Appendix 3-1

Construction Environmental Management Plan

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Carrownagowan Wind Farm

Construction and Environmental Management Plan (CEMP)

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1 INTRODUCTION

This Construction Environmental Management Plan (CEMP) outlines the scope of construction works, construction methodologies and environmental management measures which are to be implemented and followed for the Carrownagowan Wind Farm project in order to ensure that the project is constructed in accordance with best practice and with the minimum impact on the surrounding environment. For the purposes of the CEMP, the Carrownagowan Wind Farm project includes the wind farm, turbine delivery route works areas and the grid connection.

1.1 CEMP PURPOSE AND OBJECTIVES

This CEMP details the construction works and environmental management measures, which will be implemented during the construction phase of the Carrownagowan wind energy project.

The primary objective of this CEMP is to provide a framework for actions, responsibilities and protocols associated with environmental management with which the Appointed Contractor(s) are required to adhere in order to construct the project in accordance with regulatory requirements and to reduce and/or avoid any adverse environmental impacts.

The CEMP document will undergo several revisions to address, for example, any conditions stipulated in the site planning. The version presented here is to set out the fundamental work practices, construction management procedures, management responsibilities, mitigation measures and monitoring proposals that are required to be adhered to.

All site personnel will be required to be familiar with the plan's requirements as related to their role on site. There will be a requirement on the Appointed Contractor(s) that details are updated with progress, including the roles and responsibilities of those appointed on the site for the construction of the project.

2 PROJECT OVERVIEW

2.1 WIND FARM

The proposed development is a nineteen (19) No. wind turbine project. The area of the proposed Wind Farm is located within forested lands on the northern slopes of Slieve Bernagh mountain, approximately 4 km northeast of the village of Broadford, 7km north-west of Killaloe and 2.5 km south of the village of Bodyke, at its closest point. Lough Derg lies approximately 4km to the east of the proposed development area.

The site layout is shown on in Figure 2.1 below and on **Planning Drawings 19107-5005 to 19107-5012**. A schedule of the proposed wind turbines and their corresponding grid co-ordinates (ITM) is set out in Table 2.1 below.

Figure 2.1 Site Layout

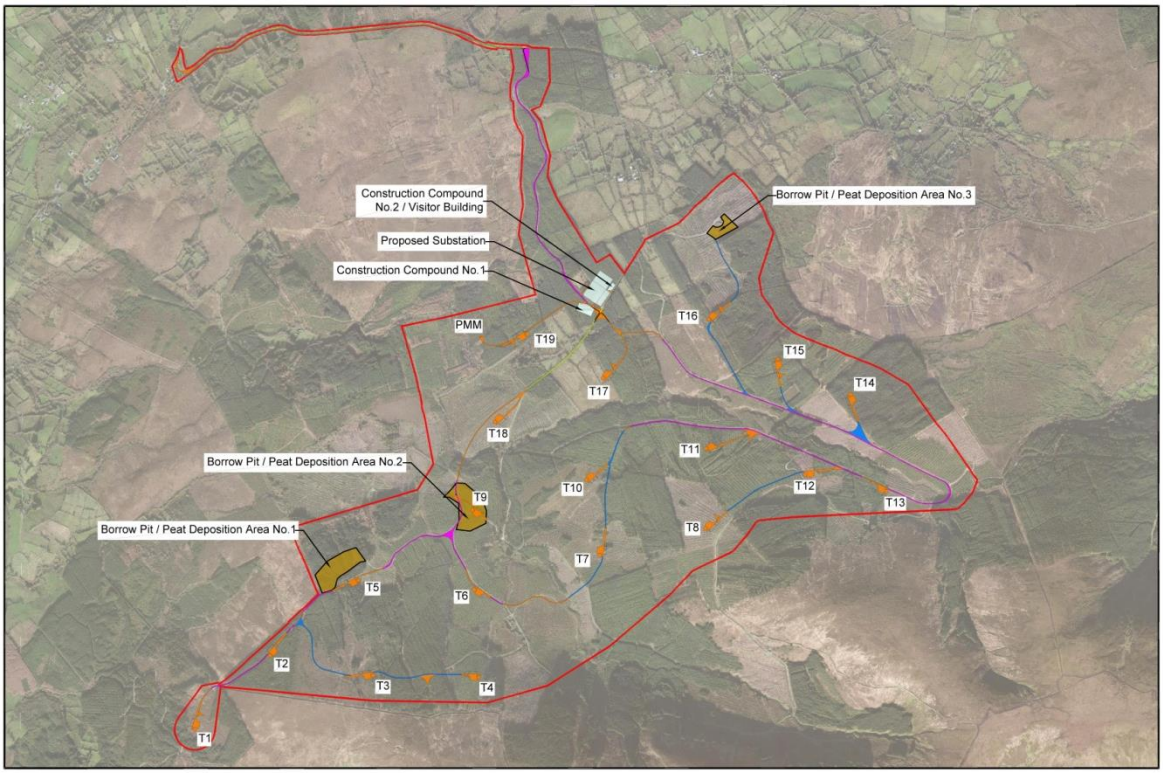


Table 2.1 Proposed Turbine Co-ordinates

Turbine ID	ITM	
	Easting:	Northing:
Turbine 1 (T1)	559385	675575
Turbine 2 (T2)	559850	676030
Turbine 3 (T3)	560484	675908
Turbine 4 (T4)	561137	675897
Turbine 5 (T5)	560394	676494
Turbine 6 (T6)	561109	676437
Turbine 7 (T7)	561881	676649
Turbine 8 (T8)	562533	676815
Turbine 9 (T9)	561098	676928
Turbine 10 (T10)	561800	677115

Turbine ID	ITM	
	Easting:	Northing:
Turbine 11 (T11)	562539	677308
Turbine 12 (T12)	563149	677146
Turbine 13 (T13)	563650	677042
Turbine 14 (T14)	563431	677641
Turbine 15 (T15)	562982	677858
Turbine 16 (T16)	562556	678103
Turbine 17 (T17)	561903	677741
Turbine 18 (T18)	561234	677472
Turbine 19 (T19)	561435	678011

2.2 GRID CONNECTION

The Carrownagowan Wind Farm will be connected to the existing ESB Networks owned 110kV substation at Ardnacrusha, County Clare which will allow the electrical energy generated from the wind farm to be exported onto the national grid. The full length of the Carrownagowan Wind Farm grid connection route is approximately 25km.

Figure 2.2 Grid Connection Route

3 CONSTRUCTION WORKS

3.1 WIND FARM PROJECT

3.1.1 Overview of Works

The proposed Carrownagowan Wind Farm project includes the following elements:

- 19 No. Wind Turbines (blade tip height up to 169m) with external transformers.
- 19 No. Wind Turbine foundations and Hardstand areas.
- 1 No. Permanent Meteorological Mast (100m height) and associated foundation and hardstand areas.
- 1 No. Substation (110kV) including associated ancillary buildings (electrical building including control, switchgear and metering rooms, and the operational building including welfare facilities, workshop and office).
- Upgraded Site Entrance
- New and upgraded internal site service roads (8.4km of existing tracks to be upgraded and 11.4km of new service roads to be constructed)
- Provision of an on-site Visitor cabin and parking
- Underground electrical collection and SCADA system linking each wind turbine to the on-site project substation.
- Construction of new roadways and localised widening along turbine delivery route
- 2 No. Temporary construction site compounds and additional mobile welfare units
- No. Borrow pits to be used as a source of stone material during construction and for storage of excess excavated peat materials
- 3 No. peat /spoil deposition areas (at borrow pit locations)
- Associated surface water management systems
- Tree felling for wind farm infrastructure

3.1.2 Construction Schedule

The proposed project duration will be of the order of 18 months. The wind farm construction works will be phased as outline in Table 3.1 below. A number of these phases will however run concurrently as follows.

- As the internal site access roads are constructed up to each turbine, hardstand areas for the crane, turbine foundations will be prepared.
- Once the roads are completed, the trenching and laying of underground cables adjacent to the roads will begin.
- Construction of the site substation compound and substation buildings will commence so that they will be ready to export power as turbines are commissioned.
-

Table 3.1 Wind Farm Construction Schedule

Phase	Activity	Duration
Phase 1	Clearfelling (to be complete ahead of construction site mobilisation)	2 -3 months (prior to construction, post consent)
Phase 2	Prepare site, Pre-construction activities, Site entrance, temporary compound	1 month
Phase 3	Access road construction + Drainage plan implementation	5 months
Phase 4	Hard standing construction for turbines	4 months
Phase 5	Turbine Foundation construction	4 months
Phase 5A	Trenching and ducting (underground electrical collection system)	2 months
Phase 6	Substation construction	4 months
Phase 7	Permanent meteorological mast erection	1 month
Phase 8	Turbine delivery	4 months
Phase 9	Turbine erection	4 months
Phase 10	Wind Farm Commissioning	4 months (approx)

3.1.3 Working Hours

Construction is proposed to occur within the following hours:-

- 7.00am – 7.00pm* (Monday – Saturday inclusive)

There will be restrictions between these hours to facilitate the residents and ensure public safety.

* The working day may extend occasionally at times when critical elements of work need to be advanced. Longer working days will occur for concrete pours for turbine bases and for turbine erection works which may spill over into weekends depending on how low wind windows fall.

3.2 GRID CONNECTION

3.2.1 Overview of Works

The grid connection will consist entirely of underground cabling (UGC) with the majority of the UGC to be installed within the public road network. The UGC works will consist of the installation of 5 No. HDPE ducts in an excavated trench to accommodate 3 No. power cables, and 1 No. fibre communications cable to allow communications between the Carrownagowan Wind Farm Substation and Ardnacrusha 110kV substation. The excavated trench will be 1.315m in depth and 0.6m in width with variations to adapt to bridge crossings, service crossings and watercourse crossings. The active construction area will generally be only along a 100-200m stretch of any roadway at any one time.

