ENERPOWER
TOTAL ENERGY SOLUTIONS

Ballynagran
Energy Plus + Community

Wind Turbine Feasibility Study

June 2013

ENERPOWER
TOTAL ENERGY SOLUTIONS

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Introduction

Enerpower was engaged to carry out a feasibility study for a proposed wind energy project at Ballynagran, Glenealy, Co Wicklow. The study was commissioned by Pat King, Vice Chairman, Ballynagran Energy Plus, to examine the feasibility of constructing a 500kW wind turbine for the generation and export of electricity to the national grid. The project feasibility has been assessed with regard to a number of parameters including planning, environmental, and financial

Project Scope

The following report gives the capital costs and paybacks specific to the supply and erection of a wind turbine on the site selected, including

- Planning Permission
- Grid Connection
- Turbine Supply, Erection and Commissioning

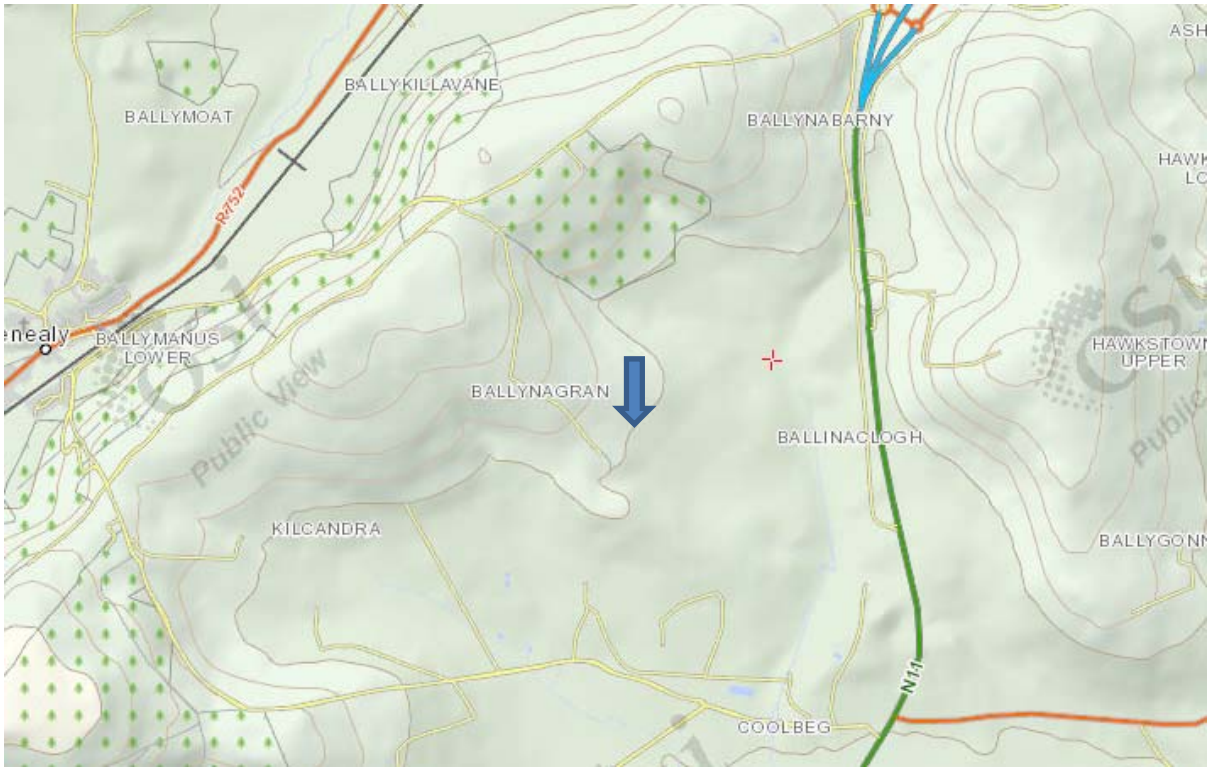
Included with this report is;

