WEST OF DUDDON SANDS OFFSHORE WINDFARM

Environmental Statement Non Technical Summary

Morecambe Wind

March 2006

RSK GENERAL NOTES

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TABLE OF CONTENTS

NON-TECHNICAL SUMMARY

An Environmental Impact Assessment (EIA) has been undertaken for the proposed West of Duddon Sands (WoDS) Offshore Windfarm to analyse the development in relation to the existing environment, and to ensure that all potential environmental impacts are identified and assessed. It examines the need for the project; the design of the windfarm and associated works; the construction, operation and decommissioning of the works and appropriate mitigation measures. A combination of field surveys, desktop surveys and modelling techniques have been used to assess the potential impacts of the windfarm. Also detailed and extensive consultations have been undertaken with statutory consultees, non-statutory consultees, interest parties and the public. This document is the Non Technical Summary of the Environmental Statement (ES), which reports the findings and conclusions of the EIA. It is required to satisfy the requirements of the DTI consenting procedure for offshore windfarms.

1 INTRODUCTION

Morecambe Wind Ltd (Morecambe Wind) is a collaboration between three companies; Elsam, Eurus and ScottishPower.

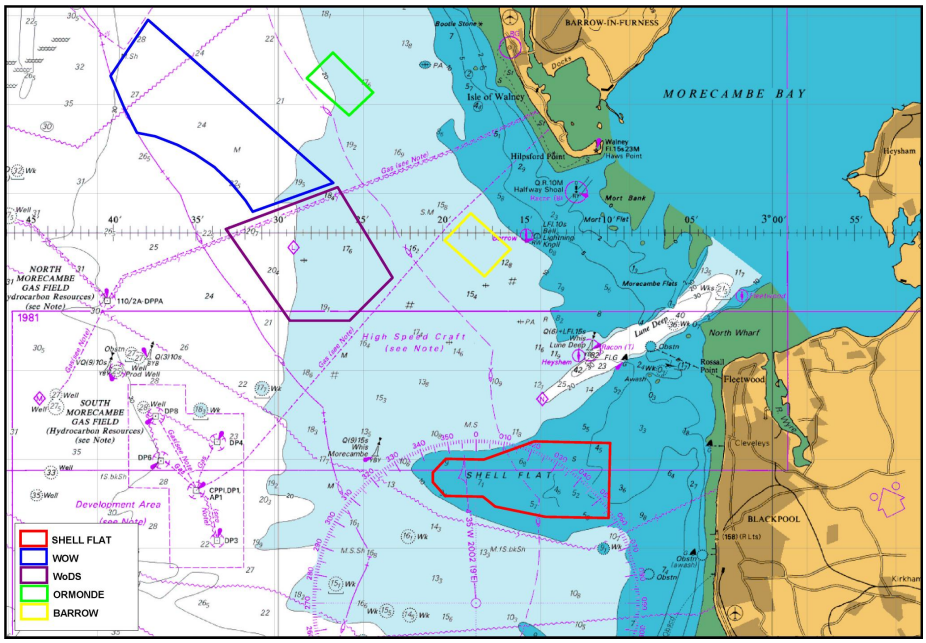
Elsam is a major Danish utility with a substantial windfarm portfolio throughout the EU. It is the world's largest owner of offshore windfarms.

Eurus is one of the worlds most successful windfarm developers and currently operates over 1100MW of windfarms.

ScottishPower is a major British utility and the leading windfarm developer in the UK and USA. It is also involved in commercial trials of wave power off Scotland.

Morecambe Wind is proposing to develop an offshore windfarm and associated infrastructure in an area approximately 14km south-west of Walney Island. The development is referred to as WoDS; and is shown in Figure 1.

Figure 1: Location of the proposed WoDS



1.1 Need For The Project

In relation to the commitments made by the European Union (under the Renewables Directive), the UK is committed to reduce its greenhouse gas emissions by 12.5% of 1990 levels by 2008-2012. The government has more recently set itself a domestic target, beyond the commitments of the European Union, to reduce CO_2 to 20% below 1990 levels by 2010. Offshore windfarms, such as this proposal, play a key role in helping the UK government meet these goals.

It would contribute approximately 5% of the renewable energy required to meet the UK's renewable energy target in 2010.

With a predicted mean generation of 1,752,000MWh per year from the full 500MW windfarm, the result would be enough electricity to supply almost 31% of Lancashire's electricity consumption (based on 2003 figures).

This is equivalent to 372,000 homes. There are 209,027 in Cumbria and 468,868 in Lancashire, a total of 677,890. Household figures are based on numbers of households with residents, obtained from 2001 National Census at <http://www.statistics.gov.uk/>. WoDS would supply over half of all the homes in Cumbria and Lancashire.

2 PROJECT DESCRIPTION

The location is shown in Figure 1.

The Crown Estate owns virtually the entire seabed out to the 12 nautical mile territorial limit, including the rights to explore and utilize the natural resources of the UK Continental Shelf. More recently the Energy Act 2004 vested rights to The Crown Estate to licence the Round 2 windfarms out to 200nm.

The 50-year lease agreement with the Crown Estate (the owners of the seabed) states that the area must not exceed 66km^2 and the installed nominal power must not exceed 500 MW. The proposed turbines will have an operating life of 20 to 25 years, after which Morecambe Wind will either replace or upgrade the turbines.

2.1 Windfarm Layout

As turbines get more powerful they have to be larger, however fewer are needed for the project and the spacing between them increases. The turbines for the project have not been decided and technology is moving quickly towards larger turbines. The largest commercially available today is 3.6MW with an 112m diameter rotor. The layout of turbines within the site will ultimately depend on the number of turbines installed.

To cover the possible designs, 3 scenarios have been assessed in the EIA; 139 turbines of 3.6 MW, 111 turbines of 4.5MW and 83 turbines of 6 MW.

Table 1: Project characteristics & size of development

	Scenario 1	**Scenario 2**	**Scenario 3**
Number of turbines	139	111	83
Power Rating per turbine	3.6MW	4.5MW	6MW
Rotor diameter (m)	90 - 112	110 – 125	120 – 145
Hub height (m above LAT)	83 – 95	90 – 100	100 – 110
Tip height (m above LAT)	137 - 150	149 – 163	167 – 183
Blade Tip clearance	22m MHWS	22m MHWS	22m MHWS
Number of Met Masts	2	2	2
Number of Offshore Substations	2	2	2
Turbine spacing (centre to centre)	N-S 649m E-W 748m	N-S 764m E-W 827m	N-S 827m E-W 1064m
Total area (foundations of all structures)	Monopile: 2,700m^2 Gravity: 62,900 m^2	Monopile: 2.600m^2 Gravity: 61.200 m^2	Monopile: 2.400m^2 Gravity: 58.700 m^2
Total area (foundations + scour protection)	Monopile: 48,200m^2 Gravity: 272,900 m^2	Monopile: 40.300m^2 Gravity: 240.300 m^2	Monopile: 31.600m^2 Gravity: 204.400 m^2
Total area disturbed during installation of 175km (sc.1) – 150 (sc.3) km of offshore cable (5 m wide disturbance zone assumed)	880,000m^2	810,000m^2	740,000m^2

Scenarios shown in table 1, are shown in Figures 2 – 4. Each take into account a number of restrictions such as:

- Minimum rotor radius clearance from the center of each wind turbine to the boundary of the windfarm;
- A minimum distance from oil/gas pipelines and electrical cables measured from the center of turbines;
- Locations of wrecks and other seabed obstructions; and
- Alignment of turbines in straight lines adjacent to key navigational routes where possible.

Figure 2: Scenario 1:139 pcs. of 3.6 MW turbines

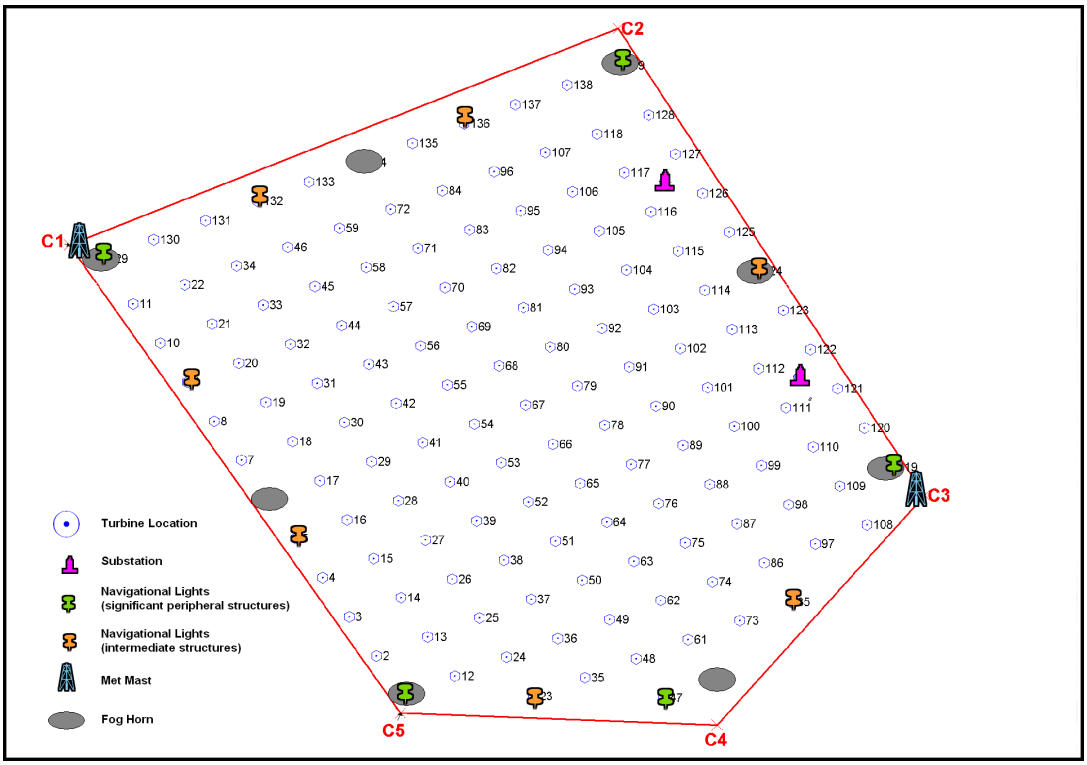


Figure 3: Scenario 2:111 pcs. of 4.5 MW turbines

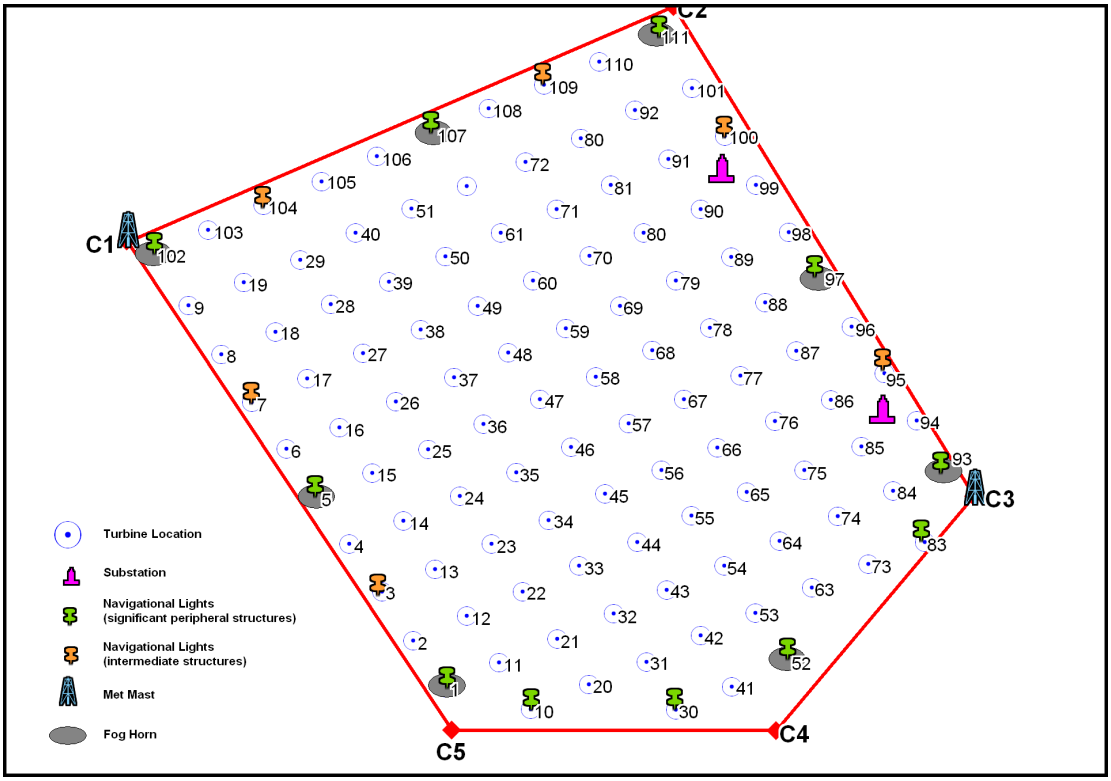
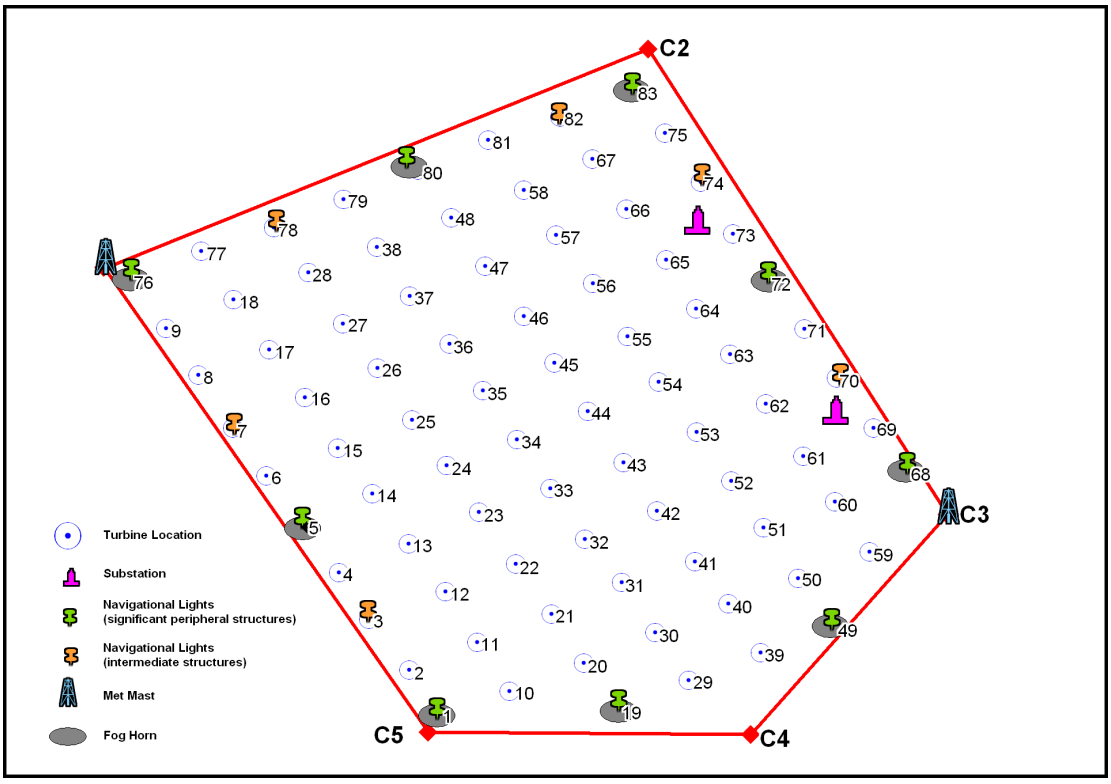


Figure 4: Scenario 3:83 pcs. of 6.0 MW turbines

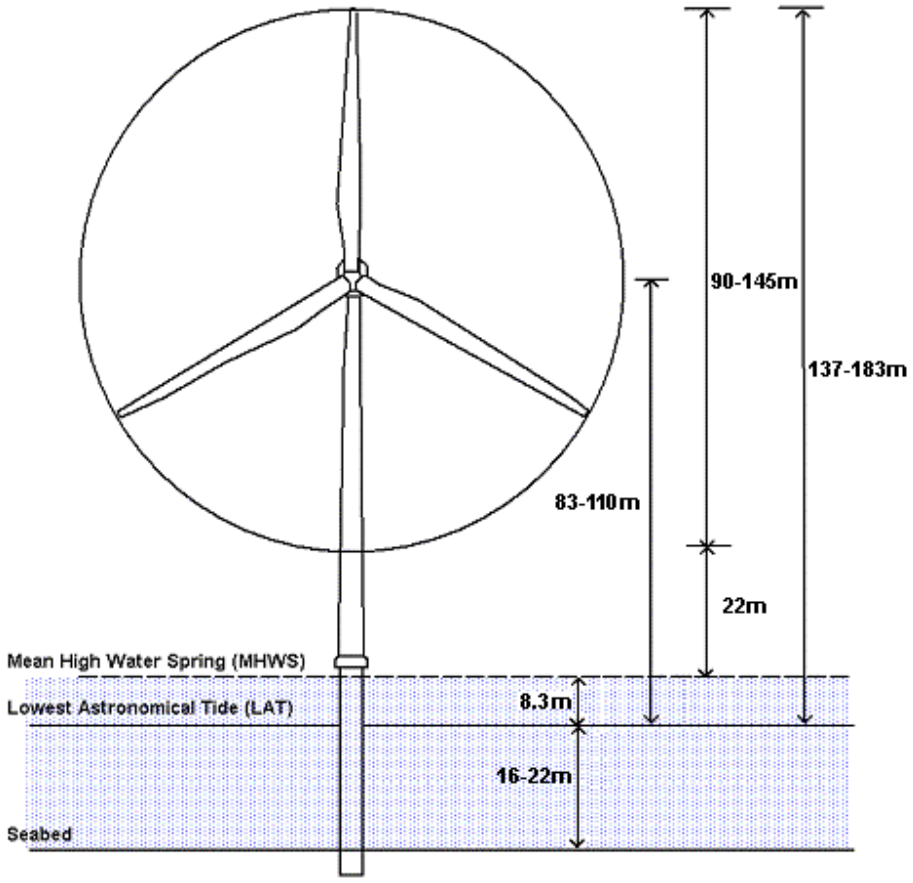


Spacing between turbines (centre-centre): N-S: 827 m , E-W: 1064m

2.2 Wind Turbines

The exact model and type of wind turbine will not be decided until the windfarm has obtained formal consent from the DTI. The in principle design of the wind turbine is represented in Figure 5. Figure 6 presents a photograph of a typical turbine design.