Further detail is included in Appendix 2-2, the Grid Connection Package, in Volume III of this EIAR.

3.2.2 Construction Schedule

The works for the grid connection route are estimated to take approximately 10 months. During the first 5 months the cable trenches will be constructed. The second 5 months will involve sequentially opening up all joint bays (these are pre-cast concrete chambers that will be required along the grid connection route over its entire length) and pulling electrical cables pulled through ducts and then joining each cable together. There is anticipated to be 35 joint bays with 2-3 days' work involved at each.

3.2.3 Working Hours

Working hours for the grid construction will be 7.00am to 7.00pm Monday to Saturday (if required), with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency.

4 CONSTRUCTION METHODOLOGIES

4.1 WIND FARM

Key elements of the civil works and activities associated with the construction phase of the wind farm development are as follows:

4.1.1 Tree Felling

Felling of commercial conifer forestry is required within and around wind farm infrastructure to accommodate the construction of foundations, hardstands and access roads as well as to facilitate assembly of turbines. It is proposed to fell to a distance of 86m around turbines and 5m on either side of roads. The felling operation, and particularly the transport of the logs off site, has the potential to generate significant amounts of contaminated runoff. This has to be intercepted and treated as part of the site drainage system.

All tree felling will be undertaken in accordance with a tree felling licence, using good working practices as outlined by the Forest Service in their '*Standard for Felling and reforestation Version October 2019* and previous versions such as the Forestry Harvesting and Environmental Guidelines (2000a) and the *'Forestry and Water Quality Guidelines' (2000b)*. The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Any excess trees, brash and minor branch residues will be gathered from the site during the works and taken to the peat deposition areas on site. Replanting requirements will form part of the felling licence application. All conditions associated with a proposed felling licence will be complied with.

4.1.2 Pre-Construction Surveys

Any detailed ground investigations, environmental surveys and archaeological testing required to support the construction process will be carried out and finalised.

4.1.3 Enabling Works

Prior to construction commencing, on site demarcation of the construction site boundary will be undertaken to prevent equipment tracking outside the planning boundary.

4.1.4 Temporary Site Construction Compounds

Two temporary site construction compounds will be set up upon commencement of the construction phase. The 2 no. site compounds will measure approximately 6,930m² in total (100m x 50m and 55m x 25m on plan respectively) as shown on **Planning Drawings 19107-5044 and 19107-5045**. The compounds will be used as a secure storage area for construction materials and also contain temporary site units to provide welfare facilities for site personnel. Facilities will include office space, meeting rooms, canteen area, a drying room and sanitary provisions.

A bunded containment area will be provided within the compounds for the storage of lubricants, oils and site generators etc. If necessary the compounds will be fenced and secured with locked gates,

During the construction phase, a self contained toilet block with a waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor(s) on a regular basis and will be removed from the site on completion of the construction phase.

The compounds will be constructed early in the project in order to provide site offices and accommodation for staff and for the delivery of materials. Any surface water management, bunding, waste management measures will also be put in place at the outset. Site security will be put in place adjacent to the entrance and will have to be maintained throughout all phases of the work.

The compounds will typically be constructed as follows:

1) The areas to be used as the compounds will be marked out at the corners using ranging rods or timber posts.
2) Drainage runs and associated settlement ponds will be installed around the perimeter;
3) The compounds will be established using a similar technique as the construction of the excavated access roads;
4) A layer of geogrid / geotextile will be installed and compacted layers of crushed stone aggregate from the proposed on-site borrow pits will be spread and lightly compacted to provide a hard area for site offices and storage containers;
5) The finished surface will be formed with a layer of Class 6F aggregate imported from local quarries.

Upon completion of the project the compounds will be decommissioned by backfilling the area with the material / peat arising during excavation, landscaping with topsoil as required.

Figure 4.1 Typical temporary site construction compound on a wind farm

4.1.5 Site Access

The Turbine Access Road is via an existing site entrance from the L-8221 Local road and all construction traffic will enter here. A large splay will be required at this existing entrance to facilitate turbine component deliveries. This splay will be coned off to a 10m radius for use by regular construction traffic.

4.1.6 Internal Access Roads

From the site entrance, an internal road network of existing and new tracks will service the infrastructure on site. Following construction, access roads will be maintained to provide long-term access for maintenance of the wind turbines.

The total length of internal access roads required to facilitate the site is 19.8km and is broken down as follows:

- 8.4km of existing tracks to be widened and upgraded,
- 7.4km of new excavated roads to be constructed,
- 4.0km of new floating roads to be constructed.

Typical service road cross-sections are shown on **Planning Drawing 19107-5023**, which includes details of each of the road types.

Widened / Upgraded Roads:

- 150mm thick Class 6F imported limestone capping or similar layer on,
- Minimum 450mm thick site won stone aggregate on,
- Suitable geogrid or geotextile material as required on,
- Existing access track / road build up where suitable.

Excavated Roads:

- Minimum 150mm thick Class 6F imported limestone capping or similar layer on,
- Minimum 450mm thick site won stone aggregate on,
- Suitable geogrid or geotextile material as required where poor ground bearing occurs.

Floating Roads:

- Minimum 150mm thick Class 6F imported limestone capping or similar layer on,
- Minimum 450mm thick site won stone aggregate on,
- Suitable geogrid or geotextile material.

On the approach of access roads to public roads the gradient will be such that runoff from the access roads will not flow out onto the public road. Existing roadside drainage will be piped across the site entrance.

4.1.6.1 Widened and Upgraded Road Construction

Typical road construction and build-up for upgrading and widening existing access roads is as follows:

1) The appointed contractor(s) will survey the area for any unforeseen hazards prior to the commencement of works and set up warning signage as appropriate.
2) The material required for widening and upgrading the existing site roads is proposed to be won from the three proposed on-site borrow pits within the wind farm site. Passing bays will need to be constructed to allow for the safe movement of site traffic along the existing roads. A site traffic management plan will be prepared by the appointed contractor(s).
3) The extraction of stone aggregate from the proposed borrow pits will be undertaken by a 30-60 Ton 360° excavators and loaded onto articulated dumper trucks that will deliver the aggregate to the required road widening / upgrading locations.
4) Widening works will begin with the use of excavators that will first remove any topsoil / vegetative layer which may be present. This material will be transported to an agreed temporary storage area and maintained for re-use during the restoration phase of the wind farm construction. Topsoil / vegetative removal will be kept to a minimum in order to prevent any runoff of silt during heavy rainfall.
5) Excavators will continue to strip and excavate the soft subsoil / peat underneath which will be temporarily stored adjacent to the access roads in accordance with approved methods with the use of an articulated dumper truck. Excavated material will only be temporarily stored on slopes under 5° and to a maximum height of under 1.0m until they are transported to the selected deposition areas where they will be permanently stored.
6) Once a section of the widened access road is exposed to suitable formation; a layer of geogrid or geotextile material may be placed along its formation depending on ground conditions.
7) The stone to be used for the widening works will be delivered to the required work area and spread out locally with the use of excavators on top of the geogrid / geotextile material. This will be compacted with the use of a roller which will roll the stone aggregate in maximum 250mm layers in order to achieve the required design strength.
8) The road upgrading works will involve the use of a roller compacting the site won stone aggregate in maximum 250mm layers laid over the existing road pavement. A layer of geogrid or geotextile material may be placed along the existing road pavement prior to the placement of the stone aggregate in order to achieve the required design strength.
9) All upgraded / widened access roads will be constructed to a minimum drivable width of 5.0m with a maximum crossfall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
10) Roadside drains as per Section 3.7 in Chapter 3 of the EIAR will be constructed to manage clean and dirty water runoff along widened and upgraded access roads.
11) The final running surface of the new widened / upgraded access roads will be capped with a minimum 150mm layer of hard wearing Class 6F stone using a road grader.
12) Any surplus spoil material generated from the road widening works will be transported back to the borrow pits to aid final reinstatement. Excavated topsoil and subsoil will be kept separate at the excavation and storage areas.

13) All excavations to be carried out will be battered back to a safe angle of repose (minimum slope angle of 45°) and comply with the final Construction and Environmental Management Plan (CEMP) to be produced by the appointed contractor(s) for Carrownagowan Wind Farm.
14) Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
15) The appointed contractor(s) will ensure that all on-site personal are aware of environmental constraints / sensitive areas within the wind farm site in which works are to avoid.

Figure 4.2 Typical upgraded forestry road on a wind farm

4.1.6.2 Excavated Road Construction

Typical road construction and build-up for new excavated roads is as follows:

1) The appointed contractor(s) will liaise with the wind turbine supplier prior to the commencement of the works to ensure that the design of the new excavated roads conforms with the wind turbine supplier's specifications.
2) The appointed contractor(s) will survey the area for any unforeseen hazards prior to the commencement of works and set up warning signage as appropriate.
3) Excavators will first remove any topsoil / vegetative layer which may be present. This material will be transported to an agreed temporary storage area and maintained for re-use during the restoration phase of the wind farm construction. Topsoil / vegetative removal will be kept to a minimum in order to prevent any runoff of silt during heavy rainfall.
4) Excavators will continue to strip and excavate the soft subsoil / peat underneath which will be temporarily stored adjacent to the access roads in accordance with approved methods with the use

of an articulated dumper truck. Excavated material will only be temporarily stored on slopes under 5° and to a maximum height of under 1.0m until they are transported to the selected deposition areas where they will be permanently stored.

