



**ORIEL WINDFARM LTD.
OFFSHORE WIND FARM**

ENVIRONMENTAL IMPACT STATEMENT

Non-Technical Summary

Volume 1 of 3

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Table of Contents

Executive Summary	1
NON-TECHNICAL SUMMARY	4
1. Introduction	4
2. Site Location	5
3. The Needs for and Benefits of the Proposal	6
3.1. Environmental Benefits	6
3.2. Economic Benefits	8
4. Site Selection and Layout Design	8
4.1. Site Selection	8
4.2. Turbine Layout Design Process	8
5. Site Layout	9
6. Turbine Type and Size	11
7. Turbine Foundations	11
8. Scour protection	14
9. Offshore Cabling and Substation	14
10. Grid Connection Onshore	15
11. Construction Timetable	15
12. Decommissioning	15
13. Navigational Restrictions	16
14. Navigational Lighting and Marking	16
15. Construction Port	17
16. Environmental Baseline Studies	17

17. Summary Findings of the Environmental Impact Assessment..... 18

17.1. Bathymetry & Topography..... 18

17.2. Hydrography 19

17.3. Marine Benthos & Sedimentology..... 19

17.4. Terrestrial Habitat Assessment 20

17.5. Fish..... 21

17.6. Birds 22

17.7. Marine Mammals & Reptiles 25

17.8. Landscape 26

17.9. Archaeology 28

17.10. Construction Effects on Land..... 29

17.11. Offshore Noise..... 29

17.12. Marine Navigational Effects 29

17.13. Aviation & Military Impacts 30

17.14. Socio-Economic Impacts 31

17.15. Effects on Mineral, Oil & Gas Deposits 32

17.16. Undersea Cables & Pipelines 32

17.17. Telecommunications & Electromagnetic Transmission 32

18. References..... 32

List of Illustrations

FIGURE 1: LOCATION OF THE LEASE AREA INSIDE THE FORESHORE LICENCE AREA..... 5

FIGURE 2: LOCATION OF TURBINES, SUBSTATION AND SUBSEA CABLE ROUTES TO SHORE..... 10

FIGURE 3: ENERCON E-112 4.5MW TURBINE WIND TURBINE LOCATED NEAR MAGDEBURG, GERMANY. 11

FIGURE 4: GRAVITY FOUNDATION STRUCTURE..... 13

Executive Summary

Development Details

- The Oriel wind farm will be a 55 turbine offshore wind farm in the north-west Irish Sea, 22km south-east of Dundalk and 24km north-east of Drogheda.
- The development will include an offshore substation and buried cabling between the turbines and the substation and between the substation and shore.
- The turbine selected will depend on the range of turbines commercially available at the time of construction. It is likely that the turbines will have an installed capacity of at least 4.5MW each and potentially upwards of 6MW. The turbines will have a maximum height between mean sea level and turbine blade tip of 160m. The wind farm will cover an area of approximately 28km².
- Three potential cable routes have been identified from the offshore substation to shore; one to the west at Castlebellingham, one to the south-west at Dunany and the third to the south at Bremore.
- On land elements of the cable route and onshore grid connection will form the subject of a separate planning application by Eirgrid.
- The site will be constructed over 1-5 phases, each phase lasting from spring to summer of a single year.
- Oil free cables will eliminate the risk of oil leaks.

Economic & Environmental Benefits

- The investment value of the Oriel wind farm will be approximately €375-€623 million.
- Construction may give Ireland the technical experience to be a significant force in the offshore wind industry.
- The project may allow Ireland to reshape its offshore construction industry, giving Ireland the potential to be one of the world's major exporters of offshore wind construction expertise.
- Approximately 243 jobs and 44 professional and managerial jobs would be created over a 5-year construction period.
- 40 operational and maintenance jobs will be created for the lifetime of the development.
- The output of the wind farm will be sufficient to meet the needs of approximately 250,000 average households.
- The use of renewable energy will play a crucial role in strategies to reduce the threat of global warming and climate change.
- The Oriel wind farm will make a contribution to Ireland's efforts to meet our Kyoto target by reducing greenhouse gas emissions. Ireland could be liable for fines of up to 2.8% of GDP or €1.3-4.0 billion.
- Approximately 296 million kilograms (approximately 30,000 tonnes) of CO₂ and approximately 236,000 kilograms (approximately 236 tonnes) of NO_x will be displaced each year by the Oriel wind farm at full production.

Environmental Studies

A number of detailed studies and surveys of the physical, ecological and human environment at the proposed development site have been carried out since 2003. Surveys ranged from geotechnical assessments of the wind farm area to birds flying above the site.

Marine Studies & Potential Impacts

- Construction, operation and decommissioning of this wind farm would have an insignificant effect on tidal flows, waves and natural sediment transport
- Should any spillage of hydraulic fluids or other pollutants occur, they would be rapidly diluted by the water flow through the site.
- Permanent loss of the seabed at the foundation locations would cover a total of 0.11km² of the wind farm area, i.e. 0.4% of the wind farm area.
- Areas of seabed disturbed in the vicinity of the cables and foundations will recover in approximately 6 months to a year.
- Operational effects will have no more than a negligible effect on fish.
- The pre-armouring and burial of the cables will result in a negligible impact on fish and marine organisms.
- It is likely that the new hard substrate provided by the foundations will attract fish and other marine organisms to the area.
- The construction of the wind farm will not significantly impact on bird populations in the area.
- Effects from offshore cable laying operations in the wind farm area would be short-term and localised on the seabed. Such operations are not thought likely to cause significant impacts on seabirds.
- In the intertidal area, the cable will be buried using a directional drill, thereby minimising impacts on birds and marine fauna in the area.
- The operational phase of the wind farm is not believed to significantly alter bird populations in the area.
- The wind farm has avoided the most valuable *Nephrops* area to the south.
- Construction and operational noise from the wind farm are not predicted to significantly affect marine mammals and reptiles in the area.
- Electromagnetic effects from the marine cables will not significantly impact on fish, mammals or other marine organisms in the area.

Other Studies & Potential Impacts

- The selected turbine layout design was a hexagonal grid. This layout will minimise landscape and visual impacts as far as possible and allow for positive visual effects.
- The proposed Oriel wind farm will not create an unacceptable level of adverse visual or landscape impact. In fact, from the majority of locations assessed, the level of impact will be quite low.
- The ecological impacts arising from the onshore cable construction phase will be temporary
- Two wreck sites are located close to but outside the development area. One is located approximately 250-300m south of the proposed cable route to shore at Castlebellingham. The cable route will avoid this shipwreck. The second site is located approximately 900m southeast of the proposed development area. This will be unaffected by the development.

- There will be no adverse impact on land due to the construction of the wind farm and there will be no impact on land from the operational wind farm.
- During the operational period leisure and fishing craft will be permitting to move through the wind farm area.

NON-TECHNICAL SUMMARY

1. Introduction

This document summarises the proposal to build, operate and decommission a 55 turbine wind farm in the north-western Irish Sea, including the key findings of the environmental assessments carried out for the proposal. Figure 1 shows a map of the Licence area within the larger Foreshore Licence area.

This Environmental Impact Statement will accompany an application to the Department of Communications Marine and Natural Resources for a Foreshore Lease under the Foreshore Act 1933 (as amended), which is required for the construction and operation of offshore electricity generating stations in the State-owned foreshore, which extends out to the 12 nautical mile limit.

The Environmental Statement itself is required by European Environmental Impact Assessment Regulations, for wind power developments with more than 5 wind turbines or a capacity greater than 5 megawatts (MW).

The content of the Statement is in accordance with the Statutory Instrument, which implements the European Regulations into Irish law. The Statement contains information relating to the construction and operation of 55 wind turbines of a maximum height between mean sea level and turbine blade tip not exceeding 160m, foundations, an offshore substation, undersea power cables between turbines and the substation, undersea power cables to shore and associated works.

This Environmental Statement has been compiled by Aqua-Fact International Services Ltd, on behalf of Oriel Windfarm Ltd., a privately owned Irish sustainable and renewable energy company. Aqua-Fact's staff have worked on approximately 45 Environmental Impact Assessments, including an EIA for an offshore wind farm off the west coast of Ireland.

Brian Britton is Managing Director of Oriel Windfarm Ltd. He is a private equity consultant based in Dundalk and his firm, Britton Consultants, has recently completed a multi-million Euro fund raising for Oriel. The company's principal backers include acknowledged leaders in sustainable energy development, the Hannevig brothers, Dan and Chris, who are regarded as groundbreaking pioneers in identifying and promoting the potential that Ireland has for wind farms. The Hannevig brothers were involved in the development of the Arklow wind farm. The company's first project is the development of the proposed wind farm.

This document represents the Non-Technical Summary of the Environmental Statement. The full Statement, incorporating more detailed technical information about the site, the design of the wind farm and its interaction with the existing environment, can be viewed at the locations listed in the Appendix.

