4909/105/DK/AK

YELLOW RIVER WIND FARM DEVELOPMENT
HAUL ROUTE ASSESSMENT

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1.0 INTRODUCTION

The following Haul Route Assessment, carried out by Jennings O'Donovan & Partners Limited is an initial assessment of the public road network and associated bridges, culverts etc. on the proposed haul route to the proposed Yellow River Wind Farm Site. A haul route has been identified which will be used for the delivery of all the wind turbine components to the site. The turbine parts will be shipped to Ireland via Dublin Port. The roads from the port to the site are considered in this report.

2.0 BACKGROUND

The site is located in the townlands of Derryarkin, Derryiron, Coolcor, Coolville, Ballyburly, Greenhills, Bunsallagh, Derrygreenagh, Knockdrin, Wood, Killowen, Corbetstown, Carrick, Garr and Dunville, approximately 1.6 km north of Rhode, Co. Offaly, and 4km south of the R400/M6 Motorway (Rochfortbridge) junction.

The site is relatively flat, ranging in elevation from 75m to 90m OD (Malin Head). The site can be located on Discovery Series Map No.'s 48 and 49 at approximate grid co-ordinate N 54 35. The site is irregular in outline and is divided in to three main sections. The western section (south-west of R400) will accommodate turbines 1 – 12, the south-eastern section (to the north of Rhode) will accommodate turbines 13 – 23) while the north-eastern section (close to Westmeath and Meath County boundaries) will accommodate turbines 24 – 32).

The site is predominantly improved agricultural grassland underlain with peaty soil. There has been extensive turf cutting in the western section of the site with old and new turf banks evident. Peat has been removed from considerable areas of the site and these areas have subsequently been further drained, improved and seeded with grasses for grazing of cattle and sheep. A network of existing local roads and private access tracks allow vehicular access to the various sections of the site.

The proposed development is to consist of 32 No. 3MW wind turbines. This route assessment has been carried out based on the dimensions of the Vestas V112 wind turbine model, with a 110 metre hub height, 112 metre blade diameter giving a maximum overall height for each turbine of 166 metres. This turbine model is currently of preference for this site. A permanent meteorological mast will also be provided.

The different categories of traffic that will visit the wind farm during the construction and operational phases are as follows: (1) Turbine Delivery Traffic; (2) Civil Works Construction Traffic; and (3) Personnel Traffic.

3.0 ROUTE DESCRIPTION

As stated earlier, there is one proposed haul route to the wind farm site. The route for civil works construction traffic will generally be designated the same as that chosen for the turbine delivery traffic. Please refer to Drawing No. 4909/TR/001 in **Appendix A** for details of this haul route to the site.

3.1 Proposed Haul Route for Turbine Deliveries

It is proposed that all the turbine parts including the tower sections will travel via the Haul Route to the site as shown on Drawing No. 4909/TR/001. On this route, the delivery traffic will travel from Dublin Port via the Port Tunnel, M50, M4, M6 and R400 to the site. Much of this route is motorway.

3.2 Stone and Concrete Deliveries

The quantities of stone (for road strengthening and construction), and concrete (for turbine bases etc.) required for construction of the wind farm are set out in Section 5.2 below.

Stone will be sourced from local Authorised Quarries. Vetting procedures will be put in place prior to construction so as to confirm/shortlist authorised sources (Registered under Section 261 of the Planning and Development Act, 2000 as amended by the Planning and Development (Amendment) Act, 2010). The shortlist will also take cognizance of sources which meet various technical requirements including grading, flakiness index, strength and petrographic suitability.

The shortlist will be incorporated into the Employer's Requirements / Specification of the tender documents.

A competitive tendering process will be undertaken and it must be open to the Contractor to make all of his materials procurement decisions provided he complies with the Employer's Requirements / Specifications.