5) All excavations to be carried out will be battered back to a safe angle of repose (minimum slope angle of 45°) and comply with the final Construction and Environmental Management Plan (CEMP) to be produced by the appointed contractor(s) for Carrownagowan Wind Farm.
6) Once a section of the excavated access road is exposed to suitable formation; a layer of geogrid or geotextile material may be placed along its formation depending on ground conditions which will be covered with site won aggregate stone as required compacted in maximum 250mm layers.
7) The stone aggregate required for the new access roads is proposed to be won from three on-site borrow pits within the wind farm site. The extraction of stone aggregate from the proposed borrow pits will be undertaken by 30-60 Ton 360° excavators and loaded onto articulated dumper trucks that will deliver the stone aggregate to the required excavated access road locations.
8) The stone will be delivered to the required work area and spread out locally with the use of excavators and compacted with the use of a roller which will roll the stone aggregate in maximum 250mm layers on top of the geogrid / geotextile material in order to achieve the required design strength.
9) All new excavated access roads will be constructed to a minimum drivable width of 5.0m with a maximum crossfall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
10) Roadside drains as per Section 3.8 in Chapter 3 of the EIAR will be constructed to manage clean and dirty water runoff along excavated access roads.
11) The final running surface of the new excavated access roads will be capped with a minimum 150mm layer of hard wearing Class 6F stone using a road grader.
12) Any surplus spoil material generated from the excavated access road works will be transported back to the borrow pits to aid final reinstatement. Excavated topsoil and subsoil will be kept separate at the excavation and storage areas.
13) Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
14) The appointed contractor(s) will ensure that on site personal will be aware of environmental constraints / sensitive areas within the wind farm site in which works are to avoid.

Figure 4.3 Typical new excavated road on a wind farm

4.1.6.3 Floating Road Construction

The new floating access roads will be constructed as follows:

1) The appointed contractor(s) will mark out the line of the proposed floated road using a GPS / total station;
2) The intended floating road area is cleared of major protrusions such as rocks, trees, bushes etc down to ground level but residual stumps and roots are left in place.
3) The local surface vegetation and soils are left in place where possible as the existing vegetation and root mat may be the strongest layer in the system and care should be taken to preserve this layer if at all possible.
4) Any local hollows and depressions are filled in with a suitable local lightweight fill such as tree brash, logs, or geogrid / geotextile material with stone aggregate.
5) A formation, 7 to 8m, wide is prepared where a layer of geogrid / geotextile is laid out by hand along the line of the proposed floated road.
6) The specification for geotextiles will be finalised by the design engineer at construction stage but past empirical experience on previous constructed wind farms within Ireland and Scotland has proven the suitability of floated road construction over peat.
7) Where there is a drainage requirement, suitably sized HDPE drainage pipes shall be laid on top of the installed geogrid / geotextile prior to the placement of stone aggregate. Cross drains will be laid at appropriate intervals to maintain the existing drainage regime on the site.
8) The stone aggregate required for the floated access roads is proposed to be won from three proposed on-site borrow pits within the wind farm site. The extraction of stone aggregate from the proposed borrow pits will be undertaken by 30-60 Ton 360° excavators and loaded onto articulated

dumper trucks that will deliver the stone aggregate to the work face of required floated access roads.

9) Wide tracked 360° excavators will be used for constructing the floated roads by cascading a minimum 450mm thickness of site won stone aggregate over the geogrid / geotextile. The suitable site won stone aggregate should be suitably sized in order to achieve a sound interlock with the geogrid / geotextile material. It is common practice for floated road construction on wind farms that the compaction of the stone aggregate is done by the wheels and tracks of construction plant alone.
10) An additional layer of geogrid / geotextile may be placed over the stone aggregate if necessary before a minimum capping layer of 150mm of Class 6F material is laid out with excavators.
11) All floated access roads will be constructed to a minimum drivable width of 5.0m with a maximum crossfall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
12) Roadside drains as per Section 3.7 in Chapter 3 of the EIAR will be constructed to manage clean and dirty water runoff along floated roads.
13) Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
14) To allow for the safe movement of site traffic during the construction of floated roads; a site traffic management plan will be prepared by the appointed contractor(s). Care will be taken when reversing vehicles on floating roads to ensure that they do not run along the edge of the road but stay within the delineated safe running zone.
15) The appointed contractor(s) will ensure that on site personnel will be aware of environmental constraints / sensitive areas within the wind farm site in which works are to avoid.

Figure 4.4 Typical floated road on a wind farm

4.1.7 Site Drainage System

A site drainage system will be constructed on the site so as to attenuate run-off, guard against soil erosion and safeguard downstream water quality. The drainage system will be implemented along all internal site access roads, storage areas, crane hardstand areas and site construction temporary compounds. Details of the proposed site drainage system are given in **Planning Drawings 19107-5013 to 19107-5019.**

The drainage system will be excavated and constructed in conjunction with the road and crane hardstand construction.

The concepts and details pertaining to the drainage are included in the Surface Water Management Plan, which is included in **Appendix 3-2 of Volume III of the EIAR** prepared as part of this planning application.

The following gives an outline of drainage management arrangements:

The surface water run-off drainage system will be implemented along all internal access routes, to separate and collect 'dirty water' run-off from the roadway and to intercept clean over land surface water flows from crossing internal roadways.

To achieve separation, clean water drains will be positioned on the upslope and dirty water drains positioned on the downslope of road sides, with road surfaces sloped towards dirty drains.

Clean water will be piped under both the access roads and downslope collection drains to avoid contamination. Piping the clean water under the service road allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water over land flow pattern of the site and thus not altering the natural existing hydrological regime on site.

Measures addressed in the drainage design include:

- Check dams will be placed at regular intervals, based on slope gradient, along all drains to slow down runoff and to encourage settlement and to reduce scour and ditch erosion.
- Consideration will be given to the use of check dams constructed in accordance with best practice utilising clean stone at points along the drainage channel during the construction phase to further mitigate against any sediment escaping to nearby watercourses.
- Low gradient drains will be provided. These reduce the velocity of flow in the drains, thus reducing soil and subsoil erosion and reducing hydraulic loading to watercourses.
- Where possible existing drains will remain untouched.
- Regular buffered outfalls that consist of numerous small drains off the main drain which end by fanning out into the surrounding vegetation by tapering drains. The drain will contain hardcore material to entrap suspended sediment.
- Drains carrying construction site runoff will be diverted into settlement ponds, which will promote sediment deposition and reduce hydraulic loading by slowing flow velocities allowing sediment to settle. Settlement ponds have been designed in the form of a three stage tiered pond system. The design of the settling pond system for the site is detailed in the **Planning Drawing 19107-5024 to 19107-5025**. These will be maintained by the contractor(s) to the satisfaction of Inland Fisheries Ireland for the entire construction period.

- Flow from the settlement ponds will enter the sediment traps where runoff will be cleaned further by a series of graded gravel filters. Silt traps will require regular inspection and cleaning and removed material will be disposed of at an appropriate location.
- Drainage ditch outfalls from silt traps will discharge at regular intervals to mimic the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points. The drainage ditches will flow onto the existing ground by fanning out onto the surrounding vegetation via tapering drains.
- The access roads will be graded so that all runoff is directed to the dirty water drains. A low mound will be constructed between the road and the clean water drain to ensure that runoff from the road cannot flow into the clean water system.
- No disturbance will be permitted to the natural vegetative buffer. They can be fenced where necessary.

Best practice and practical experience on other similar projects suggests that in addition to the above outlined drainage plans there are additional site based decisions and plans that can only be made in the field through interaction between the Site Construction Manager, the Project Hydrologist and the Project Geotechnical Engineers. In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures outlined above and to ensure protection of all watercourses.

4.1.8 Watercourse / Drainage Crossings

On the wind farm site, a number of watercourse crossings will be required, detailed as follows:

- 7 new natural river / stream crossings;
- 6 existing natural stream / drain crossings to be widened or upgraded;

See **Planning Drawing 19107-5014 to 1910-5019** for locations, **Planning Drawings 19107-5025 to 19107-5026** for typical details and Surface Water Management Plan, which is included in **Appendix 3-2 of Volume III of the EIAR** for further information on proposed drainage measures.

Where the crossing of an existing natural or artificial drainage / stream channel is unavoidable, a suitable crossing will be implemented. Typically this will be in the form of precast concrete or HDPE pipes. All crossings will cater for a minimum 1 in 200 year return rainfall event. The invert of the pipe is submerged approx $^1/_4$ of its diameter below the original drainage bed. Where natural gradients allow, a nominal back fall in the pipe will be incorporated to prevent scour and promote the settling of natural material along the invert of the pipe. An example of a permanent drain crossing is illustrated in Figure 4.5 below. New turbine service roads will be required to cross several minor drains / streams within the site. All such crossings and widening will be agreed with Inland Fisheries Ireland prior to construction. All construction method statements for crossings will be approved by Inland Fisheries Ireland.

Figure 4.5 Typical drainage channel crossing

On Carrownagowan Wind Farm is it proposed that major watercourses will be crossed using clear span pre-cast concrete culvert crossings such as a bottomless arch or bottomless box culvert. In general the major watercourses within the wind farm site, such as the Carrownagowan, Coumnagun and Inchalughoge rivers, are cut into relatively deep channels. These channels will require significant upfill to maintain vertical alignment criteria for turbine deliveries along access roads. Clear span pre-cast concrete culverts are advantageous in several manners for this type of installation. As spans increase the height can increase accordingly allowing significant light penetration under the culvert. The increase in height is complimentary to the vertical alignment requirements for access road design.

