally occurs throughout the year in the north and west of the regional study area. Whitefish landings values have declined over the ten year period, likely to be as a result of the increasing restrictions on quotas and effort. Figure 8.16 shows whitefish grounds identified through consultation. Fishing for whitefish occurs along the south boundary of the ISZ.

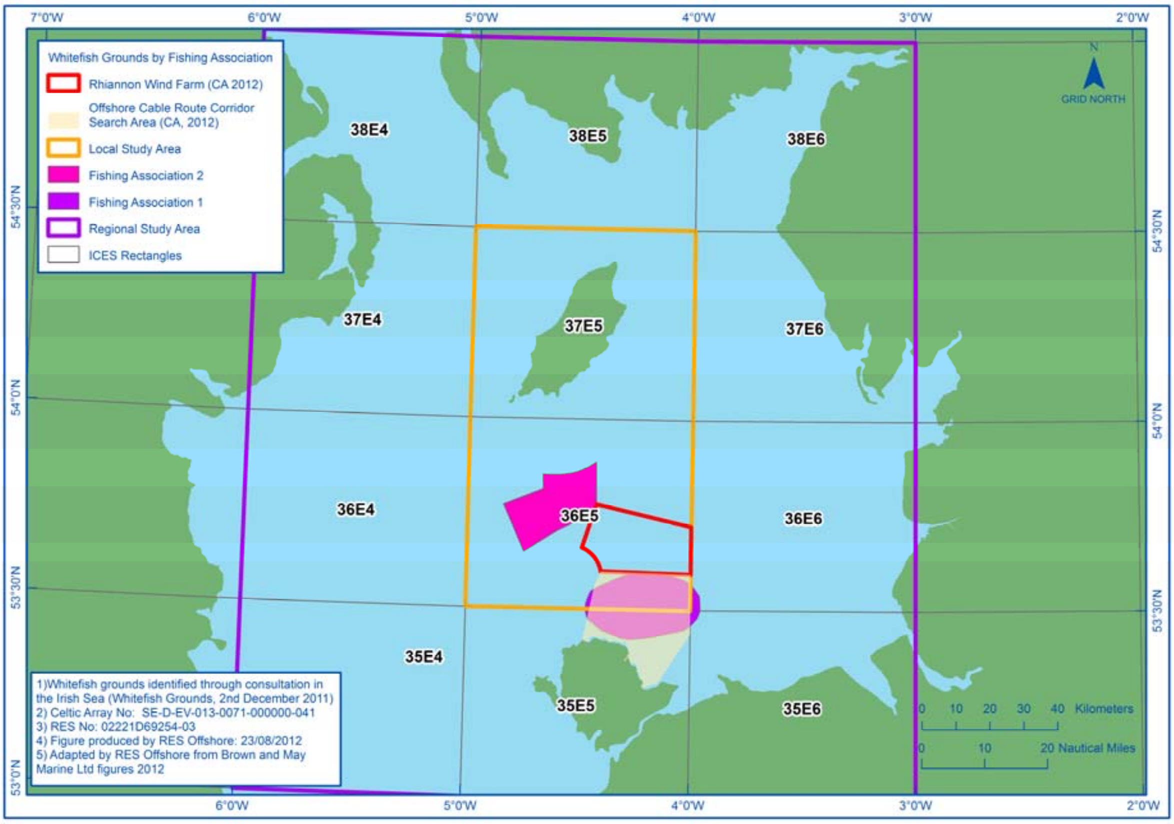


Figure 8.16 Whitefish grounds identified through consultation in the Irish Sea

Potential impacts

8.81 The ZAP process concluded that a number of impacts were not significant for a number of gear types. Therefore it is expected that the EIA will focus on gear types where potential impacts are more likely, such as scallop dredgers and mid-water trawlers.

8.82 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction	
Exclusion from established fishing grounds	As implemented at other offshore wind farm sites, Celtic Array's current strategy is to seek to establish 500m safety zones around construction works. The area of the wind farm considered to be 'construction works' may vary as foundation installation, turbine installation and commissioning could occur on a 'rolling' basis across the Site. This is likely to result in the short-term displacement of any fishing effort in the immediate vicinity. Additionally, 50m safety zones may be sought around incomplete structures or operational infrastructure. Given that the Site is principally located on scallop grounds, the potential effect of exclusion from established fishing grounds will

	mainly focus on the following receptors: • Local king scallop dredgers; • Nomadic king scallop dredgers; and • Queen scallop dredgers. Other receptors such as beam trawling and static gear fisheries will be considered, following consultation with statutory stakeholders and industry representatives, fishery operations not currently taking place in the Site may be scoped out.
Increased conflict over diminished fishing ground	The potential exclusion described above may lead to exclusion of fishing vessels from parts of the Site during construction. This displacement may lead to increased fishing pressures in other areas.
Potential impacts on fish and shellfish resources	There is the potential for a temporary displacement of sensitive fish species from the area of the construction works as a result of increased levels of suspended sediment levels or underwater noise associated with construction activities. This displacement could potentially have an effect on local fishing vessels, which may have to relocate to find the target species. The ES will consider these impacts within the Fish and Shellfish Ecology Chapter which will be cross-referenced in the Commercial Fisheries Chapter.
Potential impacts during operation	
Loss or restricted access to historical fishing grounds	It is likely that, as at other offshore wind farm sites, Celtic Array will seek to establish 500m safety zones during periods of maintenance around the offshore structures such as turbines and sub-stations and may consider 50m operational safety zones. This is could result in some displacement of fishing effort occurring in the immediate vicinity of offshore structures. Additionally, although safety zones are unlikely to be established around intra-array or export cables, the presence of buried cables may deter certain fishing activities, such as scallop dredging. Separate consideration of cable burial and protection will be carried out which could provide recommendations of cable burial depth in relation to a number of factors including fishing and scallop dredging. Given that the Site is principally located on scallop grounds, the potential effect of loss or restricted access to historical fishing ground will mainly focus on the following receptors: • Local king scallop dredgers; • Nomadic king scallop dredgers; and • Queen scallop dredgers. Other receptors such as beam trawling and static gear fisheries will be considered, following consultation with statutory stakeholders and industry representatives, fishery operations not currently taking place

	in the Site may be scoped out.
Displacement of a number of categories of vessel from the Site into other fishing areas	The potential exclusion described above may lead to exclusion of fishing vessels from parts of the Site during operation. This displacement may lead to increased fishing pressures in other areas. Given that the Site is principally located on scallop grounds, the potential effect of displacement of vessels from the Site to other fishing areas will mainly focus on the following receptors: • Local king scallop dredgers; • Nomadic king scallop dredgers; • Queen scallop dredgers; and • Mid water trawlers. Other receptors such as beam trawling and static gear fisheries will be considered, following consultation with statutory stakeholders and industry representatives, fishery operations not currently taking place in the Site may be scoped out.
Increased steaming times to fishing grounds	Longer steaming distances may occur as a result of vessel displacement especially for mobile gears such as beam trawling. In many cases under suitable weather conditions, it is likely vessels will be able to transit through the Site, which is therefore unlikely to function as a barrier *per se*. While this issue is scoped in, it will not be a focal issue of the EIA.
Damage to gear, vessel safety	As discussed above, safety zones around structures could minimise the risk of snagging etc. on obstacles on the seabed. The potential impact of unintentional debris can be effectively minimised through the application of survey and recovery protocols within the RWF EMP.
Interference with fishing activities	Operation and maintenance vessel movements will lead to an increase in maritime activity in and around the Site. The increase in the number of vessels transiting to and from site may affect fishing activity. Risks to shipping and navigation are discussed in greater detail in Section 8.2 of this report.
Potential impacts on resource	The presence of turbines and other structures may affect the composition, distribution and abundance of fish and shellfish resources within the Site, giving rise to an effect (negative or positive) on local fisheries. The ES will consider these impacts within the Fish and Shellfish Ecology Chapter which will be cross-referenced in the Commercial Fisheries Chapter. Such impacts will include the potential operation of permanent structures as fish aggregating devices (FADs) and the potential for impacts arising from electromagnetic fields (EMF) from the intra-array and export cables.

Potential impacts during decommissioning
The potential impacts associated with the decommissioning of RWF are expected to be similar to those which are predicted to occur during the construction phase. Given the requirements of UK Government guidance on decommissioning plans to remove all structures to below the level of the seabed, it is anticipated that the risk of snagging or loss of gear following decommissioning is likely to be negligible.
Potential cumulative impacts
Other projects and activities with which RWF might give rise to cumulative impacts are listed in Chapter 5 (EIA methodology). In respect of the assessment of potential impacts on commercial fishing in the ES, these will include operational and consented wind farm projects together with those in planning. The export cables associated with each project will also be considered. Consideration of potential cumulative impacts with the following, non-offshore wind, receptors will also be included in the ES: • Seagen Wales proposed tidal generation project at the Skerries; • Shipping and navigation activities; • Relevant oil and gas activities; • Areas of potential fishing exclusion such as MCZs; and • Aggregate dredging in the Irish Sea. The cumulative impact assessment is anticipated to focus on the following issues discussed in greater detail above: • Loss or restricted access to historical fishing grounds; • Displacement of a number of categories of vessel from the Site into other fishing areas; • Increased steaming times to fishing grounds; and • Potential impacts on resource (from construction and operation as assessed in the Fish Ecology Chapter). The cumulative assessment will also need to be assessed against a backdrop of decreasing commercial activity as vessels and skippers leave the industry due to increased fuel and quota pressures and decommissioning schemes. In addition, future diversification of fishing will also be considered.

Scoping Opinion from the Planning Inspectorate

8.83 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to commercial fisheries:

- The Secretary of State welcomed the consultation proposed and that which had already been undertaken to date and further welcomed the establishment of a fisheries working group;

- The methodology and physical extent of the study area should be agreed with the relevant statutory consultees. Surveys should be relevant and up to date;
- The Secretary of State recommended that the assessment of impact on commercial fisheries was not limited to the location of the proposed wind turbines, but that it should also cover other off-shore infrastructure and the off-shore cable route corridor;
- The Scoping Report had identified fish as sensitive receptors of noise associated with construction activity (i.e. piling), appropriate cross reference should be made to other specialist reports, notably the potential impact of noise and vibration on commercial fisheries; and
- The effect of operational noise on fish ecology should be scoped in.

Approach to address Scoping Opinion

8.84 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA survey and study programme

8.85 The EIA for RWF will build on the data collected as part of the ZAP process and update the following data as necessary:

- MMO fisheries statistics;
- MMO satellite tracking data;
- MMO surveillance sightings;
- Belgian fisheries statistics;
- Belgian satellite tracking data;
- Republic of Ireland SFPA fisheries statistics;
- Republic of Ireland SFPA Irish satellite tracking data;
- Isle of Man fisheries statistics;
- Isle of Man satellite tracking data;
- FIR and Working Group Consultation Data;
- VMS data from vessels operating in the Site; and
- Any other data as becomes available, for example the UK Fisheries Industry Mapping project produced by The Crown Estate.

8.86 Ongoing consultation as detailed above will additionally inform the EIA process, including:

- Consultation with fisheries regulators and data holders including DEFRA, MMO, Cefas, Marine Scotland, Irish Department of Agriculture Fisheries and Food, DARDNI, North West Inshore Fisheries Conservation Authority, Welsh Government fisheries unit and the Belgian Fisheries Authority; and
- Consultation with the commercial fisheries industry including ISZ Fishing Industry Representatives, ISZ Working Group Members and relevant fishermen.

8.87 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, consultation derived data and information. This description will include statistics by ICES rectangles, stating which fisheries target these species and during which times of the year and a characterisation of the key fisheries communities and vessel types operating within the RWF boundary and surrounding areas;
- A review and summary of the commercial fisheries consultation including an overview of the key concerns gathered from the industry regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative impacts;
- A review and summary of natural fisheries surveys and results incorporating any identified key issues specifically regarding commercial fishery species, such as any identified noise and EMF implications. Cross-referencing to the relevant chapters of the ES will be included;
- A review and summary of the shipping and navigation surveys identifying key issues specifically affecting commercial fishery operations. Cross-referencing to the relevant chapters of the ES will be included; and
- Proposals for mitigation measures (including the consideration of the potential of enhancement of fisheries) and monitoring, if required.

8.88 The EIA for RWF will take account of the following legislation and guidance:

- Marine Licence requirements (replacing Section 5 Part II of the Food and Environmental Protection Act 1985 and Section 34 of the Coast Protection Act, 1949);
- British Wind Energy Association 2004 Recommendations;
- Offshore Wind Farms, Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements – Version 2; Cefas, MCU, Defra, DTI, June 2004;
- UK Offshore Energy – Strategic Environmental Assessment; DECC, January 2009;
- Recommendations for Fisheries Liaison: FLOW, May 2008;
- Fisheries Liaison Guidelines – Issue 5: UK Oil and Gas, 2008;
- Guidelines to Improve Relations between Oil and Gas Industries and Near-shore Fishermen, UKOOA (renamed UK Oil and Gas), August 2006;

- Fishing and Submarine Cables – Working Together, International Cable Protection Committee (CPC), February 2009;
- Options and Opportunities for Marine Fisheries Mitigation Associated with Wind Farms, COWRIE 2010; and
- ZAP and EIA scoping responses and opinion.

8-2 Human environment – shipping and navigation

Introduction

8.89 This chapter characterises shipping and navigation activities in and around the Site, describes the potential impacts of wind farm development on those activities and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees, which will be used to inform the project level EIA process.

Surveys and studies carried out to date

8.90 As part of the ZAP process described in Chapter 4, Celtic Array commissioned a shipping and navigation study (Celtic Array 2012). The ZAP Report included full zonal characterisation based around the collection of data and consultation.

8.91 A large data set has been collected and as per Maritime Guidance Note 371, 28 days of seasonal marine traffic survey data have been selected for analysis. The 28 days of AIS data which were selected covered the periods 1st to 14th March 2011 and 15th to 28th June 2011 and it had been collected from the three shore based stations in the vicinity of the Irish Sea Zone (as described above). 28 days of radar data (1st to 14th March 2010 and 15th to 28th June 2010) collected by the survey vessel Franklin during 2010 was also analysed.

8.92 The principal sources of data and information used for the production of the ZAP Report and this report were:

- Automatic Identification System (AIS) data (28 days from 1 to 14 March 2011 and 15 to 28 June 2011);
- Radar data (1 March to 31 August 2010);
- UK Coastal Atlas of Recreational Boating (RYA 2009) and 2010 GIS Shape Files;
- Maritime Incident Data from the Marine Accident Investigation Branch (MAIB) (2001-2010) and the Royal National Lifeboat Institution (RNLI) (2001-2010);
- Search and Rescue (SAR) areas (as per Maritime and Coastguard Agency (MCA) Definitions);
- Port Statistics (DfT 2000-2009 and Dublin Port 2004-2010);
- Oil and Gas Platforms (UK Deal);
- Location of Round 1 and 2 wind farms (The Crown Estate);
- Marine aggregates dredging data (licence areas and active areas) from The Crown Estate and British Marine Aggregates and Producers Association (BMAPA);
- MOD PEXA areas (Sea Zone Hydro Spatial Data);
- Relevant Admiralty Charts for the Area – 1121, 1411 and 1826; and
- Admiralty Sailing Directions. West Coasts of England and Wales Pilot. NP 37. Eighteenth Edition 2011 (UKHO 2011).

8.93 AIS data for the ISZ has been collected using a combination of survey vessels and shore based stations for the following periods:

- Franklin survey vessel (1 March 2010 to 31 August 2010);
- Triad survey vessel (22 April 2010 to 23 May 2010);

- Isle of Man shore based station (9 April 2011 to present day);
- Fleetwood shore based station (8 February 2011 to 11 September 2011); and
- Point Lynas shore based station (9 February 2011 to present day);

8.94 Radar data is important for tracking those vessels without AIS such as fishing vessels (potters and small trawlers), recreational craft, military vessels and other small vessels (coasters and tugs). Radar data for the Irish Sea was collected by the survey vessel Franklin between March and August 2010.

8.95 During the course of the ZAP process consultation has been undertaken (and continues to be undertaken) with a number of organisations and individuals, namely:

- MCA (including both national representatives and the local Marine Rescue Coordination Centre at Crosby);
- Trinity House Light Services (THLS);
- The Chamber of Shipping (CoS);
- Department for Transport (DfT);
- Ministry of Defence (MOD);
- Royal Yachting Association (RYA);
- Cruising Association (CA);
- Major port authorities local to the ISZ;
- Regular vessel operators including commercial fishing and ferry operators identified from the AIS data analysis (regular routes are described in Table 8.9); and
- Other Irish Sea developers (wind farms, oil and gas).

8.96 Transboundary stakeholders were also consulted on the scope of the ZAP Report. These included the:

- Commissioners of Irish Lights;
- Republic of Ireland Department of Transport, Tourism and Sport;
- Northern Ireland Department of Regional Development, Ports and Public Transport Division; and
- Isle of Man Government.

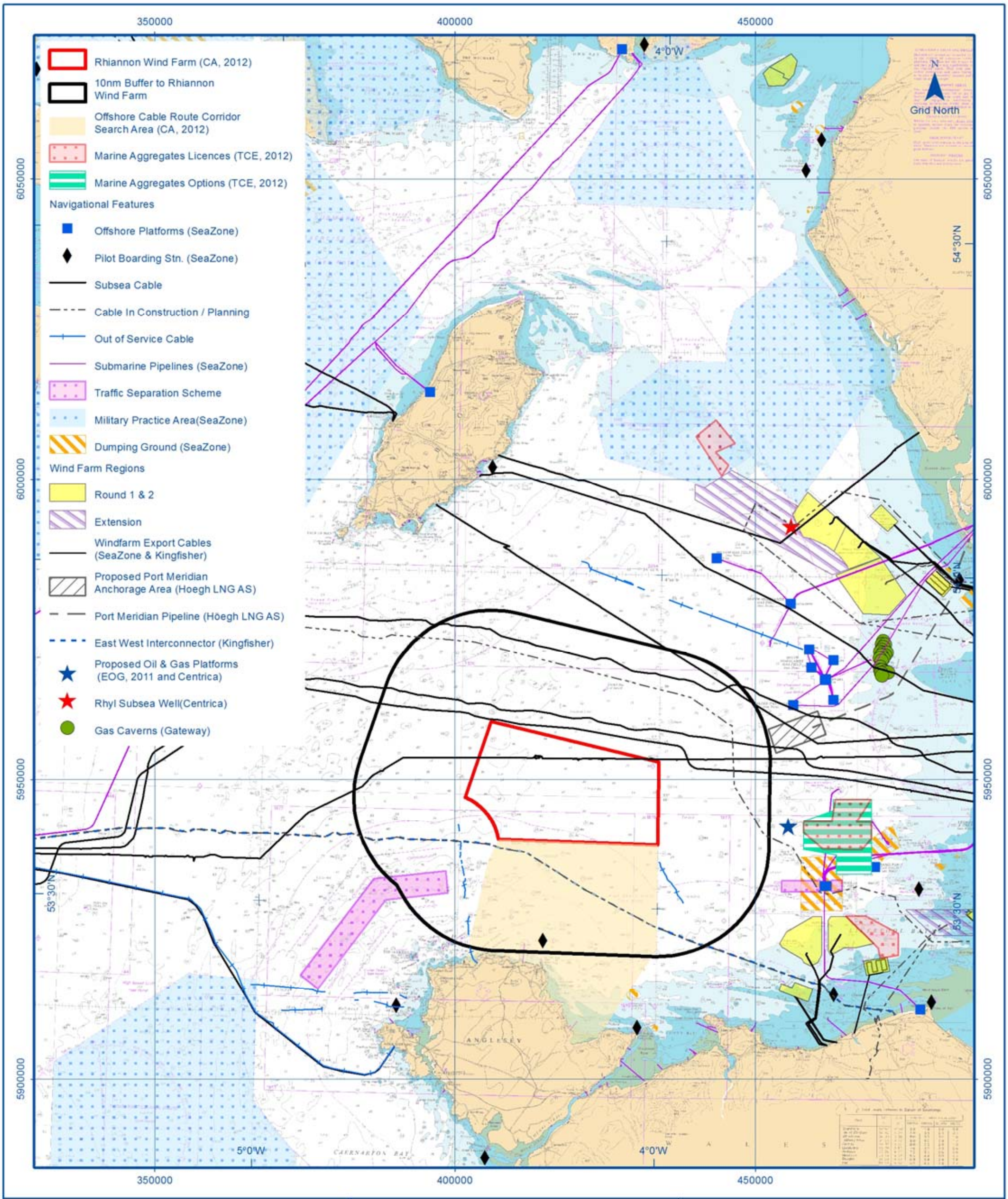
Description of current environment

Overview

8.97 The description of the current environment is based on the findings of the ZAP Report.

Navigational features

8.98 Figure 8.17 (overleaf) plots the key navigational features associated with the area in the vicinity of the Site and the broader ISZ.



This drawing was compiled using the most current data at the time of publication. Please contact Celtic Array Ltd for the latest information: info@celticarray.com

© SeaZone Solutions Ltd. 072011.012. Cables Data from KISCA, 2011; MMT, 2010; SeaZone, 2012; EirGrid, 2010.

Not to be used for navigation.

0 10 20 30 40 Kilometers

0 5 10 15 20 Nautical Miles

ISSUE	DATE	DRN	CHK	APR	ISSUE NOTE
03	10/10/12	JD	SM	EF	Project title revised
02	23/08/12	DB	JF	EF	Updated for PEI
01	17/04/12	AB	PM	EF	FIRST ISSUE

PROJECTION	DATUM	PAGE SIZE	SCALE
UTM30N	WGS84	A4	1:850,000

DRAWING NUMBER: 02221D69274-03

ROUND 3: IRISH SEA ZONE

RHIANNON WIND FARM

Key Navigational Features around Irish Sea Zone

CELTIC ARRAY DOC NO: SE-D-EV-013-0071-000000-042

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Figure 8.17

8.99 There are a number of licensed marine aggregate dredging areas in the vicinity of the Site. The closest licensed area is 13nm to the east of the Site. The closet dredge disposal sites are 13nm east and 13nm south of the Site

8.100 There are no charted anchorage areas within the Site or the ISZ. Point Lynas Pilot Boarding Station for deep draught vessels and adverse weather boarding is located to the south of the Site. Although not a chartered anchorage, vessels frequently anchor within the Point Lynas area to await a pilot or to shelter from predominant south westerly gales.

8.101 There are two Traffic Separation Schemes (TSSs) in proximity to the Site. The Anglesey TSS intersects about 5nm south west of the Site at its closest point. The Liverpool Bay TSS is around 12nm south east of the Site.

8.102 There are three military practice areas in the vicinity of the Site, none of which lie within the Site or ISZ boundary. The area to the north west of the Site is used for submarine operations based out of Her Majesty's Naval Base (HMNB) Clyde. The remaining two military practice areas are designated firing ranges.

8.103 The nearest oil and gas platform to the Site is the Calder platform which is located about 13nm east of the Site. There are numerous other platforms located to the east of the Site. Round 1 and 2 wind farm regions and the proposed extensions, are also located to the east of the Site. The proposed Walney Extension is about 23nm from the Site and Gwynt y Môr is 14nm from the Site.

8.104 In terms of oil and gas installations, planned developments in the vicinity of RWF include the Conwy platform which will be located about 12nm east of the Site and the Rhyl development which is located about 24nm east of the Site. The Conwy platform will be a Normally Unattended Installation (NUI) and the development will cover both the Conwy and Corfe fields. The scheduled date for completion of this platform is May 2012 with first oil expected in September 2012. The Rhyl development will have a single production subsea well connected to a manifold, which is tied back to a drilling and production platform (DPPA). Currently, this project is at the consenting stage and intends to be operational in mid-2012.

8.105 Other planned developments in the vicinity of the ISZ relevant to navigation include Port Meridian, which will establish a deepwater port (buoys) for Liquefied Natural Gas (LNG) offloading. The two proposed offloading buoys for the deepwater port development are to be located 10nm north east of the Site.

Ports

8.106 The main ports relevant to the development of the RWF Site and the ISZ are presented in Figure 8.18.

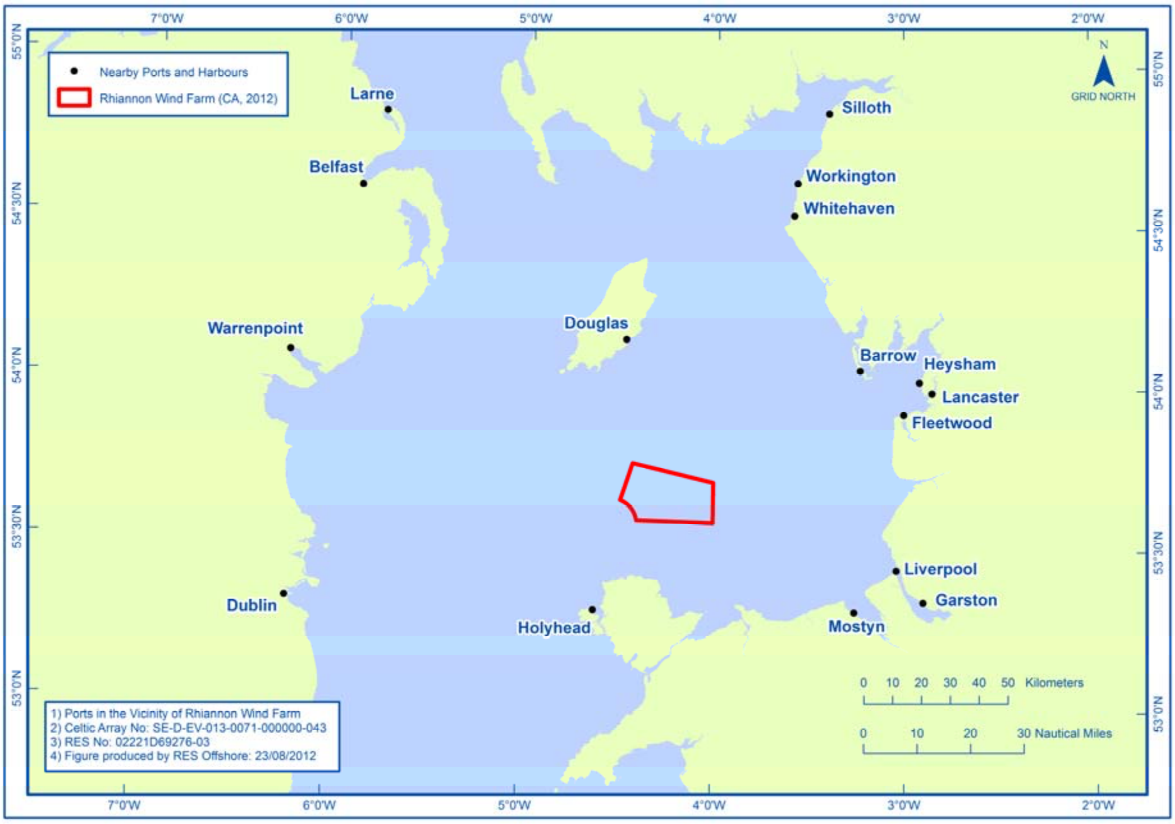


Figure 8.18 Ports in the vicinity of the Site

8.107 The nearest port is Holyhead, which is approximately 18nm from the Site. Numerous other ports in England, Wales, Northern Ireland and Ireland also lie within 50nm of the ISZ.

8.108 The number of ship arrivals to the principal ports in the vicinity of the ISZ is presented in Figure 8.19. Numbers for UK ports are based on the latest published DfT statistics (DfT 2010). Although these statistics exclude some movements, they provide a good indication of the relative traffic levels and trends. Ship arrivals statistics for Dublin were published in the Dublin Port Company Trade Statistics (2010) report and are available from 2004 onwards.

8.109 The port of Douglas on the Isle of Man is also considered to be a principal port. Annual ship arrival statistics are not available for this location but the main arrivals in this port are ferries operated by the Isle of Man Steam Packet Company. Douglas ferries route to Liverpool and Heysham for which arrival statistics are provided in Figure 8.19.

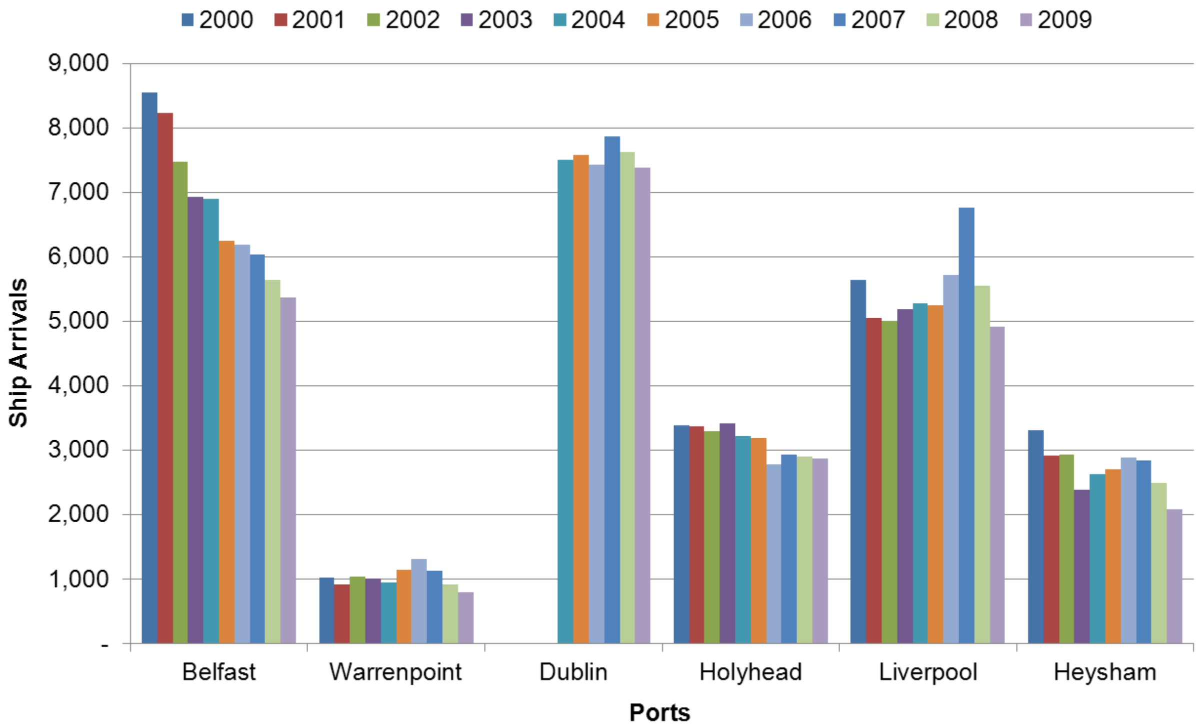


Figure 8.19 Ship arrivals to principal ports 2000-2009

8.110 Plans to build a second container terminal at Liverpool may see the number of ship arrivals at the port increase in the future. The building of this terminal is expected to increase the port's capacity from 700,000 TEUs (Twenty Foot Equivalent Units) to 1,300,000 TEUs and enable the accommodation of new generation post-Panamax size container ships.

AIS shipping survey

8.111 As discussed above, Celtic Array has collected AIS data to inform the ZAP process and this Stage 1 PEI Report. This section analyses the vessel tracks recorded by AIS during 28 days in March and June 2011 (1 to 14 March and 15 to 28 June).

