3.0 POST-PLANNING STAGES

3.1 PROGRAMME

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.

It is estimated that the following civil and electrical works will take approximately 16 months to complete (excluding turbine delivery and erection):

- Temporary Site Compound;
- Site Entrances 1 - 9;
- New River Crossings 1 - 9;
- Upgrade of Corbetstown Bridge;
- New Site Roads;
- Upgrade to local roads;
- Cable ducting;
- Turbine Bases and Hardstands 1 - 32;
- Electrical Compound and Control Buildings.

It is estimated that turbine erection will take approximately 8 months and turbine commissioning will take 6 months.

The final programme will be developed in consultation with the turbine manufacturer based on projected turbine delivery dates.

Any recommendations/mitigation measures relevant to the construction phase as identified in this EIS, or by the Department of the Environment, Community and Local Government, Wind

Farm Planning Guidelines and recommended by the Planning Authorities will be implemented.

3.2 OVERVIEW OF CONSTRUCTION METHODOLOGY

The proposed construction methodology is summarised under the following headings:

- Site Entrance
- Temporary Site Compound
- Concrete Washdown Area
- Drainage System
- Upgrade of Existing Road
- New Site Roads
- Bridge Construction
- Crane Hardstands
- Turbine Bases
- Control Buildings and Compound
- Cable Trenching
- Electrical Works
- Turbine Erection
- Turbine commissioning

3.2.1 Site Entrances

Prior to the commencement of any other works, the Site Entrance layouts will be constructed in accordance with **Figure 3.1a, 3.1b, 3.1c and 3.1d – Yellow River Wind Farm Site Entrance Details**, in conformance with NRA – Road Geometry Handbook TD 41-42/09 – Vehicular Access to All Public Access Roads.

Visibility splays will be provided for a design speed of 85km/hr, i.e. a 160m visibility splay from carriageway edge. It is not envisaged that there are any obstructions which will need to be removed.

3.2.2 Temporary Site Compound

There will be one temporary contractor's compound located adjacent to the substation site. The compound will be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts.
- Drainage runs and associated settlement ponds will be installed around the perimeter.
- A layer of geo-grid will be installed and layers of well graded granular material will be spread and compacted to provide a hard area to site offices and storage containers.
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking. The size and location of the hard standings will be at the discretion of the site manager.
- A concrete bunded area with an associated oil interceptor will be provided within the compound for the storage of lubricants, oils and site generators and coalescing media oil water separator will be installed to mitigate against any hydrocarbon spillages.
- Depending on the location of the compound, it may be fenced all round and secured with locked gates, fencing would only be utilised where significant risk of danger to third parties or vandalism was envisaged.
- Self contained port-a-loos with an integrated wastewater holding tank will be used, maintained by the providing contractor, and removed from site on completion of the

construction works. These will be located in the temporary compound, as well as in several areas throughout the site due to the dispersed nature of the site.

- Potable water will be delivered to site in suitable canisters on a daily basis for drinking, for tea and coffee as well as for use in the temporary site facilities compound.

Upon completion of the project the contractors compound will be decommissioned. The hard core stone and geo-grid will be removed from site and the area will be reinstated by backfilling with the material arising during excavation, landscaping with topsoil as required.

3.2.3 Concrete Washdown Area

A concrete washdown area will be constructed in the temporary compound. Every concrete truck delivering concrete to the site must use this facility prior to leaving the site. The concrete washout will be constructed as follows:

- The topsoil will be stripped out and placed in the peat reinstatement area adjacent to the temporary compound area.

- A filtration membrane will be installed directly onto the subsoil. The filtration membrane will conform to national and international quality standards.

- Graded granular material will be laid and compacted in layers above the membrane.

- All concrete wash down at the site will be completed in a dedicated proprietary concrete washing unit (http://www.siltbuster.com/sheets/RCW.pdf). This unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility.

Upon completion of the project the concrete washdown area will be decommissioned by removing the stone and filtration membrane and backfilling the area with the material arising during excavation, landscaping as required.

Wheel wash facilities will be located at each site entrance to reduce construction traffic fouling public roads. Each wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of

disposal. Waste will be removed from each unit and from site by a licensed waste disposal company.

3.2.4 Upgrade of Existing Roads

There is an internal excavated road network currently on the site. It is proposed to utilise this road network as much as possible. This will require the road to be upgraded and widened from approximately 3.5m to approximately 5.5m. The typical road widening details of the site roads are detailed on **Figure 2.12 –Road Construction Detail.**

3.2.5 New Site Roads

All site roads have been designed taking account of the loadings required by the turbine manufacturer, and will consist of a compacted stone structure. All roads on the site will be constructed using the traditional road construction method from suitable load bearing strata.