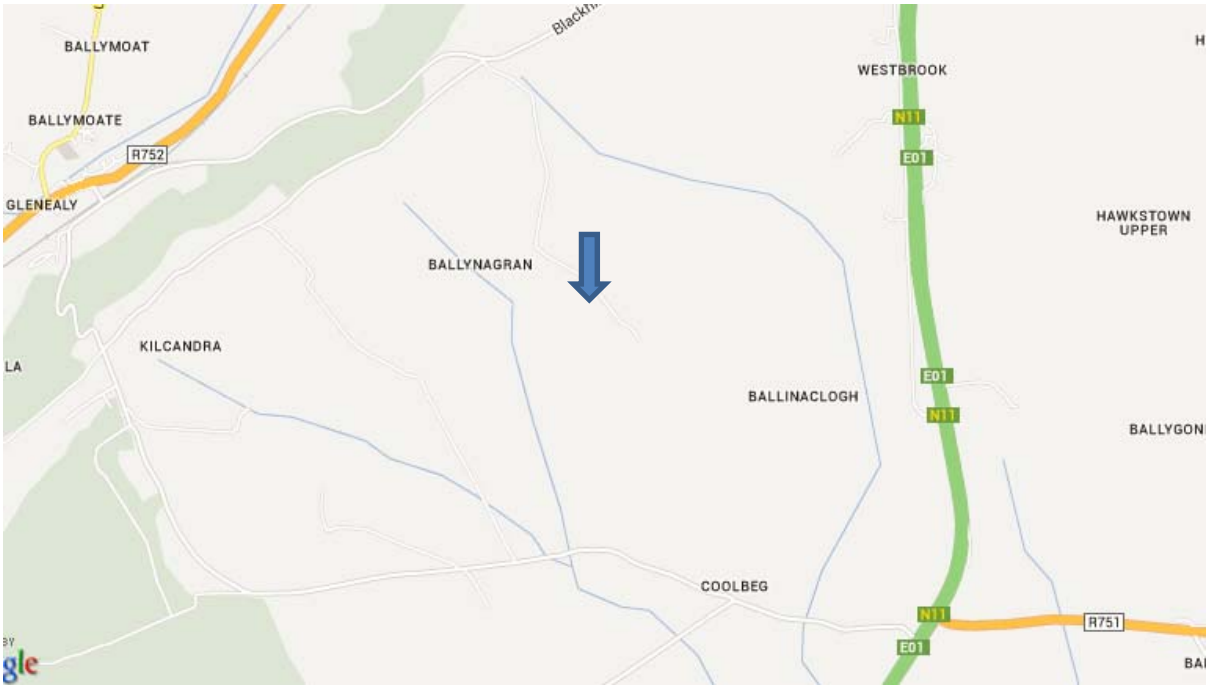
Appendix I, Photomontages of the proposed turbine from a number of vantage points

Appendix II, Drawings of the proposed turbine

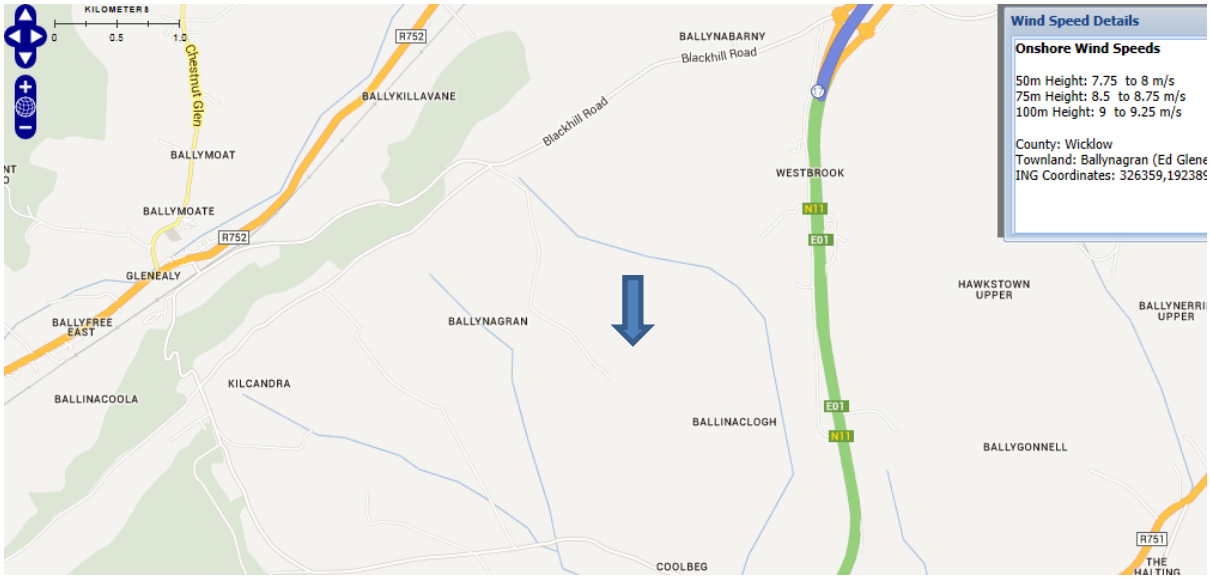
Appendix III, Site Drawings and Layouts

Site Location and Wind Speed at the Site





The map above gives the location of the proposed turbine showing the main access routes of the N11 and Blackhill Road

