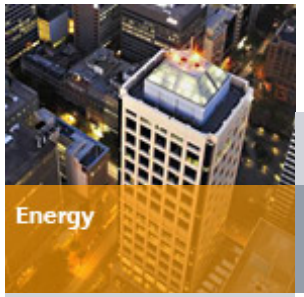


- **SWT-3.6-107**
- **Technical Specification**
- **Design**
- SWT-2.3-82 VS
- SWT-2.3-93

Technical Specification SWT-3.6-107 Wind Turbines

Rotor

Type	3-bladed, horizontal axis
Position	Upwind
Diameter	107 m
Swept area	9,000 m²
Rotor speed	5-13 rpm
Power regulation	Pitch regulation with variable speed
Rotor tilt	6 degrees

Blades

Type	B52
Blade length	52 m
Tip chord	1.0 m
Root chord	4.20 m
Aerodynamic profile	NACA 63.xxx, FFAxxx
Material	GRE
Surface gloss	Semi-matt, <30 / ISO2813
Surface color	Light gray, RAL 7035
Blade manufacturer	Siemens Wind Power A/S

Aerodynamic Brake

Type	Full span pitching
Activation	Activate, fail-safe

Load Supporting Parts

Hub	Nodular cast iron
Main bearings	Spherical roller bearing
Transmission shaft	Alloy steel
Nacelle bedplate	Steel

Service & Support

Please select

Price request for wind turbines

- Price request form

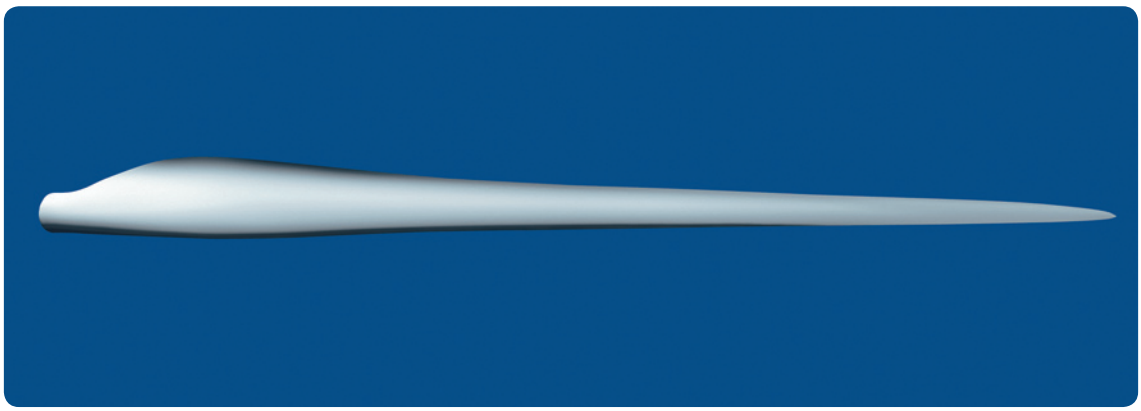
Jobs & Careers

V90-3.0 MW

An efficient way to more power

Vestas®

No. 1 in Modern Energy



Innovations in blade technology

3×44 metres of leading edge

In our quest to boost the efficiency of the V90, we made sweeping improvements to two aspects of our turbine blades: their material composition and their structure.

We at Vestas have long enjoyed a reputation for making some of the lightest blades on the market, and with the V90 we have once again raised the bar. We began by introducing several new lightweight materials, most notably carbon fibre for the load-bearing spars. Not only is carbon fibre intrinsically lighter than the fibre glass it replaces, but its strength and rigidity also reduce the quantity of material needed – thus cutting overall weight even further. So that even though the V90 has a swept area that is 27 per cent more than the V80, the new blades actually weigh about the same.

The new profile of the V90 blades also represents a significant aerodynamic advance. In collaboration with Risø National Laboratory in Denmark, Vestas engineers worked on optimising the relationship between the overall load impact on the turbine and the volume of energy generated annually. Their final blade design features an entirely new plane shape and a curved back edge.

The resulting airfoil improves energy production, while making the blade profile less sensitive to dirt on the leading edge and maintaining a favourable geometrical relationship between successive airfoil thicknesses. This translates into an increase in output combined with a decrease in load transfers – as well as improvements on the bottom line.

Reduced need for service and maintenance

A series of improvements to the V90 have made service and maintenance calls less demanding – and less frequent. Turbine access has been simplified and working areas expanded, while the arrangement of tower and nacelle components has been optimised to facilitate service procedures.

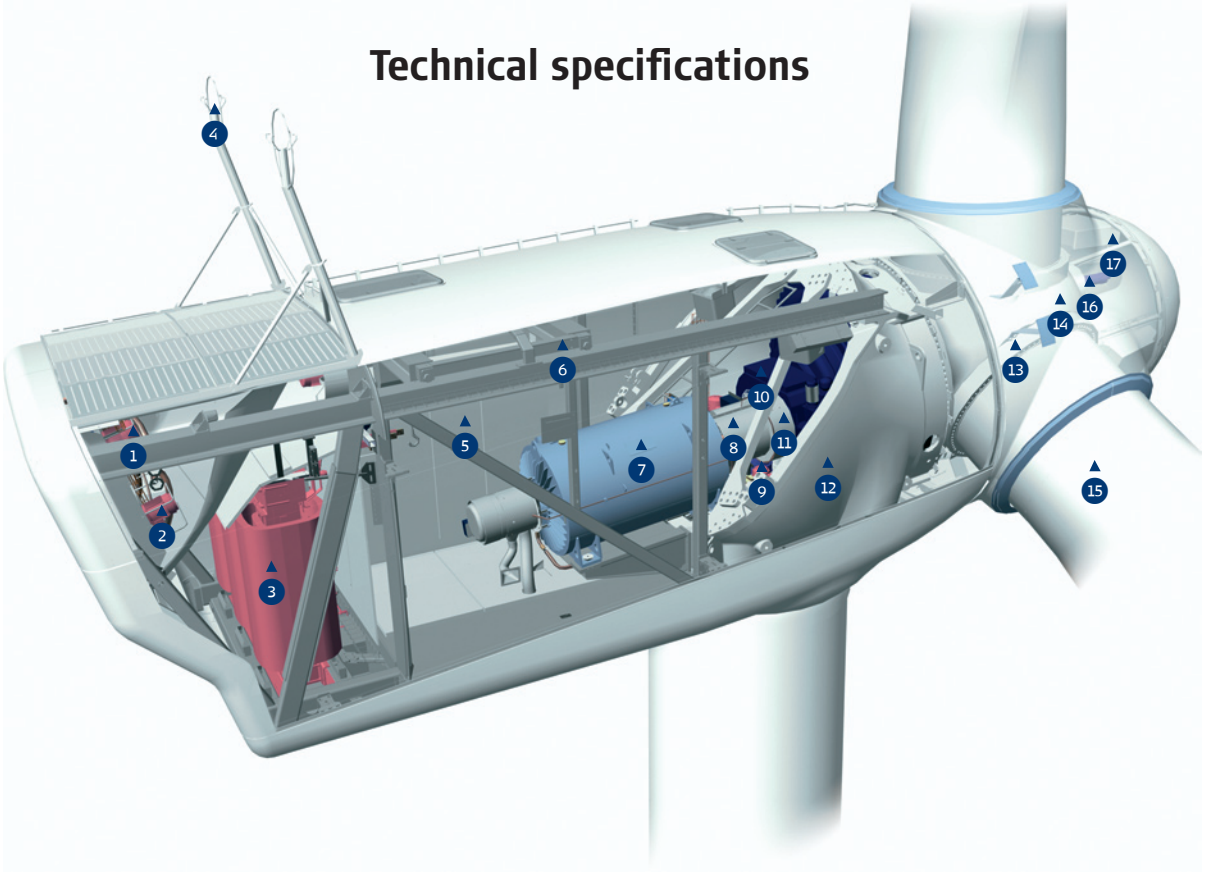
Moreover, a variety of new features, ranging from automatic blade-bearing lubrication to an oil-lubricated yaw system, have made it possible to reduce the number of preventive maintenance visits to one a year. This means considerable savings in turbine downtime and personnel costs, and is a particularly welcome development in the context of hard-to-reach offshore installations.

Proven Performance

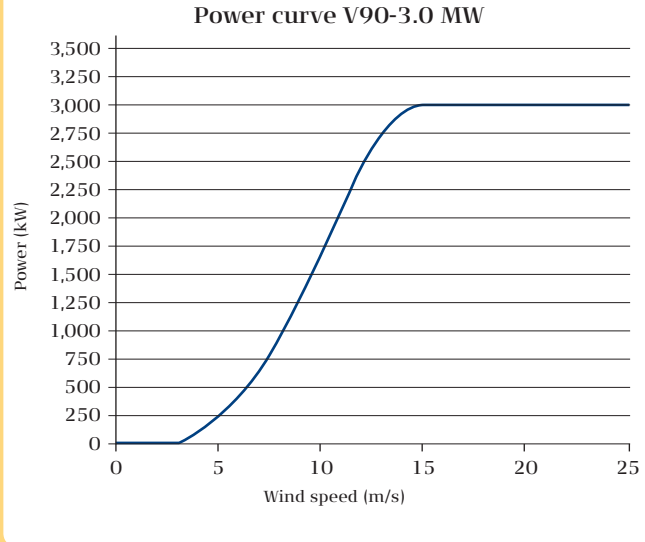
Wind power plants require substantial investments, and the process can be very complex. To assist in the evaluation and purchasing process, Vestas has identified three factors that are critical to wind turbine quality: energy production, power quality and sound level.

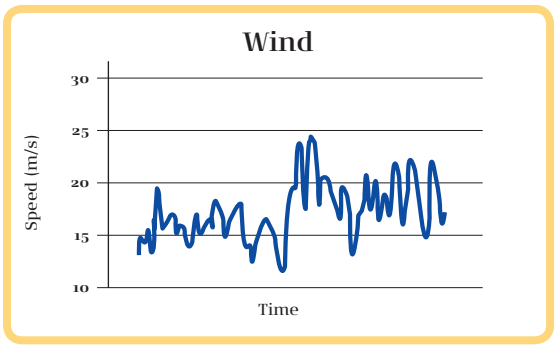
We spend months testing and documenting these performance areas for all Vestas turbines. When we are finally satisfied, we ask an independent testing organisation to verify the results – a practice we call Proven Performance. At Vestas we do not just talk about quality. We prove it.

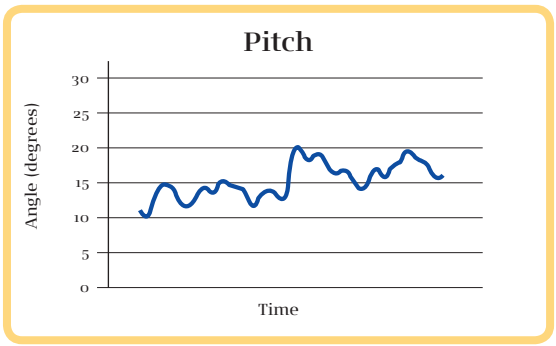
Technical specifications

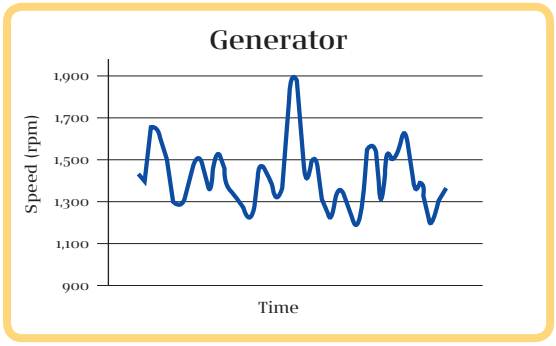


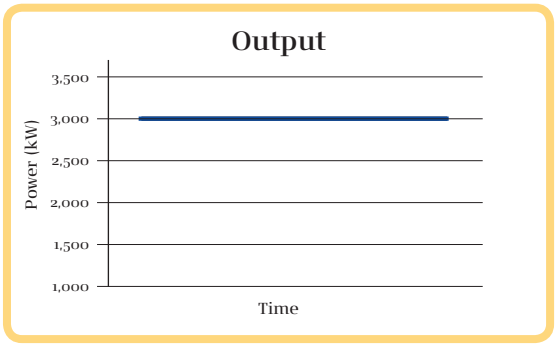
1. Oil cooler
2. Water cooler for generator
3. High voltage transformer
4. Ultrasonic wind sensors
5. VMP-Top controller with converter
6. Service crane
7. OptiSpeed® generator
8. Composite disc coupling
9. Yaw gears
10. Gearbox
11. Mechanical disc brake
12. Machine foundation
13. Blade bearing
14. Blade hub
15. Blade
16. Pitch cylinder
17. Hub controller











OptiSpeed® allows the rotor speed to vary within a range of approximately 60 per cent in relation to nominal rpm. Thus with OptiSpeed®, the rotor speed can vary by as much as 30 per cent above and below synchronous speed. This minimises both unwanted fluctuations in the output to the grid supply and the loads on the vital parts of the construction.

**Vestas OptiSpeed® is not available in the USA and Canada.*

Rotor

Diameter:	90 m
Area swept:	6,362 m²
Nominal revolutions:	16,1 rpm
Operational interval:	8.6-18.4 rpm
Number of blades:	3
Power regulation:	Pitch/OptiSpeed®
Air brake:	Full blade pitch by three separate hydraulic pitch cylinders.

Tower

Hub height:	80 m, 105 m

Operational data

Cut-in wind speed:	4 m/s
Nominal wind speed:	15 m/s
Cut-out wind speed:	25 m/s

Generator

Type:	Asynchronous with OptiSpeed®
Rated output:	3,000 kW
Operational data:	50 Hz
	1,000 V

Gearbox

Type:	Two planetary and one helical stage

Control

Type:	Microprocessor-based control of all the turbine functions with the option of remote monitoring. Output regulation and optimisation via OptiSpeed® and OptiTip® pitch regulation.

Weight

Nacelle:	70 t
Rotor:	41 t

Towers:

Hub height:	IEC IA	IEC IIA	DIBt II	DIBt III
80 m	160 t	-	-	160 t
105 m	-	285 t	235 t	-

t = metric tonnes.

DIB towers are only approved for Germany.

All specifications subject to change without notice.

An efficient way to more power

When Vestas set out to establish a new benchmark for efficiency with its development of the V90-3.0 MW turbine, high priority was given to keeping weight down. That is because wind turbines are heavy, and the heavier the turbine, the greater the costs – for production, material, transport and installation.

Our engineers therefore rethought every aspect of turbine design – from foundations to blade tip – seeking ways to minimise the cost per kWh over the design lifetime of the V90. The result is a showcase of innovative engineering – particularly as regards weight saved. In fact, despite a larger rotor and generator, the new V90 actually weighs less than the V80-2.0 MW.

The biggest reduction has come from strengthening the tower. To increase fatigue strength, we have pioneered the use of magnets to fasten internal components to the tower walls. In addition, using a stronger steel means less is needed. The decreased weight lets us construct the new towers in fewer sections, with significant savings in material, transport, and installation costs.

The most radical redesign centred on the new nacelle. Even though the 3 MW generator is 50 per cent larger than the corresponding generator in the 2 MW wind turbine, we kept overall nacelle weight almost the same. We did this by integrating the hub bedplate directly into the gearbox, eliminating the main shaft and thus shortening nacelle length. The result is a nacelle that can generate much more power without any appreciable increase in size, weight or tower load.

Together with new low-weight blades, these breakthroughs have made the V90 remarkably light for a turbine of its size – and remarkably efficient for a turbine of any dimension.

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www.vestas.com

To see a complete list of our sales and service units, visit www.vestas.com

01/08 UK

Transmission System

Coupling hub - shaft	Flange
Coupling shaft - gearbox	Shrink disc
Gearbox type	3-stage planetary-helical
Gearbox ratio	1:119
Gearbox lubrication	Forced lubrication
Oil volume	Approx. 750 l
Gearbox cooling	Separate oil cooler
Gearbox designation	PZAB 3540
Gearbox manufacturer	Winergy AG
Coupling gear - generator	Double flexible coupling

Mechanical Brake

Type	Fail-safe disc brake
Position	High-speed shaft
Number of calipers	2

Generator

Type	Asynchronous
Nominal power	3,600 kW
Synchronous speed	1,500 rpm
Voltage	690 V
Frequency	Variable
Protection	IP54
Cooling	Integrated heat exchanger
Insulation class	F
Generator designation	AMB 506L4A

Canopy

Type	Totally enclosed
Material	Steel / Aluminum

Yaw System

Type	Active
Yaw bearing	Internally geared slew ring
Yaw drive	Six electric gear motors
Yaw brake	Active friction brake and six brake motors

Controller

Type	Microprocessor
SCADA system	WebWPS
Controller designation	KK WTC 3

Tower

Type	Tapered tubular steel tower
Hub heights	80 m or site-specific
Corrosion protection	Painted
Surface gloss	Semi-matt 30-40 ISO 2813
Surface color	Light gray, RAL 7035

Operational Data

Cut-in wind speed	3-5 m/s
Nominal power at approx.	12-14 m/s
Cut-out wind speed	25 m/s
Maximum 2 s gust	55 m/s (standard version) 60-80 m/s (special version)

Masses (approximate)

Rotor	95 t
Nacelle	125 t
Tower	Site-specific

Methodology for the production of ZVIs and Photomontages for the proposed Kish / Bray Bank offshore wind energy development.

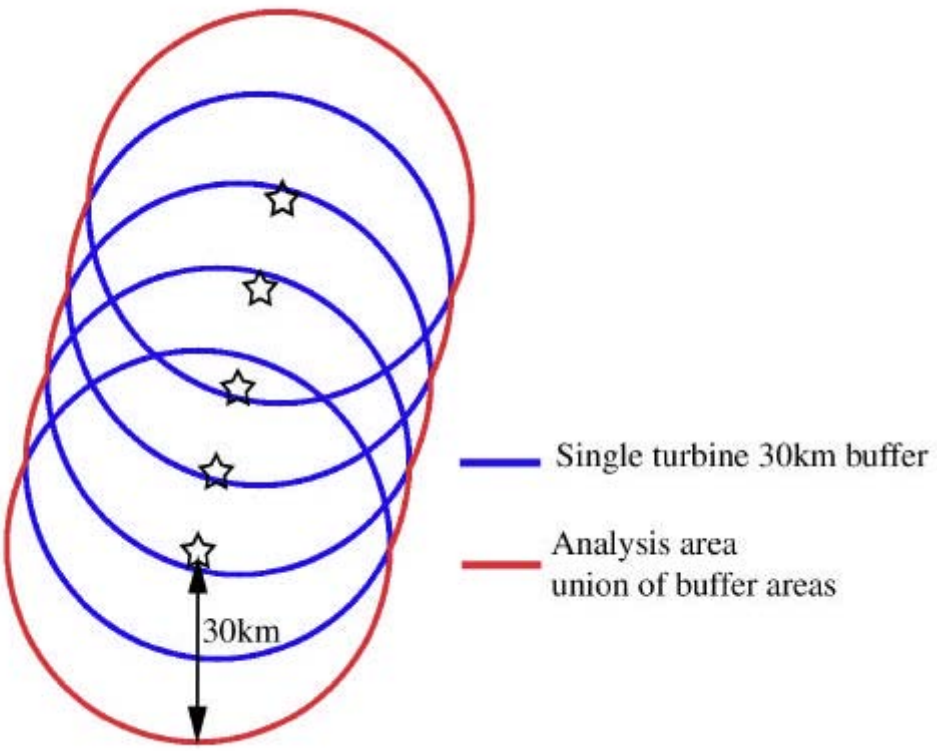
ZTV (Zone of Theoretical Visibility)

For the purpose of completeness 2 heights were chosen to analyse and demonstrate the theoretical visual impact of the proposed turbines on the surrounding sea area and coastal landscape.

1. Hub height (100m+)

2. Half blade height (130m+)

The analysis area was determined by the union of 30km buffers around each proposed turbine.