This system will consist of either one or two layers of stone depending on the load bearing capacity of base layer. Where the underlying layer is mineral subsoil, two layers of stone are used; a stone capping layer and running layer. In areas where the load bearing layer is rock, the capping layer is omitted, and the running layer is installed directly onto the rock surface.

The layout and typical construction details of the site roads are detailed on **Figure 2.12 –**Road Construction Detail and will be constructed as follows:

- Establish alignment of the new site roads from the construction drawings and mark out the centrelines with ranging rods or timber posts.

- The access roads will be of single-track design with an overall width of approximately 5.5m. There will be some local widening on the bends, junctions and around turbine bases for the safe passage of large vehicles. All bends have been designed to suit the requirements of the delivery vehicles.

- The excavated road section, where practicable, will have the turve stripped over the area of the excavation and stored growing side up for reuse.

- All machinery shall work within the construction corridors that will be indicated on the contract drawings. Vehicle movement will be restricted to site tracks except

during track and base construction. Construction activities will be kept discrete and minimal in order to retain where practical, heather and bog habitat.

- Top soil excavation shall be observed by a qualified archaeologist, in accordance with an approved scheme of archaeological monitoring.

- The soil will be excavated down to a suitable formation layer of either firm subsoil or rock.

- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Site Manager based on the characteristics of the material and the compaction plant to be used.

- Batters will have a slope of between 1:1 and 1:2 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species.

- At bends or steep inclines within the new internal site roads, reflective snow poles will be erected to warn traffic on dark mornings and evenings that there is a turn in the road or a sharp incline beyond the site road.

3.2.6 Crane Hardstands

All crane pads and associated splays will be designed taking account of the loadings provided by the turbine manufacturer, and will consist of a compacted stone structure.

All crane pads will be formed from a suitably stiff layer and the finished crane pad surface will provide a minimum strength of 200kN/m^2. Piled / floated construction using geo textiles will be used where the depth of peat exceeds 4m. Please refer to Section 2.7.9 for further details.

Crane pad and associated splay formation will consist of either 1 or 2 layers of stone depending on the properties of the underlying load bearing layer. Where the underlying layer is soft soil, 2 layers of stone formation are used, the stone capping layer and, the running layer. In areas where the load bearing layer is rock, the capping layer is omitted, and the type 3 running layer is installed directly onto the rock surface. The crane pads are approximately 50m x 25m and have a maximum cross and longitudinal fall tolerance of 2%.

Crane hardstand areas will be covered with excavated soil and re-seeded with grass after construction.

The crane hardstands will be constructed in one of two following ways:

- Typical excavation method, areas where peat is less than 4m deep.
- Piled / Floated Hardstand method, peat deeper than 4m.

The typical excavation method can be summarized as follows:

Typical Excavation Method:

- Establish alignment of the hardstands from the construction drawings and mark out the corners with ranging rods or timber posts.
- The excavated material will, where practicable have turf stripped over the area of the excavation and stored growing side up for reuse
- Soil excavation shall be observed by a qualified archaeologist, in accordance with an approved scheme of archaeological monitoring in order to identify any significant remains should they come to light.
- The soil will be excavated down to a suitable formation layer of either firm clay or rock.
- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface.
- Batters to have a slope of between 1:1 and 1:2 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species.

Piled / Floated Hardstanding Method:

Floating construction will be adopted to mitigate against the excavation of peat and thereby avoiding the risk of sediment release. This system involves:

- Installing a layer of geo-grid directly onto of the existing organic layer;
- Placement of a layer of well graded course stone;
- Application of further layers of geo grid (if required);
- Laying the final layer of a finer well graded stone for the running surface.

It is envisaged that four piled crane support pad will be constructed. Precast concrete piles will be driven down to rock. A 4m x 4m x 0.6m deep reinforced concrete pad will be constructed on top of the piles. Shuttering will be used lined with polythene and an anti-bleeding admixture used to prevent any concrete leachate.

3.2.7 Turbine Bases

The wind turbines foundation will be either:

- A standard excavated reinforced concrete base where peat depths are less than 4 metres. They will likely be formed 1 metre below the base of the peat layer on stiff subsoil material or rock.
- A reinforced concrete buoyant base where peat depths exceed 4 metres.

Turbine bases will be designed to Eurocode Standards. Foundation loads will be provided by wind turbine supplier, and factors of safety will be applied to these in accordance with European design regulations. The turbine will be anchored to the foundation using a bolt assembly which shall be cast into the concrete. Bases will measure approximately 18 metres in diameter depending on subsoil conditions and ground water level.

The turbine foundations will be constructed as follows:

Standard Excavated Reinforced Concrete Base:

(a) The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter.

(b) Where practicable the turf will be stripped over the area of the excavation and stored growing side up for reuse, the vegetable soil will be excavated and stored to one side for reuse during the landscaping around the finished turbine.

(c) No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises.