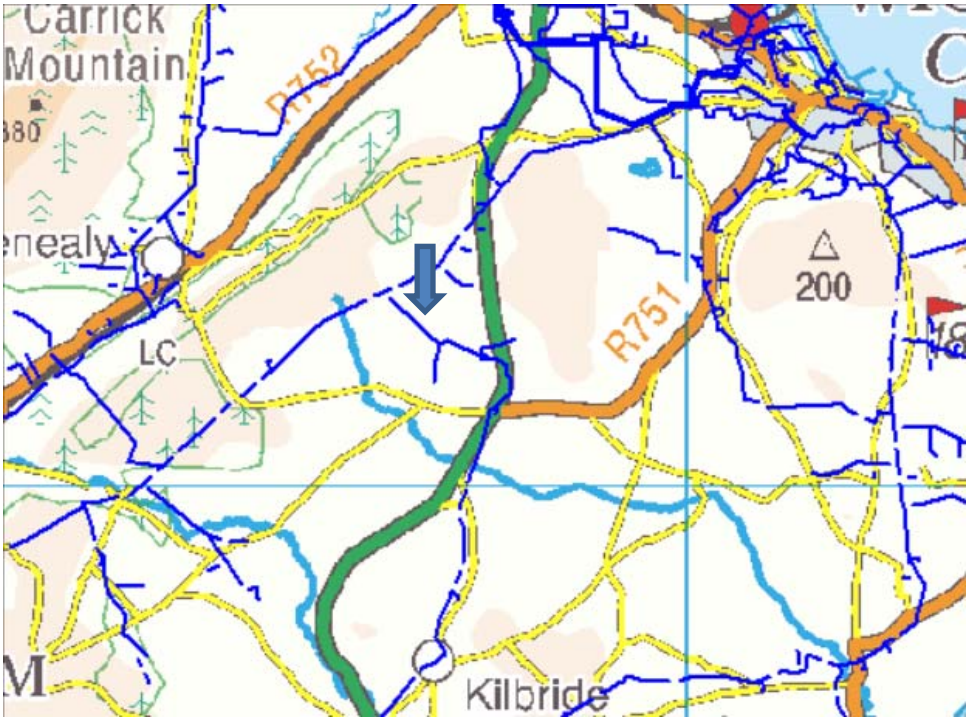


From the wind atlas above we can see a wind speed of 7.75 to 8m/s at 50m at the location of the turbine.

We have based our calculations on a wind speed at the site of 7.5 m/s on average at a hub height of 40m

Site Aerial View

ESB Networks map



The close proximity of existing 10kv power lines suggests the cost of connection to the grid should not be prohibitive

Local Grid Infrastruture

The proposed development will employ a wind turbine with a Maximum Export Capacity (MEC) of 500kW. A project at this scale will require a Low Voltage (LV) connection into the ESB Medium Voltage (MV) Network. Medium Voltage refers to the 10kV blue line on the map above. In certain circumstances there may be a requirement for an MV connection for projects with an MEC less than 150kW. A 10kV Medium Voltage 3 Phase Network line is located within close proximity of the proposed location as illustrated above. The proximity of this existing 10kv power line suggests the cost of connection to the grid should not be prohibitive

Environment

All wind farm developments, other than those exempt from planning, will be required to undertake some level of environmental impact assessment as part of the consent process. An Environmental Impact Statement (EIS) is mandatory for any development with more than 5 turbines or having a total output greater than 5MW. For developments under this mandatory limit, local authorities are required to request an Environmental Impact Assessment (EIA) if, in their view, the proposed development could have a significant impact on an environmentally sensitive area such as a Special Area of Conservation (SAC), Natural Heritage Area (NHA), or Special Protection Area (SPA). Where an EIS/EIA is not required, an environmental report will normally need to be prepared to support the planning application. This will need to cover the main items of information which the local authority will require. It is recommended for the development at Ballynagran that an environmental screening is carried out at an early stage to assess the levels of potential impact.