This covers an area from north of Rush in north County Dublin to south of Wicklow Town, County Wicklow and inland for up to 20km.

The contours for this analysis area were obtained from Ordnance Survey Ireland and were verified for errors independently. Some small errors were identified in the attribute height data associated with the contours and were amended accordingly.

As the 0m contour was not (and is not normally) shipped by OSI, this was digitised using the High Tide Watermark from the respective raster images. Once this was carried out the dataset was complete and ready for the building of the DEM (Digital Elevation Model).

All contours and rasters were georeferenced to the Irish National Grid using the following coordinate system details:

Transverse_Mercator
False_Easting: 200000.000000
False_Northing:
250000.000000
Central_Meridian: -8.000000
Scale_Factor: 1.000035
Latitude_Of_Origin:
53.500000 GCS_TM65
Datum: D_TM65 Prime
Meridian: 0

Once contours have been assigned to the correct coordinate system earth curvature calculations are easily embedded into the viewshed routine. This is particularly important for offshore developments.

The building of the DEM was carried out using the Viewshed tool as part of the 3D-Analyst or Spatial-Analyst extensions for ESRI's ArcView suite of GIS software. This is regarded as the industry standard software for GIS and terrain analysis.

Once the DEM was created, a separate point layer was created containing all of the coordinate details of the proposed turbines. For each ZTV height proposed a data file was composed detailing the particulars of the proposed heights, eye-level heights and analysis area and was appended to the point file for analysis.

Each ZTV created was reclassified into 30-turbine intervals and colourcoded to demonstrate the degree of impact between areas. Those areas close to the coast and facing the sea or at higher elevations are more

likely to endure a higher impact than those low-lying areas that are somewhat inland. This was definitely the case for the proposed Kish / Bray Bank development.

Each ZTV as the name implies is a theoretical indication of the visual impact of the proposed development upon the surrounding landscape that does not take cognisance of screening such as housing or vegetation. The DEM is made of raw contour data, ground elevation data at 10-meter intervals. It should be noted that these studies indicate a worst case scenario and are only indicative where there are clear views of the sea.

With the proposed Codling Bank development EIA submitted and awaiting a planning decision, it was important to include this in the assessment of the overall impact of wind energy developments upon coastal vistas. To do this, a separate ZTV was carried out for the 220 proposed Codling turbines. By amalgamating the results from the 2 proposed wind farms it was possible to assess the additional impact upon the analysis area. This merely demonstrates whether any portion of either or both wind farms is visible. It does not indicate the scale of either wind farm that may be visible. If only 1 turbine of a wind farm is visible, that wind farm is deemed to be visible.

Panoramic photomontages

The ZTV is an important tool and first step in the identification of potential viewpoints for further analysis by photomontage. Areas that fall outside of the theoretically impacted areas are definitely not impacted as they are screened by landform. Those areas that are theoretically impacted on the other hand require further investigation on the ground to determine whether the potential view of turbines is interrupted by screening such as housing or vegetation. More often than not low lying areas that do not directly face the sea will be screened and (especially in the case of a city such as Dublin) will have lost their view of the sea a long time ago.

The initial desktop identification of viewpoints identified approximately 30 potential viewpoints. With further analysis and deliberation this figure was whittled down to 25. Normally this figure would be greater at this stage but familiarity of the study area to the consultant made this process far easier.

The next stage was to visit all of the potential viewpoints, assess any screening that may be present and adjust the location where necessary to give the clearest possible view. All locations were selected on the basis of presenting the clearest possible view avoiding all screening where

possible. Each location was recorded using GPS and recorded vocal descriptions. This process further reduced the number of onshore viewpoints to 20.

Panoramic photo series were captured from each of the selected viewpoint locations when the weather was deemed to be most favourable. A professional digital SLR (Canon-1D Mark II with 24-70mm 2.8 L lens) mounted on a specialist panoramic tripod head was used to capture all photo series. This utilises an 8.2 megapixel sensor for maximum detail and resolution. The majority of series required 13 photos in portrait orientation to yield a 180° angle of view. Some were shorter. These were captured over 5 separate days, the visibility usually being clearest shortly after rainfall, with mid-afternoon providing the best uniform lighting. As the majority of viewpoints are facing due east, morning sun (although clear) would have yielded hazardous non-uniform lighting conditions across the face of a large panorama.

Once captured the photo series were stitched using specialist panoramic software and tweaked using photoshop.

A 3-D model of the proposed turbine type to be used (Vestas V90) was modeled based on detailed 2-D turbine specification drawings. This was subsequently imported with the DEM into a 3-D environment. Images were then captured of the model from each of the viewpoints using the GPS data and image details such as focal length (52mm) and angle of view (31°). It is possible to save a single 180° model and apply this to the photo but this doesn't properly capture the properties of the individual shots and lens type involved. These model series were stitched in the same fashion as the photos to yield accurate model panoramas.

The exact position of the Kish Lighthouse was also modeled with the wind farm. This was used as a positioning reference point where possible. 16 of the 20 panoramas actually show the lighthouse. Where this was not visible, landform such as Bray Head, Killiney Hill and Howth Head and other points of reference were used to correctly place the models onto the panoramas.

Once placed onto the photographic panoramas these models were adjusted for photo-realism thus yielding photomontages. These photomontages were imported into Adobe Illustrator with titles, maps and all information pertaining.

Cumulative impact photomontages

The cumulative impact of Kish / Bray Bank together with the Codling Bank and Arklow Bank wind farm projects was documented from all viewpoints.

For more information contact:

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GTech Surveys Limited

Television Reception Desktop Study & Broadcast Service Impact Assessment

Dublin Array Wind Energy Development

CHANGE HISTORY

Issue	Date	Details of Changes
0.1	07/01/12	Working Draft
1.0	12/01/12	First Draft Issue
1.1	17/01/12	Second Draft Issue
Author: G Phillips		Reviewer: S Clarke

Contents Page

GTech Surveys Ltd.

GTech Surveys Ltd. is a Midlands based broadcast and telecommunications consultancy, able to conduct projects throughout the entire UK and Ireland.

We undertake television reception surveys (TV signal surveys), conduct television interference and reception investigations, and support telecommunications planning work for wind farm developers, construction companies, architects, broadcasters and Local Planning Authorities.

In addition to these broadcast services, we review and prepare ES & EIA Telecommunications Chapters and documents, liaising with telecommunication providers and advising developers with respect to associated Section 106 Agreements and planning conditions. Additionally, we verify television transmitter coverage and performance and are actively involved with the UK's Digital Television Switchover project, working for Digital UK, Ofcom and Arqiva.

Our fully insured products and services are only undertaken by professional broadcast trained engineers.

GTech Surveys is a Consultant Member of the Confederation of Aerial Industries. Our membership number is T.1613. More information about the Confederation of Aerial Industries and CAI consultants can be found on their website - www.cai.org.uk

We also undertake technical research. During 2009, we undertook nationwide television reception survey work for the BIS – The UK Department for Business, Innovation and Skills. We conducted nationwide house visits to assess antenna system performance to aid the government understand the UK's readiness for the Digital Television Switchover.

Executive Summary

Impact assessments have been undertaken to determine the potential effects on television broadcast services that may arise as a result of the proposed Dublin Array wind energy development. The impacts on analogue terrestrial television, digital terrestrial television and digital satellite television service reception have all been assessed.

From the findings of technical analysis and from impact modelling, no adverse impacts have been identified for any television broadcast network. No interference is expected for any television service and subsequently, no pre or post-construction mitigation measures are required. Overall, the proposed development would have a neutral effect on the reception of television broadcast services for local residents.

This report follows the following structure:

Chapter 1 provides an introduction to the work

Chapter 2 discusses the different forms of wind turbine generated interference and how these can impact different television broadcast platforms

Chapter 3 provides a description of the available television services in the study area

Chapter 4 provides a description of the likely pre-construction television reception conditions around the proposed development

Chapter 5 describes the predicted impacts of the proposed development upon television broadcast reception before any mitigation measures are applied

Chapter 6 identifies any suitable mitigation circumstances and measures for any affected broadcast user

Chapter 7 contains an evaluation of the residual effects following mitigation

Chapter 8 is the conclusion

This study was undertaken in January 2012, to investigate areas where the proposed development could cause interference to television broadcast service reception.

1 - Introduction

This report outlines the findings of a study undertaken to determine the viewing preference of residents located around the proposed Dublin Array wind energy development and identifies the effects the proposed development may have on the reception of television broadcast services.

A desktop study was first undertaken, based on broadcast transmission information, plans of the proposed development and maps of the area. Modelling techniques and an assessment of viewers' choice of transmitter were then used to predict the potential effects upon broadcast reception in the area. The impacts of the proposed development are consequently analysed, and together with various mitigation options, conclusions are drawn on the overall effects of the proposed wind turbine development on television broadcast services for local residents. The effects on analogue terrestrial television, digital terrestrial television and digital satellite television service reception are discussed.

Figure 1 indicates the wind turbines' location in more detail. The turbine locations are detailed in the Appendix.

Tip Height	160 m
Hub Height up to	100 m
Rotor Diameter up to	130 m

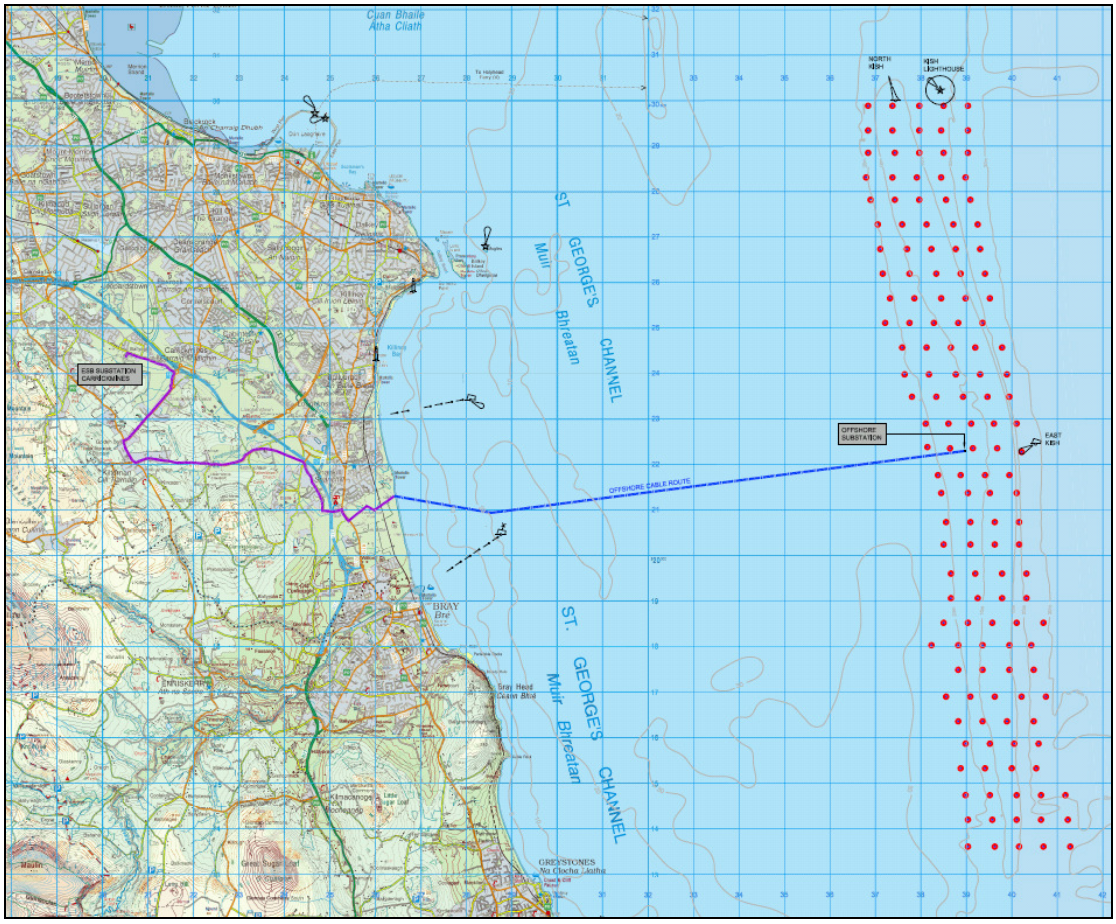


Figure 1 - The Location of the Proposed Wind Turbine Array

2 - The Mechanisms of Interference on Broadcast Services

Analogue Television Interference

This is not applicable for this study, as analogue television services will be switched off in the area after start of array operations. For more information regarding the switch to digital only television services, please refer to Saorview's website –

http://www.saorview.ie

Digital Terrestrial Television (DTT) Interference

The digital television broadcast platform offers many advantages over older analogue broadcast technologies. Due to the way picture signals are encoded and broadcast, digital television offers a much more resilient platform against the types of interference encountered by analogue television broadcast networks. The construction of digital signals ensures that they are much more impervious to the effects of interference from indirect secondary reflections, which consequently ensures good quality and coherent data stream integrity at the receiver, resulting in an interference free picture. There is no risk of interference and therefore no mitigation measures are required or proposed

Digital signals are also more robust to the interference effects created by moving wind turbine blades. Again, the structure of the signal ensures that the data stream is much less susceptible to the interference mechanisms wind turbines can generate for analogue services.

The BBC is currently investigating and quantifying the effects wind turbines have upon digital television signals. At the time of writing, this work was still ongoing, but it is widely accepted that DTT is much more resilient to the effects of wind turbine generated television interference. It is also understood that wind turbine generated interference can reduce the reliability of DTT services if signal levels are low and bit error rates (BERs) are high. However, due to the structure of the digital signal (specifically relating to the 'guard interval' – a technical description of this can be found in the Appendix), interference to DTT signals is almost practically impossible.

Digital Satellite Television

Digital satellite services are provided by geo-stationary earth orbiting satellites positioned above the equator. To ensure good reception of satellite services, satellite receive antennas (satellite dishes) are normally positioned away from trees and other clutter and are orientated to face the southern (south southeast) skies.

Disruption to satellite television services is normally caused by an obstruction on the line of sight from the satellite to the receive antenna e.g. a tall building or tall trees. Adverse weather can also influence reception. This is further detailed in the Appendix.

In the UK, Freesat and Sky services come from the 28.2 degrees east ASTRA 2A, ASTRA 2B and ASTRA 2D satellites. These three satellites occupy the same space and are collectively called the Astra Cluster. The transmission footprints of these satellites can be found in the Appendix.

The exact satellite which Saorsat services will be broadcast from has not been revealed at the time of writing. The satellite Saorsat will use has the ability to direct the signal beam over the island of Ireland, and only the island of Ireland.

Figure 2 below shows typical clearance distances and obstruction heights for interference free satellite television reception.

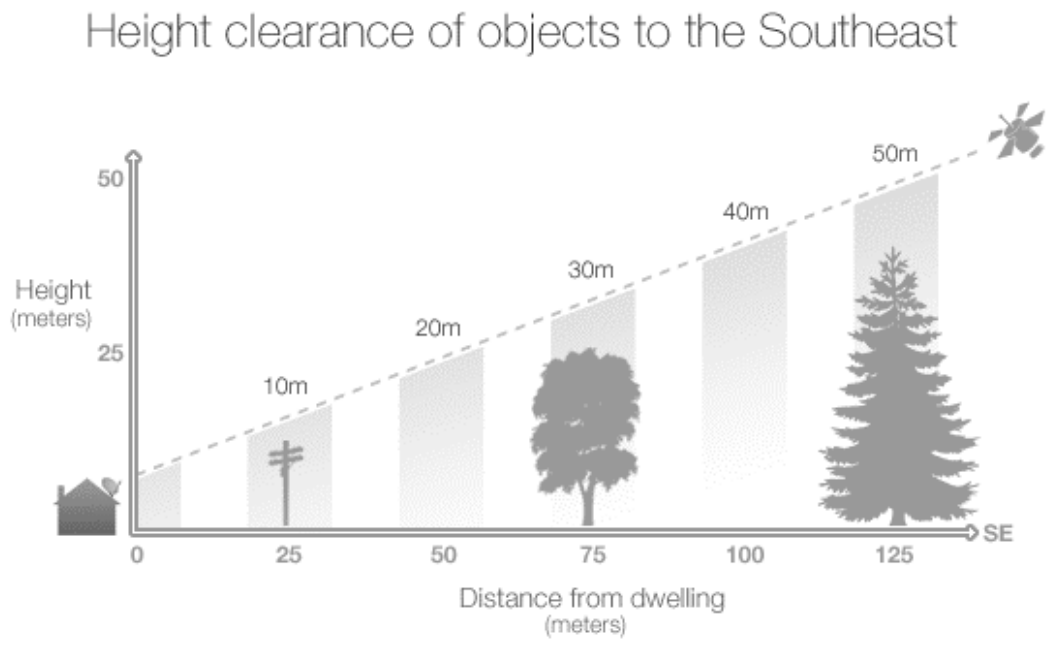


Figure 2 - Typical Clearance Distances and Obstruction Heights for Interference Free Satellite Television Reception

Radio Frequency Scattering and Signal Reflections

Wind turbines can cause signal scattering from reflections and refractions caused by the rotating turbine blades and the actual structure. The magnitude of these unwanted reflections is dependent upon several factors – the angle of the incoming wanted signal to the orientation of the turbine blade, the amplitude of the incoming signal, the electrical 'reflectivity' of the structure, the frequency of the incoming signal and the speed of blade rotation. Consequently, accurate modelling is complex.

With respect to television transmissions, two scatter zones are defined. The forward scatter zone is the area beyond the turbine with respect to the transmitter and the backscatter zone is the area between the wind turbine and the transmitter. Figure 3 shows these two zones.

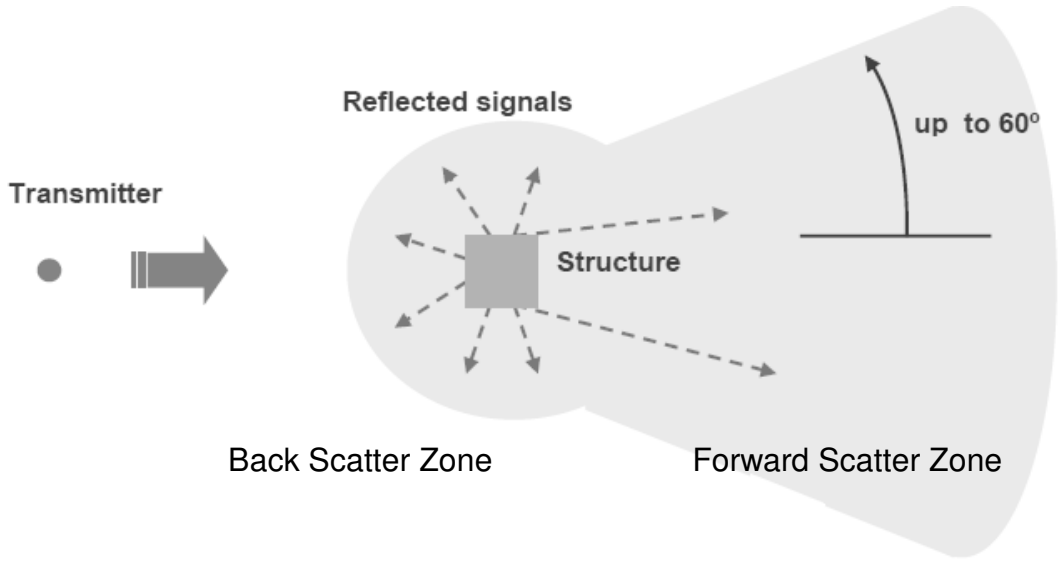


Figure 3 – Scatter Zones Created by Reflecting and Refracting Surfaces

Consider Figure 4 below, the direct signal travels a distance P1 to the viewer, whilst the signal reflected from the structure travels slightly further, distance (P2 + P3). Although travelling at the speed of light, the different path lengths can mean that one signal arrives with a significant delay relative to the other.