Figure 5: In principle design of the turbines showing realistic interval of dimensions



Current technology uses blades made from fibre-reinforced epoxy and steel towers. The turbines will be semi-matt pale grey in colour.

Safety & identification features

Because of the project's height, turbines on the corner and turbines on the boundary of the site at 2nm intervals will have red lights, to comply with the recommendations of the Civil Aviation Authority. Similarly, for shipping and navigation, every corner turbine and some intermediate turbines along the windfarm boundary will have flashing yellow lights, which will be positioned approximately 12m above the high tide and below the level of the turbine blades. In addition, each corner turbine will be fitted with a foghorn, and all towers, met masts and substations will be coloured yellow to the height of the lights. Each turbine will have a unique identification number.

Figure 6: Typical turbine design

2.2.1 Foundations

The foundations need to provide sufficient strength to transfer the different type of loadings (weight, wind and waves) acting on the structure to the surrounding soil.

The different foundation options being considered for the WoDS project are described in Table 2.

From an environmental impact point of view the main characteristics of a foundation are defined by its:

- Influence on flow/wave patterns (size and shape of foundation in water column);
- Sediment transport (size and shape close to seabed);
- Necessity for scour protection (structural performance);
- Installation activities (noise, risks and seabed levelling); and
- Decommissioning (total or partial removal).

These characteristics are assessed for each potential foundation type in each of the relevant sections.

Table 2: Turbine Foundation Construction Options

Foundation type	Monopile	Tripod	Gravity	Suction Caisson	Jacket type
Description/Construction Method	Single pile, inserted by either drilling & grouting; driven using pile drive hammer, or using a combined drill/drive process	Foundation placed directly on seabed & fixed by 3 piles, driven through sleeves. Secured by grout or by a hard-pressed connection (Hydro-lock)	Concrete base plate with centre column, with some ballast (typically rock)	Large diameter steel bucket filled with seabed material by partial vacuum	4+ legs connected by inclined tubulars
Diameter	5-6.5m	.3-.5m (tripod piles) 5-6m (centre pile) 25m (total footprint)	6m (centre column) 25m (base plate)	5-6m (centre column) 14-18m (bucket)	Not stated
Scour protection needed?	Dependent on seabed/current conditions	Dependent on seabed/current conditions	Yes	Yes	Dependent on seabed/current conditions

NB. The Jacket Type foundation construction option is only under consideration to provide the foundation for the substations

2.2.2 Scour protection

When something is placed on a soft sediment (sand/mud) seabed, the waves and currents may quickly erode the area around the item concerned. This is known as scouring. .

For the foundation options described above, the gravity foundation and the suction caisson always require scour protection.

In general deep foundations i.e. monopiles or tripods with piles, can be designed to ensure safe functioning when scouring occurs, which stabilises after several tidal cycles. If a scour hole is not stable scour protection will be required.

Scour protection involves either stones or a similar heavy material laid in a belt around the foundation preventing seabed material from moving with the tide/current. Sometimes an artificial seaweed (fronds) are built into the scour protection.

Morecambe Wind will decide the scour solution during the technical design phase. The preferred option is to minimise the need for scour protection, however, from the geophysical survey and the grab samples taken, showing that the upper seabed sediments consist of fine sand, it is expected that the foundations will be susceptible to scouring.

2.2.3 Secondary Structures

To complete the foundation structure a number of secondary structures will be attached. The most important are:

- Service Platform;
- Boat landing structure; and
- J-tubes.

The service platform will be located around the base of the tower and possibly equipped with an extension serving as a lay-down area for larger components hoisted down from the turbine nacelle.

Steel pipes protect the personnel access ladder and will act as boat buffers serving the main access points from sea.

The j-tubes hold and protect the cables to and from the structure. They can be attached to the inside or outside the foundation structure. If the j-tubes are run on the inside they will exit the structure near the seabed. If run on the outside the j-tubes will be supported on a number of attachments connected to the foundations.

2.2.4 Corrosion Protection

In the offshore environment, steel has to be protected against corrosion. In principle there are several options in the form of surface protection and corrosion allowance (i.e. designing the structure taking into account that some will be corroded). The foundations are expected to be protected using a combination of these.

2.3 Offshore Substations

Two offshore substations will collect the generated energy, transform it to a higher voltage and transfer it to the shore via 2 cables. The location of the substations will be dependent on the final design of the turbines, but indicative locations are provided in Figures 2-4.

The main structure will be approximately 25m x 28m x 15m, and is likely to be constructed of a steel tubular space-frame forming two decks. These will support the main equipment, consisting of a workshop, an equipment store, emergency accommodation for windfarm personnel, potentially a helideck, an emergency diesel generator, including a diesel storage tank; and bunding for all oil equipment (large transformers).

The foundation could be similar to the foundations of the turbines or it may be a Jacket type, i.e. a welded steel structure with 3 or 4 legs and stiffened by diagonal bracing (Table 2).

2.4 Meteorological masts

Two anemometer masts will be required to monitor wind over the project life. Their proposed locations are shown on Figures 2 to 4. Their foundations would be similar to the range described for the turbines.

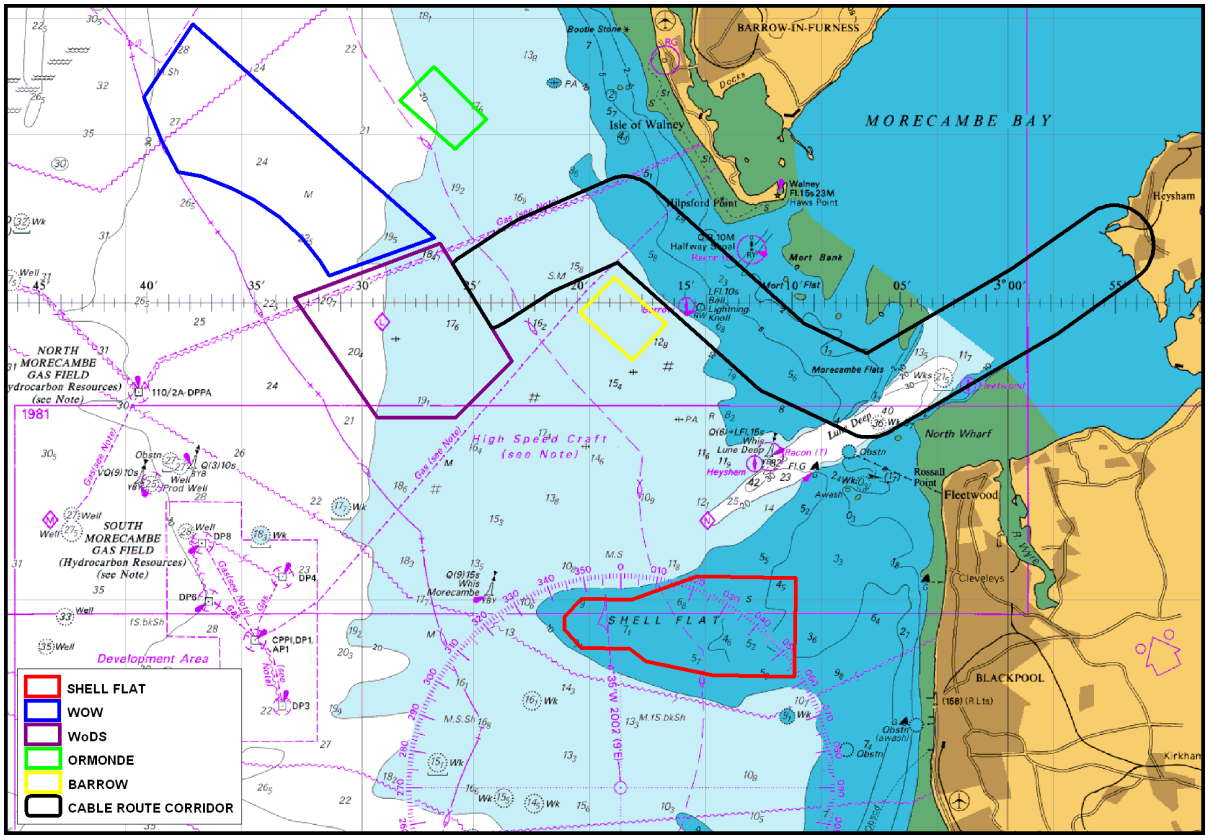
2.5 Control system

A Supervisory Control and Data Acquisition (SCADA) system will be installed at the onshore operations base to gather information from the individual wind turbine generators, substations and meteorological masts via a communications cable installed within the power cables. It provides the facility to monitor and control the project remotely.

2.6 Offshore cables

The wind turbines will be interconnected with others and also the substations within the turbine area by cables buried in the seabed, typically at 33kV. Two higher voltage (e.g. 220 kV) 3-core cables with submarine armouring, approximately 35 km long, will transfer the electricity generated by the windfarm to a common landfall from the offshore substations. The exact route has yet to be decided, although it lies within a defined route corridor. See Figure 7.

Figure 7: Location of WoDS and Offshore Cable Corridor



2.6.1 Offshore Cable Installation

The cables can be divided into three groups:

- The 'inter turbine' cables connecting the turbines to each other and the offshore substations;
- The 'export' cables connect the offshore substations to the shore; and
- The 'onshore' cables connect the export cables to the grid connection point at Heysham Substation.

To protect against potential damage, various environmental interests and also to protect other sea users the cables will be buried in a variety of ways, depending on local conditions (Table 3).

Table 3: Cable types, installation and scour protection

Cable Type	Inter Array Cables	Export Cable	Onshore cable
Connection from /to	Turbines to each other & offshore substations	Offshore substations to landfall	Onshore cable to grid connection point at Heysham substation
Target burial depth (dependent on location)	~ 1m	Up to 3m	Approximately 1.5m
Burial method	Jetting system	Plough for majority of route; cutting chain or wheel for harder substrate or jetting where necessary.	Open cut trench with e.g. JCB; or non-intrusive means e.g. horizontal directional drilling for passing under sea defences
Scour protection	Rock dumping or mattresses may be required	Rock dumping or mattresses may be required	N/A

2.6.2 Cable Crossings

Specifications for protection where the WoDS cables cross existing cables and pipelines need to be agreed between the owners. The crossed pipe/cable needs to be structurally protected from the weight and effects of the new cable. WoDS has 5 crossings with existing infrastructure (Centrica/HRL & Burlington). WoDS is working with other windfarm developers to minimise the possibility that they will need to cross each others cables.

2.7 Onshore cables, landfall and grid connection

The offshore export cable may have 5 potential landfall locations and 7 alternative onshore cable routes which have all been assessed as part of the EIA. The landfall for the sub-sea cables will be in the vicinity of Heysham harbour. The sub-sea cables will be jointed to underground cables. An underground concrete chamber (unlikely to be larger than 10m x 5m x 2m) may be required, in which the subsea cables will be jointed to the onshore cables.

The existing Heysham NGC substation needs to be extended to hold the equipment needed to connect the windfarm into the existing 400kV transmission network.

2.7.1 Landfall construction Works

Burial is required at the landfall to protect the cable and also to allow it to pass under existing sea defences. Cable burial depth will be further influenced by wave action on the beach, but is expected to be 3m below seabed level. A pipe will be laid within the sea defences through which the cable will be pulled.

The cable-laying vessel will get as close to shore as possible. The cable will be pulled off the vessel and dragged to the pipe and pulled through.

2.7.2 Onshore cable installation

The onshore cables will be buried to an extension beside the existing NGC substation at Heysham, approximately 1.5 km inshore.

A temporary construction area to accommodate site offices, storage facilities, canteen, toilets and car

parking will be required. The area will be fenced off and gates will prevent unauthorised access.

During construction, all activities other than access and cable storage will be confined to a defined working width. This will generally be 5.0m wide, although additional land may be required at certain locations such as road and railway crossings and in the vicinity of the landfall to facilitate safe construction practices.

2.8 Turbine and Foundation Installation

The construction works schedule will be optimised with the construction contractors to account for:

- The final project specification;
- Anticipated weather; and
- Availability of vessels.

It may be optimal to complete some of the infrastructure works a year ahead of the first turbine delivery to site. This scenario would involve construction and commissioning over a 2 year period. An alternative scenario is that all works are completed within 1 year facilitated by sufficient vessels and manpower.

2.8.1 Construction Programme

The construction of the offshore windfarm is currently planned to commence in 2009. An indicative outline programme for construction works over 2 years is given in Figure 8.

In general it is desirable to erect turbines in the period May – September, as this is when winds are usually lightest and sea conditions are calmest.

A 24-hour working period within health and safety guidelines will be used to carry out all activities offshore. This strategy will reduce the overall duration of construction to a minimum reducing the risk of weather interruption.

2.8.2 Construction Vessels

During construction approximately 20 vessels will be present on site simultaneously. Daily traffic would include construction vessels, such as barges, tugs, service vessels and jack-up platforms to assist with cable installation, turbine installation, and guard boats.

Figure 8: Indicative Construction Programme (2009-10 shown here)

ID	Operation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1	Mobilisation								
2	Delivery of Plant to Preassembly Base								
3	Foundation Installation								
4	Scour Protection Laying								
5	Installation of Wind Turbines								
6	Installation of Internal Grid								
7	Installation of Offshore Substations(s)								
8	Installation of Offshore Cables								
9	Onshore Landfall								
10	Testing and Commissioning								
11	Demobilisation								

2.8.3 Construction Aspects

Installation of foundations/turbines/met masts/substations

The basic requirement is to provide stable facilities for drilling, hammering and lifting operations. Typically vessels include traditional jack-up barges, conventional floating barges and new purpose-built installation vessels

Figure 9: Purpose built windfarm construction vessel (Source: MPI vessel "Resolution", (Kentish Flats, Elsam)

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2.9 Windfarm Operation

To ensure correct and efficient operation of the project, maintenance activities will need to be carried out. These can be categorised into distinct sections

- Scheduled Activities (annual maintenance to turbines and substations);
- Un- Scheduled Activities (miscellaneous faults and repairs); and
- Major Component Replacement (Blades/Gearbox and broken power cables).