(d) Soil excavation shall be observed by a qualified archaeologist in accordance with a scheme of archaeological monitoring, in order to identify any significant remains should they come to light.

(e) A layer of concrete blinding will be laid approximately 75mm thick directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface, to the same level as the top of the pile where piles exist. The concrete should be protected from rainfall during curing and all surface water runoff from the curing concrete should be prevented from entering surface water drainage directly.

(f) High tensile steel reinforcement will be fixed in accordance with the designer's drawings & schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools.

(g) Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required.

(h) The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base. These checks will be passed to turbine manufacturer for their approval.

(i) Concrete will be placed using a concrete pump and compacted when in the forms using vibrating pokers to the levels and profile indicated on the drawings.

(j) Upon completion of the concreting works the foundation base will be covered with wet hession in summer and an insulation blanket in winter and allowed to cure.

(k) Steel shutters will be used to pour the circular chimney section.

(l) The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the vegetable soil set-aside during the excavation. A gravel footpath will be formed from the access road to the turbine door and around the turbine for maintenance.

Reinforced Concrete Buoyant Base:

Follow Items (a) to (c) as above then for buoyant bases:

- A piling platform for the piling rig will be constructed. This can be done in two ways depending on the bearing capacity of the underlying soil.
  - The first method is to lay geo-textile on the existing surface and a stone layer will then be placed on top of the geo-textile by an excavator and compacted in order to give the platform sufficient bearing capacity for the piling rig.
  - The second method is to excavate the soils to a suitable intermediate mineral subsoil and backfill to the formation level.
- The piling rig, fitted with an auger, will then bore through the peat with a sleeve fitted around the auger to prevent the sidewalls of the peat from collapsing. The borehole is then extended to a suitable depth into the subsoil/bedrock.
- When the auger and the sleeve are removed high tensile steel cages will be lowered into the boreholes. These steel cages will extrude above the level of the top of the concrete pile.
- As the auger is removed concrete is pumped into the borehole.

Base construction is then undertaken as per items (e) to (l) above.

3.2.8 Control Buildings and Compound

The compound surrounding the substation will measure approximately 50 m x 37 m. The compound will be constructed as per the details in Section 3.2.2.

The compound will also include two control buildings, measuring approximately 14.5 x 8.85 metres (TSO Control Building) and 8.85 x 8.85 metres (Client Control Building) in plan. The buildings main functions are to provide housing for switchgear, control equipment and monitoring equipment necessary for the proper functioning of the substation. It will utilise Air Insulated Switchgear (AIS). The control building will be constructed by the following methodology:

- The area of the Control Buildings and Compound will be marked out using ranging rods or wooden posts and the vegetable soil stripped and removed to the nearby storage area for later use in landscaping. No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises.

- Soil excavation shall be observed by a qualified archaeologist in accordance with an approved scheme of archaeological monitoring, in order to identify any significant remains should they come to light.

- The dimensions of the Control Building and Compound area will be set to meet the requirements of Eirgrid / ESB and the necessary equipment to safely and efficiently operate the wind farm.

- The foundations will be excavated down to the level indicated by the designer and concreted.

- Excavated material will remain on site at all times.

- The blockwork walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors.

- The blockwork will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation.

- The concrete roof slabs will be lifted into position using an adequately sized mobile crane.

- The wooden roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.

Control Building finishes will be in keeping with the local area as follows: -

- Walls to be rough cast and painted off white
- Roof to be slate effect tiles
- Guttering and rainwater goods to be of an alternative to uPVC (subject to availability) and finished in white
- Doors to be made of steel or timber with steel sheeting for security
- The doors will be fitted and the external and internal finishing's applied including any fitted furniture.
- A 2.6m pallisade fence will be erected around the compound and the area surrounding the building landscaped as required, returning it as far as practicable to near original condition.

3.2.9 Cable Trenching

The transformer in each turbine is connected to the substation through a network of buried 33kV electrical cables. The Substation is connected to the Eirgrid/ESB Substation by a 110kV Cable. The ground is trenched typically using a mechanical digging machine. These machines will be regularly inspected for safety and condition and will be well maintained. The operators will have the required certification. The top layer of soil is removed and saved so that it is replaced on completion. The cables are bedded with suitable material unless the ground conditions are such that no bedding is required. The depth of the cables is to meet all national and international requirements. A suitable marking tape is installed between the cables and the surface. On completion the ground will be reinstated as previously described above.

Another option for installing the underground cables is by utilising trenchless technology. This is done by digging two pits along the cable route, an entrance pit and a receiving pit.

The first stage is to drill a pilot hole from the entrance pit to the receiving pit, along the proposed cable route. The hole is then enlarged by passing a back reamer, a larger cutting tool, along the pilot hole. The ducting for the cable is attached to the rear of the back reamer which pulls the ducting along the cable route.