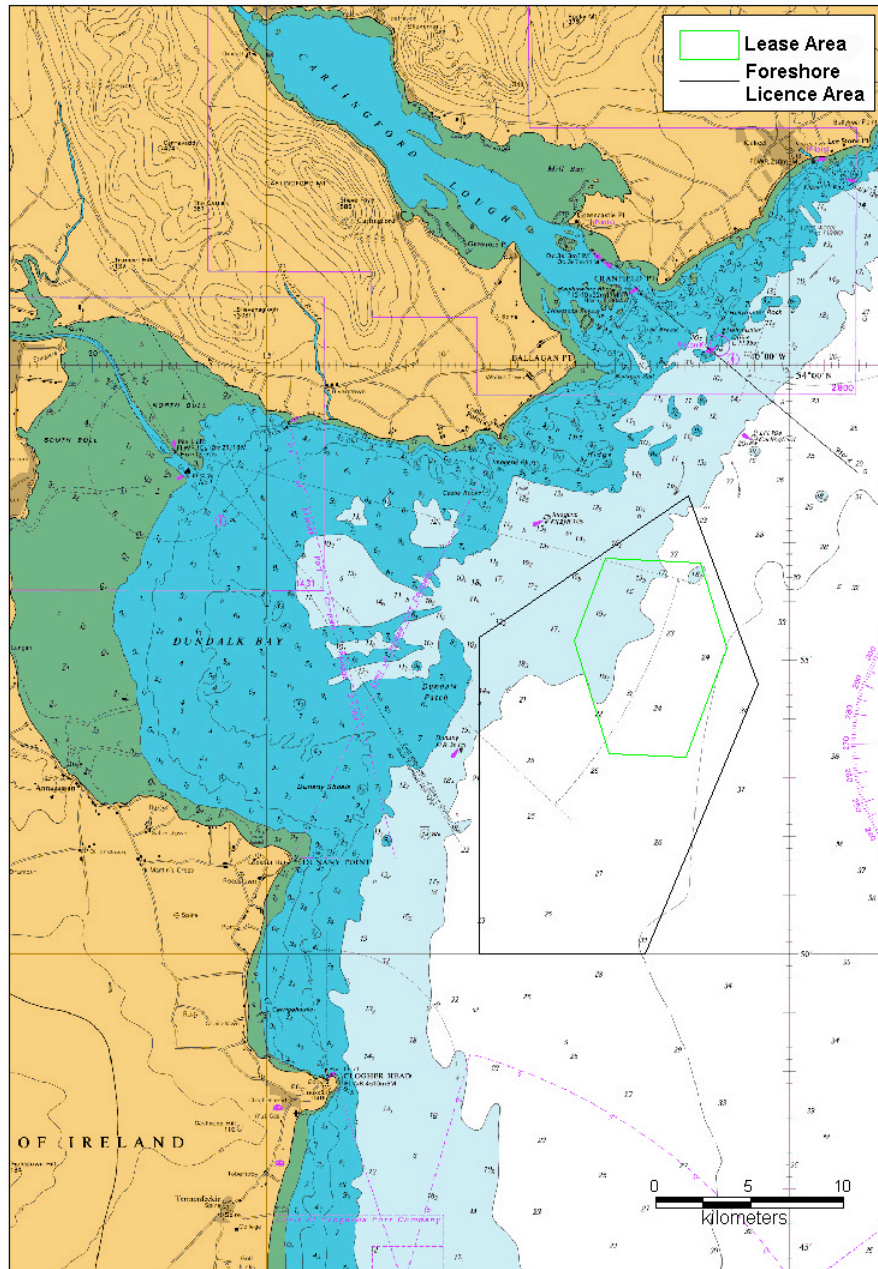


Figure 1: Location of the Lease area inside the Foreshore Licence area.

2. Site Location

The main part of the development (i.e. turbines, foundations and substation) will be located in the north-western Irish Sea, approximately 22km south-east of Dundalk and approximately 24km north-east of Drogheda. The turbines will be placed in waters ranging from approximately 15 to 30m, and would be 5km from the coast at the nearest point. Refer to Figure 1.

3. The Needs for and Benefits of the Proposal

3.1. Environmental Benefits

The International Energy Agency (IEA) defines renewable energy as energy derived from natural processes that are replenished constantly, including electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal sources and biofuels and also hydrogen derived from renewable sources. Renewable energy sources differ from fossil fuels because they are infinite resources and are replenished at the same rate they are consumed. Harnessing of renewable energy sources such as wind leads to little or no emissions of carbon dioxide and other greenhouse gases, which cause global climate change.

There has been increasing concern regarding levels of greenhouse gas emissions throughout the world in recent times. It is believed that the current atmospheric carbon dioxide levels are higher than they have been during the past 420,000 years and probably the past 20 million years (EPA, 2004). This increase is mainly due to the combustion of fossil fuels and also land-use change, especially deforestation. The recently published Stern Review of the Economics of Climate Change (Stern, 2006) is considered to be one of the most comprehensive reviews of the economic impact of global warming and the policies that are required to address this issue. There are very clear signs in recent decades that physical conditions across the marine areas of Ireland and Great Britain are changing in response to warming of the atmosphere (Boelens *et al.*, 2005).

Use of renewable energy plays an important part in the strategies to reduce the threat of climate change ('global warming'). The Irish government have recognised that if positive international action to limit greenhouse gas emissions across the globe are not taken, in the coming century Ireland's climate will be altered giving potentially higher winter rainfall with more severe flooding, lower summer waterfall and water shortages, rising sea levels, accelerated coastal erosion, loss of bogland and threats to agriculture due to additional pests and diseases. 'Business as usual' scenarios are no longer an option for Ireland.

The need to address climate change has been recognised at a global, European and national level, via legally binding targets for the reduction in the emissions of carbon dioxide. Under the Kyoto Protocol, Ireland, as a developing nation, was allowed to increase its emissions by 13% above the levels recorded in 1990. We have substantially exceeded these limits already and the Department of the Environment, Heritage and Local Government in 2000, estimated that net emissions in the period 2008 – 2010 will have increased by 35 – 40% based on a business as usual scenario, approximately three times the target agreed under the Kyoto Protocol.

If Ireland fails to meet its Kyoto agreement, not only will we face stiff fines from the EU but the Government will be obliged to purchase, at extremely high costs, "green credits" from countries which produce sufficient "green credits" to have spare supply. Estimates indicate that these fines will be in the range of €1.3 billion to €4 billion in 2012. Fines of this level would equate to approximately 2.8% of Ireland's GDP. These fines may not be once off but could be applied annually for each year that Ireland exceeds its targets. The

cost of this can only be met by taxation. Significant emission reductions will have to be implemented across all sectors of the Irish economy if these potentially crippling fines are to be avoided.

In May 2006, as part of the EU Renewable Energy Directive, the Department of Communications, Marine and Natural Resources announced the publication of the next market support mechanism for renewables, known as the Renewable Energy Feed In Tariff (REFIT). The REFIT Programme will support the construction of an initial target of at least 400MW of new renewable energy powered electricity generating plants. It aims to more than double the contribution of renewable sources in electricity production from 5.2% in 2004 to 13.2% by 2010 by increasing the total capacity of renewable energy technologies built to 1,450MWs. This new programme, if successful will be a major step by the Government towards delivering Ireland's commitments under the Kyoto agreement.

In October 2006, the Department of Communications, Marine and Natural Resources published an Energy Green Paper (DCMNR, 2006) on sustainable energy future for Ireland. This paper sets out policy proposals for Ireland up to 2020 to transform Ireland's energy landscape. The paper sets ambitious targets for boosting Ireland's renewable energy.

The Oriel wind farm is estimated to produce a peak level between 250 and 330 MW of electricity depending on the final turbine selected for the site (turbine selection will depend on the range of turbine commercially available at the time of construction, it is likely that turbine size will range from 4.5 MW to upwards of 6MW). The average output of the wind farm, given wind speed variations on the site, would be sufficient to meet the annual electricity demand of at least 250,000 average Irish households and would contribute to the additional target required to achieve Ireland's EU indicative target of 13.2% of electricity from renewable sources by 2010. The proposed Oriel wind farm would therefore represent a very significant contribution to the Irish renewables and CO₂ emissions reduction targets.

Subsidiarity, (the division of global responsibility down to the national and regional scales), is a key principle of the United Nations Framework Convention on Climate Change. For the aims of the Convention to be met each signatory state and each region within that state must meet its share of the overall emissions reduction target. Any development that contributes significantly to the regional renewable energy targets is playing a major role in mitigating against the environmental and social impacts of climate change that would occur under a global 'do nothing' scenario.

Total projected annual output of the Oriel wind farm is 788GWh for a 250MW installation. The output would be higher if 330MW is installed. There will be net gains of emissions saved per MWh. These are estimated at 375kg CO₂ and 0.3kg NO_x per MWh. These estimates resulted in emissions saved with a value of €9.6 million in a full year of production and with a present value of €98 million for the project. This amounts to approximately 296 million kilograms (approximately 30,000 tonnes) of CO₂ and approximately 236,000 kilograms (approximately 236 tonnes) of NO_x being displaced each year at full production. The electricity produced by the Oriel wind farm would displace electricity produced by conventional fossil fuel power stations. The emissions savings are based on the gases that would be emitted by fossil fuel power stations in Ireland should the Oriel wind farm not be constructed.

3.2. Economic Benefits

Construction: The project will incur a total investment of €375 - €623 million and will involve a diverse range of businesses including civil engineering design, specialist plant hire, shipping and transportation, rental of port facilities, purchase of turbine and electrical components and civil and marine engineering contractors etc. The period of intensive use of port facilities is expected to last for between 1 and 5 construction seasons (approximately 9 months each). Approximately 243 jobs and 44 professional and managerial jobs would be created over a 5-year construction period, both on shore and offshore. A number of these workers are likely to be sourced locally.

Operation: The operational and maintenance period would involve the creation of 16 jobs by the initial 50MW phase and 40 jobs would be created for the lifetime of the development. In addition, there would be investment related to monitoring of the marine environment, including the periodic hire of local boats for seabird surveys and benthic grab surveys during the first few years of the operation of the wind farm.

In the broader picture, the Oriel wind farm would be a sufficiently large and long term construction project to allow Ireland to reshape its offshore construction industry, giving Ireland the potential to be one of the world's major exporters of offshore wind construction expertise.

4. Site Selection and Layout Design

4.1. Site Selection

Dan and Chris Hannevig initiated the search for potential offshore locations, which would be suitable for wind farm development in 1998 in consultation with the Department of Communications, Marine and Natural Resources. Sites along the east coast were investigated and the Dundalk Bay area was selected as the most suitable location for the development of the Oriel wind farm.