2.10 Decommissioning

Decommissioning of the windfarm (including the removal of the turbines and foundations) is a requirement upon the project by the Crown Estate. It will be based on best industry practice at the time.

It is anticipated that the decommissioning of the windfarm will take a similar period of time and require similar construction practices in reverse, when compared to the construction of the windfarm.

3 ALTERNATIVES

3.1 Alternative Locations

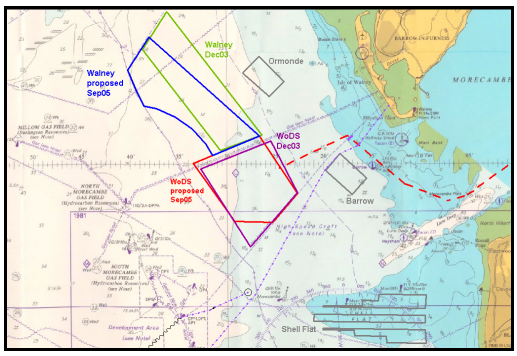
In 2002 the Consortium (Morecambe Wind) identified several areas of interest based upon suitable seabed, proximity to electrical grid connection, water depth (less than 30m), optimal wind resource known environmental constraints and the DTIs Strategic Environmental Assessment (SEA). http://www.offshore-sea.org.uk/consultations/Wind_R2/offshore_wind_SEA_final.PDF.

Sites were identified in the Wash and the northwest SEAs. WoDS is one of 15 Round 2 (R2) developments allocated by the Crown Estate in

2003. The consortium submitted tenders to the Crown Estate for those sites which are known as the Round 2 (R2) sites.

The shape of WoDS was delineated by existing pipelines, cables and military exclusion zones to the north and to the south. To the east the project had to avoid the consented Barrow Offshore Windfarm, (BOW) the proposed Ormonde Offshore Windfarm and obey the requirement to be between 8 and 12km from shore (exclusion zone for R2 for visual reasons). During the initial stages of planning the location issues with navigational routes were identified, and the site was adjusted to increase clearance distances for vessels. The relocated site is illustrated on Figure 10.

Figure 10: Development of the Site Area



3.2 Grid connection alternatives

The WoDS grid connection point was a choice of 3 onshore locations: Barrow, Heysham and Stanah. A balance is required between the environmental cost, construction cost, security and the time to deliver all sections of the connection. These include the subsea, landfall and onshore sections of the cables, the onshore substation and knock-on upgrades required to the immediate electrical grid network.

3.3 Selection of Onshore Site

The chosen connection to Heysham links the project to the most secure local point on the system (electrically). The existing substation has adequate space around it for the small extension required for the project.

4 LEGISLATION

There are two possible routes for obtaining the marine consents necessary for the construction of an offshore windfarm. Morecambe Wind have chosen to seek consent under the following legislation:

Offshore Consents:

- Food and Environment Protection Act 1985 (FEPA) – Section 5;
- Electricity Act 1989 (EA) – Section 36, Section 36a and 37;
- Coast Protection Act 1949 (CPA) – Section 34.

Onshore Consents:

- Town and Country Planning Act 1990;
- Provisions of the New Roads and Street Works Act 1991;
- Land Drainage Act 1976, Section 34.

Environmental Impact Assessment:

- The Town and Country Planning (Environmental Impact Assessments) (England and Wales) Regulations 1999 implements European Union (EU) Directive (85/331/EEC).
- The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000.
- The Food and Environment Protection Act 1985.
- The Harbour Works (Environmental Impact Assessment) Regulations 1999.
- The Habitats Directive 92/43/EEC.

4.1 International & Domestic Policy Framework

The United Nations Framework Convention on Climate Change ("The Kyoto Protocol"), signed by the UK in 1992, committed signatories to take measures aimed at reducing emissions of carbon dioxide and other greenhouse gases to their 1990 levels. The EU Renewables Directive (2001/77/EC) sets out national targets for consumption of energy from renewable sources in terms of a proportion of total electricity consumption for each member state. The UK's indicative target is set at 10%.

The UK Government's Renewables Obligation, introduced into UK legislation by the Utilities Act 2000, requires licensed suppliers to ensure that a proportion of the electricity they supply is from renewable sources, rising to 15% in 2015.

4.1.1 Regional Planning Policy Guidance Framework

The Government Office for the North West, in partnership with the Environment Agency, North West Regional Assembly, North West Development Agency and Sustainability North West, has

produced a report "From Power to Prosperity" (2001) which contains a target for the development of four offshore windfarms (total of 588MW) within the North West by 2010. The development of WoDS with a proposed installed capacity of 500MW would make a significant contribution towards meeting this target.

There are a number of structure plans relevant to the windfarm which have been taken into account. These include:

Cumbria County Structure Plans

- Policy R44 Renewable Energy Projects; and
- Policy ST4 Major Development Proposals.

Lancashire County Structure Plans

- Policy 25 Renewable Energy Projects;
- Policy 20 Landscape Management; and
- Policy 23 Coastal Zone.

Note: The Lancashire County Council Structure Plan 2001 – 2016 (March 2005) states that with the exception of associated onshore infrastructure, offshore windfarms fall outside of the remit of the landuse planning system. However it does state that the development of offshore windfarms will be supported.

5 SUMMARY OF ONSHORE ENVIRONMENTAL IMPACTS

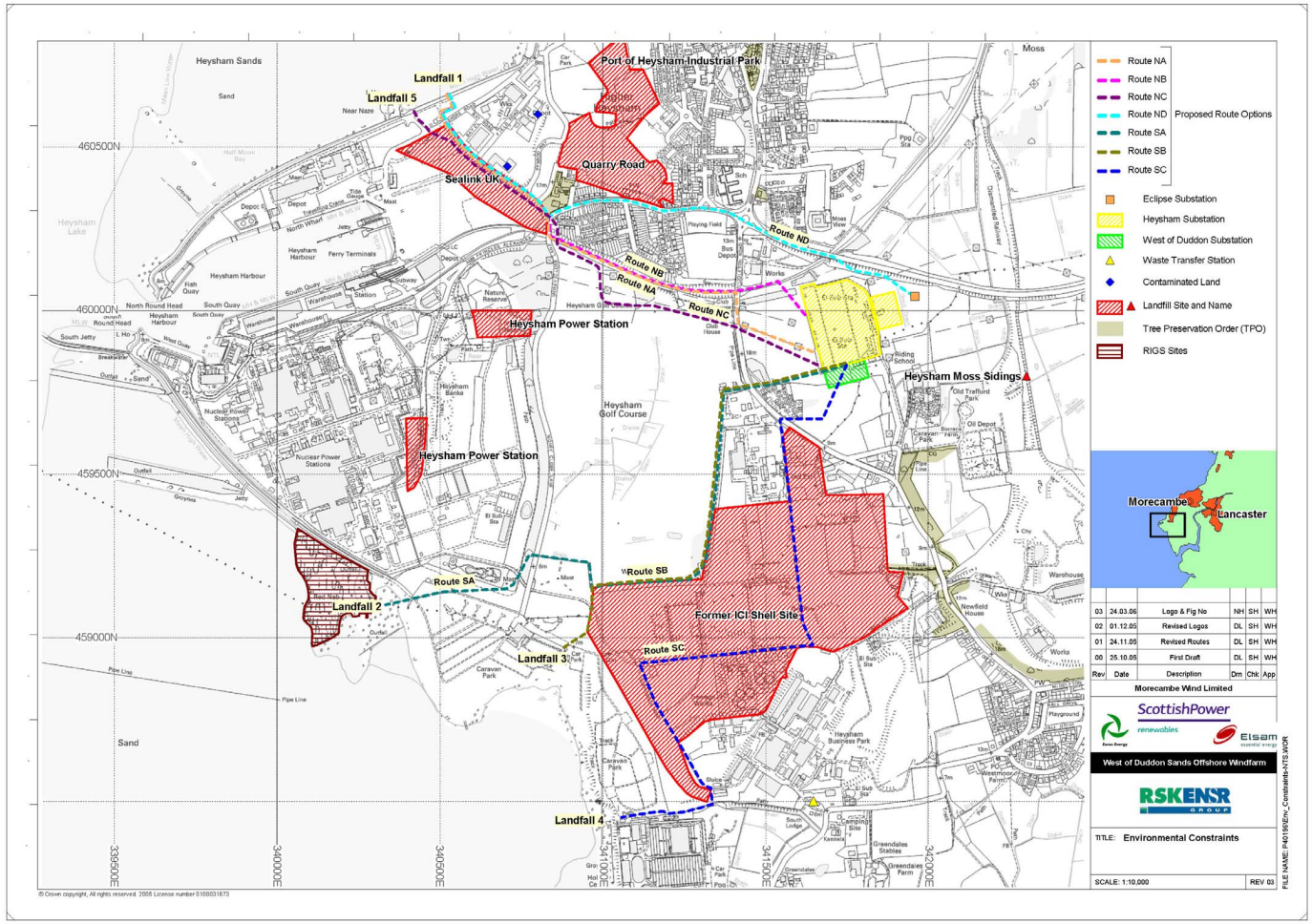
The environmental impacts have been separated into two sections – one dealing with the onshore impacts (as follows) and the other dealing with the offshore impacts (Section 6).

5.1 Route Descriptions

Seven alternative onshore cable routes utilising five potential landfalls have been assessed as part of the EIA for WoDS (Figure 11).

From the landfalls around the Heysham coast, the proposed cable routes head in a general easterly direction towards the existing substation for Heysham Power station. The majority of the routes are along existing roads and tracks with only small amounts of undisturbed land being affected.

Figure 11: Onshore Cable Route Environmental Constraints



5.2 Human Impact

5.2.1 Employment

It is anticipated that during the 2 year construction period there is potential for creation of approximately 200 full time jobs and approximately 30 to 40 staff to run the local maintenance facility during the operational life of the project. The project may also act as a catalyst to attract a new industry to the area capable of producing and maintaining wind turbines, towers and foundations and associated equipment.

During the construction period there may also be additional benefits for the local economy, particularly from utilising local service industries, the provision of employment for local people and the requirement for accommodation for the majority of the workforce. However, due to the small numbers involved, any effect is likely to be negligible.

5.2.2 Landscape and Topography

The area of the proposed onshore cable route is bounded by the sea to the west. Much of the landscape is typically low lying, being characterised as Low Coastal Drumlins, although the area surrounding Heysham Power Station falls under the Suburban Landscape Type. The coastal edge provides extensive sandy beaches at low tide, with the sea wall, harbour and coastal defences forming a man-made element in the natural landscape.

Some temporary visual impact will occur due to the cable laying activities, vehicle movements and construction compound. The main effect to receptors would be the drilling through the sea wall from the beach (should this option be chosen following consultation with the Environment Agency (EA)), which would result in significant, short-lived impacts to visitors and local people using the beach or coastal tracks, in addition to local residents. Visual impacts from elsewhere are expected to be minimal. No mitigation measures are considered necessary during construction works to mitigate the landscape or visual impact, as the construction period will be short-lived and the route reinstated upon completion.

5.2.3 Infrastructure

Depending upon the final route chosen, it will be necessary to lay the cable within the highway at various locations. There may be some minor disruption to traffic in the area during the construction period. Some of the cable route may also be situated within an existing railway line, and pass close to high-voltage overhead electricity cables, although no impacts are anticipated.

5.2.4 Planning

The areas of the cable routes are covered by a number of local, regional and national planning policies, guidance, legislation, and designations, relating to issues such as land use, tourism, renewable energy, and protected species. All relevant legislation and guidance has been adhered to during the consultation process and all necessary consents will be obtained for construction and operation. Where a route option crosses or is in the close vicinity of a significant planning application, careful consultation with Lancaster City Council will be required to minimise any potential impacts, although it is anticipated that these will be negligible.

5.2.5 Recreation and Tourism

Recreational facilities within the vicinity of the proposed cable routes include Heysham Golf Course, Heysham Nature Reserve, two caravan sites, a campsite and two areas of urban green space. Construction may cause disruption to the use of these facilities. Tourists to the area may also experience very minor traffic delays as a result of the presence of construction traffic.

Some of the cable routes may cross public rights of way and footpaths. Public access will be maintained where practicable, and any periods of closure will be as short as possible, and advertised in advance by the construction contractor.

5.2.6 Archaeology

A number of features of cultural heritage interest have been identified in the broad study area, although only a few are in close proximity to the cable route(s). However, all of the route options under consideration are almost entirely within modern highway and are likely to have been extensively disturbed in the recent past.

When a preferred cable route has been selected, a more detailed archaeological desk based assessment will be undertaken, and appropriate mitigation measures (e.g. watching brief during construction) will be carried out to deal with any remains encountered.

5.3 Biological Impact

5.3.1 Statutory and Non-statutory Nature Conservation Sites

On the basis of rich habitat type and importance to birds, Morecambe Bay is a Ramsar Site, Special Protection Area (SPA) and Special Area of Conservation (SAC), all of which are crossed by all proposed offshore and landfall cable route options. Some of the landfalls also cross Sites of Special Scientific Interest (SSSI). In addition, several non-

statutory nature conservation sites are located within 500m of the cable routes. During construction there is likely to be some temporary disturbance to the sandflat habitat at the chosen landfall location.

5.3.2 Vegetation and Habitats

The length of habitat crossed by the cable will vary considerably depending on the route selected. The majority of each route lies within existing roads/tracks or railway lines and goes through vegetation of little ecological importance, such as improved grassland; any more diverse areas will not be directly affected by the cable route. The potential for adverse impacts is negligible.

5.3.3 Intertidal Ecology

A number of biotopes are found along the shore including concrete sea wall, intertidal sand flat, shingle and some ecologically valuable and sensitive saltmarsh at one of the landfalls. The intertidal environment in the area is often not pristine and is subjected to a degree of anthropogenic influence from activities such as coastal defence, recreational beach use, littering, mussel cultivation and bait digging. With the exception of the saltmarsh area at the Ocean Edge Caravan Park and the Red Nab geological feature, there are no rare, endangered or unique species or habitats located at the sites under study, for the five landfall options.

Construction in the sandy intertidal areas will result in the disturbance of sediment and some very localised smothering of benthic communities and temporary suspension of sediment in the water column. It is important that no disturbance is caused to the saltmarsh feature or particularly the Red Nab rock formation, which has been afforded legislative protection.

5.3.4 Protected Species

Great crested newts, water voles, and breeding and roosting birds may all be found adjacent to some of the proposed cable routes, and be potentially impacted during construction.

Detailed mitigation measures will be discussed and agreed with authorities such as English Nature and RSPB to minimise any impacts. And may include additional surveys to establish presence/absence, newt exclusion fencing and trapping by licensed handlers, construction timing to avoid seasonal (e.g. nesting) sensitivities, undergrowth removal to deter habitat use and restrictions on working should populations of e.g. wading birds be deemed to be affected.

5.4 Physical Impact

5.4.1 Soils

A large proportion of the onshore cable routes will be laid in roads, or alongside railway lines. Outside these areas, soils are unclassified due to a lack of survey data. It is expected that the soils are not of high quality and prone to waterlogging. No long-term impact on soils is anticipated if standard cable removal and reinstatement procedures are adopted.

5.4.2 Geology and Geomorphology

All of the proposed route options are underlain by the same superficial and solid geological units. The superficial deposits mainly comprise tidal flat deposits, which are fine to medium-grained sands containing shell fragments. Underlying the sands are the red brown sandstones of the Sherwood Sandstone Group, and the Millstone Grit Group. Due to the low-lying nature of the land, the small scale of the works and the presence of made-ground in much of the western section of the study area, impacts on bedrock, topography and overburden are not expected to be significant.

5.4.3 Landfill Sites and Contaminated Land

Several licenced landfill sites, sites of potential contamination and pollution incidents, are recorded n close proximity to the potential onshore cable routes, which include a former ICI/Shell Site and a waste transfer station. There is potential, therefore, to encounter made ground and contaminated land in this area and that the proposed routes may cross land designated for future filling. Where cable route options pass through the Sealink UK landfill site, ICI/Shell 2 landfill site and the Shell/ICI oil refinery site at Middleton Wood, impacts to groundwater, surface water and soils may occur as a result of potential contaminants. Should contaminated ground be encountered during construction, mitigation measures will be incorporated into the trench design (e.g. inserting clay plugs into the trench to prevent contaminant transfer during operation) and advice will be sought from the Environment Agency (EA). If a decision is made to pass through the ICI/Shell landfill site/refinery site working procedures will need to be agreed in advance with the EA and the Environmental Health Department of the local council. No impact from contaminated ground is anticipated during the operational life of the cable.