Various locations could be considered for sourcing stone and Readymix concrete. However, the most obvious haul route to the site is via the M6 Motorway and R400 Regional Road from the north. The R400 to the south is not considered to be a viable haul route to the site due to the volume of traffic through Rhode village and the possible need for upgrading the Esker Beg Bridge over the Philipstown River. Traffic through Rochfortbridge should also be avoided. Thus, the haul route for stone and Readymix concrete shall be via the R400 to the north of the site and via the M6 Motorway.

The constraints above rule out the supply of stone and concrete from Rathangan and Edenderry. The distance to Birr (c. 70km), Athlone (c. 55km), Portlaoise (c. 65km), Ardnagross (c 65km) and Ferbane (c. 56km) are such as to be uncompetitive in terms of price.

Stone will be sourced locally, as will suppliers of ISEN206 Certified Readymix Concrete and will travel to the site is via the M6 Motorway and R400 Regional Road from the north.

3.3 Construction/Personnel Traffic

All other traffic, including building works related construction traffic, will also approach the site via the route specified above.

Construction Personnel will travel to site via car and, depending on where they live, may use a variety of routes to get to the site.

4.0 DELIVERY VECHICLE SPECIFICATION

The proposed turbine is in the 3MW range, with hub height of up to 110 metres, a blade diameter of up to 112m, giving an overall height of up to 166 metres. This would be similar to a Vestas V112 model.

The Vestas transport guidelines (Vestas Document No. 0006-4198 V00, Type T05 – "Road, Crane Pad and Hardstand Specifications for Vestas Turbines V100 – 1.8MW and V112 – 3.0MW") will be used to assess the turbine delivery requirements. This document specifies the following minimum requirements for access roads, outlined in ***Table HRA 1***.

Parameter	Unit	Value
Useful width of Carriageway	m	5.5m
Clearance Width (ideally)	m	7.5m
Access Road Minimum Bend Outer Radius	m	48.5m
Access Road Max. Longitudinal Gradient	%	8
Access road Minimum Longitudinal radii (convex or concave)	m	200
Access Road Maximum Lateral Gradient	%	2.0
Road Overhead Clearance (Vertically) from Road Surface	m	6.6m
Access Road Min. Spec. (Axle Load)	tonnes	17
Road Load Allowable Bearing Capacity	kN/m^2	180
Minimum Road CBR (ASTM Standard at OMC and MDD) (unpaved road)	%	60

Table HRA 1 – Vestas Transport Guidelines for V112 Turbines

The largest loads to be delivered to site will be the turbine blades which are 54.65 metres long. They will be delivered on an extendable semi-trailer. Approximately 4.65 metres of the blades will hang over the rear of the trailer. Following delivery to the site, the trailer may be retracted somewhat for the return trip. The tower is delivered in four sections, each of maximum length 30m (will be up to 32m to account for protective packing) and also delivered on a semi-trailer. The machine house components are delivered on a telescopic

semi-trailer, the hub is delivered on a flat bed trailer and the generator is delivered on an 8-axled semi-trailer.

5.0 TIMESCALE AND ESTIMATED VOLUME OF CONSTRUCTION TRAFFIC

5.1 Timescale of Construction Traffic

Assuming that the proposed development progresses favourably and planning permission is granted, it is estimated that construction could begin, at the earliest, in the second quarter of 2015. An estimated timescale for the completion of construction for a project of this size is in the region of 26 months i.e. inclusive of all works to site roads, access routes, substation building and construction and commissioning of turbines. This allows a total of 16 months for civil works construction. Turbine erection would take 8 months and turbine commissioning would take 6 months. There will be some overlap with civil works and turbine erection, and also with turbine erection and commissioning.

5.2 Estimated Volume of Construction Traffic

During the construction of site roads, crane hardstands, turbine foundations and substation building, a worst case scenario estimates that the maximum number of loads to be delivered to site would be approximately **13,989** (total for Civil Works). This includes loads of stone, concrete, reinforcing steel, geo-textiles, electrical cable, switchgear and general building materials. It is proposed to source all imported stone from local quarries.