Following selection of the Dundalk Bay area, a more detailed site selection process began. A number of constraints were key in the site selection process. The north-eastern sector of the Foreshore Licence area was selected for the position of the turbines (Lease area). Refer to Chapter 2 "Alternatives Considered" Section 2.1 "Alternative Locations" of the main EIS for a detailed description of site selection.

4.2. Turbine Layout Design Process

Within the technical constraints of the site, turbine layout design was guided principally by two considerations: visual and landscape effects and geotechnical/engineering constraints.

It was seen to be of key importance to design a wind farm layout that minimised the visual and landscape impacts when viewed from the coast for a given number of turbines. The landscape impacts were considered a priority over the engineering impacts and as a result, a landscape-led approach formed the basis of the turbine site selection. Any engineering difficulties encountered as a result of the landscape-based design could be overcome by alterations of the engineering design to accommodate each turbine site.

The selected turbine layout design was a hexagonal grid, which spans approximately 6km north to south and approximately 4.8km east to west (at its widest point). This reduced as far as possible, the horizontal extent of the wind farm when viewed from the coast. This layout was selected as the preferred layout for the Oriel wind farm. This was felt to minimise landscape and visual impacts as far as possible and allow for positive visual effects. Refer to Chapter 2 “Alternatives Considered” Section 2.5 “Alternative Turbine Layouts” of the main EIS for a detailed description of turbine layout design.

5. Site Layout

Figure 2 shows the proposed 55 turbine layout of the wind farm including the cable routes to shore and the offshore substation. The layout comprises eight east-west rows. The turbines are separated by 600m in the east-west direction and 925m in the north-south direction. The layout is compact both in distance between turbines and in overall shape, which were considered to give landscape and visual advantages over more largely spaced turbines. The layout will cover a total area of 28km².

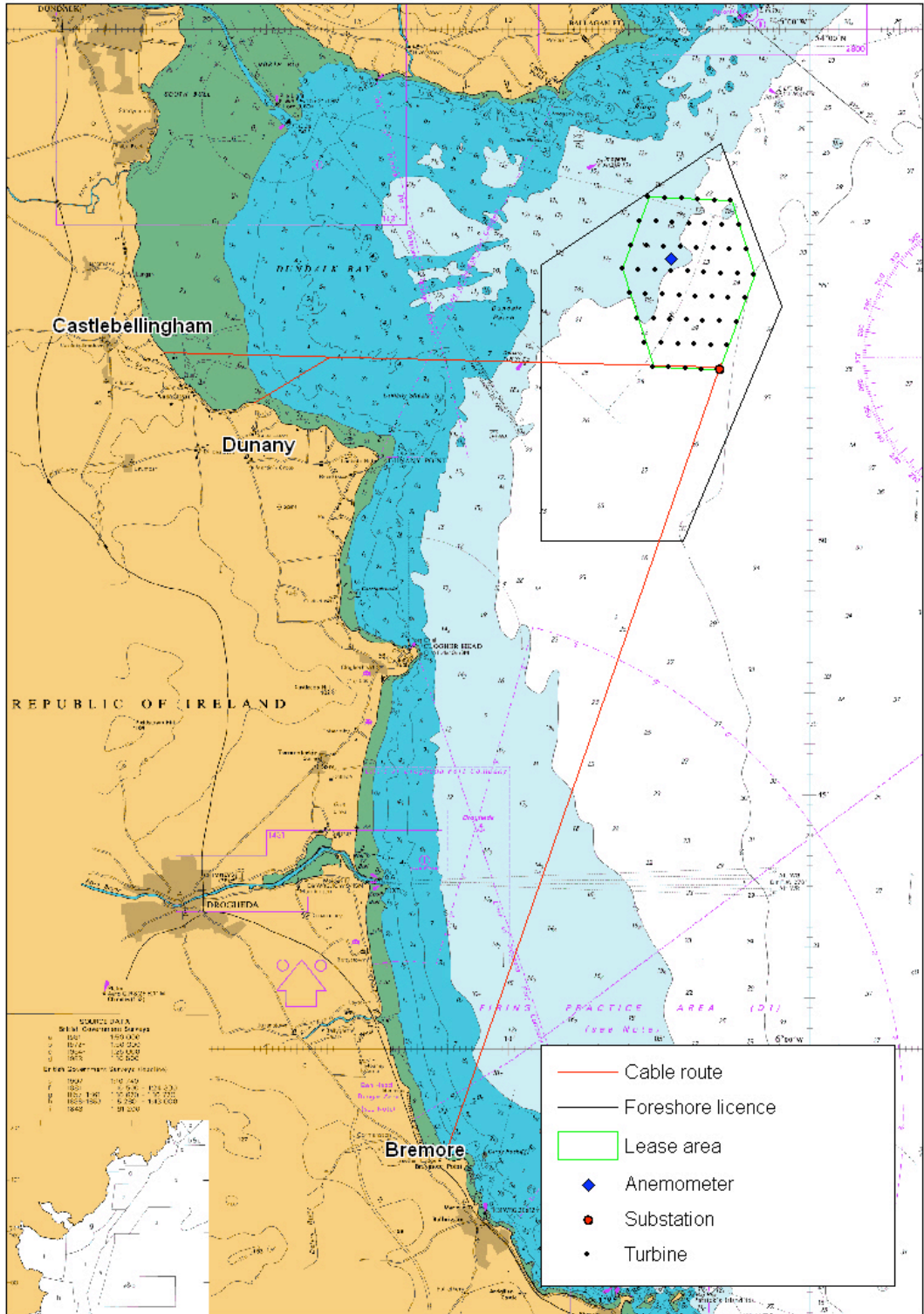


Figure 2: Location of turbines, substation and subsea cable routes to shore.

6. Turbine Type and Size

A final decision has not yet being made with respect to the technical specifications of the turbines for the proposed development. However, the turbines will be three bladed with a tubular tower and a nacelle, which would contain the generator, gearbox and other operating equipment.

Turbines considered for the site would range in installed capacity from a minimum of 4.5MW to potentially upwards of 6MW, depending on commercial availability at the time of construction. The maximum dimensions for any turbine considered would be 100m from mean sea level to hub-height and 120m rotor diameter, giving a maximum height above mean sea level of 160m. The base of the turbines would be bolted to the platform at the top of the foundation that would be placed above the highest astronomical tide and storm surge and would provide access to maintenance personnel. Once erected, the turbines would operate automatically, requiring planned servicing on a periodic basis (normally once a year).

The final choice of turbine model would be made by competitive tender prior to construction. A photograph of a model of a 4.5MW production turbine of a type that would be suitable for use at the site is given below (Figure 3). Larger machines of 6 MW are not yet in commercial production but are expected by the time the Oriel wind farm will be constructed. Details on turbine type can be found in Chapter 2 “Alternatives Considered” Section 2.6 “Alternative Turbine Manufactures” and Section 2.7 “Alternative Turbine Types” of the main EIS.



Figure 3: Enercon E-112 4.5MW turbine wind turbine located near Magdeburg, Germany.

7. Turbine Foundations

A number of foundation types were explored during the design phase of this project. These included gravity, monopile and multi-pile (tripod) designs. The foundation type favoured for the proposed development is the concrete caisson gravity foundation. These foundations have been used for the construction of almost all onshore wind farms to date. Details on turbine

foundations can be seen in Chapter 2: “Alternatives Considered” Section 2.8 “Alternative Foundations” of the main EIS.

The design is based on a bottom plate, with a hollow cylindrical up stand and a central concrete cylinder onto which the turbine tower is bolted (see Figure 4). These foundations may be cylindrical, polygon, square or rectangular in shape. Some levelling of the seafloor may be need in some areas (depending on the seafloor) before the gravity foundations are laid down. Typical dimensions for a concrete gravity foundation at water depths of 15 and 30m are foundation base diameters of 40-50m and a weight between 2,000 to 4,000 tonnes purely for the concrete. The ballast material can be comprised of hydraulic sand or iron ore, concrete, gravel, water or olivine. Depending on the construction design of the foundations, the concrete itself, due to its weight may be sufficient to act as the ballast.