The cables are terminated on the transformers at each turbine location. These terminations are located within / without the base of the turbine towers. On decommissioning the cables will be cut away below ground level and sealed.

3.2.10 Electrical Works

Substation and switchgear: - The substation will have a domestic electrical system including lights, sockets, fire alarm and intruder alarm. This would be designed, installed and commissioned by registered electrical contractors. The high voltage switchgear is installed using a truck mounted hydraulic crane. The indoor equipment is then connected, wired tested and commissioned typically by engineers supplied by the switchgear manufacturer. The operation of this equipment is by suitably authorised operators who have undergone extensive training. The equipment will be decommissioned in the reverse of the above, removed from site, dismantled and disposed of in an approved manner.

Transformers: - The transformers are delivered by the manufacturer and will be placed directly onto the turbine foundation. The units will be placed directly onto the turbine foundation prior to the installation of the turbine towers. The transformers will be of the sealed type and will be inspected for any damage prior to offloading.

The units will be installed using a small mobile all-terrain crane and will be tested, commissioned and energised by suitably trained and authorised persons. The accessible MV and LV sections of the transformer will be protected within an enclosure which shall be locked at all times displaying appropriate warning signs. The units will be decommissioned in the same manner, removed from site and disposed of by a company certified to handle such materials. This specialist company will also dispose of any oil or residual waste products.

3.2.11 Turbine Erection

The turbine will be supplied with a light grey semi-matt finish and installed with a height not exceeding 166m measured from existing ground levels to the blade tip in the vertical position.

The turbines will be delivered in sections to the site. The sections are lifted by adequately sized mobile cranes (1 main crane and a smaller tail crane to assist with the initial lift free of the transport) and positioned on the foundations / other turbine sections until the entire turbine is erected.

Upon completion of the erection, all fasteners will be tightened to the correct torque and the internal fit out of the turbine undertaken, and finally the mains power will be connected to the turbine controller.

When the controller is 'booted up', the turbine commissioning will commence, and following the successful execution of the 'tests on completion' the turbines will be handed over as complete.

3.2.12 Bridge Construction

The bridges will be constructed so as to avoid any instream works or any disturbance to the riverbed. The general methodology is as follows:

(a) Roads will be constructed to either side of the River/Stream in accordance with the detail in Figure 2.12 as far as the bridge footings.

(b) The abutment locations will be set out such that they are set back from the Stream edge.

(c) Mini-piles will be utilised in the bridge footings to reduce excavation volumes. These will be steel lined Odex or equivalent piles. Concrete will be placed inside each pile.

(d) Reinforced steel bars for the abutments will be fixed in accordance with the detailed design which will take place post-planning. Ducting will also be fixed.

(e) Marine plywood (or better quality) shuttering will be erected around the reinforced steel cages. All joints will be sealed.

(f) Concrete with anti-bleeding admixture will be placed from the delivery truck.

(g) The shuttering will be removed when the concrete has cured sufficiently and working space will be backfilled with soil.

(h) Pre-stressed concrete bridge beams will be lifted by a mobile crane from the delivery truck to span the Stream/River.

(i) A pre-cast edge beam/parapet beam will be placed at both edges of the bridge. These beams should extrude at least 50mm above the final finished road level.

(j) Polysulphide sealant will be used to seal any gaps between the beams.

(k) Reinforcing steel and ducting will be fixed.

(l) Infill concrete will be placed between the beams by concrete pump and allowed to cure.

(m) The concrete finished road will be overlain by a bridge deck water proofing membrane which will be overlain by 100mm of dense bitumen macadam (60mm base course plus 40mm wearing course).

(n) An aluminium handrail will be erected along the edge beams.

Bridge construction details are shown in Figure 2.15.

3.3 MACHINERY TO BE USED DURING CONSTRUCTION

The items of construction plant and machinery, which will typically be used during the course of construction, are as follows:

- 8 – 12 No. Hydraulic Excavators
- 4 – 12 No. Dump Trucks
- 1000 tonne Crane (1)
- 100 tonne Crane (1)
- Concrete Pump (Lorry mounted)
- 4 No. 2 tonne Dumpers
- 150 mm Dewatering Pumps
- Site Generators
- 8 – 12 No. Four-Wheel Drive Vehicles
- Cement Mixer
- Miscellaneous Power Tools

3.4 LABOUR

It is anticipated that up to 75 construction jobs will be created during the construction period of this project with a maximum anticipated total number of 45 on site at one time. The number of people employed will be at its highest during turbine foundation construction and turbine erection.