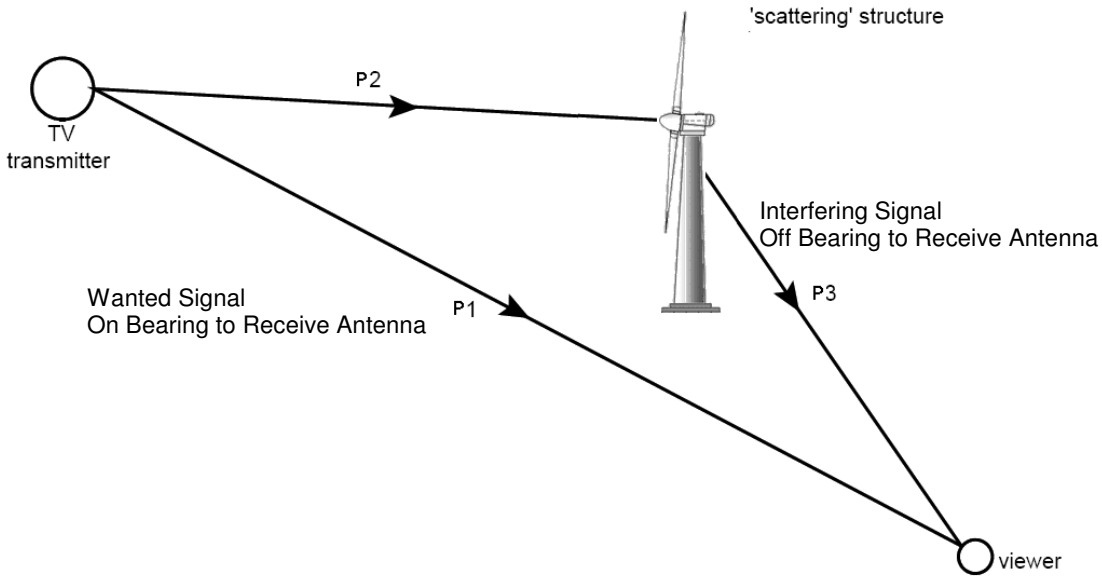


Figure 4 - Direct and Indirect Signal Paths

To avoid interference it is necessary to ensure that the ratio of wanted signal along the direct path (P1) to the unwanted signal along indirect paths (P2+P3) is sufficiently high. Domestic Yagi type TV receiving antennas generally have a significant directional response to incoming signals, which means that the antenna may discriminate against interfering signals that arrive on significantly different bearings. This can result in an increase in the ratio of wanted to unwanted signal, as presented to the television receiver. Very little unwanted signal is received off bearing with a Yagi type TV antenna. This is shown in Figure 5.

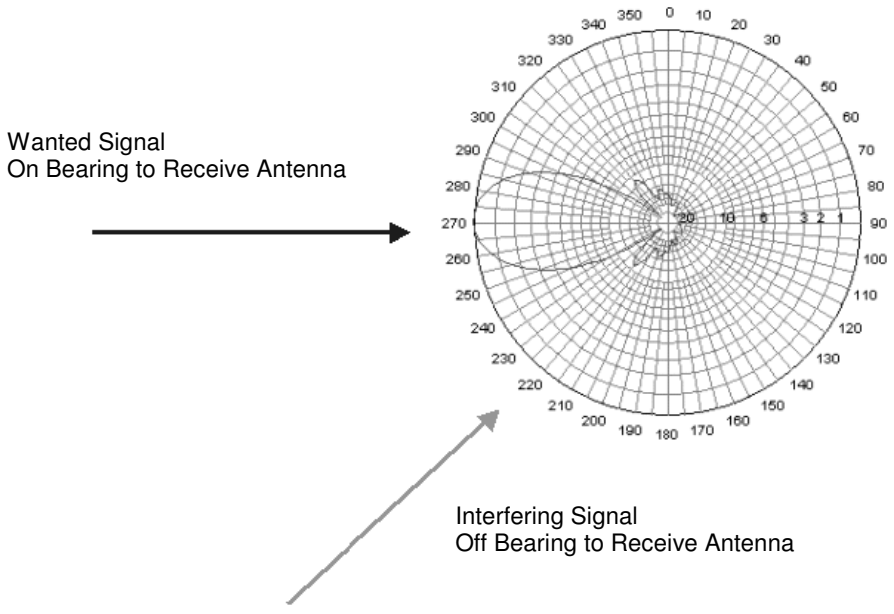


Figure 5 - Domestic Yagi Receive Antenna Response

3 - Available Television Broadcast Services In the Study Area

Analogue Terrestrial Television

Although analogue transmissions are still available in the study area at the time of writing, by the time of wind turbine operations, transmissions would have ceased as part of the switch to digital only services. Subsequently, analogue transmissions will no longer be considered in this study.

Digital Terrestrial Television (DTT)

The area around Dublin is served by DTT transmissions from the following transmitters -

- Three Rock (Easting Northing 317700 223300)
- Kippure (Easting Northing 311500 215400)
- Greystones

Digital Television Switchover

Analogue television services from the aforementioned transmitters are expected to be switched off before array operations. For more information regarding the switch to digital only television services, please refer to Saorview's website * –

http://www.saorview.ie/

Technical transmission information for each service at the aforementioned transmitter site is detailed in Tables A, B and C found in the Appendix.

Digital Satellite Television – Freesat and Sky

Freesat and Sky digital satellite television services are provided by geo-stationary earth orbiting satellites positioned above the equator. For the reception of the 28.2E ASTRA satellite cluster, dish elevations of 21.4 degrees are required at this latitude. Optimal receive dish azimuths are 139.5 degrees with respect to true north.

** - Websites & links accessed and verified January 2012*

4 - Description of Pre-construction (Baseline) Television Reception Conditions

The three serving transmitters in the area are expected to provide good coverage around the Dublin area. Depending upon location, residents will be receiving transmissions from one of the three aforementioned transmitters.

It is expected that television reception around the Dublin area is currently free from interference.

It is unlikely that terrestrial transmissions will be available around the array's location. This is due to antenna tilt (used to minimise interference to coastal parts of the UK), transmitter powers and the distance from the transmitters to the array's location.

5 - Predicted Effects

Methodology

To assess the effects of the proposed array upon television broadcast service reception, the development was considered to create interference to services in the immediate areas around the site, in signal reflection areas and in the shadow zones. These methods, used in conjunction with broadcast transmission information, plans and maps of the study area and modelling techniques (further described in the Appendix), contribute towards predicting the potential effects upon broadcast service reception in the study area.

This assessment is finally used to determine what actual risks exist and what viable solutions are available to minimise any risks.

Predicted Effects from Modelling

Analogue Terrestrial Television

Due to the forthcoming switch to digital only television services (Digital Television Switchover), analogue signals will no longer be available in the area once the array is operational. Consequently, interference would not be possible.

Digital Terrestrial Television – Freeview

Digital services are much less affected by signal reflections from moving wind turbine blades. Modelling has indicated that DTT services are not at risk from signal interference generated from the development. This is due to the proposed development's offshore location, the good coverage provided by the serving transmitters and the favorable proximity of residents with respect to the proposed development.

Digital Satellite Television – Freesat and Sky

Tall buildings and wind turbines can disrupt satellite reception by causing obstructions on the line of sight to the receive dish from the serving satellite. Using the mathematical tangent function and based on the heights of the proposed wind turbines and the angle and orientation of the incoming satellite signals, interference to satellite reception could occur up to 540m in a northwesterly direction (320 - 330 degrees with respect to true north) of each turbine. However, as no satellite signal receive dishes are located in these areas, no interference can occur.

Predicted Effects

The predicted effects are discussed below and summarised in Table 1.

Broadcast platform	Area(s) of predicted interference	Risk of interference	Antenna protection (Chapter 2)	Alternative good digital reception
Analogue TV	Not possible	No	N/A	N/A
DTT - Saorview	None	No	N/A	N/A
Digital Satellite TV	None	No	N/A	N/A

Table 1 - Summary of Predicted Interference

Predicted Effects - Conclusions

- Interference to analogue television services would not be possible
- Interference to DTT services is practically impossible
- Interference to digital satellite television reception would not be possible

6 – Mitigation Circumstances & Measures

Mitigating Circumstances

None applicable.

Mitigation Measures

None required.

7 - Evaluation of Residual Effects

Effect	Type of Effect	Probability of Effect Occurring	Policy Importance or Sensitivity	Magnitude of Effect	Significance	
					Level	Rationale
Interference to television broadcast services	Negative / Adverse	Unlikely	Local	Neutral	Not significant	Analogue television interference would not be possible due to the forthcoming switch to digital only television services. The study area is likely to be well served by DTT transmissions from the Kippure, Greystones and Three Rock transmitters and modelling has indicated that the proposed development would not impact these services. This is due to the favorable locations of residents with respect to the proposed development and the current good coverage provided by the DTT transmitters. Due to the location of the proposed development with respect to the locations of satellite receive dishes, interference to digital satellite reception will not be possible. When all considered, the proposed array will have a neutral effect on television reception for local residents.

8 – Conclusions

A desktop study has been performed to assess the possible effects and impacts on the reception of television broadcast services from the proposed wind energy array to the southeast of Dublin Bay. The study has focused on the three television broadcast platforms that could possibly be impacted by the proposed development – analogue terrestrial television, digital terrestrial television and digital satellite television services.

Analogue Terrestrial Television

Due to the forthcoming Digital Television Switchover, it would not be possible for the proposed development to impact analogue terrestrial television reception, as analogue transmissions in the area will be switched off before array operation.

Digital Terrestrial Television (DTT)

From modelling (no viewers are located in any areas where interference could occur) and analysis of current likely reception conditions, the proposed array will not have any effect upon the reception of DTT services. DTT is more commonly known as 'Saorview' in Ireland.

Digital Satellite Television

Due to the location of the proposed development and the locations of any satellite signal receive dishes (satellite dishes), the proposed array cannot have any effect upon the reception of digital satellite television services such as Freesat and Sky.

Overall, due to these factors, the proposed development will have a neutral effect upon the reception of television broadcast services for local residents. No pre or post-construction mitigation measures are required as no interference will occur for any television broadcast platform.

APPENDIX

Turbine Locations

Turbine	Easting	Northing	Latitude	Longitude
T1	336839.3	229885.3	53° 18' 6.577" N	05° 56' 53.317" W
T2	337375	229885.3	53° 18' 5.2009" N	05° 56' 20.7947" W
T3	337964.3	229885.3	53° 18' 4.65" N	05° 55' 48.9911" W
T4	338500	229885.3	53° 18' 4.1472" N	05° 55' 20.0805" W
T5	339035.7	229885.3	53° 18' 3.6424" N	05° 54' 51.1701" W
T6	336839.3	229344.3	53° 17' 48.2093" N	05° 56' 50.5449" W
T7	337375	229344.3	53° 17' 47.7108" N	05° 56' 21.6369" W
T8	337964.3	229344.3	53° 17' 47.16" N	05° 55' 49.837" W
T9	338446.4	229344.3	53° 17' 46.7076" N	05° 55' 23.822" W
T10	339035.7	229344.3	53° 17' 46.1525" N	05° 54' 52.0225" W
T11	336839.3	228852.5	53° 17' 32.3096" N	05° 56' 51.3073" W
T12	337428.6	228852.5	53° 17' 31.3651" N	05° 55' 56.6381" W
T13	337964.3	228852.5	53° 17' 31.2605" N	05° 55' 50.6014" W
T14	338500	228852.5	53° 17' 30.7578" N	05° 55' 21.7013" W
T15	339035.7	228852.5	53° 17' 30.2532" N	05° 54' 52.7972" W
T16	336785.7	228311.5	53° 17' 14.8692" N	05° 56' 55.0376" W
T17	337375	228311.5	53° 17' 14.3209" N	05° 56' 23.2442" W
T18	337910.8	228311.5	53° 17' 13.8204" N	05° 55' 54.3375" W
T19	338446.4	228311.5	53° 17' 14.9087" N	05° 55' 25.3646" W
T20	338982.2	228311.5	53° 17' 12.8138" N	05° 54' 56.5354" W
T21	336892.9	227819.7	53° 16' 58.87" N	05° 56' 50.0164" W
T22	337428.6	227819.7	53° 16' 58.3714" N	05° 56' 21.179" W
T23	337964.3	227819.7	53° 16' 57.8709" N	05° 55' 52.2195" W
T24	338553.6	227819.7	53° 16' 57.3179" N	05° 55' 20.4299" W
T25	339089.3	227819.7	53° 16' 56.8134" N	05° 54' 51.532" W
T26	337053.6	227278.7	53° 16' 41.2303" N	05° 56' 42.1868" W
T27	337589.3	227278.7	53° 16' 40.7312" N	05° 56' 13.2915" W
T28	338125	227278.7	53° 16' 40.2302" N	05° 55' 44.3965" W
T29	338714.3	227278.7	53° 16' 39.6769" N	05° 55' 12.6055" W
T30	339250	227278.7	53° 16' 39.1718" N	05° 54' 43.7161" W
T31	337107.2	226737.7	53° 16' 23.6902" N	05° 56' 40.1351" W
T32	337696.4	226737.7	53° 16' 23.141" N	05° 56' 8.3577" W
T33	338232.2	226737.7	53° 16' 22.6396" N	05° 55' 39.4606" W
T34	338767.9	226737.7	53° 16' 22.1364" N	05° 55' 10.5691" W
T35	339303.6	226737.7	53° 16' 21.6312" N	05° 54' 41.6779" W
T36	337160.7	226196.7	53° 16' 6.1501" N	05° 56' 38.0892" W
T37	337750	226196.7	53° 16' 5.6008" N	05° 56' 6.31" W
T38	338339.3	226196.7	53° 16' 5.049" N	05° 55' 34.5312" W
T39	338875	226196.7	53° 16' 4.5456" N	05° 55' 5.643" W
T40	339410.7	226196.7	53° 16' 4.0399" N	05° 54' 36.7551" W
T41	337321.4	225655.7	53° 15' 48.5941" N	05° 56' 35.1162" W
T42	337857.1	225655.7	53° 15' 48.0105" N	05° 56' 1.378" W
T43	338446.4	225655.7	53° 15' 47.4585" N	05° 55' 29.6026" W
T44	338982.1	225655.7	53° 15' 46.9547" N	05° 55' 0.7181" W

T45	339517.9	225655.7	53° 15' 46.4487" N	05° 54' 31.828" W
T46	337214.3	225114.8	53° 15' 31.1229" N	05° 56' 36.8775" W
T47	337750	225114.8	53° 15' 30.6236" N	05° 56' 7.9954" W
T48	338285.7	225114.8	53° 15' 30.1224" N	05° 55' 39.1136" W
T49	338821.4	225114.8	53° 15' 29.6192" N	05° 55' 10.2319" W
T50	339357.1	225114.8	53° 15' 29.114" N	05° 54' 41.3506" W
T51	337589.3	224573.8	53° 15' 13.2833" N	05° 56' 17.5009" W
T52	338125	224573.8	53° 15' 12.7828" N	05° 55' 48.6223" W
T53	338660.7	224573.8	53° 15' 12.2801" N	05° 55' 19.7439" W
T54	339196.4	224573.8	53° 15' 11.7757" N	05° 54' 50.8656" W
T55	339785.7	224573.8	53° 15' 11.2185" N	05° 54' 19.0982" W
T56	337642.9	223983.6	53° 14' 55.7431" N	05° 56' 15.453" W
T57	338178.6	223983.6	53° 14' 55.2423" N	05° 55' 46.5776" W
T58	338767.9	223983.6	53° 14' 53.0987" N	05° 55' 14.8905" W
T59	339303.6	223983.6	53° 14' 52.594" N	05° 54' 46.0159" W
T60	339892.9	223983.6	53° 14' 52.0364" N	05° 54' 14.2525" W
T61	337803.6	223491.8	53° 14' 38.1028" N	05° 56' 7.6331" W
T62	338339.3	223491.8	53° 14' 37.6015" N	05° 55' 38.761" W
T63	338928.6	223491.8	53° 14' 37.0479" N	05° 55' 7.0" W
T64	339464.3	223491.8	53° 14' 36.5427" N	05° 54' 38.1289" W
T65	339946.4	223491.8	53° 14' 36.0863" N	05° 54' 12.1464" W
T66	338107	222902	53° 14' 18.7513" N	05° 55' 52.2011" W
T67	338607	222902	53° 14' 18.2826" N	05° 55' 25.2565" W
T68	339107	222902	53° 14' 17.8123" N	05° 54' 58.3122" W
T69	330607	222902	53° 14' 17.3403" N	05° 54' 31.3681" W
T70	340107.1	222902.5	53° 14' 15.2661" N	05° 54' 4.4972" W
T71	338143	222386	53° 14' 2.0356" N	05° 55' 51.0659" W
T72	338642	222360	53° 14' 0.7273" N	05° 55' 24.2188" W
T73	339142.9	222360.7	53° 14' 0.2787" N	05° 54' 57.228" W
T74	339678.6	222360.7	53° 13' 59.7727" N	05° 54' 28.3633" W
T75	340214.3	222280.6	53° 13' 59.265" N	05° 53' 59.499" W
T76	338375	221770	53° 13' 41.9034" N	05° 55' 39.5271" W
T77	338875	221770.5	53° 13' 43.0407" N	05° 55' 39.5271" W
T78	339410.7	221770.5	53° 13' 40.9453" N	05° 54' 43.727" W
T79	339946.4	221770.5	53° 13' 40.4386" N	05° 54' 14.8661" W
T80	338446.4	221377.1	53° 13' 29.1341" N	05° 55' 36.2941" W
T81	339035.7	221377.1	53° 13' 26.99" N	05° 55' 4.6248" W
T82	339517.9	221377.1	53° 13' 28.1258" N	05° 54' 38.5709" W
T83	340107.1	221377.1	53° 13' 27.5681" N	05° 54' 6.8303" W
T84	338553.6	220737.7	53° 13' 8.3622" N	05° 55' 31.5185" W
T85	339089.3	220737.7	53° 13' 7.8587" N	05° 55' 2.6633" W
T86	339625	220737.7	53° 13' 7.3533" N	05° 54' 33.8085" W
T87	340160.7	220737.7	53° 13' 6.8461" N	05° 54' 4.9539" W
T88	338500	220245.9	53° 12' 52.5128" N	05° 55' 35.1737" W
T89	339089.3	220245.9	53° 12' 50.3686" N	05° 55' 3.512" W
T90	339625	220245.9	53° 12' 49.8634" N	05° 54' 34.6657" W
T91	340160.7	220245.9	53° 12' 50.9467" N	05° 54' 5.7312" W
T92	338660.7	219606.6	53° 12' 31.6939" N	05° 55' 27.5181" W
T93	339196.4	219606.6	53° 12' 31.1902" N	05° 54' 58.6698" W