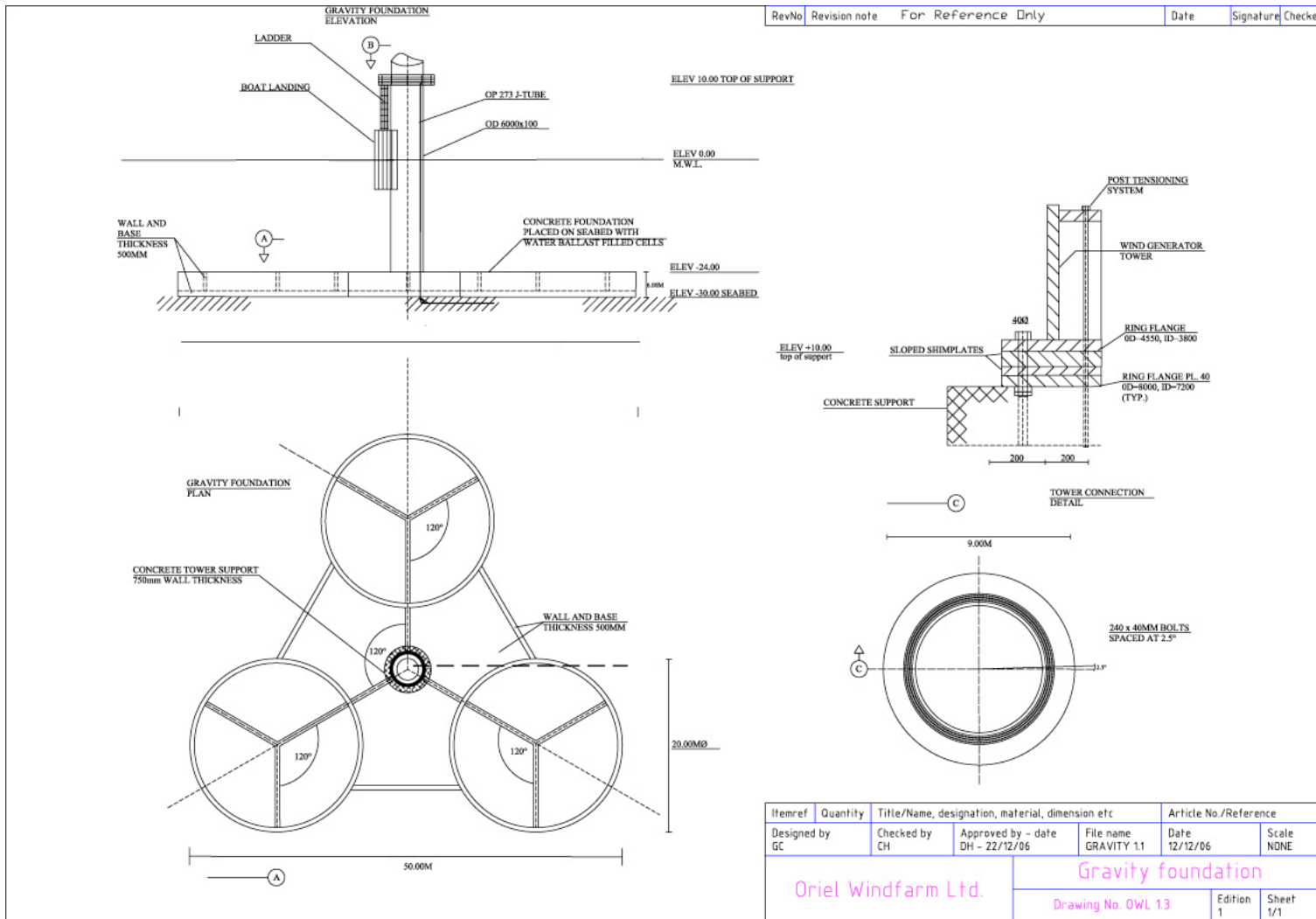


Figure 4: Gravity foundation structure.

The gravity foundation can be built on a floating dry dock and floated to its final destination before being lowered into place by a crane on a barge. Water and compressed air jets can be used to bed the structure into its final position. The bottom is sealed with concrete and the enclosure is filled with the ballast material to achieve the necessary mass.

8. Scour protection

Scour is the removal of sediments from around the bases of the foundations by current action. Gravity bases must be protected against deep scour by either incorporating scour into the foundation design or by placing layers of stones and boulders on the seabed surrounding the structure. Alternatively, fronds can be used as a means of scour protection to weaken the currents approaching the foundation. Fronds act like natural seagrass in weakening currents.

9. Offshore Cabling and Substation

The turbines will be interconnected by 33kV power cables. These cables will be interconnected at the offshore substation. At the substation, the voltage will be transformed from 33kV to 110kV and a 110kV power cable will bring the power to shore. The substation will contain switchgear, a number of 33kV/110kV transformers and a diesel backup generator. The cooling oil tank for transformers, the transformers themselves and the diesel tank would all be securely banded to ensure capture of all oil or diesel that could be released in the unlikely event of a leak. The substation would have a boat mooring and would act as the base for maintenance operations on the wind farm.

All of the cables will be buried to a depth of at least 2m using a plough. The cable installation using a plough will involve the plough opening a trench in the seafloor, into which the cable will be passed and the trench will be immediately backfilled by the passing plough. In areas where harder sediments are present, a jetting system will be used to fluidise the sediment to allow the plough to bury the cable.

Three potential landfall locations have been identified. The first landfall location is situated approximately 2km south-east of Castlebellingham, Co. Louth. The second landfall is located approximately 2.25km north-west of Dunany Point, Co. Louth. The third landfall location is located approximately 1km west of Bremore Point, Co. Dublin. In the intertidal and landfall areas, a directional drill will be used to install the cable 2m minimum below the seabed surface, thereby minimising any disturbance to flora and fauna in the area.

The marine cables will be fitted with substantial armour to withstand the high mechanical stresses during installation and potential disturbance during operations. In the event of damage to cables, measures have been taken to protect water quality through the selection of oil free XLPE-type cables that would have minimal pollution risk,. Armouring and electrostatic screening of the cables will bring the electromagnetic field in the vicinity of the cable to an effective zero.

10. Grid Connection Onshore

Due to uncertainties regarding the ongoing development of Bremore Port and future ESB infrastructural developments at Stephenstown, Co. Dublin onshore grid connection aspects for the Bremore cable route have not been examined at present. Onshore grid connection aspects have not been examined for the Dunany route either. However, if either of these two routes are selected, a full survey, to the level carried out for the Castlebellingham route, will be carried out. With respect to the Castlebellingham route, the wind farm will be connected to the National Grid at a location approximately 2.5km east of Tallanstown, Co. Louth. The onshore cabling will be buried underground. The final route from the landfall point to the point of connection will be the responsibility of EirGrid and would be the subject of a separate planning application. Refer to Chapter 2: “Alternatives Considered” Section 2.4.2 “Alternative Routes for Onshore Connection” of the main EIS for more details on onshore connection.

11. Construction Timetable

The wind farm will be constructed over 5 phases of 11 turbines each. Each phase will be completed over a single construction season. Each construction season would last between April and October. Each phase will be fully commissioned and producing electricity by the end of each working season. If all relevant consents are gained, preparatory construction is expected to begin in early 2009.

Each construction phase would comprise the following:

- Pre-construction design and fabrication
- Preparation of onshore compounds and port facilities
- Mobilisation onshore
- Foundation construction
- Seabed preparation (if required)
- Mobilisation offshore
- Installation of foundations and scour protection (if required)
- Installation of towers, nacelles and blades
- Laying of cables
- Commissioning and testing of turbines.

The following activities would take place during the first construction season:

- Installation of the offshore substation
- Laying of site to shore cable
- Building and commissioning of onshore grid connection facilities.

12. Decommissioning

The wind farm is expected to last until the end of the century. During this time the turbines may be replaced and upgraded on an ongoing basis. The decision to replace/upgrade the turbines will depend on an economic/commercial evaluation and advances in turbine technology. The turbines and substation design will allow for an effective and complete return to preconstruction conditions. Every element of the wind farm will be recycled

following decommissioning unless there are overriding environmental reasons to leave some elements in place i.e foundations providing established artificial reefs.

A method statement will be drawn up at the time of decommissioning which will be agreed with all relevant authorities at the time. The final decision on the method will be made by the contractor and must be with the consent of the Minister for Communications, Marine & Natural Resources. Decommissioning is usually the reverse of the installation process.

13. Navigational Restrictions

During the construction of each phase, all vessels not related to the construction of the wind farm will be excluded from the offshore construction area around the turbines and cabling under construction. This would mean that only the area being worked on in any season would be out of bounds to all shipping. The area of exclusion would extend 300m beyond the outside of the turbine array of each phase, to allow safe manoeuvring of vessels when constructing machines on the edge of the layout.

During the operational lifetime of the wind farm, there will be no exclusion zone in operation around the wind farm. However, there will be a safety zone (60m radius – under the swing of the blade) around each turbine. Anchoring to a depth of 1.5m will be permitted within the wind farm area. Marine Notices will be issued and charts will be updated warning of the dangers of trawling within the wind farm area. Vessels will not be permitted to make fast to the turbines, anemometer mast, or the sub-station.

During decommissioning of each phase, the construction area exclusion would be reinstated for the single season of works. Following decommissioning of each phase all restrictions would be removed from that area since the area would be clear of all obstructions. Refer to Chapter 4: “Human Beings” Section 4.5 “Shipping, Navigation, Undersea Cables and Pipelines” of the main EIS for more details on navigational restrictions.

14. Navigational Lighting and Marking

During the construction phases, non-wind farm vessels would be excluded from the construction areas as described above. The construction areas for each phase would be marked by the existing navigational buoys with additional temporary buoys marking off the extent of the construction area. Some relocation of the existing buoys may be required during some of the construction phases.

Each buoy will also be fitted with a radar reflector. The markings and light sequences on the buoys will allow vessels to avoid the wind farm construction areas.

During the operational life of the wind farm the turbines will be used to mark the full extent of the wind farm. In addition, the base of all turbine foundations will be painted yellow to 11m above the mean high water level at spring tides

as determined with the Commissioners of Irish Lights in accordance with IALA conditions. The band will allow yachtsmen to avoid turbines during periods of low visibility should they decide to navigate through the wind farm. Each turbine will be given a identification number, which will be marked on all marine charts, to allow navigators to determine their location within the wind farm if they become disorientated during poor visibility or fog.

The wind farm navigation lighting will be established in agreement with the Commissioners of Irish Lights who have responsibility for navigation markings in Irish territorial waters. Refer to Chapter 4: “Human Beings” Section 4.5 “Shipping, Navigation, Undersea Cables and Pipelines” of the main EIS for more details on navigational marking and lighting.

15. Construction Port

The onshore construction phases may take place at Greenore Port, Co. Louth. Greenore port may be selected as the onshore construction site, due to its relatively short distance to the offshore site, its capacity to handle the required vessels and equipment and the space available for construction of the foundations in the vicinity of the port. Temporary site facilities may be required at Greenore port (if the existing facilities prove unsuitable).

During the operational and maintenance phases of the wind farm, a smaller port in the area of the proposed development may prove suitable as a base for operation and maintenance activities. One possibility is Clogher Head. There will be a need for storage capacity onshore close to the wind farm site. In case major repairs are carried out, a larger area for temporary storage of spare parts will be needed.