The selection criteria for crossing natural streams and rivers within the site were:

1. Avoid crossing streams or rivers at acute angles;
2. Avoid meanders at the crossing location;
3. Cross where foundations could be constructed without excess excavation;
4. Consider vertical alignment requirements;

The design of a clear span pre-cast concrete culvert crossings will ensure that:

1. The existing channel profile within the watercourse is maintained;
2. Gradients within the watercourse are not altered;
3. There is unrestricted passage for all size classes of fish by retaining the natural watercourse stream / river bed;
4. There are no blockages within the watercourse. The large size of a clear span culvert allows for the passage of debris in the event of flood flow conditions;
5. The watercourse velocity is not changed;

6. The clear span of a culvert will ensure that the existing stream / river bank is maintained during construction which will in turn avoid the occurrence of in-stream works;

Construction of the four clear span crossings will be supervised by the Construction Manager, a suitably qualified engineer, the project manager and the Environmental Manager in accordance with Inland Fisheries Ireland *"Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters, 2016"* and Office of Public Works *"Construction, Replacement or Alteration of Bridges and Culverts, 2013"*.

The proposed installation works for a clear span pre-cast concrete culvert will comprise the following:

1) Prior to the commencement of works the design of the culvert will be submitted for approval to the Office of Public Works (OPW) under Section 50 of the Arterial Drainage Act, 1945 and to Inland Fisheries Ireland (IFI);
2) Upon design approval the extent of the excavations required for the culvert foundations at either side of the watercourse will be marked out. The foundations are to be set to an agreed minimum distance by IFI from the existing watercourse so as not to impact on the riparian habitat. Health and safety measures such as lifebuoys on stakes will be installed and where appropriate life jackets will be provided to persons working near the watercourse;
3) Appropriate environmental control measures such as silt curtains, silt traps and mats will be erected on both sides of the watercourse. These environmental control measures will reduce the potential for sedimentation of the watercourse;
4) Excavators will begin to excavate the foundations to formation level where all excavations will be battered back to a safe angle of repose (minimum slope angle of 45°) and comply with the final Construction and Environmental Management Plan (CEMP) to be produced by the appointed contractor(s) for Carrownagowan Wind Farm. All excavation works will stop in the event of heavy rainfall.
5) All excavated material will be transported to the on-site deposition areas located outside of the 75m hydrology buffer zone at the proposed borrow pits. Some of the excavated material will subsequently be reused as backfill around the culvert abutments and structure upon installation. Bare ground will be minimised.
6) Once formation is reached at suitable ground conditions; steel reinforcement and shuttering will be installed. The culvert abutments will be prepared for the pouring of concrete by dewatering standing water within the excavations, which is likely to contain suspended solids, via a pump to an adequately sized settlement pond located outside of the 75m hydrology buffer zone. The standing water will be treated through the settlement pond and clean filtration stone prior to outfall over vegetation away from the watercourse;
7) Ready-mix concrete will be delivered to the culvert abutments by a ready-mix concrete truck and placed into each abutment by means of an excavator. Upon completion the abutments will be covered and allowed to cure;
8) Following curing, the shuttering around the abutments will be struck and removed. A small temporary hardstand will be constructed so that a lifting crane, which will install the pre-cast concrete culvert components onto the abutments, can be set up;
9) Deliveries of the pre-cast concrete culvert components will arrive to site. These components will be individually fitted and manoeuvred into position by the lifting crane onto the concrete abutments. The components will be inspected to ensure that each unit is level and secure;
10) Backfilling on either side of the culvert will commence in accordance with the culvert supplier's specifications using excavated material;

11) The access road surface will be laid over the culvert structure using site won stone aggregate and compacted in maximum 250mm layers with the use of 10-20 Ton roller. An internal cable trench will be installed within the carriageway of the culvert so that it can cross over the watercourse;
12) Vegetated soil bunds, as per Section 3.8.3.9.1 in Chapter 3 of the EIAR, will be installed to divert dirty water generated on the section of road over the culvert crossing into the dirty water system outside of the 75m hydrology buffer zone. This will ensure that dirty water will not enter the clean watercourse;
13) Steel parapet railings and timber post and rail fencing will be installed at the sides and on the approaches to the culvert. This will prevent persons or vehicles falling into the watercourse while travelling across the culvert;

Figure 4.6 Typical clear span pre-cast concrete units in place over an existing watercourse

Figure 4.7 Completed clear span pre-cast concrete culvert crossing over existing watercourse

4.1.9 Traffic Management

The majority of material required for the construction of the roads, crane hardstands and the substation compound will come from stone aggregate extracted from three proposed on-site borrow pits. Material to be delivered to site will only consist of material for the capping of roads and hardstands, and reinforced concrete for the construction of the 19 no. turbine bases. It is anticipated that a succession of 20T and/or 8m³ trucks will transport the material at a peak frequency of 8 to 12 trucks/hour. Peaks in construction traffic are typically associated with the pouring of turbine foundations. Specialist vehicles will be used for the delivery of the wind turbine components and substation transformers.

During the construction of the grid connection route, deliveries of quarry and building materials to site will be made. All deliveries are expected to be on flatbed trucks (whether 40ft or smaller depending on size of deliveries) or concrete wagons. Materials such as aggregates and concrete will be sourced locally. Heavy vehicles would typically arrive and depart at a uniform rate throughout the day. The proposed grid connection route site would operate for 12 hours per day during the construction period. However, hours of operation will be limited for HGV movements in order to allow for residents to avoid non-coinciding commuting during the morning and evening peak hours, in particular during local school start and finish times. Therefore the proposed works would permit heavy vehicle movements access for approximately 10 hours per day during the construction period. It is anticipated that a succession of 8m³ or 10m³ trucks will transport the material at a peak frequency of 3 trucks/hour.

The vast majority of construction deliveries for the wind farm site, including all specialist delivery vehicles will be via the R465 Regional road. The scale of the grid connection route will require deliveries to access various locations where the grid connection is to be constructed along the public roads. It is envisaged that deliveries will use the R465 and R466 Regional roads to access the northern section of the cable route and use the R466 and R471 Regional roads to access the southern section (See Figure 4.8).

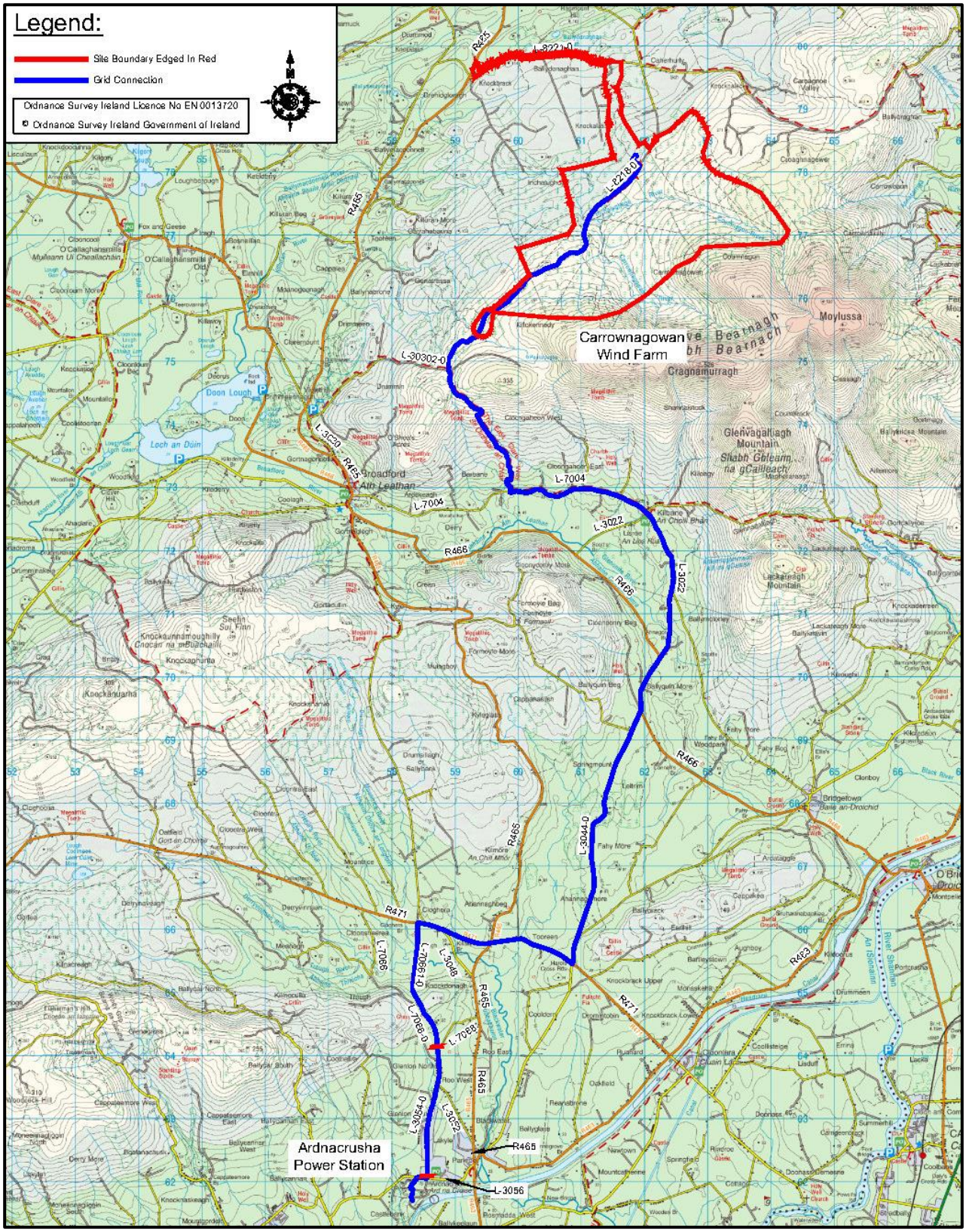


Figure 4.8 Route Access Map of Site and Grid

4.1.10 Peat / Excavated Material Deposition Areas

It has been calculated that there will be approximately 280,550m^3 of material excavated during the construction of Carrownagowan Wind Farm. Of this, an estimated 140,775m^3 will be peat and 139,775m^3 will be spoil. Excavated peat, estimated at 68,370m^3, and spoil, estimated at 19,894m^3 will be reused for the backfilling, landscaping and restoration around wind farm infrastructure such as turbines and hardstands. Peat will be deposited only within the buildable areas around the turbines to a maximum height of 0.3m and will not impact on any of the constrained areas as defined at the preliminary stages of the design process.