3.5 TEMPORARY SITE FACILITIES

A temporary site compound will be required for the duration of the construction phase. The temporary compound will be constructed by the method described in Section 3.2.2. Upon completion of the project the compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required. The temporary compound will cover an area of approximately 50m x 30m (1,500m^2). Located in the temporary compound will be:

- 7 No. Pre-Fabricated Site Offices/Meeting Room
- 2 No. Prefabricated Changing Rooms/Drying Room
- 2 No. Prefabricated Units for eating packed lunches
- 2 No. Prefabricated Toilet blocks with Male/Female toilets
- 6 No. Lock up steel containers for storage of tools and small components
- 4 First Aid Units

There will be a coalescing media oil water separator installed where the surface water from the temporary compound will drain into the on-site drainage network.

Provision of Potable Water

Potable water will be delivered to site in suitable canisters on a daily basis for drinking, for tea and coffee as well as for use in the temporary site facilities compound.

The Discharges of Wastewater

A sanitation area which is to be located in the temporary compound for use by site workers during the construction phase will consist of temporary port-a-loo units. Additional port-a-loo units will be placed at various locations throughout the site as construction work progresses. These units will be self contained and will be managed and serviced on a weekly basis (or more frequently if required) during the construction phase, and removed from the site on completion of the construction phase.

Telephone

Telecommunications will be provided using mobile phones.

Temporary Power Supplies

Power will be provided using both electrical connection and 1-2 diesel driven generators.

Storage of Hydrocarbons

No diesel will be stored on site. The contractor will be responsible for bringing fuel to site in a bunded fuel bowser to re-fuel the mobile generators that will provide power to the temporary site facilities and also to fuel the excavators and various items of plant on site.

Refuelling

The issue of accidental spillage of hydrocarbons such as diesel and lubrication oil during refuelling of plant machinery is a potential risk during the construction phase.

Fuel will be brought to site in a bunded fuel bowser. Since July 1st 2003, European Regulations came into force, which govern, the design, testing and manufacture of containers for dangerous goods. The carriage of Dangerous Goods by Road Regulations now classifies diesel as a dangerous substance.

If dangerous goods are being transported by road then they must now be conveyed in a container which complies with the ADR. ADR is the European Agreement on the international and national Carriage of Dangerous goods by Road under Directive 95/55/EC. The manufacturer of the bunded fuel bowser must supply with each bowser;

- a copy of the IBC approval certificate,
- a test certificate for the leakproofness test,
- An identification plate attached to the container.

They are suitable for diesel and kerosene and are designed to help companies comply with current and pending EU Environmental Regulation by eliminating accidental spillage. The outer container bund has in excess of 110% capacity of the inner container. For loads in excess of 1000 litre or 220 gallon transported by road, the vehicle driver must have undergone training and hold a special licence.

All the machinery will be refuelled, where possible, within the temporary compound. In all cases, a purpose designed, removable, drip tray will be provided beneath connection points to catch any residual oil during filling and disconnection of the flexible tanker hose. The drip tray will be regularly emptied and disposed of off site by a specialist licensed contractor.

Vehicle refuelling will not occur within 100 m of any watercourse and all machinery will be maintained in good working order, free from leakage of fuel or hydraulic fluid.

Oil booms and oil soakage pads will be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge.

An Outline Pollution Contingency Plan has been prepared for the site. Please refer to **Appendix H** for details of this Pollution Contingency Plan.

Servicing

Where it is necessary to service machinery on-site due to breakdown, this will occur, where possible, within the temporary compound. In all cases, drip trays will be used and no vehicle maintenance will occur within 100 m of any natural watercourse and 20m of drainage channels. All machinery will be maintained in good working order, free from leakage of fuel or hydraulic fluid.

Parking of vehicles overnight or in periods of cessation of operations will be on hardstand areas and never close to open excavations or surface watercourses.

On site discharge of wash water from concrete mixers will be avoided at all times.

Disposal

Oily water condensate and recovered oil from any accidental spillage will be disposed of by recycling and the services of a specialist, licensed, waste oil recycler will be engaged for this task.

Any contaminated surface soils, (in the unlikely event that contamination occurs), will be removed and similarly disposed of by a specialist, licensed contractor. Disposal will be undertaken with prior approval from Offaly County Council.

Mitigation Measures

Construction Phase:

- No fuel will be stored on site. Lubricating oils, greases and hydraulic fluids will be stored in bunded containers 100 m from any natural watercourse and 20m from drainage channels.

- Refuelling of machinery will be carried out as described under the 'Refuelling' section.

- It is recommended by the Best Practice Guide (Enterprise Ireland, BPGCS005), that oil filling areas are located at least 10 m from surface watercourses. For reasons of mitigation by avoidance, a 100 m buffer zone around any natural watercourses and 20m from any drainage channels will be implemented.

- A construction phase Environmental Management Plan will be in operation to audit equipment, materials storage and transfer areas, drainage structures and their attenuation ability on a regular basis. It is proposed that this Plan will be agreed with the Planning Authority.

- Monitoring of streams and drains will be carried out on a regular basis during the construction phase so that construction works are not significantly impacting on-site streams/drains or watercourses down gradient of the site.