16. Environmental Baseline Studies

A number of detailed studies and surveys have been commissioned by the developers and coordinated by Aqua-Fact International Services Ltd. The purpose of the baseline studies was to build a detailed picture of the interaction of the physical, ecological and human environment at the proposed development site. Surveys ranged from geotechnical assessments of the wind farm area to birds flying above the site. The findings of these studies aided in the finer detail of the site selection process and site design as described earlier and allowed the most effective mitigation measures to be selected to reduce the environmental effects of the scheme.

Finally, the baseline studies provided the necessary data to allow an assessment of the effects of the construction, operation and decommissioning of the offshore wind farm, on the more important physical, ecological and human elements of the proposed wind farm area following the implementation of mitigation measures.

Baseline studies were carried out by experts in each field and covered the following areas: -

- Bathymetry & Topography: The physical depths and shape of the seabed.
- Hydrography: Wave, tide and currents.

- Marine Benthos & Sedimentology: Flora and fauna communities and associated sediments in the upper layer of the seabed.
- Terrestrial Habitat Assessment: Habitat mapping of the potential onshore cable route.
- Fish: The species and ecology of the fish using the area including commercial, sports, leisure, and migratory fish.
- Marine Mammals & Reptiles: Residents and visitors and their ecology.
- Ornithological: Bird species, breeding and overwintering, including observations of flight heights, roosting, migration etc.
- Landscape and seascape character assessment and identification of the more important viewpoints and types of viewer looking out over the site.
- Archaeological: Shipwrecks and shoreline sites of interest.
- Commercial fisheries: Number of boats, catch, income and fishing methods for the *Nephrops* fisheries etc.
- Navigation: Commercial and leisure sea navigation and navigational risk assessment
- Air traffic and radar interests
- Mineral, oil, gas resources.
- Undersea pipes and cables.
- Military use of the area.
- Telecommunications networks and electromagnetic signals.
- Tourism.

Some studies began as early as 2003. Studies involving birds and marine mammals and reptiles involved seasonal surveys to ensure that the picture built up of the environment is not just a snapshot but shows seasonal changes and trends. These surveys are ongoing. The baseline studies have been coordinated to allow an understanding of the interaction between for example benthic life and sediment distribution. This then allows the assessment of indirect effects i.e. the knock on effects on sea mammals from any direct impact of the construction of the wind farm on fish for example.

17. Summary Findings of the Environmental Impact Assessment

In carrying out and presenting the results of the specialist assessments within the Environmental Impact Statement (EIS), care has been taken to adopt a worst case scenario approach in order to ensure that environmental impacts are not underestimated.

17.1. Bathymetry & Topography

This work was carried out by Imar Survey Ltd. who specialise in marine geophysical and hydrographical surveying. Water depths in the Lease area range from approximately 15 to 30m.

The seabed topography (relief of the seafloor) is composed of three types of features:

- Exposed till
- Smooth sediments
- Recently eroded sediments.

The areas most suited to the emplacement of turbine foundations are the smooth sediment areas. There are obstacles to the emplacement of

foundations on the exposed till and recently exposed sediments. However, these obstacles can be overcome by levelling/infilling the areas in question. These topographical features are not a precluding factor in the development of the proposed wind farm. Refer to Chapter 5 “Physical Environment” of the main EIS for more detailed information on bathymetry and topography.

17.2. Hydrography

This work was carried out by Imar Survey Ltd. who specialise in marine geophysical and hydrographical surveying. Tides in the area range from 5.5m during spring tides and under 2m during neap tides. Tidal currents do not exceed 2 m/s. The current flows northwards on a flooding tide and southwards on the ebb. The average wave height for each month shows that the highest average wave height is in January at 1.73m. The maximum currents in the area are 0.5m/s on a flooding spring tide.

There is considerable evidence of active sediment transport both in the wind farm area and along the cable routes. Channels, eroded banks, broad scoured areas and sand waves have been noted. Seabed installations are known to focus current activity in an area and thus increase their strength and sediment transport capabilities. However, the presence of the turbine foundations is not believed to significantly alter the current direction or velocities in the area. The scouring of material from around the gravity bases may occur in some areas. Scour protection in the form of fronds and careful monitoring will be required at these sites. The currents in the area will not prove a precluding factor in the development of the proposed wind farm. Refer to Chapter 5 “Physical Environment” of the main EIS for more detailed information on hydrography.

17.3. Marine Benthos & Sedimentology

Aqua-Fact International Services Ltd. were responsible for the wind farm area site survey work and the intertidal area site survey work (collecting faunal and sediment samples and analyses of these samples). The developer was responsible for the collection of the cable route samples. Aqua-Fact were responsible for analysing these samples.

Direct effects on benthic habitats through permanent loss of the seabed at the foundation locations would be very small. The 55 turbines would occupy an area of 0.11km², this is 0.4% of the wind farm area. The overall impact on the Boreal Offshore Sand and Mud Associations (which are the dominant benthic habitat types in the wind farm area), is considered to be insignificant. Areas of rock scour protection would provide a hard substratum habitat and would likely be colonised by marine flora and fauna.

There would be some indirect effects on the seabed communities from sediment disturbance and smothering in the vicinity of the cable laying areas. The cable laying operation is expected to last approximately 10 days and the technique used will ensure that the minimum amount of sediment resuspension will occur. The impacts will be short-term and temporary and it is expected that conditions will return to normal over the course of a tidal cycle.

The communities along the cable routes will be impacted by cable ploughing in the immediate area of the cable route (3m wide strip, trench will be 300mm wide) through the removal and possible mortality of species in the community.

Following ploughing, recolonisation will begin immediately and through time the communities return to their original state.

A directional drill will be used in the intertidal area to bury the cable 2m deep into the seabed. This will minimise disturbance to and impacts on the marine flora and fauna in these areas.

During construction and operation, the low substance inputs expected following implementation of mitigation measures and good management of substance use, will not have significant impacts on identified benthic communities. Construction noise and vibration should not interfere with the ecological functioning of identified biotopes.

Habitats may also be altered due to a change in water movements around the foundations. However, the use of scour protection in the form of fronds will minimise any impacts.

A monitoring programme has been suggested to follow the site through construction and into its operational phase, covering the first 3 years of operation. This would ensure verification of the baseline assessment and provide valuable information on the proposed wind farm over a prolonged period. Refer to Chapter 9 “Marine & Terrestrial Ecology” Section 9.3 “Marine Benthos” and Section 9.4 “Intertidal Surveys” of the main EIS for more detail on the marine benthos and sedimentology.

17.4. Terrestrial Habitat Assessment

Aqua-Fact International Services Ltd. carried out the terrestrial habitat assessment. The objectives of the terrestrial ecology survey of the Castlebellingham to Tallanstown cross-country route options were to assess the ecological value, to identify associated ecological constraints and to assess the likely impact of the proposed onshore cable route development on the terrestrial ecology of the area.

The ecological survey and habitat mapping revealed that the Castlebellingham to Tallanstown route corridor is low-lying, gently undulating and dominated by agricultural activity. The majority of the land is dominated by fields of improved agricultural grassland and arable crops that is of low conservation value. Most of these fields are bounded by hedgerow, which in an agricultural dominated landscape can be an important refuge for wildlife. The River Glyde and its tributaries flow through the area and a number of parcels of broadleaved woodland of high local conservation value occur within the site. A relatively small area of other habitats of local conservation value such as scrub and wet grassland mosaics occurred within the site.

The ecological impacts arising from cable construction phase will be temporary (1 year) and in the form of noise disturbance and habitat removal. It is proposed to avoid cable construction within or adjacent to the Stabannan-Braganstown NHA and SPA so as not to adversely impact on the features for which the site was designated. It is proposed to undertake directional drilling at approximately 2m depth avoiding contact with the surface. Where conditions prove unsuitable for directional drilling it is proposed to employ measures to mitigate against adverse ecological impacts. Impacts arising from hedgerow removal will be mitigated against by replanting and thus are considered short-term (1-7 years). It is proposed to avoid habitats of local

conservation value such as mixed broadleaved and riparian woodland during pipe construction and to minimise hedgerow removal and river crossings. No significant ecological impacts are expected from the operational phase nor are indirect impacts expected as a result of the construction or operation phases. Once the exact route of the cable has been identified it is proposed to undertake a detailed ecological walkover Phase 1 habitat and mammal survey on this route. Refer to Chapter 9 “Marine & Terrestrial Ecology” Section 9.5 “Terrestrial Ecology” of the main EIS for more detail on the terrestrial habitat assessment.

17.5. Fish

A fisheries assessment of the proposed wind farm area was carried out by Roden & Ludgate in 2003. Principal sources of fish data for this area of the Irish Sea were obtained from Bord Iascaigh Mhara (BIM), the Marine Institute, the Department of Communications, Marine and Natural Resources, Department of Agriculture and Rural Development Northern Ireland and the Centre for Environmental, Fisheries and Aquaculture Sciences (CEFAS) and consultation with local fishing organisations.

The assessment provided a general overview of fish communities that are found in this part of the Irish Sea. Commercial fisheries in the area concentrate on the Dublin Bay prawn *Nephrops norvegicus*, shellfish including cockles, razorshell, Pacific oysters, bottom mussels, brown crab and lobster and whitefish i.e. cod and whiting. The area is an important spawning and nursery ground for a number of whitefish species and a recovery ground for cod. Migratory fish such as European eel, Atlantic salmon and sea trout may also be found in the wind farm area in moderate numbers.

Potential areas of impact examined were the construction and operational noise and vibration, electromagnetic fields and habitat modification.

The noise and vibrations from the construction phase will be the result of increased vessel activity in the area and minor excavation works when ploughing to install the cables. There will be a small amount of directional drilling noise when installing the cables in the intertidal areas. The increased vessel noise in the area during the construction phase will be temporary and short-lived. Avoidance reactions from intermittent or short-term noise sources would be most plausible at short distances (less than 30m) from the sound source.