Noise

Noise from wind turbines can occur at the construction phase and during the operating phase of a project. Noise from construction phase activities include site traffic, excavators, heavy goods vehicles and pouring of foundations. Noise from the operating phase is both mechanical and aerodynamic. The mechanical noise originates from the gearbox and generator in the nacelle. Aerodynamic noise is caused by the movement of the turbine blades past the tower as they rotate causing

a swishing sound. There are no published limits for construction noise in Ireland. However the National Roads Authority (NRA) Noise Guidelines provide indicative noise limits allowable at dwelling facades during construction activities. The assessment of noise from an operating wind turbine is recommended for noise sensitive locations or receptors within 500m of the turbine location. With no such noise sensitive receptors being within this distance of the proposed turbine location, turbine noise is not expected to be an issue in this case. A desktop assessment of the noise implications of the proposed development using specialist software should be sufficient for a planning decision at this location.

Shadow flicker

Shadow flicker is a phenomenon caused by the movement of wind turbine blades across the path of direct sunlight. It creates moving shadows on residences in close proximity to the turbine at certain times of the day or year. In the event that shadow flicker is expected to create a nuisance effect there are a number of mitigation measures possible. The provision of screening or the use of wind turbine control software to turn off the turbine during periods of shadow flicker can be used. The general guide for the assessment of potentially sensitive locations or receptors is within a distance of ten rotor diameters from the proposed turbine location. The DoEHLG's Wind Energy Development Guidelines set recommended limits for shadow flicker at 30 hours per year or 30 minutes per day for receptors within 500m of the turbine. The selected wind turbine position at Ballynagran has no sensitive receptors within 500m of the proposed turbine location. It is however recommended that that some shadow flicker analysis be carried out as part of the Planning Application.

Proposed Turbine Generating Capacity

Vestas V39	500	KW
Generator Capacity	**500**	
Wind Speed Av	7.5	m/s
Capacity Factor @ 30%	150	KWh
Hours pa	8,740	Hours
Total KWh pa	1,311,000	KWh
Elec Sales/KWh to grid Day	0.070	€
Elec Sales/KWh to grid Night	0.050	€
Sales Night	21,632	€
Sales Day	60,568	€
Total Sales	82,200	€
Operation & Maintenance pa	6,555	€
Balance	**75,645**	€

Capital Costs

Capital Costs	
V39 Vestas 500KW Turbine Supplied with 50M Tower	260,000
Turbine Foundations	44,000
Turbine errection and Commission	16,500
630kVA to 10KV step up transformer in metal painted housing	16,500
Two sets of MV terminations	4,000
MV cable 3x70mmsq XLPE 850M	12,000
MV two way switchblock, for a new ESB incomer c/w VTs and CTs	41,500
AGIP Panel	15,300
Electrical installation and Commissioning	16,500
Electrical Design	6,500
Sub Station Building	20,000
Access and Roads	15,000
Grid Connection	25,000
Grid Application	3,200
Planning Permission	11,250
Total	**507,250**

Payback Analysis 500 KW

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Maintenance	€ 6,555	€ 6,784	€ 7,022	€ 7,268	€ 7,522	€ 7,785	€ 8,058	€ 8,340	€ 8,632	€ 8,934
Savings	€ 82,200	€ 86,310	€ 90,625	€ 95,156	€ 99,914	€ 104,910	€ 110,155	€ 115,663	€ 121,446	€ 127,519
Net Savings	€ 75,645	€ 79,525	€ 83,603	€ 87,889	€ 92,392	€ 97,125	€ 102,098	€ 107,323	€ 112,815	€ 118,585
Cumulative Savings	€ 75,645	€ 155,170	€ 238,773	€ 326,662	€ 419,054	€ 516,179	€ 618,277	€ 725,600	€ 838,415	€ 957,000

Please note that the above figures assume a 5% increase in electricity prices pa.

Maintenance costs are shown to increase by 3.5%

Capital cost payback is acheived after 5 years 11 months.

Conclusions

The technical and financial considerations examined as part of this study support the feasibility of installing a 500kW wind turbine at 40M hub height.

The main summary points are as follows;