5.4.4 Surface Water

The proposed cable routes do not cross any major watercourses, but do cross several small, poor quality drainage ditches and dykes. These will be temporarily flumed or blocked during construction, and this will be performed swiftly to minimise

impact. Where flows are high, fluming of the minor watercourse will be carried out to temporarily redirect the flow around the construction area. All trench water, or water resulting from dewatering, will be disposed of in consultation with the EA and discharge consents obtained as necessary.

5.4.5 Hydrogeology

The underlying Sherwood Sandstone Group may be highly productive as an aquifer and able to support large abstractions for public supply, while the Millstone Grit Group rocks constitute a minor aquifer and may be useful as a local water source. No direct impact on aquifers is anticipated during construction or operation due to the shallow depth of the trench. During construction, Method Statements as part of a scheme-specific Environmental Management Plan will be adhered in order to ensure no contaminants are accidentally released into the groundwater system.

5.4.6 Flooding

There is a relatively low potential for flooding events across the area. However, short lengths of the southern cable route options are at risk from marine flooding. Measures will be incorporated into the construction method statement to ensure that there are no adverse effects from construction should a flood event occur. The construction of the proposed cable will have no impact on existing marine flood defences, as the sea wall will be crossed using a non-open cut method should that route be selected.

6 SUMMARY OF OFFSHORE ENVIRONMENTAL IMPACTS

Impacts to the human, physical and biological environment have been considered for Morecambe Bay and surrounding areas.

6.1 Employment, Enterprises & Services

During the 2-year construction phase of WoDS, it is anticipated that approximately 200 jobs will be created.

Suitable deep-water ports are available including: Barrow, Heysham, Fleetwood, Warrenpoint, Belfast, Dublin and Cairnryan. The project will therefore be able to draw on the support services of these ports as required, which will potentially assist in sustaining employment levels or increase employment opportunities locally.

Morecambe Wind will liaise with the local Enterprise Boards and set out to maximise local business awareness of opportunities for employment and procurement.

The operation of the windfarm will require the permanent employment of up to 30 to 40 people, who will all be based locally. There will also be the requirement for associated support services including supplies, support vessels and maintenance.

Given the timescales involved and the likely developments in technology and associated economics, it is difficult to predict the potential impacts associated with decommissioning, but it is likely that they will be similar to that during construction.

6.2 Commercial Fisheries

Baseline research indicates that the WoDS site has recently sustained occasional activity from a limited number of vessels. Of the vessels with a history of more regularly fishing the site, one and possibly two of these have recently relocated to the North Sea.

Recent patterns of declining effort and landings, the average age of the vessels involved, the possibility of future decommissioning and little prospect of increased fishing opportunities in the Eastern Irish Sea, all suggest that there will not be any material growth of this industry in the general area of WoDS in the immediate and near future.

During Construction

Safety Issues for Fishing Vessels

During the construction activities, in line with normal offshore practice, areas of the windfarm site will be closed to all vessels, including fishing vessels, other than construction vessels. A third of the site could be closed at any time, and the area could change on a monthly basis.

Similarly, for the export cable installation, a 500m safety zone will apply around laying and trenching vessels and appropriate arrangements will be made in the confined approaches to Heysham Port. During periods between cable laying and burial, a temporary safety zone will be in place along any unburied cable sections.

The standard fisheries liaison and notification procedures for the installation of offshore structures will be implemented. In line with standard offshore practice contractors will be required to remove all construction related debris that could constitute obstacles to fishing.

Adverse Impacts on Commercially Exploited Species

Dealt with in biological impacts. See Section 6.15

Complete Loss or Restricted Access to Traditional Grounds

The extent to which this loss of area will impact commercial fishing will be a function of:

1. The number of vessels involved;
2. The extent of their traditional activity in the site; and
3. Whether similar catch rates can be achieved in other areas.

The available evidence suggests that of the over 15m vessels, only 2-3 vessels have a track record of any regular activity in the site and at least one of these has recently moved to the North Sea. The announced increase of 39% in the 2006 North Sea Nephrops quotas may induce further fishing effort to be relocated to the North Sea.

The obtained evidence also suggests that the site is not a principal fishing area for under 10m vessels, with the larger proportion of the activity that has occurred being from a limited number of vessels based at Barrow. In view of the limited number of vessels involved, and the limited history of activity within the site area it is expected that the overall impact from loss of fishing area will be no greater than minor.

Interference with Fishing Activities

With the exception of restricted access to grounds, the only other potential interferences to fishing relate to the installation of the export cables. The only material impact to fishing could be a very short-term displacement of the River Lune salmon netters. The salmon fishing season runs from 1 June to 31 August with fishing prohibited at weekends. If possible, the installation of this section of the cable will be scheduled to minimise interference with this activity.

As with other offshore cable installations, the short duration and small area involved will only result in short term displacement resulting in minimal interference.

Increased Steaming Times to Fishing Grounds Impact

The five main ports where vessels could be impacted by increased steaming times or increased steaming distances to fishing grounds are Fleetwood, Barrow, Whitehaven, Maryport and Kilkeel. In the case of Kilkeel vessels steaming to their Eastern Irish Sea Nephrops grounds, virtually all of the steaming tracks from Kilkeel to their traditional grounds pass to the north of the site. Similarly, vessels steaming south from Maryport and Whitehaven to the Nephrops grounds will not be impacted.

In view of the limited number of vessels that could potentially be affected, it is expected that there will only be a minor impact on increased steaming times.

During Operation

Safety Issues for Fishing Vessels

Seafish is currently undertaking a study into 'The Impacts of Wind Farms on Fishing Activities', the final detailed report of which has yet to be made available. The majority of fishermen consulted were of the opinion that it would not be safe for trawlers to operate within windfarm sites due to the potential for hooking trawl gears on sub-sea structures, pipes and cables.

It is also recognised that partially or unburied cables are vulnerable to hookings from trawl doors, beam trawls and shellfish dredges. In view of the uncertainty of the inter-field cables remaining sufficiently buried during the life of the windfarm and the potential risks of towed gear hookings, for the purpose of this assessment it is taken that all trawling and shellfish dredging, irrespective of vessel size, will be excluded from within 500m of the foundations.

In good weather and visibility, it is possible that certain static gears such as potting and netting could be safely deployed within the site. This may however require modifications to gears and operating practices, particularly in respect of tidal drift. However, it is appreciated that the final Seafish study may draw different conclusions.

Adverse Impacts on Commercially Exploited Species

There may be a moderate negative impact from electromagnetic effects confined to elasmobranch species. As skates, rays and dogfish species comprise less that 5% of the overall values of landings it is not expected that electromagnetic effects will have any significant effect on commercial fishing.

Complete Loss or Restricted Access to Traditional Grounds

As trawling is expected to be excluded from within the site on safety grounds, the loss of access for trawlers is as discussed above.

As stated above, it is possible that static gears such as potting, lining and fixed netting may be feasible within the site under certain conditions and with certain modifications to operating patterns and gears and anchoring methods. It is also possible that such methods may gain from the beneficial effects of trawler safety (exclusion) zones from the site.

Increased Steaming Times to Fishing Grounds

Under suitable weather conditions, vessels of under 300 tonnes would be able to steam through the site. All fishing vessels with a history of fishing the area are under 300 tonnes and the impact on increased steaming times is expected to be negligible.

6.3 Shipping & Navigation

During the initial stages of consultation on marine traffic usage of the WoDS area, it was identified that there were issues with clearance distances between the proposed site and other existing or proposed infrastructure. In order to increase clearance distances, WoDS was slightly reshaped. The remainder of this section assesses the potential impacts on shipping from the revised windfarm shape.

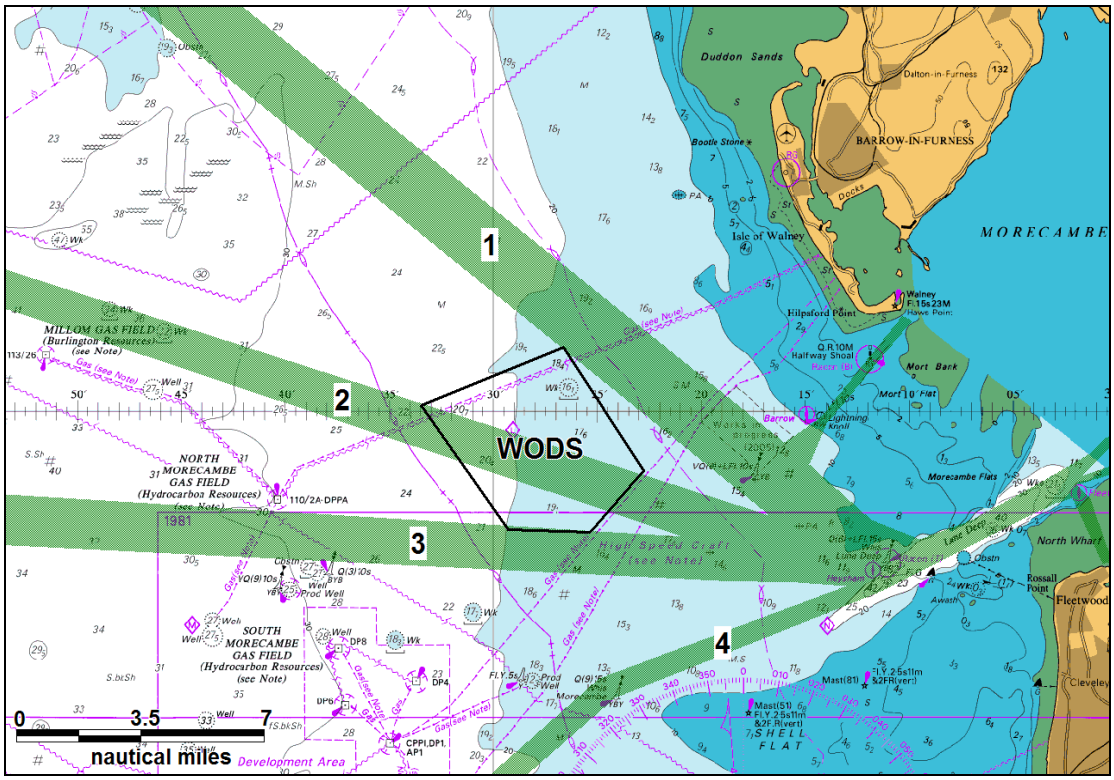
The current usage of the area around WoDS was established using reference to various existing information (usage of main ports in the area; existing offshore infrastructure), consultation with representatives of the main users of the area in terms of commercial and recreational traffic, and two surveys of usage, each of 14 days duration. The surveys used a combination of shore based radar, automatic identification systems and visual observations to determine usage.

Results of the background studies show that the area around WoDS is not a heavily trafficked area in terms of shipping and is characterised by having a number of regular runners (i.e. ferries) to and from

ports in Morecambe Bay (Heysham/Fleetwood) and ports in Northern Ireland (Belfast/Larne) and the Isle of Man (Douglas). Using the radar, a total of 229 tracks were identified to pass within the revised WoDS site, an average of 8 vessel movements per day. Excluding unspecified tracks, passenger ferries were the largest single vessel type identified passing within the proposed WoDS site, followed by cargo ships and fishing vessels.

Based on analysis of the 28 days of survey data, the main shipping lanes are presented in Figure 12:

Figure 12: Main Shipping Lanes identified from Survey Data



During Construction

The assessment provided below relates to the changed shape of the windfarm, and can therefore be considered to be the residual impact (impacts remaining after the instigation of mitigation measures).

During the construction phase there will be an increased level of vessel activity within the WoDS site and along the proposed cable routes. There will also be a number of additional vessel movements to the operations bases in order to supply and re-crew the operations.

During Operation

Commercial Shipping

The location of WoDS in isolation will result in re-routeing of the Heysham/Douglas ferry route as well as the lesser-used weather routeing of the ferry between Fleetwood/Larne.

If no other windfarms were planned it is considered Route No.s 1 and 3 would increase their clearance from the site, whilst traffic on Route 2 would be displaced onto Routes 1 & 3 until clear of the site when they would rejoin their chosen route.

Dredging

Based on the 14nm distance between the closest dredging licence area and the proposed windfarm, there will be no impact during active dredging operations.

However, the maritime traffic survey, corroborated by the supplementary data supplied by BMAPA, identified occasional dredger transits between Morecambe Bay ports and Area 331 passing through the proposed WoDS site (average of one transit per week).

The navigational impact will be similar to that described earlier, with this NW/SE traffic having to funnel between WoDS / Barrow and WoDS / Ormonde GTP, and deviate slightly from the most economical route in order to maintain a satisfactory clearance from each, leading to a small increase in voyage distance and time.

Impact on Recreational Vessels

Based on the review, there is a potential impact on recreational routes between Morecambe Bay and the Isle of Man, especially with the construction of both WoDS and the Walney Offshore Windfarm (WOW). However, the impact can be mitigated by the plan for a marked channel through the area. The developers plan to hold further talks with RYA/CA to agree such a channel.

Impact on Fishing Vessels

The impact on fisheries is considered in detail in the Commercial Fisheries section. The main concerns raised by fishermen and their local associations and organisations were loss of fishing area, interference with fishing activities and increased steaming distances.

Formal Safety Assessment

A Formal Safety Assessment (FSA) was carried out in-line with the IMO Formal Safety Assessment process and DTI guidance. Under this review it was concluded that the WoDS project was a large scale development with the potential to impact navigational safety. As a result, the content and methods of the risk assessment were responsive to this and included the following:

- Comprehensive Hazard Log;
- Risk Ranking;
- Detailed and quantified Navigational Risk Assessment for selected hazards;
- Preliminary search and rescue overview;
- Preliminary emergency response overview;
- Comprehensive risk control/mitigation measures log.

Hazards associated with the windfarm were identified and associated scenarios prioritised by risk level. As well as ranking the hazard by expected risk, based on the estimated frequency versus consequence, the worst case risk was also ranked in order to capture scenarios with a particularly high worst-case risk.

No risks were assessed as being unacceptable. A total of 7 risks were ranked within the tolerable (As Low as Reasonably Practicable (ALARP)) region based on the expected frequency/outcome whilst 14 were ranked as tolerable based on the worst case risk. The two highest ranked hazards were:

- Helicopter collides with windfarm structure during search and rescue operation; and
- Fishing Vessel collides with another vessel adjacent to windfarm.

The assessment also assumed the layout of 139 x 3.6 MW turbines, 2 offshore substations and 2 met masts which was identified as being the “worst case” from a navigational risk perspective based on the greatest number of structures.

The consequences of collision were ranked and the majority of incidents are expected to result in only minor damage. In a scenario involving a larger ship it is expected that a head-on collision at steaming speed would lead to the collapse of a turbine with the likely consequence being limited pollution from oil/diesel contained within the wind turbine. Breach of a fuel tank is considered unlikely and in the case of a tanker or nuclear vessel the additional safety features associated with these vessels would further mitigate the risk of pollution. In terms of smaller vessels such as fishing and recreation craft, the worst case scenario would be risk of damage leading to sinking of the vessel and potential loss of life.

A quantitative assessment of the potential consequences of collision due to the WoDS development indicated that the incremental increase in risk to both people and the environment was likely to be minimal compared to background risk levels in the UK.

Impact on Marine Radar Systems

Maritime and Coastguard Agency (MCA) trials have identified areas of concern with regard to the potential impact of wind turbines on ship borne and shore based radar systems. This is due to the turbines returning radar responses strong enough to produce interfering side lobe, multiple and reflected echoes (ghosts).

Based on the assessment of impact on navigation, it is anticipated that the NW/SE shipping between Morecambe Bay ports and the Isle of Man, which currently passes through the centre of the site, will move to the South of WoDS. The traffic to the South is also likely to increase its passing distance. Similarly, the NW/SE shipping between Morecambe Bay ports and the North Channel (e.g. ferries to/from Northern Ireland) will move to the NE of the WoDS site.

In isolation, based on the available sea room, vessels can keep 1.5nm or more from the structures and based on the MCA template will be in the ALARP region becoming tolerable.