During the operational phase of the wind farm, because of the spatial extent of the low-frequency hydrodynamic/acoustic fields from the turbines, fish will perceive them to be very different compared to the low-frequency fields of other animals. Therefore, fish are not expected to be impaired in their ability to detect and interpret the fields from different sources (i.e. turbines or animals). Furthermore, the continuous character of the turbine noise will likely promote habituation in the fish. Thomsen *et al.* (2006) calculated that dab and salmon might detect operational noise of a wind turbine at relatively short distances of no more than 1km. They also calculated that cod and herring might detect operational noise of a wind turbine perhaps up to 4.5km from the source. Studies carried out at the Horns Rev offshore wind farm showed that there was no indication that noise and vibrations from the turbine generators had any impact on the fish community at Horns Rev (Bioconsult a/s, 2004). The operational wind farm is not believed to adversely impact on fish

populations.

Habitats and feeding grounds will be lost and disturbed as a result of the emplacement of the foundations and the cable-laying activities. There will be a permanent loss of seabed habitat and feeding grounds from the 'footprint' of the turbine foundations. The foundations will be approximately 40 to 50m diameter, therefore the 55 turbines and 1 substation would occupy a maximum area of approximately 0.11km². As a result, non-mobile species occurring in the 'footprint' will be lost and mobile species utilising these habitats for feeding and spawning will lose this resource. Any impact is likely to be minimal, as it will be restricted to the 'footprint' of the turbine foundations. The presence of a new hard substrate (the foundations) will provide a new surface for colonization in the area and this will compensate for the loss of habitat and feeding grounds beneath the turbines.

The impacts from cable laying are expected to be short-term and minimal. The impacts will be restricted to the width of the cable laying area (3m wide plough will be used, trench itself will be 300mm wide) and the seabed will be returned to its original state following passage of the cable laying plough. It is expected that the habitats and feeding grounds will return to their original state (approximately 6 months to a year). There will be a slight increase in the turbidity of the water during the laying of the cables. Turbidity will be minimal, as water jetting will only be used at excessively hard spots on the seabed. This could result in a small increase in siltation resulting in no more than minimal smothering of shell/fish eggs and larvae with no long-term effect.

The presence of the marine electrical cables may cause electromagnetic interference on some fish species (e.g. elasmobranchs, salmonids and eels). Salmonids, plaice and eels are capable of sensing magnetic cues during certain types of spatial activity, due to the presence of biological magnetite. Elasmobranchs possess electroreceptors, which allow them to detect weak electric fields. However, due to the pre-armouring and the burial of the cable to a depth of 2m minimum and the naturally high geomagnetic levels in the area, the impact from the wind farm cabling system will be negligible.

Fish species are mobile and readily move from one area to another if disturbed or if environmental conditions are not suitable. The most likely impact would occur if their habitat, food source or spawning grounds were disturbed and if no alternative was available to them. However, the extent of the fish habitat available in the vicinity of the wind farm area is so great, that the area, which will be lost or altered by the turbines and cable laying, is considered to be insignificant. Refer to Chapter 8: "Commercial Fisheries" of the main EIS for more details on fisheries in the area

17.6. Birds

A comprehensive assessment of bird populations was carried out by Cork Ecology in 2003. Fulmar Ecological Services and BI Aquatics carried out comprehensive boat bird surveys over eighty-four 4km² boxes (which included a 5km perimeter around the proposed wind farm site) to allow a full picture to be formed of the importance of the this area for bird populations of the Irish Sea.

The area outlined for the proposed development is not designated or proposed for designation as Special Area of Conservation (SAC), Special

Protection Area (SPA) or National Heritage Area (NHA). However there are some coastal areas close to the site that are designated. The following Annex I Birds Directive Species occur in the area: great northern diver, red-throated diver, Greenland white-fronted goose, barnacle goose, little tern, common tern, roseate tern, sandwich tern, Arctic tern, golden plover, bar-tailed godwit, peregrine falcon, ruff, whooper swan, Bewick's swan and the short-eared owl.

This main impacts of wind farms on birds are:

- Disturbance leading to displacement, including barriers to movement;
- Collision risk and mortality;
- Direct loss of habitat to wind turbines and associated infrastructure;
- Other potential effects.

Eleven species of seabirds were selected as key species. They are red-throated and great-northern divers, Manx shearwater, gannet, kittiwake, sandwich, arctic, common and roseate terns, guillemot and razorbills. These species were selected due to their likely occurrence in the wind farm area or due to sensitive populations. Wildfowl, waders and passerines were also selected as key groups. These were chosen due to the possibility of passing over the wind farm area during migration.

The construction period will involve increased vessel activity in the area, transporting materials to the site and carrying out installation of the foundations and turbines. In addition, cable installation between turbines and the shore will also be carried out. The construction of the wind farm is likely to cause temporary disturbance to birds feeding in the vicinity of the construction site and possibly disturbance to migrating birds. Construction operations are most likely to be carried out during spring and summer months, when weather conditions are most stable and construction could continue for several seasons. Highest numbers of seabirds are likely to occur in and around the wind farm area during the summer months and several species are likely to use the area as feeding grounds (Watson, 1980). The potential impacts during the construction period with respect to disturbance to feeding sites, migration routes and indirect effects were considered low or very low for all key species. Therefore, the construction of the wind farm will not significantly impact on bird populations in the area.

In order to keep the impacts as low as possible the following mitigation measures will be taken. Operations will be timed to avoid sensitive periods, based on the information from the baseline surveys. The construction timescales will be minimised as far as possible. The movements of the construction vessels will be minimised.

Effects from offshore cable laying operations in the wind farm area would be short-term and localised on the seabed. Such operations are not thought likely to cause significant impacts on seabirds (Söker *et al.*, 2000). The potential impacts on waders, wildfowl and passerines were considered to be medium. For all other species, the impacts were considered to be very low. In the area where the cable will transect a conservation designation, the cable will be buried 2m minimum below the seabed using a directional drill, this will minimise any impacts on or disturbance to birds in the area.

In order to keep the impacts as low as possible the following mitigation measures will be taken. Operations will be timed to avoid sensitive periods, based on the information from the baseline surveys. The cable installation in

the area of conservation designations will be done using a directional bore, which will install the cable 2m minimum below the seabed, minimising impact to the birds in the area. The number of cables to be laid will be minimised.

The significance of the potential risk of birds colliding with the turbines in the Oriel wind farm ranged from low to medium depending on the key species. Gannets, divers and terns were considered the species most susceptible to collision. However, studies from the Horns Rev wind farm showed that gannets and divers actively avoided the wind farm area. Arctic/common terns however did enter the wind farm area but after a few hundred metres changed their flight pattern and left the wind farm area.

The significance of the potential impact from habitat loss was considered medium for Manx shearwaters, terns, guillemots and razorbills. From the baseline studies, terns and razorbills were more common outside the Lease area than within it. Manx shearwater and guillemots were very numerous within the Lease area but also in most parts of the study area. It is predicted that terns and razorbills will not be significantly impacted by habitat loss due to their low occurrence in the Lease area. While Manx shearwater and guillemots are common within the Lease area, their high presence outside the Lease area, suggests that they are common in a much wider area than the study area. For this reason, the presence of the wind farm is not believed to significantly impact on their habitat.

Disturbance to feeding sites was also thought potentially significant for red-throated divers, terns, guillemots and razorbills. The significance of the potential impact on the flight patterns of birds was mostly low although divers and Manx shearwaters could be more susceptible to disturbance. For the reasons stated in the previous two paragraphs, the disturbance to feeding sites and flight patterns is believed to insignificant.

Potential significance of impacts from indirect changes to food sources ranged from very low to low. Waders and wildfowl will not generally be affected by the wind farm, as they are only likely to be present in the wind farm area during migration, if at all

In order to keep the impacts as low as possible the following mitigation measures will/have been taken. Careful consideration was given to the layout of the wind farm, considering number, exact location and orientation of turbines to avoid creating barriers to migrating birds. Careful consideration was given to the design of the turbines, including visibility by day and night, to reduce the risk of bird collisions, based on the best available information. A phased approach will be taken i.e. erect a small number of turbines and monitor the effects. There will be the option to shut down the turbines in the short-term to avoid excessive bird mortality, if necessary. Long term monitoring of bird populations and behaviour in and around the wind farm area will be carried out. Collisions may be more likely in poor visibility, however this can be addressed by lighting. The turbines will have to carry lighting in relation to air and ship safety. This and any additional lighting for birds would have to be monitored to ensure that it did not exacerbate the collision problem in the manner of lighthouses and passerine migrants. The installation of foghorns could also be assessed for collision avoidance.

Routine maintenance vessel activity from the supporting harbour to the wind farm are not thought likely to cause any significant ecological effects on birds

in the vicinity, providing standard operating procedures for vessels are followed (Hiscock *et al.*, 2002). Impacts resulting from any such activities required for the Oriel wind farm development on bird species in the area are therefore likely to be minimal and short-term. Decommissioning of a wind farm would be likely to cause similar or reduced impacts to those predicted for the construction phase.

In order to keep the impacts as low as possible the following mitigation measures will be taken. Operations will be timed to avoid sensitive periods, based on information from baseline surveys. The movement and number of maintenance vessels in the area will be minimised. The turbines will be carefully designed to reduce vibrations and noise being transmitted through water, based on the best available information

Ongoing bird monitoring will continue during the pre-construction phase. The developer proposes further monitoring during the construction and post-construction phases of the wind farm. These surveys will cover the same areas as the baseline work to ensure consistent survey results, and confirm the conclusions reached in the assessment. Refer to Chapter 10: “Birds” of the main EIS for more detail on birds in the area”

17.7. Marine Mammals & Reptiles

A comprehensive assessment of mammal populations was carried out by Cork Ecology in 2003. Fulmar Ecological Services and BI Aquatics carried out comprehensive boat surveys over an area of more than eighty-four 4km² boxes to allow a full picture to be formed of the marine mammals and reptiles that make regular use or visit this part of the Irish Sea and assesses the impacts of the construction, operation and decommissioning of the wind farm on those species. This data has been considered together with the results of sightings from the Whale and Dolphin Group and seal population surveys from the National Parks and Wildlife.