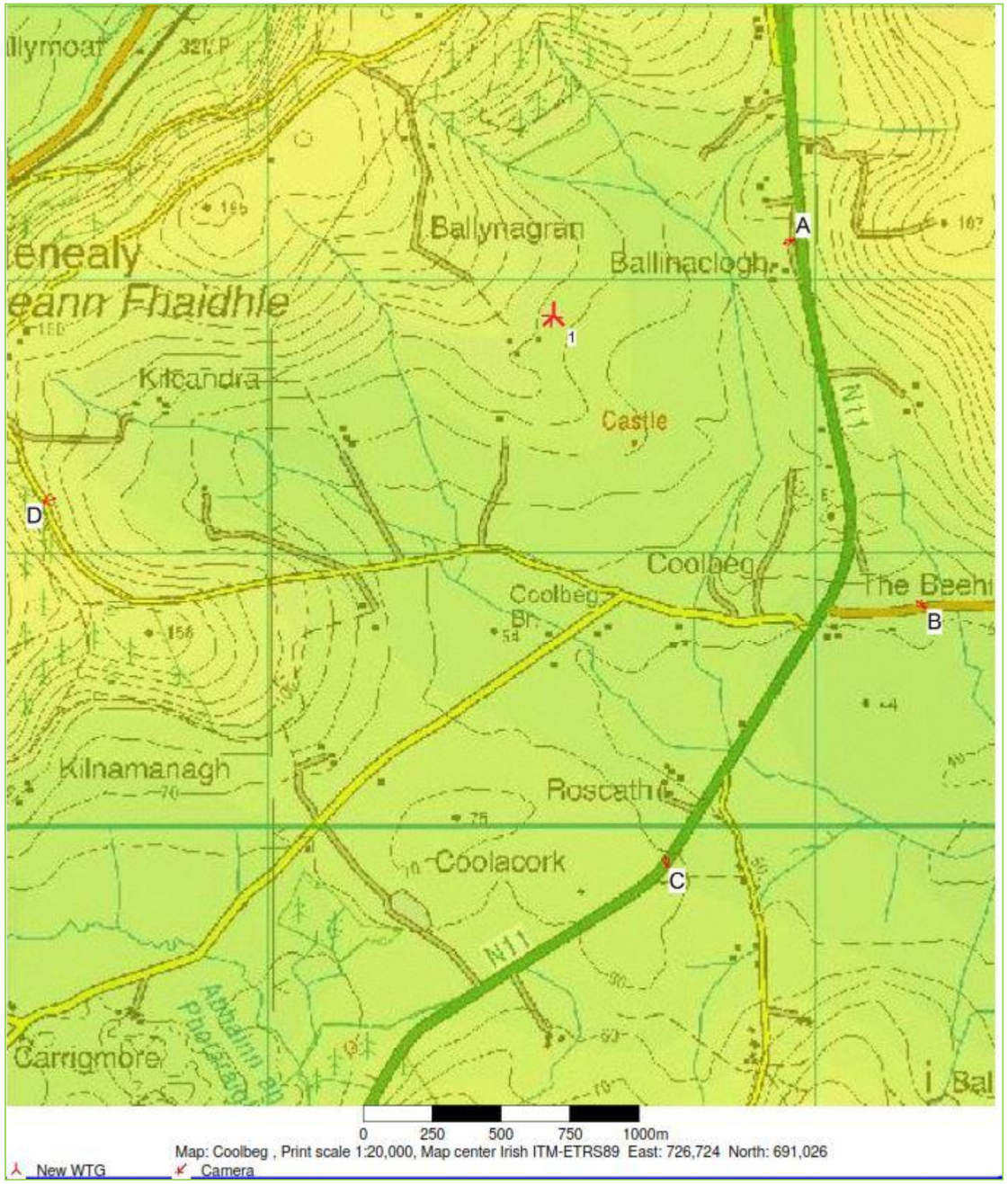
- The site is elevated, unconstrained, and is considered to have a strong wind resource.
- Close proximity to the 10kV Medium Voltage electricity network may enable a low cost grid connection.
- There are no sensitive receptors (residential housing) within a 500m buffer zone of the proposed turbine location.
- Shadow flicker is not expected to be a concern as there are no dwellings within 500m of the proposed turbine location.
- Road infrastructure to the site is good with less than 2km of tertiary roads from a main national route.
- The site is not within an area of special environmental designation. However and environmental assessment screening will be required as part of a planning application submission.

In conclusion, the development of a 500kW wind turbine project is feasible. It is recommended that a preplanning meeting be scheduled with the Planning Authority before a full planning application is considered further.

Photomontage and Wirelines Viewpoint Analysis:

Proposed Development: 1no. 500kW Wind Turbine (Vestas V39 500 - Hub Height 40.5m and Rotor Diameter of 39m)