T94	339785.7	219606.6	53° 12' 30.6339" N	05° 54' 26.9354" W
T95	340321.4	219606.6	53° 12' 30.1262" N	05° 53' 58.0877" W
T96	338660.7	219065.6	53° 12' 14.2036" N	05° 55' 28.3635" W
T97	339250	219065.6	53° 12' 13.6495" N	05° 54' 56.6324" W
T98	339785.7	219065.6	53° 12' 13.1438" N	05° 54' 27.7878" W
T99	340321.4	219065.6	53° 12' 12.6361" N	05° 53' 58.9433" W
T100	338500	218524.6	53° 11' 55.2734" N	05° 55' 37.9375" W
T101	339035.7	218524.6	53° 11' 56.3611" N	05° 55' 9.0189" W
T102	339571.4	218524.6	53° 11' 55.8563" N	05° 54' 40.1775" W
T103	340107.1	218524.6	53° 11' 55.3495" N	05° 54' 11.3361" W
T104	340696.4	218524.6	53° 11' 54.7897" N	05° 53' 39.6093" W
T105	338232.1	218032.8	53° 11' 41.2149" N	05° 55' 53.0502" W
T106	338821.4	218032.8	53° 11' 40.6628" N	05° 55' 21.3258" W
T107	339357.1	218032.8	53° 11' 40.1589" N	05° 54' 52.4871" W
T108	339946.4	218032.8	53° 11' 39.6022" N	05° 54' 20.7632" W
T109	340428.6	218032.8	53° 11' 39.145" N	05° 53' 54.8051" W
T110	338821.4	217491.8	53° 11' 23.1725" N	05° 55' 22.1715" W
T111	339357.1	217491.8	53° 11' 22.6687" N	05° 54' 53.3361" W
T112	339946.4	217491.8	53° 11' 20.5215" N	05° 54' 21.6933" W
T113	340482.1	217491.8	53° 11' 21.6042" N	05° 53' 52.7809" W
T114	338553.6	216901.7	53° 11' 4.3459" N	05° 55' 37.5071" W
T115	339089.3	216901.7	53° 11' 3.843" N	05° 55' 8.6751" W
T116	339625	216901.7	53° 11' 3.3383" N	05° 54' 39.8433" W
T117	340214.3	216901.7	53° 11' 2.781" N	05° 54' 8.1271" W
T118	340750	216901.7	53° 11' 2.272" N	05° 53' 39.2958" W
T119	338821.4	216360.7	53° 10' 46.6046" N	05° 55' 23.9389" W
T120	339357.1	216360.7	53° 10' 47.6882" N	05° 54' 55.0333" W
T121	339892.9	216360.7	53° 10' 47.1825" N	05° 54' 26.1993" W
T122	340482.1	216360.7	53° 10' 45.0367" N	05° 53' 54.5694" W
T123	338982.1	215868.9	53° 10' 30.5538" N	05° 55' 16.06" W
T124	339517.9	215868.9	53° 10' 30.0495" N	05° 54' 47.2289" W
T125	340053.6	215868.9	53° 10' 29.5434" N	05° 54' 18.4036" W
T126	340589.3	215868.9	53° 10' 29.0354" N	05° 53' 49.5784" W
T127	338875	215327.9	53° 10' 13.1641" N	05° 55' 22.668" W
T128	339410.7	215327.9	53° 10' 12.6604" N	05° 54' 53.8457" W
T129	340000	215327.9	53° 10' 12.1041" N	05° 54' 22.1397" W
T130	340535.7	215327.9	53° 10' 11.5963" N	05° 53' 53.3177" W
T131	338982.1	214737.7	53° 09' 53.9826" N	05° 55' 17.8281" W
T132	339517.9	214737.7	53° 09' 53.4785" N	05° 54' 49.0" W
T133	340107.1	214737.7	53° 09' 52.922" N	05° 54' 17.3072" W
T134	340642.9	214737.7	53° 09' 52.4138" N	05° 53' 48.4835" W
T135	341178.6	214737.7	53° 09' 51.9037" N	05° 53' 19.6655" W
T136	339035.7	214196.7	53° 09' 36.4419" N	05° 55' 15.7901" W
T137	339571.4	214196.7	53° 09' 35.9377" N	05° 54' 46.9745" W
T138	340107.1	214196.7	53° 09' 35.4317" N	05° 54' 18.1593" W
T139	340642.9	214196.7	53° 09' 34.9237" N	05° 53' 49.3389" W
T140	341232.1	214196.7	53° 09' 34.3628" N	05° 53' 17.6464" W
T141	339035.7	213606.6	53° 09' 17.3641" N	05° 55' 16.7121" W
T142	339625	213606.6	53° 09' 16.8096" N	05° 54' 45.0174" W

T143	340160.7	213606.6	53° 09' 16.3035" N	05° 54' 16.2056" W
T144	340696.4	213606.6	53° 09' 15.7954" N	05° 53' 47.3942" W
T145	341285.7	213606.6	53° 09' 15.2342" N	05° 53' 15.7002" W

Transmitter Frequency Tables

Digital TV Channel	Polarization
54	Horizontal

Table A – Three Rock Digital Terrestrial Television Services

Digital TV Channel	Polarization
52	Vertical

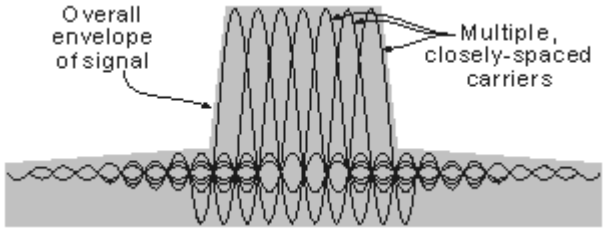
Table B – Greystones Digital Terrestrial Television Services

Digital TV Channel	Polarization
54	Horizontal

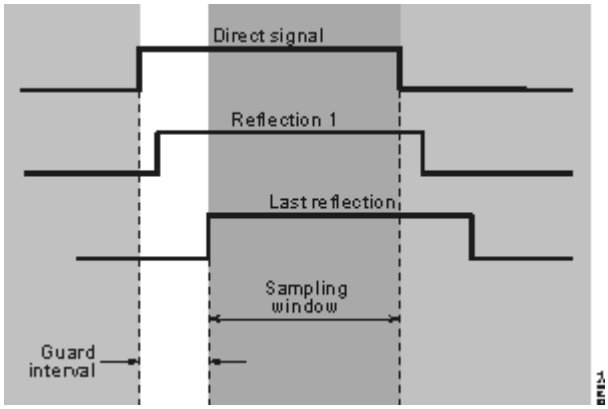
Table C – Kippure Digital Terrestrial Television Services

The COFDM (DTT) Signal

The data to be transmitted on a COFDM signal is spread across the carriers of the signal, each carrier taking part of the payload. This reduces the data rate taken by each carrier.



The lower data rate has the advantage that interference from reflections is much less critical. This is achieved by adding a guard band time or guard interval into the system. This ensures that the data is only sampled when the signal is stable and no new delayed signals arrive that would alter the timing and phase of the signal.



Guard Interval

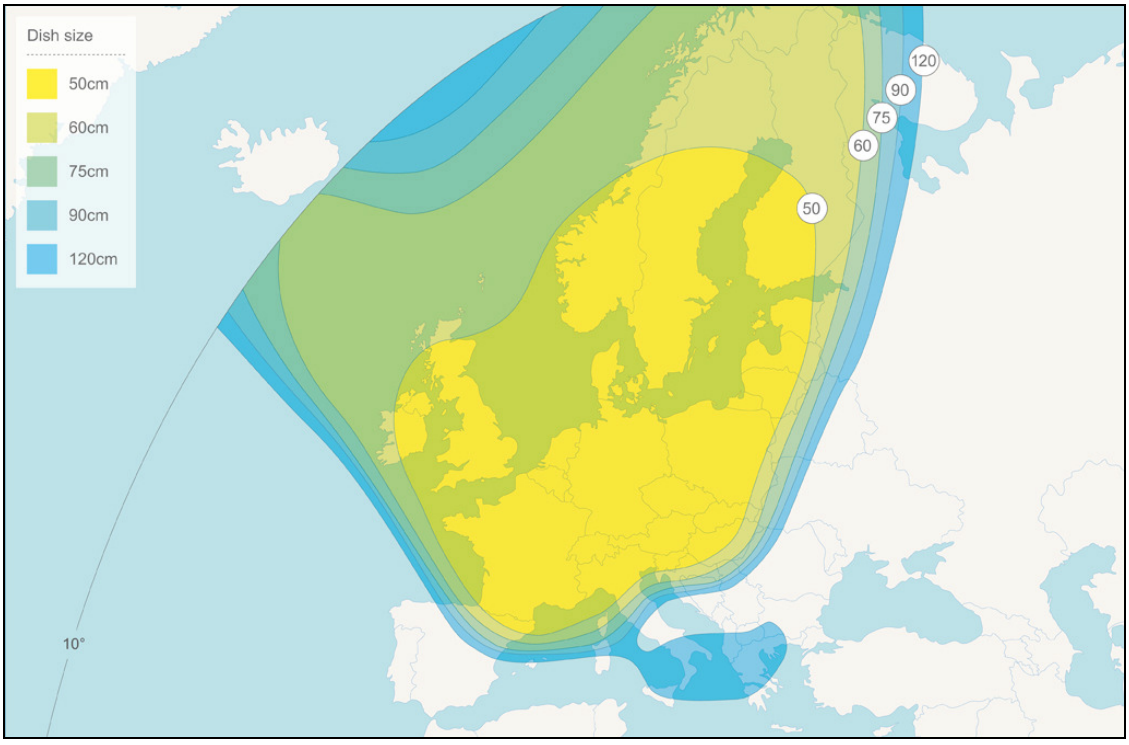
The distribution of the data across a large number of carriers in the COFDM signal has some further advantages. Nulls caused by multi-path effects or interference on a given frequency only affect a small number of the carriers, the remaining ones being received correctly. By using error-coding techniques, which does mean adding further data to the transmitted signal, it enables many or all of the corrupted data to be reconstructed within the receiver. This can be done because the error correction code is transmitted in a different part of the signal.

Rain Fade

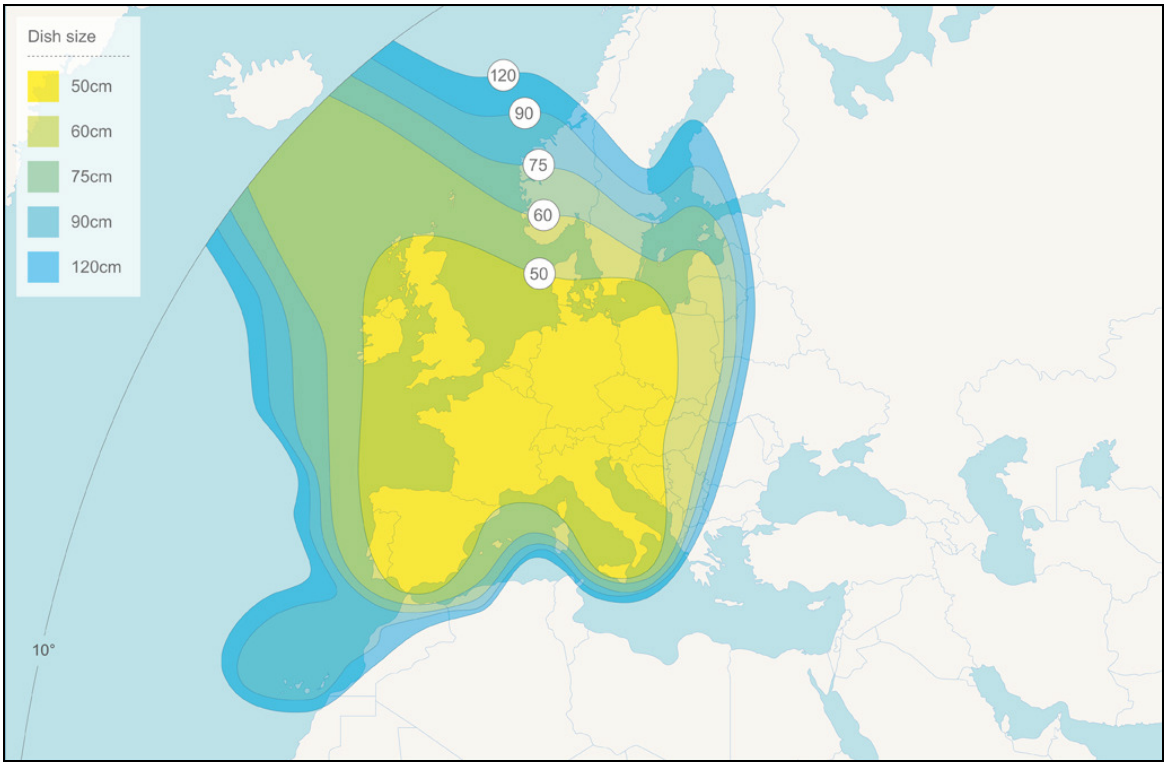
Rain fade refers primarily to the absorption of a microwave Radio Frequency (RF) signal by atmospheric rain, snow or ice, and losses are especially prevalent at frequencies above 11 GHz. It also refers to the degradation of a signal caused by the electromagnetic interference of the leading edge of a storm front. Rain fade can be caused by precipitation at the uplink or downlink location. However, it does not need to be raining at a location for it to be affected by rain fade, as the signal may pass through precipitation many miles away, especially if the satellite dish has a low look angle. From 5 to 20 percent of rain fade or satellite signal attenuation may also be caused by rain, snow or ice on the uplink or downlink antenna reflector, radome or feed horn.

Rain fade causes data stream break up on digital services and increased noise on received analogue pictures. During times of very heavy rain, users may receive no signal at all, as set top boxes may not be able to lock onto the data transport streams and decode the information.

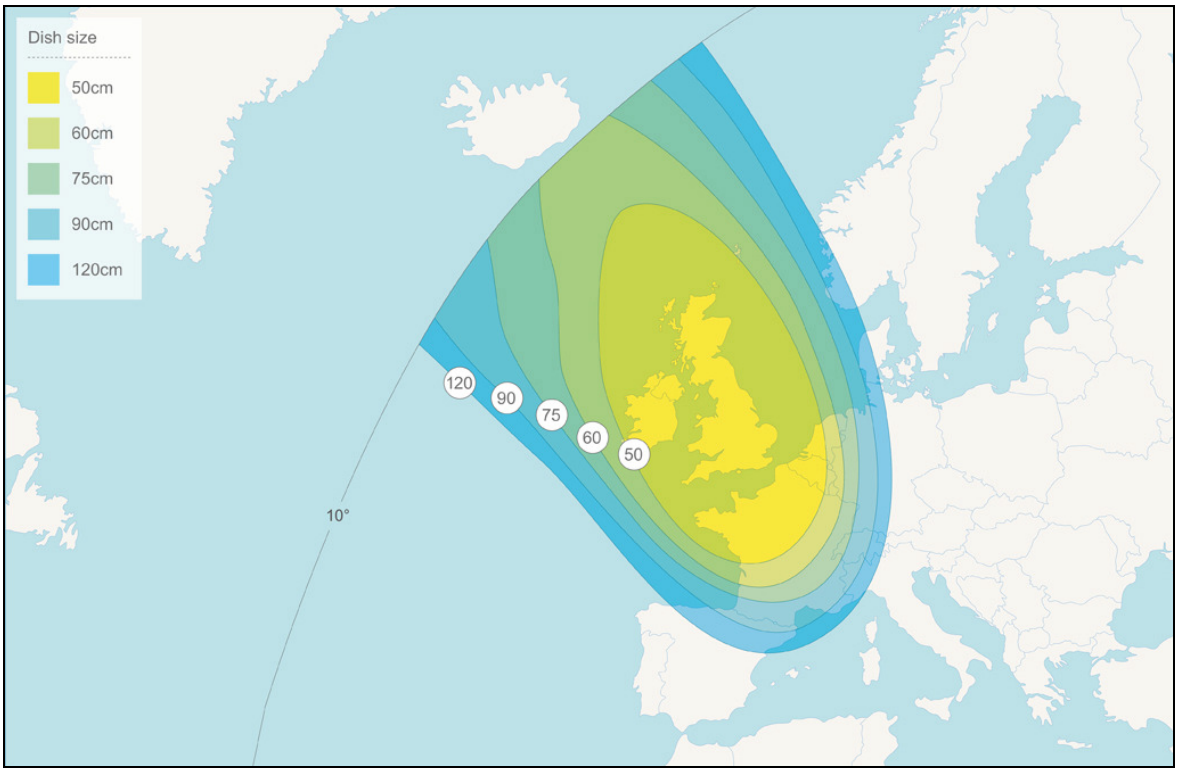
ASTRA 2A, ASTRA 2B and ASTRA 2D satellite Transmission Footprints



ASTRA 2A and ASTRA 2B Footprint Image - North Beam



ASTRA 2A and ASTRA 2B Footprint Image South Beam



ASTRA 2D Footprint Image

Computer Modelling and ITU-R P.1812-1 Information

Using our modelling software, serving transmitter information and wind turbine characteristics, the following is undertaken to determine terrestrial television impacts.

1. DTM data is used to calculate free space loss and when applicable, hilltop diffraction etc from the main serving transmitter to the turbines' locations and areas beyond. This factors in the serving transmitter's location, antenna height, antenna ERP and the transmit antenna radiation pattern. Diffraction losses are calculated in accordance with ITU-R P.1812 based on an iterative process using a terrain profile derived from the DTM database. All UK television frequency modelling is carried out at 10m AGL, as is this.

2. A model of the turbine (or turbines) is generated from its height and rotor cross sectional area. The turbine is subsequently modelled as an omni-directional co-channel interferer operating with a low transmit power. Data from the field survey is used to determine this radiated power.

2. Locations of potential sensitive receptors – normally residential dwellings with domestic yagi antennas are factored into calculations. For analogue, the points where the wanted signal is between 10 and 20dB above the unwanted signal are flagged as potential interference areas. These points are stored. For DTT services, calculations are also undertaken to determine the point the guard interval is compromised.

3. These stored geographical values are used to plot charts of critical wanted to unwanted signal ratio reduction areas.

ITU-R P.1812-1

Title – "A path-specific propagation prediction method for point-to-area terrestrial services in the VHF and UHF bands"

International Telecommunication Union/ITU Radiocommunications Sector

Publication Date: Oct 1, 2009

Scope:

This Recommendation describes a propagation prediction method suitable for terrestrial point-to-area services in the frequency range 30 MHz to 3 GHz for the detailed evaluation of signal levels exceeded for a given percentage of time, p%, in the range 1% = p = 50% and a given percentage of locations, pL, in the range 1% = pL = 99%. The method provides detailed analysis based on the terrain profile.

The method is suitable for predictions for radiocommunication systems utilizing terrestrial circuits having path lengths from 0.25 km up to about 3000 km distance, with both terminals within approximately 3 km height above ground. It is not suitable for propagation predictions on either air-ground or space-Earth radio circuits.

This Recommendation complements Recommendation ITU-R P.1546.

Terrestrial Ecology Impact Assessment on the proposed onshore cable route from the Dublin Array Offshore Wind Farm

Report prepared for:
Saorgus Energy Ltd.

October 2011

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1.0 Introduction

EcoServe was appointed by Saorgus Energy Ltd. to carry out a terrestrial ecology impact assessment on the proposed cable route for the Kish and Bray banks offshore wind farm (Dublin Array). The assessment took place at Shanganagh Park, Shankill, Co. Dublin, from the point where the onshore transmission cable makes landfall to the point where it connects to the electricity grid. The principal aim of this survey was to identify and map the habitats present along the proposed cable route, to note the occurrence of mammal species and to identify associated ecological constraints and any potential impacts of the proposed onshore cable route. The initial proposed cable route passed through a long section of linear woodland (WL) (Figure 1). The results of the archeological survey and the current survey which identified the presence of a badger sett, and the potential impact on the linear woodland, has resulted in an alternative proposed cable route (Figure 2).

1.1 Study area

The area surveyed encompassed the sea shore, Shanganagh Park and a section of road to the M11 motorway, along the proposed route for the transmission cable. The cable route has a length of approximately 2km from the point of landfall to where it joins the M11. Shanganagh Park is located to the south of Shankill, Co. Dublin and north of Bray, Co. Wicklow.

1.2 Proposed works

It is proposed that the energy cable will be installed by directional drilling under the beach from the field behind the beach area to approximately 200m out to sea. The conduits will be installed in trenches throughout the park, with directional drilling under the existing railway line. After the conduit has been installed the trench will be backfilled and the ground re-seeded.

2.0 Existing environment

2.1 Conservation

The proposed development site itself is not under any designation as per the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997) as amended or the Wildlife Acts 1976 to 2010.

2.1.1 Conservation Designations

A number of conservation designations exist in Ireland providing protection to habitats and species. A summary of these designations is presented here.

Special Protection Areas (SPAs) are created under the European Union's Birds Directive (2009/147/EC) and are designated for the protection of species of wild birds. No formal criteria are set out in the Directive for selecting SPAs, so Ireland has set the following criteria:

- Site regularly used by 1% or more of the all-Ireland population of an Annex 1 species
- Site regularly used by 1% or more of the biogeographical population of a migratory species
- Site regularly used by more than 20,000 waterfowl. In addition, sites important for dispersed species require protection under the Directive.