However, when consideration is given to the proposed nearby turbines at Barrow, WOW and Ormonde, it is no longer possible for vessels on the NW/SE route to/from the North Channel to maintain a 1.5nm clearance from all turbines as the traffic funnels between sites that are less than 2.5nm apart.

Impact on Visual Navigation and Collision Avoidance

There is a potential for visual navigation to be impaired by the location of offshore windfarm structures, based on vessels not being visible to each

other (hidden behind structures) and navigational aids and/or landmarks not being visible to shipping.

The impacts on visual navigation were considered for Routes 1, 2 and 3 which were identified to be the main shipping routes in this area. Three scenarios were considered for each route; Head on, Converging/Crossing and Overtaking.

It is concluded that the visual impact of the windfarm on navigation aids and/or landmarks was limited. This is mainly due to the following:

- The WoDS site is positioned approximately 7nm from the nearest landfall and therefore, the structures associated with the windfarm will not block or hinder the view of the coastline or important landmarks to a degree that will affect maritime safety;
- Existing navigational aids are located at distance of at least 4nm from the structures and no significant impact is anticipated at this distance; and
- The site itself will form a significant aid to navigation, which will be very visible to shipping with lights on selected structures as well as buoys at selected locations on the perimeter of the site.

Impact on Search and Rescue (SAR)

The WoDS site lies within the Western Search and Rescue Region, which has a Maritime Rescue Co-ordination Centre (MRCC) based at Swansea, and a nearest district Sub-Centre based at Liverpool.

The risk assessment indicated that there will not be a significant increase in the frequency of maritime incidents due to the WoDS development. Additionally it highlighted that, giving account to the design features associated with the windfarm, and commitments by the developer such as an emergency turbine/blade shutdown system as required by MCA, SAR issues can be well managed.

Marine Navigational Markings

Throughout the project, marine navigational marking will be provided in accordance with Trinity House requirements, which will comply with the IALA standards. This will include, during the construction / decommissioning phases, that buoyed working areas be established, and, where advised by Trinity House, additional temporary marking will be applied.

Safety Zones will be established under the provisions of the Energy Act and define an area in which all vessels other than those authorised or those vessels seeking refuge in an emergency situation or the emergency services are allowed to enter.

6.4 Tourism

Addressed under onshore environmental impacts.

6.5 Leisure Activities

The Lake District, Blackpool (including the town centre and beach), Morecambe and Lytham St Annes represent prime holiday areas. Many land-based leisure activities are undertaken along the coast such as walking, bird watching, golf and horse-riding, and the region is moderately important, on a national scale, for water-based leisure activities such as fishing, sailing, power boating, wind-surfing, scuba diving, jet-skiing, canoeing, surfing and bathing.

During Construction

With regard to leisure activities, the most likely ones to be affected by the construction activities for and physical presence of WoDS would be sea-based recreation, such as sailing and yachting, wind-surfing, scuba diving, leisure fishing and power boating.

Scuba divers may also be potentially affected by underwater noise generated during both construction and operation of WoDS. This Maritime and Coastguard Agency specifically raised this issue when consulted.

During Operation

During consultations the Furness Fishing Association (Boat Based Angling Section) expressed concern over potential electromagnetic field effects from generators and underwater cables on fish stocks.

The minimum clearance of the rotor tips to high tide will be 22m. This allows for 97% of the UK sailing fleet to pass safely below the rotating blades. The remaining 3% of vessels are of the larger classes and hence are also skippered by the most professional, experienced and competent sailors and are therefore highly unlikely to be involved in a collision with a turbine. A 50m safety zone around the foundations is proposed for these vessels.

Other water-based leisure activities including wind surfing and jet-skiing are unlikely to be affected by the proposed windfarm, as they rarely travel far from the shore.

The buried offshore cables are likely to affect recreational users through interference with anchors. However, this could be minimised through the provision of buoys where leisure craft can temporarily moor.

It is difficult to predict the potential impacts associated with decommissioning, but it is likely that they will be similar to that during construction.

6.6 Noise

During Construction

Offshore the greatest generation of noise will be from driving foundation piles into the seabed. It should be noted that a decision on which foundation type will be used has not yet been finalised, however, the impact discussion below is based on the use of pile driven foundations.

Underwater noise during the piling operations is calculated to give rise to local maxima in the area of between 192 dB and 261dB re 1 μ Pa @1m.

Underwater noise levels during piling could be expected to give rise to subtle behavioural effects to more sensitive submarine fauna in the whole Duddon Sands area. The literature and research suggests, however, that these effects would be short-lived and transient. Soft start piling procedures and general good practice will help to further minimise this effect.

The underwater propagation calculations show, however, that physiological effects could occur to more sensitive species within the proximity. Care will need to be exercised, therefore, if the presence of any significant species is suspected during piling, with visual observations and sonar scans used as required, and piling suspended if necessary.

Overall the impact is considered to be moderate, but short-lived.

During Operation

The cumulative sum of all underwater noise output from the turbines is expected to give rise to general noise levels within the windfarm footprint between 95 and 100 dB, rising locally to 120 dB in the immediate vicinity of each turbine.

Ambient underwater noise levels are expected to be elevated by approximately 10 dB within the footprint of the windfarm itself, but should not generate levels sufficient to cause behavioural responses more than 5m away from each turbine structure.

Overall, the impact is considered to be minor, but continuous.

6.7 Military

WoDS site and cable route is not located within any designated military exercise or test area. Defence Estates (the responsible authority) have been consulted and advised that they do not anticipate any interference with MOD radar/ communications or with low flying aircraft from WoDS.

6.8 Aviation

There are three aerodromes in the vicinity of WoDS: Blackpool Airport (CAA), Warton Airbase (RAF/BAE Systems) and Walney Airfield (privately owned by BAE Systems, located at the north end of Walney Island).

There are no identified impacts from the presence of WoDS with regard to the level of operational aviation activities, as the windfarm does not lie within the take-off or landing zones of any of the aerodromes within the area.

NATS have informed Morecambe Wind that there is an interaction with their service. This is the subject to further investigation.

6.9 Offshore Development and Infrastructure

The most likely impact from the proposed windfarm during construction and installation operations will be the instances where export cables are required to cross existing pipelines. The exact positioning of the cable crossing points will be determined in consultation with pipeline owners and operators.

Centrica have expressed concerns over potential interference with helicopter flight paths to and from the offshore facilities they operate, namely DP4 and North Morecambe, as the proposed windfarm lies within 6nm of these 2 facilities.

Morecambe Wind will continue to consult with Centrica Energy, CHC Scotia Helicopters and the Civil Aviation Authority to resolve any identified potential effects.

The physical presence of WoDS will also effectively exclude the area for future use for the exploitation of other resources or routing of pipelines or installation of other facilities by other marine commercial activities.

6.10 Aggregate Dredging Areas

No aggregate extraction areas will be directly affected by the development of WoDS. The physical presence of WoDS and associated export cable on existing vessel movements associated with marine aggregates extraction activities is the only residual impact of minor, negative significance.

6.11 Waste Disposal Sites

WoDS export cables lie in close proximity to known disposal sites. Detailed export cable routing for the proposed windfarm have still to be finalised. It will be important these cables are routed around spoil

areas in order to avoid the possible re-suspension of potentially contaminated sediments.

WoDS is not located on any known licensed aggregate spoil areas. However, there is the potential for interference with vessel traffic serving these spoil sites.

Decommissioning impacts are likely to equal those experienced during construction.

6.12 Transportation

Addressed under onshore environmental impacts. Section 5.2.3

6.13 Telecommunications

There is no perceived impact on telecommunications and television service during the construction phase of the project (i.e. turbine installation and cable installation), as it is understood that there are no submarine telecommunication cables in the vicinity of the windfarm or the windfarm cable route.

The telecommunications providers consulted perceived that there is the potential for the wndfarm to restrict the available routes and landings for the laying of future cables thus potentially increasing future installation costs.

Crown Castle (the independent owner and operator of shared wireless infrastructures in the UK) ,has communicated that they are concerned about potential interference of the offshore windfarm facilities with the BBC UHF transmission signal, whilst Ofcom have indicated that there is the potential risk of interference with the microwave links operated by Centrica Energy between their gas terminal at Barrow and their offshore production facilities.

Upon installation of appropriate mitigation measures, if required, the overall residual impact is anticipated to be of minor negative significance.

6.14 Landscape

WoDS will be located approximately 14kms from the coastline of Walney Island in a north-west to south south-easterly direction. The total area of the windfarm will be approximately 66km^2.

Three potential scenarios for the proposed development have been considered and the assessment is based on the scenario deemed as 'worst case' in relation to visual effects, that being Scenario 1 comprising 139 turbines of 3.6MW each to a proposed blade tip height of 150m above LAT (Lowest Astronomical Tide) a capacity of 500MW. The other scenarios considered comprised a fewer number of larger turbines.

A total of 18 viewpoints were agreed with the Local Planning Authorities and statutory consultees as the basis for the study of the potential effects on landscapes/seascape character and visual amenity. The viewpoints were selected following analysis of computer generated Zone of Theoretical Visibility (ZTV) study and preliminary field surveys. The viewpoints selected represent both low-level coastal viewpoints, more inland views from higher ground, and views from a range of sensitive visual receptors including residential areas, recreational areas, public footpaths and public highways. Computer generated wireframe and photomontage images were prepared for all 18 viewpoints in order to demonstrate and illustrate the potential effects of the proposed windfarm.

For the purposes of the landscape assessment and in reference to the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (EIA Regulations 1999), 'significant' visual effects would be those effects assessed to be Severe, Major or Major/Moderate.

The assessment included for potential significant visual effects during the construction and operational phases of the windfarm. During construction of the turbines, offshore substations and cable laying, the assessment concluded that there would be temporary, short term visual effects essentially from the closer range viewpoints on Walney Island, however the significance of the visual effects was assessed to be minor to negligible (not significant).

The Landscape and Seascape Assessment seeks to identify the key features of the existing landscape and seascape within the study area, and considers the changes that the proposed development would have on this character. This is based on receptor sensitivity and the capacity of the seascape to accommodate change. A summary of the findings of this assessment is given in Table 4.

Table 4: Summary of Seascape Sensitivity

Seascape Unit	Sensitivity of Resource/Ability to Accommodate Change	Landscape/Seascape Magnitude of Change	Significance of Seascape Effect
Duddon Estuary	High / Large - medium	Medium/small	Slight
Barrow-in-Furness Walney Island	Low/ Large High/ Small	Small Medium	Slight Moderate
Morecambe Bay	High/Medium	Small	Slight
Fylde Coast	Medium/ Large	Small	Slight

The Visual Assessment assesses the change that would result to existing views and visual amenity to receptors. This takes into account the sensitivity and importance of receptor groups and the nature, scale or magnitude and duration of the change. The existing and proposed view from each location was compared using the photomontages and wireframe illustrations and the following factors were taken into consideration:

- distance of viewpoint from the closest turbine;
- number and proportion of turbines visible;
- the degree of visual intrusion or extent and nature of the view that would be occupied by the development;
- arrangement of turbines;
- whether turbines would be seen against the sea or sky; and
- the sensitivity of the viewpoint and receptors.

Visibility in coastal areas is very variable and is influenced by wind, light, tidal movements and atmospheric conditions. Seascapes are altered by weather to a much greater extent than any terrestrial environment, and conditions can alter frequently within a short space of time.

Based on climate data supplied by the Met Office, a detailed visibility assessment was undertaken and concluded that from more distant views to the north such as VP2 Seascale (~ 41.1km) the closest row of turbines could potentially be visible for up to 14 days per year (3.7%). At closer distance views such as VP11 South Walney Nature Reserve the closest row of turbines could potentially be visible for up to 206 days per year (56.6%). To the south the closest row of turbines could potentially be visible for up to 43 days per year (11.8%)from St. Anne's Pier.

Visual receptors fall in to three main groups of viewers, namely residents, visitors and people travelling through an area, but also include people engaged in work. Residents with open or direct sea views are considered to be most sensitive as their views are valued and exposure to the view may be frequent. The fairly flat topography of most of the study area and screening by buildings or other structures and sand dunes greatly restricts potential views to receptors living beyond the sea front. Most of the coastline within the study area, stretching from the relatively isolated fells of west Cumbria in the north to the commercial centres of Blackpool and St Annes in the south, is important for recreation and tourism. Recreation users and visitors are therefore likely to be one of the main groups affected by the development.

The 18 selected viewpoints ranged from Seascale Beach in the north, to St. Anne's Pier in the south. 5 viewpoints were assessed to be more sensitive where it was considered that the potential for the most significant visual effects may occur, these viewpoints being: VP4 Black Combe; VP5 Coastal Path, Haverigg; VP10 Biggar Bank Road, Walney; VP11 South Walney Nature Reserve and; VP16 Rossall Point, Fleetwood. A summary of the findings of the assessment from these viewpoints is given in Table 5, whilst an example of a photomontage and associated wireframe from Walney Island Nature Reserve is presented in Figure 13.

Table 5: Summary of Visual Impact During Operation

Viewpoint	Elevation AOD	Magnitude of Change	Sensitivity of Viewpoint	Significance of effect
VP4 Black Combe	504m	Small	High	Moderate/minor
VP5 Coastal path Haverigg	6m	Small	High	Moderate/minor
VP10 Biggar Bank, Walney	10m	Medium Medium	High (residents) Medium (road users)	Moderate Minor
VP 11 South Walney Nature Reserve	6m	Medium	High	Moderate
VP16 Rossall Point, Fleetwood	3m	Small	High	Moderate/minor

In summary and with reference to the EIA Regulations 1999 the assessment of effects on the landscape/seascape character and visual amenity caused by WoDS did not reveal any 'significant effects'.

Figure 13: Photomontage and Associated Wireframe from Walney Island Nature Reserve

6.15 Biological Environment

6.15.1 Birds

The windfarm site lies 14km offshore at its closest point, and itself is unlikely to support significant numbers of waterfowl. However the wider WoDS area covers a number of designated areas including Special Protection Areas (SPAs), Special Areas of Conservation (SAC), National Nature Reserves (NNRs), Sites of Special Scientific Interest (SSSI) and Ramsar sites. One reserve is also managed by RSPB for its ornithological importance.

The coastal intertidal mudflats, freshwater wetlands, salt marshes, sand dunes, saline lagoons, shingle banks and dock structures in adjacent coastal areas provide ideal conditions for foraging and nesting grounds for a variety of Species of Conservation Interest. Supporting internationally and nationally important numbers of wintering waterfowl and breeding seabird colonies year round, these areas also provide a vital resting ground for migrating birds on the spring/autumn passage.

A number of bird surveys (aerial, boat, radar and onshore counts) have been carried out in and around the WoDS area. The most abundant species recorded during the boat surveys were Auks, notably Guillemot, Gulls and Gannet. Other species, including Red-throated Diver and Common Scoter were recorded in relatively low numbers, particularly within the windfarm area.

Manx Shearwater is also abundant when peak counts are considered, but the population within the windfarm is actually highly variable between months and years. Peak counts tend to be recorded during July and August. At other times numbers are low or the species is absent from the survey area.

During Construction

Windfarm area

Noise and vibration caused by construction activities has the potential to disturb bird populations. It is expected that the most sensitive species, including seaducks, divers and other seabird species, will be displaced from active construction areas during the construction phase. Other species, including gulls, may remain within the construction area, attracted by enhanced foraging opportunities.

The most sensitive populations in the region of construction are the Common Scoter and Red-throated Diver populations associated with the Liverpool Bay pSPA, located to the south of WoDS. The noise assessment undertaken indicates that the maximum noise level likely to be experienced during piling (the noisiest operation during construction) at the SPA boundary will be no more than 55dB. The period over which construction will take place, and the greater distances of most turbines from the Liverpool Bay pSPA northern boundary, together with higher concentrations of the most susceptible species (such as common scoter) being recorded from areas to the south of the proposed Shell Flat Windfarm area, reduce the risk of disturbance to features of conservation importance within the Liverpool Bay SPA. The effect is, therefore, considered to be of negligible magnitude.