Berms will be formed along sections of floated access roads in order to store an additional volume of 9,713m^3 of excavated peat. These berms will also act as a physical edge protection measure to prevent vehicles falling off the raised floated road edge. This form of storage will be provided on both sides of the internal floated roads where the overall dimensions of the berms will be 1m high by 2.5m wide.

The remainder of the surplus excavated peat and spoil material, estimated at 114,083m^3 will be stored within the 3 no. deposition areas at the proposed on-site borrow pits. The borrow pits will be filled with peat in a continuous cycle once sections of rock have been extracted. This will allow trucks to transport stone material from the borrow pits to the work faces and return laden with peat to deposit in the extracted section of the pits. An engineered retaining rockfill berm will be formed on the perimeter of each borrow pit. Construction of the initial outside retaining berm will take place using the 'excavate and replace' methodology with the excavated peat being side cast to the inner edge of the berm footprint. The deposited peat will be bound in cells and landscaped at a nominal fall in order to maintain the existing rainfall catchment regimes. Additionally storage will be provided for peat that is stripped at the borrow pit locations and any remaining peat which cannot be stored within the borrow pit areas.

Construction details of the peat deposition areas are included in **Planning Drawing 19107-5029 to 19107-5031**.

4.1.11 Turbine Hardstands

The layout of the crane hardstand is designed to accommodate the delivery of the turbine components prior to their erection and to support the cranes during erection. Hardstands are also used for maintenance during the operation of the turbine. The hardstands will be rectangular in shape with additional minor hardstand fingers to lay the turbine blades across once delivered. The area of a single hardstand is approximately 40m long by 35m wide. Refer to **Planning Drawing 19107-5021** for further details. Due to the significant loads that will be imposed by the outriggers of the main lifting crane during the erection process for the installation of the wind turbines on site; it is intended that the proposed crane hardstands will be constructed using excavation methods over the footprint of the hardstand area / turbine base.

1) Each crane hardstand will be formed on competent subgrade of the underlying subsoil / rock which will comprise of site won stone aggregate, obtained from the on-site borrow pits, laid on a geotextile filter membrane.
2) The stone aggregate will be compacted in 250mm layers and will vary from approximately 300mm to 900mm deep depending on the depth of peat and gradient of the underlying subgrade. Turbine locations have been selected to minimise the impact on peat which will minimise the volumes of peat needed to be excavated at each crane hardstand.
3) Temporary set down areas will be formed to facilitate the storage of the turbine components at each crane hardstand (e.g. the rotor hub assembly, the turbine blades, the turbine towers and nacelle). Each temporary set down area will be constructed using compacted stone aggregate which will be fully removed and reinstated after all turbines have been erected.
4) Plate bearing test results will be undertaken on the finished hardstand surface to check if ground bearing strengths are to the wind supplier's specifications. Once complete the main assembly crane will be set up on the hardstand and erect the wind turbine.

Figure 4.9 Typical finished hardstand on a wind farm

4.1.12 Turbine Bases

For the 19 no. wind turbines that are proposed to be constructed each turbine will have a reinforced concrete base pad foundation with a central pedestal above the base that will in turn support the wind turbine tower. Each turbine base will bear onto rock or other such suitable bearing stratum. Wind turbine bases will be constructed utilising a spread foundation, which is wide and shallow. A typical foundation will be approximately 24m in diameter and will generally be installed to a depth of approximately 3.0m below grade. Approximately 700m^3 of concrete and 100 tonnes of steel will be used in the construction of each turbine base. The final dimensions of the wind turbine bases will be determined as part of detailed engineering design at construction stage following confirmation of the turbine supplier and from using detailed geotechnical data that will be conducted at each turbine location. Refer to **Planning Drawing 19107-5021** for further details.

The proposed works will be restricted to the turbine locations and will comprise the following:

1) 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.
2) Any existing peat found within the footprint of the turbine base will be excavated out during the course of formation works at the adjacent crane hardstand area. The excavation works will be carried out using hydraulic excavators where surplus peat / subsoil material will be transported to the on-site deposition areas via articulated dumper trucks or tractor and trailer for subsequent reuse in the permanent reinstatement of the borrow pits.
3) Standing water in turbine base excavations is likely to contain an increased concentration of suspended solids. Dewatering of turbine base excavations can result in significant flow rates to the drainage and settlement system if high capacity pumps are used. In order to avoid the need for pumping it is proposed to provide drainage channels from the excavations so as to prevent a build-up of water. Where this is not feasible, temporary storage will be provided within the excavations and dewatering carried out at a flow rate that is within the capacity of the settlement ponds.
4) The excavated surface will be levelled and adequate drainage measures will be put in place along with suitable set back areas to facilitate placing of stone and ultimately the erection of shuttering for the turbine base.
5) In the event that poor ground conditions are encountered during excavation and a significant depth to sub-formation is required, a piled foundation may be considered. A piled foundation requires the use of a piling machine equipped with an auger drill to bore a number of holes around the area of the turbine base to a sub-formation depth determined at construction stage. Once all the holes have being bored, reinforcement steel is inserted into each hole with concrete poured afterwards.
6) Suitable stone aggregate will be used to form a solid level working foundation surface. The stone will be rolled and compacted to a suitable formation level;
7) Shutters and steel reinforcement will be then be put in place and the foundation of the turbine will be prepared for pouring of concrete.
8) 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. 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;
9) High tensile steel reinforcement will be fixed in accordance with the designer's drawings and schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools;

10) Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required;
11) 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 the turbine supplier for their approval;
12) Ready-mix concrete will be delivered to each turbine base by a fleet of ready-mix concrete trucks via the internal access roads. Concrete will placed into each base by means of a concrete pump where vibrating pokers will be used to ensure that full and proper compaction of the concrete around the reinforcement in the turbine base has been made. Upon completion of the concreting works the foundation base will be covered and allowed to cure;
13) Steel shutters will be used to pour the circular chimney section;
14) Following curing, the shuttering around the turbine base will be struck and removed;
15) Earth wires will be placed around the base; and,
16) The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the vegetated soil set aside during the excavation. A gravel footpath will be formed from the access track to the turbine door and around the turbine for maintenance.

Prior to works commencing a traffic management plan will be prepared by the appointed contractor(s) and agreed with Clare County Council. A traffic management plan is included in **Appendix 3-4 of Volume III of the EIAR.**

Figure 4.10 Typical construction of a wind turbine base

4.1.13 Internal Site Cables

A network of underground cabling serving each turbine with electrical power and signal transmission will be installed within the site. The distribution system will electrically connect the wind turbines to the substation compound by underground electrical cables along the internal access roads. Cable jointing bays will be required to allow cables to be joined from the turbines to the substation compound.

Cabling on site is likely to consist of single or twin cable trenches for open ground sections and for trenches within internal access roads. A cable marker post will typically be installed on top in order to protect and identify the cable trench underneath. The typical build up for the internal site cable trenches will consist of selected excavated backfill on top of bedding material that will be specified by the electrical designer at construction stage. The minimum cover depth over the ducts will be 750mm which is measured from the top of the cable duct to existing ground level. Where ducting is within internal access roads; the cable trench will be backfilled with lean-mix concrete in order to protect ducting from being damaged by heavy axle loads that will pass above. The excavated material generated from the trenches will be reused as backfill where possible or else it will be deposited within the proposed on-site borrow pits following their reinstatement.

Where an open drain or watercourse is encountered during the installation of the internal site cable trenches; the cable trenches will cross the open drain or watercourse within the road carriageway via new or existing road crossings points to ensure that no in-stream works occur. Marker tapes of non-corrodible material in bright red and yellow colour will be placed within the trench after backfilling for identification and safety purposes in accordance with ESB Networks guidelines (esbnetworks.ie). An earth berm may be placed over the cable trench with a marker post installed on top in a secure and robust manner so as to prevent the post from being damaged by animals or prevailing ground conditions. Cable marker posts will either be made of concrete, recycled plastic or timber material. Each marker post will contain appropriately worded warning signage highlighting to persons the presence of high voltage electricity cables underneath.

4.1.14 Substation Compound and Buildings

The development is proposed to include a substation compound within the proposed development lands. The substation compound will contain two buildings, connection points and associated equipment, incoming and outgoing circuit breakers, earth fault, over-current and other protection devices, metering equipment and other items of switchgear for exporting power from the wind farm via a grid connection to the ESB Networks owned 110kV substation at Ardnacrusha, County Clare.

The substation compound will be accessed via the existing / proposed internal access roads which will serve the wind farm turbines. The compound will consist of two sections, one for the Transmission System Operator (TSO), which is EirGrid, and one for the Independent Power Producer (IPP), which is Coillte. The TSO section comprises of an EirGrid substation building, external electrical equipment and a hardstand area while the IPP section will comprise of an IPP substation building, external electrical gear (such as a transformer) and a similar hardstand area.

The EirGrid substation building within the TSO section of the compound will be made up of a control room, a battery room, a generator room, a store room, a messroom and a toilet. The EirGrid substation building will be 440m^2 in area. The IPP substation building within the IPP section of the compound will be made up

of a store room, a communications room, a control room, a staff room, an office, a switchgear room and a toilet. The IPP substation building will be 195m^2 in area.