- Truck rutting will be kept to a minimum by confining plant and machinery movement to the development footprint area.

Operational Phase:

- All vehicles visiting the site will be refuelled off site during the operational phase.

- Trained personnel will carry out greasing or oiling of turbine components when necessary. Lubricants will not be stored on site and will be handled with care at all times.

- Regular environmental auditing, maintenance and checking of the drainage network and their ability to take run-off and attenuate suspended solid loading, regular cleaning of drainage and stilling ponds, checks of on-site storage of materials, control of vehicle access and mobility will all take place.

- The offices, canteen, drying room, toilets and any temporary storage container will be removed from site at the end of the construction period. The hardcore area will be removed and the area reinstated by adding further layers of peat and topsoil.

3.6 CONSTRUCTION MATERIALS

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. 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 3.1a, 3.1b and 3.1c,*** 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	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

Material	Quantity	No. of truck deliveries
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	-	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

Material	Quantity	No. of truck deliveries
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 11m3 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.	24,000m^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 3.1a Estimated quantity of construction materials and deliveries to site 'Worst Case scenario'

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 3.1b Estimated quantity of wind turbine components and deliveries to site 'Worst Case scenario'

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 3.1c Estimated other loads and deliveries to site 'Worst Case scenario'

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

Table 3.1d Estimated total quantity of construction materials and deliveries to site 'Worst Case scenario' for Civil Works and Turbine Installation Phase of Works

During the course of the construction, the following items will be imported, stored and used on site:

- Hydrocarbons fuels for mechanical plant.
- Lubricating oils for mechanical plant.
- Shutter release oils, paints and curing agents.

Please refer to Section 3.5 for mitigation measures relating to refuelling and servicing. An outline Environmental Management Plan has been prepared for the site. Please refer to **Appendix I** for details of the Environmental Management Plan.

3.7 PEAT REMOVAL & RE-USE

The indicative volume of peat removal has been established as being 41,082.8m^3. This is based on the average of peat depths recorded at each turbine location by Whiteford Geoservices Ltd. Please refer to Table 3.3 – Indicative Peat Excavation Volumes.

Peat reinstatement will be possible through the following methods:

- Saving the top layer of the peat excavated for landscaping uses over any backfilled areas.
- Placing the excavated peat along roadside berms.

The peat reinstatement areas have been sized to take at least 110% of the indicative volume of peat to be removed. The peat management proposals are discussed further in Section 3.8.

In the unlikely event that excess peat is encountered, which cannot be reused on site, this peat will be disposed of in an environmentally sensitive manner in consultation with Offaly County Council.

Turbine	Deepest peat depth in Turbine Vicinity (m)	Area of Base (m^2)	Area of Hardstand (m^2)	Area of splays (m2)	Total Volume of Peat Excavated from Base (m^3)	Total Volume of Peat Excavated from Hardstand (m^3)	Total Volume of Peat Excavated from Splays (m3)	Total Volume of Peat Excavated (m^3)	Method of Hardstand Construction
T1	0.25	255.0	1250.0	745.0	63.8	312.5	186.3	562.5	Excavated
T2	0.05	255.0	1250.0	745.0	12.8	62.5	37.3	112.5	Excavated
T3	0.10	255.0	1250.0	745.0	25.5	125.0	74.5	225.0	Excavated
T4	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T5	0.00	255.0	1250.0	745.0	0.0	0.0	0.0	0.0	Excavated
T6	0.48	255.0	1250.0	745.0	122.4	600.0	357.6	1080.0	Excavated
T7	3.00	255.0	1250.0	745.0	765.0	3750.0	2235.0	6750.0	Excavated
T8	0.52	255.0	1250.0	745.0	132.6	650.0	387.4	1170.0	Excavated
T9	1.50	255.0	1250.0	745.0	382.5	1875.0	1117.5	3375.0	Excavated
T10	0.05	255.0	1250.0	745.0	12.8	62.5	37.3	112.5	Excavated
T11	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T12	0.03	255.0	1250.0	745.0	7.4	36.3	21.6	65.3	Excavated
T13	0.48	255.0	1250.0	745.0	122.4	600.0	357.6	1080.0	Excavated
T14	1.00	255.0	1250.0	745.0	255.0	1250.0	745.0	2250.0	Excavated
T15	1.00	255.0	1250.0	745.0	255.0	1250.0	745.0	2250.0	Excavated
T16	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T17	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T18	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T19	0.21	255.0	1250.0	745.0	53.6	262.5	156.5	472.5	Excavated
T20	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T21	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T22	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T23	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T24	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T25	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T26	0.50	255.0	1250.0	745.0	127.5	625.0	372.5	1125.0	Excavated
T27	0.22	255.0	1250.0	745.0	56.1	275.0	163.9	495.0	Excavated
T28	0.18	255.0	1250.0	745.0	45.9	225.0	134.1	405.0	Excavated
T29	0.14	255.0	1250.0	745.0	35.7	175.0	104.3	315.0	Excavated
T30	1.46	255.0	1250.0	745.0	372.3	1825.0	1087.7	3285.0	Excavated
T31	0.64	255.0	1250.0	745.0	163.2	800.0	476.8	1440.0	Excavated
T32	0.95	255.0	1250.0	745.0	242.3	1187.5	707.8	2137.5	Excavated
Substation	0.0	0.0	1850.0		0.0	0.0		0.0	Excavated
TOTAL					**4,656**	**22,823.8**	**13,603.0**	**41,082.8**	