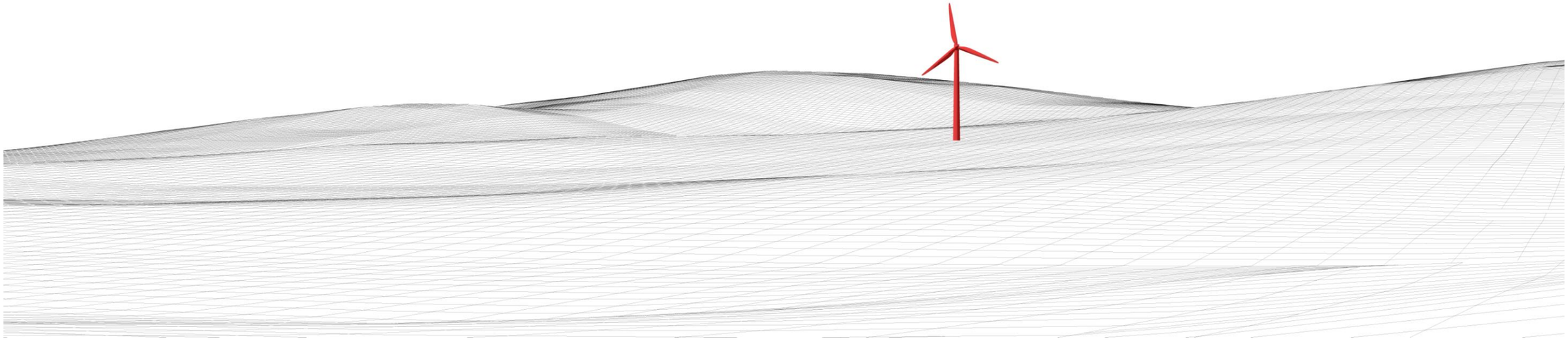
Viewpoint Locations Map



entrust, 31-33 Merrion Road 'The Lodge', Ballsbridge, Dublin 4. t 01-4433358 e conor@entrust.ie www.entrust.ie