The external doors for both buildings will be flat steel with a three-point locking system and wind restraints. The floors of each building will consist of a concrete slab with ducts to house electrical cabling. Each building will have a dark coloured, pitched tile roof with a plastered external finish that may be painted to an agreed colour to minimise visual impact. The discharge from the toilet within each building will go to a holding tank located within the substation compound where the effluent will be temporarily stored and removed at regular intervals. Parking for each building will be located within the compound area.

The daily average wastewater production during the operational phase is estimated from the average number of workers on site, which is expected to be a maximum of two workers, resulting in a typical wastewater production rate of 60 litres per day. The wastewater generated during the operational phase will be managed by a holding tank which is of twin-hull design and fitted with an alarm to indicate levels and when it is due for empty. The holding tank will be emptied by a permitted contractor only.

The substation compound will be surrounded by a hardstand area for storage and parking etc. covering an area of approximately 2.1 hectares. The substation compound and buildings will be contained within a 2.6m high galvanised steel palisade fencing. Access to the fenced off compound shall be through similar styled palisade double gates. No additional landscaping is proposed. Layout drawings of the proposed substation compound and associated buildings are provided in the planning drawings accompanying this planning application (see **Planning Drawings 19107-5049 to 19107-5053**).

The substation compound as well as the two substation buildings will be constructed by the following methodology:

1) Prior to construction, interception ditches will be installed upslope of the proposed substation compound to intercept any existing overland flows (clean water) and convey it downslope in order to limit the extent of surface water coming into contact with the works. The clean water conveyed will be discharged via a level spreader downslope of the works over existing vegetation.
2) The area of the substation compound will be marked out using ranging rods or wooden posts and the soil stripped and removed to a temporary storage area for later use in landscaping. All remaining excavated material will be brought to the on-site borrow pits for final deposition. The area will be surveyed and all existing services will be identified. All plant operators and general operatives will be inducted and informed as to the location of any services.
3) Perimeter drains will be installed or upgraded to collect surface water run-off from the substation compound which will include the installation of check dams, silt traps and level spreaders to cater for surface run-off.
4) All soils/peat on the substation site will be removed and replaced with site won compacted crushed rock or granular fill;
5) Formation of the substation compound will be achieved where the compound will be constructed with compacted layers of suitable hardcore;
6) The foundations for both substation buildings will be excavated down to the level indicated by the designer and appropriately shuttered. Reinforced concrete will be laid over it.
7) The blockwork walls for each building 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;

8) 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 two buildings for this operation;
9) The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
10) The construction and components of the substation buildings will be to EirGrid and ESB Networks specifications;
11) The timber roof trusses at each building will then be lifted into position using a telescopic loader or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
12) Installation of a domestic wastewater holding tank to hold effluent from the toilets within in the substation and control buildings.
13) Installation of a Class 1 full retention oil separator to collect and treat oil spills within the substation compound.
14) Installation of a rainwater harvesting tank to collect rainwater from the roofs of the substation buildings for toilet flushing and hand washing.
15) Commencement of civil works associated with the construction of the transformer bund, equipment plinths etc. within the substation compound.
16) Commencement of civil works associated with construction of underground cable ducts and trenches within the substation compound.
17) Installation of electrical equipment within the substation compound and buildings including transformers, busbars, circuit breakers, cable supports, switchgear, panels etc. and all associated cabling.
18) Installation of palisade fencing and associated gates to perimeter of the substation compound.

Figure 4.11 Typical substation building and compound

4.1.15 Meteorological Mast

A permanent meteorological mast is proposed for the site to monitor the wind regime while the wind farm is in operation. The mast will be located adjacent to the turbine access road at T19 and is situated in an area of low surface gradient and negligible peat stability risk. The meteorological mast will be installed to a height of up to 100m which will be representative of the hub height of the turbines. The meteorological mast will be surrounded by a galvanised steel palisade fence, 2.4m in height. Details of the meteorological mast are shown in **Planning Drawing 19107-5022**. Excavated material will be used for backfill/adjacent landscaping or will be relocated to the 3 no. deposition areas.

Figure 4.12 Typical meteorological mast on a wind farm

4.1.16 Visitor Building

Upon completion of the wind farm development it is proposed to install a prefabricated modular timber building within the compound of Temporary Site Construction Compound No. 2. This building will function as a learning hub where it will host workshops for school groups and members of the public and also act as a base for guided tours of the wind farm during its operation. The building will be 86m² in area and will accommodate a classroom and toilet facilities for up to 30 visitors.

The prefabricated building will have a flat roof with a modular external timber surface. The foundation of the building will consist of a concrete slab while access to the building will be made via concrete / timber stairs or ramps. The temporary site construction compound at this location will be repurposed for use as a car park and surrounded by a 2.6m high galvanised steel palisade fence with planted screening. There will be a very small water requirement for toilet flushing and hand washing and therefore it is proposed to harvest water from the roof of the building. The discharge from the toilet within the building will go to a holding tank located within the compound where the effluent will be temporarily stored and removed at regular intervals.

Details of the visitor building and compound are shown in **Planning Drawing 19107-5047**.

Figure 4.13 Typical prefabricated modular timber building

4.1.17 Turbine Delivery

The components for the 19 no. turbines will be delivered by cargo ships to either Foynes Port in County Limerick or Galway Port. The components for each turbine will be delivered in separate loads, some of which are abnormal in terms of their width and length. The components will be transported from either Foynes Port or Galway Port to the site along the motorway, national, regional and local road network.

Pre and post-construction surveys will be carried out to ensure the structural integrity of the selected haulage route. Repairs will be carried out on the public road network, as necessary, during the construction phase, to ensure that the condition does not deteriorate below a standard that could affect the use of the road, as required. Following completion of construction, the condition of the public road network will be of at least the same standard as it was prior to commencement of construction.

A permit for moving abnormal loads to the wind farm site will be sought from An Garda Síochána and the applicable local authorities on the selected haulage route with a transportation plan for the time of deliveries established at construction stage.

Refer to **Appendix 3-7 of Volume III of the EIAR** for a detailed description of the proposed turbine delivery routes from both Galway and Foynes and transport assessment.

The road route for starting at Galway Port, which is shown on **Planning Drawing 19107-5056**, is as follows:

- Starting at Galway Port;
- Lough Atalia Road to the R339 Regional road (Wellbrook Road);
- Wellbrook Road to the R336 Regional road (Tuam Road);
- Tuam Road to the N6 National Primary road (Bóthar na dTreabh);
- Bóthar na dTreabh to the M6 Motorway;
- M6 Motorway to the M6 / M18 Motorway interchange;
- M6 / M18 Motorway interchange to Junction 18 on the M18 Motorway;
- Junction 18 on the M18 Motorway to Coolready on the R352 Regional road;
- Coolready to the Junction of the R465 Regional road / L-8221 Local road;
- L-8221 Local road to the site entrance.

Alternatively the road route for starting at Foynes Port, which is shown on **Planning Drawing 19107-5056**, is as follows:

- Starting at Foynes Port;
- N69 National Secondary road to Junction 2 on the N18 National Primary road;
- Junction 2 on the N18 National Primary road to Junction 18 on the M18 Motorway;
- Junction 18 on the M18 Motorway to Coolready on the R352 Regional road;
- Coolready to the Junction of the R465 Regional road / L-8221 Local road;
- L-8221 Local road to the site entrance.

The Limerick Tunnel on the N18 National Primary road has a height clearance of 4.65m and will accommodate the turbine blades and the upper tower sections on the route above. However, it may not be high enough for the bottom tower sections or the nacelles for the turbine types envisaged on this project. Therefore these turbine components will travel as follows:

- Starting at Foynes Port;
- N69 National Secondary road to Junction 2 on the N18 National Primary road;
- Junction 2 on the N18 National road to Shannon Bridge on the R510 Regional road;
- Shannon Bridge to the Roundabout on the R527 and R857 Regional roads;
- R857 Regional road to Junction 4 on the N18 National Primary road;
- Junction 4 on the N18 National Primary road to Junction 18 on the M18 Motorway;
- Junction 18 on the M18 Motorway to Coolready on the R352 Regional road;
- Coolready to the Junction of the R465 Regional road / L-8221 Local road;
- L-8221 Local road to the site entrance.

As part of the design process a number of options were examined for access to the site during the construction phase of the wind farm. There is no requirement for any road or junction widening from either Foynes Port or Galway Port to Junction 18 on the M18 Motorway. However an existing 90 degree bend along the R352 Regional road at Coolready is unsuitable for transporting turbine blades and therefore third party land will be required to facilitate widening on the northern side of the bend as shown in **Planning Drawings 19107-5057**. The junction of the R352 and R465 Regional roads in Bodyke village is also not suitable for turbine delivery nor are deliveries feasible at the preceding bend on the R352 Regional road. Consequently, a new section of access road measuring 0.5km in length is required through third party land to the south of Bodyke at Coolready and Ballydonaghan in order to access the R465 Regional road from the R352 Regional road. The proposed delivery works are shown in **Planning Drawings 19107-5058**

Additionally, the existing junction of the R465 Regional road and L-8221 Local road at Drummod is bound on two sides by private houses and will also require a new section of access road measuring 0.2km in length through third party lands for turbine deliveries to successfully turn onto the L-8221 Local road from the R456 Regional road. There are agreements in place between the developer and the landowners for the third party lands required for these works. All works will be constructed with imported 150mm of Class 804 or similar aggregate on imported 450mm Class 6F material and geogrid where necessary. Following the completion of the project, these delivery areas will remain permanent and will be cordoned off from the Regional and Local roads they bound. In the event that a turbine component requires replacement during the operation of the wind farm, the delivery access roads will be reused for transporting these components again. All material generated from the excavation works at these areas will be reused where possible or will be brought to an authorised waste facility. The proposed delivery works are shown in **Planning Drawings 19107-5059**.