Table 3.3 – Indicative Peat excavation volumes

3.8 PEAT STORAGE MANAGEMENT AND RESTORATION

The majority of the site consists of improved grasslands and cutover bog. Existing land uses at the site include peat extraction and agriculture i.e. grazing. Please refer to Chapter 6 for further discussion.

A Detailed Peat Management Plan will be prepared prior to the commencement of construction at the site. The preparation, application and documentation of this Detailed Peat Management Plan should enable all parties – including contractors, designers and competent authorities – to learn from the systematic implementation and assessment of best practice, particularly through the recording of summary information on performance outcomes.

The Detailed Peat Management Plan will also cover the storage and restoration of all peat excavated during the construction phase. Peat with a volume of approximately **41,082.8m^3** will be re-used during the construction phase as follows;

- Resurfacing of hardstanding and splay areas.
- Reinstatement of splays, stilling ponds, etc
- Roadside berms and landscaping
- Landowner land reclaimation/improvement activities

Peat will not be placed:

- Within 100 m of a natural watercourses.
- Within 20 metres of a major arterial drain or 10m of any minor drain or drains containing dry weather flows greater than 1 litre/second.
- Within areas of gradient greater than 1:20.
- Within gully channels, hags, pool systems, and wet flushes.
- Within areas of deep peat depth and containing little fibrous content and high humification values.
- Within areas designated as sensitive habitat (e.g. areas of intact active bog).

3.9 PEAT EXCAVATION AND REINSTATEMENT METHODOLOGY

The following methodology is proposed for such work:

- Prior to excavation, all grass areas to be cut into turves which are to be carefully stacked and re-used within one week of cutting during the period 1st April to 31st August or within two weeks of cutting during the remainder of the year. Turves not used within these periods shall be regarded as topsoil.

- Peat will be spread in thin layers over a large area. Depths will not exceed the height of the bund wall / bank containing it.

- Bund walls will be constructed using mineral subsoil/peat where no natural peat bank exists to constrain the viscous peat.

- Outfall locations within the storage areas will be diverted or damned, where possible" using plastic lumber or a rock dam and suitable impermeable geotextile. This action will also encourage the phreatic table to rise, encouraging peat formation.

- Acrotelm peat, which has been excavated during the construction phase will be placed on top of the thin layers to encourage rapid re-vegetation and bog regeneration. The acrotelm layer typically extends 0.3 metres into the peat.

- All reinstatement areas will be suitably fenced and signs warning the public will be erected.

- Any bare areas to be grassed shall be covered with topsoil to a minimum depth of 100mm which shall be reduced to a fine tilth, free from stones and debris with any dimensions greater than 35mm. The topsoil shall be graded and lightly compacted to a 100mm thickness or existing thickness-whichever is greater. Any upstanding debris or stones exceeding 25mm dimension shall be removed.

- Prior to seeding or turfing, an approved fertilizer shall be evenly distributed on the topsoil at a rate of not less than 100g per sq. metre.

- Due regard will be paid to the season and weather condition before sowing grass seed. Immediately prior to sowing the grass seed, the topsoil shall be reduced to a fine tilth. Sowing the grass seed shall be carried out by an even distribution, using a blend of (per hectare) 170kg Manhattan Rye Grass and 13kg Dwarf Clover or other similar approved mix. For slopes in excess of ten degrees, these quantities shall be increased by 50%. The seed shall be covered by lightly raking into the surface of the topsoil.

- All work will be carried out in an environmentally sensitive manner in consultation with the Local Authority and the National Parks and Wildlife Service.

- A waste license will be obtained from the Local Authority / Environmental Protection Agency prior to any disposal of peat as per the Waste Management Regulations 2006 and the Waste management Act 1996 to 2008.

The proposed method of disposal will not create a significant environmental impact. The proposed measures and methodology will help in the reinstatement of worked out areas of peat and aid in the attenuation of run off at these locations. If managed responsibly, it will help in the regeneration and landscaping of the bog and result in no threat to existing drains, streams or their aquatic habitats.