There are currently 150 sites designated as SPAs in Ireland, with a small number still being considered for designation. As well as providing for the designation of SPAs, the Birds Directive provides general protection to all wild bird species in Ireland.

Special Areas of Conservation (SACs) are designated under the European Union's Habitats Directive (92/43/EEC), which was transposed into Irish law by the European Communities (Natural Habitats) Regulations 1997 (S.I. 94/1997) as amended. SACs are designated for the protection of habitats, plants or animals listed under Annex I and II of the Directive. A total of approximately 13,500 km^2 has been designated as SAC in Ireland and its surrounding waters.

Natural Heritage Areas (NHAs) are designated under the Wildlife Acts 1976 to 2010 for the protection of Ireland's natural heritage, including habitats, species or geological features. To date, 148 NHAs have been designated throughout Ireland, though these are limited to areas supporting two habitat types: Raised Bog and Blanket Bog. In addition to the 148 designated NHAs, there are 630 non-statutorily proposed NHAs (pNHAs), which have no statutory protection and will not have any until they are statutorily proposed.

Ramsar sites are internationally important sites designated under the Convention on Wetlands of International Importance (Ramsar, Iran, 1971), to which Ireland is a Contracting Party. Ramsar sites may be designated for a number of reasons. The criteria for selection are based on wetland types, species and ecological communities, waterbirds, fish, and other taxa. Ireland has 45 Ramsar sites, covering an area of 66,994 ha.

2.1.2 Conservation Designations in the vicinity of the cable route

There are no nature conservation designations within the immediate area of this study; however there are designated sites within 10 kilometres of the site. North of the study site, Dalkey Island SPA (site code 004172) is designated as a Special Protection Area. Dalkey Coastal Zone and Killiney (site code 001206) and South Dublin Bay are designated as a Proposed Natural Heritage Areas, with South Dublin Bay also designated as a Special Area of Conservation. Sandymount Strand/Tolka Estuary (site code 004024) is a designated Special Protected Area. Also to the north of the study site, Loughlinstown Wood (site code 001211) is a Proposed Natural Heritage Area. West and southwest of the study site, Dingle Glen (site code 001207) and Ballybetagh Bog (site code 001202) are also Proposed Natural Heritage Areas.

2.2 Field survey

2.2.1 Methodology

Habitat and plant survey

The habitats and plants along and adjacent to the proposed cable route were surveyed by conducting a walk-over survey on the 15th October 2011 during good weather conditions. The purpose of the habitat survey was to identify all of the existing habitats along the cable route, with the collation of a species list for each. Habitats in the locality of the proposed cable route were identified using the Fossitt (2000) classification system, with all impacted and adjacent habitats identified to Level III of this system. Relevant habitat information was noted onto wire maps of the study area. For each habitat classified, a list of species and their estimated abundance was recorded. Plant abundance was determined based on the DAFOR scale (D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare).

Mammal survey

All signs, either direct or indirect, of mammals were recorded, and their position noted on a map of the study area. The mammal survey was conducted by walking line transects along the proposed cable route and the adjoining habitats.

2.2.2 Habitat and plant survey

The proposed cable route lies within a suburban / urban fringe setting and runs from the upper shore at the proposed landfall site on Shanganagh beach through Shanganagh Park, which includes a mixture of amenity parks and fields, to the M11 motorway following the route already defined by the R119 Dublin Road and Crinken Lane, passing close to a residential area. The habitat survey identified a total of twelve different habitat classes based on the Fossitt classification system (Table 1) along the proposed cable route (See Figure 2). A full description of the habitat classes based on Fossitt Classification scheme can be seen in Appendix II).

Table 1 Habitat Classes identified during a survey of the study area

Fossitt Classification			
Level I	**Level II**	**Level III**	**Habitat Code**
Grassland and Marsh	Improved grassland	Amenity Grassland	GA2
	Semi-natural grassland	Dry meadows and grassy verges	GS2
Woodland and Scrub	Highly modified/non-native woodland	(Mixed) Broadleaved woodland	WD1
		Mixed broadleaved/conifer woodland	WD2
	Linear woodland/scrub	Hedgerows	WL1
		Treelines	WL2
	Scrub/transitional woodland	Scrub	WS1
		Immature woodland	WS2
Exposed rock and disturbed ground	Disturbed ground	Spoil and bare ground	ED2
Freshwater	Drainage ditches	Drainage ditches	FW4
Coastland	Sea cliffs and islets	Sedimentary sea cliffs	CS3
Cultivated and built land	Built land	Buildings and artificial surfaces	BL3

On entering the park from the shoreline there is a sedimentary cliff (CS3) leading onto a section of immature woodland (WS2), when following the path of the initial proposed cable route. This immature woodland contains bramble (*Rubus fruticosus* agg), small-leaved Elm (*Ulmus minor*) and sea buckthorn (*Hippophae rhamnoides*). The immature woodland is followed by a section of hedgerow (WL1) composed of bramble, hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*) and small-leaved elm. The path of the initial proposed cable route encounters a section of (mixed) broadleaved woodland (WD1) upon exiting the hedgerow (WL1). Areas of (mixed) broadleaved woodland contain 75 – 100% broadleaved trees with the remainder composed of conifers (Fossitt, 2000). Tree species may be native or non-native. The species ash (*Fraxinus excelsior*) and sycamore (*Acer pseduoplantanus*) are the most frequently occurring trees in this woodland, with ivy (*Hedera helix*) shrubs and the grass creeping bent (*Agrostis stolonifera*) also occurring frequently.

As the initial proposed cable route continues west it moves into an area of mixed broadleaved/conifer woodland (WD2) containing Lawson's Cypress (*Chamaecyparis lawsoniana*). The woodland quickly returns to a (mixed) deciduous composition with

sycamore being the more frequently occurring tree species. The shrubs of this woodland are dominated by bramble, with the grass layer being abundant in bindweed (*Calystegia sepium*) and creeping buttercup (*Ranunculus repens*). Within this section of woodland there is evidence of the Eurasian badger (*Meles meles*). The survey identified a badger sett occurring along the path of the initial proposed cable route. This sett contained a single entrance hole and has been classified as an outlier sett based on the classification outlined by Thornton (1988). These setts are used only sporadically, and, when not in use by badgers, may be taken over by foxes or rabbits.

A small section of scrub (WS1), composed of gorse (*Ulex europaeus)* and bramble, can be found running parallel to the railway line, on both sides. Once the initial proposed cable route crosses under the railway line it meets a section of (mixed) deciduous woodland. This woodland consists of newly planted trees and is dominated by ash and sycamore. The cable exits this woodland into an area of amenity grassland.

This section of the cable route, the initial proposed cable route, has been subsequently amended, due to the impact it would have on a large section of woodland and the presence of the badger sett. An amended proposed cable route has been designed for this section of the park. This amended proposed cable route follows a parallel course to the north of the initial proposed cable route (See Figure 2).

The alternative proposed cable route enters the park from the shoreline encountering the same section of immature woodland, although at a different point, as the initial proposed cable route. Upon passing under the immature woodland the alternative cable route moves through a section of amenity grassland (GA2), intersecting with two hedgerows before reaching the railway line. Fossitt (2000) describes amenity grassland as being improved, or species-poor, and managed for purposes other than grass production. At the railway line the alternative proposed cable route encounters the scrub line running parallel to the railway line. The composition of the scrub at this point is similar to that encountered along the initial proposed cable route. Once the alternative cable route passes under the railway line and through the section of scrub, it once again enters amenity grassland. At this point, the cable route continues through amenity grassland to the location where it merges with the initial proposed cable route. From this point, the initial and alternative cable routes follow the same path.

The cable route, at this point, continues through the amenity grassland until it reaches a section of (mixed) deciduous woodland. This woodland is an extension of the newly planted ash and sycamore woodland already encountered by the initial proposed cable route. After exiting this woodland, the proposed cable route will follow a straight line parallel to a drainage ditch (FW4) and treeline (WL2), until it exits the park. There is sufficient space between the drainage ditch and treelines, made up of a walking trail and amenity grassland that neither should need to be removed to facilitate the pipeline. Within the treeline, whitebeam (*Sorbus hibernica*) and crab apple (*Malus sylvestris*) are the rarest species, with wood false-brome (*Brachypodium sylvaticum*) being the dominant. As the cable route exits the park it follows the roadway until it reaches the M11 motorway.

2.2.3 Mammal Survey

A survey for signs of mammal activity was conducted along the two proposed routes for the transmission cable. This survey involved looking for indirect indicators, such as setts and

feeding signs, of mammal presence. Line transects were performed along the cable route and through adjoining habitats.

The mammal survey yielded only two indicators of mammal presence. The most significant indicator was a badger sett located in the area of woodland beside the golf course (See Figure 1). In the section of hedgerow beside the grassland used as football pitches there was a small rabbit (*Oryctolagus cuniculus*) burrow and signs of possible rabbit hairs caught in a barbed wire fence.

2.4 Mapping

All habitats mapped to Level III of the Fossitt (2000) classification system were digitised into colour-coded polygons and lines in a GIS (Geographic Information System) vector layer using ESRI ArcGIS v10. Features of interest, such as rare species, were added and geo-referenced. The vector layers were created using orthophotography of the study area as a guide. Polygons were divided based on the Fossitt (2000) classification assigned to different habitats.

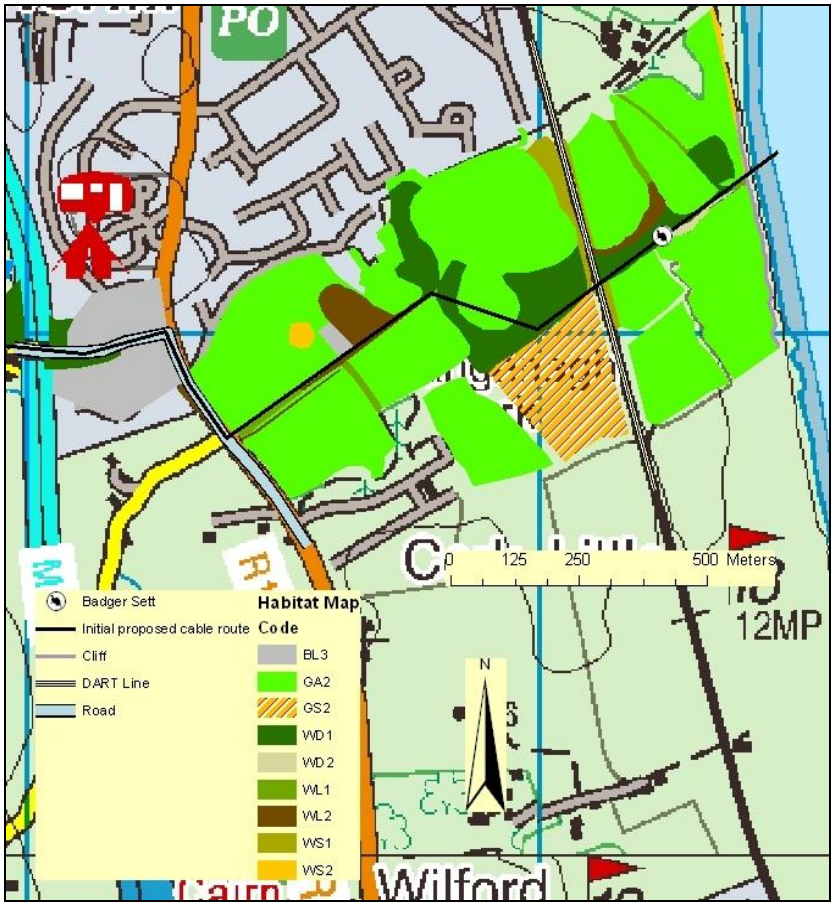

Figure 1. Habitat map of the original proposed cable route (Option 1)

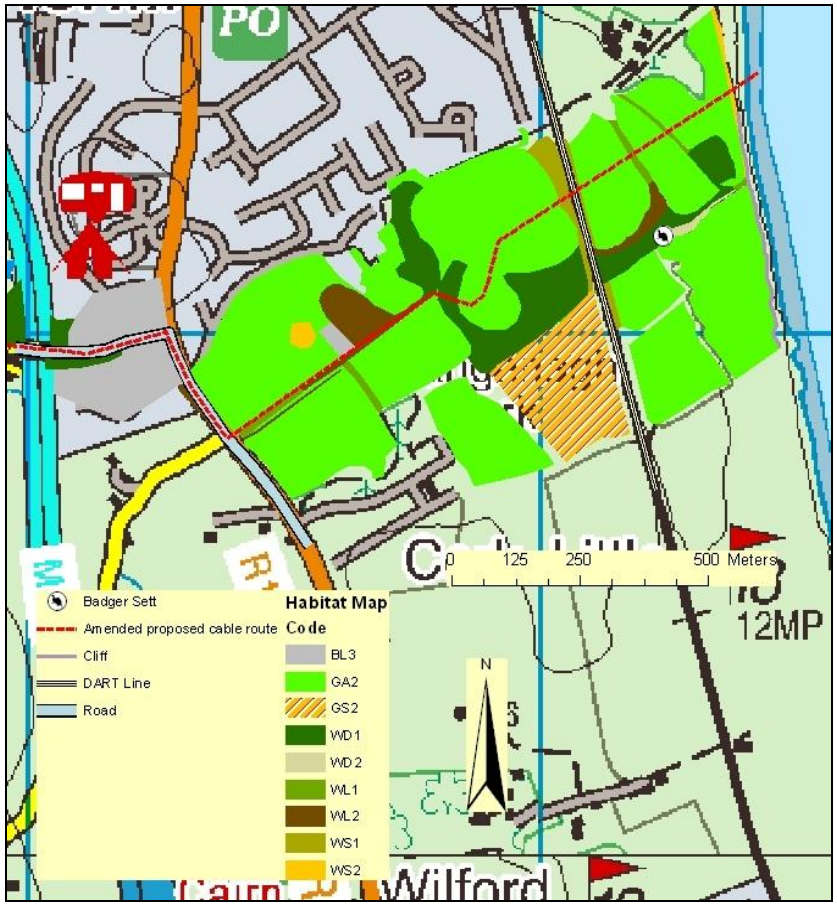

Figure 2. Habitat map of the proposed cable route (Option 2)

3.0 Potential impacts

The duration of impacts, based on the EPA (2002) terminology, are as follows:

- Temporary Impact – Impact lasting for one year or less.
- Short-term Impact – Impact lasting one to seven years.
- Medium-term Impact – Impact lasting seven to fifteen years.
- Long-term Impact – Impact lasting fifteen to sixty years.
- Permanent Impact – Impact lasting over sixty years.

This chapter examines the predicted impacts that the proposed energy conduit will have on the terrestrial habitats and fauna.

The construction of the energy cable may give rise to the following impacts:

4.1 Loss or alteration of habitats and loss of species

There is a potential for habitat loss as a result of the construction of the conduit. The following habitats may be impacted upon during construction:

- Hedgerows
- Mixed broadleaved woodland
- Scrub
- Treelines
- Amenity Grasslands

The loss or removal of wooded habitats will impact upon the available nesting sites for bird and mammal species, as well as, loss of feeding habitat. There is also the potential for bats to use hedgerows in the area, and the loss of this habitat may impact on the movement of bats between roosts and feeding grounds.

4.2 Habitat fragmentation

The presence of a trench may inhibit the movements of terrestrial species i.e. habitat fragmentation for terrestrial fauna. This disturbance is likely to be a temporary impact, lasting for the duration of the construction.

4.3 Disturbance

Noise, disturbance and vibration from the machinery might cause certain species, including badgers to avoid the area during the working hours. Badgers are nocturnal animals that rest during the day in under-ground setts. They are known to utilise many setts, so in theory they should respond by moving away from the disturbance area. Thus, the impact of ground investigation works on badgers is expected to be temporarily and localised as the badgers will still be able to utilise the area for feeding during night time. These disturbances are likely to be temporary impacts, lasting for the duration of the construction.

4.4 Ground deterioration

Activities associated with the excavation of a trench will lead to a localised clearance of the vegetation. Soil heaps stored on site may be subjected to erosion by wind or rain. In addition trampling by people or machinery will result in ground deterioration in the vicinity of the excavation areas. In addition there will be disturbance to fauna, due to noise and activity of

machinery. These disturbances are likely to be temporary impacts, lasting for the duration of the construction.

4.5 Pollution

Pollution can occur from the drilling plant, service vehicles and storage containers in a number of ways. Site machinery and vehicles create a risk of contamination through neglected spillages, the improper storage, handling and transfer of oil and chemicals and refuelling of engines. Incorrectly maintained sanitation facilities and/or using 'outdoor toilet' introduce toxins and excess nutrients into the environment. Rubbish items, such as chewing gums, cigarette butts beverage containers and food wrappings may create hazard to fauna that may accidentally ingest it or get entangled into it.

Accidental leakage or discharge of chemicals and pollutants could cause changes in the pH of the soil and could have a direct toxic impact on the fauna and flora on site.

5.0 Predicted impacts

Once the trench has been backfilled and the area re-seeded, there are no long term impacts predicted to arise from the operation of the energy conduit.

5.1 Loss or alteration of habitats and loss of species

Habitat loss, resulting from the construction of the cable will directly impact areas of hedgerow, (mixed) deciduous woodland, and amenity grassland. The method of construction will require the removal of sections of hedgerow that intersect the cable route, resulting in a short-term impact. The proposed cable route will intersect with two sections of hedgerow, occurring in the region between the coast and the railway line.

The railway line is bordered on either side by a screening of scrub, and sections that intersect the cable route may also have to be removed. The removal of section of scrub will result in a short-term impact.

The majority of the proposed cable route occurs in areas of amenity grassland. Large sections of this grassland will be removed during construction, resulting in a temporary impact.

To the west of the railway line, the cable route passes through a section of (mixed) deciduous woodland. A small section of this woodland may need to be cleared. This impact will have medium-term duration.

Before exiting Shanganagh Park, the proposed cable route runs parallel to a section of hedgerow and a treeline. A crab apple tree occurs in this hedgerow, the only one recorded in the park. There is ample space between the treeline and hedgerow that neither should be impacted during construction.

Upon exiting the park the cable route follows a roadway until it reaches the M11. This section of the cable route will not impact on any habitats or faunal species.

5.2 Habitat fragmentation

Temporary fragmentation of habitats may occur during construction of the trenches.

6.0 Mitigation measures

6.1 Loss or alteration of habitats and loss of species

To minimise habitat and species loss and disturbance, efforts should be made to keep the area of ground disturbed by the cable trench to a minimum and removing vegetation during sensitive periods such as nesting should be avoided. Following construction of the cable trenches, efforts should be made to restore habitats to their current condition, if impacted upon. Cable trenches should be filled to their pre-construction level and with material of a similar nature to allow re-colonisation of the earth by similar species.

Section 40 of the Wildlife Act 1976 to 2010, restricts the cutting, grubbing, burning or destruction by other means of vegetation growing on uncultivated land or in hedges or ditches during the nesting and breeding season for birds and wildlife, from 1 March to 31 August. Unless agreed in advance with the National Parks & Wildlife Service, removal of hedgerows and trees should be done outside of the restricted period to prevent the destruction of active bird's nests.

6.2 Habitat fragmentation

To reduce the potential impact of habitat fragmentation it is suggested to erect a fence around any uncovered area of trench during construction or as the pipe is laid they backfill the trench so as not to leave an open trench.

6.3 Disturbance

Noise, disturbance and vibration from the machinery should be kept to minimum in terms of intensity, duration and spatial extent. Where possible, working hours shall be restricted to the daytime in order to minimise the disturbance.