For the purposes of this assessment it has been assumed that disturbance caused during construction (and decommissioning) will result in the temporary displacement of all birds recorded during the boat surveys within 2km of the windfarm area. For most species numbers are sufficiently low that no impact is predicted as a result of disturbance caused by construction activities. Whilst Guillemot, Razorbill, Lesser Black-backed Gull, Gannet and Manx Shearwater occur in higher numbers the potential magnitude of disturbance impacts is not considered to be substantial because; disturbance is temporary; there is extensive alternative habitat available for all of these species; while peak counts for some species within the windfarm are relatively high, their stay in the area is short; monitoring at the Danish Horns Rev offshore windfarm indicated that gulls showed increased preference for the windfarm area during the construction period compared to preconstruction.

On this basis the magnitude of potential disturbance / displacement impacts caused during the construction period are considered to be Negligible for all species.

Cable route

Cable installation will involve specialist installation and service vessels. It is considered unlikely that this activity will cause significant impact to bird populations due to the temporary nature of the works and the limited area of activity.
Consequently the magnitude of potential impacts arising from construction are considered to be Negligible.

During Operation

The key potential impacts arising from windfarm operations are likely to be; Direct habitat loss; Disturbance / displacement; Mortality arising from collision with turbines, and; “Barrier” effects

Habitat loss

Relatively small areas of sea-bed will be permanently lost due to the construction of turbine foundations, installation of scour protection and cable installation. The impact of this loss is considered to be negligible due to the small area affected (typically less than 0.5% of the windfarm area).

Disturbance / displacement

This effect has the potential to cause an impact to a population if it excludes a significant number of birds from good quality foraging habitat. The greatest displacement impacts are potentially, therefore, on highly sensitive species with restricted distributions that are closely related to food availability.

The most numerous species recorded within the proposed windfarm area are: gulls, including Herring Gull and Lesser Black-backed Gull; auks, notably Guillemot; Manx Shearwater and Gannet.
Gull species tend to be amongst the least sensitive to windfarms, and some species, such as Herring Gull may be attracted to turbines, as they are with other human structures, due to enhanced foraging opportunities and the availability of perches. Gulls are particularly tolerant of disturbance arising from vessel movements. The magnitude of potential impacts arising from displacement on gulls is, therefore, considered to be Negligible.

There is limited information on the likely response of auks to windfarm operation. Pre and post construction monitoring undertaken at Horns Rev indicates a possible avoidance effect, although high levels of ongoing construction works at the windfarm site could have affected the monitoring there. It is also acknowledged that possible shifts in the distribution of prey species cannot be discounted as a potential cause of changes in the distribution of auks and other seabird species. A key finding from the North Hoyle monitoring study is that Guillemot, and other auks, exhibited little difference in the level of foraging within the windfarm following construction. As it is unlikely that the construction of WoDS will result in the permanent loss of more than 5% of available habitat of the eastern Irish Sea it is, therefore, concluded that the likely magnitude of the displacement effect on these species is Low.

Over 94% of the global Manx Shearwater population breeds along the British coastline. Breeding populations in Britain and Ireland are focused on the small offshore islands of western Scotland, south-west Wales and various islands off Kerry.

The sensitivity of Manx Shearwater to windfarms has not been fully assessed previously and it is not known how this species will respond to windfarm operation. For the purpose of this assessment it is assumed, cautiously, that Manx Shearwater will avoid the windfarm, ie that displacement effects will be high. Although the effect may be strong, it is not expected that this will result in an impact of high magnitude to the Manx Shearwater population of the Irish Sea because; WoDS is located south-east of the locations where most Manx Shearwater were observed during boat surveys. In addition the time shearwaters are present in this area is very short; during June to September the large majority of Manx Shearwater are found to the west of the Irish Sea Front within the stratified waters of the western Irish Sea; Manx Shearwater forage over very large areas, responding to the availability of prey species.

As it is unlikely that the construction of the windfarm will result in the permanent loss of more than 5% of available habitat of the eastern Irish Sea it is, therefore, concluded that the likely magnitude of the displacement effect on this species is Low.

The origin of the gannets observed at WoDS is, not clear (due to the large distance to the closest colonies) but it seems most likely that they are foraging birds associated with Scottish colonies. While Gannets are colonial breeders they forage over large distances and are widespread throughout British coastal and marine waters. Aerial surveys undertaken during August 2004, for example, indicate observations of Gannets throughout the East Irish Sea and North welsh coast. It is considered unlikely that the operation of the windfarm will result in a substantial displacement of Gannets from favoured feeding areas, hence it is concluded that the likely magnitude of the displacement effect on this species is Low.

Collision mortality

There have been few systematic surveys of collision rates between birds and turbines in offshore windfarms. Consultation with English Nature and RSPB about WOW and WoDS indicated a key concern about migratory geese (Pink-footed Goose) and swans (Whooper Swan). In response to this concern offshore radar surveys were commissioned during the autumn migration period.

The results of these surveys indicate a low likelihood of significant mortality of migratory species arising from collision with turbines at the windfarms, either alone or in-combination. There were few movements through the windfarm area recorded during the migratory period (by the radar survey) in October 2005, even though it is known that a passage of both species took place during the surveys. These observations suggest that these species may follow a coastal route that is concentrated inshore of WoDS. Consequently the magnitude of collision impacts on migratory species is predicted to be Negligible.

In addition to migratory species, the baseline surveys revealed the presence of a range of other species, including auks, ducks, gulls and other seabirds (such as Manx Shearwater). The flight heights of individuals of these species were recorded during boat surveys.

Very few Auks fly at height categories above 15m asl and consequently the risk of these species colliding with turbine blades is considered to be Negligible.

The majority of ducks including the highly sensitive Common Scoter were recorded below 15m during

the boat surveys. During the radar survey a similar pattern was observed with all individuals placed in height categories below 30m. These findings are consistent with other surveys, particularly those undertaken at Shell Flat where the flight behaviour of large numbers of Common Scoter was observed during baseline surveys. As with that study it is concluded here that the risk of ducks colliding with turbines is Negligible.

Some studies have indicated that gulls may be susceptible to collision, although they do have high flight manoeuvrability. For most gull species the number of birds observed flying at rotor height within the proposed windfarm area was sufficiently low to conclude that the magnitude of collision effects will be Negligible.

Lesser Black-backed Gull was recorded more frequently at rotor height than other gull species and is, therefore, potentially at greater risk of collision. The Lesser Black-backed Gull potentially affected by the windfarm is considered to be of Very High sensitivity. The reason for treating this population in this cautious way is due to the presence of the Morecambe Bay SPA. A more detailed collision risk modelling exercise was carried out for this species, which concluded that the risk that collision rates are unlikely to exceed 11 birds per annum and, therefore, the magnitude of this impact is considered to be negligible.

Gannet was also recorded in moderate numbers at rotor height. There is little evidence about the behaviour of Gannet around windfarms. It is expected that many individuals will avoid the windfarm area as alternative foraging habitat for this species is widespread in coastal and marine areas. While this species is not considered to be amongst the most sensitive to windfarm developments, it is only moderately manoeuvrable in flight. It is expected, therefore, that there will be some risk of collision of this species with turbine structures. Consequently it is predicted that there will be a Low magnitude impact due to collision for this species.
All remaining species were observed in very low numbers at rotor height and hence the magnitude of the potential impact of collision for these species is considered to be Negligible.

Barrier effects

As some birds are known to avoid windfarms, notably wildfowl, the potential arises for a barrier effect to bird movements. This potential effect is likely to be most severe if a large windfarm is constructed across a regular migratory pathway or between areas where birds roost and feed, for example. The baseline surveys for this assessment have not highlighted any specific or regular movements of birds through the windfarm area between foraging and roosting areas. Small numbers of Common Scoter were observed, but considering the large number of birds known to be present to the south, these movements are considered to be of negligible magnitude.

It is known that Pink-footed Goose and Whooper Swan migrate along the west coast of England, although the precise route(s) is not clear. Studies at Walney Observatory in October 2004 observed most movements of these species at or beyond 6km from the shore. The radar studies undertaken in October 2005 indicated relatively few movements of either species within the windfarm area, even though it is known that a passage of both species took place during the surveys.

Taken together these observations suggest that these species may follow a coastal route that is concentrated inshore of the windfarms. The observation of small numbers of birds both within and to the west of the windfarm area also suggests, however, that, once constructed, some birds will modify their flight paths. The relative positioning of the windfarms ensures that birds approaching from the North and North-west (and South and South-east) encounter the windfarms with their narrowest profile. Consequently the magnitude of the deviation required to avoid the windfarms is extremely small, particularly when compared to the length of the migratory flights made by these species.

It is concluded, therefore, that the windfarms will have a Negligible magnitude barrier effect on foraging and migratory wildfowl.

Conclusions

A systematic assessment of the potential impacts arising from the proposed construction, operation and decommissioning of the windfarm, alone and in-combination with other developments in the eastern Irish Sea has been undertaken and it is concluded that in all cases the overall effects are likely to be negligible or low.

When these predictions are combined with sensitivity on a species by species basis is concluded that there will be no impacts of High or Very High significance.

6.15.2 Benthos

Potential impacts to benthos from the development include temporary loss of seabed area during construction, smothering effects from the settlement of disturbed suspended materials during construction and physical loss of habitat by presence of turbine and scour protection. No benthic species of particular conservation importance were recorded within the proposed windfarm site, or within the cable route corridors during the baseline survey carried out in 2005. Based on the benthic communities likely to be present in the area, given the physical conditions, it is unlikely that any species of conservation importance will occur.

The windfarm area is currently subject to some trawling operations. Once constructed a safety (exclusion) zone will be sought around each turbine which will dictate that no bottom trawling operations are allowed. Reduced levels of trawling will allow the benthic communities in the area to return to a more natural state.

Development of magnetic fields around the cable routes is known to have the potential to affect some species of fish, and current industry research is being focussed on whether the same fields have the potential to affect some benthic invertebrate species.

Decommissioning effects are likely to be of a similar order to those experienced by the benthos during construction of the windfarm.

6.15.3 Fish and Shellfish

There are several fish species of conservation interest which are likely to be present around the WoDS area and cable route corridor. These include basking shark, common goby, sand goby, allis shad, twaite shad, salmon, river lamprey, sea lamprey and smelt (or sparling). No shellfish of conservation interest are likely to be present. In addition to the species of conservation interest, potential impacts to those of commercial importance have also been considered in the ES. In terms of commercially important fish species, the WoDS area is used by plaice, cod, sole and whitings with skates and rays caught in the general area. Shellfish such as nephrops and cockles are also present. It is also likely that some skate and ray reproductive activity takes place in the area, though it is not recorded as being particularly important in this regard.

Impacts to fish and shellfish from the development are likely to result from the following:

During Construction

During Construction there is potential for impact to fish and shellfish from noise, suspended solids and change in substrate.

The main source of construction noise will be from percussion piling potentially used for installation of the foundations, which may cause death of some fish close to the site of the piling, however after piling has started fish which are disturbed by the noise are likely to move away from the area immediately.

Increased suspended solids during the cable-laying may cause impacts to the eggs and juveniles of some species (potentially smothering juveniles), but such impacts are anticipated to be minor. The areas lost, for installation of monopiles (and any scour protection required), will be small, however larger areas will be lost should tripods be used. The addition of hard substrate into the area will result in new species colonising the piles and scour protection; it may be the case that these species are of commercial value, which may be seen as a positive impact

During Operation

Operational Impacts may include reduced fishing and electro magnetic fields. Species which are often taken as by-catch and subsequently released as discards will benefit from the reduction in this source of fishing impact, such as Nephrops. While trawling is reduced there may be an increase in fixed gear fishing (i.e. potting), which will probably target species, which have been attracted to the area by the introduction of new hard substrates.

Studies are ongoing to provide more details on the type and magnitude of impacts from EMF on marine and migratory fish. The specifications for the intra-array and export cables will minimise potential magnetic fields. These cables will be buried to reduce the potential for them to be exposed on the seabed and potentially snagged. This burial may assist in reducing the strength of the fields present on the seabed itself.

At the decommissioning stage the primary concerns will be with respect to noise and increased suspended sediment concentrations as with construction. Loss of habitat created by the introduction of hard substrates into the windfarm area will also result in impacts to the fish and shellfish of the area.

6.15.4 Marine Mammals

Protection is given to all cetacean species in UK waters through The Countryside and Rights of Way Act (2000). This act prohibits the deliberate killing and injuring as well as intentional or reckless disturbance of any cetacean species. This reflects the requirements of the Convention on the Conservation of European Wildlife and Habitats (Berne Convention) and Article 12 of the EU Habitats Directive (1992), implemented by the Conservation Regulations 1994. In particular, harbour porpoises and bottlenose dolphins are listed as species of European conservation priority in Annex II of the Directive.

The primary concern of statutory consultees, such as English Nature and CEFAS, relates to the potential effects that WoDS may cause to marine mammal species. These include a generation of underwater noise, physical disturbances and secondary effects such as changes to navigation that result from the presence of the windfarm.

The Eastern Irish Sea is generally a region with low abundance of cetaceans and pinnipeds, although harbour porpoises (*Phocoena phocoena*) and bottlenose dolphins (*Tursiops truncatus*) display medium abundances in parts of the region. Other species which either occur regularly in the region or are listed in Annex IV of the EU Habitats Directive include i.e. minke whale (*Balaenoptera*

acutorostrata), harbour porpoise, bottlenose dolphin, long-finned pilot whale (*Globicephala melas*), northern bottlenose whale (*Hyperoodon ampullatus*), Risso's dolphin (*Grampus griseus*), common dolphin (*Delphinus delphis*), common seal (*Phoca vitulina*), and grey seal (*Halichoerus grypus*). The other large (non-marine mammal) species, basking shark (*Cetorhinus maximus*), leatherback turtle (*Dermochelys coriacea*) and loggerhead turtle (*Caretta caretta*) are included in this section due to their inclusion in the UK Biodiversity Action Plan and protection under the Wildlife and Countryside Act (1981).

During Construction

Noise and Vibration

Underwater noise is a well-documented factor affecting marine mammal distribution and behaviour during marine construction works.

Installation of monopiles (should they be the chosen foundation type) has the greatest potential to create high underwater noise levels. Sound levels above 200 dB (approximate hearing threshold for marine mammals such as dolphins, porpoises and seals), which may be found within 500 m of pile driving operations, have been estimated to cause temporary shifts in the hearing thresholds of bottlenose dolphins. In harbour porpoises, physiological effects from underwater noise may be possible within the distance of 500 m. A zone of responsiveness from the noise source may be found at any point between the zone of physiological effect and the zone of audibility, i.e. anywhere between 0.5 and > 20km.

The reactions of animals to the driving of mono-piles has only been investigated at one offshore windfarm site (off Denmark), where large-scale short-term behavioural reactions of harbour porpoises were found to a distance of approximately 15km, a range largely corresponding with that calculated based on the noise level perceived by porpoises. Installation of tripod foundations is likely to result in lower noise levels that monopiles due to their reduced diameters, reducing the level of force required to push them through the sediment.

The installation of either gravity or bucket designs for the foundations will probably introduce a zone of responsiveness for marine mammals in the immediate vicinity of the WoDS site during the entire period of construction. The exact radius of the zone of responsiveness cannot be accurately estimated but may approach that estimated for the construction of monopile and tripod foundations.

Based on measurements recorded at other NE Irish Sea windfarms (Barrow and North Hoyle), it is thought that without any mitigation measures a zone of 500 m in all directions from the driving location should be anticipated for physiological impacts to bottlenose dolphins, harbour porpoises and seals during pile driving. In the worst-case scenario, the zone of physiological impact may be as far as 1000 m from the piling site.

Due to their marginal use of the East Irish Sea and their expected lower levels of sensitivity to short-term underwater noise emissions and longer-term disturbances from vehicles, neither basking sharks nor sea turtles are expected to be significantly impacted by the construction activities.

Sedimentation

Possible impacts on marine mammals from sediment suspension during the installation of foundations and cable routes are considered to be negligible. Direct, physical loss of habitat due to seabed excavation and sedimentation is regarded as negligible, due to the very small proportion of potential feeding area affected by any of the foundation designs.

Vessel Activity

Bottlenose dolphin, harbour porpoise and common seal are commonly observed close to boats and ships. Based on previous research, the presence of disturbance from construction vehicles and service and transport boats may cause variations in, or significantly lower levels of, acoustic activities of harbour. The exact level of disturbance to the three species from vehicles during the construction of WoDS may be regarded as uncertain, with the most likely scenario being short-term movements in response to peak periods of construction vessel activity.