Due to the underlying ground conditions of the site, there is no possibility that on-site borrow pits will be used to source road making materials. These materials would be delivered to site over a period of 16 months i.e. approximately **876** loads per month or an average of **40** loads per day excluding weekends and bank holidays, however, this will increase to approximately 70 loads per day to facilitate the concrete pouring of turbine foundations. All civil construction material would be delivered to site using standard rigid lorries, low-loaders and ready-mix lorries etc.

Turbine parts would be delivered to site over a period of 8 months, after civil works are completed. It is estimated that approximately **304** loads of the various turbine and crane

parts would be delivered during this period. The majority of these loads would be classified abnormal loads, and the relevant approvals and permits will be obtained by the developer or appointed haulage contractor in advance of the delivery period.

Following the completion of all construction works, it is estimated that a maximum of **100** loads will be required to remove all temporary on-site equipment and materials e.g. temporary compound, fencing, cabins, storage containers etc.

Therefore, the total number of delivery vehicle visits to the site during the construction phase is estimated to be **14,393**. It is to be noted that this is a 'worst case scenario', based on the assumption that all stone to be used for construction is to be imported. In practice, there may be some localised areas where surplus excavated material (e.g. gravel) can be used for road construction. Please refer to ***Tables HRA 2 to 4,*** below for the detailed delivery loads calculation.

Prior to the delivery to site of the turbine components, the Developer would consult with the Offaly and Westmeath County Council Roads Departments, An Garda Siochana, and the National Roads Authority to discuss the requirement for the provision of a Garda escort and any other requirements the various statutory bodies may have. The Developer would also make known the intended timescale for deliveries, and all efforts would be made to avoid school bus runs, church services, peak traffic times etc. Furthermore, all local residents along the affected route would be notified of the timescale of deliveries.

Material	Quantity	No. of truck deliveries
1. CIVIL WORKS MATERIAL		
Concrete Each turbine foundation will be of approximately 18.3 metre in diameter and 2.15m in depth. The bottom 1m will be cylindrical while the top 1.15 will taper in the form of a truncated cone. There will then be an upstand of 0.5m at a diameter of approx. 5.5m. This will result in 480m^3 of structural concrete per base plus 30m^3 of blinding concrete giving a total volume of 510m^3 per base and 16,320m^3 for 32 bases. At 6m^3 per load, the number of loads will be **2,720**.	16,320 m^3	2,720

Reinforcing Steel Each base will require approximately 110kg of reinforcing steel per m^3 of structural concrete or 52.8 tonnes per base delivered in 20t loads.	1,690 tonne	85
Crane Deliveries to site, including ballast, booms, etc. A crane of 750 to 1,000 tonnes lifting capacity will be required to correctly position the nacelles. The weight of a crane would be 96 tonnes for a 750 tonne lifting capacity crane. Cranes will be delivered to the site in 4 loads. Ballast is also normally employed for craneage. This usually comprises some 4 loads of concrete slabs for the large crane. A second crane will also be required to assist with the removal of tower sections from delivery trailers. This crane would typically be rated at 150 to 200 tonnes.	3 Cranes	9
Transformers, Panels and Cabling 32 turbine transformers are required, one for each turbine. **32 loads** using 12 metre trailers each are allowed for the transformers and turbine switchgear. Cabling will be along the internal access tracks, connecting each turbine to the electrical control building. In total this will be a maximum of 33.1 km in length. This includes double lengths required in some areas where two circuits may be laid. Cables can be laid singly with multiple cables in same trench or as a multicore cable. Assume 18.2t/km, the total mass of cables required is estimated at 602tonnes. This would require **31** loads to site. Some **2** loads are required for signal cabling. Another **12** loads are required for ducting.	-	75
Substation Building electrical equipment Delivery of electrical switch gear to be installed within the electrical control building and at the site itself.	-	8
Electrical Control Building and Sub Station Compound - stone, blocks, roofing One electrical control building measuring approx. $215m^2$. Building materials will be mainly composed of local building materials for the construction of the small control building. Some **20 loads** are apportioned for concrete blocks, roofing, ducting and general materials with **14 loads** for concrete foundations for this building. Another **60 loads** in total are apportioned to the electrical equipment contained within the control buildings and the sub station compound. A hard stand compound for the sub station with a total area of 2,160 m^2 must also be constructed. This will require an approximate total of $1,296m^3$ of imported stone and gravel, based on an average road depth of 0.6m. Delivery of this material will require approximately **118 loads** of $11m^3$ each Fencing materials will require a further **20 loads** to deliver.	-	232