A - Viewpoint 1 - N11 Looking W/SW

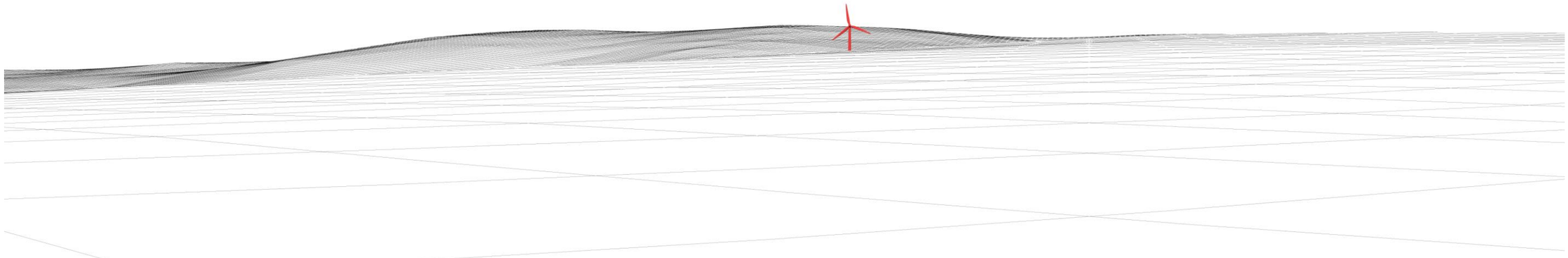
Wireline



Photomontage

B- Viewpoint 2 - Beehive Pub Looking NW

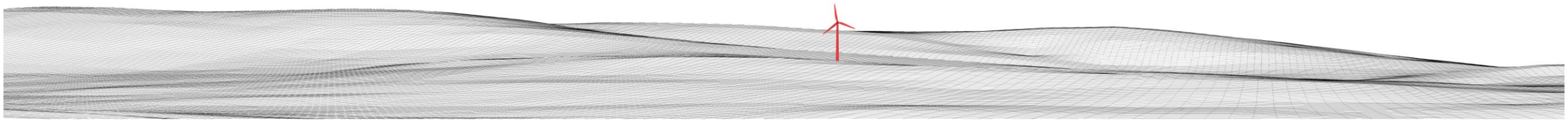
Wireline



Photomontage

C- Viewpoint 3 - N11 Looking North

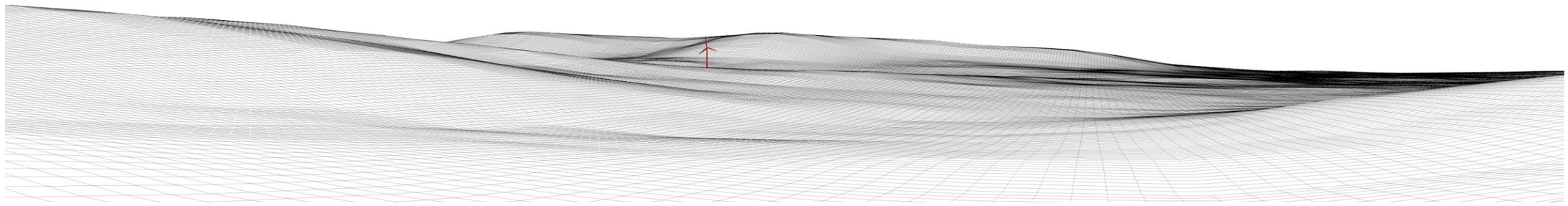
Wireline



Photomontage

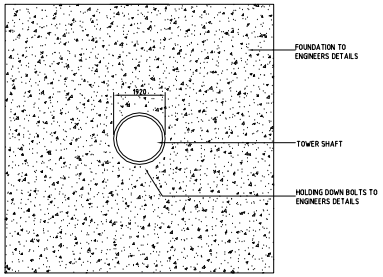
D- Viewpoint 4 - Viewing Direction of Some Local Residents looking NE

Wireline

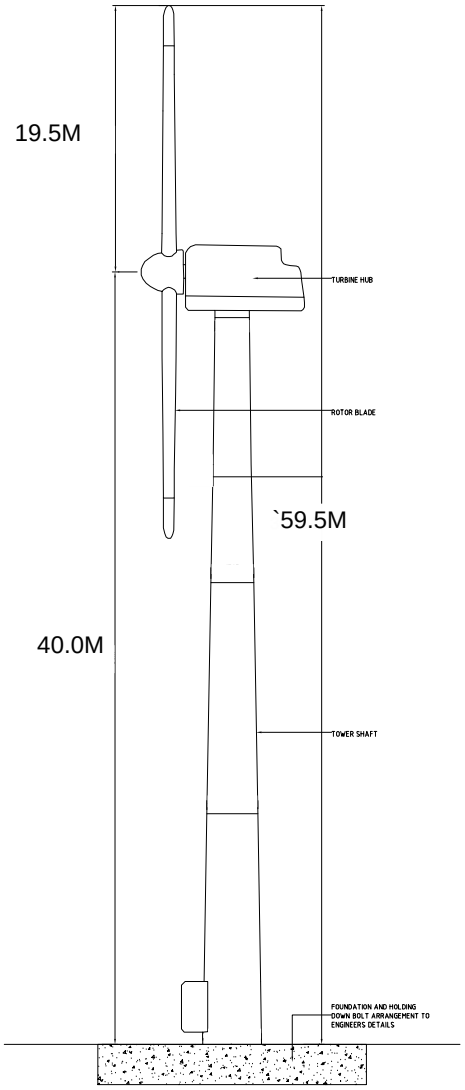


Photomontage

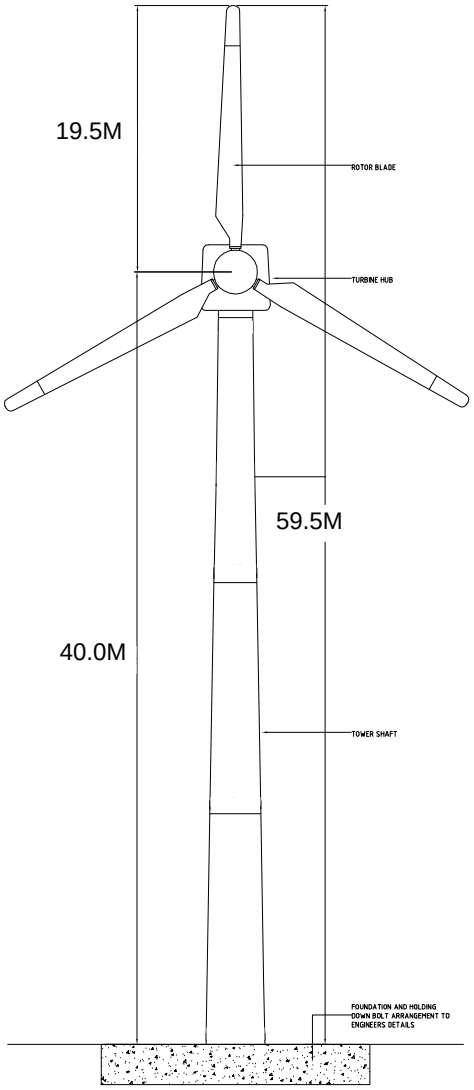
NOTES



PLAN LAYOUT
SCALE 1:100



SIDE ELEVATION
SCALE 1:100



FRONT ELEVATION
(1:50)

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Proposed Location of Wind Turbine

Proposed Level of Concrete Base 96.00m

Proposed Turning Area

Overhead 10kw ESB Lines

Existing Roadway

Proposed Entrance Through Existing Gate to Existing Roadway

Proposed New Hardcore Track

Proposed New Post & Rail Fence

Overhead 10kw ESB Lines

10kV

Shed

Shed

N 692,000

N 691,900

N 691,800

E 726,800

E 726,900

E 727,000

E 727,100

Survey Notes

1. All levels are to Malin Head Datum.
2. 50m Square Grid relative to Irish Transverse Mercator (ITM) Co-ordinate System.
3. All dimensions are in meters.
4. Only visible services surveyed.
5. Any discrepancies in the survey are to be reported to Davidson Hickey & Associates immediately.
6. Do not scale drawing, this shall be permitted in digital form only.