During Operation

Studies conducted on a Danish offshore windfarm showed that both harbour porpoises and grey seals returned to the windfarm area following construction, which is not unexpected given that the underwater noise from wind turbines has low intensity and frequency.

Indirect abundance increases of potential prey (e.g. fish) due to habitat alterations such as the addition of scour protection have also been recorded at a Danish offshore windfarm.

During operation, the power cables connecting the windfarms to shore will generate a narrow strip of electromagnetic force; however, marine mammals are generally not regarded as sensitive to this. Modelling, measurements and monitoring results show that the field of impact is narrow (< 1 m) and impacts on marine mammals are deemed negligible.

6.16 The Physical Environment

6.16.1 Marine Geology and Coastal Processes

WoDS is within the Manx Furness Basin, where the base rocks are overlain by thick deposits of sediments associated with the Irish Sea Mud belt. Across the windfarm site the surface seabed sediments are fairly uniform, dominated by clayey silts, except along the cable route to shore where the nature of the seabed environment becomes more mobile, with increased percentages of sand and gravel

While the proposed development is likely to have some localised impact on the waves, currents and corresponding sediment transport regime in the immediate vicinity of the proposed windfarm area and cable route, it is unlikely to have any significant or measurable far-field impacts.

During the construction phase of this project there will be some localised displacement of seabed sediments and a likely increase in suspended sediment in the water column. If construction of the turbine foundations requires significant bed disturbances then there will be locally high, but short-term, suspended sediment loads.

There is the potential for localised scour (erosion) at the base of each turbine foundation, and this may need some mitigation measures in the form of physical scour protection. Routine monitoring will be undertaken to ensure the condition of the cable, including burial, remedial action may be required at some locations over the design life of the cable, this may be in the form of jetting, rock dumping or concrete mattresses.

6.16.2 Oceanography

The development is exposed to strong wave conditions; in particular exposure is towards the southwest, from waves generated within the Irish Sea. The predominantly southwesterly winds have an effective fetch of over 200km, and these waves are enhanced by swell entering the St. Georges Channel. Wave heights are less along the cable route where the reduced water depths can cause larger waves to break.

In the WoDS area the tide floods to the east-northeast and ebbs to west-southwest as water moves in and out of Morecambe Bay. The bathymetric character of the WoDS area is flat. The seabed dips slightly to the west. Water depths across the site vary from 17.5m to 22.8m, at Lowest Astronomical Tide.

The principal characteristic of this development, with regard the oceanographic regime, will be the insertion of a non-dynamic, hard form of engineering into an extremely mobile and dynamic environment.

The modification to the wave regime by the proposed development will be localised to the immediate vicinity of the turbine foundations, where there will be some diffraction and reflection of wave energy. However the design of the turbine foundations and the distances that will separate each individual turbine will ensure that the effects on the wave and current regime are negligible.

The turbine foundation construction will account for water level changes as a result of tides and potential storm surges

Buried cables will not modify the wave and tidal current regime.

6.16.3 Water Quality

During construction a number of vessels will be operating in the vicinity, and there is the potential for accidental discharges. If the turbine foundations are to be grouted into the seabed there is the potential for small releases of cement at the turbine locations. Increased turbidity during the construction phase may have a minor temporary impact on water quality.

During operation there is expected to be a localised effect on currents, wave conditions and sediment transport in the immediate area of the turbine foundations, this is not expected to have any impact on the water quality.

6.16.4 Climate and Air Quality

The long term impacts on climate and air quality of the proposed development will be beneficial, as it will provide an alternative to the combustion of fossil fuels for electricity generation. It is anticipated that the development of this project will offset approximately 1,500,000tonnes of CO_2, 7,750 tonnes of SO_2 and almost 2,675 tonnes of NO_2 emissions per year (if output from the windfarm displaces a nominal 50:50 mix of coal and gas generated electricity).

Studies have shown the life cycle carbon footprint of a wind turbine (manufacture, installation, operation and maintenance) over its lifetime and subsequent decommissioning is equal to the carbon free electricity generated by the turbine after 6-8 months (for Vestas V90-3MW turbine) ref. Vestas.com.

During construction there will be some emissions to air from both onshore and offshore. This will be in the form of emissions from construction equipment and vessels, most of which will be powered by diesel engines and generators. The emissions will include greenhouse gases. However, the offshore construction period is likely to be relatively short,

therefore the emission levels are not considered significant in the regional or national content.

During its operational life, the only likely sources of emissions to air will be the exhaust fumes from the support vessels ferrying the maintenance teams to and from the windfarm. However, these emissions are considered to be negligible.

6.16.5 Munitions

The proposed windfarm site does not lie within any known areas of munitions dumping and the closest MOD firing range/exercise area is some 28km to the north at Eskmeals. However during World War II a significant number of bombs were dropped over the Irish Sea, a number of which may still remain in situ. There is, therefore, a potential risk of the windfarm structures, cables and personnel encountering munitions during installation.

Appropriate method statements will be produced for safe working in and within the seabed. These will refer to all site available information. In addition awareness training will be given to all site based personnel and a trained expert will investigate any suspicious objects discovered.

6.16.6 Contamination

The sediments of the Eastern Irish Sea are largely derived from eroded boulder clays and contain high proportions of sands and silty clays. They do not inherently contain high levels of toxic metals. The sediment quality within the WoDS study area (in terms of trace metals, total petroleum hydrocarbon (TPH) caesium 137 concentrations) is typical for the area. Any resuspension of sediment caused by construction activities is unlikely to cause impacts from a contamination perspective.

6.17 Archaeology

A desk-based assessment of the potential impact upon archaeological remains from the proposed WoDS development has been carried out.

The potential for archaeological material was assessed by reference to a number of areas surrounding the proposed development, as well as within the detailed area of study. Information was sought from a wide range of local and national bodies. In addition, the findings of the desk study were correlated with the results of the geophysical surveys conducted over the full search area in 2005.

Any wrecks, prehistoric deposits, land surfaces and artefacts that are present within the study areas, have the potential to be impacted by the construction activities. In addition to impacts originating directly from the process of construction, maintenance and decommissioning of the windfarm and associated cable route there is the possibility of further impacts to archaeological sites. This may include changes in the scouring and sedimentation patterns that may expose previously buried sites to degradation, corrosion and erosion.

Within the whole marine study area, there are no recorded wrecks of national importance, which would receive protection under the Protection of Wrecks Act. However, there are a total of 13 other known wrecks. 9 are considered live wrecks, with the potential to impact navigational interests (of which 5 have been identified), 1 has been identified from aerial photography lying on the Heysham foreshore. 3 are known wrecks, however they have been given the status of dead, as their remains have not been relocated despite repeated surveys.

The assessment of the geophysical data also identified some potential for the presence of unknown sites within the study area, however, the assessment also concluded that these features are unlikely to be of great archaeological significance. Appropriate mitigation will be applied such that any sites that do exist are not damaged by construction, maintenance or decommissioning either directly and indirectly.

It is proposed that all aspects of any further archaeological work are detailed by a Written Scheme of Investigation (WSI). The WSI would make provision for other forms of archaeological mitigation that might be required in the light of pre-construction investigations, including field investigation, post-fieldwork activities, archiving and dissemination of results. It should be subject to the approval of Lancashire's County Archaeologist and English Heritage's Maritime Team.

7 CUMULATIVE IMPACT ASSESSMENT

This section assesses the cumulative impacts that may arise from the interactions of construction and operation of WoDS with other developments in the eastern Irish Sea and on the coast in the vicinity of the landfall and onshore cable route.

Cumulative impacts are those that may result from the combined or incremental effects of past, present or future activities. While a single activity may itself result in an insignificant impact, it may, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

Defra recommended that the Irish Sea Pilot report (http://mspp.abpmer.co.uk/mspp/index.asp) should be used as the basis for the cumulative impact assessment associated with WoDS. This recommendation has been taken onboard, with the focus of the assessment being that of the North West Coast of England.

Past, present, and future developments were identified through detailed consultations and searches of published information. This focussed on:

- Existing and proposed offshore windfarms;
- Onshore cable routes;
- Existing and proposed marine aggregate extraction sites;
- Existing and proposed oil and gas exploration;
- Existing and proposed offshore infrastructure (cables and pipelines);
- Existing and proposed waste disposal sites (spoil dumping); and
- Other large scale developments.

7.1 International Impact

The WoDS Project itself will have a positive international impact, in terms of decreasing

production of greenhouse gases and associated benefits for global air quality. However, cumulative air quality benefits depend on how far other countries go towards meeting their own Kyoto Protocol targets. It is not possible to quantify cumulative benefits at this time.

7.2 National Impact

Of the 18 offshore windfarm projects offered in Round One of the UK's licencing program, currently 13 lave been consented and 4 have been built (North Hoyle, Scroby Sands, Kentish Flats and BOW)

The Round Two developments (R2) are larger scale. The development rate of new wind turbines is such that by the time R2 developments are potentially built; the output from each turbine may be twice that of those in R1. The 15 round two developments amount to 7200MW and include sites within and beyond territorial waters. It is anticipated that the R2 developments could contribute electricity for more than 4 million households, assisting the UK Government meet its domestic goals for reduction in emission of greenhouse gases.

7.3 Regional Impact

In December 2004, Defra commissioned a consortium to research options for developing, implementing and managing marine spatial planning (MSP) in UK coastal and offshore waters. The Irish Sea was the pilot project area, and the regional cumulative impacts for WoDS are considered in relation to the area covered by the Irish Sea Pilot.

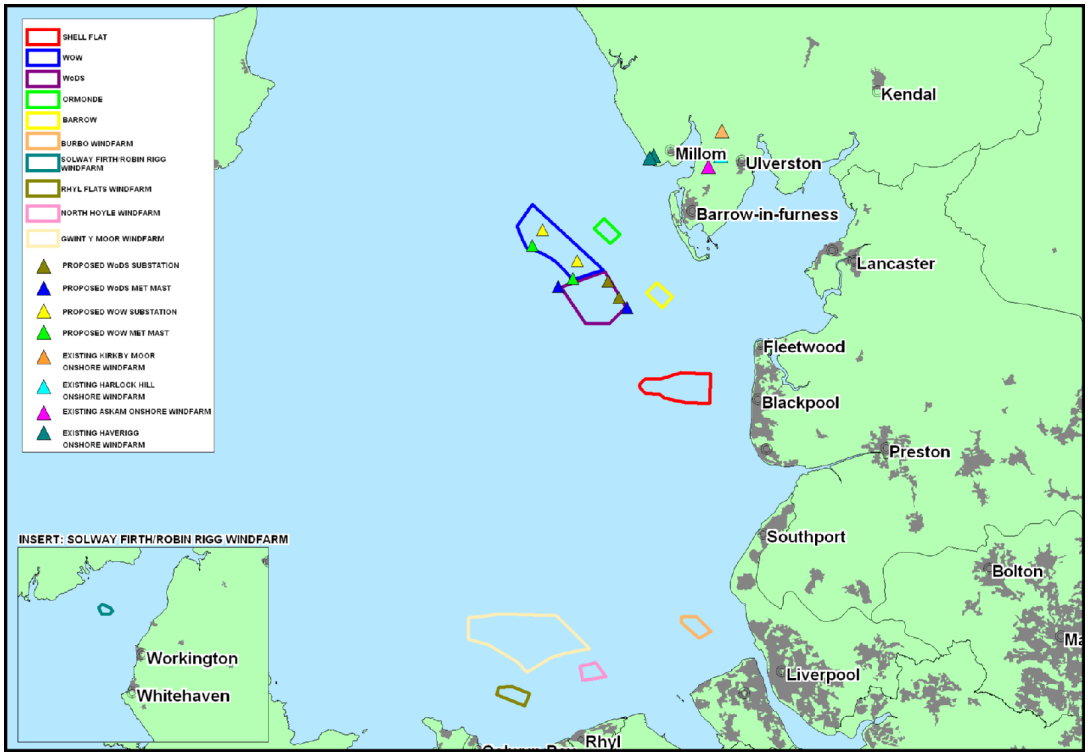
The Spatial Plan covers the majority of the Irish Sea from a southern limit adjacent to Anglesey to a northern limit of the Mull of Galloway. It includes waters of England, Scotland, Wales and Northern Ireland.

7.3.1 Existing and Proposed Windfarms

There are several existing onshore windfarms in operation at Askam, Haverigg I and II, Harlock Hill and Kirkby Moor in Cumbria. There are no proposed new onshore windfarms.

In addition, the waters off the west coast of the England have optimum conditions: shallow offshore waters and strong prevailing winds suitable for offshore windfarms. There are 10 offshore windfarm developments proposed in the Eastern Irish Sea (Figure 14).

Figure 14: Regional Offshore Windfarms Projects



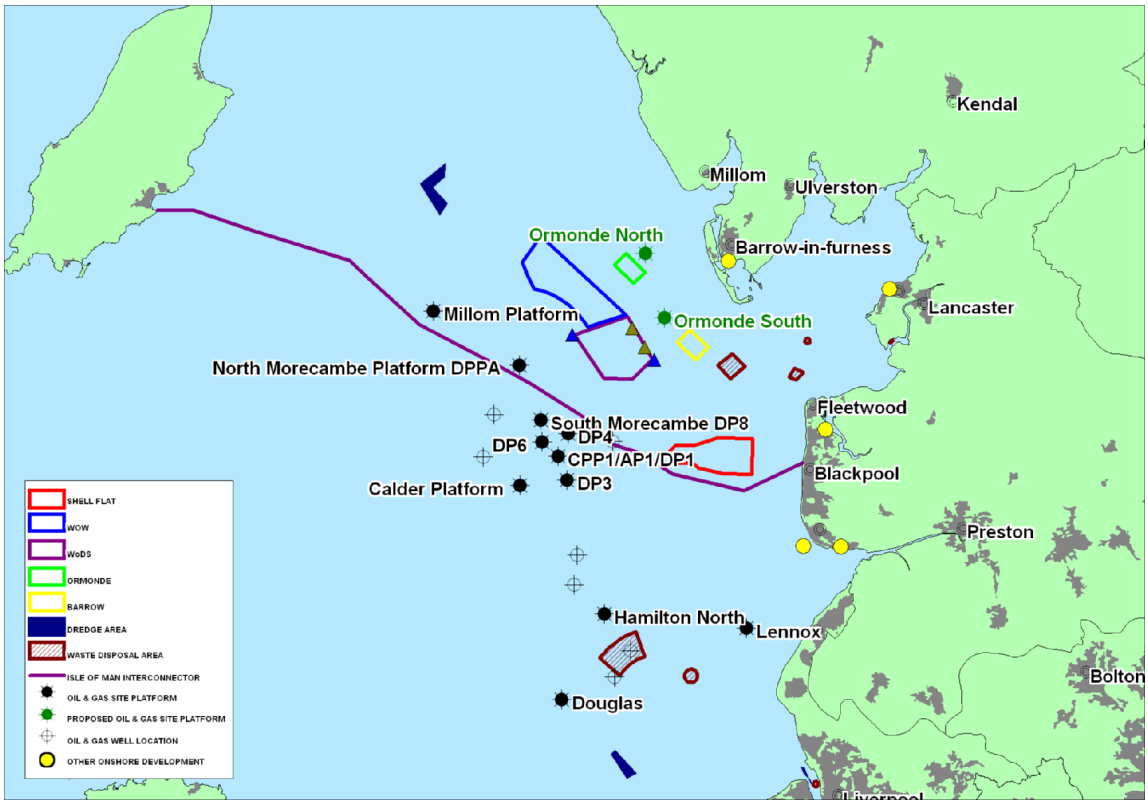
In order to assess the cumulative impacts of regional offshore windfarm developments, a review has been undertaken of the Environmental Statements (ESs) published to date for the BOW, Rhyl Flats, North Hoyle, Shell Flat, Ormonde, Burbo Banks, Gwynt-y-Mor, WOW and Robin Rigg (Solway Firth) projects. Any details contained within these reports, has been used to quantify this cumulative impact assessment wherever possible. There is however a lack of consistency between the data provided within the four reports.

7.3.2 Other Onshore and Offshore Developments

Figure 15 shows offshore infrastructure present in the Eastern Irish Sea which have been included in the cumulative assessment. These include:-

- Cables and Pipelines;
- Onshore Cable Routes e.g. from BOW; and
- A proposed onshore natural gas storage facility and associated infrastructure;
- New sand extraction area along St Annes Foreshore;
- The redevelopment of Lytham Quays;
- The redevelopment of Barrow Docks;
- The redevelopment of Morecambe West End promenade and seafront; and
- Potential bridge across Morecambe Bay.