8.112 Vessels tracked within the ISZ and a 10nm buffer around it, are presented in Figure 8.20 and colour-coded by type.

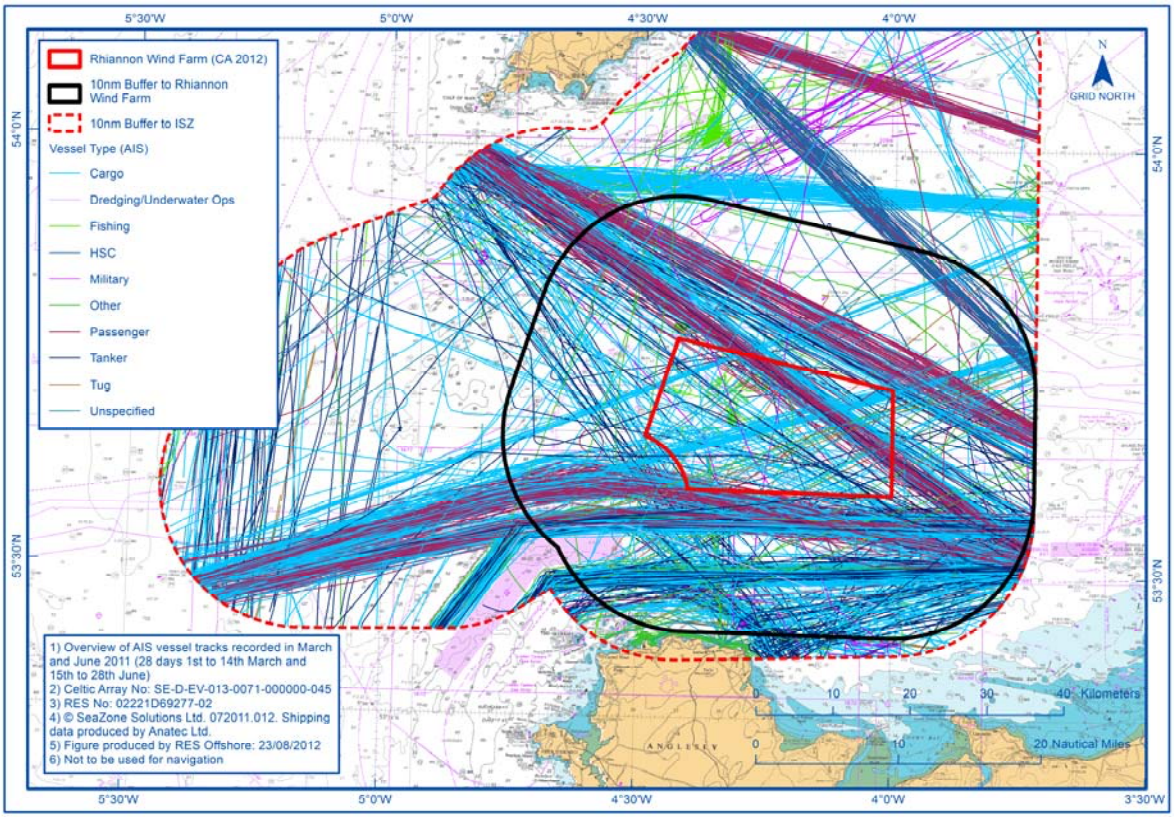


Figure 8.20 Overview of AIS tracks recorded in March and June 2011 (28 days 1 to 14 March and 15 to 28 June).

8.113 Figure 8.21 presents the distribution of vessel types passing through the ISZ and buffer during the 28 day period. Figure 8.21 excludes the 6% of vessels which were 'unspecified' (i.e. those vessels which did not display any vessel type on their AIS).

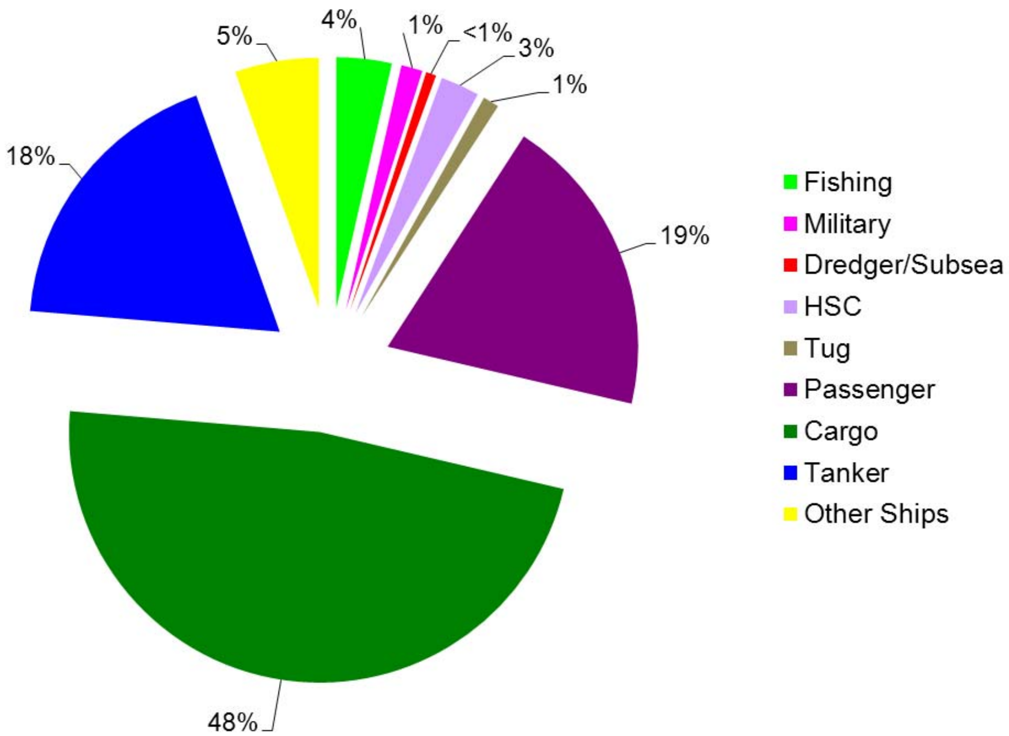


Figure 8.21 Vessel type distributions

8.114 The most common types of vessels were cargo vessels (48%), passenger vessels (19%) and tankers (18%). 'Other' ships made up 5% of traffic. Vessels in this category include recreational sailing craft, offshore support vessels and crew transfer vessels transiting to and from existing offshore wind farm developments.

8.115 The tracks of the cargo vessels, passenger vessels and tankers within the ISZ and 10nm buffer during the 28 day period are shown respectively in Figure 8.22, Figure 8.23 and Figure 8.24.

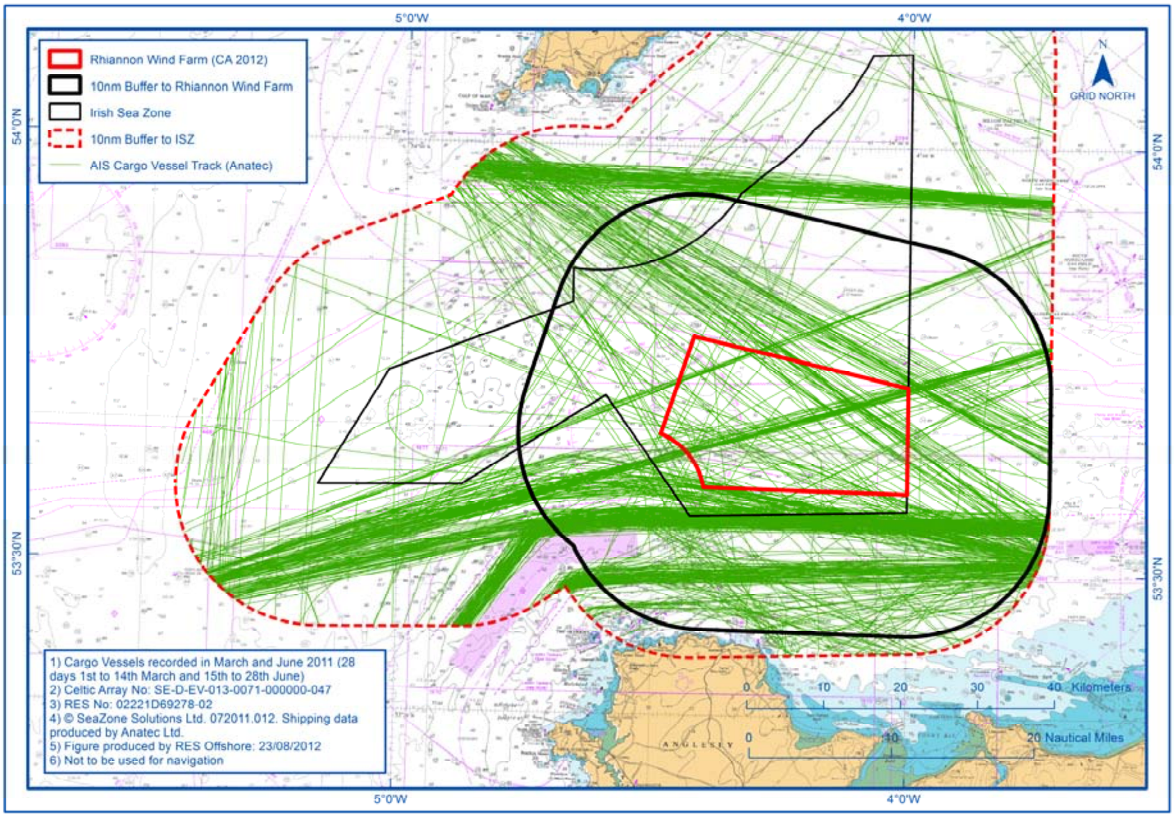


Figure 8.22 Cargo vessels recorded in March and June 2011 (28 days 1 to 14 March and 15 to 28 June)

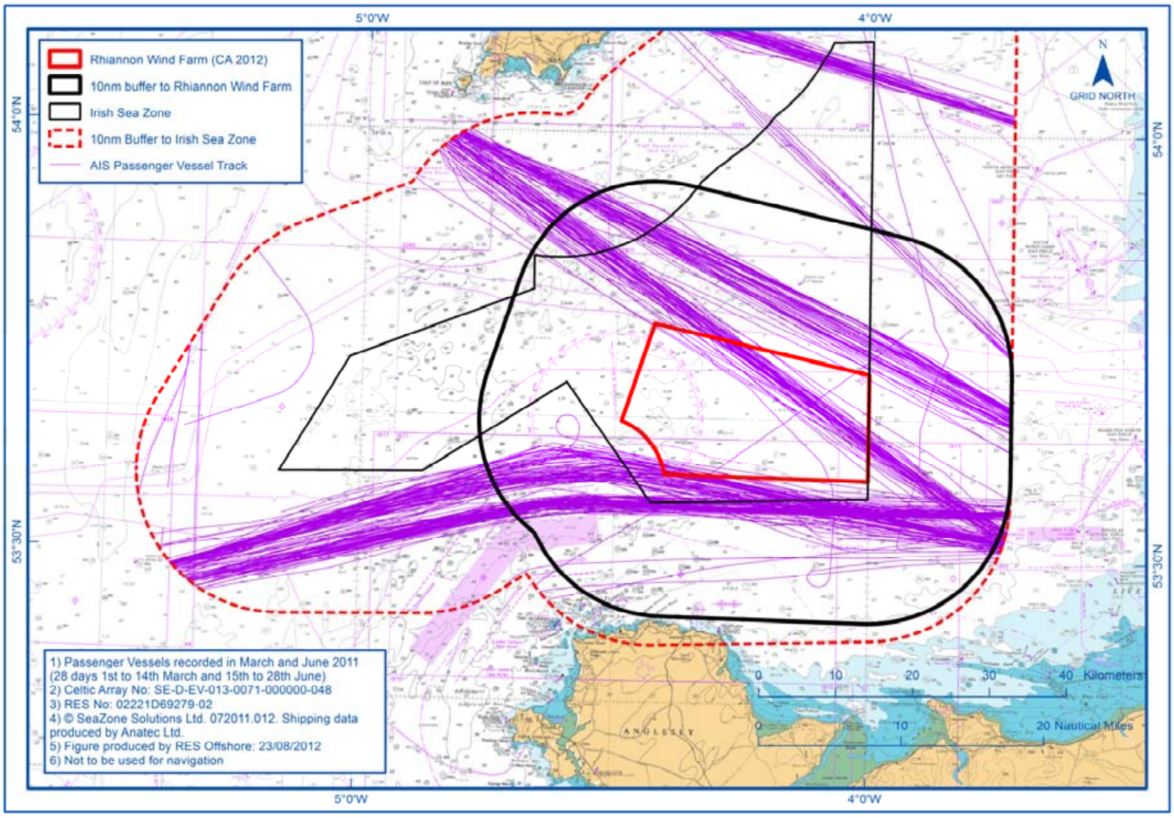


Figure 8.23 Passenger vessels recorded in March and June 2011 (28 days 1 to 14 March and 15 to 28 June)

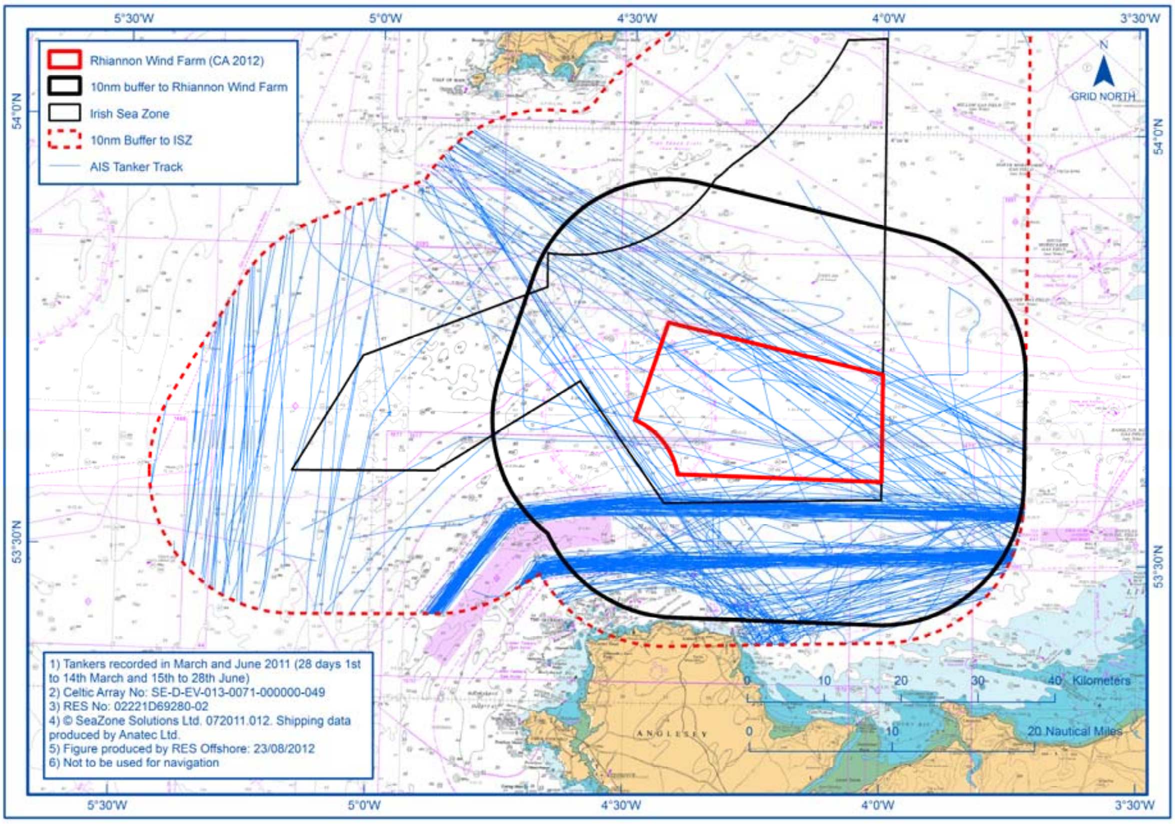


Figure 8.24 Tankers recorded in March and June 2011 (28 days 1 to 14 March and 15 to 28 June)

8.116 During these periods, there was an average of 48 vessels in the ISZ and buffer per day. The busiest day was 28 June 2011 when a total of 62 ships were recorded while the quietest day was 12 March 2011 when 37 ships were recorded. It should be noted that not all these vessels were within the Site boundary.

8.117 The average length of vessels passing through the ISZ and 10nm buffer during the 28 day period was 118m. The longest vessel was the Container/RoRo vessel Atlantic Cartier at 293m, recorded as heading for Halifax, on one day during the 28 day period. This vessel is 33m wide at the beam and broadcast a draught of 11.2m.

8.118 The average draught of vessels passing through the ISZ and 10nm buffer during the 28 day period was 6m. The vessel with the deepest draught was the Shuttle Tanker Grena at 14.5m, recorded as heading for Pembroke and the Ross oil field, on two days during the 28 day period. This vessel is 45m wide at the beam and 277m long.

8.119 The average speed of vessels passing within the ISZ and 10nm buffer during the 28 day period was 13 knots. The fastest vessel tracked was the high speed catamaran passenger vessel Manannan, which was regularly recorded transiting between Liverpool and Douglas at speeds up to 33.8 knots.

8.120 The main destinations for vessels within the ISZ and 10nm buffer are presented in Figure 8.25.

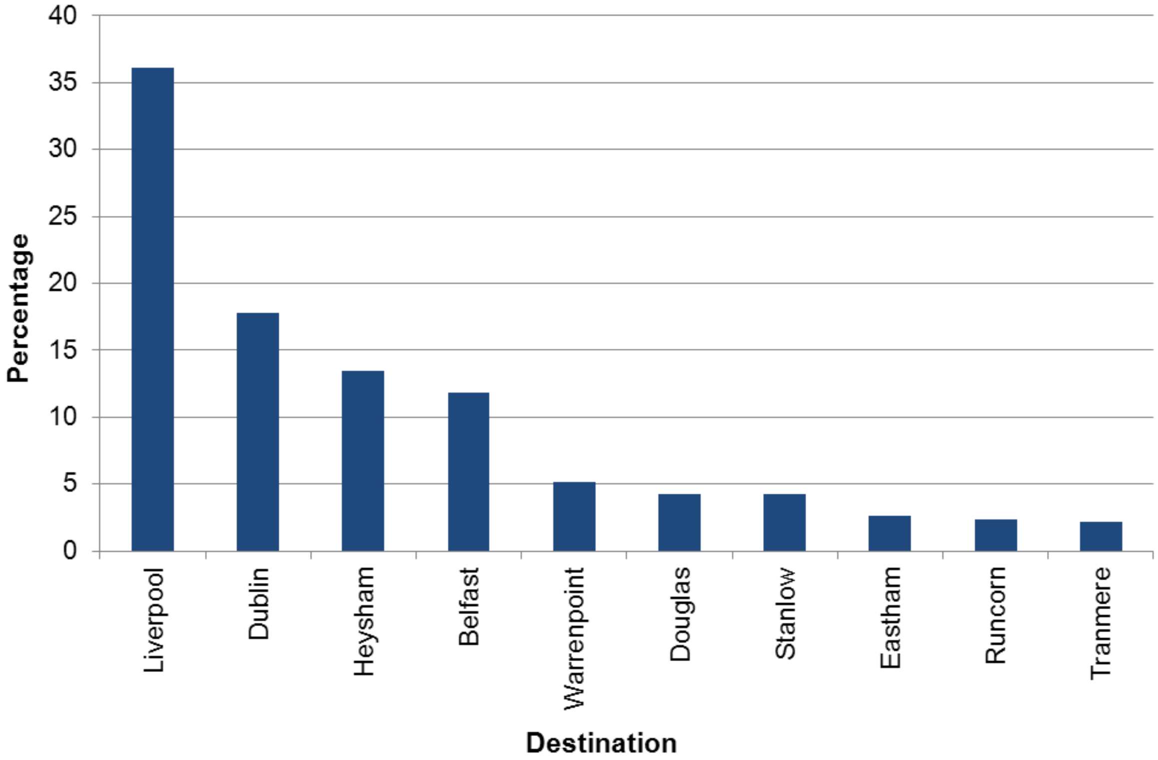


Figure 8.25 Main destination ports of vessels passing through ISZ and buffer (28 days 1 to 14 March and 15 to 28 June)

8.121 The main destination was Liverpool, with 36% of vessels heading to this port. Other frequent destinations for vessels were Dublin, Heysham and Belfast.

8.122 The 28 days of AIS track data for all vessels have been converted to a vessel density per year grid to show grid-cells where there are higher densities of vessel activity. The results are presented in Figure 8.26. The value ranges are based on indicators of relative national values of ship density within areas of potential future wind farm developments in the UK. The highest value (>600) is indicative of a high density shipping area at a national level.

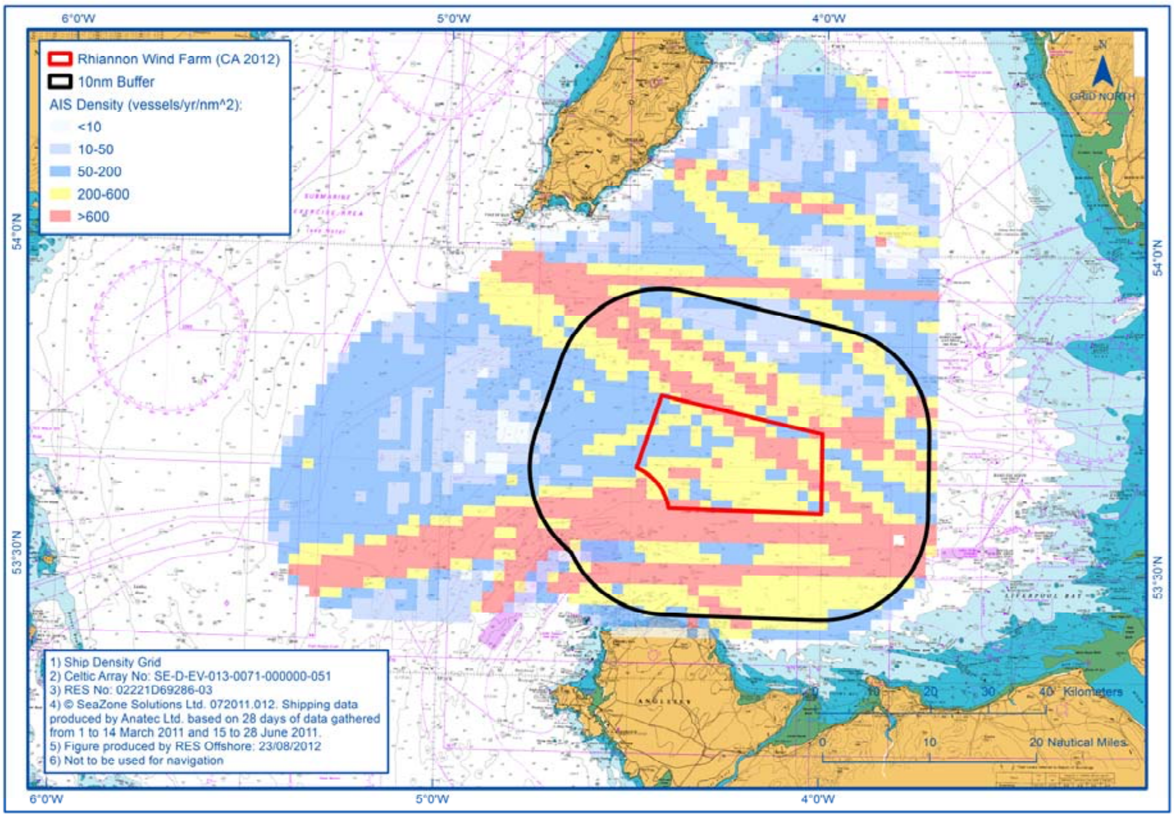


Figure 8.26 Ship density grids

Radar shipping survey

8.123 Tracks of vessels picked up on radar by the survey vessel Franklin during the periods 1st to 14th March 2010 and 15th to 28th June 2010 were considered as part of the ZAP Report. 23% of vessels recorded in the survey were not classified. The most common vessel types recorded were fishing and recreational which accounted for 65% and 12% of traffic respectively in the ISZ.

Main routes

8.124 Main routes passing through the ISZ and 10nm buffer have been identified using principles set out in MGN 371 (MCA 2008). AIS data has been assessed and vessels transiting at similar headings to similar locations are identified as following a route. Regular operators not already identified by the 90th percentile because of the smaller volumes of traffic have also been identified from the AIS data. The main routes and 90th percentiles are plotted in Figure 8.27. A brief description of the traffic on the main routes is presented in Table 8.9.

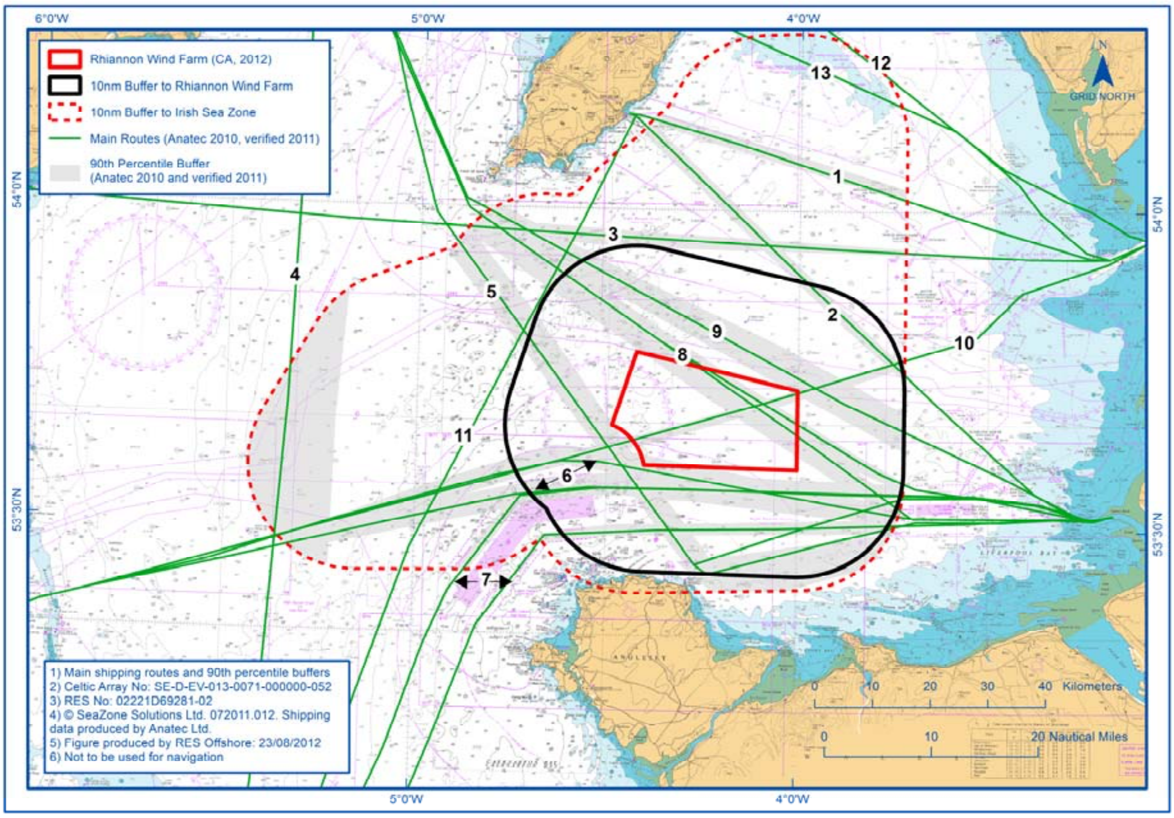


Figure 8.27 90th percentiles for the main routes identified in the Irish Sea

Table 8.9 Description of main routes in the ISZ

Route Number	Description
1	Heysham (UK) to Douglas (Isle of Man). Route 1 is the IOMSPC route between Heysham and Douglas. The main vessel to operate on this route is the RoRo passenger ferry Ben-My-Chree. The high speed ferry Manannan also operates seasonally on this route.
2	Liverpool/Birkenhead (UK) to Douglas (Isle of Man). Traffic on route 2 mainly comprises passenger ferries. The main ferries on this route are Ben-My-Chree and the seasonal Manannan.
3	Heysham (UK) to Warrenpoint (Northern Ireland). Route 3 is generally used by RoRo vessels operated by Seatruck.
4	Belfast (Northern Ireland) to various UK and European Ports. The majority of vessels on route 4 are tankers and cargo vessels.
5	Lynas Pilot Station from North Channel. The majority of vessels on route 5 are tankers headed to the Point Lynas pilot boarding station and then onwards to River Mersey ports.

Route Number	Description
6	Liverpool (UK) to Dublin (Ireland). Traffic on route 6 mainly comprises RoRo traffic transiting north of the Anglesey TSS to shorten journey times. The route is operated by P&O and Seatruck.
7	Various European Ports to Liverpool (UK). Traffic on route 7 includes a variety of cargo and tanker traffic heading to Liverpool via the Anglesey TSS.
8	Liverpool (UK) to Belfast (Northern Ireland). Route 8 comprises a variety of cargo and tanker traffic using the Liverpool Bay TSS.
9	Liverpool (UK) to Belfast (Northern Ireland). Traffic on route 9 mainly comprises RoRo vessels operated by Stenaline. This route does not use the Liverpool Bay TSS.
10	Heysham (UK) to Dublin (Ireland). Route 10 traffic mainly comprises RoRo vessels operated by Seatruck.
11	Milford Haven (UK) to Douglas (Isle of Man). The majority of vessels using route 11 are tankers.
12	Heysham (UK) to Belfast/Larne (Northern Ireland). Traffic on route 12 mainly comprises RoRo vessels operated by Stenaline (Heysham to Belfast) and Seatruck (Heysham to Larne). This route is on the edge of the 10nm boundary but previous bad weather routes have intersected the zone.
13	Ramsey (Isle of Man) to Glasson Dock (UK). Small cargo vessels make up the majority of the traffic on route 13.

8.125 Commercial ferry vessels are an important receptor in the Irish Sea. From Table 8.9, it can be seen the main routes used by commercial ferry operators are 1, 2, 3, 6, 9, 10 and 12.

Adverse weather routes

8.126 During adverse weather conditions, vessels may utilise different routes than those outlined above. As part of the ZAP Report observations have been made of vessel movements during periods of adverse weather conditions which were experienced in the Irish Sea area in February 2011 (4^{th} and 7^{th}), May 2011 (23^{rd} and 24^{th}), September 2011 (6^{th}, 7^{th}, 12^{th} and 13^{th}) and December 2011 (13^{th}, 14^{th}, 28^{th} and 29^{th}). Figures 8.28 and 8.29 present the adverse weather routes observed.