Palisade fencing for temporary compound, temporary facilities including removal etc.	-	25
Construction of Temporary Compound & Car parking Areas A construction compound plus area to accommodate the vehicles of visitors to the site and workers is required. The area of the compounds is 1,500m^2. This area will require approximately 900m^3 of hardcore material. This will require 82 loads at 11m^3 each.	1,500m^3	82
Rock for Site Road Construction For a 5.5m useful width of carriageway, an average width of 6.0m is assumed to include side slopes etc. The construction of 18,275m of new access tracks will cover an area of 109,650 m^2. Some 5,916m of existing access track will be upgraded. These currently range from 2.8m to 4.5m wide. An average width of 3.5m wide is assumed and these will have to be widened to 5.5m wide covering an area of 11,832m^2. The total will be approx. 72,889m^3 of imported stone and gravel, based on an average road depth of 0.6m. Delivery of this material will require approximately **6,626 loads** of 11m^3 each	72,889m^3	6,626
Rock for Site Access Splays and Additional Access Track Areas The construction of these items will cover an area of 32,917 m^2. This will require an approximate total of 19,750m^3 of imported stone and gravel, based on an average road depth of 0.6m. Delivery of this material will require approximately **1,795 loads** of 11m^3 each	19,750m^3	1,795
Rock for Crane Hardstand and Associated Splays, Construction and Backfilling of Turbine Bases. Each turbine will have adjacent hard cored areas for craneage each with an area of 1,250m^2. These will cover an area of some 40,000m^2 total. At a depth averaging 0.6m, this would be 24,000m^3 of material required for 32 turbines. This development will require **2,182 loads** of 11m^3 each.	38,304m^3	2,182
Other Equipment This will include the delivery of geo-textile matting for access tracks and, hardstands, tools, temporary fencing, silt fencing, drainage materials and excavation plant and will constitute no more than **150 loads.**		150
SUB -TOTAL (i) - TOTAL TRAFFIC FOR CIVIL WORKS		**13,989**

Table HRA 2 Estimated quantity of construction materials and deliveries to site 'Worst Case scenario' for Civil Works Phase of Works

2. WIND TURBINE COMPONENTS	Quantity	No. of truck deliveries
Steel Towers Each of the 32 steel turbine towers will be transported in five sections (one cast-in section and four above ground). The cast-in sections for two turbines can be transported in one load while all other sections will be in individual loads. Using steel towers, the loads are thus **144 loads** of tractor units pulling 12 - 33 metre long trailers.		144
Rotor Blades Each of the rotor blades would be up to 55 m maximum length (54.65m long plus packing) and will be delivered individually on a 50 m trailer. Each rotor blade will weigh approximately 9 tonnes. Delivery of blades will require a total of **96 loads.**		96
Turbine nacelles The nacelle components for each turbine would weigh approximately 70 tonnes maximum for transportation. Each nacelle will be delivered in two partial loads and will require a 27-metre trailer with a tractor. Delivery of 32 nacelles will require a total of **64 loads**.		64
SUB -TOTAL (ii) - TRAFFIC FOR WIND TURBINE DELIVERIES		**304**

Table HRA 3 Estimated quantity of construction materials and deliveries to site for Wind Turbine Installation Phase of Works

3. OTHER LOADS	Quantity	No. of truck deliveries
Removal of 'Other equipment' This material will include removal of temporary fencing, temporary site cabins and storage containers and excavation plant following the completion of construction activities and will constitute no more than **100 loads.**		**100**
SUB -TOTAL (iii) - TRAFFIC FOR REMOVAL OF EQUIPMENT		**100**