Figure 15: Offshore Infrastructure in the Eastern Irish Sea



7.4 Human Impact

7.4.1 Employment

There is the potential for around 695-792 wind turbines to be installed in the Eastern Irish Sea. .

The North West can utilise its existing highly skilled offshore oil and gas industry workforce for the manufacture and installation of wind turbine components locally. Construction jobs from all proposed windfarms (with the exception of Burbo – no data given) amount to approximately 1888-1908.

The offshore windfarms in the area are scheduled for construction during years 2005 to 2012, although these may be delayed due to planning or engineering constraints

Employment figures for construction (where applicable) and operations of other developments in the region are not all available, however, positive cumulative impacts are expected on employment, with associated effects on the local and regional economy.

Therefore, there is likely to be a positive cumulative impact to the North West in terms of economic growth.

7.4.2 Commercial Fisheries

The scale of any cumulative effect on commercial fishing will largely be a function of the range of fishing areas of the vessels that could be potentially impacted, relative to the locations of the various windfarm developments within the Irish Sea.

Due to their wider operational ranges, larger vessels (over 15m) have the potential to be impacted by a greater number of windfarm developments than smaller, shorter-range vessels.

The full assessment shows that it is only the adjacent sites, i.e. WOW, Ormonde, BOW and Shell Flat, which may have a cumulative impact on fishing relevant to the WoDS development.

No further impacts are anticipated from already established offshore infrastructure.

7.4.3 Shipping and Navigation

Based on the shipping traffic survey, and the analysis work carried out, several concerns were initially raised. Some of these related to the alignment of the WoDS site with the other windfarms. WoDS layout was revised which has reduced the impact on navigation by increasing separation distances between sites as well as reducing the re-routeing required by traffic.

The increase in the base case risk level in terms of major ship to ship collisions in the local area is in the order of 29%. Taking into account the overall length of shipping routes passing through the area, the increase is an average of approximately 8%.

7.4.4 Tourism and Leisure

Even if more than one windfarm is being constructed at one time, cumulative impacts of noise, visual and traffic are unlikely to be increased by a significant amount due to the offshore nature of the developments. Recreational fishermen, sailing, power boating, windsurfing, scuba diving, jetskiing, waterskiing, and surfing will have to avoid the windfarm areas during construction, but at 14km offshore any impact will be minimal for the near-shore activities. There may be a significant increase in the demand for temporary construction accommodation. However this is unlikely to cause a significant impact given the tourist nature of the local area and the abundance of such accommodation.

7.4.5 Noise

Airborne

Depending upon their location in relation to land receptors, any proposed windfarm site has the potential to increase local noise levels during construction, associated with piling operations and construction vessels travelling to and from the site. During construction of the windfarm, piling would be considered as the most significant potential airborne noise impact. The data provided by all developers within their relevant ESs confirm that the noise generated by each individual windfarm during construction will not be a significant impact. Operational noise levels are lower, and therefore also very localised.

Underwater noise

BOW is the closest neighbouring development to WoDs, and therefore likely to constitute the worst case for cumulative impact assessment. Short-term construction noise is anticipated to cause increased underwater noise levels of around 153dB at BOW from piling at WoDS. This construction noise will, however, be limited to short periods during the daytime only.

7.4.6 Military and Munitions

The presence of numerous large-scale offshore windfarms will have an increased cumulative impact, through increased restrictions on military activity in the area. However, the MOD has confirmed that they have no current objection to the proposed WoDS. From the various ESs, there are no identified impacts or objections on the military from the Robin Rigg, Ormonde, Burbo, BOW, North Hoyle or Gwynt-y-Mor projects. The MOD raised some issues regarding their activities from Warton and the Shell Flat project, whilst the Rhyl Flats ES does not address the issue.

As with all new offshore developments there is the potential for encountering previously unknown munitions or areas of contamination during construction. This risk increases as the number of windfarms increases.

7.4.7 Aviation

Whilst the proposed WoDS would not impinge on operations out of Blackpool, Heysham or Barrow airports, it would have implications on the use of helicopters servicing nearby oil and gas facilities.

Several airfields are present in the general eastern Irish sea area, from which different operators fly. The locations of some of the windfarms have the potential to interfere with their current flight patterns and radar reception. Several discussions are ongoing between the windfarm developers and aviation interests to reduce possible conflicts between the two industries. It can be concluded that the presence of several large-scale offshore windfarms will have an increased cumulative impact on the aviation activity in the area.

7.4.8 Traffic

The potential for increased road traffic associated with individual windfarm projects such as WoDS has been assessed as low, as the majority of equipment and parts will arrive by sea. There is the potential for WoDS and WOW to be built at the same time, resulting in the potential for cumulative traffic impacts. However, if a new turbine manufacturing plant is set up in a local port such as Barrow-in-Furness, the cumulative impact of numerous projects, over a longer construction time could occur. This positive cumulative impact would be low to moderate.

The laying of the onshore cable route is likely to cause a minimal amount of disturbance to the traffic levels in the Heysham area. This is not likely to cause significant impacts. However, should the WoDS cable route be laid in the same time frame as other windfarms significant impacts may occur due to the frequency of landfalls located at Heysham.

Additional traffic movements are expected during the construction of the proposed onshore developments, however this is only likely to result in significant cumulative impacts if construction occurs simultaneously.

7.4.9 Visual Impact

Due to the close proximity of WoDS to the WOW, the cumulative effects assessment was undertaken as a joint exercise.

A total of 18 viewpoints were agreed with the Local Planning Authorities and statutory consultees as the basis for the study of the potential cumulative effects on landscapes/seascape character and visual amenity. The 18 selected viewpoints ranged from Seascale Beach in the north, to St. Anne's Pier in the south.

The results of the detailed assessment indicated that some residual landscape/seascape and visual effects already exist due to the existing BOW and the existing onshore windfarms at Haverigg, Askam, Harlock Hill and Kikby Moor.

The cumulative assessment has determined that as a result of the number of existing and anticipated windfarms proposed within the seascape units, that the overall character of all four seascape units will inevitably change, with major changes to the character of the seascape in certain areas.

6 viewpoints were assessed to be more sensitive where it was considered that the potential for the most significant visual effects may occur, these viewpoints being: VP4 Black Combe; VP5 Coastal Path, Haverigg; VP10 Biggar Bank Road, Walney; VP11 South Walney Nature Reserve and; VP16 Rossall Point, Fleetwood. A summary of the findings of the assessment from these viewpoints is given in Table 6.

Table 6: Summary of Cumulative Visual Effects from Viewpoints

Viewpoint	Magnitude of Change	Sensitivity of Viewpoint	Significance of Residual Visual Effect
VP4 Black Combe	Medium	High	Moderate
VP5 Coastal path Haverigg	Large	High	Major
VP9 High Haume Farm	Medium	High	Moderate
VP10 Biggar Bank, Walney	Large Large	High (residents & visitors) Medium (road users)	Major Major/moderate
VP11 South Walney Nature Reserve	Large	High	Major
VP16 Rossall Point, Fleetwood	Medium	High	Moderate

It is concluded within the WOW and WoDS Landscape/Seascape and Visual Assessment, that the most 'significant' residual cumulative visual effects will primarily occur on the western shoreline of Walney Island, and on the Coast Path close to Haverigg on the northern shoreline of the Duddon Estuary, where the significance of effects are assessed to be major. Moderate residual effects will occur at the elevated viewpoint on Black Combe. Moderate effects will also occur along the western shoreline of the Fylde Coast, but are due primarily to the development of the Shell Flat Windfarm and not attributable to WoDS or WOW.

7.4.10 Marine Archaeology

While there are no protected wrecks within the WoDS study area, potential for archaeological interest within the site and the export cable route corridor does exist. The same is true of the other windfarm developments, though it should be noted that the SS Penrhos, within the Rhyl Offshore Windfarm is a protected site. Construction operations have the potential to negatively impact archaeology, and by adding to the number of construction projects proposed, WoDs is therefore contributing to the potential cumulative impacts on marine archaeology. However, it should be noted that all possible steps will be taken to avoid damage to any archaeological feature discovered during activities through to the decommissioning of the windfarm. Consent conditions are likely to dictate that all windfarm developers are required to avoid archaeological features during the construction of their developments.

7.5 Biological Impact

7.5.1 Birds

Of all the planned or existing activities (e.g. oil and gas, aggregate extraction) in the Eastern Irish Sea, other windfarms have the greatest potential to interact cumulatively with respect to impacts on birds. However, assessments of collision and barrier effects for several bird species concluded that cumulative impacts are unlikely to be significant either for WoDS alone or in combination with other windfarms in the area. There are no additional cumulative impacts to birds anticipated, associated with other on- and offshore developments.

7.5.2 Benthic

WoDS will potentially be 1 of 5 windfarms in relatively close proximity to each other, and its construction alone will not have a disproportionate effect in comparison to any of the other developments. In general the distance between the developments will ensure that there are no greater combined impacts than that created by the individual windfarms. Effects on the benthos from construction, and similarly, decommissioning, operations themselves are unlikely to be significant as the biotopes present are not sensitive to the probable impact sources. During operation, changes to the sediment type and some loss of soft substrate in the area will be the main impact to the benthos; if all proposed windfarm projects go ahead, the impact of loss of seabed has the potential to be moderate, depending on e.g. type of scour protection and foundations used. However, the introduction of hard substrate (e.g. scour protection) has the potential to increase benthic diversity, and could be viewed as a positive impact. Electromagnetic fields from subsea cables of the windfarms in the area may potentially impact benthos moderately; although this will be minimised by shielded cables on the WoDS development.

Fishing (trawling), gas pipelines and a telecommunications cable are all activities or structures already present in the benthic environment in the vicinity of WoDS. Trawling will be having an ongoing effect, with the biotopes present all likely to recover quickly from the impacts. Effects of the pipeline and the cable, which have been installed for a number of years, are likely to be negligible and therefore unlikely to create an additive impact with the construction of the WoDS facilities.

7.5.3 Marine Mammals

The offshore areas of Morecambe Bay are considered to be suitable habitat for grey seal, bottlenose dolphin, and particularly harbour porpoise. However, in general the north eastern Irish Sea is not considered to be important habitat for marine mammals, based on the relatively low number of observations compared with other parts of the British coastline.

In the event that the turbine foundations at all windfarms are pile-driven, there is potential for cumulative disturbance to the species present and if pile-driving operations at adjacent windfarms are simultaneous, disturbance could be significant. It is more likely that the windfarm construction works follow different time schedules, and therefore the overall construction periods will be extended over several construction seasons. However such an extended cumulative construction period may induce a stronger overall impact, as sensitivity to underwater noise is partly related to duration (Schustermann *et al.*, 2000).

The long-term cumulative impact on species abundance in the area is unknown, but the overall impact on the available habitat for grey seals, harbour porpoises and bottle-nose dolphins will likely be small. Accordingly, no significant effects are expected on general health of the species in question as these impacts are temporary albeit prolonged by cumulative development.

During operation, it is estimated that within 180m of each turbine, behavioural changes may occur. Given the number of turbines proposed to be installed, there may be cumulative impacts on behaviour. While grey seal, bottlenose dolphin and harbour porpoise are likely to avoid areas in proximity to turbines, the reduction in available habitat may result in a change of their distribution pattern, rather than a reduction in numbers. The potential for an increased supply of prey species associated with any introduced hard substrates (turbines/scour protection) could help sustain larger populations of marine mammals.

7.5.4 Fish and shellfish

In general the distance between the developments will ensure that there are no greater combined impacts on fish and shellfish than that created by the individual windfarms.

During construction, the greatest impact to the fish species present will be from percussion piling should that installation method be used. Slow start (where the trength of the percussion blows are reduced as piling commences) has the potential to provide some degree of “warning” to fish present, with the intention that they move away from the source. However, should other noisy operations be taking place in adjacent sites (such as WOW or Ormonde), then fish moving away from one noise source could become closer to other noise sources. Should concurrent piling occur, effects could be considered significant, however, the likelihood of this occurring is low.

It is currently proposed that trawling is excluded from around the individual turbines within the WoDS area; this is also the case for the other

adjacent windfarms, with the exception of WOW where exclusion of bottom trawling from the whole windfarm area is proposed. For the fish and shellfish within any safety (exclusion) zones that are established, the impacts will be positive, allowing the individuals to mature naturally and potentially to provide a protected source of juveniles to repopulate the fished areas.

Groups that are considered to be most affected by EMF derived from the electrical transmission cables are migratory species such as salmon, sea trout and eels, and the elasmobranches, i.e. skates, rays, dogfish and sharks. It is not considered, overall, that there will be a cumulative impact to migratory species.

Elasmobranchs are present in the windfarm areas, and will be using these areas to feed in, and potentially for reproduction. EMF from the 5 proposed windfarms may have a cumulative effect on these species. EMF can act as an attractant or deterrent to these fish, depending upon the strength of the field. Given the proposed alignment of the export cables into the Heysham area, this could be a particular area of cumulative EMF effects on elasmobranchs.

Decommissioning of WoDS and its cables will generate disturbance to the sediment, which is similar to that from construction operations. Should all developments be decommissioned concurrently this is still unlikely to cause a cumulative effect on the fish and shellfish. Noise levels from decommissioning are anticipated to be much lower, and therefore unlikely to be significant cumulatively.

7.6 Physical Impacts

7.6.1 Geology

The total area of seabed disturbed by offshore construction, assuming all 10 proposed windfarm projects were built in the Eastern Irish Sea, is approximately 369.3km^2, this is a small overall percentage of the whole area and the potential for cumulative impacts is therefore considered to be small and not significant.

Approximately 530.94km^2 of seabed are currently subject to disturbance from other offshore developments. This equates to less than 0.3% of the total area of the Eastern Irish Sea, and as such, the cumulative impact is not anticipated to be significant.

The issue of sediment transport is not considered to be significant at any of the 10 individual windfarm sites (Rhyl Flats, North Hoyle, Burbo, Robin Rigg, Gwynt-y-Mor, WoDS, WOW, Ormonde, Shell Flat and BOW) thus the cumulative impact is assessed not to be significant.

The laying of the onshore cable route is likely to cause a minimal amount of ground disturbance. However, should all proposed windfarms and their associated cable route be developed the quantity of ground disturbance increases.

7.6.2 Oceanography

The laying of the onshore cable route is likely to cause a minimal amount of ground disturbance. However, should all proposed windfarms and their associated cable route be developed the quantity of ground disturbance increases.

7.6.3 Water Quality

The individual impact on water quality of WoDS and of other windfarms in the area is predicted to be low; therefore cumulative effects are considered to be insignificant, particularly as each of the facilities mayl be constructed in different years. Other offshore developments that reduce water quality, such as aggregate dredging, are not anticipated to cause cumulative impacts.

7.6.4 Climate Change and Air Quality

Some greenhouse gas and dust emissions will result from construction and operation of local windfarms, although this will be offset through the positive contribution of wind energy to reducing overall carbon emissions nationally. No cumulative impacts with offshore gas facilities on air quality are anticipated. These projects would constitute to over 25% of the 2010 target and 15% of the 2015 target.

Construction of the offshore windfarms will help the UK Government meet its domestic goals for reduction in emission of greenhouse gases. The wind energy industry is the most technically and commercially advanced to achieve the majority of the government's targets for 10% and 15% electricity from renewable sources by 2010 and 2015 respectively. Offshore wind will play a significant part of the total wind-generated electricity.

The cumulative impact of both onshore and offshore windfarm developments in a national context will make a significant contribution towards the reduction of harmful gases (which contribute to global warming and acid rain) that would otherwise be generated from fossil fuel electricity generation in the UK, and will therefore be beneficial in terms of air quality.

7.6.5 Energy Supply

Further development of wind energy in the Eastern Irish Sea will make an important contribution towards the North West's targets for renewable energy. No cumulative impacts associated with

other on- and offshore energy developments are anticipated.

7.7 Accidental Impact

Although accidental environmental impacts such as collisions will be statistically more likely to occur if all the proposed windfarms are developed, site-specific contingency measures will be in place to minimise potential effects. Therefore any cumulative impacts will be minimised.

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