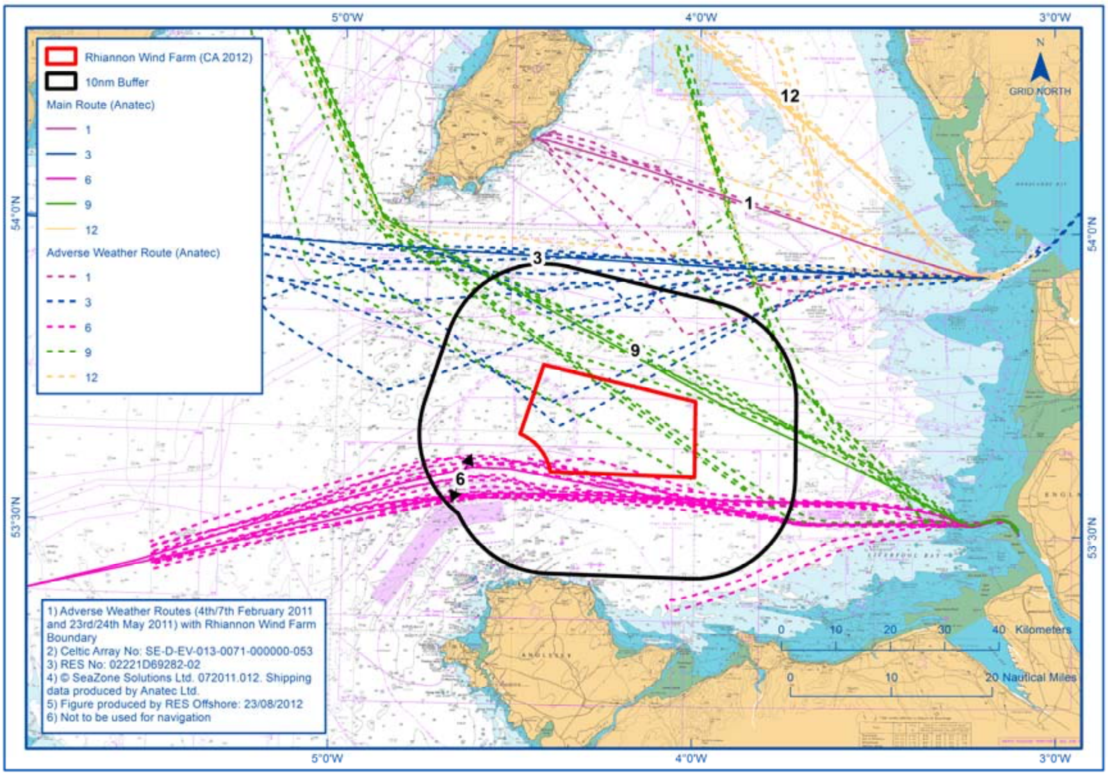


Figure 8.28 Adverse weather routes (4/7 February 2011 and 23/24 May 2011)

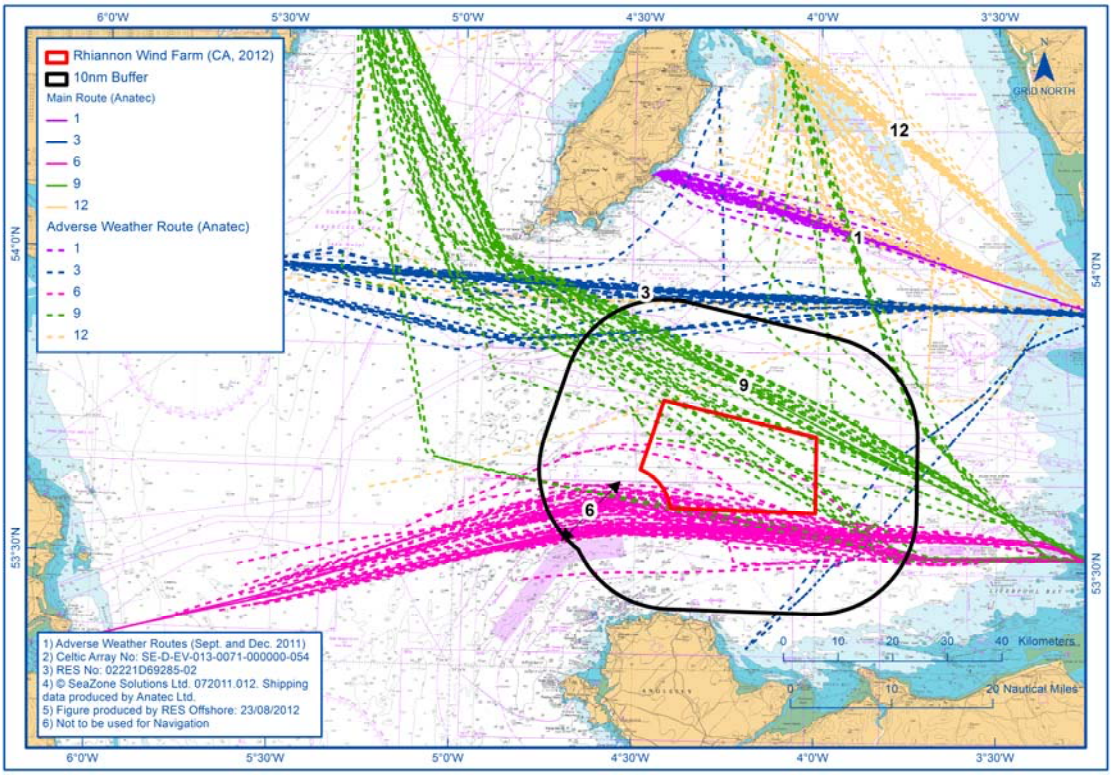


Figure 8.29 Adverse weather routes (Dates from September and December 2011)

Fishing vessel activity

8.127 Fishing vessel activity was considered as part of the ZAP Report for navigation. Further details on commercial fishing vessel use of the Site and ISZ are provided in Section 8.1 of this report.

Recreational vessels

8.128 A plot of the cruising routes, sailing areas, racing areas and coastal recreational facilities (marinas, clubs etc.) in the vicinity of the ISZ, based on data from 2010, is presented in Figure 8.30.

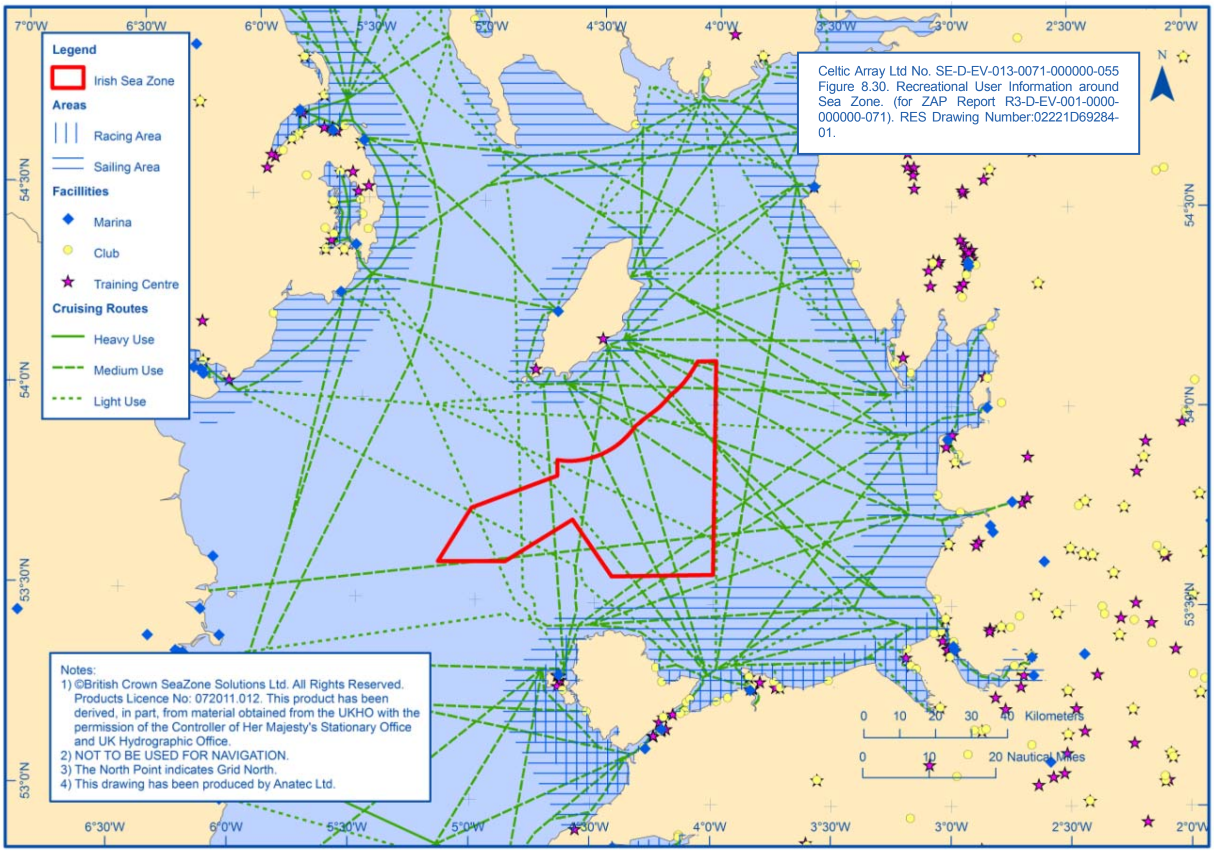


Figure 8.30 Recreational user information around Irish Sea Zone

8.129 Recreational craft routes have been divided up into the following three categories based on route usage:

- Heavy Recreational Routes - very popular routes on which a minimum of six or more recreational vessels will probably be seen at all times during summer daylight hours. These also include the entrances to harbours, anchorages and places of refuge;
- Medium Recreational Routes - popular routes on which some recreational craft will be seen at most times during summer daylight hours; and
- Light Recreational Routes - routes known to be in common use but which do not qualify for medium or heavy classification.

8.130 There are fifteen medium use routes and six light use routes intersecting the ISZ, a number of which intersect the Site and cable corridor area. The nearest heavy use route is over 40nm to the south east of the Site. Further assessment of recreational routes will be made as part of the EIA and in consultation with local and national stakeholders.

Maritime incidents

8.131 Maritime incidents occurring in the vicinity of the ISZ in recent years were considered in the ZAP Report.

Potential impacts

8.132 A summary of the main potential impacts is presented below. The ZAP Report summarised potential impacts and recommended that four issues form the main focus of the EIA. These are changes to vessel to vessel collision risk, increase in vessel to structure risk (including vessels not under command), availability of adverse weather routeing and displacement of vessels from main routes.

8.133 Following the publication of the ZAP Report, two ferry companies (Seatruck Ferries and Isle of Man Steam Packet Company) raised concerns about the potential for development to impact their regular routes. These concerns focused on deviations to direct routes, availability of adverse weather routeing, concentration of vessel traffic into areas and the potential for a ship's radar functions to be affected. Discussion of their concerns for the entire zone is ongoing and the issues are actively being reviewed. Concerns specific to RWF will be factored into the environmental impact assessment.

8.134 The Isle of Man Government and Manx tourism and trade organisations have also raised concerns that development in the ISZ could significantly reduce the delivery of goods and passengers to the island. These concerns will be considered as part of the EIA. The following potential impacts may arise from the construction, operation or decommissioning of RWF.

8.135 The following potential impacts may arise from the construction, operation or decommissioning of RWF: (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

<table>
<tr><td colspan="2">Potential impacts during construction</td></tr>
<tr><td>Vessel to vessel collision risk</td><td rowspan="3">During construction a temporary increase in vessel movements in the Site and along the export cable corridor will occur. These vessels may include small workboats, transport barges, jack-up construction vessels, mobile cranes, dredgers, service/boats, tugs, etc.

Increased vessel to vessel collision risk may occur from the presence of construction vessels, either when stationary or when crossing shipping lanes.

The construction of RWF may reduce the current available area around shipping lanes in the vicinity of the Site.

It is anticipated that such risks can be effectively minimised through approaches such as the use of safety zones, vessel management systems, site monitoring by guard vessels and radar and the issue of Notices to Mariners, in accordance with good industry practice.</td></tr>
<tr><td>Vessel to structure collision risk</td></tr>
<tr><td>Displacement of vessels from main routes</td></tr>
<tr><td colspan="2">Potential impacts during operation</td></tr>
<tr><td>Vessel to vessel collision risk</td><td>The physical presence of structures and their associated operational safety zones (if applied for and granted) may displace vessels onto new routes including into channels between the Site and other wind farm projects in the ISZ or between the Site and other offshore structures (e.g. Round 1 and 2 offshore wind farms or other offshore installations).</td></tr>
<tr><td>Vessel to structure collision risk</td><td>Additionally the presence of structures may increase risks of vessel to structure collisions, including the risk of collision of vessels not under command (NUC), for example vessels drifting because of machinery related problems.

The increase in traffic volumes resultant from the wind farm O&M vessels may also lead to an increase in encounters and therefore increased risk of vessel to vessel collisions.</td></tr>
<tr><td>Interaction between RWF and Traffic Separation Schemes</td><td>The Site is located approximately 5-7nm from the northern and southern points respectively of the Anglesey TSS, see Figure 8.17. These distances could introduce the potential for increased concentration of traffic in existing vessel routes and affect impact vessel to vessel and vessel to structure collision risk.

The boundary of the Site has been drawn to ensure a buffer of 5nm from the Anglesey TSS and a buffer of 1nm from a line drawn between northern most limit of traffic passing between the Anglesey and Liverpool Bay TSSs. This increases the distance of the Site from the Anglesey TSS and the dense shipping route to the south.</td></tr>
</table>

	While this issue remains scoped in, it is expected that maintaining these clearance distances from the TSS traffic will greatly reduce the risk of interaction with the Site.
Displacement of vessels from main routes	The physical presence of structures may displace vessels from current routes and affect existing transits to ports. It should be noted, however, that the ZAP Report has informed the selection of the Site so as to allow the maximum number of vessels to continue on existing routes or with minimal deviation.
Change to availability of adverse weather routes	The physical presence of structures within current open sea areas could affect the availability of adverse weather routes. Within this area of the Irish Sea, vessels head approximately south west and then north west (or vice versa for inward bound vessels) to counter the effects of the wind and ease movement on board the vessel. It should be noted that the ZAP Report has informed the selection of the Site so as to allow the maximum number of vessels to continue on adverse weather routes.
Risk of impacts on the effectiveness of communication and navigational equipment	VHF radio, telecommunications equipment, radar and navigational equipment such as compasses may be affected when in close proximity to RWF because of physical presence of structures and cables. Implementing standard safety measures is expected to address a number of these issues and for this reason, it is not viewed as a focal issue for the EIA. Specific issues raised through consultation, such as some potential radar impacts, will be considered further.
Anchor snagging risk on export and intra-array cables in and around anchorages	The presence of export cables or the intra-array cables which connect individual wind turbines to the offshore substation(s) could increase the risk of anchor snagging. This is particularly relevant to export cables. The probability of vessels anchoring within the wind farm footprint is expected to be low.
Effects on commercial fishing vessels	The navigation or safety of commercial fishing vessels has the potential to be affected by the issues discussed above. Fishing vessel collision risk (both with other vessels and with structures) will be assessed as part of the shipping and navigation EIA process. The risk of fishing gear snagging on structures or intra-array cables is discussed in Section 8.1 of this report. The implications of RWF on VHF and radar capability may be more significant for smaller vessels with a lower capability of equipment than the large commercial vessels considered above, particularly because they may be closer to turbines or even within the turbine array.

Effects on recreational vessels	The navigation or safety of recreational vessels has the potential to be affected by the issues discussed above. Recreational vessel collision risk (both with other vessels and with structures) will be assessed as part of the shipping and navigation EIA process. The implications of RWF on VHF and radar capability may be more significant for smaller vessels with a lower capability of equipment than the large commercial vessels considered above, particularly as they may be closer to turbines or even within the turbine array.
Effects on emergency responders and users of emergency services	The ES will consider the potential impacts of RWF on maritime emergency response activities. RWF may give rise to an increased demand for emergency response facilities (including Search and Rescue and pollution control) because of the presence of operation and maintenance activities over the lifetime of RWF. MGN 371 requires an Emergency Response and Cooperation Plan (ERCoP) to be developed for each wind farm project to identify how emergencies will be dealt with in the Site. Following the introduction of this plan and further analysis, the potential impacts on emergency services are not expected to be significant.
Navigation markings and impacts on visual navigation	RWF will result in a change in existing navigation charts to record the presence of structures. The structures will require appropriate marking and lighting.
Potential impacts during decommissioning	
It is anticipated that the effects of the decommissioning of RWF on shipping and navigation will be broadly similar to those occurring during construction, albeit with a lowering of risk levels as structures are removed. At decommissioning, cables can either be left in situ or removed and both options have a risks and merits associated with them. For example, if concrete mattressing is used it may be safer to leave these in place following decommissioning. The approach to cables will be decided by considering the circumstances of the cables and in consultation with relevant regulators.	
Potential Cumulative impacts	
Cumulative impacts arising from the interaction between RWF and one or more of the above developments may include: • Changes to vessel to vessel collision risk due to increased encounters and reduced sea room; • Displacement of different vessel types (commercial, fishing, recreational) into areas of fishing, recreational, dredging etc. areas thereby increasing	

encounter rates and risk of collision;

- Route deviations for commercial, fishing and recreational vessels; and
- Changes to the availability of adverse weather routes.

Scoping Opinion from the Planning Inspectorate

8.136 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to shipping and navigation:

- The Secretary of State welcomed the proposed consultation with relevant marine bodies and recommended that the results of the consultations are used effectively to inform the Site layout and to identify potential impacts and appropriate mitigation. In addition, the Secretary of State recommended consultation with the appropriate harbour authorities in the vicinity of the development;
- The Secretary of State further recommended that consultation with the relevant commercial operators who operate within the study area was undertaken;
- The Secretary of State welcomed the navigational risk assessment as proposed in the offshore Scoping Report. It was suggested that consideration should be given to the inclusion of an assessment of the cumulative and in combination effects on shipping routes and patterns and also the inclusion of a comprehensive vessel traffic analysis;
- The Secretary of State noted that an irregular arrangement of wind turbines would make it more difficult to navigate and therefore recommended that this issue is taken into account in the design of the development, along with other relevant constraints;
- The Secretary of State recommended that marine navigation aids should be incorporated to mark the proposal during construction, operation and decommissioning, including intra-array and export cables as necessary. Furthermore, elements which are planned to be left on-site after decommissioning may need to be appropriately marked; and
- The Secretary of State recommended that the impact on navigation and appropriate mitigation measures should cover all potential cable laying construction methods.

Approach to address Scoping Opinion

8.137 The level of detail as to how these issues will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA Survey and Study Programme

8.138 As part of the EIA process a Navigation Assessment (NA) and a NRA will be undertaken for RWF to assess the construction, operational, decommissioning and cumulative impacts of the development discussed above, as well as to inform the orientation of the Site boundary and the RWF design layout. The NA and NRA will also consider the risk of impacts on communication and navigation equipment.

8.139 The NA will include a baseline review of commercial shipping and navigation, commercial fishing and recreational activities in the study area, specifically determining the proximity of the Site to shipping routes, navigation channels/separation schemes, port entrances, marking and lighting of the Site and other areas and features of navigational importance.

8.140 The NRA will be produced to conform to the guidance described below. The NRA will provide, as a minimum, a comprehensive hazard log, detailed and quantified navigation risk assessment, a preliminary search and rescue assessment or overview and a preliminary emergency response assessment or overview.

8.141 The ZAP process has collected a large amount of AIS, radar and visual data on shipping in the vicinity of RWF and the ISZ. Furthermore Celtic Array intends to continue to collect data from coastal based AIS-receivers on the Isle of Man and Anglesey from February 2011 until the consent application date. In addition a recent 14 day vessel traffic survey was undertaken in the summer of 2012. The data collected as part of ZAP and the ongoing collection of coastal AIS data and the summer 2012 survey will give a good understanding of shipping routes and crucially of adverse weather routeing. It is proposed that a dedicated 14 day winter survey is not required due to the large data resource already collected, as described above. This would be less than the 28 days recommended. However it is suggested that the full 28 days is not necessary because of the data that has already been collected and the continued data collection from coastal sources. This proposal and the detailed methodology will be consulted on with navigation authorities and the survey requirements would be agreed in the early stages of consultation.

8.142 The following key guidance will be used to inform the EIA process and, if required, the collection and analysis of survey data:

- DECC Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (DECC 2005); and
- MCA Marine Guidance Note 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MCA 2008).

8.143 The DECC Methodology (DECC 2005) is centred on risk assessment and control. It specifies the requirements for a submission including ensuring that sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions.

8.144 MGN 371 (MCA 2008) highlights issues that should be taken into consideration when assessing the impact on navigational safety and emergency response (Search and Rescue (SAR) and Counter Pollution). It includes guidance on site position and design, impacts on navigation, mitigation measures and SAR.

8.145 Other guidance documents used to inform EIA process will include:

- MCA Marine Guidance Notice 372 (2008). Guidance to Mariners operating in the Vicinity of UK OREIs;
- Trinity House Lighthouse Service (2008). Guidance based on IALA Recommendation O-139 On The Marking of Man-Made Offshore Structures, 1st Edition;
- DECC (2011 revision). Standard Marking Schedule for Offshore Installations;

- BWEA, DTI, MCA and PLA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind farm;
- Howard, M. and Brown, C. (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 MCA;
- IMO (2002). Guidelines for Formal Safety Assessment for use in the IMO Rule Making Process (MSC/Circ.1023/MEPC/Circ.392); and
- BERR (2007). Guidance Notes on Applying for Safety Zones around Offshore Renewable Energy Installations – Guidance Notes.

Consultation

8.146 During the course of the EIA process consultation will be undertaken with a number of stakeholders including:

- MCA (including both national representatives and the local Marine Rescue Coordination Centre at Crosby);
- Trinity House Lighthouse Service;
- Chamber of Shipping;
- Department of Transport;
- Ministry of Defence;
- Royal Yachting Association;
- Cruising Association;
- Major port authorities local to the ISZ;
- Regular vessel operators including commercial fishing and ferry operators identified from the AIS data analysis; and
- Other Irish Sea developers (wind farms, oil and gas).

8.147 Transboundary stakeholders will also be consulted on the scope of the EIA work. These will include:

- Commissioners of Irish Lights;
- Republic of Ireland Department of Transport, Tourism and Sport;
- Northern Ireland Department of Regional Development, Ports and Public Transport Division; and
- Isle of Man Government.

8-3 Human environment – aviation

Introduction

8.148 This section characterises the aviation related activities in and around the Site, describes the potential impacts of wind farm development on those activities and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies that have been agreed with relevant consultees which will be used to inform RWF's EIA process.

Surveys and studies carried out to date

8.149 Celtic Array considered aviation and radar issues as part of the ZAP process described in Chapter 18 of the ZAP Report (Celtic Array 2012).

8.150 The main method of establishing the baseline environment and assessing the potential impacts of offshore wind farm development on military and civilian aviation and radar is to consult with those who own and operate the potentially affected systems and infrastructure.

8.151 Celtic Array consulted widely as part of the ZAP process to identify organisations which could be affected by the development of wind farms in the ISZ.

8.152 Consultation to date has included the following meetings/conference calls:

- Civil Aviation Authority (CAA) and Department for Transport held on 19 March 2010 and CAA update on 16 February 2011;
- Defence Estates (now the Defence Infrastructure Organisation, DIO) held on 31 March 2010 and 7th August 2012;
- Isle of Man Airport held on 24 June 2010, 16 September 2010, 5 May 2011 and 23 February 2012; and
- NATS held on 23 November 2010, 2nd June 2011 and 11th July 2012.

8.153 The following data sources and guidance have been considered as part of the ZAP and the Stage 1 PEI processes:

- CAA (2012). CAP 764, CAA Policy and Guidance on Wind Turbines;
- QinetiQ, G.J. Poupart, (2003). Wind Farm impact on Radar Aviation Interests – Final Report;
- NATS (En Route) Ltd (NERL) and MOD low flying published self-assessment maps; and
- The UK Aeronautical Information publication.

Description of current environment

8.154 Figure 8.31 below shows the location of the Site in relation to the aviation issues discussed in the section.

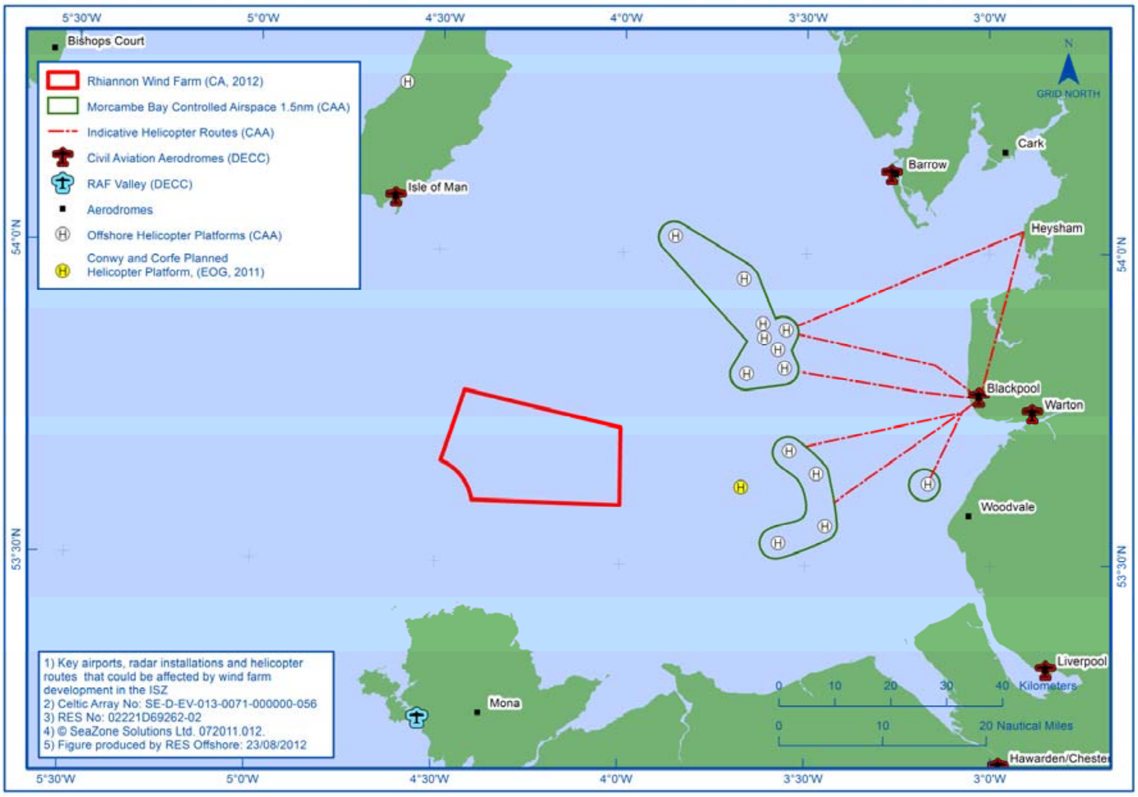


Figure 8.31 Key airports, radar installations and helicopter routes that could be affected by wind farm development of the Site

Controlled airspace

8.155 The majority of the ISZ lies beneath controlled airspace corridors, including the south eastern extent of the Isle of Man Controlled Traffic Area (CTA) and Surveillance Minimum Altitude Areas (SMAA). The CTA is an area of controlled airspace where all aircraft are required to carry secondary surveillance radar transponders. The SMAA is the region of airspace within which the air traffic controllers at the Isle of Man airport direct aircraft at defined altitudes during approaches to landing.

Military aviation infrastructure

8.156 Military infrastructure and facilities are administered by the Defence Infrastructure Organisation (DIO). Potential impacts are associated with the radar facilities at RAF Valley (located on Anglesey about 45km from the Site) and Warton radar station (located in Lancashire about 72km from the Site). The ZAP Report did not anticipate any significant effects on Air Traffic Control operations at Warton aerodrome, however should the RWCS change this issue may be scoped back into the EIA.

8.157 Other non-aviation, military infrastructure is discussed in Section 8.6 of this report.

NERL radar

8.158 NATS (En Route) PLC (NERL) provides en-route air traffic services to aircraft flying within the UK airspace. NERL radars are present at St. Anne’s (near Blackpool) and Lowther Hill (Dumfries and Galloway). A technical and operational assessment performed by NERL in February 2012 indicated there would be no impact on Lowther

Hill and potential interference with St Anne's radar. This assessment was performed on the basis of the ZAP engineering envelope and may need to be updated for the RWF EIA, should the RWCS change.

Civilian airports

8.159 The Isle of Man Airport is situated in the southern part of the Isle of Man and is located about 34km to the north western edge of the Site. The airport operates primary radar and, as discussed above, parts of the Site may encroach on the airport's CTA and SMAAs.

Helicopter operations

8.160 Helicopters service the eastern Irish Sea oil and gas industry in the Morecambe Bay and Liverpool Bay areas. Helicopter operations and maintenance support is also anticipated to be used at some of the Round 2 and Round 2 Extension offshore wind farms within the Irish Sea and so, in future, there may be increased helicopter activity around these areas.

Potential impacts

8.161 There are two ways aviation operations may be impacted by offshore wind development. First, the physical presence of the turbines can cause an obstruction, and secondly, they have the potential to cause interference to communications, navigation, and surveillance systems (including radar). Turbines in the line of sight to primary radar have the potential to cause interference to the system and appear as "clutter" on a radar controller's screen.

8.162 A summary of the main potential impacts is presented below (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction	
Aviation and radar	There are not anticipated to be any additional impacts on aviation and radar interests specifically associated with the construction of RWF.
Potential impacts during operation	
Impacts on air traffic control radar at RAF valley	Discussions with the DIO have identified that there is the potential for an impact on the air traffic control (ATC) facility at RAF Valley arising from development within the ISZ. RAF Valley is located on the Isle of Anglesey and is approximately 45km from the Site. A study, performed as part as the ZAP process, considered turbines with a maximum tip height of 224m and found there is only a clear line of sight to the ATC radar from the western area of the ISZ and therefore development of RWF may not be problematic in this respect. Celtic Array will continue to liaise with the DIO to identify the level of impact which the development of the Site may give rise to, including the range of turbine heights described in Chapter 4.

Impacts on other military aviation facilities and operations	Development within the ISZ is not likely to have an impact on any air defence infrastructure, nor is it anticipated to affect low flying activities.
Impacts on NERL radar	Development on the eastern edge of the ISZ (including within the Site) may be visible to the NERL radars at Lowther Hill and St Anne's. Celtic Array is in discussions with NATS to identify the level of impact that development of the Site may give rise to.
Impacts on Isle of Man Airport	The Isle of Man Airport is situated in the southern part of the Isle of Man and is located approximately 34km to the north western edge of the Site boundary. The airport operates primary radar and parts of the RWF Site may encroach on the airport's CTA and surveillance minimum altitude zones. Celtic Array is in discussions with the Isle of Man Airport and the suppliers of its new radar, to identify the potential level of effect on the airport that development at the Site may cause.
Impacts on helicopter operations	The Civil Aviation Authority (CAA) provides guidance on air safety issues. In the January 2012 update to the CAA guidance CAP 764, it is stated that: *"For many years, the CAA has emphasised the importance of operators and developers taking into consideration all existing and planned obstacles around offshore helicopters destinations that might impact on the safe operation of associated helicopter low visibility approaches in poor weather conditions. In order to help achieve a safe operating environment, a consultation zone of 9 Nautical Mile (NM) radius exists around offshore helicopter destinations. This consultation is not a prohibition on development within a 9nm radius of offshore operations, but a trigger for consultation with offshore helicopter operators, the operators of existing installations and exploration and development locations to determine a solution that maintains safe helicopter operations alongside the proposed development."* Celtic Array consulted with ten Irish Sea helicopter operators while developing the ZAP Report. Celtic Array will continue to consult with these operators in respect of the potential development of the Site.
Potential impacts during decommissioning	
There are not anticipated to be any additional impacts on aviation and radar interests specifically associated with the decommissioning of RWF.	