CO-ORDINATE SYSTEM
ITM
IRISH TRANSVERSE MERCATOR

SURVEY LOCATION

0m 20m 40m
1:500

LEGEND

Symbols

- AJ – Access Junction
- AV – Air Valve
- B – Bollard
- BH – Building Height
- BIN – Bin
- BM – Bench Mark
- CAM – Security Camera
- CH – Chimney Height
- CBX – Cable Box
- E – Eaves Height
- EC – Eircom Cover
- ESP – Esb Pole
- FH – Fence Height
- FP – Flag Pole
- GCP – Ground Control Point
- GFL – Ground Floor Level
- GT – Gully Trap
- GV – Gas Valve
- HYD – Hydrant
- IL – Invert Level
- LS – Lamp Standard
- MH – Manhole
- MP – Mini Pillar
- P – Pole
- PIPE – Pipe
- EPY – ESB Pylon
- R – Ridge Height
- RG – Road Gully
- RS – Road Sign
- S – Sign
- SB – Service Box
- ESS – ESB Substation
- SV – Sluice Valve
- TCB – Telephone Call Box
- TC – Telecom Pole
- TS – Traffic Signal
- W – Well
- Wetland

Line Types

- Wall Face
- Fence
- Overhead Cables
- 54.0 Contour Major
- Contour Minor
- Hedge
- White Line
- Yellow Line
- Double Yellow Line
- Building Line

Rev:	Date:	Details:	By:

DHA DAVIDSON HICKEY & ASSOCIATES

Waterford Office:
High Road, Kilmeaden, Co. Waterford..
Mobile: +353 (0)86 6027695 (Douglas)
Phone: +353 (0)51 384908
Fax: +353 (0)51 384908

Kilkenny Office:
Dangan, Thomastown, Co. Kilkenny.
Mobile: +353 (0)87 2030037 (Mark)
Email: info@davidsonhickey.com
Web: www.davidsonhickey.com

Project:	PROPOSED WIND TURBINE AT BALTYNAGRAN, CO. WICKLOW		
Client:		Stage:	
Scale:	A1=1:500	Drawn:	D.D.
Co-ordinate System:	ITM	Date:	15-06-2013
Drawing:	DRAFT LAYOUT PLAN	Drawing No.:	02
			Revision:

BALLYNAGRAN

ED GLENEALY

BALLINACLOGH

Proposed Location of Wind Turbine

Macdermot's Castle (in ruins)

CF

FT

TH

10kV

38kV

N 692,300 N 692,200 N 692,100 N 692,000 N 691,900 N 691,800 N 691,700 N 691,600 N 691,500 N 691,400

E 726,500 E 726,600 E 726,700 E 726,800 E 726,900 E 727,000 E 727,100 E 727,200 E 727,300 E 727,400 E 727,500

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N NE E SE S SW W NW

CO-ORDINATE SYSTEM

ITM

IRISH TRANSVERSE MERCATOR

SURVEY LOCATION

E 600,000 E 700,000 E 800,000 E 900,000 E 1,000,000

N 1,000,000 N 900,000 N 800,000 N 700,000 N 600,000 N 500,000

0m 20m 40m

1:500

LEGEND

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Rev:	Date:	Details:	By:

DHA DAVIDSON HICKEY & ASSOCIATES

Waterford Office: High Road, Kilmeaden, Co. Waterford. Mobile: +353 (0)86 6027995 (Douglas) Phone: +353 (0)51 384908 Fax: +353 (0)51 384908

Kilkenny Office: Dangan, Thomastown, Co. Kilkenny. Mobile: +353 (0)87 2030037 (Mark) Email: info@davidsonhickey.com Web: www.davidsonhickey.com

Project: PROPOSED WIND TURBINE AT BALYNAGRAN, CO. WICKLOW			
Client:	Stage:		
Scale: A2- 1:2500	Drawn: D.D.		
Co-ordinate System: ITM	Date: 15-06-2013		
Drawing: DRAFT LOCATION MAP	Drawing No.: 01	Revision:	