6.4 Pollution

All materials should be properly stored in designated areas and away from the shore. All fuels or chemicals kept on the site should be stored in bunded containers. All machinery should be well-maintained and refuelling carried out within bunded enclosures or away from the beach. Where machinery is working within the immediate vicinity of the beach, oil interceptors should be installed. Spoil and fluids need to be contained and handled according to their contaminants. All other waste material, including rubbish should be contained in appropriate receptacles and properly disposed of. Emergency response procedures should be in place to deal with accidental spillages should such occur. This should include appropriate training of the crew members and a contact list of relevant statutory organisations (to include EPA and NPWS). All accidental spillages should be contained and cleaned up immediately. Remediation measures should be consulted with the relevant organisations (EPA and NPWS) and carried out without delay in the event of pollution of the adjacent watercourse. Documentary evidence of appropriate disposal of waste materials and appropriate crew training should be requested to ensure that fuel, oil and chemical spills do not pose a threat to the aquatic or terrestrial ecology.

7.0 Residual impacts

With the implementation of the recommended mitigation measures, the residual impacts would be expected to greatly reduce or removed entirely the predicted impacts. Therefore all impacts would be considered insignificant.

8.0 Cumulative impacts

When assessing the cumulative impacts it is necessary to also consider the effect of other developments that, together with the current project, would have a cumulative impact on the terrestrial environment. As there are no current or planned projects for this area there will be no cumulative impacts.

9.0 Do nothing scenario

Should this development not proceed and in the absence of any other change either anthropogenic or natural then there will be no change to the existing environment.

10.0 Reinstatement

Terrestrial areas temporarily disturbed during construction, should be re-vegetated with shrubs, ground cover or grass in order to restore the green ambiance which existed before the commencement of the project to blend with the original environment,

11.0 Monitoring

No monitoring is required following the completion of construction.

12.0 References

Fossitt, J. A. (2000). A Guide to Habitats in Ireland. Kilkenny, Heritage Council.

Thornton, P. S. (1988) Density and distribution of badgers in south-west England – a predictive model. Mammal Review 18: 11-2

Appendix I

Table 2. List of species recorded within their habitats in Shanganagh Park habitat survey. Habitats are identified according to Fossitt habitat classification.

WD1	WL1	WL2	GA2	FW4	WS1
Acanthus sp.	*Angelica sylvestris*	*Acer pseudoplatanus*	*Lolium perenne*	*Angelica sylvestris*	*Betula pendula*
Acer compestre	*Anthriscus sylvestris*	*Aesculus hippocastanum*	*Plantago media*	*Epilobium hirsutum*	*Crataegus monogyna*
Acer platanoides	*Apium nodiflorum*	*Agrostis capillaris*	*Ranunculus acris*	*Epilobium palustre*	*Euronymus europaeus*
Acer pseudoplatanus	*Fraxinus excelsior*	*Agrostis stolonifera*	*Trifolium pratanse*	*Holcus lanatus*	*Fraxinus excelsior*
Aegopodium podagaria	*Fagus sylvatica*	*Anthriscus sylvestris*	*Trifolium repens*	*Nasturtium officinale*	*Hedera helix*
Aesculus hippocastanum	*Betula pendula*	*Arrhenatherum elatius*		*Ranunculus repens*	*Prunus spinosa*
Agrostis stolonifera	*Brachypodium sylvaticum*	*Betula pendula*		*Sparganium erectum*	*Rosa canina*
Alnus glutinosa	*Crataegus monogyna*	*Brachypodium sylvaticum*		*Veronica beccabunga*	*Sorbus aucuparia*
Alnus incana	*Epilobium hirsutum*	*Buddleia davidii*			*Viburnum opulus*
Asplenium scolopendrium	*Equisetum arvense*	*Calystegia sepium*			
Betula pendula	*Fagus sylvatica*	*Chamerion angustifolium*			
Brachypodium sylvaticum	*Fraxinus excelsior*	*Cirsium arvense*			
Calystegia sepium	*Geum urbanum*	*Crataegus monogyna*			
Carex remota	*Corylus avellana*	*Dactylis glomerata*			
Carpinis betulus	*Hedera helix*	*Epilobium hirsutum*			
Castanea sativa	*Heracleum sphondylium*	*Epilobium montanum*			
Chamaecyparis x lawsonii	*Ilex aquifolium*	*Equisetum telmateia*			
Cirsium vulgare	*Ligustrum vulgare*	*Fagus sylvatica*			
Cornus sanguinea	*Quercus robur*	*Fraxinus excelsior*			
Corylus avellana	*Prunus spinosa*	*Geranium robertianum*			
Crataegus monogyna	*Quercus robur*	*Hedera helix*			
Crocosmia crocosmiflora	*Rosa canina*	*Heracleum sphondylium*			
Dactylis glomerata	*Rubus fruticosus*	*Holcus lanatus*			
Dryopteris dilatata	*Rumex sanguineus*	*Ilex aquifolium*			
Epilobium hirsutum	*Salix sp.*	*Ligustrum vulgare*			

WD1 (continued)	WL1 (continued)	WL2 (continued)	GA2	FW4	WS1
Fagus sylvatica	*Acer pseudoplatanus*	*Malus sylvestris*			
Fraxinus excelsior	*Ulmus minor*	*Petasites fragrans*			
Galium aparine	*Ulmus x hollandica*	*Plantago media*			
Geranium robertianum	*Urtica dioica*	*Populus nigra 'Italica'*			
Geum urbanum		*Ranunculus repens*			
Hedera helix		*Rosa canina*			
Heracleum sphondylium		*Rubus fruticosus*			
Ilex aquifolium		*Rumex obtusifolius*			
Ligustrum vulgare		*Salix cinerea*			
Pinus sylvestris		*Sambucus nigra*			
Polystichum setiferum		*Senegio jacobaea*			
Quercus petraea		*Sorbus hibernica*			
Quercus robur		*Taraxacum officinale*			
Ranunculus repens		*Trifolium pratense*			
Rosa canina		*Trifolium repens*			
Rubus fruticosus		*Tussilago farfara*			
Rumex obtusifolius		*Ulex europaeus*			
Salix fragilis		*Ulmus minor*			
Salix viminalis		*Urtica dioica*			
Symphoricarpos albus		*Viburnum lantana*			
Taraxacum officinale		*Vicia sepium*			
Tilia x europaea					
Ulmus glabra					
Ulmus minor					
Urtica dioica					
Vicia sepium					

Table 3. List of species recorded from Shanganagh Park and their associated common names

Latin Name	Common name	Latin Name	Common name
Acanthus sp.	Herbaceous plant	*Holcus lanatus*	Velvet grass
Acer compestre	Field maple	*Ilex aquifolium*	Holly
Acer platanoides	Norway maple	*Ligustrum vulgare*	Wild privet
Acer pseudoplatanus	Sycamore	*Lolium perenne*	Perennial ryegrass
Aegopodium podagaria	Ground elder	*Malus sylvestris*	Crab apple
Aesculus hippocastanum	Horse chestnut	*Nasturtium officinale*	Water-cress
Agrostis capillaris	Common bent	*Petasites fragrans*	Winter heliotrope
Agrostis stolonifera	Creeping bent grass	*Pinus sylvestris*	Scots pine
Alnus glutinosa	Black alder	*Plantago media*	Hoary plantain
Alnus incana	Grey alder	*Polystichum setiferum*	Soft shield fern
Angelica sylvestris	Wild angelica	*Populus nigra 'Italica'*	True Lombardy poplar
Apium nodiflorum	Fool's water-cress	*Prunus spinosa*	Blackthorn
Arrhenatherum elatius	False oat-grass	*Quercus petraea*	Sessile oak
Asplenium scolopendrium	Hart's tongue fern	*Quercus robur*	Oak
Betula pendula	Silver birch	*Ranunculus repens*	Creeping buttercup
Brachypodium sylvaticum	False brome	*Ranunculus acris*	Buttercup
Buddleia davidii	Summer lilac	*Rosa canina*	Dog rose
Calystegia sepium	Hedge bindweed	*Rubus fruticosus*	Blackberry
Carex remota	Remote sedge	*Rubus sp.*	Bramble
Carpinis betulus	Common hornbeam	*Ruderal sp.*	
Castanea sativa	Sweet chestnut	*Rumex obtusifolius*	Broad-leaved dock
Chamaecyparis x lawsonii	cypress	*Rumex sanguineus*	Wood dock
Chamerion angustifolium	Willow herb	*Salix cinerea*	Grey willow
Cirsium arvense	Creeping Thistle	*Salix fragilis*	Crack willow
Cirsium vulgare	Spear Thistle	*Salix sp.*	Willow sp
Cornus sanguinea	Common Dogwoood	*Salix viminalis*	Common Osier
Corylus avellana	Common Hazel	*Sambucus nigra*	Black-berried elder
Crataegus monogyna	Single-seeded hawthorn	*Jacobaea vulgaris,*	Ragwort
Crataegus sp.	Hawthorn	*Sorbus aucuparia*	Mountain ash
Crocosmia crocosmiflora	Montbretia	*Sorbus hibernica*	Whitebeam
Dactylis glomerata	Cock's-foot	*Sparganium erectum*	Branched bur-reed
Dryopteris dilatata	Broad buckler fern	*Symphoricarpos albus*	Common snowberry
Epilobium hirsutum	Willowherb	*Taraxacum officinale*	Dandelion
Epilobium montanum	Broad-leaved willowherb	*Tilia x europaea*	Common lime
Epilobium palustre	Marsh willowherb	*Trifolium pratense*	Red clover
Equisetum arvense	Field horsetail	*Trifolium repens*	White clover
Equisetum telmateia	Great horsetail	*Tussilago farfara*	Coltsfoot
Euronymus europaeus	European spindle	*Ulex europaeus*	Gorse
Fagus sp.	Beechnut tree	*Ulmus glabra*	Scots elm
Fagus sylvatica	European Beech	*Ulmus minor*	Field elm
Fraxinus excelsior	Common Ash	*Ulmus x hollandica*	Dutch elm
Fraxinus sp.	Ash tree	*Urtica dioica*	Stinging nettle
Galium aparine	Cleavers	*Veronica beccabunga*	Brooklime
Geranium robertianum	Herb Robert	*Viburnum lantana*	Wayfaring tree
Geum urbanum	Herb Bennet	*Viburnum opulus*	Guelder rose
Hedera helix	Ivy	*Vicia sepium*	Bush vetch
Heracleum sphondylium	Hogweed		

Appendix II

Fossitt Classification scheme

Amenity grassland (improved) GA2

This type of grassland is improved, or species-poor, and is managed for purposes other than grass production. It includes amenity, recreational or landscaped grasslands, but excludes farmland. Most areas of amenity grassland have been reseeded and are regularly mown to maintain very short swards. Fertilisers and herbicides are often applied but there is rarely any grazing by livestock. The sward may comprise a variety of grasses, including some that also occur in improved agricultural grassland - GA1, but rye-grasses (*Lolium* spp.) are rarely abundant. Broadleaved herbs such as Daisy (*Bellis perennis*), Dandelion (*Taraxacum* spp.), clovers (*Trifolium* spp.) and plantains (*Plantago* spp.) are common. Amenity grassland is typically associated with lawns and other managed grassland areas in gardens, parks, grounds of various buildings or institutions, golf course fairways, grassy sports fields and race courses. Ornamental flower beds and borders - BC4 should be excluded and, if trees are a prominent feature, the category scattered trees and parkland - WD5 should be considered.

Note that amenity areas that support unimproved or semi-natural grassland should be considered elsewhere in the grassland section. If a playing field occurs on machair - CD6, for example, it should be considered as amenity grassland only if it has been heavily modified or reseeded.

Dry meadows and grassy verges GS2

Dry meadows that are rarely fertilised or grazed, and are mown only once or twice a year for hay are now rare in Ireland. Most have been improved for agriculture and this type of grassland is now best represented on grassy roadside verges, on the margins of tilled fields, on railway embankments, in churchyards and cemeteries, and in some neglected fields or gardens. These areas are occasionally mown (or treated with herbicides in the case of some railway embankments), and there is little or no grazing or fertiliser application. This pattern of management produces grasslands with a high proportion of tall, coarse and tussocky grasses such as False Oat-grass (*Arrhenatherum elatius*) and Cock's-foot (*Dactylis glomerata*). Other grasses may include Yorkshire-fog (*Holcus lanatus*), Smooth Meadow-grass (*Poa pratensis*), Barren Brome (*Anisantha sterilis*) and Meadow Foxtail (Alopecurus pratensis). The broadleaved herb component is characterised by a range of species that either grow tall, such as Cow Parsley (Anthriscus sylvestris), Hogweed (*Heracleum sphondylium*), Goat's-beard (*Tragopogon pratensis*), Nettle (*Urtica dioica*) and Common Knapweed (*Centaurea nigra*), or climb the stems of others, as in the case of Bush Vetch (*Vicia sepium*) and Meadow Vetchling (*Lathyrus pratensis*). Grassy verges may support other smaller broadleaved herbs such as Pignut (*Conopodium majus*), Creeping Cinquefoil (*Potentilla reptans*) and clovers (*Trifolium* spp.).

Links with Annex I: Corresponds to the annexed habitat, 'lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) (6510)'.

(Mixed) broadleaved woodland WD1

This general category includes woodland areas with 75-100% cover of broadleaved trees, and 0-25% cover of conifers. It should be used in situations where woodland stands cannot be classified as semi-natural on the basis of the criteria outlined above. Trees may include native and non-native species. Plantations of broadleaved trees are included if the canopy height is greater than 5 m, or 4 m in the case of wetland areas. Stands of immature or sapling trees are excluded (see immature woodland - WS2). If a number of different broadleaved tree species contribute significantly to the canopy, the term 'mixed' should be used in the habitat title.

Mixed broadleaved/conifer woodland WD2

This general category includes woodland areas with mixed stands of broadleaved trees and conifers, where both types have a minimum cover of 25%, and a maximum of 75%. Trees may be either native or non-native species. Mixed broadleaved/conifer plantations are included if the canopy height is greater than 5 m, or 4 m in the case of wetland areas. Stands of immature or sapling trees are excluded (see immature woodland - WS2).

Hedgerows WL1

Linear strips of shrubs, often with occasional trees, that typically form field or property boundaries. Most hedgerows originate from planting and many occur on raised banks of earth that are derived from the excavation of associated drainage ditches. Dimensions of hedgerows vary considerably, depending largely on management and composition, and are taken here as being mainly less than 5 m high and 4 m wide. When wider or taller than this, or dominated by trees, the habitat should be considered as a narrow strip of scrub or woodland, or as a treeline - WL2. Some hedgerows may be overgrown or fragmented if management has been neglected, but they should still be considered in this category unless they have changed beyond recognition. Linear strips of low scrub are included in this category if they occur as field boundaries.

Species composition varies with factors such as age, management, geology, soils and exposure. Hedgerows commonly support a high proportion of spinose plants such as Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Gorse (*Ulex europaeus*), Holly (*Ilex aquifolium*), Dog-rose (*Rosa canina*) or Bramble (Rubus fruticosus agg.), in addition to many other native and non-native trees and shrubs including, for example, Ash (*Fraxinus excelsior*), Hazel (*Corylus avellana*), Beech (*Fagus sylvatica*), Elder (*Sambucus nigra*), elms (*Ulmus* spp.) and willows (*Salix* spp.). Some of these may occur as scattered tall trees. Fuchsia (*Fuchsia magellanica*), an introduced shrub, is a common component of hedgerows in parts of the south and west of Ireland. Hedgerows frequently support climbing plants such as Ivy (Hedera helix), Honeysuckle (*Lonicera periclymenum*), Hedge Bindweed (*Calystegia sepium*), Cleavers (*Galium aparine*) and Bush Vetch (*Vicia sepium*). Tall grasses, including False Brome (*Brachypodium sylvaticum*) and Hairy-brome (*Bromopsis ramosa*), ferns, and woodland herbs are characteristic.

Drainage ditches are often closely associated with hedgerows and should be recorded separately if they contain standing water or support aquatic plants (see drainage ditches - FW4). Dry ditches are not distinguished as separate habitats. Linear boundaries of low scrub, Gorse (*Ulex europaeus*) and Bramble (*Rubus fruticosus* agg.) in particular, should be included here, but note that earth banks - BL2 and stone walls and other stonework - BL1 are treated as separate categories.

Treelines WL2

A treeline is a narrow row or single line of trees that is greater than 5 m in height and typically occurs along field or property boundaries. This category includes tree-lined roads or avenues, narrow shelter belts with no more than a single line of trees, and overgrown hedgerows that are dominated by trees. Most treelines are planted and trees are often regularly spaced. They commonly comprise a high proportion of non-native species such as Beech (*Fagus sylvatica*), Horse Chestnut (*Aesculus hippocastanum*), Sycamore (*Acer pseudoplatanus*), limes (*Tilia* spp.), some poplars (*Populus* spp.) and conifers. Trees may occur on level ground or on banks of earth. The presence or absence of hedgerow or scrub at the base should be noted. If treelines are greater than 4 m wide at the base they should be considered as narrow stretches of woodland.

Scrub WS1

This broad category includes areas that are dominated by at least 50% cover of shrubs, stunted trees or brambles. The canopy height is generally less than 5 m, or 4 m in the case of wetland areas. Scrub

frequently develops as a precursor to woodland and is often found in inaccessible locations, or on abandoned or marginal farmland. In the absence of grazing and mowing, scrub can expand to replace grassland or heath vegetation. Trees are included as components of scrub if their growth is stunted as a result of exposure, poor soils or waterlogging. If tall trees are present, these should have a scattered distribution and should not form a distinct canopy. This category does not include areas that are dominated by young or sapling trees (<5 or 4 m in height) or young conifer plantations (see immature woodland - WS2 or conifer plantation - WD4). Linear boundary features of scrub that are less than 4 m wide should be considered under hedgerows - WL1.

Scrub can be either open, or dense and impenetrable, and it can occur on areas of dry, damp or waterlogged ground. Common components include spinose plants such as Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Gorse (*Ulex europaeus*), Juniper (*Juniperus communis*), Bramble (*Rubus fruticosus* agg.) and erect or scrambling roses (*Rosa* spp.), in addition to a number of willows (*Salix* spp.), small birches (*Betula* spp.) and stunted Hazel (*Corylus avellana*). Scrub may also contain Bog-myrtle (*Myrica gale*) and Broom (*Cytisus scoparius*). The field layer is often impoverished and poorly-developed but, in some situations, may be similar to that of woodland. Lowgrowing Western Gorse (*Ulex gallii*) and prostrate Juniper (*Juniperus communis*) can also be components of heath. Note that any areas that are dominated by non-native shrubs should be excluded (see ornamental/non-native shrub - WS3).

Links with Annex I: Stands of juniper scrub correspond to the annexed habitat, '*Juniperus communis* formations on heaths or calcareous grasslands (5130)'.

Immature woodland WS2

Immature woodland includes areas that are dominated by young or sapling trees that have not yet reached the threshold heights (5 m, or 4 m in the case of wetland areas) for inclusion in the woodland categories previously described. Recently planted areas and young plantations should also be included here, with the exception of conifer plantations - WD4. Any areas that are dominated by shrubs or stunted trees should be considered under scrub - WS1.

Spoil and bare ground ED2

This category includes heaps of spoil and rubble, and other areas of bare ground that are either very transient in nature, or persist for longer periods of time because of ongoing disturbance or maintenance. Spoil is generally associated with the excavation or construction of roads and buildings, or with drainage and dredging activities. Once the disturbance ends, spoil is readily colonised by plants. Note that heaps of unconsolidated material associated with ongoing mining or quarrying activity should be considered under active quarries and mines - ED4. Bare ground can include land that has recently been cleared for agriculture (but not yet tilled - see tilled land - BC3) or construction, and other areas with unconsolidated surfaces that are largely unvegetated because they are heavily trampled or regularly driven over or maintained (weeded or treated with chemicals). Examples of the latter can include unpaved forestry roads, paths and car parks, and derelict land in urban areas. If disturbance or maintenance ceased, these areas would readily be invaded by plants. Note that vegetation cover should not exceed 50% (see recolonising bare ground - ED3) and that any paved areas should be considered under buildings and artificial surfaces - BL3.