Potential cumulative impacts
Other projects and activities with which RWF might give rise to cumulative impacts are listed in Chapter 5 (EIA methodology). In respect of the assessment of potential impacts on aviation interests in the ES these will include wind farm projects which are operational, consented, in planning and those for which are reasonably foreseeable as well as oil and gas platforms serviced by helicopters.

Scoping Opinion from the Planning Inspectorate

8.163 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to aviation and radar:

- The Secretary of State recommended that appropriate notification is given of the location of masts and lighting of structures in order that users of the area airspace have knowledge of obstacles.

Approach to address Scoping Opinion

8.164 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA survey and study programme

8.165 Ongoing consultation as detailed above will continue to inform the EIA process. The EIA for RWF will build on the data collected as part of the ZAP process, updated as necessary.

8.166 If necessary, modelling of potential impacts on radar at RAF Valley, the Isle of Man Airport and at Lowther Hill and St. Anne's will be carried out in consultation with the relevant stakeholders to provide a quantitative assessment of risk to those facilities.

8.167 The ES will include:

- A description of the existing/baseline environment in the area of the Site, within the ISZ and the wider Irish Sea area making reference to the information described above and, in particular, consultation derived data and information;
- A review and summary of the aviation consultation including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative and transboundary impacts; and
- Mitigation measures and monitoring proposals, if required.

8.168 The EIA for RWF will take account of the following guidance:

- CAA (2012), CAP 764, CAA Policy and Guidance on Wind Turbines;
- The CAA's 2009 updated version of 'Policy and Guidelines on Wind Turbines' – a document to ensure consistency in the assessment of the potential impacts of proposed wind turbine development on the aviation industry;

- 'ATC Air Performance Metrics' by the recently formed MOD Air Traffic Management Performance Criteria Working Group (ATMPC WG) – this document informs those in the wind farm industry of wind farm mitigation solutions; and
- The Wind Energy, Defence and Civil Aviation Interests Working Group's 2002 Report on 'Wind Energy and Aviation Interests: Interim Guidelines' – this report details both military and independent airport operator issues and consultation procedures.

8-4 Human environment – seascape, landscape and visual amenity

Introduction

8.169 This section characterises the seascape, landscape and visual environment in and around the Site, describes the potential impacts of wind farm development on that environment and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees which will be used to inform RWF's EIA process.

8.170 To assist the understanding of the potential visibility of the RWF Site, a sample selection of representative viewpoints around the wind farm site have been identified from those used during ZAP, and photomontages prepared from these locations. The photomontages are set out in Annex 2 of this Report. The viewpoints have all been selected on the basis that they have open views towards the proposed wind farm and are popular destinations for local residents, walkers and visitors. Several of the viewpoints are also located within or close to areas of nationally protected landscapes including the Anglesey AONB and Heritage Coast, the Great Orme Heritage Coast and the Lake District National Park.

8.171 The photomontages are prepared using images taken by a professional photographer. A digital wireframe model of the proposed wind farm is then created and correctly scaled before being placed over the existing image and then rendered to reflect the conditions under which the original photograph was taken. For each viewpoint, photomontages have been prepared to illustrate different options being considered in the engineering envelope described in Chapter 4. Three scheme options were modelled, comprising of 5MW turbines only, 15MW turbines only, and a mixed turbine height scheme of 220 x 5MW turbines with 73 x 15MW turbines to illustrate the visual effects that might arise in the event that a mixed turbine scheme is considered to be the realistic worst case development scenario. The photomontages are shown in Annex 2 of this Report. Photomontages are presented here for illustrative purposes only and larger versions more suitable to provide a visual representation will be available at exhibitions and later in the consultation process.

Surveys and studies carried out to date

8.172 As part of the ZAP process described in Chapter 4 of the ZAP Report, Celtic Array commissioned a seascape and landscape study (Celtic Array 2012). The ZAP Report included characterisation of the seascape and landscape within a 35km study area surrounding the ISZ together with consideration of key landscape receptors up to 60km from the ISZ.

8.173 The following guidance was considered as part of the ZAP process and has been taken into account in the preparation of this report:

- Guidance on the Assessment of Effect of Offshore Wind Farms: Seascape and Visual Impact Report (DTI 2005);
- Maritime Ireland/Wales Interreg 1994 – 1999 Guidance ‘Guide to Best Practice in Seascape Assessment’ (GSA) (March 2001);
- Guidelines for Landscape and Visual Impact Assessment (GLAVIA) (Institute of Environmental Management and Assessment (IEMA) and the Landscape Institute’s (LI), second edition 2002);
- Visual Representation of Windfarms Best Practice Guidance (SNH 2007);
- Cumulative Effects on Windfarms (SNH 2005); and
- Siting and Design of Windfarms (SNH 2009).

8.174 Baseline data for the ZAP Report and this report was collected from sources including published GIS datasets such as OS Open Data, CORINE Landuse, NASA terrain and OpenStreetMap data.

8.175 Site visits to inform the ZAP Report were carried out in June 2011 (North Wales) and October 2011 (Isle of Man) to establish the seascape, landscape and visual baseline.

8.176 Published survey and assessment information used in the collection of baseline data for the ZAP Report and this report has included:

- Landscape of Wales – Regional Landscape Character Assessment, CCW (2011);
- Seascape Assessment of Wales, CCW (2010); and
- Isle of Man Landscape Character Assessment, Isle of Man Government (2008).

Stakeholder consultation

8.177 Stakeholder consultation with a wide range of stakeholders (e.g. CCW, NE, Isle of Anglesey County Council) was also carried out to inform the ZAP Report. Consultation with these parties will continue as the EIA progresses. In addition, relevant stakeholders were consulted on the scope of the RWF EIA by the Planning Inspectorate.

Description of current environment

8.178 The ZAP Report provided a broad summary of the seascape, landscape and visual environment in the vicinity of the Site.

8.179 The majority of the 35km study area considered in the ZAP process lies within the Irish Sea itself. The study area in relation to the ISZ and the Site is shown in Figure 8.32. The study area also extends across Anglesey and the coastal margins of Gwynedd and Conwy. To the north part of the Isle of Man also falls within the study area. As noted above an additional 60km area around the ISZ was considered in respect of nationally designated landscapes such as the Lake District National Park, Snowdonia National Park and Clwydian Range AONB because of their national importance, elevated height and potential sensitivity to change.

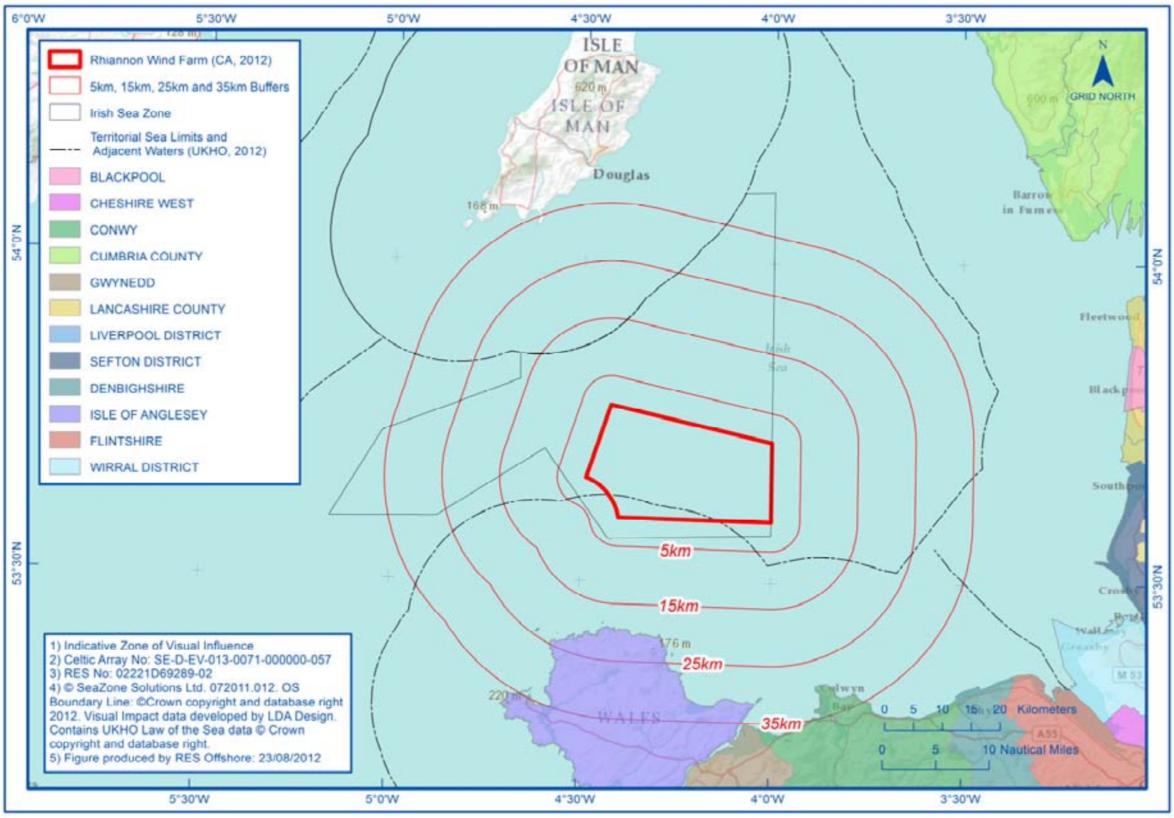
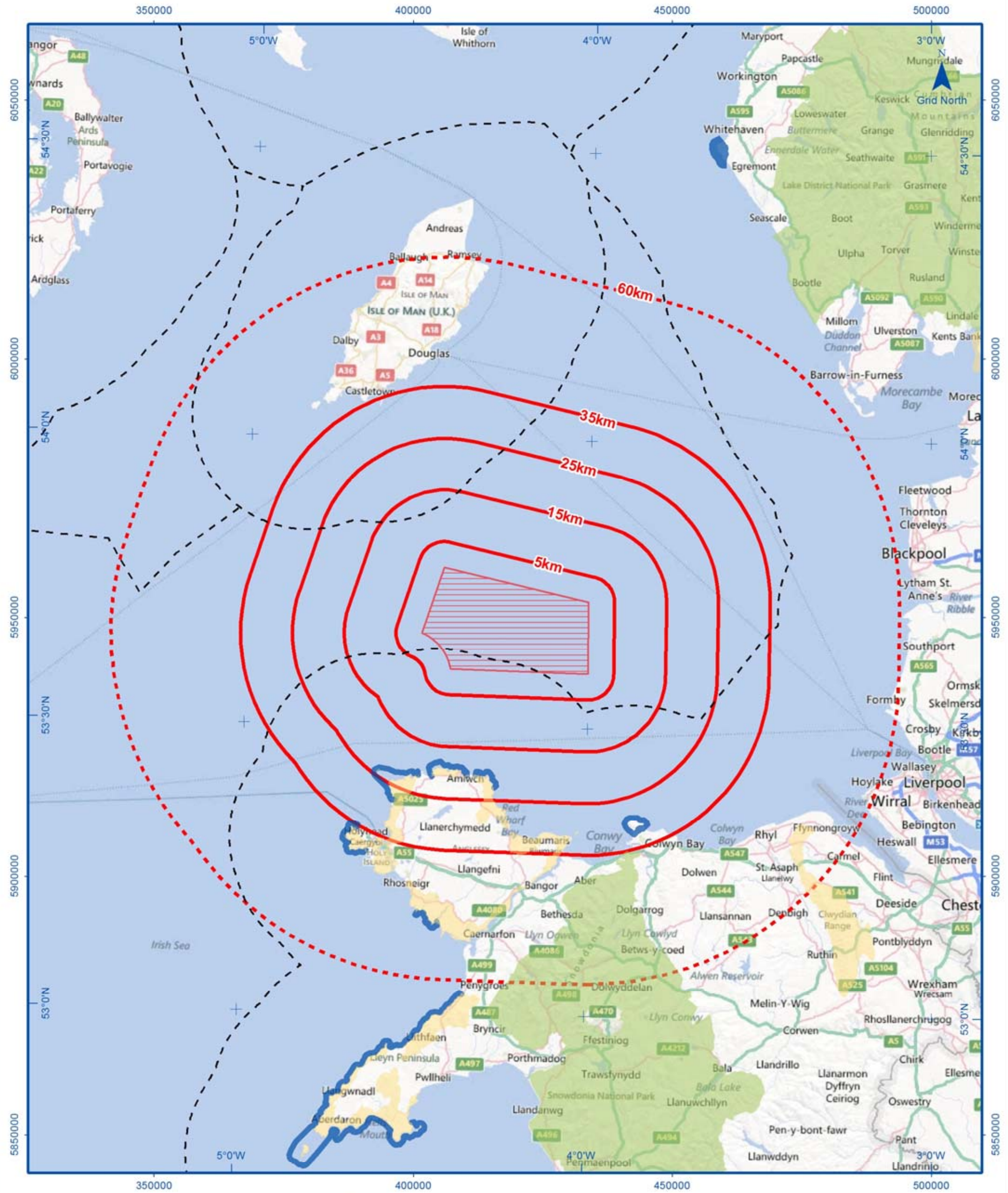


Figure 8.32 35km study area for visual impact of the Site

8.180 The nature and magnitude of any potential impact on these areas will depend on a variety of factors including the location and height of the turbines forming the Site. It is likely that some of the areas below will be able to be scoped out of the ES following calculation of zones of theoretical visibility (ZTV) carried out as part of the EIA process.

Designated landscapes

8.181 The key characteristics of the landscape designations which lie within a 60km study area are described below. It must be noted that following the establishment of the RWCS, those areas/features within the designated landscapes that are likely to be significantly affected will be assessed in more detail as part of the EIA. Figure 8.33 shows the location of the landscape designations.



Rhiannon Wind Farm (CA2012)

5km, 15km, 25km &35km radii around Rhiannon WF

60km radii around Rhiannon WF

Territorial Sea Limits and Adjacent Waters (UKHO, 2012)

National Parks (CCW)

Area of Outstanding Natural Beauty (CCW)

Heritage Coast (CCW)

Figure 8.33

This drawing was compiled using the most current data at the time of publication. Please contact Celtic Array Ltd for the latest information: info@celticarray.com

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04	10/10/12	JD	SM	EF	Project title revised
03	24/08/12	JD	JF	EF	Updated for PEI
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0 10 20 30 40 Kilometers

0 5 10 15 20 Nautical Miles

ROUND 3: IRISH SEA ZONE

RHIANNON WIND FARM

Designated landscape features identified within 60km of Rhiannon Wind Farm

CELTIC ARRAY DOC NO: SE-D-EV-013-0071-000000-058

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Snowdonia National Park

8.182 Snowdonia National Park covers an extensive area of north west Wales to the south east of Anglesey. The majority of the National Park lies beyond the 35km study area. ZTV calculations carried out for the ZAP Report show that there is potential for intervisibility with the ISZ across the north west facing slopes of this mountainous designated landscape. The key characteristics of this area are discussed below within the Eryri regional character area. Coastal views are a characteristic of only a small part of the national park and these are part of expansive panoramic elevated views.

Lake District National Park

8.183 ZTV calculations for the ZAP Report suggest intervisibility with the ISZ on the south west facing slopes of the outer extents of the national park. While distant and panoramic views are a feature of much of the exposed mountainous areas, it is only the western uplands and lowlands and coastal margins where sea views are a feature. However, these views take in a considerable range and expanse of elements including existing offshore wind farms and oil/gas platforms.

Anglesey AONB and North Anglesey Heritage Coast

8.184 The Anglesey AONB designation covers almost all the coastal regions of Anglesey, Holyhead Mountain and Mynydd Bodafon. As stated within the Isle of Anglesey County Council's website, the AONB was designated '*in order to protect the aesthetic appeal and variety of the island's coastal landscape and habitats from inappropriate development'.*

8.185 The AONB also encompasses three sections of heritage coast, which are designated because of their open, undeveloped coastline. The North Anglesey section lies within the study area and is the only section of the heritage coast to have potential intervisibility with the ISZ. The views out from much of the AONB and heritage coast include a variety of features such as the Wyfla Power Station, Holyhead docks and industry, remnants of open cast mining, settlements, offshore wind farms and onshore wind farms - although it is acknowledged that these views further inland may be obscured by topographical variability.

Clwydian Range AONB

8.186 The Clywdian Range AONB is a chain of hills extending approximately 3km north south from Nant y Garth in the south to Prestatyn in the north. The Offa's Dyke National Trail follows the ridgeline. Much of the range is enclosed by woodland and agriculture but views out to the surrounding landscape are available from parts of the ridgeline such as at Moel Famau and Craig Fawr. Views to the sea will be distant and potentially encompass existing offshore wind farms, the docks around Birkenhead and Liverpool and the coastal resorts along North Wales. Distant panoramic views are a characteristic, but specific sea views are not common from the majority of the AONB.

Great Orme Heritage Coast

8.187 The Great Orme Heritage Coast is defined by the distinctive headland which lies at the north western end of the Creuddyn Peninsula, approximately 30km from the ISZ. It is primarily an open grassland area on top of high sea cliffs. Views from the headland to Snowdonia and also across the sea are a key characteristic. Sea views incorporate existing offshore wind farms at Rhyl Flats, North Hoyle and will also include the Gwynt y Môr site when completed.

St Bees Head Heritage Coast

8.188 St Bees Head Heritage Coast lies approximately 50km to the north east of the ISZ. It is defined by its 90m high red sandstone cliffs where distant coastal views, as far as the Isle of Man, are possible. Much of the area has ecological designations and there are large sea bird colonies. The Cumbria Coastal Path and also the coast to coast long distance path begin at St Bees Head. Sea views are a key part of the character of this area.

Welsh landscape character areas

8.189 Figure 8.34 shows the location of landscape character areas within the study area which includes two main character areas in Anglesey with the northern extents of four others. The key characteristics of these areas, set out below, are directly taken from CCW (2011).

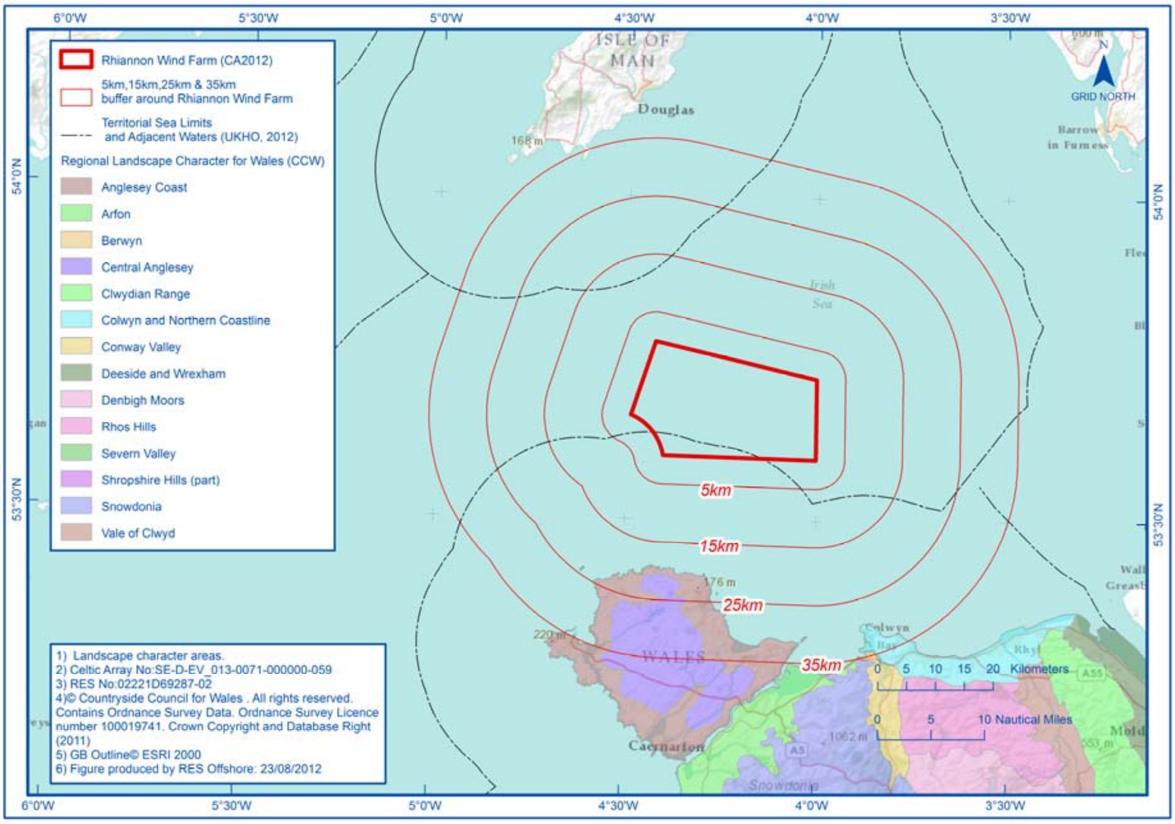


Figure 8.34 Landscape character areas identified within the Site study area

Anglesey Coast

8.190 This character area incorporates all the coastal areas of the Isle of Anglesey where the highest land on the island generally lies and much of which is designated as an AONB. Parys Mountain (147m AOD) which lies in the north of the island and Holyhead Mountain (220m) in the west, are the two highest points. The geological orientation lies south west to north east, resulting in a 'corrugated topography' which creates a variety of coastline types including rocky headlands and sandy bays. This variety gives dramatic landforms visible along the coast.

8.191 In addition, the other key characteristics of the character area within the study area, as set out by CCW (2011), include:

- 'Igneous rock intrusion and outcrops of quartzite have created the dramatic landforms and skyline of Holyhead Mountain and South Stack, at Holy Island;
- The striking and windswept heathland landscapes of the wild coastline at Holyhead Mountain and North and South Stack, together with the barren, mined landscape of Parys Mountain, contrast markedly with the gentler, green, pastoral landscapes inland, away from the immediate coastal edge;
- Settlement relates primarily to former industry, such as the mining town of Amlwch at the foot of Parys Mountain, or to strategic transport routes, such as Thomas Telford's A5 and the port town of Holyhead (the only large settlement in the area) on Holy Island;
- The copper ore seams at Parys Mountain have resulted in a visually distinctive landscape of open cast craters and without vegetation, colourful spoil heaps, the legacy of intensive 18th to 19th century copper mining;
- Wylfa Nuclear Power Station is a prominent landscape feature visible on part of the north coast, while the single, slender, tall chimney at the Anglesey Aluminium works on Holy Island is a widely visible land mark;
- The strategically important, late 13th century castle of Beaumaris overlooking the Menai Strait and one of the last of the great frontier castles built by Edward I is a key element of the historic landscape and designated a World Heritage Site; and
- Other significant elements of the historic landscape include prehistoric and funerary sites such as standing stones, chambered tombs, barrows and cairns, distinctive Iron Age hill and promontory forts, the largest and most prominent being Bwrdd Arthur, on the Penmon peninsula.'

Central Anglesey

8.192 Defined by CCW (2011) as the 'land-locked central part of the largest island in Wales', the Central Anglesey character area is generally low lying in comparison to the higher coastal areas defined above. The 'corrugated topography' created by the south west to north east orientation of the geology is visible across the landscape. The key characteristics are as follows:

- 'Apart from rock outcrops, much of the area is masked and levelled by thick layers of glacial boulder clays. In part of north west Anglesey this has resulted in a classic 'basket of eggs' drumlin landscape;
- Silty and peat soils underlie lowland pastoral grazing land bounded by a strongly geometric pattern of medium to large scale and, more occasionally, small scale fields;
- A number of minor rivers and streams cross the landscape, whose alignment is influenced by the north east to south west trend. There are many shallow hollows with wetland features including rush pasture and valley mires, for example Cors Erddreiniog NNR;
- The largest reservoir is Llyn Alaw, a notable visual feature, providing significant over wintering habitat for wildfowl;

- This is generally a rolling, open landscape with a well-established pattern of hedged field boundaries. Woodlands larger than a small copse are an exception, notably around Llangefni Dingle and Llyn Cefni reservoir and estate woodlands at Presaddfed (Bodedern);
- Elements of the historic landscape include prehistoric ritual and funerary monuments including cairns and round barrows, Iron Age hillforts and Early Christian churches, burial grounds and inscribed stones;
- The only urban settlement is the county town of Llangefni, in the centre of the island. Its nucleated historic core contrasts with modern peripheral housing and business park developments. There are a few villages, but numerous scattered hamlets and farms throughout the area. Linear, ribbon villages concentrate along the A5 road (now superseded by the A55 Expressway);
- A generally tranquil but not wild or remote landscape, with activity and noise concentrated on the principal settlements and the central transport corridors of the A5 and A55; and
- Windmill towers, including some restored examples and the wind farm north of Llandeusant feature in views from the more elevated points within the area, while there are clusters of wind turbines in the north of the area.'

Arfon

8.193 Only the very northern extents of this character area lie within the study area. The wider character area includes areas of the Snowdonia National Park. The character area is a band of lowlands and foothills between the Menai Strait and uplands of Eryri. The key characteristics of the Arfon character area, as set out by CCW (2011), are defined below:

- 'A broad, gently undulating lowland and valley land form, rising from the coast to a maximum of about 200m and flanked by the foothills and upland backdrop of Eryri;
- Woodland cover is a feature of the valley slopes, while scattered mature oak trees characterise a number of parklands within the area;
- The principal river, the Seiont, follows a meandering course before discharging into the Menai Strait at Caernarfon, whereas the Gwyrfai opens into a broad estuary at Foryd Bay, a short distance to the south west;
- Ecologically important sand and shingle beaches at Morfa Dinlle, Foryd Bay and extensive tidal flats at Traeth Lafan;
- A rich concentration of prehistoric settlements and sites includes burial sites, hillforts and stone built hut circles and their field systems, which often survive on the more marginal parts of the foothills;
- Caernarfon Castle and its associated Medieval walled town overlooking the Menai Strait is a key historic feature and a World Heritage Site;
- Settlement pattern relates to sites of strategic significance such as Caernarfon, or to centres such as Bangor that later developed as a staging point on the road to Holyhead;

- The intimate, wooded pastoral landscape of the valleys and lower slopes contrasts with the more open and exposed, sheep grazed pastures along the coast and Eryri foothills;
- Bethesda, Penygroes and Llanberis are characterised by extensive remains of former slate quarries, workings, haulage systems and waste tips, including associated worker's housing and smallholdings that encroached onto former commons – the 'gwerin' landscapes; and
- An inland backdrop of steeply rising mountains, with many views to well-known ridges and peaks, including Snowdon.'

Eryri

8.194 This mountainous character area which broadly covers the Snowdonia National Park has only a small coastal extent within the study area. The key characteristics of the whole area, as set out by CCW (2011), are defined below:

- 'The highest point in England and Wales, at 1085m, is at the summit of Snowdon;
- U-shaped glacial valleys are distinctive, carved through the mountainous terrain by the ice in the last Ice Age, creating further topographic variation in a landscape often defined by massive, angular skylines;
- Principal land cover elements include hill sheep grazing, forestry, heather dominated moorland and upland grassland. Rock outcrops and slate/shale ridges are frequently apparent;
- Many prehistoric ritual and funerary sites including cairns, standing stones and stone circles are prominently located along hill crests, mountains, ridges and passes, often forming strong visual features;
- Deserted stone-built Iron Age, Roman period, medieval and later, settlements and field systems survive in an almost unbroken 'cordon' of relict landscapes along the lower slopes between the Dyfi in the south west and the Conwy in the north east;
- Slate mining has created the slate landscape of Blaenau Ffestiniog and slate is the principal building material in much of the area;
- Copper mining was historically important in Eryri, notably at Sygun, near Beddgelert and Drws-y-Coed, near Nantlle. The exploitation of other minerals, for example, gold, lead, zinc and manganese, have also left industrial archaeological remains in the landscape;
- The few areas of settlement are primarily defined by small towns, for example, Dolgellau and compact valley villages in slate and stone such as Beddgelert and Betws-y-Coed;
- The landscape is sparsely populated and the few roads are confined to valley roads and twisting mountain passes;
- A landscape of great perceptual variation and spatial experience with angular mountain ranges contrasting with hills softened by moorland heather and plantations and often juxtaposed with deeply dissected valleys; and
- There are many small and a few large water bodies, from natural lakes and built reservoirs to tidal estuaries and sea views, which add visual diversity to this iconic landscape area.'

Conwy Valley

8.195 The Conwy Valley character area is a north south area following the Conwy River valley which lies as a distinct edge to the uplands to the west. Only the very northern extents, around the Conwy Estuary lie within the study area. The key characteristics of the character area, as set out by CCW (2011), are defined below:

- ‘A broad glacial valley between the adjacent uplands of Eryri and Rhos Hills, with the east facing slopes of the Carneddau creating a strong sense of containment to the valley;
- Soils support lowland pasture and hay meadow with hill sheep grazing to the valley sides, while hanging woodland, including beech and oak, characterises the slopes;
- A geometric field pattern of varying scale and set within mixed hedgerows, defines much of the valley;
- The strategic historic importance of the valley is represented by a number of defensive sites placed at river crossing points;
- Conwy Castle with its associated walled town (a World Heritage Site), dramatically located on a promontory overlooking the estuary, is a key landmark feature;
- Beyond the principal towns of Conwy and Llanrwst at the opposite end of the valley floor, settlement is confined to compact, linear hamlets and villages along the valley sides;
- A strongly textured landscape with a patchwork or mosaic character created by the proximity of lowland pasture and the wooded valley sides;
- Tidal movement in the Conwy Estuary provides constant localised variation;
- At Conwy, the castle and town walls are complimented by the road and railway bridges over the river, providing further spatial variation and time depth; and
- The area, while being a distinctive landscape in itself, forms a natural boundary between the gentler landscapes to the east and the steeper, higher, craggier landscapes to the west.’

Colwyn and Northern Coastline

8.196 This regional character area incorporates the north east coastal areas of Wales, of which the western portion lies within the study area. This coastal strip includes the main urban and resort areas of North Wales. The key characteristics of the character area, as set out by CCW (2011), are defined below:

- ‘Carboniferous limestone has resulted in distinctive coastal headlands such as the Great Orme’s Head and escarpments, ridges and rock outcrops, in addition to characteristic limestone weathering features such as clints and grykes;
- The tidal estuary of the Clwyd flows northwards towards the coast and a number of narrow river valleys, such as the Dulas, fall partly within the area;
- The tidal flats associated with the Clwyd and areas of remnant sandbanks and dunes contrast markedly with the artificial coastal edge created by the sea walls;
- Land use is defined primarily by urban development and recreational land uses associated with the strip development of a number of, by now coalesced, 19th

century seaside resort towns. More recent caravan parks and holiday camps add to the perception of a single coalesced settlement extending from Llanddulas to Prestatyn. Sheep grazed pasture forms the hinterland to these resorts;

- The Victorian resort town of Llandudno is famed for its natural setting between two rocky headlands, its pier and its grand sweeping promenade and building façades, arguably the finest of their type in Wales;
- At the eastern end, a network of medium scale pastoral fields of regular pattern is defined by ditches and, to a lesser extent mixed, managed hedgerows and occasionally interspersed with small stands of mixed farm woodland;
- At the western end, the Great Orme has a range of archaeological features illustrating a variety of historic land uses, including prehistoric caves, extensive evidence of underground, Bronze Age copper mining, ritual and funerary monuments and hillforts;
- Rhuddlan Castle is strategically sited at a crossing point over the Clwyd, at what was once the eastern boundary of the Medieval kingdom of Gwynedd;
- A number of historic parklands lie within the area, while the estate architecture of Gwyrch Castle and wooded parkland is a locally prominent feature; and
- Beyond the intensively developed areas of settlement and their urban edges, this is a tranquil and often isolated limestone landscape, most notably at the windswept cliffs of Great Orme. Quiet narrow valleys also provide contrast with the settled areas, notably south of Llanddulas, where further variation is provided by areas of limestone quarrying.'