The L-8221 Local road from its junction with the R465 Regional road to Caherhurly has a paved width of between 3.0m to 3.5m between there and the site entrance. This will require widening to 5.0m to facilitate delivery of turbine components but extra width may be required if roadside drainage is to be provided. This section of road will be strengthened with a minimum 150mm of Clause 804 aggregate on geogrid and surfaced to the agreement of Clare County Council. It is recommended that a reinforced concrete slab be installed above each of the identified structures along the L-8221 Local road to ensure that they have sufficient structural capacity to cater for the delivery of abnormal loads to the wind farm. The Assessment of Existing Structures along the L-8221 Local Road, which is included in **Appendix 3-8 of Volume III of the EIAR,** details this assessment further**.**

The existing site entrance to the wind farm on the L-8221 Local road will require widening on its eastern side to allow the long turbine component loads turn south at this point. The widened area of the junction

will be cordoned off to a radius of 10m for normal traffic and the space will only be made available specifically for turbine delivery. Following completion of the project the widened area will remain in place by cordoning off the area with a permanent fence installed to a 10m junction radius. This area will only be made available for any replacement turbine component deliveries. The position of this permanent fence will be consistent with the junction sight distance requirements as outlined Chapter 3 of the EIAR. The design of the widened junction for the turning movement of the longest load, which is the turbine blade truck, has been verified using swept path analysis software.

There is already a substantial network of existing access roads within the Coillte site. One of these roads includes the L-8218 Local road which will be utilised in providing access to the western side of the site. The L-8218 will be widened to a drivable width of 5.0m over a length of 0.7km. This section of road will be strengthened with a minimum 150mm of Clause 804 aggregate on geogrid and surfaced to the agreement of Clare County Council. Two new junctions will be constructed on the L-8218 Local road so that access can be provided from the main site entrance on the L-8221 Local road to the wind farm. Each of the two new junctions will have widened splays on their western side in order for turbine deliveries to turn and manoeuvre successfully. Following completion of the project these widened splays will be cordoned off to a radius of 10m for normal traffic and the space will only be made available specifically for replacement turbine component deliveries.

The majority of the turbine delivery route will follow Motorway, National Primary and Regional roads as described. As such, it is not anticipated that any significant widening or strengthening of roads will be required along the transport routes apart from the works described above. There may be a requirement, pending final confirmation of the transport delivery configuration at construction stage, for the temporary removal of road signage and/or temporary widening of grass road verges in order to cater for the swept path of these abnormal delivery vehicles. The developer will consult with the Road / Area Engineers of the relevant local authorities to temporarily remove any road signage and provide temporary grass verge widening where this may be required.

4.1.18 Turbine Erection

The erection of turbines will occur in the last month of the construction phase. The erection of turbines is typically phased at an average of one turbine erected per week. The erection of turbines is a specialist process with specially designed large scale cranes required to erect the turbine components. The cranes themselves have to be built up on site at the turbine hardstand location and will have to be dismantled substantially before progressing to the next turbine base location for erection of the next turbine.

Components can be placed on hardstands prior to assembly. Large cranes will be required for erecting the turbines, supported by smaller assist cranes. The tower of the turbine is erected first followed by the nacelle. Once the nacelle is in place, the blades are then assembled on the ground and fitted to the hub. The hub with blades attached is then lifted into place on the nacelle. The turbine erection process is a carefully managed and precision operation and is heavily dependent on specialist plant and good weather windows. Once the turbine is in place, electrical commissioning and final energisation follows.

The Project Manager for the site will notify Clare County Council and the Irish Aviation Authority (IAA) at least 30 days prior to erection of the wind turbines.

After the turbines have been put in place, the project manager is to provide confirmation of the coordinates of the as constructed positions of the turbines and the highest point of the turbines to the top of blade spin to the IAA.

4.1.19 Wind Farm Commissioning

The final stage of the project construction includes commissioning of the wind farm. It will include testing of the turbines for compliance with standards and for compliance with the National Electricity Grid Code. Once the tests results are satisfactory, the wind farm will be authorised by ESB Networks / EirGrid to export electricity onto the national grid.

4.2 GRID CONNECTION

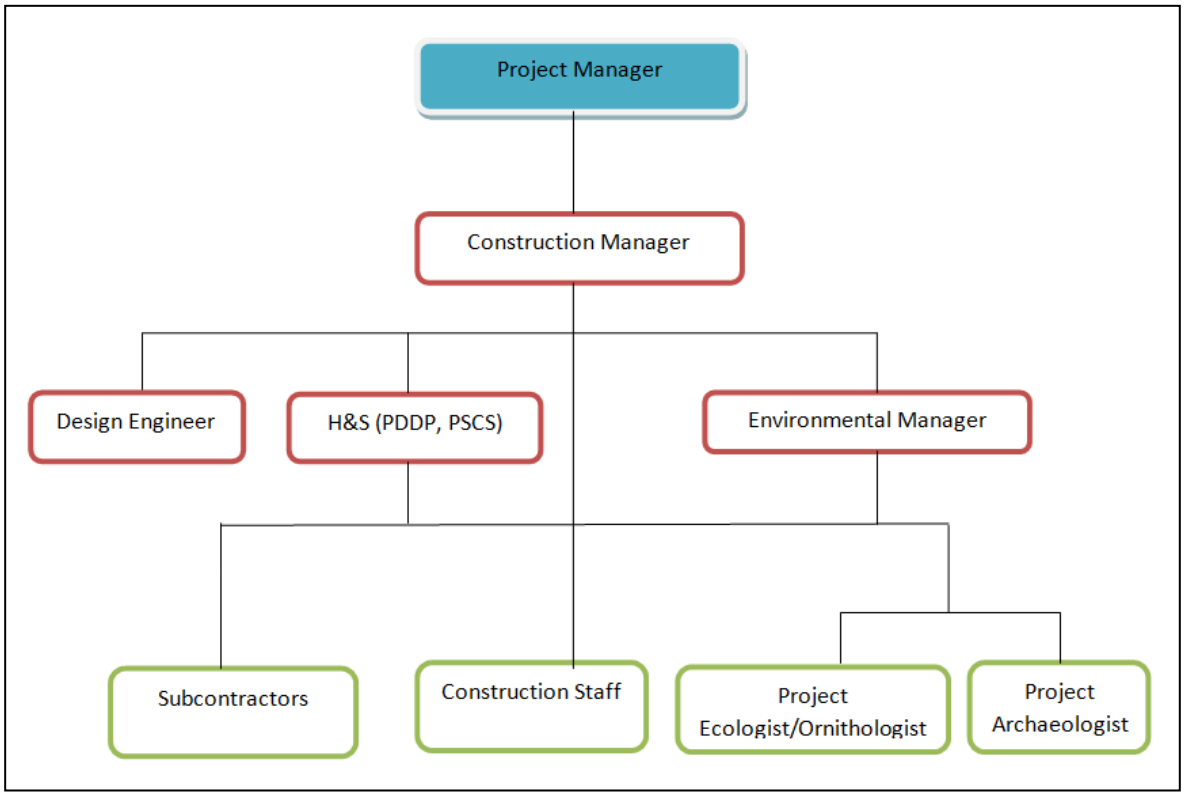
The construction techniques and methodologies which will be implemented during construction of the proposed Carrownagowan Wind Farm 110kV grid connection to the existing ESB Ardnacrusha 110kV substation are fully detailed in Appendix 2 of this CEMP and also included in the grid package in Volume III, Appendix 2-2 of the EIAR. The construction methodology presents detail on the underground cable construction and the methods for stream crossings.

5 CONSTRUCTION & ENVIRONMENTAL MANAGEMENT - ORGANISATIONAL STRUCTURE, DUTIES & RESPONSIBILITIES

5.1 ON SITE ORGANISATIONAL STRUCTURE AND RESPONSIBILITY

An example of an Organisational Structure for the Appointed Contractor(s)'s Project Team is included below. This structure will be defined by the Appointed Contractor(s) and will include the names of the assigned personnel with the appropriate responsibility and reporting structure reflected.

The Appointed Contractor(s) will be *required to finalise the Organisational Structure* for the project to oversee this CEMP and to outline the specific responsibilities for the roles required.



5.2 DUTIES AND RESPONSIBILITIES

The general role of key people on site implementing the CEMP will be;

- The Project Manager - liaises with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main contractor(s)'s project team.
- The Construction Manager - liaises with the Environmental Manager when preparing site works where there is a risk of environmental damage and manages the construction personnel and general works.
- The Design Engineer - undertakes and certifies the Design and supervises the standard of works, including geotechnical aspects (Geotechnical engineer may need to be consulted).
- The Environmental Manager - ensures that the CEMP is developed, implemented and maintained.