In 1991 the Irish government declared all Irish waters, extending to the limit of our continental shelf, a whale and dolphin sanctuary. For the purposes of this assessment all whales, dolphins and seals found in Irish waters were considered to be of high sensitivity due to the National and International protection afforded to each species.

Two species of cetacean were recorded during the year’s seasonal surveys: the harbour porpoise and the minke whale. Harbour porpoise was by far the most abundant species recorded both from boat surveys and Irish Whale and Dolphin Group sightings. The common dolphin and bottlenose dolphin are also known from the area. Both the grey and harbour seals are regular visitors to the wind farm area. The leatherback turtle is reported annually and is considered a regular and normal member of the marine fauna.

There are two important aspects, which must be addressed when examining the effects, which wind farms have on marine mammals and reptiles:

- Noise and Vibrations
- Electromagnetic Interference

It is predicted, based on experience elsewhere, that the impacts of the construction and construction related activities on seals will be insignificant and of short duration. It is also predicted that the operation of the wind farm

will not have significant impacts on the seal population in the area. While they will probably hear the airborne noise of an offshore wind farm, it will only be slightly above their lowest audible threshold at the base of the turbine. As the underwater noise from offshore turbines is not higher than ambient background noise at 20m distance from the turbine, the noise produced from the operational wind farm is not thought to have significant impacts upon the seals in the area.

It is predicted that the impacts of the construction and construction related activities on porpoises and dolphins will be insignificant. It is also predicted that porpoises and dolphins will not be significantly affected by the operation of the wind farm. The wind farm is not expected to produce noises that will exceed ambient levels at the frequencies heard by porpoises and dolphins.

It is predicted that the electromagnetic field generated by the cabling will not significantly impact dolphins and porpoises in the area. Pre-armouring and burial of the cables will bring the electromagnetic field in the vicinity of the cable to an effective zero. Also, igneous intrusions created at the time of the opening of the Atlantic Ocean have been well documented in the Mourne and Carlingford area and are expected to continue under Dundalk bay. Against this background, magnetic fields were unlikely to have an effect on mammals in the area.

It is predicted that the wind farm development will not significantly negatively impact on the leatherback turtle population that visit the area. The most significant issue relating to leatherback turtles is the disruption of their navigational magnetic compass from the generation of electromagnetic fields from the power cables. However, due to the reason stated above, the impacts from electromagnetic effects will be insignificant.

Ongoing mammal and reptile monitoring will continue during the pre-construction phase. The developer proposes further monitoring during the construction and post-construction phases of the wind farm. These surveys will cover the same areas as the baseline work to ensure consistent survey results, and confirm the conclusions reached in the assessment. Refer to Chapter 11: “Marine Mammals & Reptiles” of the main EIS for more detail on mammals and reptiles in the area”

17.8. Landscape

The landscape and visual assessment for the Oriel wind farm proposal was carried out by MosArt and Macroworks, who were also closely involved with the wind farm design process to minimise visual and landscape impacts. The aim of the impact assessment was to:

- describe the landscape and seascape in the vicinity of the site and identify the most sensitive places from which the proposal would be seen including towns and villages, footpaths, beaches, golf courses, mountain tops etc.
- select a number of viewpoints from which to assess the impact of the scheme in detail. These were also used during the design process of the wind farm as described earlier
- develop a methodology for assessing the overall significance of impact at any viewpoint, through definitions of viewpoint sensitivity, dominance of the wind farm and compatibility or non-compatibility of the wind farm with the existing view

- assess the impact of the wind farm according to the methodology,

A 30km radius study area was chosen for the proposed development. A zone of visual influence (ZVI) was generated to identify the extent of the proposed wind farm's visibility over the 30km radius study area. The ZVI shows the number of turbines that would be visible from any point at sea or on land assuming a worst case bare ground i.e. no trees, hedges or buildings.

A visibility assessment was carried out to describe the general extent of visibility of the proposed wind farm within the study area. The visibility assessment concentrated mainly on publicly accessible areas such as the road and public footpath network, residential and outdoor recreational areas. Thirty-eight viewshed reference points (VRPs) were selected for visual representation of the wind farm in the full Environmental Impact Statement in agreement with the Local Authorities. These viewpoints are considered to be representative of the spectrum of receptors in the study area, located at different distances, directions and heights relative to the proposed development.

The landscape and visual assessment established the following:

- Sensitivity of VRPs – the landscape within which the Oriel wind farm is proposed is generally highly sensitive. This is principally due to the coastal character of the region and the fact that many of the VRPs used in this assessment are locations of amenity importance or are designated as being scenic or highly valued in County Development Plans. This landscape sensitivity is typical for offshore wind farm proposals.
- Visual presence – despite the height and number of turbines involved, the proposed wind farm would be dominant or highly dominant from just 7 of the 38 locations assessed in this study. This is principally due to the distance of the wind farm from shore, coupled with the relatively complex landscape within which the turbines would be viewed comprising not least of all an extensive mountain range. The project is predicted to be co-dominant from 11 locations, sub-dominant from 15 locations and of minimal presence from the remaining 5 VRPs.
- Aesthetic impact - the majority (22) of the locations assessed in this study will experience a minor adverse level of aesthetic impact. There will be some locations that will suffer a higher level of impact, however, with 3 locations classified as moderate adverse and 2 locations classified as major adverse. These two latter locations are judged to be the most critical with respect to aesthetic impacts, located at VRP 19 on the R172 North of Sandymount and at VRP 1 on The Ulster Way at Slieveacarnane. The former is not an area which will be exposed other than to passing traffic and then only briefly. Eight locations will experience a positive effect and a further 3 locations a neutral impact.
- Significance – this is the most important assessment criteria as it combines the issues of sensitivity, visual presence and aesthetic impacts into a single summary classification of significance of impact. In this instance, there is just one location predicted to experience a Significant impact, namely at VRP 19 on the R172 North of Sandymount. Six locations will experience a moderate impact. The majority of locations, however, will experience either a slight (17 VRPs) or negligible impact (14 VRPs).

Taking the above summary, MosArt concludes that the proposed Oriel wind farm will not create an unacceptable level of adverse visual or landscape impact. In fact, from the majority of locations assessed, the level of impact will be quite low. Refer to Chapter 13: “Landscape & Visual Impacts” of the main EIS for more detail on these issues.

17.9. Archaeology

The Archaeological Diving Company Ltd carried out by the Archaeological assessment. This company is one of the most experienced marine archaeological consultancies in Ireland. The consultancy examined all evidence relating to the presence of shipwrecks in the vicinity of the offshore components of the scheme including the potential cable routes to shore, and carried out desk top studies of the three alternative landfall sites for the cable to shore to identify any archaeological remains on land that might be affected by the laying of these cables.

The archaeologists examined records of shipwreckings in the vicinity of the proposed wind farm area. There are many shipwrecking incidents recorded within Dundalk Bay but the majority of these remain unlocated. No wrecks are located within the wind farm footprint. Two wrecksites, which have been located, close to but outside the development area. The first site is an unknown wreck located approximately 200m south of the proposed cable route to shore at Castlebellingham. It is located on the Admiralty Chart in c. 1.2m of water in tidal mudflats. The second site is located approximately 900m southeast of the proposed development area, at ING 329140.91440E 294613.448342N. This is a previously unrecorded anomaly that was identified by the Irish National Seabed Survey (G-125). It represents a small feature, measuring c. 5m long, 2m wide and it stands c. 3m off the seabed, at a depth of c. 29m.

Interpretation of geophysical data acquired for the present project within the proposed development area revealed one anomaly. The side-scan sonar anomaly SS10 is located slightly to the east of the location for a proposed turbine site. It is recommended that turbines avoid being sited directly over any of the geophysical anomaly sites, to minimise potential impacts with archaeological features. In the event that avoidance is not possible, further assessment of the anomalies in advance of construction would be necessary, to qualify the archaeological potential of the anomaly(s), and to propose additional mitigations if necessary.

It is proposed that the construction phase will not require dredging works. Onsite impacts will be governed by the sinking of concrete caissons into position from the surface onto the seabed. Cables will be laid using a subsea plough.

This report recommends that marine geophysical surveys, which meet archaeological specifications as identified by the Department of the Environment, Heritage and Local Government are carried out along the Bremeore cable route before construction commences, and that these surveys are subject to full archaeological assessment and reporting.

This report recommends that the wrecksite located c. 200m south of the Castlebellingham cable route is avoided. In the event that the Castlebellingham route emerges as the preferred cable route, it is

recommended that any impact with anomaly SS13 is avoided, given the possibility that this anomaly retains archaeological potential. In the event that avoidance is not possible, further assessment of the anomalies in advance of construction would be necessary, to qualify the archaeological potential of the anomaly(s), and to propose additional mitigations if necessary. Such qualification may require an underwater assessment.

Refer to Chapter 7: “Cultural Heritage/Archaeology” of the main EIS for more detail on these issues.

17.10. Construction Effects on Land

The concrete gravity foundations may be constructed on a dry dock or floating dry dock, possibly at the port of Greenore. This would lead to a short-term increase in the traffic levels around Greenore during the foundation construction period. It is expected that there will be at least 200 truck movements per foundation unit. Phase 1, consisting of 11 foundations is predicted to last for 36 weeks, this will result in an increase in traffic of approximately 23 truck movements per day. Skilled craftsmen will also increase traffic movements in the Greenore area. Until the exact location of the construction sites and the location of the dry dock is decided upon, it is not possible to accurately predict what the impact of the increase in traffic movements will be in the area.