Welsh regional seascape units

8.197 The characteristics and special qualities of the seascape units around Wales and their comparative sensitivity to offshore development are defined by CCW in 'Seascape Assessment of Wales' (CCW 2010) and are described below. Four seascape units lie wholly within the 35km study area, with limited extents of the Holyhead Mountain North Stack to Penrhyn Mawr, Rhos Point to Great Orme's Head and the Conwy Estuary Regional Seascape Units (RSU). Descriptions of all seven RSUs are set out below:

Rhos Point to Great Orme's Head

- 'Dramatic rocky limestone headlands and cliffs and sweeping bays with promenades and coastal defences in places;
- Resort settlements - principally Llandudno - with coherent urban form on flatter land, with semi-natural vegetation, woodland and some pasture on steeper slopes with limestone outcrops;
- Tidal and moderately exposed with some protection from Great and Little Orme headlands;
- Focused views out to sea from the pier and promenade at Llandudno from associated settlements and the elevated and panoramic views from Great Orme Country Park. The North Wales Coastal Path and other settlements also have views; and
- Key cultural associations: the legends associated with the Creuddyn peninsula and the development of the holiday resort of Llandudno.'

The sensitivity of this RSU to offshore wind farms, as defined by CCW, is Medium; 'Tall objects 13km out to sea may be clearly visible from the popular view points and historic amenities around the Ormes and Llandudno. Such objects may create new focal points in a generally open sea horizon. A large horizon spread may act to enclose the limited arc of sea views available from Llandudno North Shore. However, apart from the headlands this is an urbanised coastline with many more prominent visual elements in the foreground along the coastline. There are also a number of existing objects visible out to sea, including the Douglas platform and existing wind farms'.

Conwy Estuary

- 'Enclosed estuary with soft edges lying in a broad, flat bottomed valley and steep sides, some wooded, rising to Snowdonia to the west;
- A rural pastoral valley to the south with settlements to the north and woodlands that flank the estuary. Most notably Conwy (World Heritage Site) with its prominent castle, walled town and waterfront;
- The estuary is tidal with strong currents and suspended solids; and
- Key views are to and from Conwy Castle and related historic settlement, the road and railway bridges, Deganwy Castle, adjacent historic gardens and from sensitive parts of Llansanffraid Glan Conwy'.

The sensitivity of this RSU to offshore wind farms, as defined by CCW, is High; 'Tall objects out at sea would only be seen from limited locations within this seascape, however any such development within the estuary would seriously affect the integrity and scale of both the natural and the historic setting.'

Great Orme's Head to Puffin Island

- 'The distinctive whaleback rocky limestone headland of the Great Orme forms the eastern landmark;
- Snowdonia reaches the coast in massive rocky acid tuff cliffs falling to the shore with large quarries on the slopes and acts as a backcloth for the whole coast;
- Road, rail and electricity lines are fitted along the steep coastline and mountainous hinterland;
- The western mainland coast is low lying with gently sloping rural farmland;
- Ynys Môn rises to gentle hills and soft low cliffs with Puffin Island at its furthest eastern extent enclosing the coast to the west;
- There are tidal currents associated with the Menai Strait and the Conwy estuary; and
- Key views are to and from the Great Orme Country Park, historic settlements such as Beaumaris town and castle, Penmon Point, Penrhyn Castle, the coastal path and promenades and beaches in settlements such as Bangor and Llanfairfechan/Penmaenmawr.'

The sensitivity of this RSU to offshore wind farms, as defined by CCW, is Medium; 'A limited arc of view to an open sea horizon would be the focus of low level views towards any development of tall structures offshore in that area. However, headlands would mask wider views of the open sea. Any tall structures within the bay itself would become land marks because of the enclosure and many viewing locations.'

Puffin Island to Point Lynas

- 'A generally rocky and fine-grained north east facing coast with medium-sized sloping cliffs and small headlands and occasional beaches and coves between stretches of intertidal rocks;
- Red Wharf Bay forms an extensive sandy bay. This is the largest undeveloped sandy bay on the North Wales coast;
- Rural pastoral farming dominates with clustered settlements and numerous scattered caravan parks to the west;
- The sea is open to the north east with long views along the North Wales coast especially to The Great Orme's Head;
- Puffin Island is the largest island on the coast (1km length), compared to the much smaller Ynys Dulas and Ynys Moelfre; and
- Puffin Island lies at the tip of the Penmon peninsula.'

The sensitivity of this RSU to offshore wind farms as defined by CCW is Medium; 'Tall objects placed out to sea would be widely visible from this rural coastline, however this coastline is not as remote or as dramatic as many others.'

Point Lynas to Carmel Head

- 'Fine grain, rocky, north facing convex coast of many small bays and headlands with low cliffs and only one small sandy beach;
- Undulating, glaciated, old rock coastal plateau supporting pastoral farming with areas of semi-natural vegetation;
- Few settlements, but the area contains a number of wind farms inland and Wylfa nuclear power station on the coast; and
- Exposed northern aspect with open sea and long views'.

The sensitivity of this RSU to offshore wind farms, as defined by CCW, is Medium; 'Existing wind farms inland and some large industrial structures on the coast decrease sensitivity to tall structures offshore.'

Carmel Head to Holyhead Mountain North Stack

- 'Holy Island to the west and Anglesey to the east separated by the Alaw estuary;
- Holyhead Mountain is the dominant landform with rocky cliffs around North Stack. On a smaller scale Carmel Head has cliffs with rocky slopes rising steeply. Elsewhere, there is a small scale indented coast with low cliffs and rocky platforms with a few sandy coves;
- Holyhead is a busy ferry port, with a large harbour and protective seawall. The tall chimney stack of the Anglesey aluminium smelter is prominent to the south of Holyhead;
- Elsewhere, the hinterland and coast is generally rural with minor leisure uses;
- The west facing coastline is exposed but partly sheltered by Holy Island to the west and south; and
- Views across to and from respective landforms.'

The sensitivity of this RSU to offshore wind farms, as defined by CCW, is Medium; 'Land based wind farms exist to the east. Holyhead port and the Anglesey aluminium smelting works set a precedent for large structures in this seascape. However, Holyhead Mountain and Carmel Head are more remote from this development'.

Holyhead Mountain North Stack to Penrhyn Mawr

- 'An indented and precipitous west and north west facing rocky coast with high cliffs backed by Holyhead Mountain and exposed island headlands;
- Semi-natural vegetation on Holyhead Mountain and Penrhyn Mawr with pastoral farming elsewhere on the gently undulating coastal plateau;
- Settlement is very limited but high points covered with wireless masts and headlands host a lighthouse and signal station;
- The sea is exposed and open with large waves;
- Long open views across the Irish Sea and from ferries; and
- The cliffs are popular as one of the best coastal climbing locations in Europe.'

The sensitivity of this RSU to offshore wind farms, as defined by CCW, is High to Medium; 'The south westerly prospects are more sensitive than the north westerly to tall objects placed at sea. North west is associated with ferries arriving and departing Holyhead and in south west locations, tall objects may silhouette at sunset.'

Isle of Man – landscape character types

8.198 The ZAP Report utilised the Isle of Man's Landscape Character Assessment (Chris Blandford Associates 2008) and considered eight Landscape Character Types (LCT) which lie within 35km of the ISZ. As with the Welsh areas, it is likely that some of the areas listed below (together with the more detailed Landscape Character Areas (LCAs) described in the Landscape Character Assessment) will be able to be scoped out of the ES following calculation of ZTV carried out as part of the EIA process.

Uplands

8.199 The Uplands LCT lies within the centre of the island. Because of their topography, it is only the south east facing slopes which were shown, on the initial ZTV, to have potential intervisibility with the ISZ. There are two character areas – northern and southern. The key characteristics, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- 'Rolling open and expansive fells with numerous pronounced rounded summits and associated spurs;
- Some small steep sided, deeply incised valleys cut by upland streams with stretches of white water and some large boulders at the head water;
- Expansive panoramic views across the whole Island with some lower areas enclosed by surrounding peaks and river valleys;
- Occasional blocks of coniferous plantations with abrupt rectilinear edges;
- Moorland vegetation, areas of upland farming, rough pasture and impoverished grassland;
- Variety of historic and current field divisions including the Mountain Hedge, Manx hedges and post and wire fences that enclose fields of a variety of size and shape;

- Gorse is a prevalent shrub growing on top of the Manx hedges with heather on the upper moors and peaks;
- Scattered dwellings and upland farms with a variety of out houses with corrugated roof out-houses;
- Network of small steep winding single track roads and some wider well-kept roads with conspicuous road and route markings along the TT routes;
- Remnants of historic settlement and land uses in the form of old field patterns, shielings, cairns, standing stones, cairns, hut circles, mineral extraction and areas of peat cutting;
- Some upland areas abut the sea where there are dramatic rocky steep cliffs that descend into the sea;
- Exposed rocky outcrops with areas of scree slopes in southern areas;
- Simple and smooth texture; and
- Remote feel in places.'

Broad Lowland Valley

8.200 The Broad Lowland Valley LCT lies between the southern and northern uplands in approximately the centre of the island. The key characteristics, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- 'Wide valley with misfit rivers meandering in a flat valley floor through a sequence of gravel beds and deep pools;
- Relatively steep valley sides rise up into areas of upland and inland plateau;
- Variety of former river terraces along the valley sides gives a variety of relief in the eastern area of the valley floor;
- Tributaries drain into the river from the surrounding upland areas as well as from various straightened drainage channels from surrounding flatter land;
- Variety of small to medium sized fields of pasture with areas of meadow running alongside the river;
- Riparian woodland, Curragh, scrub and ground cover found on the river banks;
- Fragmented deciduous woodland blocks and mature trees found in the various hedgerows give rise to a wooded enclosed feel in the valley bottom; and
- Settlement along the valley floor consisting of single dwellings (white houses) strung out along the valley road with some smaller nucleated settlements at road junctions such as Crosby and Greeba.'

Incised Slopes

8.201 The Incised Slopes LCT covers much of the island below the uplands and to the coast. The key characteristics, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- 'A network of deeply incised steep sided/gently sloping wooded glens (some of them National Glens containing exotic Victorian planting and pleasure gardens) cut across the area as rivers valleys run out to the sea, creating narrow linear landscape elements;

- Predominantly open pastoral land with arable fields;
- Relatively varied field pattern of a variety of shapes and sizes;
- Field boundaries are predominantly Manx hedges, planted with shrubs on top with numerous mature trees and some stone walls in places;
- Occasional blocky, angular coniferous plantations;
- A variety of settlements, lone standing farmsteads with outhouses and individual dwellings linked by a network of small/winding/enclosed/open roads and single track lanes;
- Distant views to coast and sea from several locations; and
- Various historic and archaeological sites include Keeills, standing stones, burial chambers, cairns.'

Rugged Coast

8.202 The Rugged Coast LCT is the predominant coastal type within the study area lying mostly on the south-east side of the island. The key characteristics, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- 'Rugged indented and varied coastline;
- Sequences of rocky cliffs and stacks with extensive rocky wild headlands with some wave cut platforms to gently graded sandy bays of varied enclosure and scale;
- Variation in scale of bays, from large beaches to small concealed/intimate coves;
- Steeply/gently sloping pastoral and arable land with a strong visual connection down to the sea shore with signs of the influence of the sea including smell of seaweed and windswept vegetation within the area;
- Numerous deep, steep-sided wooded glens form small coves/beaches (Port Grenaugh, Port Soderick, Port Cornaa, Port Mooar, Glen Wyllin) where rivers flow into the sea;
- Coastal settlements vary in size and character with a variety of historic elements such as Castle defences and ports often located in the sheltered coves and bays along the coast where there is a gently graded and accessible shore;
- Numerous historic and heritage sites, including, burial chambers, tumuli and promontory forts are situated at high points overlooking the sea;
- A combination of open views down cliffs to the shoreline and open and expansive views to sea;
- Varied rocky and sandy foreshore; and
- A relatively strong sense of tranquillity within several of the bays and small coves.'

Undulating Lowland Plain

8.203 The Undulating Lowland Plain LCT lies mostly in the northern extents of the island with some small areas to the south. The key characteristics, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- ‘Low-lying gently undulating predominantly arable farmland with patches of pasture, rough grassland and wet meadow;
- Medium sized predominantly rectangular field pattern;
- Network of narrow hedgerow lined lanes with occasional mature deciduous trees within hedgerows and patches of fragmented woodland;
- Open and glimpsed views to the sea from higher areas;
- Relatively dispersed settlement pattern, consisting of small (historic/vernacular), often nucleated settlements and individual farmsteads/crofts and dwellings;
- Numerous small rivers straightened and canalised drainage channels flow along field boundaries to drain the landscape;
- Areas of standing water surrounded by wetland vegetation and Curragh woodland;
- Views to an upland backdrop;
- Marl pits filled with water in the north; and
- Use of Limestone as a building material in areas surrounding Castletown.’

Smooth Coastal Strip

8.204 The Smooth Coastal Strip LCT lies around the northern end of the island, with one defined area within the study area. The key characteristics of the type, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- ‘Yellowy conglomerate post-glacial deposits form loose sheer cliffs, some 10-20 meters high along the southern stretches of this coastline;
- Stretches of gently graded sand and shingle beaches;
- Sand dunes with rough grasses, scrubs, occasional areas of lichen and areas of heath developing on the back dunes;
- Cliffs form and abrupt boundary between the sand and shingle and the arable fields of the Undulating Inland Plain;
- Open, expansive panoramic views to sea and along the coast line;
- Strong sense of remoteness and tranquillity; and
- Sweeping, unbroken, smooth coastline with shingle spur forming at the point of Ayre.’

Coastal Cliffs

8.205 Coastal Cliffs LCT lies at the south of the island and within the study area. The key characteristics, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- 'High, steep sided dramatic rocky cliffs descend to the sea directly from surrounding Uplands, some with steep grassy slopes to rear;
- Small enclosed rocky coves with occasional sandy beaches;
- Sea stacks, rocky foreshores and wave cut platforms exposed at low tide;
- Cliff top paths along gently shelving grassy slopes with dramatic panoramic coastal views;
- Bird colonies nesting on the cliffs;
- Numerous archaeological sites in prominent cliff top locations as well as abandoned mine workings; and
- Moorland vegetation on exposed, open and gently rounded hill tops with gently shelving grassed slopes running down to the cliff top.'

Islands

8.206 The Calf of Man is the main small island which lies off the south west of the mainland and within the study area. The key characteristics of the Calf of Man and other smaller islands, according to the Landscape Character Assessment (Chris Blandford Associates 2008), are defined below:

- 'A number of small rugged islands lie in close proximity the coastline;
- Steep rocky and dramatic cliffs;
- Rounded, sometimes steeply sloping land with much undulation;
- Low heathland vegetation with maritime grasses and flowers such as sea thrift;
- Large area of rock pools in the intertidal zone exposed during low tide with its own habitats;
- Bird colonies nesting on cliffs; and
- Often provide important sites for wildlife and contain key heritage sites.'

Isle of Man seascape units

8.207 There are no defined seascape units for the Isle of Man, but by applying best practice guidance (CCW 2001) following desk based study and site visits six regional seascape character units (RSU) were defined in the ZAP Report. These are described below, however, as with the other areas/units described above some of the RSUs may be able to be scoped out of the environmental statement following calculation of zones of theoretical visibility (ZTV) carried out as part of the EIA process.

Maughold Head to Clay Head

- A combination of semi-enclosed bays and rugged cliffs rising steeply from the expansive open sea to the east. Cliffs are green and vegetated in places, in particular around Laxey Bay;
- Rocky shore and coastline leading to shallow beaches, though jagged rocky outcrops protruding into the sea can be inaccessible, most notably around Maughold Head;
- Main coastal settlement at Laxey where houses climb the steep valley slopes of the River Laxey and nestle around the bay and along the wide promenade and

seafront road. Elsewhere settlement is generally limited to isolated dwellings set back from the coastal edge; and

- Extensive panoramic open views possible from the rugged coastal edge, with more localised views within the bays contained by headlands.

Clay Head to Douglas Head

- A rocky indented coastline with rocky foreshores including banded bedrock and scattered large offshore rocks to the north of the seascape unit. Further south, around Douglas, the coastline is dominated by built form, although rocky headlands with jagged sea cliffs occur around Onchan Head and Douglas Head;
- Beaches are confined to the south of the unit where a gently graded sandy beach is evident at Douglas;
- Main coastal settlements of Douglas and Onchan dominate the southern extent of the unit, the latter extending along the cliff top reaching as far as the cliff edge path. Douglas includes a Victorian esplanade and promenade, as well as piers and breakwaters associated with the harbour; and
- Open panoramic views out to sea, the natural environment contrasting strongly with the urban form of settlements. Further north, a greater sense of remoteness prevails on the open and exposed headlands.

Douglas Head to Santon Head

- A rocky indented coastline with high jagged rocky cliffs above which sits heathland vegetation and an irregular pastoral landscape;
- Small coves occur along the coast, with a rocky foreshore and a number of offshore rocky outcrops. A graded shale beach is located at Port Soderick;
- Marine Drive, a Victorian pleasure drive located along the cliff edge affords wide, open panoramic views along the coastline and seascape; and
- Settlement extremely limited and located away from the cliff edge.

Santon Head to Langness

- Low rocky jagged sea cliffs with the eastern edge of Langness peninsula indented with a series of rugged small gullets;
- Shelving shale beaches around sheltered coves such as Port Grenaugh and Port Soldrick with shallow sandy beaches to the north eastern edge of the peninsula. Intertidal rock pools found on rocky platforms in the littoral zone north east of Langness;
- Settlement limited with only isolated dwellings generally set back from the coast edge, although whitewashed buildings are evident around Derbyhaven. The proximity of Ronaldsway Airport and associated infrastructure disturb the sense of tranquillity within the seascape unit; and
- Open, expansive panoramic views across the sea and coast, with Langness and St. Michael's Island facilitating dramatic views north eastwards along the coastline. A strong sense of tranquillity, in particular in the northern section of the unit.

Langness to Kallow Point

- A series of bays and headlands that includes a wide sandy bay at Castletown scattered with weed-covered rocks and expanses of large, jagged boulders and Bay ny Carrickey containing a shelving stony beach with a series of wave cut platforms that extend into the sea;
- Topographically a relatively flat area adjacent to the coast becoming more undulating further inland;
- Coastal settlements of Port St Mary and Castletown located along the A5 with occasional dwellings scattered along more minor roads;
- Despite the indented coastline a strong sense of openness prevails across the bays with views to distinctive headlands and peninsulas creating a sense of place; and
- The settled character of the coast generally disturbs the tranquillity of the area.

Spanish Head and Calf of Man

- A series of small scale rugged bays and cliffs with rocky outcrops extending into the sea on the mainland, with the Calf of Man Island rising dramatically from the sea providing a series of rugged cliff faces;
- Settlement extremely limited in coastal areas and Calf of Man only accessible at certain times of the year;
- Strong sense of isolation, openness and tranquillity within the unit with a general lack of detracting elements; and
- Wide, open panoramic views, in particular from the Calf of Man and across Port St Mary Bay.

Potential impacts

8.208 The following potential impacts on seascape, landscape and visual amenity may arise from the construction, operation or decommissioning of RWF. These effects will be considered in the ES unless specifically scoped out below (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction/decommissioning	
Construction vessels	The presence of construction vessels, cranes, cable installation vessels and associated smaller vessels is not expected to impact seascape, landscape and visual amenity as it a temporary effect.
Potential impacts during operation	
Effects on Welsh Landscape Character Areas and Regional Seascape Units	Although the ZAP Report identified a number of potential impacts ranging from minor to major-moderate, it was concluded that overall the potential operational impacts of the ISZ were not likely to be significant for visual effects on the grounds of the long distance over which the wind farm projects will be viewed. Therefore, collectively the development of the ISZ is expected to only have a localised impact on seascape at a national level.

	Further identification and assessment of the potential impacts will however take place through the EIA process.
Effects on Manx Landscape Character Types, Landscape Character Areas and Regional Seascape Units	As discussed above the ZAP Report considered the Landscape Character Types and defined regional seascape units and identified a number of potential impacts ranging from moderate to minor. Further identification and assessment of potential impacts will take place through the EIA process. The ES will also consider effects on the Manx Landscape Character Areas.
Effects on designated areas e.g. National Park, AONB, Heritage coast and local designations	The ZAP Report identified potential for effects on designated landscape areas, ranging from negligible to moderate depending on their proximity to the ISZ. As discussed above these areas may include the Snowdonia National Park, the Lake District National Park, Anglesey AONB and North Anglesey Heritage Coast, the Clwydian Range AONB and the Great Orme Heritage Coast; effects on such areas will be further assessed going forwards through the EIA.
Views from coastal settlements	The ZAP Report concluded that residents that live within the coastal edges of Anglesey and Isle of Man are most likely to have views of RWF and so will be one of the key receptor groups to be assessed through EIA. As the Site is located in the South East of the ISZ, it is expected that Anglesey will be the focus for the assessment of coastal settlements.
Recreational walkers/ tourists	People in this receptor group include users of footways and cycle ways and visitors to coastal facilities and beaches whose principal preoccupation is with the enjoyment of the outdoor environment, open countryside and the tourism/amenity resource the coastline offers. This will include the coastal resorts along the North Wales Coast, North Wales Coastal Path and coastal paths along the Isle of Man.
Effects on other receptor groups	A number of other receptor groups potentially affected by development of the ISZ were identified by the ZAP Report and will be further assessed as part of RWF's EIA. These include: • Effects on views from commercial shipping, ferries and cruise ships; • Effects on view for recreational sailors and other leisure users of the marine environment such as recreational fishermen; • Effects on views of travelling public along roads and railways; and • Effects on views of agricultural workers and those associated with tourism, as well as those working in industries which are related to the sea such as fishermen.

Effects on cultural heritage	As discussed in Section 8.6 (archaeology and cultural heritage) the visual effects of the Site on historical and cultural heritage will be considered as part of the cultural heritage chapter of the ES. Cross-referencing will be provided between that chapter and the assessment of seascape and landscape impact. This will include consideration of the setting of listed buildings, scheduled monuments, registered parks and gardens and historically important landscapes.
Potential cumulative impacts	

The RWF Site is further offshore than existing projects and while cumulative impacts may arise, many effects are only likely to be significant for receptors in discrete locations.

The potential cumulative visual impacts could include the following types:

- Simultaneous (or combined) visibility – where two or more offshore wind farm sites are visible from a fixed viewpoint in the same arc of view, for example Gwynt y Môr and RWF;
- Successive visibility – where two or more offshore wind farm sites are visible from a fixed viewpoint, but the observer is required to turn to see the different sites; and
- Sequential visibility – where two or more sites are not visible at one location, but could move into sight as an observer moves, for example while driving along a road or walking a coastal path.

A cumulative study area of a 60km radius around the ISZ was established for the ZAP Report, following best practice guidance (SNH 2005). This area includes the vast majority of the other existing, consented and in-planning offshore wind farms within the Irish Sea listed in Chapter 5.

The offshore wind farms in UK waters lie in two main areas – off the eastern North Wales coast; and to the west of the south Cumbrian coast. Intervisibility between these two offshore wind farm areas is very limited due to the long distances between them.

Interactions are likely to occur with other activities as well as offshore wind. This includes onshore wind projects, described below and the oil and gas platforms listed in Chapters 5 (EIA methodology) and 8.30 (other marine users).

Onshore, the ZAP Report identified eleven wind farms. However, only four, located on the Isle of Anglesey (Trysglwyn, Rhyd-y-Groes, Llyn Alaw and Ysgellog Farm), are likely to significantly visually interact with RWF.

The seascape baseline and its associated sensitivity has the potential to evolve with future development possibilities in the Irish Sea such as offshore wind farms, tidal power and oil/gas projects. The ES will, as discussed in Chapter 5, take account of those structures consented or in planning but not yet constructed.

Scoping Opinion from the Planning Inspectorate

8.209 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6 July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to landscape and seascape:

- The Secretary of State considered that the development of a wind farm in this location will create a visual impact, particularly for commercial/recreational users, including ferry passengers and sail boats as well as commercial shipping lanes. The assessment will need to take these into account along with any cumulative impacts on these users;
- The assessment will also need to factor in those elements of the proposal which may be viewed from the shore; and
- The Secretary of State considered that a full assessment of the potential cumulative visual impacts with existing offshore wind farms and also assess the general visual impact of the turbines should be undertaken.

Approach to address Scoping Opinion

8.210 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA Survey and Study Programme

8.211 The EIA for RWF will build on the data collected as part of the ZAP process and update the data described above as necessary. In particular it is currently proposed that, following consultation with CCW, NE and Isle of Man DEFA on technical scopes, the following work will be carried out:

- Identification of EIA study area, including identification of key stakeholders;
- Production of baseline figures and production of Zone(s) of Theoretical Visibility;
- Landscape character data review and descriptions;
- Seascape character data review, including definition of units if not already available;
- Visual receptor research and identification;
- Cumulative baseline review;
- Identification of viewpoints, for agreement with relevant stakeholders with reference to ZAP consultation;
- Production of wireframes and photomontages for each of the agreed viewpoints; and
- Liaison between archaeological and landscape consultants to consider potential visual effects on cultural heritage.

8.212 As discussed above archaeological consultants will be responsible for undertaking the assessment of the visual impact that offshore development may have on onshore historic receptors. However, considerable landscape expertise will be required to inform this work.

8.213 In addition it is anticipated that a workshop with key stakeholders will be undertaken to discuss and agree appropriate viewpoints on which the assessment will be based on.

8.214 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, data and information derived through consultation;
- Analysis and interpretation of the data collected;
- A review and summary of consultation activities including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF, including potential cumulative impacts;
- A review and summary of cultural heritage issues with cross-referencing to the relevant chapters of the ES;
- Proposals for mitigation measures, if any are available and required; and
- Reference and adhere to relevant legislation and development plans – including (but not limited to):
    - Section 85 of the Countryside Rights of Way Act (CROW) Act 2000;
    - National Parks and Access to the Countryside Act 1949; and
    - AONB Management Plans.

8-5 Human environment – other users of the sea

Introduction

8.215 This section considers other users of the Irish Sea not considered elsewhere in this report which could potentially be affected by the development of the Site. Such users include:

- Marine aggregate extraction and dredge disposal sites;
- Ministry of Defence;
- Coastal defences;
- Subsea Cables;
- Telecommunications and broadcasting;
- Existing and planned oil and gas developments;
- Gas storage and transportation; and
- Other offshore wind projects.

8.216 Future users of the study area have also been considered. These include:

- Potential carbon capture and storage (CCS) operators;
- Developers of proposed offshore wind farms;
- Proposals for future onshore development which may have an offshore component or impact; and

- Developers of proposed marine energy (wave and tidal power) projects.

Surveys and studies carried out to date

8.217 The interests of other users of the marine environment in the Irish Sea were considered as part of the ZAP process (Celtic Array 2012).

8.218 In addition, the following data sources have been used to inform this section:

- Aggregate extraction information from The Crown Estate (2010);
- British Marine Aggregates British Marine Aggregate Producers Association, active zone dredging charts (2011);
- Kingfisher Awareness Charts (2012);
- Seazone hydrospatial GIS data (2012); and
- Offshore SEA 2 (DECC 2011).

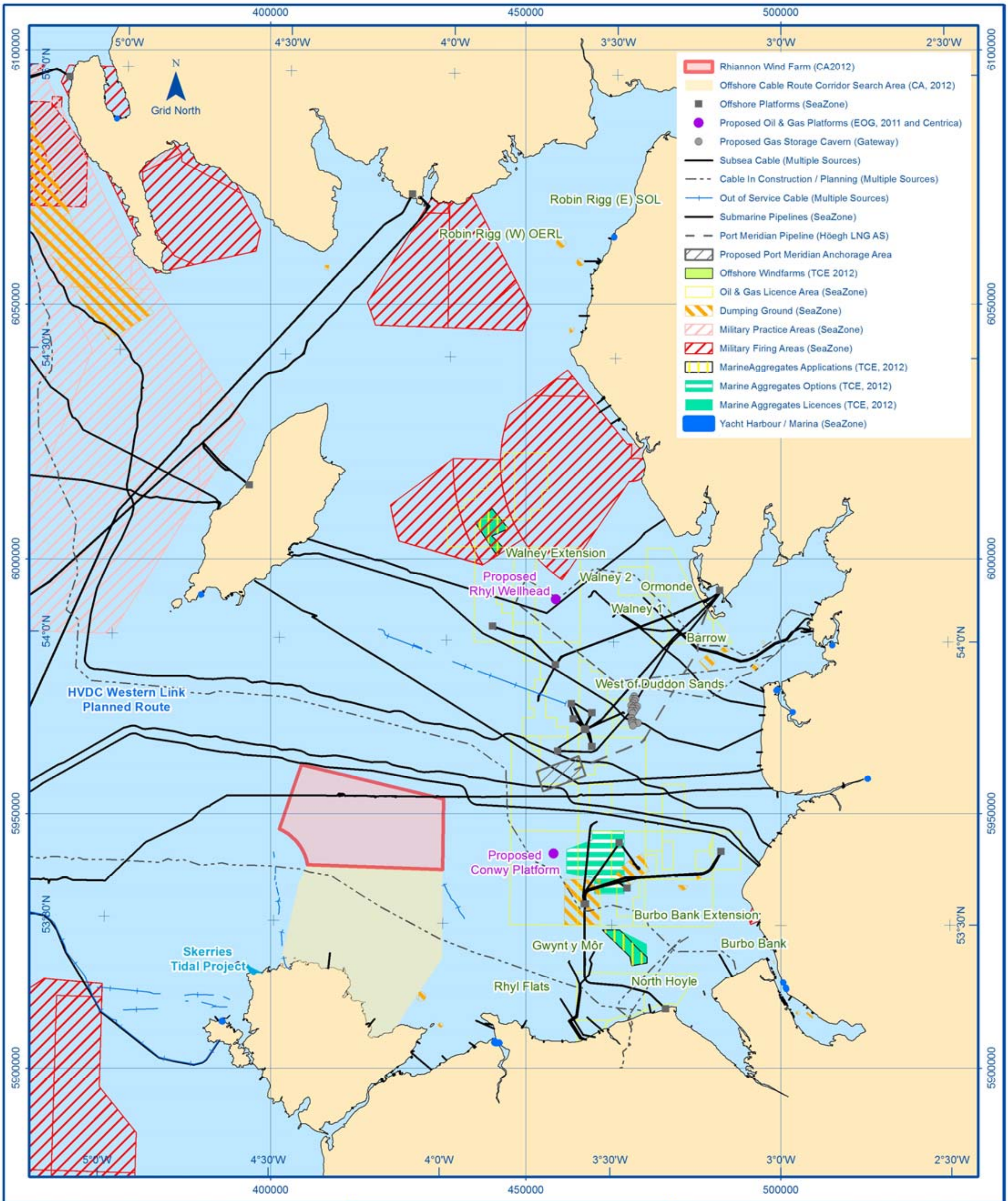
8.219 A wide range of stakeholders were identified and have been consulted as part of the ZAP process and through numerous subsequent informal consultation meetings since 2010. This has included meeting with the following parties:

- MOD, DIO;
- National Grid/Scottish Power Electricity Transmission;
- Cable owning/operating companies; and
- Oil and gas owners and operators.