Table HRA 4 - Estimated total quantity of removal journeys

4. OVERALL TOTAL LOADS	Quantity	No. of truck deliveries
OVERALL TOTAL FOR CONSTRUCTION PHASE [Total of Sub-Totals (i) & (ii) & (iii)]	-	**14,393**

Table HRA 5 - Estimated total quantity of construction materials and deliveries to site 'Worst Case scenario' for Civil Works and Turbine Installation Phase of Works

During the operational phase of the development, the wind farm would normally be unmanned. However, good practice dictates that the site is checked on a daily basis for operational issues, security, drainage control and environmental factors. A simple car or van would normally be required for these routine inspections. Operational and monitoring activities would be carried out remotely via telephone and computer links. However, some regular visits to the site would be necessary by technical staff for maintenance and routine inspections. Under normal circumstances the operation of the wind farm would require 6-7 visits to the site per month by a team of 3-4 in 2 vans per team trained personnel. Thus, a total of 45 visits per month are envisaged during normal operation. In the case of a major

fault e.g. Breakdown of a turbine component, larger machinery, including possibly mobile cranes, will require access to the site.

6.0 DETAILED ROUTE ASSESSMENT

6.1 Overview of Proposed Haul Route

The Dublin Port Tunnel, the M50, M4 and M6 Motorways and their associated junctions are all major roads in good condition and present no problems to the delivery of wind turbines. The R400 will serve as the only access to the site. Apart from the R400, some 18,275m of new road will be constructed while some 5,916m of existing road will be widened. These existing roads which are to be widened vary in width from 2.8m to 4.5m. **Drawings 4909 - HRA - 100 to 113** show various cross sections, photographs and junction details. Junction details are shown on **Drawings 4909 - HRA - 200 to 212.**

6.2 R400 from M6 Motorway to Junction at Derryiron.

The delivery traffic will turn off the M6 Motorway and proceed in a south-easterly direction along the R400 Regional Road. The exit road from the motorway is considered to be adequate. After approx. 4km from the M6, the existing junction to Derryiron and Derryarkin will be used so as to gain access to proposed turbines T1 to T12. This 4km length of road is straight, in a good condition at present and its width is adequate varying from 6.4m upwards (see cross-section No. 2 and photograph on Drawing 4909-HRA-102). Details of the junction of the R400 and the Kilmurray's Road are shown on Drawing 4909 - HRA – 200.

6.3 Junction at Kilmurray's Road to Turbine T1.

The first 2,500m of the Kilmurray's Road as far as the Piggery is 7m wide and is considered to be adequate as an access route for wind turbine components. From the Piggery to the Quarry, a length of 460m, the road width ranges from 3.5m to 4.7m and will need to be widened on its northern side by up to 2.5m. From the Quarry to the Proposed Junction for Turbines 1, 2, 3 & 5, a length of 880m, the road width is approximately 3m. This section can be widened on either side by 3m. A complete new access road will be built from this junction to serve turbines T1, T2, T3 and T5.

6.4 Haul Route Through Private Lands Parallel to R400

So as to avoid any possible damage to an existing bridge over the Yellow River on the R400, a second entrance from the R400 will be upgraded approx. 2km further to the south-east. Construction traffic will use the new haul route serving turbines T8, T9, T10, T11 and T12 and the Met Mast (generally parallel to the R400) and will then re-emerge onto the R400 at the second entrance which is at cross-section No.1, Drawing 4909-HRA-101. Details of the proposed new junction are shown on Drawing 4909 - HRA – 201.

6.5 R400 to Roundabout North of Rhode Village

Construction traffic will then proceed south-eastwards along the R400 to the roundabout located some 1.2km to the north of Rhode village centre (approx. 7.5km from M6). At this location, a new access road will be created in a north-easterly direction from the roundabout such that traffic can be diverted away from Rhode Village and link with the Cooville Road. Details of the proposed alterations to the junction are shown on Drawing 4909 - HRA – 202.