The exact location of the construction works has not been finalised. Two options were considered. At site 1, the construction noise is expected to be substantially lower than the existing total noise, and the adverse impact is consequently judged to be negligible. At site 2, the noise levels will all be substantially below the normal construction noise limit of 70 dB(A). The impacts from traffic noise are expected to be negligible. Refer to Chapter 4: “Human Beings” Section 4.3 “Noise” and Section 4.4 “Traffic” of the main EIS for more detail on these issues.

17.11. Offshore Noise

The noise from the construction phase will be created by the increase in vessel activity at the offshore site. The impact from this on land will be negligible. The noise levels on land during the operational phase of the proposed wind farm will be at or below 22 dB(A) (22dB at Cooley Point and 15dB at Dunany Point). These noise levels will be significantly below the background noise level of 30 dB(A) which would be expected to prevail at relatively low wind speeds, close to the cut-in speed of the turbines. Under these conditions, the turbine noise would be inaudible. Consequently, there is no identified potential for an adverse noise impact during the operational phase of the proposed wind farm. Refer to Chapter 4: “Human Beings” Section 4.3 “Noise” of the main EIS for more detail on this issue.

17.12. Marine Navigational Effects

The coastal route from the entrance to the Boyne River and the southern entrance to Carlingford Lough passes through the site of the proposed wind farm. There is also a coastal route which is sometimes used by small vessels inshore of the proposed wind farm, between the ports of Warrenpoint and Dundalk. The main Irish Sea north-south shipping routes pass well outside of the area to the east. Large vessels generally follow the through route in the Irish Sea and hence pass well to seaward side of Dundalk Bay. None of the shipping to or from Dundalk has to pass through the proposed wind farm.

Although well outside of the immediate area of the proposed wind farm, vessels arriving and departing at Drogheda port from a northerly direction may well have to adjust their course slightly to seaward in order to avoid the site. Any extra distance is considered to be negligible. During the summer months the area is popular with yachtsmen and pleasure boats. All non-construction vessels would be excluded from the active construction area during each construction year, which would be marked with navigational buoys.

During the operational period, there would be no restrictions on the passage of craft through the wind farm. Leisure vessels will be free to cross the area during the operational phase although there would be a safety zone of 60m diameter around each turbine and vessels will be strictly prohibited from making fast to the turbines. Local fishermen will be free to place pots for catching lobster within the proposed wind farm area. This would not be inhibited by the presence of the wind farm during the operational period. Anchoring to a depth of 1.5m will be permitted within the proposed wind farm area.

There is a “tolerable” risk of large vessels (both under power and not under power) colliding with a turbine. There is a “consider” risk of fishing vessels (ranging in size from below 15m up to 35m) colliding with a turbine. “Consider” means that with regard to people and property, reasonable additional measures to reduce the risk further should be considered. If the proposed development gets approval, it is expected that the Lease granted to allow development will contain conditions recommended by the Maritime Safety Office of the Department of Transport to minimise this risk. There is a “tolerable” risk of damage to cables within the wind farm area and a “consider” risk to cables running to shore.

The outer limits of the wind farm area will be marked by light buoys and a foghorn. Each turbine will be painted yellow up to a height of 11m above high tides to allow leisure sailors to see and avoid turbines even in bad visibility conditions. The minimum distance between blade tip and water at the astronomical high tide will be just over 30m; this will be in excess of the likely height of the top of the mast on a yacht using this area. With the strong currents and tides in the area, there is a small risk of collision if a yacht was becalmed and unable to use an engine to get out of the area, but overall, effects on leisure vessels from the safety zone are considered to be minimal.

The proposed wind farm may affect the radar reliability (picture) of vessels arriving from seaward onto the coast of the area, which are using radar as an aid to confirming their position or detecting other vessels on the far side of the proposed wind farm. Provided that the seaward extremities of the proposed wind farm were conspicuously marked by AIS/Racon and that appropriate other navigational marks are installed this hazard could be deemed to be negligible. It is not considered that the proposed wind farm will affect VHF or other forms of radio communications. Refer to Chapter 4: “Human Beings” Section 4.5 “Shipping, Navigation, Undersea Cables & Pipelines” of the main EIS for more detail on these issues.

17.13. Aviation & Military Impacts

The only airfield, which may be impacted by the proposed development, is Gormanston military aerodrome. It is located within 25km of the proposed development. The Department of Defence did note that the Air Corps would

be monitoring the development, as it may constitute a hazard to Maritime Patrol Aircraft.

The Irish Coastguard was consulted and has requested that a system be put in place to have the rotors stopped at very short notice in the event of SAR operations taking place in the area of the wind farm. This request will be complied with.

Furthermore, the Irish Aviation Authority and Irish Coastguard will be advised of the co-ordinates, height and elevation of each turbine. The details of the aeronautical obstacle lighting requirements for the turbines will be agreed with the Irish Aviation Authority. The Irish Aviation Authority will be contacted during decommissioning to determine if there are any particular guidelines to be adhered to by the developer. Refer to Chapter 4: “Human Beings” Section 4.7 “Aviation” of the main EIS for more detail on this issue.

17.14. Socio-Economic Impacts

The total construction costs are estimated at €375-€623 million Total project annual output is 788GWh for a 250MW installation and production is forecast to begin in 2009/2010. The electricity produced will meet the needs of approximately 250,000 homes.

The design, construction, operation and maintenance of the wind farm development will provide employment to the local community. The design and planning stage will provide employment for a number of technical consultants. The construction phase will provide employment for local tradesmen, labourers and specialised contractors, perhaps from other areas of the country. This will have a direct short-term impact on the local economy. The operational phase will present an opportunity for local mechanical-electrical contractors to become involved with the maintenance programmes for this wind farm development.

Over a 5-year construction period, this wind farm development will provide 243 jobs during the construction phases and 44 professional and managerial jobs during the construction phases. During the operation and maintenance phases, the wind farm will provide 16 jobs in the initial 50MW phase and 40 jobs in the lifetime of the development

The social benefits of avoided pollution are valued at a minimum of €9.6 million in a full year of production and with a present value of €97.9 million for the project.

A number of other economic impacts may arise but it is not possible to place a value on them. They are:

- Skills obtained in developing and operating this project are transferable and a competency would be developed that could be used elsewhere in the economy. This would greatly increase the value added potential of the National Renewable Energy Centre at Dundalk Institute of Technology for example;
- There is potential for other sectors such as tourism and fishing to benefit from proximity to the wind farm. The indications to date are that any negative impacts will be minor and opportunities exist;
- The investment would contribute to policy aims such as developing the Dublin-Belfast corridor, regional economic development and

sustainable energy thereby underpinning the credibility of policy making;

- Due to the shortfall in turbine manufacturers' output an opportunity exists for the development of new production facilities. Co. Louth has the potential to benefit from this opportunity.

Refer to Chapter 4: "Human Beings" Section 4.8 "Socio-Economics" of the main EIS for more detail on this issue.

17.15. Effects on Mineral, Oil & Gas Deposits

While there is a number of living and non-living resources identified along the east coast, none have been identified in extractable volumes from the area in question. It is therefore considered that the wind resource of the area offers the greatest potential for exploitation. Refer to Chapter 12: "Living and Non-Living Resources" of the main EIS for more detail on these issues.

17.16. Undersea Cables & Pipelines

Bord Gáis own and operate two subsea Interconnector Gas Transmission Pipelines in the Irish Sea. These pipelines have landfalls at Gormanston, Co. Meath and Loughshinny, Co. Dublin. They are a distance of approximately 25km and 38km respectively from the Lease area and thus are not a cause of concern for the proposed development. If the Bremore route is selected, the route will be planned to avoid interference with the Bord Gáis interconnector. Refer to Chapter 4: "Human Beings" Section 4.5 "Shipping, Navigation, Undersea Cables & Pipelines" of the main EIS for more detail on these issues.

17.17. Telecommunications & Electromagnetic Transmission

There are no power or telecommunications cables in the vicinity of the Lease area. It is very difficult to quantify the exact degree of interference which will be caused by electromagnetic signals as a result of the proposed wind farm. In the event of interference with television reception, either the receiver's antennae can be improved or relays can be installed to transmit the signal around the wind farm. Oriel Windfarm Ltd. have, at the request of RTE, signed a Protocol stating that if the wind farm does interfere with television signals/broadcast radio receivers or RTE installations, Oriel Windfarm Ltd. will take appropriate action to rectify the problem. No concerns have been raised by the telephone companies that were consulted, therefore no problems have been highlighted to mitigate against.

Vodafone, O2, Meteor, Eircom and BT were contacted regarding the proposed wind farm development. The proposed wind farm is not expected to interfere with mobile phone systems. Refer to Chapter 14: "Electromagnetic Effects" of the main EIS for more detail on these issues.

18. References

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Appendix

The full Environmental Impact Statement can be viewed at the following addresses:

- Oriel Windfarm Offices, Unit 22 Regional Development Centre, DKIT, Dundalk, Co. Louth.
- Dundalk Garda Station as requested by DCMNR
- Any other locations as requested by DCMNR

The full Environmental Statement contains the full environmental assessments that have been undertaken including maps, visualisations, diagrams and plates. A volume of appendices the full Environmental Impact Statement.

Copies of the full Environmental Statement, Non-Technical Summary and Volume of Appendices can be obtained from Aqua-Fact International Services Ltd., 12 Kilkerrin Park, Liosbaun, Tuam Road, Galway, Co Galway. Tel: 091 756812.

Volume 1: Non-Technical Summary	Free
Volume 2: Environmental Impact Statement	€175
Volume 3: Appendices	P.O.A
Photomontages	€1,600 + VAT