8.220 Operators of offshore wind farms have been consulted, either through direct meetings or through industry forums organised by RenewableUK or The Crown Estate. Other relevant marine users not specifically consulted with as part of the ZAP process will be identified and included as part of the RWF consultation as necessary.

Description of the current environment

8.221 Figure 8.35 shows the other users of the Irish Sea discussed in this section.



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GB Outline © ESRI 2000.
Not to be used for navigation.
Cables Data from KISCA, 2011; MMT, 2010; SeaZone, 2012; EirGrid, 2010;

0 10 20 30 40 Kilometers
0 5 10 15 20 Nautical Miles

ISSUE	DATE	DRN	CHK	APR	ISSUE NOTE
04	11/10/12	JD	SM	EF	Project title changed
03	31/08/12	JD	JF	EF	Cable information updated
02	24/08/12	JD	JF	EF	Updated for PEI
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ROUND 3: IRISH SEA ZONE

RHIANNON WIND FARM

OTHER USERS OF THE MARINE ENVIRONMENT

CELTIC ARRAY DOC NO: SE-D-EV-013-0071-000000-060

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Figure 8.35

Marine aggregate extraction and dredge disposal sites

8.222 There are currently four active licensed areas for aggregate dredging in the Irish Sea (northwest region) (The Crown Estate 2010). In addition, there are two dredging areas in the Mersey Estuary for shipping channel clearance. These are:

- Licence Area 331 – this area is 49km north east of the Site and is operated by Tarmac Marine Dredging Ltd. It is mostly dredged for coarse sand;
- Licence Area 457 – this area is 24km east of the Site and is operated to Westminster Gravels Ltd. The permission is for the dredging coarse sand over a 15 year period;
- Licence Area 392 – located 33km south east of the Site, this site is operated by Tarmac Marine Dredging Ltd;
- Licence Area 393 – this site is located 33km south east of the Site and is operated by Norwest Sand and Ballast Co; and
- Licence Areas A and B – 65km south east of the Site in the outer Mersey estuary. Extraction in Liverpool Bay has been carried out since the 1960's. Mersey Docks and Harbour Company (MDHC) undertake annual dredging of the Mersey to ensure the channel remains deep enough for shipping.

8.223 In 2010, a total area of 119.08km^2 was licensed for dredging in the North West and 0.31 million tonnes of material were extracted (The Crown Estate 2010, BMAPA 2011).

8.224 There are several dredge disposal sites in the Irish Sea. The nearest sites to the Site are:

- Conwy Bay (IS055) (25km south of the Site);
- Holyhead Deep (IS040) (32km south of the Site);
- Site Y (IS150) (24km east of the Site); and
- Barrow D (IS205) (58km north east of the Site).

Ministry of Defence

8.225 There are three operational areas which are in the vicinity of the proposed development. Military aviation and radar interests are considered in Section 8.3.

8.226 Altcar Rifle Range (PEXA X5306, not classified as 'Danger Area') is located on Formby beach, on the English coast near the Mersey Estuary. The Altcar Rifle Range covers 250 hectares (620 acre) of beaches, sand dunes, marshland, fields and small woods.

8.227 The Barrow Restricted Area surrounds the 169 acre shipyard at Barrow which is operated by BAE Systems Submarine Solutions for the production and testing of submarines.

8.228 The extensive Eskmeals MOD Danger Practice and Exercise Area 406 (Eskmeals D406/D406B/D406C PEXA), operated by Qinetiq, is located in Cumbria. Fourteen firing locations enable equipment proving over land for short ranges up to 1km and over sea for long ranges up to 49km. This DPEXA, given its classification as 'Danger', is usually considered as excluding offshore wind farm development.

8.229 Unexploded munitions will be associated with Eskmeals and may be associated with historical testing activity in Isle of Man waters. A detailed Unexploded Ordinance (UXO) survey will be conducted for RWF although such issues are likely to be primarily engineering and health and safety concerns rather than requiring consideration as part of the EIA process.

Coastal defences

8.230 Because of the hard rock and elevation of much of the North Wales coastline, the requirement for coastal defences is greatly reduced compared with lowland areas. Sea defences in the region are built mainly in low lying estuaries and inlets or where natural coastal habitats such as sand dunes have been lost either directly under the footprint of development or indirectly through erosion as a result of a reduced supply of sediment. Coastal defences around the north western coastline of England consist of a number of raised earth embankments, hard defences and erosion protection structures such as groynes. Natural sea defences such as salt marsh and sand dune habitats are particularly widespread here.

8.231 Shoreline Management Plans (SMPs) which cover the relevant areas of coastline include the following:

- St Annes Head to Great Orme's Head SMP2 area. This new SMP will cover the coastal regions of Pembrokeshire, Ceredigion, Powys, Gwynedd, Conwy and Ynys Mon; and
- Great Orme's Head to Scotland. This new SMP covers defence policies between Great Orme's Head in North Wales and the Scottish Border.

8.232 These SMPs provide further information on the baseline environment in respect to coastal defences.

Subsea Cables

8.233 Only one operational telecommunications cable (SIRIUS South) crosses the Site. An interconnector cable is planned which passes to the south of the Site and will cross the proposed cable corridor. Another telecoms cable (ESAT 2) passes immediately north of the wind farm boundary. These cables are listed in Table 8.10 below.

Table 8.10 Irish Sea submarine cables

Name	Type	Maintenance Authority	Between	Status
Installed				
SIRIUS South	Telecoms	Virgin Media (formally NTL)	Blackpool (UK) – Dublin	Installed
ESAT 2	Telecoms	ESAT	Lytham (UK) - Dublin	Installed
Planned				
EirGrid East West Interconnector	Electricity and Telecoms	EirGrid	Between Rush North Beach, Co. Dublin in Ireland and Barkby Beach, North Wales	Under construction. Completion due in 2012.

8.234 There are also a number of out of service telecommunications cables in the area.

8.235 As with the existing cable routes across the Irish Sea, engagement with cable owners at the project level will aim to ensure coexistence of offshore wind and these routes. This will include consideration of the interface of maintenance crews from both sectors.

Telecommunications and broadcasting

8.236 The RWF Site is 19km from the shore at its closest point and potential interference with telecommunications systems is likely to be minimal.

8.237 In discussions with oil and gas platform operators fixed link communications have not been raised as a concern. At no point is RWF located between an oil and gas installation and its nearest point to shore.

Oil and gas activity

8.238 Oil and gas activity is situated at some distance from the Site with most activity occurring within the Morecambe Bay area and Liverpool Bay areas.

8.239 There are a number of gas fields in the area which, along with relevant infrastructure, are listed in Table 8.11 and 8.12 below.

Table 8.11 Oil and gas fields in the vicinity of the Site

Name of field	Oil/ gas	Owner	Operator	Platforms	Pipeline[8]	landed at
Douglas field	Oil & Gas	BHP Billington	BHP Billington	Douglas Complex – 3 platforms - wellhead, processing, accommodation	Oil - BHP pipeline to storage Gas -BHP pipeline to Point of Ayr	Oil to floating offshore storage installation Gas to Point of Ayr
Hamilton field	Oil	BHP Billington	BHP Billington	Hamilton (unmanned)	BHP pipeline to Douglas	Floating offshore storage installation
Hamilton North field	Gas	BHP Billington	BHP Billington	Hamilton North (unmanned)	BHP pipeline to Douglas	Point of Ayr
Lennox field	Gas	BHP Billington	BHP Billington	Lennox (unmanned)	BHP pipeline to Douglas	Point of Ayr
North Morecambe	Gas	HRL	HRL	North Morecombe (usually unmanned)	HRL pipeline	North Morecambe terminal

[8] See Table 8.12 below

Name of field	Oil/ gas	Owner	Operator	Platforms	Pipeline[8]	landed at
South Morecambe	Gas	HRL	HRL	South Morecambe Central Processing Complex of three platforms and four unmanned wellhead platforms	HRL pipeline	South Morecambe terminal
Bains	Gas	HRL	HRL	-	Tie-back to South Morecambe	South Morecambe terminal
Millom field	Gas	ConocoPhilips (100%) (COP)	HRL	Millom West (unmanned)	COP pipeline to North Morecambe	North Morecambe terminal
Dalton field	Gas	ConocoPhilips (100%)	HRL	-	COP pipeline to North Morecambe	North Morecambe terminal
Calder field	Gas	ConocoPhilips (100%)	HRL	Unmanned platform	COP pipeline to Rivers terminal	Rivers terminal
Darwen	Gas	ConocoPhilips (100%)	Not currently operational	The planned projects would tie-back to Calder and then gas to Rivers terminal		
Crossens	Gas	ConocoPhilips (100%)	Not currently operational			
Asland	Gas	ConocoPhilips (100%)	Not currently operational			

8.240 A floating oil receiving station was built by Shell just off Amlwch in 1972. Oil from the station was pumped to a shore station at Amlwch port. The pipeline and an exclusion zone for anchoring and fishing are still shown on Admiralty charts.

Planned oil and gas developments

8.241 Celtic Array is currently aware of two planned oil or gas projects in the vicinity of the Site.

8.242 The Rhyl field development (Centrica 2011) is being developed by Hydrocarbon Resources Limited and will consist of a single production subsea well connecting to a manifold in Block 113/27b, which is located 44km North East of the Site. Gas will be exported to North Morecambe Drilling and Production Platform (DPPA), described above. The ES was submitted to DECC in January 2011, with work expected to commence and complete in the first half of 2012.

8.243 EOG Resources[9] is due to start installation in 2012 of a ‘normally unattended installation’ and three subsea wells to extract oil from the Conwy and Corfe fields. Oil will be exported back to the Douglas complex to the south east. The Installation is located approximately 22km to the east of the Site.

Oil and gas licensing

8.244 Oil and gas exploration and extraction activity is regulated by the UK Government through a system of licences for areas of seabed which are divided into blocks (or sub-blocks). The Irish Sea region contains six oil and gas licensing blocks. These are numbered 108 to 113.

8.245 Of the six blocks, only three contain sub-blocks which are currently licensed. None of these licences are within the Site. Two licensed sub-blocks are located north of the Site in block 112, seven licensed sub-blocks are north east of the Site in block 113 and there are 27 licensed sub-blocks in block 110 to the east of the Site. All these licences are active, but there are no known plans for development.

8.246 Blocks are awarded in licensing rounds with the 26th Seaward Licensing Round having closed in April 2010 and the 27th round being launched on 1 February 2012. All the blocks within the Site are on offer in the licensing round, which closed on 1 May 2012. The results of the 27th round of licensing have not yet been published.

8.247 Figure 8.36 below shows currently licensed areas, sub-blocks for which licences may be granted under the 26th Round and the areas under offer in the 27th licensing round.

[9] This information was provided by EOG Resources at a consultation meeting on the 10th May 2011

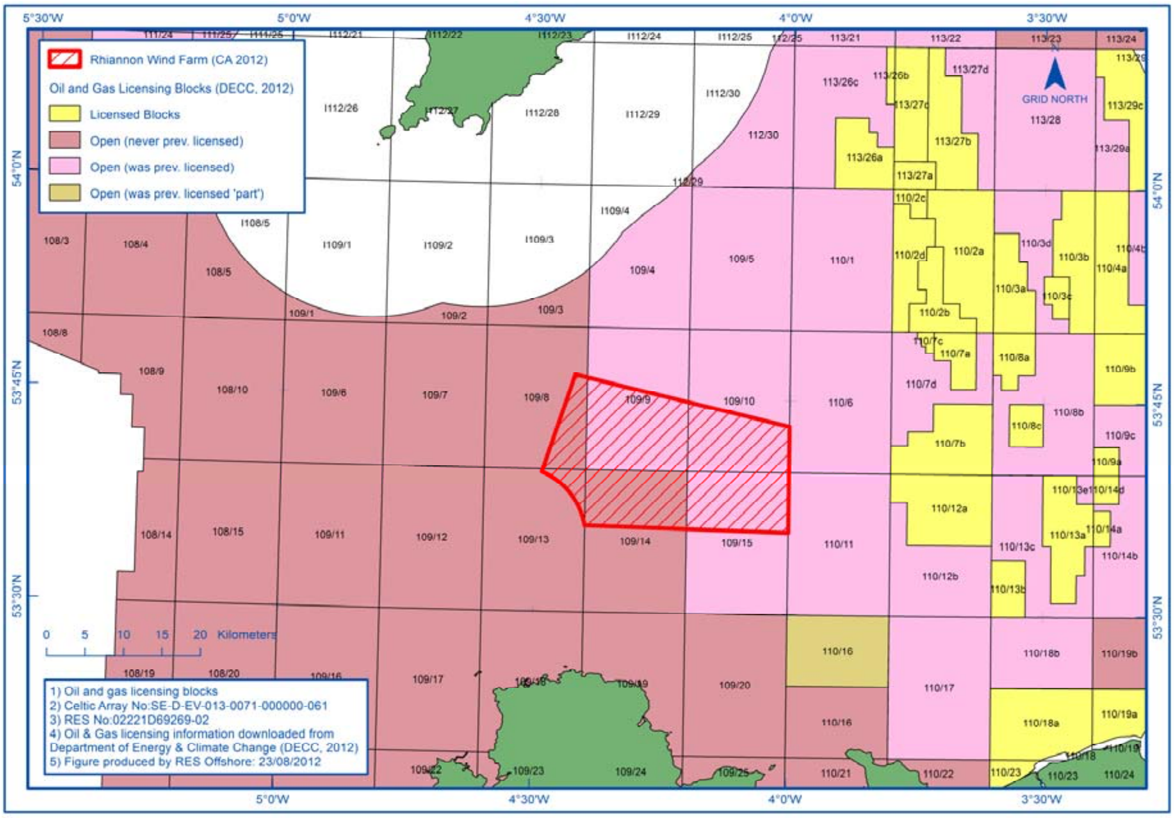

Figure 8.36 Oil and gas licensing blocks

8.248 Further details on licensed areas are provided in Table 8.13 (www.og.decc.gov.uk, accurate to December 2011) below:

Table 8.12 Oil and gas licence areas

Block	Sub-block	License ref. number	Name of Operator
110	2a	153	Hydrocarbon Resources Ltd
110	2b	706	Burlington Resources (Irish Sea) Ltd
110	2c	706	Burlington Resources (Irish Sea) Ltd
110	2d	1568	Serica Energy (UK) Ltd
110	3a	251	Hydrocarbon Resources Ltd
110	3b	1547	Venture North Sea Gas Ltd
110	3c	543	Hydrocarbon Resources Ltd
110	4	1548	Venture North Sea Gas Ltd
110	7a	99	Burlington Resources (Irish Sea) Ltd
110	7b	1476	EOG Resources United Kingdom Ltd

Block	Sub-block	License ref. number	Name of Operator
110	7c	865	Burlington Resources (Irish Sea) Ltd
110	8a	251	Hydrocarbon Resources Ltd
110	8c	251	Burlington Resources (Irish Sea) Ltd
110	9a	261	Burlington Resources (Irish Sea) Ltd
110	9b	1548	Venture North Sea Gas Ltd
110	12	1476	EOG Resources United Kingdom Ltd
110	13a	710	BHP Billiton Petroleum Ltd
110	13b	710	BHP Billiton Petroleum Ltd
110	14a	99	BHP Billiton Petroleum Ltd
110	14c Lennox Field Extension	99	BHP Billiton Petroleum Ltd
110	14c Rest of Block	99	Challenger Minerals (North Sea) Ltd
110	14d Crosby Area	99	Challenger Minerals (North Sea) Ltd
110	14d Rest of Block	99	Burlington Resources (Irish Sea) Ltd
110	15a	791	BHP Billiton Petroleum Ltd
110	18a	1481	Nexen Exploration U.K. Ltd
110	19a	1481	Nexen Exploration U.K. Ltd
110	23	1481	Nexen Exploration U.K. Ltd
112	13	1739	No operator, but licensed by Iona Energy Company (UK) Ltd
112	14	1739	No operator, but licensed by Iona Energy Company (UK) Ltd
113	26a	287	Burlington Resources (Irish Sea) Ltd
113	26b	1482	Serica Energy (UK) Ltd
113	27a	547	Burlington Resources (Irish Sea) Ltd
113	27b	1483	Hydrocarbon Resources Ltd
113	27c	1482	Serica Energy (UK) Ltd
113	29c	1475	Nautical Petroleum PLC
113	30	1475	Nautical Petroleum PLC

Gas storage and transportation

8.249 Two projects in the vicinity of the Site are related to the storage and transportation of gas. These activities relate to processed gas and are distinct from the exploration and extraction activities described above.

8.250 Port Meridian Ltd (Port Meridian 2011) intends to operate a deep water Liquefied Natural Gas (LNG) port facility, approximately 20km east of the Site. The LNG facility will consist of a buoyed loading system for tankers and a permanently moored regasification vessel. A pipeline from the vessel will make landfall at Walney Island. Consent for the offshore elements of the LNG facility were granted in 2009 (with an amended application consented in 2010) along with a separate planning permission for the onshore elements of the facility.

8.251 The Gateway Gas Storage project is located 37km east of the Site (Gateway Storage 2011) and will be operated by Stag Energy. The facility is designed to store gas in salt caverns beneath the seabed with gas being injected and removed via a pipeline to onshore facilities. Up to 20 monopile platform structures will be associated with the gas storage project.

8.252 Consent was granted in 2009 for the offshore elements of the gas storage project in the form of a licence under the Food and Environment Protection Act 1985 (FEPA), although in due course a further licence will be required for the storage of the gas itself. Planning permission for associated onshore works has also been granted.

Carbon capture and storage

8.253 Carbon capture and storage (CCS) is a process to capture and to store the carbon dioxide (CO_2) gas emitted by fossil fuel power plants or other carbon intensive activity, such as steel manufacturing. At present the technology remains at a prototype stage, but most approaches would utilise oil and gas technology to transport CO2 via a pipeline to a suitable area of the seabed, where it can be stored underground, possibly in exhausted hydrocarbon reserves.

8.254 There are no publically available plans for CCS projects in the Irish Sea at present. However, there are suitable conditions for CCS development to take place in the vicinity of the Site in the future.

Offshore wind farms in the Irish Sea

8.255 The Irish Sea is considered to have excellent potential for wind farm development with a number of existing and proposed projects located in the vicinity of the ISZ. However, the potential for RWF to have an impact upon these wind farms is limited, with the only likely impacts relating to the routeing of export cables and the potential requirement for crossing agreements or limitations on spacing within the restricted corridors available to reach landfall locations in the vicinity of the grid connection.

8.256 Potential cumulative impacts of RWF together with other wind farm developments will vary according to receptor type and these are therefore considered within each of the relevant chapters of this report.

8.257 Table 8.14 provides further details on the wind farm projects shown in Figure 8.35.

8.258 The Crown Estate has not released any information relating to a subsequent leasing round for offshore wind in UK waters, except for the Northern Ireland leasing round which is described below.

Scottish territorial seas offshore wind projects

8.259 The Scottish Government completed a Strategic Environmental Assessment for offshore wind in March 2011, following the issue of ten exclusivity agreements with The Crown Estate in 2009. Of these ten potential sites, four were identified on the West Coast of Scotland. Of these potential sites, two are active and two are currently suspended.

8.260 The two active projects are called Islay Array and Argyll Array, both located more than 230km from the ISZ. At this distance, they are outside of the Irish Sea and therefore will not be considered as part of this Stage 1 PEI Report.

8.261 The two suspended projects are Wigtown Bay and Solway Firth. In March 2011 the Scottish Government published its Sectoral Marine plan for offshore wind. It stated that Scottish Ministers believed that because of the number of constraints acting upon these two projects they were unsuitable for development at this time. DONG Energy, which originally held an exclusivity agreement for the Wigtown Bay Project, has subsequently entered into an exclusivity agreement with The Crown Estate that allows them to undertake a high level consultation programme and feasibility study to potentially locate a project in the Solway Firth area. If this study, which commenced in December 2011, identifies a viable project, the resulting plans will need to be considered in future ISZ project assessments.

8.262 There is little potential for the development of the Site to affect these projects. Potential cumulative impacts (primarily in respect of birds) are considered in relevant technical chapters of this report.

Northern Ireland territorial waters offshore wind projects

8.263 A commercial leasing round for a single site of up to 600MW off the south east coast of County Down in Northern Ireland waters was launched by The Crown Estate in December 2011. This followed the strategic environmental assessment of an offshore renewable energy programme and the subsequent publication of regional locational guidance by Northern Ireland's Department of Enterprise, Trade and Investment (DETI). In October 2012 development rights for the site were awarded to First Flight Wind Ltd as this document was going to print.

8.264 As The Crown Estate's leasing round in Northern Ireland requires any project to connect to the Northern Irish grid there is little potential for conflict with development in the Site. Celtic Array will continue to monitor plans in Northern Irish waters as necessary. Potential cumulative impacts (primarily in respect of birds and potentially navigation) are considered in the relevant technical chapters of this report.

Isle of Man territorial waters offshore wind projects

8.265 The Isle of Man government has aspirations to develop renewable energy in Manx territorial waters as detailed in AEA (2010) and Aquaterra (2006). Such plans are subject to the completion of a Marine Plan (the Plan) which is currently in development. The aim of the Plan is to develop a stringent consenting regime which will give consent for all types of development within Manx territorial waters. In September 2012, the Isle of Man government released a Statement of Public Participation on the Plan (Isle of Man government 2012). This document outlines how and when interested groups and members of the public can have their say on the formulation of the Plan. Celtic Array is in communication with the relevant authorities and will ensure appropriate consideration of any potential projects is made as information becomes available.

Table 8.13 Offshore wind farm projects in the Irish Sea

Name	Location	Distance from Site (km)	Project Capacity (MW)	Status	Developer
Barrow	UK waters	55	90	Operational	Centrica / DONG Energy
Burbo Bank	UK waters	53	90	Operational	DONG Energy
North Hoyle	UK waters	39	60	Operational	RWE Npower renewables
Rhyl Flats	UK waters	31	90	Operational	RWE Npower renewables
Robin Rigg	UK waters	116	180	Operational	E.ON UK Renewables
Walney I	UK waters	46	183.6	Operational	DONG Energy and SSE Renewables
Arklow Bank	Republic of Ireland	>100	25.2	Operational	GE Energy
Gwynt y Môr	UK waters	26	576	Under Construction	RWE Npower renewables, Stadtwerke Munchen and Siemens
Ormonde	UK waters	55	150	Under Construction	Vattenfall
Walney II	UK waters	44	183.6	Operational	DONG Energy, SSE Renewables and OPW
West of Duddon Sands	UK waters	42	500	Consented	Scottish Power / DONG Energy
Walney Extension	UK waters	42	750	In planning, consent application expected in 2013	DONG Energy
Burbo Bank extension	UK waters	43	234	In planning, consent application expected in 2013	DONG Energy
Codling Wind Park	Republic of Ireland	>100	up 1100	Consented, awaiting grid connection	Fred Olsen Renewables / Treasury Holdings

Name	Location	Distance from Site (km)	Project Capacity (MW)	Status	Developer
Oriel Windfarm	Republic of Ireland	106	330	Consent awaiting determination, grid connection agreed	Oriel Windfarm Ltd
Dublin Array	Republic of Ireland	>100	520	Consent awaiting determination, grid connection agreed	Saorgus Energy
Codling Wind Park Extension	Republic of Ireland	>100	Up to 1000	Application submitted	Fred Olsen Renewables / Treasury Holdings

Onshore projects with potential to interact with offshore elements of RWF

8.266 A new nuclear power station is being proposed at a site on Anglesey at Wylfa, next to the existing Magnox reactor, with an installed capacity of 3.3GW (Horizon 2012). The ownership of the new nuclear project is likely to change, but currently it is assumed that the project will continue on its existing timetable.

8.267 Recent information suggests that construction activity associated with Wylfa has the potential to interact with the development of RWF due to the number of vessels bringing material to a marine off-loading facility serving the Wylfa site that may be located at Porth Y Ogof (Horizon 2012).

8.268 Future increases in shipping activity are discussed in Section 8.2 above.

8.269 Additionally, the potential interaction on marine processes arising from the offshore elements of the Wylfa project is discussed in Chapter 6 above.

Wave and tidal power projects

8.270 A tidal stream energy project is proposed in Welsh territorial seas, less than 1km off the coast of Anglesey. An application for consent was made in 2011 and work is programmed to start in 2016, if consent is granted. The tidal stream project is owned by SeaGeneration (Wales) Ltd, a joint venture between Marine Current Turbines (MCT) Ltd and RWE Npower renewables to take forward up to nine of MCT's Seagen devices in an array with a total generation capacity of 10MW.

8.271 As a result of the distance between the tidal stream project and the Site, as well as its proximity to shore, it is unlikely to have a major interaction with RWF.

8.272 Parts of the Irish Sea have excellent potential for tidal and, to a lesser extent, wave generation projects. In December 2011, The Crown Estate launched a commercial leasing round for multiple tidal generation sites providing up to 200MW of capacity in the Rathlin Island and Torr Head Strategic Area in Northern Ireland. This follows the Strategic Environmental Assessment of an offshore renewables programme and the subsequent publication of regional locational guidance by Northern Ireland's

Department of Enterprise, Trade and Investment (DETI). Celtic Array will continue to monitor the progress of other plans and projects in the Irish Sea.

Potential impacts

8.273 Potential impacts in relation to 'other users' include the direct impact of wind farm activity on a user and in-combination effects of wind farm development in association with other user pressures and their associated impact on receptors.

8.274 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction	
Interference with oil and gas operations	No impacts are anticipated on current oil and gas activity other than in respect of potential impacts on shipping and aviation (Section 8.2). There is the potential for RWF's offshore export cable to interact with oil and gas projects, as discussed in Chapter 3. The export cable route corridor will be refined during the EIA process as more information becomes available. Licences for sub-blocks within the Site may be granted in the 27th Licensing Round and no decision has been made on applications yet. The nature of potential interactions in this respect is not known at this time.
Physical effects on wind farms and subsea cables from construction activities	Only two cables pass through the Site and cable route areas (the EirGrid East West Interconnector and the SIRIUS South). A buffer distance between the cable and turbines will be negotiated, as well as arrangements for the interfaces between maintenance crews and any cable to cable crossings.
Effects on disposal sites and dredging activities	No impacts are anticipated on current dredging and disposal activities other than those considered in Section 8.1 (navigation). Given the findings of the ZAP Report on physical processes (see Chapter 6), there is no pathway through which effects (other than those related to navigation) may occur.
Impacts on military exercise areas	Given the absence of overlap of PEXAs and the Site it is proposed that this issue be scoped out of the EIA. (Military considerations not related to exercise areas remain scoped in and aviation is considered separately in Section 8.3).

Potential impacts during operation	
Interference with oil and gas operations	No impacts are anticipated on current oil and gas activity other than in respect of potential impacts on helicopter operations (see Section 8.3) and on shipping (Section 8.2). There is the potential for RWF's offshore export cable to interact with oil and gas projects. As discussed in Chapter 3, as the cable route becomes better defined these interactions will be identified and addressed. Licences for sub-blocks within the Site may be granted in the 27th Licensing Round. The nature of potential interactions in this respect is not known at this time.
Disposal sites and dredging activities	No impacts are anticipated on dredging and disposal activities other than those considered in Section 8.1 (navigation). Given the findings of the ZAP Report on physical processes (see Chapter 6), there is no pathway through which effects other than those related to navigation may occur.
Effects on wind farms and subsea cables	Two cables pass in the vicinity of RWF (the EirGrid East West Interconnector and the SIRIUS South). A buffer distance between the cable and turbines will be negotiated, as well as arrangements for maintenance crew interfaces and cable to cable crossings.
Impacts on military exercise areas	The potential for offshore wind farm development to be affected by military operations is one of the factors that influenced site selection at a strategic level (Celtic Array 2012). Given the absence of overlap of PEXAs and the Site it is proposed that this issue be scoped out of the EIA. Potential impacts on military aviation are considered in Section 8.3 and other military issues remain a consideration.
Impacts on coastal defences	The potential for development within the Site to influence coastal defences through changes in regional coastal erosion patterns is considered in Chapter 6.
Proposed new Wylfa power station	Navigational activity associated with RWF (O&M vessels etc.) may interact with vessel traffic associated with the construction of the Wylfa power station. This is discussed further in Section 8.2.
Potential for disruption to telecomms signals	As RWF is located in the Irish Sea, it is unlikely to interfere with telecommunications systems. Consultation with Ofcom will be held to ensure all potential disruptions are considered.

Potential impacts during decommissioning
The effects on the activities described above during decommissioning are anticipated to be similar to those discussed in respect of the construction of the wind farm with an incremental reduction in navigational and other risks as individual turbines are removed from the Site and activity eventually ceases.
Potential cumulative impacts
There is unlikely to be a significant cumulative impact on any of the receptors described in this section other than in respect of navigation and aviation interests associated with the construction and operation of relevant facilities. These issues are considered in Sections 8.2 and 8.3, respectively. As discussed above, impacts on other wind farm or transmission cable operators may arise from the routeing of export cables and the potential requirement for crossing agreements or limitations on spacing within the restricted corridors available to reach landfall locations in the vicinity of grid connection points. Similar interactions may also arise with pipeline infrastructure associated with oil and gas extraction, gas storage or gas transportation. Celtic Array will ensure that any application to the Planning Inspectorate and MMO includes an outline of the export cable route which is sufficient in detail to cover any potential cumulative effects and relevant planning considerations.

Scoping Opinion from the Planning Inspectorate

8.275 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to other users:

- The Secretary of State required the potential impacts during construction on oil and gas operations to be scoped in as there is potential for the export cable corridor to interfere with gas and oil projects. In addition, no decisions have been made at this stage as to the where the next areas to be licensed for oil and gas exploration and extraction activity.

Approach to address Scoping Opinion

8.276 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA Survey and Study Programme

8.277 The EIA for the receptors described in this section will be carried out through a desk study supported by extensive consultation with owners of relevant assets and other stakeholders.

8.278 Datasets referred to as part of the desk study will include the Seazone and UK Deal databases as well as industry specific charts such as Kingfisher and BMAPA.

8.279 Meetings with other marine renewable operators, oil and gas companies, MOD, dredging and disposal operators and cable owners will be held to assess the interactions with RWF.

8-6 Human environment – archaeology and cultural heritage

Introduction

8.280 This section characterises the archaeological and cultural heritage of the Site and surrounding area, describes the potential impacts of wind farm development on that heritage and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies that have been agreed with relevant consultees which will be used to inform RWF's EIA process.

8.281 The main historic environment themes relevant to the Site are:

- Prehistory: sites, artefacts and deposits pertaining to human activity originally taking place on land during periods of lower sea-level;
- Maritime: wrecks of boats and ships and shipping-related material from later prehistoric to modern periods; and
- Aviation: wrecks and debris from aircraft crashes in the modern period.

Surveys and studies carried out to date

8.282 As part of the ZAP process described in Chapter 4, Celtic Array commissioned an archaeological and cultural heritage study, which included full zonal characterisation based around the collection of geophysical and geotechnical data, as well as consultation with stakeholders.