6.6 Roundabout North of Rhode Village to Coolville Road

This new access road will be over private lands for an approximate length of 1,150m. Details of the proposed new junction on the Coolville Road are shown on Drawing 4909 - HRA – 203.

6.7 Coolville Road to Private Lands

The existing Coolville Road (private road) is 3m in width and will need to be widened on its western side by approx. 3m. The approximate length of this section of road is 550m. Details of the proposed new junction at the northern end of this section of the Coolville Road and new access road into private lands are shown on Drawing 4909 - HRA – 204.

6.8 New Access Road Through Private Lands Linking Coolville Road to L50122-1

This new access road will be over private lands for an approximate length of 1,665m before it crosses the L50122-1 at Tooreen. Details of the proposed new junction on the L50122-1 Road are shown on Drawing 4909 - HRA – 205.

6.9 Private Lands to L50122-1 to Private Lands

This new access road will be over private lands for an approximate length of 735m before crossing the L50122-1 before turning in a northerly direction on private lands. Details of the proposed new junction on the L50122-1 Road at Greenhills are shown on Drawing 4909 - HRA – 206.

6.10 L50122-1 To Wood

The proposed haul route will follow the L50122 for a further 1,450m so as to come to the end of this road. The existing L50122 Road is 3m in width and will need to be widened on its eastern side by approx. 3m. At the end of the road at Wood, the haul route will split into three branches within private lands. One branch will serve turbine T16, another will serve turbines T18, T19, T20 and T21 while the third branch will be the main route serving turbines T17, T22 and T23 and the northern part of the proposed wind farm. Details of the proposed new junction at the northern end of this section of the L50122-1 Road and new access road into private lands are shown on Drawing 4909 - HRA – 207.

6.11 New Access Road Through Private Lands Linking L50122-1 to L1008-1 (Garr Road)

This new access road will be over private lands for an approximate length of 1,520m before it joins the L1008-1 Garr Road. It will serve turbines T17, T22 and T23. Details of the proposed new junction on the L1008-1 Road (Garr Road) are shown on Drawing 4909 - HRA – 208.

6.12 L1008-1 (Garr Road) To Private Lands at Corbetstown

The proposed haul route will follow the L1008-1 for approx. 60m before leaving this road at Corbetstown so as to gain access to the northern part of the wind farm. The existing L1008-1 Road varies in width from 3.7m to 4.7m and will need to be widened on its western side by up to 2.3m. Details of the proposed new junction at the northern end of this section of the L1008-1 Road and new access road into private lands are shown on Drawing 4909 - HRA – 208.

6.13 New Access Road Through Private Lands Linking L1008-1 (Garr Road) and L0081-1 at Carrick

This new access road will be over private lands for an approximate length of 2,875m before it will join the L0081-1 Road. It will serve turbines T24, T25, T26, T27, T28 and T29.

Another branch at the proposed new junction will serve turbine T30. Details of the proposed new junction on the L0081-1 Road are shown on Drawing 4909 - HRA – 209.

6.14 L0081-1 To Private Lands

The proposed haul route will follow the L0081-1 for approx. 550m before it branches into two. This existing junction will need to be upgraded. The easterly branch will proceed along the public road for approximately 300m and a new junction will then be required so as to gain access into private lands to serve turbine T31. The northerly branch will proceed along the public road for approx. 450m before coming to a bend which will have to be realigned and a further 100m before a new junction is created so as to gain access to private lands to serve turbine T32. The existing L1008-1 Road is 3.6m in width and will need to be widened on its western side by approx. 2.4m. Details of the existing junction upgrade, the two proposed new junctions and the bend upgrade are shown on Drawing 4909 - HRA – 210.

6.15 L10092-1 and L10093-1 to Proposed Substation

The L10092-1 road will give access to the proposed new 110kV substation to serve the wind farm and will also accommodate underground electrical cabling from the south western part of the wind farm (turbines T1 to T12). The junction with the R400 is adequate. The L10093-1 will accommodate underground electrical cabling from the northern part of the wind farm (turbines T13 to T32).