Sedimentary sea cliffs CS3

This category includes steep to almost vertical coastal cliffs that are greater than 3 m inheight and are formed primarily of unconsolidated material. Sedimentary sea cliffs may comprise mud, sand, gravel or mixtures of these sediments. Stones and large boulders in a matrix of finer material may also be exposed on the cliff face in the case of sea cliffs that are composed of glacial till. Some sedimentary sea cliffs support

substantial vegetation cover with a variety of seashore plants; others, especially those that are steep and unstable, may be completely unvegetated.

Links with Annex I: Corresponds loosely to the annexed habitat, 'vegetated sea cliffs of the Atlantic and Baltic coasts (1230)'.

Buildings and artificial surfaces BL3

This broad category incorporates areas of built land that do not fit elsewhere in the classification. It includes all buildings (domestic, agricultural, industrial and community) other than derelict stone buildings and ruins (see stone walls and other stonework - BL1). It also includes areas of land that are covered with artificial surfaces of tarmac, cement, paving stones, bricks, blocks or astroturf (e.g. roads, car parks, pavements, runways, yards, and some tracks, paths, driveways and sports grounds). Unpaved areas are excluded (see spoil and bare ground - ED2). Any other built structures that are not made of natural stone, including walls made of bricks, cement blocks and mass concrete, should be considered here. Note that greenhouses and polythene tunnels are excluded (see horticultural land - BC2), as are refuse dumps (see refuse and other waste - ED5). Plant cover should not exceed 50%.

Drainage ditches FW4

This category includes linear water bodies or wet channels that are entirely artificial in origin, and some sections of natural watercourses that have been excavated or modified to enhance drainage and control the flow of water. Drainage ditches are generally not used for navigation and are typically narrower than canals - FW3, but there may be exceptions. To be included here, drainage ditches should either contain water (flowing or stagnant) or be wet enough to support wetland vegetation. Dry ditches that lack wetland plants are not included. As with canals - FW3, drainage ditches must be maintained and cleared in order to keep them open. Those that are overgrown with vegetation are likely to be cleared intermittently. Note that water levels are also likely to undergo seasonal fluctuations. Drainage ditches may be intimately associated with hedgerows and should be recorded as a separate habitat if they meet the criteria outlined above.

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Habitats Directive Assessment of the proposed Dublin Array on the Kish and Bray Banks

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1 INTRODUCTION

EcoServe has been appointed by Saorgus Energy Limited to undertake a Habitats Directive Assessment (HDA) (i.e. an Appropriate Assessment) on the proposed development (Dublin Array) on the Kish and Bray banks as required by the Habitats Directive (92/43/EEC) due to the potential impact of the proposed development on NATURA 2000 sites. The methodology for an AA will follow NPWS guidelines (Environment Heritage and Local Government 2009) and EU guidance on the provisions of Article 6(3) and (4) of the Habitats Directive (European Commission 2001).

1.1 Legislation

In 1979, the European Community adopted Directive 79/409/EEC on the conservation of wild birds (replaced by Directive 2009/147/EC), which was in response to the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1979). It provides a framework for the protection of all wild bird species naturally occurring in the European Union. It covers the protection, management and control of these species and lays down rules for their exploitation. Article 4 of the Birds Directive states that "species mentioned in Annex I shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution" (2009/147/EC). The Directive provides for the creation of Special Protection Areas (SPAs) for the protection of Annex I species as well as for regularly occurring migratory species not listed in Annex I with particular reference to wetlands of international importance. The Birds Directive is implemented in Ireland under the Wildlife Acts 1976 to 2010 and by Statutory Instruments relating to the designation of each individual SPA.

On the 21st of May 1992, the European Community adopted Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna. The Habitats Directive was developed in order for the Community to meet its obligations under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1979) and also compliment the provisions of the Birds Directive. The main aim of the Directive is "to contribute towards ensuring biodiversity through the conservation of natural habitats of wild fauna and flora in the European territory of the Member States to which the treaty applies" (92/43/EEC). Actions taken in order to fulfil the Directive must be designed to "maintain or restore, at a favourable conservation status, natural habitats and species of wild fauna and flora of Community interest" (92/43/EEC). The Directive provides for the creation of protected sites known as Special Areas of Conservation (SACs) for a number of habitat types and certain species of flora and fauna. The Directive also seeks to establish "Natura 2000", a network of protected areas throughout Europe. SACs together with the Special Protection Areas (SPAs) designated under the 1979 Birds Directive, form the Natura 2000 network. The Directive was incorporated into Irish law by the European Communities (Natural Habitats) Regulations, 1997.

1.2 What are European sites?

In Ireland, the Natura 2000 network comprises sites that are designated as Special Areas of Conservation (SACs) and/or Special Protection Areas (SPAs)[1].

There are 142 SPA sites in Ireland with a further 19 proposed SPA sites, but they are afforded the same protection so it could be said that there are 161 SPA sites. They are generally designated on the basis that the site is used regularly by 1% or more of the national population of bird species listed in Annex 1 of the Birds Directive, the site is used by 1% or more of the population of a regularly occurring migratory species or the site is used by over 20,000 waterfowl or 20,000 seabirds in a single season.

[1] including Ramsar sites (classified under the Ramsar Convention 1971)

Ireland has 423 SAC sites, covering around 10% of the country. SACs are designated on the basis that the Habitats Directive requires the establishment of a European network of sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Habitats Directive. The listed habitat types and species are those meeting the Directive's criteria and thus considered to be most in need of conservation at a European level. There are 58 habitats and 25 species in Ireland that are included in Annex I and Annex II of the Directive.

1.3 Habitats Directive Assessment

An appropriate assessment is required under the Habitats Directive for any plan or project likely to have significant effect on an internationally important site for nature conservation. These internationally important sites include Special Protection Areas (SPAs) and Special Areas of Conservation (SACs).

Article 6(3) of the Habitats Directive establishes the need for appropriate assessment;

"*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*."

Article 6(4) discusses alternative solutions, overriding public interest and compensatory measures;

"*If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted*."

In certain cases, mitigation measures and avoidance measures cannot remove an adverse effect on the SPA or SAC. In accordance with the precautionary principle where it is uncertain whether adverse effects will occur, the following steps must be taken;

- Consider alternative solutions that do not have an adverse impact; and
- Declare Imperative Reasons of Overriding Public Interest (IROPI Test); and
- Develop and agree compensation measures.

If it can be demonstrated in an auditable fashion that there are no feasible alternative solutions, the competent authority will consider whether there are imperative reasons of overriding public interest that require the plan to proceed. If it is decided that a plan must go ahead for imperative reasons of overriding public interest, compensation for its effects must be identified and agreed. The compensation measures could include recreation or restoration of comparable habitat at a new or existing site, and may occur in another country if necessary (Defence Estates, 2006).

The IROPI Test is for reasons of a social or economic nature however, where the European site concerned "hosts a priority natural habitat type and/ or a priority species the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission to other imperative reasons of overriding public interest" (Article 6 (4).

1.3.1 Objectives of Habitats Directive Assessment

The objective of an appropriate assessment is to assess the impacts of plans or projects in combination with the effects of other plans and projects against the conservation objectives of European designated sites (i.e. part of the Natura 2000 network) to ascertain whether a plan or project would adversely affect the integrity of those sites. Where significant negative effects on the integrity of the sites are identified, the plan or project should only go ahead if there are no alternative solutions or the plan or project must be carried out for imperative reasons of overriding public interest.

The focus of the assessment of the significance of the effect on the European site is directed to the designated interest features and the conservation objectives of the site, along with its integrity, on the basis of informed and professional judgment. An effect can be defined as something, which would compromise the functioning and viability of the European site and prevent it from sustaining the features for which it was designated in an adequate condition. In accordance with the precautionary principle if there is insufficient information available to make a judgment decision it may have to be assumed that there is potential for a significant effect.

1.4 The Habitats directive assessment process

There are four main stages in a Habitats Directive Assessment (HDA)[2] and they are outlined in Figure 1.

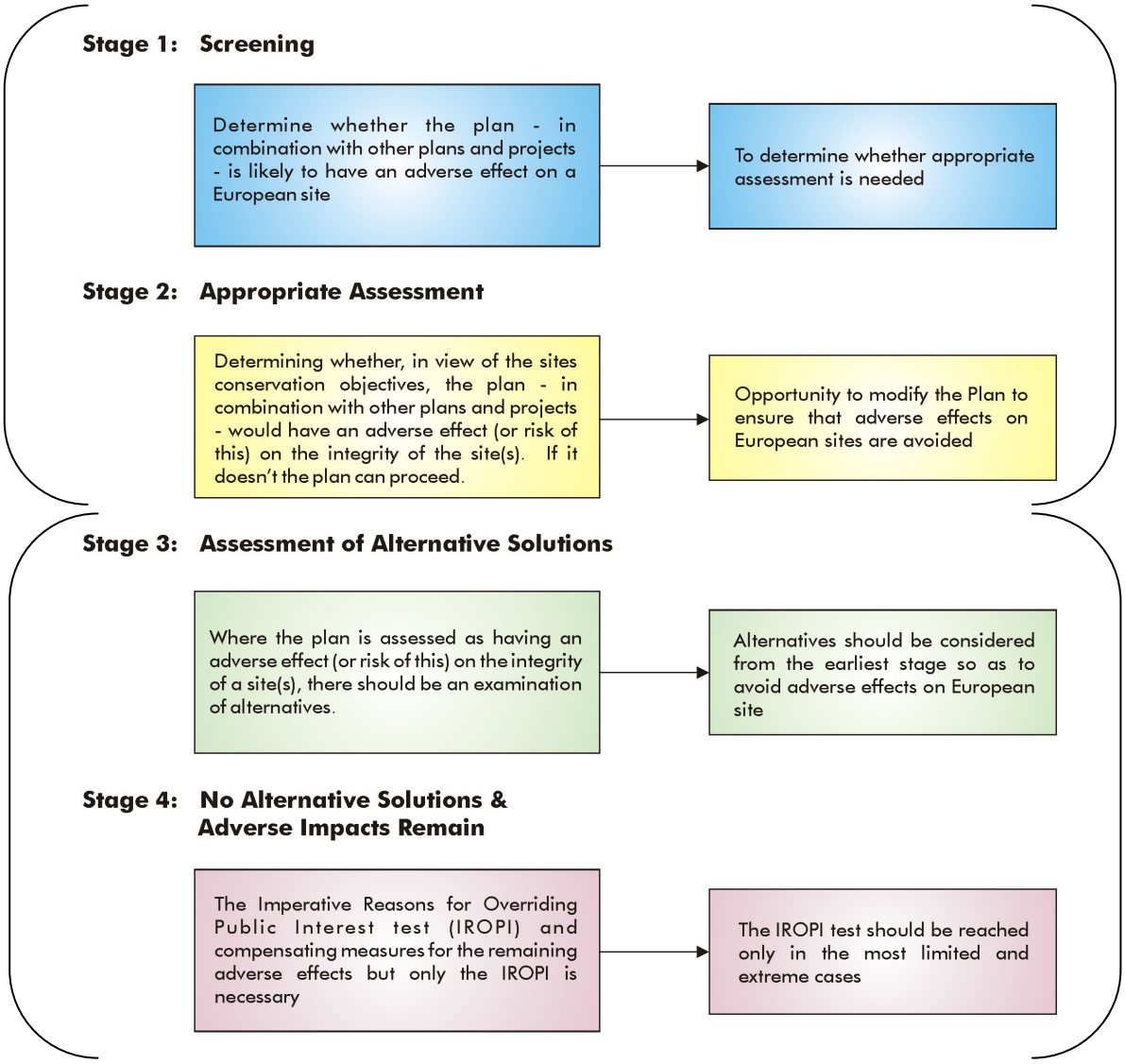

Figure 1. Stages in the Habitats Directive Decision Making Process. Source: Adapted from Appropriate Assessment of Plans. Authors: Scott Wilson, Levett-Therivel Sustainability Consultants, Treweek Environmental Consultants and Land Use Consultants (September 2006).

[2] Assessment of plans and projects significantly affecting Natura 2000 sites (Methodological guidance on the provision of Article 6(3) and (4) of the Habitats Directive 92/43/EEC), European Commission, 2002

2 METHODOLOGY

The existing information on the ecology of the area and on the 'Natura 2000' sites (SPAs and SACs) was collected during a literature review and results of field surveys.

2.1 Field survey

Baseline surveys were originally carried out in 2001, however these surveys have recently been updated to provide further information following the original methodologies. Field surveys involving marine mammal monitoring and seabird surveys were carried over a period of two years in total from 2001 to 2002 and more recently again from 2010 to 2011. The marine benthos was surveyed in 2002 and repeated in 2007. Where information was available the fish data has been updated.

2.2 Consultations

The Kish and Bray Banks are not designated sites of conservation (i.e. SAC and SPA), therefore no Conservation Management Plans would have been developed in relation to potential conservation objectives of the sites (National Parks and Wildlife Services: Dr Rebecca Jeffrey). Telephone consultation with Dr Rebecca Jeffrey and written correspondence with the Development Application Unit (DAU) of the Department of Arts, Heritage and the Gaeltacht (DAHG) for comment on the development (Appendix I) were carried during the scoping of the Appropriate Assessment. A copy of the letter was also sent to the District Conservation Officers (DCO) within the North Wexford and Wicklow area and the Dublin Louth and Meath areas with responsibility for some of the NATURA 2000 sites in question,

Table 1. Details of consultations with NPWS and relevant NGOs for the scoping of the AA.

Name of consultee	Details	Subject/query	Date contacted
Dr Rebecca Jeffrey (NPWS)	email	Designation status of Kish and Bray Bank	23/06/2011
David Tuohy (DAU)	telephone conversation/ e-mail/letter	General issues/concerns to be circulated to NPWS	11/08/2011
Maurice Eakin (DCO, NPWS)	telephone conversation/ e-mail	General issues/concerns	29/08/2011
Enda Mullen (DCO, NPWS)	e-mail	General issues/concerns	29/08/2011
Dr David Tierney (NPWS - Birds)	telephone conversation/ e-mail	General issues/concerns	29/08/2011

2.3 Appropriate Assessment

While a distance of 15km is currently recommended in the case of plans, and derives from UK guidance (Scott Wilson et al., 2006) a 35 km study area was created around the proposed Dublin Array to indicate the Natura 2000 sites that can be potentially affected by the proposed development. This will allow the consideration of the passage of migratory seabirds over the Irish Sea to their overwintering colonies and the potential feeding/passage of seabirds from colonies many of which are designated Natura 2000 sites on the east coast. An Appropriate Assessment was then carried out in relation to all of the sites within the perimeter according to the principles laid out by the EU guidance documents (EEC 2001 & 2007). A precautionary principle was applied when potential impacts could not be ruled out.

3 PROPOSED DEVELOPMENT

The proposed project on the Kish Bank and the Bray Bank would be developed over two construction seasons and would consist of up to 145 wind turbines, each with a capacity of at least 3.6 MW, leading to a minimum total installed capacity of 522 MW. This project is one of two offshore wind farms off the east coast to have received a grid connection offer from Eirgrid under the "Gate 3" round of offers designed to meet Ireland's 2020 renewable energy targets.

The wind turbines would be the generic three-bladed type that consists of a horizontal nacelle located on top of a tubular tower. At present, wind turbines having a capacity of up to 6 MW are being designed. The capacity of turbines to be used on any given phase of the project would depend on the capacity of turbines that is commercially available at that time. The distance from mean high water springs level (MHWS) to the axis of rotation of the blades would be up to 100 m, and the rotor diameter would be approximately 125 m in diameter, resulting in a maximum tip height above sea level of 160 m. The resulting minimum distance from mean high water springs level to the blade tips would be 30 m.

The turbines would be finished in a mid grey colour with a semi-matt finish, in compliance with best practice recommended by wind turbine manufacturers. The base of each turbine would be painted with yellow markings to aid sea navigation, as recommended by the Commissioners of Irish Lights. In addition, turbines would be fitted with marine navigation lights and aviation lights, as specified by the Commissioners of Irish Lights and the Irish Aviation Authority.

The wind turbines would be arranged in a row pattern, four to five deep, running north-south along the banks. Turbines within a row would be placed approximately 500 m apart, with rows also being separated by 500 m. This layout arrangement would result in a uniform appearance when viewed from land in that, from most viewpoints, avenues of turbines would be seen along the horizon.

The total area of the proposed lease area is approximately 54 km². A meteorological monitoring mast with a height of up to 100 m above high water springs sea level would be located within this area to record meteorological data from the offshore wind farm site.

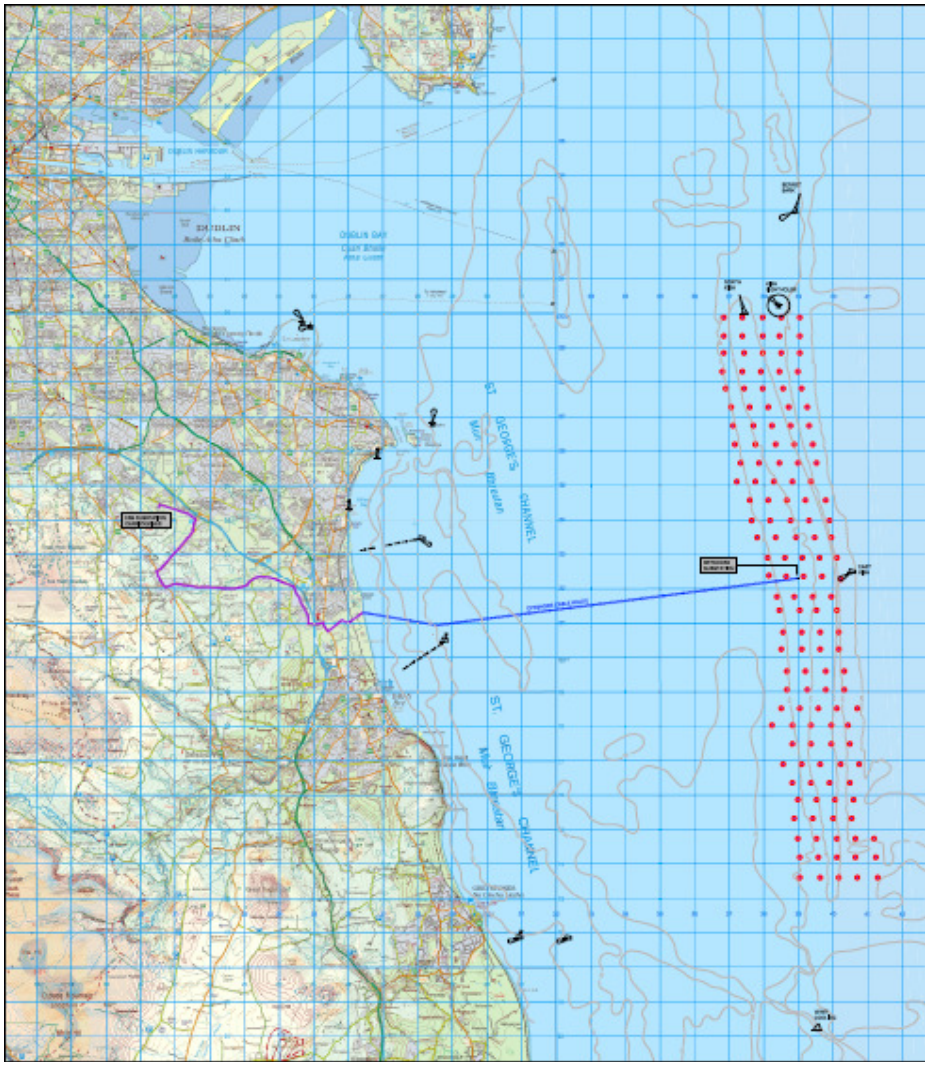

Figure 2. Proposed site layout and cable route for the Dublin Array project

4 THE EXISTING ENVIRONMENT

4.1 Kish and Bray banks

The Kish and Bray banks lie approximately 10 km off the coast of Dublin and Wicklow, with the Bray Bank being a southerly continuation of the Kish Bank. The Kish Lighthouse marks the northern end of the Kish Bank and the Codling Bank lies to the southern end of the Bray Bank. The combined sites of the Kish and Bray banks that have been marked for exploration have a total area of approximately 54 km². They extend for approximately 3 km in the east–west direction and 18 km in the north-south direction.