8.283 The archaeological investigation undertaken for the ZAP Report was conducted in stages. The principal stages and sources of data and information used for the production of the ZAP Report include:

- An initial assessment of documentary sources (Wessex Archaeology 2010a) incorporating:
  - United Kingdom Hydrographic Office (UKHO) wreck and obstruction dataset;
  - Royal Commission on the Ancient and Historic Monuments of Wales (RCAHMW) historic environment records documentary search;
  - ALSF *England's Shipping* (Wessex Archaeology 2004);
  - ALSF *Navigational Hazards Project* (Merritt *et al*. 2007);
  - ALSF *Aircraft Crash Sites at Sea* (Wessex Archaeology 2008);
  - Geological and palaeoenvironmental literature relating to the development of the ISZ;
  - Maritime history literature; and
  - Previous archaeological studies in the area.
- Archaeological review of geophysical survey data (October 2011). Twelve corridors, representing a 12% sample of the ISZ area were reviewed. These were evenly distributed across the ISZ spaced 5km apart, oriented north east to south west and were 500m wide (comprising three survey lines each spaced 150m apart). The data examined consisted of information from:
  - Side-scan sonar – which provides images of the seabed for identification of wrecks and other seabed features of archaeological interest;

- Sub-bottom profiler – which provides vertical slices through the seabed primarily for identifying sediment layers and infilled features such as old river channels that may have archaeological potential;
- Multibeam bathymetry – which produces a three dimensional model of the seabed which is useful for understanding the nature of the seabed and archaeological features preserved upon it; and
- Marine magnetometer – which can detect ferrous (containing iron) materials, such as shipwrecks or aircraft, lying beneath the seabed.

- Archaeological review of geotechnical data from met mast boreholes (October 2011). Four potential met mast borehole locations were drilled in March 2011 for engineering purposes. The borehole samples were archaeologically assessed to provide an indication of the potential for prehistoric archaeology to be preserved within them.

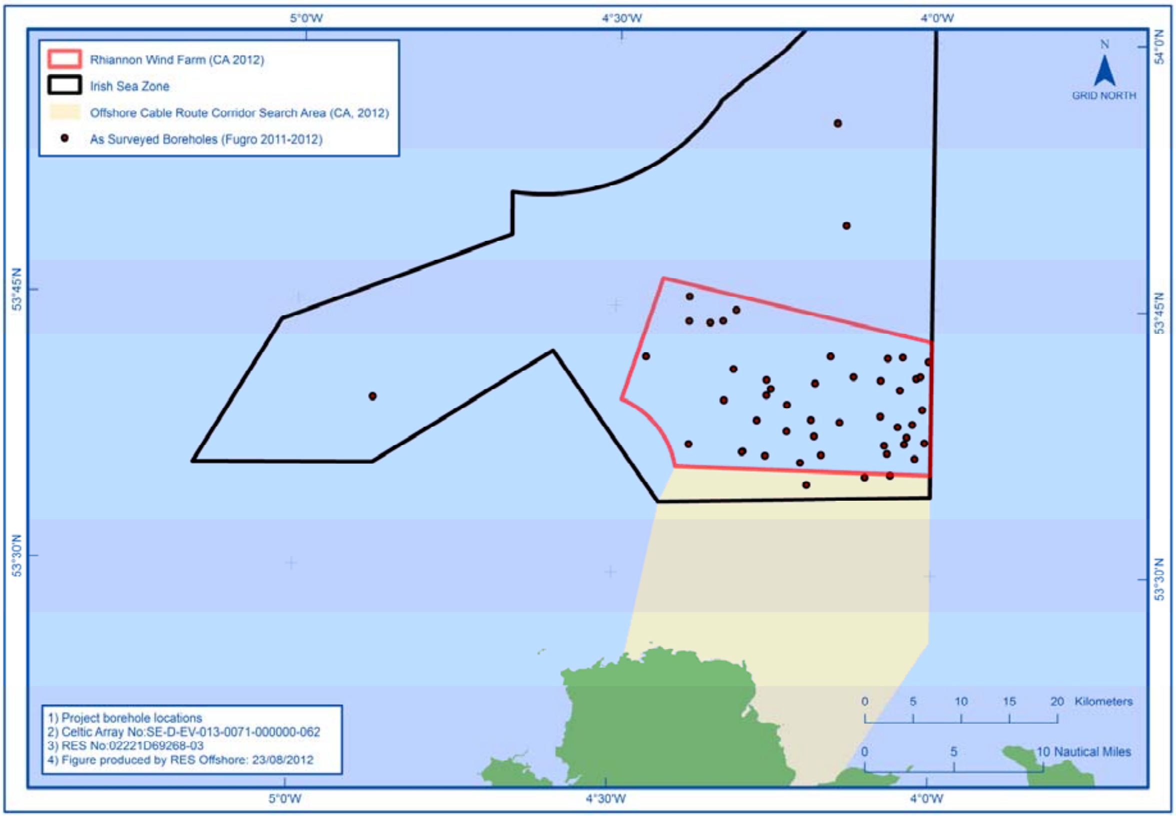

Figure 8.37 Borehole locations

8.284 A further series of geotechnical boreholes are being taken at approximately forty sites across the zone during 2012. The borehole samples obtained from this survey will also be archaeologically assessed.

8.285 Guidance documents relevant to this report include:

- Revised Joint Nautical Archaeology Policy Committee (JNAPC) code of practice for seabed development (JNAPC 2006);

- Collaborative Offshore Wind Research into the Environment (COWRIE) guidance on Historic Environment for the offshore renewable energy sector (Wessex Archaeology 2007); and
- Guidance for Assessment of Cumulative Impacts on the Historic Environment (Oxford Archaeology and George Lambrick Archaeology 2008).

8.286 Legislation considered as part of the ZAP Report and this report includes:

- Protection of Wrecks Act 1973 – within UK territorial waters (12nm);
- Protection of Military Remains Act 1986 – relevant to all UK waters; and
- Merchant Shipping Act 1995 – relevant to all UK waters.

Consultation

8.287 Stakeholder consultation has formed an important part of the ZAP Report and the drafting of the ZAP Report. Consultees have included:

- Cadw;
- The RCAHMW;
- English Heritage;
- Manx National Heritage;
- Clwyd-Powys Archaeological Trust; and
- Gwynedd Archaeological Planning Services.

8.288 For the part of the Site within Welsh territorial seas, Cadw administers the responsibilities of the Welsh Government with regards to archaeological and built heritage matters up to the 12 nautical mile limit.

Description of current environment

Archaeological context

8.289 The Site is characterised by proximity to major shipping lanes around Liverpool Bay and the west coast of the UK mainland; this area is also associated with the area of the eastern Irish Sea basin likely to have been dry land during the Palaeolithic and Mesolithic - and therefore holds an increased potential for encountering submerged prehistoric landscapes.

8.290 Evidence of human occupation for in excess of 700,000 years has been previously recorded at sites around the UK (Parfitt et al. 2005, Parfitt et al. 2010). During this period, fluctuations in relative sea level (RSL) from repeated glacial/interglacial cycles may have resulted in areas of the ISZ being periodically sub-aerially exposed. This will have permitted the movement of Pleistocene animals and may have facilitated occupation and exploitation by early hominins.

8.291 The presence of Palaeolithic cave sites along the North Wales coast indicate that such occupation in the vicinity of the Site during times of low RSL was potentially possible. However, any archaeological material deposited in the more exposed parts of the Site during this time is likely to have been removed by subsequent glaciations (Flemming 2005). However to the east, approximately 30km from the Site, palaeoenvironmental analysis of borehole samples has recovered pollen sequences relating to the upper Palaeolithic (ca. 34,000 BP, an archaeologically important period) suggesting isolated pockets of material from this date could also have survived further offshore (Wessex Archaeology 2011b).

8.292 The area of the Site is associated with shallower bathymetry than the west of the ISZ (ca. <50–30m) and is in close proximity to the general position of the Mesolithic coastline around 10,000 BP suggested by recent palaeogeographical research (University of Birmingham 2011). This area is more likely to contain submerged and buried coastal peaty sediments of higher archaeological potential. The potential for encountering preserved artefacts and archaeological material in general in the east of the ISZ generally is also significantly higher. Finds of this nature could be of high archaeological importance.

8.293 By the Mesolithic period, gradual relative sea level (RSL) rise would have probably placed much of the ISZ either on the coastline or just offshore (Shennan and Horton 2002). The Mesolithic record of the British Isles suggests a strong relationship between human activity and coasts, wetlands, rivers and streams. These areas provide rich sources of food and resources for these hunter/gatherer groups, as well as important transport routes inland or between islands. Any surviving sedimentary deposits from this period could potentially contain both in-situ and derived artefacts from a time when these coastal and littoral landscapes, now submerged by the sea, were utilised intensively by human populations.

8.294 It should be noted that some studies have suggested that the ISZ has been a completely marine environment since the last glacial maximum (LGM) and no terrestrial phase has occurred (Van Landeghem et al. 2009). In such a case the archaeological potential of the Site would be considered to be lower given the absence of a once exposed land surface upon which human communities could have lived.

8.295 In addition to these submerged coastal landscapes, the Mesolithic archaeological record may contain examples of coastal or sea going craft made from dugout logs or hide covered wooden frames. By the end of the Mesolithic, the Site would have been completely submerged and archaeological evidence from the Neolithic onwards will be of an increasingly maritime nature. Any artefacts from this period not related to maritime activity are likely to be derived and re-deposited within the ISZ after introduction to the area by fluvial processes or coastal erosion.

8.296 The earliest evidence for maritime craft within the UK is during the Mesolithic and Neolithic. This evidence consists of dugout log boats (Mowat 1996), rafts and possibly hide-covered boats (McGrail 1987). These vessels were likely used predominantly on inland waters and coastal areas, for fishing and transportation. A number of possible sea-going log boats have been recorded along the east coast of Ireland (Wessex Archaeology 2005). Long distance travel was perhaps restricted to favourable weather conditions. The survival of these craft types is very sparse other than in sealed primary contexts (McGrail 1987). Because of the seabed sedimentology of relatively mobile sandwaves and sandy gravels/gravely sands, these earliest archaeological materials are likely to be poorly preserved except in favourable, buried subsurface sediments.

8.297 Sea levels similar to the present day are thought to have developed by around 2000 BP (Lambeck and Purcell 2001). The archaeological record after this time would increasingly be of a fully maritime nature with a similar coastline to that of today. From the Bronze Age onwards, boat building technologies became more advanced, for example the sewn plank boat remains recovered from Goldcliffe and Caldicot in the Severn Estuary (Van de Noort 2003).

8.298 These advances continued into the Iron Age with the development of the 'Romano-Celtic' boat type. Evidence suggests that these new boat types were capable of coastal and sea-going voyages (Marsden 1994). During the later Roman occupation of Britain (43–409 AD), archaeological evidence suggests that contact occurred across the Irish Sea basin and trade routes were established. Small numbers of Roman coins have been found on the Isle of Man (Kinvig 1975). The preservation of these vessel types may be restricted to sealed, anaerobic contexts but finds of these larger vessels' cargo may be more likely especially with regards to fired pottery and other non-perishable items. The early medieval period saw a rapid increase in maritime transport and trade. As a result of this the expansion of the surrounding towns and harbours along with the further development of ship building technology also occurred. Thus the maritime traffic passing through the Site would have increased. The Viking settlement of the Irish Sea basin during the early medieval period encouraged long distance contact and trading between the Irish Sea and beyond (Redknap 2000).

8.299 The Drogheda boat dating to around 1500 AD, following in the construction methods of Viking period clinker vessels, is a rare example of coastal trading vessels from the late medieval period. The wreck was found to be carrying a large cargo of several thousand salted herring, likely caught off the east coast of Ireland and Isle of Man during the autumn (Harland 2009). Wrecks of this nature would be of national to international significance. The location of the Site adjacent to these historic fishing grounds would suggest an increased potential for encountering similar wrecks.

8.300 As suggested by the documentary sources, from the post-medieval period onwards the evidence for maritime activity, both documentary and physical, increases dramatically. Improved ship building techniques allowed a diverse and specialised array of vessels and permitted more efficient and rapid maritime trade and transportation throughout Europe and the rest of the world. Liverpool, to the east of the Site, was a major trading hub to Europe, North America and the West Indies following the expansion of the British Empire and was a principal location for shipbuilding, sugar refining, the coal industry and the slave trade.

8.301 Boats, ships and aircraft lost during the two World Wars would also be considered as important finds because of the magnitude of the loss endured by all countries involved and record the rapid development of wartime technologies. Legislation exists to protect military aviation losses as well as maritime wrecks of archaeological importance.

Maritime and aviation archaeology

8.302 The ZAP Report identified within the study area (the ISZ with a 1km buffer around it) a total of 61 wrecks, categorised by their date of loss in Tables 8.15 and 8.16 below. Of these wrecks, nine are within the Site boundary.

Table 8.14 Dates of loss of documented wrecks

Wreck Date Range of Loss	Number
1850 – 1913	7
1914 – 1918	10
1919 – 1938	2
1939 – 1945	4
Post-1945	4
Unknown	34
Total	**61**

Table 8.15 Vessel types of documented wrecks

Vessel Type	Number
Fishing	4
Barque	1
Steam Ship	19
Sailing	3
Trawler	1
Submarine	4
Unknown	29
Total	**61**

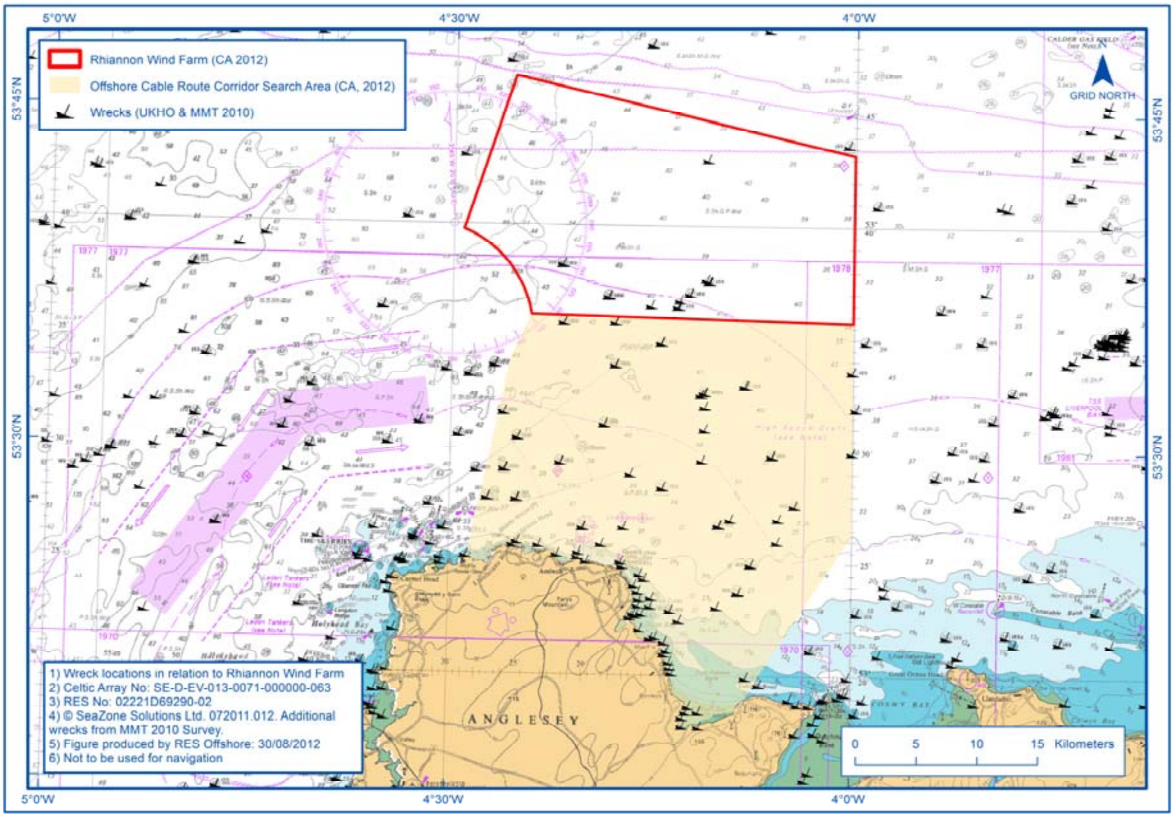

Figure 8.38 Wreck locations in the vicinity of the Project

8.303 No previously unidentified wrecks were located within the ZAP Report corridors, but the absence of such sites within the RWF boundary will only be able to be fully established during EIA. The identification of all relevant UKHO recorded wrecks within the corridors provides a high level of confidence in the datasets.

8.304 The most significant wrecks located within the ZAP Report corridors, in terms of the archaeology present and the confidence in their identification, are the three previously recorded wrecks - SS Peveril (WA ID 7020), SS Lucy (WA ID 7061) and SS Skerries (WA ID 7105). Additionally, two other sites (7021 and 7060) were identified as probable pieces of debris. These features are summarised in Table 8.17, though none were located within the Site boundaries.

Table 8.16 Selected gazetteer on main features of archaeological interest (A1 archaeological discrimination) (see WA 2011b)

WA_ID	Classification	Notes
7020	Wreck	Location of the known wreck of the *Peveril*, identified by all the geophysical equipment. Structure is discernible from linear shadows and within the wreck area there are also a number of dark reflectors, two larger dark reflectors with large shadows indicate two upstanding areas of the wreck with the wreck appearing mostly intact and upright. Height is a minimum as wreck is at edge of range. Debris appears contained to within the wreck itself, but a probable piece of debris is located nearby in anomaly 7021. A large magnetic contact suggests that it is most likely of metal construction. There is a scour mark to the southwest possibly containing another piece of debris (WA ID 7022).
7021	Debris	Linear dark reflector with faint shadow, in the vicinity of wreck 7020, most likely a piece of debris from the wreck.
7060	Debris	T-bar shaped dark reflector, the shape looks anthropogenic in origin and associated is a second smaller linear anomaly about 40m away, probably debris.
7061	Wreck	Location of the known wreck of the *Lucy*, identified by all of the geophysical equipment. Connecting linear and curvilinear dark reflectors showing the structure of a wreck, intact and upright on seabed. Surrounding seabed is absent of any sediment build-up suggesting wreck is not buried. No debris scatter and no scour marks visible. Distinct medium magnetic anomaly.

WA_ID	Classification	Notes
7105	Wreck	Location of the known wreck of the *Skerries*, identified by all of the geophysical equipment. Area containing dark reflectors with shadows identified as a wreck. Banding in the data has distorted the image therefore, although dark reflectors are visible and identified as structure it is difficult to distinguish any detail further than that. Height recorded is the minimum as shadow extends beyond range. Long extended sediment build-up running from the wreck to the north over 110m in length. So far one small linear reflector next to main wreck area identified as debris but there could be more. Large magnetic anomaly and isolated irregular seabed mound in the bathymetric data.

Palaeolandscape and geoarchaeological issues

8.305 The geoarchaeological assessment of geotechnical boreholes at possible meteorological mast sites (Wessex Archaeology 2011a) suggests that the prehistoric archaeological potential of the seabed sediments at these locations is likely to be low as they are either too old or consist of glacial sediments or reworked sediments – i.e. any artefacts within them are unlikely to be *in situ*.

8.306 This initial conclusion is not exhaustive for the Site because it focuses on the met mast locations within the ISZ. However, it provides an indication of the range of sediments preserved in the Irish Sea and confirms that it is possible to examine their archaeological potential within their geological context.

8.307 The geophysical assessment of sub-bottom profiler datasets (Wessex Archaeology 2011b), found that the Site is likely to contain geological features of possible archaeological potential.

8.308 These features fall into three broad categories of features visible on the geophysical survey lines:

- Terrestrial palaeochannels - old river channels now underwater due to sea level change;
- Underfilled glacial channels - glacially eroded channels partially filled by sediments; and
- Infilled depressions.

8.309 Of these, the channel deposits were considered to be potentially the most important archaeologically.

Potential impacts

8.310 The following identification of potential impacts has been based on consideration of the ZAP Report, previous wind farm ESs and CREL's/DONG Energy's experience of offshore wind farm development.

8.311 The potential impacts described in this section may arise from the construction, operation or decommissioning of RWF. These effects will be considered in the ES unless specifically scoped out below.

8.312 As described in the COWRIE guidance document 'Historic Environment Guidance for the Renewable Energy Sector' (Wessex Archaeology 2007), there may be direct and indirect impacts upon cultural heritage receptors preserved offshore from offshore renewable energy developments. These are paraphrased below (ibid. p9):

> *"Direct impacts can include direct damage to structures, features, deposits and artefacts and the disturbance or destruction of relationships between these elements and their wider surroundings."*

> *"Indirect effects may arise where the direct impact has effects beyond its primary footprint, implicating archaeological sites or deposits that lie some distance away."*

8.313 Direct impacts generally occur during the installation, maintenance and decommissioning of the turbine and cable infrastructure. Indirect impacts may develop from direct impacts via a number of varied processes. Examples include, but are not restricted to, the instigation of erosion of cultural heritage receptors following changes to the seabed during infrastructure installation or from anchoring or jacking-up of vessels working on the development.

8.314 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction/decommissioning	
Direct physical disturbance to marine archaeological features	The installation of the foundations for RWF, the use of scour protection and the construction of associated infrastructure such as offshore substations and intra-array cables could directly disturb or damage artefacts of cultural importance or, in the case of submerged palaeo-channels (see above) affect sites of archaeological interest. Such impacts may also arise from activities associated with the construction activity such as vessel anchoring or the positioning of jack-up vessels. This impact can be mitigated through the identification and avoidance of archaeological features and therefore while it is scoped in, it is not expected to be a focus of the EIA.
Indirect physical disturbance to marine archaeological features	Changes to currents, sediment transport and erosion patterns during the construction period have the potential to impact on sites, deposits or artefacts even where direct physical contact from construction activities does not occur. Appropriate 'buffers' placed around features can act as mitigation for this impact. Given the findings of the ZAP Report relating to physical processes (see Chapter 6 of this report) that such effects are likely to be small scale and local, it is proposed that such effects during the construction phase be scoped out of the EIA process.

Potential impacts during operation	
Disturbance to marine archaeological features	No significant direct impacts are predicted to occur during the operational phase because no new disturbance of seabed is likely to take place. However, some activities associated with maintenance (for example, positioning of jack-up vessels) may give rise to impacts similar to those considered above as having the potential to arise during the construction phase. Major maintenance activities will be subject to the same types of mitigation as construction activities and therefore this potential impact is not expected to be a focus of the EIA. Indirect changes to the hydrodynamic and sedimentary regimes could occur, resulting in disturbance to archaeological features through sediment transport, scouring or deposition. Numerical modelling studies carried out for the ZAP Report indicate there is little potential, at the zonal-level, for significant effects to occur. For this reason, it is not expected that this potential impact will form a focus of the EIA.
Visual impacts on onshore historical and cultural heritage features	The visual effects of RWF on onshore historical and cultural heritage features will be considered as part of the archaeology and cultural heritage chapter of the ES. Cross-referencing will be provided between this chapter and the one on assessment of seascape and landscape impact. Identification and assessment of potential impacts will include consideration of the setting of listed buildings, scheduled monuments, registered parks and gardens and historically important landscapes.
Potential cumulative impacts	
There is potential for cumulative impacts on features of archaeological interest. In particular, the construction of RWF, together with the construction of the projects identified in Chapter 5 of this report, could incrementally reduce the quality or number of archaeological features, particularly in respect of palaeofeatures. Conversely, however, survey activity associated with the development of these projects may increase the knowledge base in respect of marine archaeological features by providing information on features which would not usually be accessible or through archaeological finds (if appropriately handled through the application of finds protocols). This could deliver positive impacts in respect of cultural heritage.	

Scoping Opinion from the Planning Inspectorate

8.315 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to archaeology and cultural heritage:

- The Secretary of State considered that the ES should include proposals for monitoring and reporting on the historic environment throughout the lifetime of RWF; and

- The Secretary of State agreed to scope out indirect physical disturbance to marine archaeological features.

Approach to address Scoping Opinion

8.316 The level of detail as to how these issues will be addressed will be determined following Stage 1 consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches.

EIA Survey and Study Programme

8.317 The EIA for RWF will build on the data collected as part of the ZAP process and update the baseline data as necessary.

8.318 Ongoing consultation with Cadw, RCAHMW, English Heritage, Manx National Heritage, Clwyd-Powys Archaeological Trust and the Gwynedd Archaeological Planning Services will additionally inform the EIA process.

8.319 Since April 2012, Celtic Array has been undertaking a geotechnical campaign with an anticipated forty boreholes. The data collected will be subject to an archaeological review which will be carried out onshore, as an offshore review will not be possible because of working practicalities and restrictions on the survey vessel.

8.320 The ZAP Report archaeological review of geophysical data was undertaken by analysing broad survey corridors to obtain regional conclusions on archaeological potential for the whole ISZ. Further EIA level analysis will be carried out on the data for the Site and the technical specifications of surveys will be agreed with expert authorities as part of consultation.

8.321 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, data and information derived through consultation;
- A review and summary of the consultation including an overview of the key concerns gathered from stakeholders regarding the potential development of RWF;
- Assessment of the potential impacts arising from RWF, including potential cumulative impacts;
- A review and summary of seascape and visual impact studies incorporating any identified key issues specifically regarding cultural heritage. Cross-referencing to the relevant chapters of the ES will be included; and
- Proposals for mitigation measures and monitoring, if required.

8.322 The EIA for RWF will take account of the following legislation and guidance:

- Revised JNAPC code of practice for seabed development (JNAPC 2006);
- COWRIE guidance on Historic Environment for the offshore renewable energy sector (Wessex Archaeology 2007);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment (Oxford Archaeology and George Lambrick Archaeology 2008);
- Protection of Wrecks Act 1973;

- Protection of Military Remains Act 1986;
- Merchant Shipping Act 1995; and
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather 2009).

8-7 Human environment – socio-economics

Introduction

8.323 This section characterises the socio-economic environment in and around the Site, describes the potential impacts of wind farm development on that environment and outlines the issues which will be considered in the ES. It also outlines the scope of future surveys and studies to be consulted on with relevant consultees which will be used to inform RWF's EIA process.

Surveys and studies carried out to date

8.324 As part of the ZAP process described in Chapter 4, Celtic Array commissioned a socio-economic study (Celtic Array 2012). The ZAP Report included full zonal characterisation of the socio-economic environment. The principal sources of data and information used for the production of the ZAP Report and this report were:

- Shipping and navigation baseline, prepared for Celtic Array by Anatec, December 2012 (see see Section 8.2);
- Commercial fisheries baseline, prepared for Celtic Array by Brown & May Marine Ltd, December 2012 (see Section 8.1);
- Other users baseline, prepared by Celtic Array (see Section 8.6);
- Office of National Statistics, Nomis database;
- Northern Ireland Statistics and Research Agency; and
- Central Statistics Office (Statistics Ireland).

8.325 Celtic Array has undertaken comprehensive stakeholder engagement at key points in the ZAP assessment process, as discussed in Chapter 3. Scoping responses received on socio-economic issues during the ZAP Report raised a number of key concerns including:

- The need to maintain ongoing consultation with key stakeholders;
- Understanding of the benefits to local communities which will result from development; and
- Employment opportunities for local people in North Wales and other areas during the construction and maintenance stages.

8.326 There was also recognition of the increasing importance of the renewable energy sector and the local opportunities that the sector could provide for the region, particularly in respect of the ports sector.

8.327 It is important to understand that while Celtic Array remains fully committed to keeping the general public and relevant stakeholders up to date, it is not possible to quantify economic benefits until the design of RWF becomes more certain. As discussed below, the ES for RWF will seek to place any potential impacts and benefits in the context of those communities most likely to be affected by development.

Description of current environment

8.328 This description of the current socio-economic environment is presented at a regional and country level for North West England, Wales, Scotland, Northern Ireland, the Republic of Ireland and the Isle of Man which together comprise the study area. Unless referenced in the text, all the information is drawn from Celtic Array (2012).

Population demographics

8.329 Demographic information for the study areas in 2006 (the latest data for which population estimates are available across all of the study areas) shows that the proportion of the population of working age (i.e. 15 to 64) is relatively consistent across the study areas from 65% in Wales and North West England to 69% in the Republic of Ireland.

8.330 Analysis shows significantly higher levels of population growth in the Republic of Ireland (8%) and Isle of Man (5%) between 2001 and 2006 than the regions within the study areas. Levels of population growth over the five year period are similar for the North West England and Wales, at just below 2%.

8.331 There is a forecasted gradual rise in population across all of the countries within the UK between 2010 and 2020. While the forecasted population as a whole is shown to increase across the study areas, the projected proportion of people of working age varies.

Employment

8.332 A breakdown of the working age population shows a higher degree of economic participation within the Isle of Man, Scotland and North West England than Wales, Northern Ireland and the Republic of Ireland.

8.333 All of the study areas have experienced some increase in unemployment levels between 2006 and 2011. The most significant increase in unemployment between 2006 and 2011 has been in the Republic of Ireland where there has seen nearly a 10% increase in unemployment levels over a five year period. In comparison, the Isle of Man has seen a modest increase in unemployment level over the periods of 0.7%.

8.334 In 2006, the highest regional unemployment rate in the study area (Scotland) was 5.5% which is four percentage points higher than the lowest (Isle of Man) at 1.5%. By 2011, the difference between unemployment rates across the regions had increased and the highest rate was 14% (Republic of Ireland) and was almost 12% higher than the lowest rate at 2.2% (Isle of Man). The regional average unemployment rate in North West England in 2011 (7.9%) was fairly similar to that experienced in Wales (8.6%) and Scotland (7.9%).

Key industrial sectors

8.335 Public sector employment is a dominant sector in all of the economies, growing in importance over the period in all places apart from the Republic of Ireland.

8.336 In 2006, construction was a more important sector in Northern Ireland and the Republic of Ireland than in the other study areas. Manufacturing was a significant sector in all of the study area economies but not for the Isle of Man.

8.337 The Isle of Man economy in 2006 was dominated by employment in the distribution, hotels and restaurants sector, the banking and finance sector and public sector services. Banking and finance is a significantly more important sector in the Isle of Man than for the other study area economies.

8.338 All the economies within the study area have seen a reduction in the importance of the manufacturing and construction sectors in terms of levels of employment. Wales and Northern Ireland have also seen a reduction in the importance of the distribution, hotel and restaurant sector.

8.339 There is little consistent information collated on the importance of tourism to the study area economies. For the Isle of Man, for example, data for 2006-2007 showed that as a proportion of national income by sector, tourism only accounted for 5.1%. This compares less favourably, in terms of the importance of the sector to the overall economy, with for example the finance sector (36%), professional and scientific services (20.5%) and even manufacturing (7.3%).

8.340 Statistics produced by Failte Ireland, the Republic of Ireland's National Tourism Development Authority, using proxy measurements for employment, estimated that the tourist sector amounted to 6.4% of total employment. Appling the same industry classification as used by Failte Ireland the equivalent percentages for North West England (5.5%) and Northern Ireland (5.4%) are slightly lower, whereas in Wales and Scotland the importance of the sector for employment is roughly the same as that for the Republic of Ireland, being 6.5% and 6.7% respectively.