3.10 AVOIDANCE OF RAISED BOG DISTURBANCE

The proposed Yellow River Wind Farm turbine layout was designed in such a way as to have minimal impacts on raised bog and according to the recommendations specified by the ecologist for the site. Ecological feed back has been incorporated in to the wind farm design and has helped in the identification of suitable ground, minimising crossings of watercourses and avoiding wet and deep peat areas.

The final footprint has been designed to avoid the following:

- Areas of deep peat

- Areas of excessive gradient

- Natural and man-made drainage channels within the peat

The following mitigation by avoidance measures are proposed:

- Flow will be maintained in all existing drains
- Peat excavation will be avoided (where possible)

In order to minimise the disturbance of raised bog the following design features have been incorporated into the internal site layout:

- Existing site drainage should be maintained.
- Construction works will be confined to the minimum area possible.
- Minimum removal of vegetation will take place so as to reduce the area of bare peat. When the foundations for turbines are being excavated, the surface vegetation will be removed in sods which can be stored (vegetation side up) and later replaced around the foundation platform. This will allow a more rapid re-vegetation of bare peat and this will help reduce potential soil erosion.
- Once stripped, acrotelm peat will be carefully stored in suitable areas and kept moist.

3.11 SITE MANAGEMENT AND HABITAT ENHANCEMENT

In order to maintain the site for biodiversity, disturbance will be kept to a minimum and the site restored following the construction period. The following measures are proposed:

- In laying out the road network, the proposed route of new roads will be pegged out ahead of construction preparations. This will also define the construction corridor that will be offset to a maximum of 15m either side of the centre line of the road. The construction corridor will be marked out and once defined construction vehicles or personnel will not be allowed outside the corridor.

- Access onto areas outside of the proposed hardstand area will be confined to temporary roadways. Within any area of peat along the proposed access road network, access during stripping of the vegetation will be undertaken on temporary roadway.

- Reinstatement of vegetation on exposed soils will also be undertaken immediately following completion of construction (or in tandem where feasible) using a combination of techniques, turving, artificial planting and reseeding.

- Sediment traps and stilling ponds will be put in place to prevent the potential siltation of downstream watercourses.

3.12 COMMISSIONING

All individual parts of the wind turbine and the associated electrical infrastructure within the site control building will have passed stringent factory tests prior to delivery. Once the turbines have been fully assembled on site and the construction and installation completed, the wind farm and the wind turbines will go through a thorough period of commissioning and operational tests prior to being handed over from the construction team.

A typical turbine commissioning would take 2 – 4 days per turbine, a maximum of approximately 128 days in total. Another week will be required for system testing including grid connection testing. Thus, the total time period for commissioning will be approximately six months. Some fine-tuning will be necessary during the first three months of the operational period. Various site finishing works will be carried out concurrent with the commissioning phase.

3.13 OPERATIONAL PHASE

A service contract will be entered into with the turbine manufacturer to facilitate the proper operation and maintenance of the turbines. While routine operation and monitoring will be carried out remotely via the SCADA System, the following visits to site are envisaged: -

Scheduled

- Six-month service, three week visit by four technicians
- Annual service, six week visit by four technicians
- Weekly visit by Developer or agents to check over the site, notices etc.

Unscheduled

- Visits which may arise as a result of malfunction, damage by lightning or vandalism.

During the six-month and annual service visits, some waste lubricating and cooling oils will arise. These will be recorded, drained into designated storage containers, brought off site and delivered to a suitable independent commercial facility for treatment/re-use/disposal in accordance with The European Communities (Waste Oils) Regulations, 1992 (S.I. No. 399 of 1992).

As part of the annual service visits, the condition of paintwork will be inspected and documented. It is anticipated that a major touch up and repainting will be necessary to the towers after 10 – 15 years. This will be carried out using access from mobile cranes.

3.14 DECOMMISSIONING

At the end of the useful life of the turbines, both a commercial and an environmental appraisal of the site will be carried out. The commercial appraisal will assess whether or not the turbines should be replaced in their entirety by new turbines or if the site should be terminated in relation to electricity generation.

If the site is to be decommissioned, then the environmental appraisal will provide the background as to the extent of the facilities to be removed. It is anticipated that in any decommissioning, the turbines and towers will be removed from site. However, it is not envisaged that turbine bases, cables, crane hardstandings and access roads be dug up. However, the upstand section from each turbine base will be removed. Consideration would be given to providing a topsoil/peat covering to these items in any decommissioning phase. Consideration could also be given to any potential uses

for the control building. Consultation will be made with Offaly County Council at this stage.

Any materials (e.g. turbine components) removed from site can be disposed of in an environmentally friendly manner, for example:

- The steel turbine towers can be re-cycled and used again for manufacturing.
- Generator components can be broken down and sent for re-use/re-cycling where appropriate.

On decommissioning the cables will be cut away below ground level and sealed.