Surrounding habitat

The Kish and Bray banks are surrounded by deeper water and a number of sand banks. To the north of the Kish Bank is the Bennet Bank and to the west are the Burford Bank and the Frazer Bank. Immediately south of the Bray Bank is the Codling Bank. The offshore water depths to the east of

the Banks ranges from 22m in the north to an area of deeper water (46m) to the south west of the Bray Bank. East of the banks the water depths range from 31 to 42m.

4.2 European designations

No 'Natura 2000' sites (SACs and SPAs) are located within the proposed development area. However 41 designated sites (16 SPA sites and 25 SAC sites) are located within a 35 km perimeter defined as the study area (Table 2).

Table 2. NATURA 2000 sites within 35 km radius of the proposed development area.

Site Code	Site Name	Designation	Site Code	Site Name	Designation
004006	North Bull Island	SPA/SAC	002274	Wicklow Reef	SAC
004014	Rockabill	SPA	000733	Vale of Clara	SAC
004015	Rogerstown Estuary	SPA	000717	Deputy's Pass Nature Reserve	SAC
004016	Baldoyle Bay	SPA/SAC	001766	Magherabeg Dunes	SAC
000210	South Dublin Bay	SAC	000729	Buckroney-Brittas Dunes	SAC
004025	Malahide Estuary	SPA/SAC	001742	Kilpatrick Sandhills	SAC
004069	Lambay Island	SPA/SAC	000719	Glen of the Downs	SAC
004113	Howth Head Coast	SPA/SAC	000716	Carriggower Bog	SAC
004117	Ireland's Eye	SPA/SAC	002122	Wicklow Mountains	SAC
004122	Skerries Islands	SPA	000725	Knocksink Wood	SAC
004172	Dalkey Island	SPA	000713	Ballyman Glen	SAC
000714	Bray Head	SAC	001398	Rye Water Valley/Carton	SAC
004127	Wicklow Head	SPA	000713	Red Bog Kildare	SAC
004186	The Murrough	SPA	002122	Wicklow Mountains	SAC/SPA
004024	Sandymount Strand/Tolka Estuary	SPA	000781	Slaney River Valley	SAC
004025	Broadmeadow/Swords Estuary	SPA	000206	North Dublin Bay	SAC
004063	Poulaphouca Reservoir	SPA	001209	Glenasmole Valley	SAC

5 APPROPRIATE ASSESSMENT

5.1 Preliminary screening

The Preliminary Screening Matrix identifies all SAC and SPA sites within a 35km radius of the outer boundary of the study area. These were screened to identify sites with a potential to experience a significant effect. Sites that have no physical or other potential links with the development and were not host to sea bird colonies were excluded from further assessment as being not likely to be affected by the development (Table 3).

Table 3. Preliminary screening matrix. Sites are indicated where seabirds recorded near the Kish and Bray banks are listed as a qualifying interest under the column 'host to seabird colony'.

		Potential for impacts		
	Designation	Physical (direct) connection	Host to seabird colony	Seabird species recorded on the Kish Bank identified as a qualifying feature for the site
North Bull Island	SPA/SAC	No	Yes	Yes
Rockabill	SPA	No	Yes	Yes
Rogerstown Estuary	SPA	No	Yes	No
Baldoyle Bay	SPA/SAC	No	Yes	No
South Dublin Bay and River Tolka Estuary	SAC	No	Yes	Yes
Malahide Estuary	SPA/SAC	No	Yes	Yes
Lambay Island	SPA/SAC	No	Yes	Yes
Howth Head Coast	SPA/SAC	No	Yes	Yes
Ireland's Eye	SPA/SAC	No	Yes	Yes
Skerries Islands	SPA	No	Yes	Yes
Dalkey Island	SPA	No	Yes	Yes
The Murrough	SPA	No	Yes	Yes
Bray Head	SAC	No	No	No
Sandymount Strand/Tolka Estuary	SPA	No	No	No
Broadmeadow/Swords Estuary	SPA	No	No	No
Poulaphouca Reservoir	SPA	No	No	No
Wicklow Reef	SAC	No	No	No
Vale of Clara	SAC	No	No	No
Deputy's Pass Nature Reserve	SAC	No	No	No
Magherabeg Dunes	SAC	No	No	No
Buckroney-Brittas Dunes	SAC	No	No	No

Kilpatrick Sandhills	SAC	No	No	No
Glen of the Downs	SAC	No	No	No
Potential for impacts				
		Physical (direct) connection	Host to seabird colony	
Carriggower Bog	SAC	No	No	No
Wicklow Mountains	SAC	No	No	No
Knocksink Wood	SAC	No	No	No
Ballyman Glen	SAC	No	No	No
Rye Water Valley/Carton	SAC	No	No	No
Red Bog Kildare	SAC	No	No	No
Wicklow Mountains	SAC	No	No	No
Slaney River Valley	SAC	No	No	No
North Dublin Bay	SAC	No	No	No
Glenasmole Valley	SAC	No	No	No

Based on the Preliminary Screening Matrix it has been concluded that a potential impact of the proposed Dublin Array on 23 SPA/SAC can be ruled out as there is no direct or indirect connection to these sites and they are not host to seabird colonies. Therefore the Appropriate Assessment will focus on the 10 SPAs which have identified seabird colonies as a qualifying interest of the site and which are within 35km of the proposed development.

5.2 European sites of concern

The SPA sites identified in Table 4 host seabird colonies with bird populations and while they have no direct physical connection the seabird populations they host have been recorded within the survey site. As a result the seabirds identified as qualifying interests at each site will be examined further to identified whether they could potentially be impacted upon.

Table 4. European sites of concern.

		Potential for impacts	
	Designation (Site code)	Physical (direct) connection	Host to seabird colony
North Bull Island	SPA (004006)	No	Yes
Rockabill	SPA (004014)	No	Yes
South Dublin Bay and River Tolka Estuary	SAC (004024)	No	Yes
Malahide Estuary	SPA (004025)	No	Yes
Lambay Island	SPA (004069)	No	Yes
Howth Head Coast	SPA (004113)	No	Yes
Ireland's Eye	SPA	No	Yes

	(004117)		
Skerries Islands	SPA (004122)	No	Yes
Dalkey Island	SPA (004172)	No	Yes
The Murrough	SPA (004186)	No	Yes

5.3 Conservation Objectives

While no Conservation Management Plans are currently available for the concerned 'Natura 2000' sites, Conservation Objectives are outlined here and the qualifying features in relation to the proposed development, are presented below.

Qualifying features are species and habitats listed under relevant Annexes of the Habitats Directive or the Birds Directive, for which the site has been selected as an SAC or SPA respectively.

European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status areas designated as candidate Special Areas of Conservation. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

According to the EU Habitats Directive, favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, is stable or increasing,
- the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future,
- the conservation status of its typical species is favourable as defined below.

The favourable conservation status of a species is achieved when:

- population data on the species concerned indicate that it is maintaining itself, and
- the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

5.4 Sensitivity of the qualifying features

For the purpose of Appropriate Assessment the sensitivity of 'Natura 2000' sites is considered with regards to the qualifying features. A set of conditions defining the sensitivity of each of the qualifying features has been identified in relation to the proposed development (Table). These sensitivities have been based on the EU guidance on wind energy development in accordance with the EU nature legislation (EU Commission, 2010). Member States are explicitly required under Article 4 of the Birds Directive to pay particular attention to wetlands. To this end, in the case of any selected SPA which is, or contains, a wetland, the 'Wetland & Waterbirds' are identified and listed as a special conservation interest for the site where these species have been recorded within the study area.

Table 5. Sensitivity of the qualifying features of the SPA based on species identified as particularly vulnerable to wind farms (EU Commission, 2010) highlighted here in bold and in relation to the species. Also presented in the table is the conservation status of the species in Ireland and the species potential sensitivity based on their ecology, case studies, their conservation status and the information gathered from surveys carried on the Kish and Bray Bank.

SPA	Qualifying Features	Sensitivity (EU Commission, 2010)	"Red Amber Green"[3] (Lynas, 2008)	Potential Sensitivity[4]
North Bull Island	Black-headed Gull (*Larus ridibundus*) [A179]		RED	
Rockabill	Roseate Tern (*Sterna dougallii*) [A192]		AMBER	Disturbance to feeding sites
	Common Tern (*Sterna hirundo*) [A193]		AMBER	Disturbance to feeding sites
	Arctic Tern (*Sterna paradisaea*) [A194]		AMBER	Disturbance to feeding sites
	Kittiwake (*Rissa tridactyla*) [A188]		AMBER	
	Black Guillemot (*Cepphus grille*)		AMBER	
South Dublin Bay and River Tolka Estuary	Black-headed Gull (*Larus ridibundus*) [A179]		RED	
	Roseate Tern (*Sterna dougallii*) [A192]		AMBER	Disturbance to feeding sites
	Common Tern (Sterna hirundo) [A193]		AMBER	Disturbance to feeding sites
	Arctic Tern (*Sterna paradisaea*) [A194]		AMBER	Disturbance to feeding sites
Malahide Estuary	Great Crested Grebe (*Podiceps cristatus*) [A005]		AMBER	
Lambay Island	Fulmar (*Fulmarus glacialis*) [A009]		GREEN	
	Cormorant (*Phalacrocorax carbo*) [A017]	Habitat Displacement Collision Barrier effect	AMBER	
	Shag (*Phalacrocorax aristotelis*) [A018]	Change in habitat structure	AMBER	Disturbance to feeding sites
	Lesser Black-backed Gull (*Larus fuscus*) [A183]		AMBER	
	Herring Gull (*Larus argentatus*) [A 184]	Collision Barrier effect **Potential positive effect**	RED	
	Kittiwake (*Rissa tridactyla*) [A188]		AMBER	
	Guillemot (Uria aalge) [A199]		AMBER	
	Razorbill (*Alca torda*) [A200]		AMBER	
	Puffin (*Fratercula arctica*) [A204]		AMBER	
Howth Head Coast	Kittiwake (Rissa tridactyla) [A188]		AMBER	

[3] BirdWatch Ireland has prepared a "red amber green" categorisation of Irish birds. "**Red**" is defined as of high conservation concern, "**amber**" as of medium conservation concern and "**green**" as of no conservation concern (Lynas *et al*. 2008).

[4] Those species where the percentage of the population potentially impacted is less than 5% is not considered to have a significant impact on the population and are not included in the list of potential sensitive species.

Ireland's Eye	Razorbill (*Alca torda*) [A200]		AMBER	Disturbance to feeding sites
	Guillemot (*Uria aalge*) [A199]		AMBER	
	Kittiwake (*Rissa tridactyla*) [A188]		AMBER	
	Herring Gull (*Larus argentatus*) [A184]	Collision Barrier effect **Potential positive effect**	RED	
	Cormorant (*Phalacrocorax carbo*) [A017]	Habitat Displacement Collision Barrier effect	AMBER	
Skerries Islands	**Cormorant (*Phalacrocorax carbo*) [A017]**	Habitat Displacement Collision Barrier effect	AMBER	
	Shag (*Phalacrocorax aristotelis*) [A018]	Change in habitat structure	AMBER	Disturbance to feeding sites
	Herring Gull (*Larus argentatus*) [A184]	Collision Barrier effect **Potential positive effect**	RED	
Dalkey Island	Arctic Tern (*Sterna paradisaea*) [A194]		AMBER	Disturbance to feeding sites
	Roseate Tern (*Sterna dougallii*) [A192]		AMBER	Disturbance to feeding sites
	Common Tern (*Sterna hirundo*) [A193]		AMBER	Disturbance to feeding sites
The Murrough	**Red-throated Diver (*Gavia stellata*) [A001]**	Habitat Displacement Collision Barrier effect	AMBER	
	Black-headed Gull (*Larus ridibundus*) [A179]		RED	
	Herring Gull (*Larus argentatus*) [A184]	Collision Barrier effect **Potential positive effect**	RED	
	Little Tern (*Sterna albifrons*) [A195]	Collision Barrier effect	AMBER	

Very few Atlantic Puffins were recorded in the study are in the 2010-11 and the 2001-02 surveys. The red-throated Diver first appeared in November to the west of the bank and in December and January were recorded over shallow water of the bank and adjacent Codling. A peak of 22 birds was recorded in the study area however a maximum of 12 birds were recorded within the proposed development area. Only a single observation, of a Great Crested Grebe flying east in mid-August (presumably a bird in post-breeding dispersal from Ireland to Wales or beyond).

5.5 Potential impacts on the ecology of the area

No offshore Special Protection Areas (SPAs) have been designated or proposed anywhere in Ireland, including the Kish/Bray bank area, for marine birds listed on Annex I of the EU Birds Directive.

5.5.1 Direct loss of habitat

Physical habitat loss caused by the introduction of hard substrata into a soft-bottom environment seems negligible, because the proportion of soft bottom area lost is low (<1%) and the benthos as a food resource for seabirds appears hardly affected. The direct loss of habitat to the birds by the footprint of the wind turbines is less than 1%, so no significant impact is expected.

5.5.2 Habitat alteration

The construction of turbines introduces a new type of habitat for benthic organisms as opposed to the soft sediment present on the sand bank. The settlement of sessile invertebrates and algae, as well as the subsequent attraction of mobile invertebrates and fish, will result in a reef effect. Initial results from Horns Rev wind farm in Denmark have indicated that the benthic community and the sand eel population were not negatively affected. The new habitat will reflect the footprint of the wind turbines and so will not be greater than 1%, so no significant impact is expected

5.5.3 Barrier effect

There is no evidence that the Kish and Bray Banks are located such that the Dublin Array would act as a barrier to migrating or foraging species. It has been shown that migrating and foraging species can perceive and avoid wind farms by altering their flight routes around them or through the corridors between the wind turbines (Desholm and Kahlert, 2005). Again here no significant effect is expected.

5.6 Cumulative effects (potential sources of in-combination effect)

The Habitats Directive Article 6(3) states that if there is a likely significant effect on a European site "individually or in combination with other plans or projects" that a HDA should be undertaken. This section identifies the hierarchy of relevant Plans and Policies and in addition it provides details on relevant Plans and Projects that have potential to interact with this Project.

Currently there is one offshore (Arklow Bank) and one coastal wind farm (Carnsore point) in operation along the western Irish Sea. The Codling Bank has also been approved for the first phase of development. Both the Codling Bank and Carnsore Point have predicted that there will be no significant impacts; the Arklow is currently being assessed through ongoing monitoring. Unfortunately, we have been unable to access the monitoring reports from the Arklow Bank wind farm to assess if the monitoring has shown any differences and if there have in fact been significant differences. Other wind farms in operation within the southern and eastern section of the Irish Sea include North Hoyle and the Rhyle Flats off North Wales and the Burbo Bank off Liverpool. Each of these wind farms has predicted no significant impact in relation to birds.

Reviews of available literature suggest that the barrier effect has not been proven to significantly impact on the fitness of bird populations (Drewitt and Langston, 2006) and the known effects of each of the individual wind farms mentioned are low or negligible. Further work including surveys, assessments and monitoring have been carried out at a project level in order to determine the likely significant effect of the proposed wind farm on the flora and fauna in the Irish Sea. Cumulative effects were considered on key species, depending on whether species were localised or widespread in the Irish Sea.

Within the Offshore Renewable Energy Development Plan (OREDP) the Dublin Array has been incorporated as a pre-existing development to receive a grid connection offer under Gate 3 along with Oriel windfarm and Fuinneamh Sceirde Teoranta. This scenario of 800 MW is considered to have a low impact on the area. The OREDP also stated that 1500 MW could potentially occur without likely significant adverse effects on the environment in the area where the Dublin Array is proposed (East Coast –North) and only after the installation of 5 or more arrays within this area would significant adverse effects result.

5.7 Potential impacts on the management objectives of 'Natura 2000' sites

Within the list of qualifying interests include the Puffin, Red-throated Diver and the Great Crested Grebe these are not considered as key species in relation to the proposed development due to their

low numbers and therefore there is expected to be no significant impact. There are not expected to be any significant effects to any of the identified species in relation to both collision and barrier effects potentially caused by the proposed wind farm.

5.7.1 Potential impacts on SPA

Under normal operating conditions no impacts on the management objectives of the NATURA 2000 sites on the habitats will result. A favourable conservation status of the species listed in table 1 will be achieved in relation to the natural range of the species which will neither be reduced or likely to be reduced for the foreseeable future, and also there will continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

While the population data on the species concerned indicate that they are currently maintaining or have a population increase in recent years (Amber Species) those which are Red listed have had a decline in recent years. The magnitude of the disturbance to feeding sites is thought to be potentially significant for a number of species based on the percentage of the Irish population recorded feeding in this area i.e. the shags, terns and razorbills.

The Red listed species include the Herring gull and the black-headed gull. It is predicted that there will be a positive impact with an increase in gull numbers during both the construction and operation of the proposed wind farm due both to resting opportunities on the foundations of the turbines and/or the attraction to increased ship traffic.

Of the Amber species listed the terns, shags, razorbills and cormorants have the potential to be impacted through disturbance to feeding sites however, case studies have shown a reduced sensitivity in breeding birds or rapid habituation during the breeding season where alternative feeding sites are not available. This may see the magnitude for terns such as the Roseate tern being reduced and consequently the potential impact being subsequently determined as low. Similarly the common and Arctic terns are also predicted to enter the wind farm.

5.8 Mitigation Measures

An adequate level of diligence should be implemented when installing and operating the wind farm.

Disturbance and displacement

Construction will be on a low number of turbines at any one time on a continuous basis with the exception of the northern 25% of the site from mid-August to mid-September to facilitate the Roseate Tern visiting the Kish Bank for feeding following their breeding season.

The use of fast boats and helicopters should be kept to a minimum to reduce disturbance on birds. Except in emergencies such use should also be kept to set routes, especially outside the wind farm area.

Given these mitigation measures, it is predicted that there would be no significant effects on terns, auks, divers and gulls from the construction of the project, and during the breeding season it is expected that there will be rapid habituation.

5.9 Conclusion

With the recommended mitigation measures in place any impacts on the conservation objectives of the NATURA 2000 sites resulting from the proposed wind farm will be reduced and in some cases avoided.

6 REFERENCES

Boland, H., Crowe, O. and Walsh, A. (2008) Irish wetland bird survey: results of waterbird monitoring in Ireland in 2006/07. Irish Birds 8: 341-350.

EEC (2001). Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.

EEC (2007). Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC: Clarification of the concepts of: Alternative solutions, imperative reasons or overriding public interest, compensatory measures, overall coherence, opinion of the commission.

EPA (2007). Urban waste water discharges in Ireland for population equivalents greater than 500 persons: a report for the Years 2004 and 2005.

EPA (2009). Urban waste water discharges in Ireland for population equivalents greater than 500 persons: a report for the years 2006 and 2007.

EPA (2010). ENVision environmental map viewer. Environmental Protection Agency. On-line resource: http://maps.epa.ie/internetmapviewer/MapViewer.aspx (retrieved: 25th May 2010).

ISI (2009). National Invasive Species Database: ISI Risk assessment - November 2009 list. Invasive Species Ireland. On-line resource: http://invasivespecies.biodiversityireland.ie/ (retrieved: 1st June 2010).

NPWS (2001). Malahide Estuary cSAC (205) – site synopsis. National Parks and Wildlife Services.

NPWS (2004). Broadmeadow/Swords Estuary SPA (4025) – site synopsis. National Parks and Wildlife Services.

O'Brien, M. (1999). Investigation of the pollution status of the inner and outer Malahide Estuary. MSc dissertation. Dublin, Trinity College.

Wilson, J.G., (2003). Evaluation of estuarine quality status at system level with the biological quality index and the pollution load index (PLI). *Biology and Environment: Proceedings of the Royal Irish Academy*, **103:** 47–59.