Income and earnings

8.341 In April 2011, the median gross weekly earnings for full-time employees in Northern Ireland, (both public and private) were £450.60, an increase of 3.0% over the year from April 2010. This rate of growth was higher than in the UK as a whole where the rate of growth was 0.4% for the year, although median earnings in the UK were higher at £500.70 in April 2011. This effectively narrowed the NI/UK full-time pay gap to 90.0% of the UK's median earnings compared with 87.7% a year earlier (NI Department of Finance and Personnel Statistics Bulletin, April 2011).

8.342 Average weekly earnings information for 2010 is available by Standard Industrial Classification (SIC) or industry grouping for each study area. In general, the data shows that the best paid sectors are mining and quarrying; electricity, gas, steam and air conditioning supply; information and communication services; and financial and insurance activities. The lowest wages were typically experienced in the agriculture, forestry and fishing; wholesale and retail trade; repair of motor vehicles and motorcycles; accommodation and food service activities and administrative and support service activities sectors. Manufacturing and construction wages were in the middle of the average wage range and were highest in Scotland for both sectors.

8.343 Wages in Republic of Ireland are generally higher than the rest of the regions, but this could, in part, be a result of exchange rate conversions between Euros and British Pounds.

8.344 The water supply, sewerage, waste management and remediation activities sector was the only SIC area for which wages reduced for all three regions (North West England, Wales and Scotland). The greatest reductions in wages were observed for Wales, most notably in this same sector as well as other service-related sectors (accommodation, food, administration and support services and other services). The greatest increases in wages were observed in the public administration and defence and electricity, gas, steam and air conditioning supply sectors for all regions and the arts, entertainment and recreation sector in Scotland.

8.345 Wages in the manufacturing and construction sectors experienced small increases, with average wage levels across all three regions rising by 2.7% and 1.6% respectively.

The average wage increase for electricity, gas, steam and air conditioning supply sector employees across the three regions was 6.0%.

Education and skills

8.346 In terms of the qualifications and skills levels contained within the individual labour markets analysis shows a slightly lower proportion of people with qualifications in Northern Ireland at all National Vocational Qualification (NVQ) levels and slightly higher proportions of people with NVQ2 equivalent (broadly five GCSEs at grades A*-C) and higher in Scotland than the other UK areas. The most recent data for the Republic of Ireland produced by the Central Statistics Office Ireland, show that in 2006 15.6% of the population aged 15 and above had completed a degree or higher course. Although not a direct statistical comparison, in 2006 in Wales 24.2% and in North West England 24.8% of people aged over 16 had NVQ 4 equivalent qualifications, the classification which includes degree and higher degree qualifications.

8.347 Although comparable data is not collected in the Republic of Ireland, the Central Statistics Office has collected data, showing that 70% of the relevant age cohort in 2006 entered higher education. This was an increase from the level (60%) in 2001. In 2011, the percentage of people aged 20-24 years having completed at least Upper Second Level Education was 87.6% compared with 85.3% in 2006.

8.348 Data provided by the UK Higher Education Statistics Agency (HESA) shows the level of unemployment among recent graduates. Although the proportion of unemployed graduates was slightly higher in North West England and Northern Ireland, across these regions of the UK they are relatively consistent, at around 10%.

Skills gaps

8.349 Research undertaken by Cambridge Econometrics for RenewableUK shows that the number of people working in the UK's offshore renewable sector has grown from 700 people in 2007, to around 3,200 in 2011.

8.350 The Cambridge Econometrics study suggests offshore growth could provide direct and indirect employment for in the region of 65,000 people; however, this is dependent on the UK being able to meet a reasonable share of associated demand domestically.

8.351 Research undertaken for the then British Wind Energy Association (BWEA, now RenewableUK) in 2008 concluded that:

> *"The UK faces a significant demand/supply imbalance in the wind energy labour market already and the sector continues to grow. The pools of people with the skills and experience to perform many of the roles are limited. As growth accelerates, filling the new roles will be challenging and a number of specialist roles will become even more difficult to fill. Industry players currently see this issue as the fourth most significant barrier to growth in the sector."*

8.352 This research suggests that significant vacancy levels were driven by a lack of experience, a lack of qualifications and a shortage of applicants and that the industry was already facing a *considerable* staffing challenge with more than half of the companies surveyed in 2008 having have vacancy levels of above 5% and in certain specialist roles that shortage was significantly higher. The research showed that the majority of non-graduate hires into the sector had experience in some other related industry, such as another renewable energy, oil and gas, or construction.

Potential impacts

8.353 There are a number of potential socio-economic impacts associated with development of RWF. Direct capital spend on the project may accrue to local, regional and UK companies and may support direct employment e.g. construction jobs. The supply chain will also benefit. Indirect expenditure from the multiplier effect may also benefit the regional economies of the Irish Sea. Impacts on industry (e.g. commercial fisheries, shipping etc.) are also important considerations and are discussed in more detail in the relevant sections of this document.

8.354 The following potential impacts may arise from the construction, operation or decommissioning of RWF (additional impacts scoped in by the Planning Inspectorate following their Scoping Opinion are discussed in the proceeding sections).

Potential impacts during construction	
Effects on spending, income and employment patterns	The construction and installation of the wind farm and its ancillary infrastructure may influence direct and indirect demand for goods and services, leading to changes in spending, income and employment patterns. This potential effect may occur through direct employment, through employment in the supply chain, particularly at ports and through multiplier effects arising from such employment (for example increased expenditure in local communities).
Potential impacts during operation	
Effects on spending, income and employment patterns	The O&M of RWF and its ancillary infrastructure may influence direct and indirect demand for goods and services, leading to changes in spending, income and employment patterns. This potential effect may occur through direct employment, through employment in the supply chain, particularly at O&M ports and through multiplier effects arising from such employment (for example increased expenditure in local communities).
Shipping and Navigation	As discussed in Section 8.2, the physical presence of the turbines may give rise to deviations to existing shipping routes resulting in potential additional journey time for shipping operators.
Commercial fisheries - displacement	As discussed in Section 8.1, the physical presence of the turbines may give rise to vessel displacement which may result, directly or indirectly, in changes in the volume of catch and/or fishing costs.
Potential impacts during decommissioning	
Impacts during decommissioning are likely to be similar to those during construction of RWF although the absence of pile driving is likely to result in a significantly lesser impact on commercial fisheries than during the construction phase.	

Potential cumulative impacts	
Effects on spending, income and employment patterns	The construction and installation of the wind farms and their ancillary infrastructure may influence direct and indirect demand for goods and services, leading to changes in spending, income and employment patterns. In particular, the development of a regional supply chain and 'hubs' of specialism as well as port redevelopment are likely to give rise to significant positive cumulative impacts. The O&M of RWF and its ancillary infrastructure may influence direct and indirect demand for goods and services, leading to changes in spending, income and employment patterns. As with the construction phase discussed above, the development of a regional supply chain and 'hubs' of specialism, including ports and aviation facilities providing specialised facilities for O&M, are likely to give rise to significant positive cumulative impacts.
Shipping and Navigation	As discussed in Section 8.2, the physical presence of the turbines at multiple projects may give rise to deviations to existing shipping routes resulting in potential additional journey time and cost for shipping operators.
Commercial fisheries - displacement	As discussed in Section 8.1, the physical presence of the turbines at multiple projects may give rise to vessel displacement which may result, directly or indirectly, in changes in the volume of catch and/or fishing costs, thus influencing profitability from fishing.

Scoping Opinion from the Planning Inspectorate

8.353 Celtic Array submitted an offshore Scoping Report to the Planning Inspectorate on the 6th July 2012 to establish and agree the scope of the EIA for RWF. The following represents the Planning Inspectorate's opinion in respect to socio-economics:

- The Secretary of State suggested that a more detailed Socio-Economic Impact Assessment is considered in order to fully appreciate the impacts of a development of this scale;
- The impact upon the tourism economy, including coastal tourism and recreation should be considered as well as further consideration of any impacts which may arise during construction, operation and decommissioning; and
- The Secretary of State recommended that the types of jobs generated by RWF should be considered in the context of the available workforce in the area, both during the construction and operational stages of the project.

8.354 The Isle of Anglesey County Council also requested that more local socio-economic statistics should be used in future socio-economic assessments.

Approach to address Scoping Opinion

8.355 The level of detail as to how these issues will be addressed will be determined following Stage 1 PEI consultation. Consultation with key technical stakeholders will be ongoing throughout the pre-application stage to discuss EIA methodologies and assessment approaches. In addition more localised statistics on socio-economic indices will be sourced for the EIA.

EIA survey and study programme

8.355 The EIA for RWF will build on the data collected as part of the ZAP process and update the data described above as necessary.

8.356 Ongoing consultation will additionally inform the EIA process. In addition to the shipping and fisheries described in Sections 8.1 and 8.2 such consultation will include:

- Local authorities;
- Tourist boards;
- Recreational vessel operators (fishing, diving, pleasure trips);
- Ports authorities and companies;
- Welsh Government;
- Isle of Man Government;
- Government of the Republic of Ireland;
- Scottish Government; and
- Community groups.

8.357 The ES will include:

- A description of the existing/baseline environment in the area of RWF, within the ISZ and the wider Irish Sea basin making reference to the information described above and, in particular, consultation derived data and information;
- A review and summary of the consultation process including an overview of the key concerns gathered from relevant stakeholders;
- Assessment of the potential impacts arising from RWF described in the above section, including potential cumulative impacts;
- A review and summary of commercial fisheries EIA incorporating relevant findings from the process described in Section 8.1. Cross-referencing to the relevant chapters of the ES will be included;
- A review and summary of the shipping and navigation EIA incorporating relevant findings from the process described in Section 8.2. Cross-referencing to the relevant chapters of the ES will be included;
- Utilisation of more ‘local’ socio-economic data; and
- Proposals for mitigation measures, if required.

9 PROPOSED STRUCTURE OF THE ENVIRONMENTAL STATEMENT

9.1 This chapter describes a provisional structure for the ES (or Stage 2 PEI Report) which will be prepared in support of the application for development consent for RWF to the Planning Inspectorate. The final structure of the ES will be in accordance to the recommended style and content as stipulated by the Planning Inspectorate in the Scoping Opinion.

9.2 It is proposed to adopt a three volume format for the ES, comprising:

- Volume 1: Non-technical Summary;
- Volume 2: Environmental Statement and Appendices; and
- Volume 3: Environmental Statement figures.

9.3 The ES Main Text (Volume 2) will comprise of a series of introductory chapters and EIA chapters. Each technical chapter will begin with a description of relevant baseline conditions and assess the potential impacts of RWF on that baseline, including any potential cumulative and in combination impacts. A provisional structure for Volume 2 is set out below:

1. Introduction
2. The Applicant
3. Legislative and policy context
4. Need for the project and consideration of alternatives
5. Environmental Impact Assessment Process
6. Project Description

   A description of the project including

   - Site Layout
   - Foundations
   - Turbines
   - Offshore electrical elements
   - Export cable and landfall
   - Construction
   - Operation and Maintenance
   - Decommissioning
7. Assessment Methodology
8. Offshore Physical Environment

   a. Geology and sediment
   b. Physical processes
   c. Underwater noise (baseline only, impacts assessed in Chapters 9b and 8d)

9. Offshore Biological Environment

    a. Benthic ecology
    b. Fish and shellfish ecology
    c. Ornithology
    d. Marine Mammals, basking sharks and turtles
    e. Nature conservation designations

10. Offshore Human Environment

    a. Shipping and Navigation
    b. Commercial Fisheries
    c. Aviation
    d. Seascape, Landscape and Visual Amenity
    e. Other users of the sea
    f. Marine Archaeology and cultural heritage
    g. Socio-economic issues

11. QHSE Management

    Details of RWF environmental management plan

12. Summary of mitigation measures proposed

13. Summary of residual impacts

10 POTENTIAL IMPACTS OF THE PROJECT

10.1 Table 10.1 below summarises the potential impacts which could be associated with the construction, operation and decommissioning of RWF. These potential impacts will be examined further under the EIA. At this stage, it is possible to identify some industry best practice measures to mitigate potential impacts.

Table 10.1 Potential impacts associated with RWF

Potential impacts - General

Impact type	Stage	Description
Climate change	Ongoing	RWF is a source of low carbon electricity and is likely to replace carbon-intense electricity generation, such as coal; this would help the UK's efforts to combat climate change.
Security of supply	Ongoing	The wind farm is expected to help make the UK less dependent on imported oil, gas and coal as it is likely to replace some of the electricity generated from these sources.
Cumulative impacts	Temporary/ Ongoing	There is potential for cumulative impacts across the physical, environmental and human factors described below.
Other users	Temporary/ Ongoing	Impacts on oil and gas activity, coastal erosion defences, some onshore activities, aggregate dredging and telecommunications will be examined.

Potential impacts on the seabed and seabed ecology

Impact type	Stage	Description
Changes to Wave and Tidal regimes on local sediment transport and frontal systems	Temporary/ Ongoing	The results of ZAP concluded that impacts on the wave and tidal regime were unlikely and that corresponding impacts on frontal systems and regional sediment transport were also unlikely. However through consultation the impacts on the local sediment transport regime have been scoped in as more 'localised' data will be collected as part of the EIA. Given the importance of the Irish Sea frontal systems, impacts on this receptor have also been scoped in.

Impact type	Stage	Description
Sediment	Temporary/ Ongoing	During construction and decommissioning there is a possibility that sediment could be disturbed and mixed into the seawater. Sediment disturbance during the operational life of the project is likely to be localised to the foundations and substructures and so affect a small area only. Impacts on sediment quality and local sediment transport are also scoped in to the EIA.
Shape of the seabed	Temporary/ Ongoing	There could be changes to the shape of the seabed in the vicinity of the wind farm. Scouring can occur around the base of a turbine during its lifetime and this effect will be examined.
Water quality	Temporary/ Ongoing	Wind turbines produce little waste or by-products. The chance of incidents can be managed with standard environmental management measures and best practice. As requested in the Scoping Opinion this impact type will be assessed as part of the EIA.
Geology	Temporary/ Ongoing	The Planning Inspectorate has asked that impacts on geology be considered as part of the EIA. Impacts however are unlikely to be significant given the scale and nature of this receptor.
Disturbance of seabed species	Temporary/ Ongoing	Species living on the seabed can be affected by wind farm processes, such as by the movement of sediments. Some protected seabed species and habitats were detected in surveys.
Loss, change or disturbance of seabed habitats	Temporary/ Ongoing	Seabed habitats and species could be impacted by the construction, operation and decommissioning of the wind farm. It is expected that this potential impact will be reduced by making minor adjustments to the location of turbines just prior to construction.
Change in benthic communities	Temporary/ Ongoing	Changes to the composition of benthic communities within the Site may occur, either from the colonisation of hard foundation and scour protection surface or through changes in fishing activity arising from the use of safety zones around turbines. The impact of the potential to introduce or spread non-native species during construction and operation activities will be considered as part of the EIA.

Potential impacts on fish ecology

Impact type	Stage	Description
Disturbance of fish species	Temporary/ Ongoing	Fish species could be impacted by the wind farm by disturbing habitats or communities. None of the fish species recorded in fish surveys to date are protected individually under national or international legislation.
Noise disturbance of fish	Temporary/ Ongoing	Construction noise could impact fish species, in particular spawning species. Operational noise is unlikely to have a significant effect on fish species. However as requested by the Planning Inspectorate this will be considered as part of the EIA.
Electro-magnetic field effects on fish	Temporary/ Ongoing	Research on electro-magnetic fields to date has failed to show significant impacts on their behaviour. Members of the shark family (including basking sharks) could be sensitive to electro-magnetic fields.
Change to tidal fronts affecting basking sharks	Temporary/ Ongoing	Basking shark feeding behaviour can be associated with tidal fronts, however since sea current modelling showed no significant impacts on tidal fronts, basking sharks should not be significantly affected.

Potential impacts on marine mammals, basking shark and turtles

Impact type	Stage	Description
Noise disturbance on marine mammals and turtles.	Temporary/ Ongoing	Construction noise could have an impact on marine mammals and turtles, including indirectly by affecting their prey species. Operational noise is not expected to have a significant effect on marine mammals and turtles. However, this will be considered as part of the EIA in line with the Scoping Opinion.
Risk of collision of marine mammals with wind farm vessels	Temporary/ Ongoing	Marine mammals and turtles (and also basking sharks) could potentially collide with vessels used to construct, operate and decommission a wind farm.

Impact type	Stage	Description
Effects of turbine on physical processes – basking shark and tidal fronts	Temporary/ Ongoing	Any changes affecting tidal fronts could give rise to alteration in mixing and primary productivity with resulting changes in levels of the plankton on which the sharks depend. Studies associated with offshore wind farms (e.g. Cefas 2005) and project environmental statements have concluded that impacts associated with marine processes (currents and tides) are generally only minor in scale and 'near-field' (i.e. occurring within or close to individual wind farm footprints). The ZAP physical process studies concluded that any effects on the frontal systems would be insignificant. However this will be considered further as part of the EIA in view of stakeholder concerns.

Potential impacts on birds

Impact type	Stage	Description
Disturbance of bird species	Temporary/ Ongoing	Construction or decommissioning activity and the noise it generates could disturb birds. Protected bird species in particular could be impacted by the wind farm.
Collision risk and barrier impacts on bird species	Ongoing	The presence of the wind farm could pose a barrier or collision risk to certain species.
Changes in habitat or prey supply	Temporary/ Ongoing	There is increasing recognition of the possibility of indirect effects upon habitat and prey resources such as fish following construction and during operation, which subsequently impact upon individual birds and thence perhaps to a population scale (Perrow *et al*. 2011). While indirect effects may have a negative impact, positive impacts may also accrue through the reef effect (Linley *et al*. 2007), whereby turbine bases are colonised by flora and fauna that form a resource for fish and thereby birds. Certain species, such as gulls, which are not prone to displacement, may feed within the Site preferentially, such as recorded during monitoring studies of the operational Horns Rev offshore wind farm (NERI 2005). This will be considered as part of the EIA.

Potential impacts on commercial fisheries

Impact type	Stage	Description
Exclusion from fishing grounds and Loss/Restricted access	Temporary/ Ongoing	Construction, operation and decommissioning activity could restrict access to current commercial fishing grounds.
Increased fishing competition	Temporary/ Ongoing	If commercial fishing vessels are displaced this could result in more competition.
Increased distances to fishing grounds	Ongoing	The presence of the wind farm could have a barrier effect and mean that fishing vessels need to travel further to reach fishing grounds.
Changes to commercial fish species	Temporary/ Ongoing	The wind farm could change the abundance of commercial fish species (including shellfish species).
Interference with fishing activities	Ongoing	Operation and maintenance vessel movements may lead to an increase in maritime activity in and around the Site. The increase in the number of vessels transiting to and from site may affect fishing activity.
Potential impacts on resource	Temporary/ Ongoing	The presence of turbines and other structures may affect the composition, distribution and abundance of fish and shellfish resources within the Site, giving rise to an effect (negative or positive) on local fisheries.

Potential impacts on shipping and navigation

Impact type	Stage	Description
Navigation safety impacts on fishing vessels	Temporary/ Ongoing	The wind farm turbines, its power cables and the vessels used to construct and operate it could impact the ability of fishing vessels to navigate safely.
Vessel to vessel collision risk	Temporary/ Ongoing	The potential that the presence of the wind farm could cause shipping traffic to take different routes and this could affect the likelihood of vessels colliding.

Impact type	Stage	Description
Vessel to structure collision risk	Temporary/ Ongoing	The presence of the wind turbines could pose a collision risk to vessels.
Displacement from main shipping routes	Temporary/ Ongoing	Regular shipping routes may need to deviate due to the presence of the wind farm.
Change to availability of adverse weather shipping routes	Temporary/ Ongoing	During periods of high winds and poor visibility ships may be required to deviate from their regular routes. The presence of the wind farm on vessels operating in bad weather will be considered.
Disruption to search and rescue activities	Temporary/ Ongoing	The wind farm could place increased demand on emergency search and rescue services. Also the presence of the turbines could affect the ability to perform a rescue in or near the wind farm.
Impacts on communication and navigation equipment	Temporary/ Ongoing	Radio equipment, compasses and other navigation aids could be affected by the presence of the turbines.
Snagging risk from power cables	Temporary/ Ongoing	Cables running between turbines and from the wind farm to shore are likely to be buried or covered, even so they can pose a snagging risk to anchors and certain types of fishing gear.

Potential impacts on aviation

Impact type	Stage	Description
Construction and decommissioning impacts on aviation	Temporary	Construction and decommissioning are not expected to cause any additional impacts to the presence of the wind farm.
Impacts on air traffic “en route” services	Ongoing	Radar equipment providing air traffic control services for aircraft travelling between airports (en route) could be affected by the presence of the wind farm. In particular, Lowther Hill radar station in southern Scotland and St Anne’s radar station in Lancashire.
Impacts on the Isle of Man Airport	Ongoing	The air traffic control services provided by the Isle of Man airport could be affected by the presence of the wind farm.

Impact type	Stage	Description
Impact on oil and gas helicopter operations	Ongoing	Helicopter servicing oil and gas platforms to the east of the wind farm could have their operations impacted by the wind farm.
Impacts on military aviation	Ongoing	No impacts on military aviation activities are anticipated at present.
Impacts on air traffic control radar at RAF valley	Ongoing	Discussions with the DIO have identified that there is the potential for an impact on the air traffic control (ATC) facility at RAF Valley arising from development within the ISZ. The impact of RWF on RAF valley will be considered as part of the EIA.

Potential impacts on visual amenity

Impact type	Stage	Description
Visual impacts of the presence of construction vessels and the wind farm	Temporary/ Ongoing	The presence of construction vessels, cranes, cable installation vessels and associated smaller vessels is not expected to impact seascape, landscape and visual amenity as it is a temporary effect. The presence of the wind farm could affect the landscape, seascape and visual amenity of local residents. Impacts on national parks, designated areas, cycle ways and footpaths will be considered.
Visual impacts on commercial services		As stated in the Scoping Opinion consideration will be given on the visual impact on commercial/recreational users, including ferry passenger and sail boats as well as commercial shipping lanes. The assessment will take these into account along with any cumulative impacts on these users.

Potential impacts on historic features and archaeology

Impact type	Stage	Description
Direct physical disturbance to marine archaeological features	Temporary	The installation of the foundations for RWF, the use of scour protection and the construction of associated infrastructure such as offshore substations and intra-array cables could directly disturb or damage artefacts of cultural importance or, in the case of submerged palaeo-channels affect sites of archaeological interest. Such impacts may also arise from activities associated with the construction activity such as vessel anchoring or the positioning of jack-up vessels. This impact can be mitigated through the identification and avoidance of archaeological features and therefore while it is scoped in, it is not expected to be a focus of the EIA.
Indirect physical disturbance to marine archaeological features	Temporary	Changes to currents, sediment transport and erosion patterns during the construction period have the potential to impact on sites, deposits or artefacts even where direct physical contact from construction activities does not occur. Appropriate 'buffers' placed around features can act as mitigation for this impact.
Visual impacts on onshore historical and cultural heritage features	Ongoing	The visual effects of RWF on onshore historical and cultural heritage features will be considered as part of the archaeology and cultural heritage chapter of the ES.

Potential impacts on communities

Impact type	Stage	Description
Tourism impacts	Temporary/ Ongoing	The wind farm could impact tourism in a number of ways. By attracting people to visit the wind farm and affecting current tourism trends. Indirect impacts, such as changes to transportation could also occur.
Jobs and employment	Temporary/ Ongoing	Construction and operation of the wind farm will create a number of jobs. How these are distributed across the region will not be known until the design criteria of the project is finalised.

Impact type	Stage	Description
Welsh Language	Temporary/ Ongoing	We want to ensure our project is part of the communities it is located nearest to and we're aware that Welsh speaking communities could be influenced by the project.

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ANNEX 1 – PUBLIC CONSULTATION EVENTS AND INFORMATION

Public events will take place on the times and dates shown below.

These events will be advertised in local press. English and Welsh speakers will be available at the events in Wales or if they are not available there will be an opportunity for people to be called by a Welsh speaker.

Conwy County Borough Council

- Clwyd suite in the Conwy Leisure Centre, Colwyn Bay – Friday 23rd November – 11am to 7pm
- Conwy Civic Hall Auditorium, Conwy – Wednesday 21st November – 11am to 7pm
- Arcadia Room, Venue Cymru, Llandudno – Monday 26th November – 11am to 7pm

Denbighshire County Council

- Tynewydd Centre, Rhyl – Tuesday 27th November – 11am to 7pm

Gwynedd County Council

- Bangor University, Main Hall, Bangor – Tuesday 20th November – 11am to 7pm

Isle of Anglesey County Council

- Amlwch War Memorial Hall, Amlwch – Friday 16th November – 11am to 7pm
- Beaumaris Town Hall, Beaumaris – Monday 19th November – 11am to 7pm
- Holyhead Town Hall, Holyhead – Saturday 24th November – 10am to 3pm
- Oriel Ynys Mon, Llangefni – Wednesday 28th November – 11am to 7pm

Isle of Man

- Mount Tabor Methodist Church Hall, Port St Mary – Friday 30th November – 11am to 7pm
- The iMuseum, Douglas – Saturday 1st December – 10am to 5pm
- Ramsey Town Hall, Ramsey – Monday 3rd December – 11am to 7pm

This document, as well as the full Community Consultation Document, will be on display at the following libraries. In North Wales, copies of the Community Consultation Document will made available in Welsh and English.

Location	Local Authority	Library name
Isle of Man	Isle of Man Government	Castletown Library
Isle of Man	Isle of Man Government	Family Library (formally Junior Library), Douglas
Isle of Man	Isle of Man Government	George Herdman Library, Port Erin.
Isle of Man	Isle of Man Government	Henry Bloom Noble Library, Douglas
Isle of Man	Isle of Man Government	Isle of Man College Library, Douglas
Isle of Man	Isle of Man Government	Onchan Public Library
Isle of Man	Isle of Man Government	Ramsey Library
Isle of Man	Isle of Man Government	Ward Library, Peel
Wales	Conwy County Borough Council	Llandudno Library
Wales	Conwy County Borough Council	Llanfairfechan Library

Location	Local Authority	Library name
Wales	Conwy County Borough Council	Penmaenmawr Library
Wales	Conwy County Borough Council	Penrhyn Bay Library
Wales	Gwynedd County Council	Bangor Library
Wales	Gwynedd County Council	Blaenau Ffestiniog library
Wales	Gwynedd County Council	Gwynedd Mobile Library
Wales	Gwynedd County Council	Porthmadog Library
Wales	Isle of Anglesey County Council	Amlwch Library
Wales	Isle of Anglesey County Council	Newborough Library
Wales	Isle of Anglesey County Council	Rhosneigr Library
Wales	Isle of Anglesey County Council	Menai Bridge Library
Wales	Isle of Anglesey County Council	Mobile Library
Wales	Isle of Anglesey County Council	Beaumaris Library
Wales	Isle of Anglesey County Council	Benllech Library
Wales	Isle of Anglesey County Council	Cemaes Library
Wales	Isle of Anglesey County Council	Holyhead Library
Wales	Isle of Anglesey County Council	Llangefni Library
Wales	Isle of Anglesey County Council	Moelfre Library
Wales	Flintshire County Council	Flint Library Learners' Centre
Wales	Flintshire County Council	Mold Library and Museum
Wales	Denbighshire County Council	Prestatyn Library
Wales	Denbighshire County Council	Rhyl Library
Wales	Denbighshire County Council	Saint Asaph Library

ANNEX 2 – PHOTOMONTAGES

To assist the understanding of the potential visibility of the RWF a sample selection of representative viewpoints around the wind farm site have been identified from those used during ZAP and photomontages prepared from these locations. These viewpoints have all been selected on the basis that they have open views towards the proposed wind farm and are popular destinations for local residents, walkers and visitors. Several of the viewpoints are also located within or close to areas of nationally protected landscapes including the Anglesey AONB and Heritage Coast, the Great Orme Heritage Coast and the Lake District National Park.

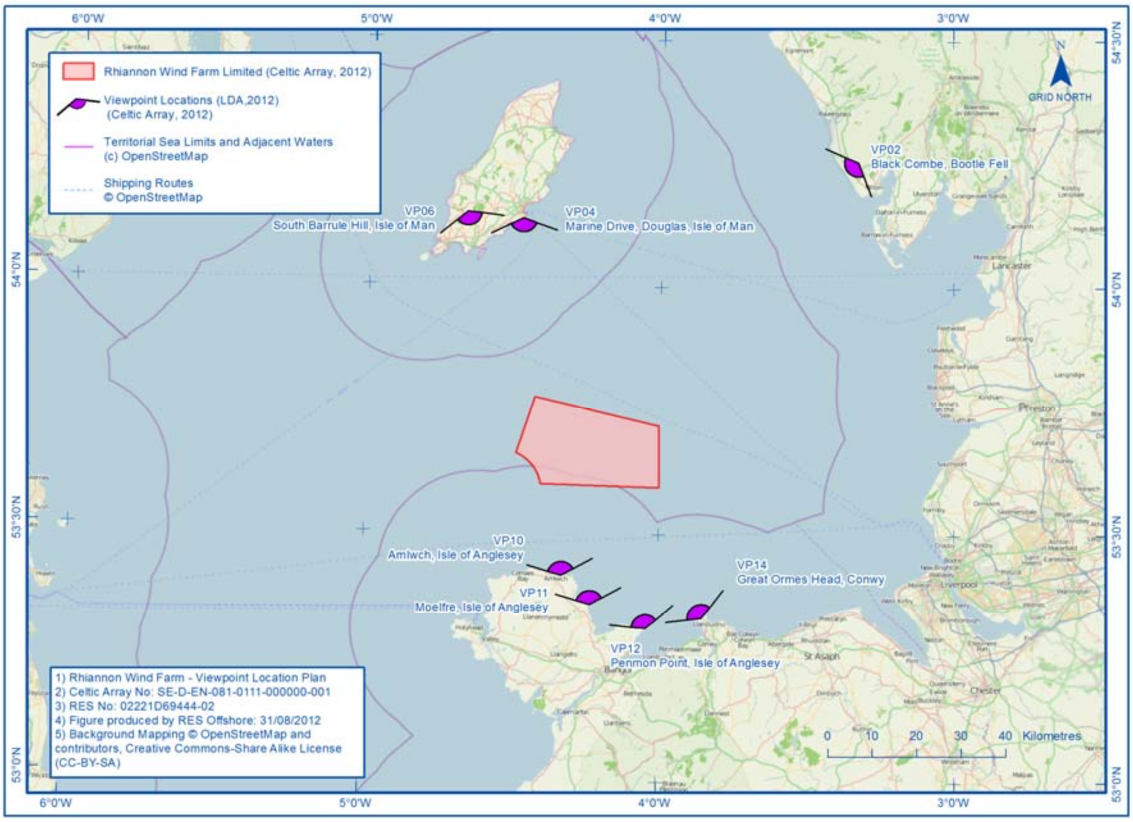

Figure A1 Location of viewpoints used for photomontages

The photomontages are prepared using images taken by a professional photographer. A digital wireframe model of the proposed wind farm is then created and correctly scaled before being placed over the existing image and then rendered to reflect the conditions under which the original photograph was taken. For each viewpoint, photomontages have been prepared to illustrate different options being considered in the engineering envelope described in Chapter 4. Three scheme options were modelled, comprising of 5MW turbines only, 15MW turbines only, and a mixed turbine height scheme of 220 x 5MW turbines with 73 x 15MW turbines to illustrate the visual effects that might arise in the event that a mixed turbine scheme is considered to be the realistic worst case development scenario.

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