Other roles will be outlined as follows;

- Health and Safety (PSDP and PSCS)
- Project Archaeologist (report to the Environmental Manager)
- Project Ecologist / Ornithologist (report to the Environmental Manager)
- Geotechnical Engineer (as required by Design Engineer)

The roles and responsibilities outlined below are indicative and will be updated on the appointment of the main contractor(s). Details of the personnel and their responsibilities must be added to the CEMP. *An outline of potential roles is provided below but will require revision.*

5.2.1 Project Manager – To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: _____

A Project Manager is to be appointed on behalf of the main Contractor(s) to manage and oversee the entire project. The Project Manager is responsible for:

- implementing of the Construction and Environmental Management Plan (CEMP)
- implementing the Health and Safety Plan
- management of the construction project
- liaison with the client/developer
- liaison with the Project Team
- assigning duties and responsibilities in relation to the CEMP
- production of construction schedule
- materials procurement
- maintaining a site project diary

5.2.2 Construction Manager – To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: _____

The Construction Manager manages all the works to construct the project, on behalf of the main contractor(s). The Construction Manager reports to the Project Manager. In relation to the CEMP, the Construction Manager is responsible for:

5.2.2.1 Site-Specific Method Statements

- Liaising with the Environmental Manager in preparing site-specific Method Statements for all Works activities where there is a risk of environmental damage, by incorporating relevant Environmental Control Measures and referring to relevant Environmental Control Measure Sheets;
- Liaising with the Environmental Manager in reviewing and updating site-specific Method Statements for all Works activities where Environmental Control Measure and Environmental Control Sheets have been altered, and

- Liaising with the Environmental Manager where third party agreement is required in relation to site-specific Method Statements, Environmental Control Measures and/or Environmental Control Measure Sheets.

5.2.2.2 General

- Being aware of all project Environmental Commitments and Requirements
- Ensuring that all relevant information on project programming, timing, construction methodology, etc., is communicated from the Project Manager, to the Environmental Manager in a timely and efficient manner in order to allow pre-emptive actions relating to the environment to be taken where required;
- Programming and planning of excavation works and communicating this schedule to the Environmental Manager;
- Ensuring that adequate resources are provided to design and install any environmental interventions;
- Liaising with the Design Engineer and providing information on environmental management to the Design Engineer during the course of the construction phase;
- Liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main contractor(s)'s project staff; and
- Ensuring that the Environmental Manager performs regular and frequent environmental site inspections.

5.2.3 Design Engineer – To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: _____

The Design Engineer is appointed by the Contractor(s) for the works.

The Design Engineer reports to the Project Manager and is responsible for:

- Design of the Works;
- Review and approval of relevant elements of the method statements – assist the Construction Manager with the overall review;
- Participating in Third Party Consultations; and
- Liaising with Third Parties through the Environmental Manager.

5.2.4 Environmental Manager – To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: _____

The Environmental Manager is appointed by the Contractor(s) and reports to the Project Manager.

The Environmental Manager is responsible for:

5.2.4.1 General

- Being familiar with the project environmental commitments and requirements;
- Being familiar with baseline data gathered for the various environmental assessments and during pre-construction surveys;
- Assisting the Construction Manager in liaising with the Design Engineer and the provision of the information on environmental management to the Design Engineer during the course of the construction phase, and
- Liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main contractor(s)'s project staff.
- Implementing the environmental procedures of the CEMP
- Liaising with the Construction Manager to ensure that the control measures set out in the Schedule of Environmental Mitigation are implemented
- Liaising with the client/developer in relation to environmental issues
- Auditing the construction works from an environmental viewpoint

5.2.4.2 Site-Specific Method Statements

- Liaising with the Construction Manager in preparing site-specific Method Statements for all Works activities where there is a risk of environmental damage. These site-specific Method statements should incorporate relevant Environmental Control Measures and take account of relevant Environmental Control Measure Sheets;
- Liaising with the Construction Manager in reviewing and updating site-specific Method Statements for all Works activities where Environmental Control Measure and Environmental Control Sheets have been altered, and
- Liaising with the Construction Manager where third party agreement is required in relation to site-specific Method Statements, Environmental Control Measures and/or Environmental Control Measure Sheets.

5.2.4.3 Third Party Consultations

- Overseeing, ensuring coordination and playing a lead role in third party consultations required statutorily, contractually and in order to fulfil best practice requirements;
- Ensuring that the minutes of meetings, action lists, formal communications, etc., are well documented and that the consultation certificates are issued to the Design Engineer as required;
- Liaising with all prescribed bodies during site visits, inspections and consultations;

- Where new Environmental Control Measures are agreed as a result of third party consultation, ensuring that the CEMP is amended accordingly;
- Where new Environmental Control Measures are agreed as a result of third party consultation, the Environmental Manager should liaise with the Construction Manager in updating relevant site-specific Method Statements, and
- Where required, liaising with the Construction Manager in agreeing site-specific Method Statements with third parties.

5.2.4.4 Licensing

- Ensuring that all relevant works have (and are being carried out in accordance with) the required permits, licences, certificates, planning permissions, etc,;
- Liaising with the designated licence holders with respect to licences granted pursuant to the Wildlife Act, 1976, as amended (if required);
- Bringing to the attention of the Project, Design and Construction Team any timing and legal constraints that may be imposed on the carrying out of certain tasks.

5.2.4.5 Waste Management Documentation

- Holding copies of all permits and licences provided by waste contractors;
- Ensuring that any operations or activities that require certificates of registration, waste collection permits, waste permits, waste licences, etc., have appropriate authorisation, and
- Gathering and holding documentation with the respect to waste disposal.

5.2.4.6 Legislation

- Keeping up to date with changes in environmental legislation that may affect environmental management during the construction phase;
- Advising the Construction Manager of these changes, and
- Reviewing and amending the CEMP in light of these changes and bringing the changes to the attention of the main contractor(s)'s senior management and subcontractors.

5.2.4.7 Specialist environmental contractors

- Identifying requirements for specialist environmental contractors (including ecologists, waste contractors and spill clean-up specialists) before commencement of the project;
- Procuring the services of specialist environmental contractors and liaising with them with respect to site access and report production;
- Ensuring that the specialist environmental contractors are competent and have sufficient expertise to co-ordinate and manage environmental issues, and
- Co-ordinating the activities of all specialist environmental contractors on environmental matters arising out of the contract.

5.2.4.8 Environmental Induction Training and Environmental Tool Box Talks

- Ensuring that Environmental Induction Training is carried out for all the main contractor(s)'s site personnel. The induction training may be carried out in conjunction with Safety Induction Training,

- Providing toolbox talks on Environmental Control Measures associated with Site-specific Method Statements to those who will undertake the work.

5.2.4.9 Environmental Incidents/Spillages

- Prepare and be in readiness to implement at all times an Emergency Response Plan.
- Notifying the relevant statutory authority of environmental incidents, and
- Carrying out an investigation and producing a report regarding environmental incidents. The report of the incident and details of remedial actions taken should be made available to the relevant authority, the Design Engineer and the Construction Manager.

5.2.4.10 Site environmental inspections

- Carrying out regular documented inspections of the site to ensure that work is being carried out in accordance with the Environmental Control Measures and relevant site-specific Method Statements,
- Carrying out a daily inspection of the bunded areas and site drainage system.
- Appending copies of the inspection reports to the CEMP.
- Liaising with the Construction Manager to organise any repairs or maintenance required following the daily inspection of the site.

5.2.5 Other Roles

5.2.5.1 Health and Safety Personnel – To be updated upon appointment of Contractor(s)/finalisation of CEMP

The Health and Safety personnel for the construction project are appointed by the Contractor(s) in line with the Construction Regulations:

- carrying out duty of Project Supervisor Construction Stage
- responsible for safety induction of all staff and personnel on site
- implementing the Health and Safety Plan
- auditing and updating the Health & Safety Plan
- all other required legal duties

5.2.5.2 Project Archaeologist – To be updated upon appointment of Contractor(s)/finalisation of CEMP

The Archaeologist may be appointed by the Developer or the Contractor(s) and is responsible for:

- ensuring implementation of archaeological mitigation measures
- monitoring of groundworks associated with the development
- liaison with the Environmental Manager/Construction Manager
- liaison with the Project Manager/client/developer

5.2.5.3 Project Ecologist – To be updated upon appointment of Contractor(s)/finalisation of CEMP

The Ecologist may be appointed by the Developer or the Contractor(s) and is responsible for:

- ensuring implementation of ecological mitigation measures
- advising on re-vegetation onsite
- monitoring of success of re-vegetation

5.2.5.4 Project Ornithologist – To be updated upon appointment of Contractor(s)/finalisation of CEMP

The Ornithologist may be appointed by the Developer or the Contractor(s) and is responsible for:

- Ensuring all pre-construction (completed) and construction phase avian monitoring is conducted at the site.
- Advice on any mitigation required.
- Consultations with National Parks and Wildlife Service (NPWS).

5.2.5.5 Geotechnical Engineer – To be updated upon appointment of Contractor(s)/finalisation of CEMP

The Geotechnical Engineer may be appointed by the Developer or the Contractor(s) and is responsible for:

- Assisting the Design Engineer as required
- Providing advice on geotechnical aspects of the works
- Requirement for specific geotechnical engineer by the Contractor(s)

5.2.5.6 All site personnel - To be updated upon appointment of Contractor(s)/finalisation of CEMP

The site personnel appointed by the Contractor(s) are responsible for:

- adhering to the relevant Environmental Control Measures and relevant site-specific Method Statements
- adhering to the Health and Safety Plan
- reporting immediately to the Environmental Manager and Construction Manager any incidents where there has been a breach of agreed procedures including:
  - a spillage of a potentially environmentally harmful substance;
  - an unauthorised discharge to ground, water or air, damage to a protected habitat, etc.

5.3 CONTACTS

5.3.1 Main Contractor(s) Contacts

Position Title:	Name:	Phone:	Email:
Main Contractor(s)			
Project Manager			
Construction Manager*			
Design Engineer			
Environmental Manager*			
Safety (PSCS)*			
Safety Officers*			
Site Emergency Number*			
Project Ecologist/Ornithologist			
Project Archaeologist			
Overall Project PSDP			

*24 hour contact details required

5.3.2 Employer Contacts

Organisation:	Position:	Name:	Phone:	Email:
Employers Ecologist	Project Ecologist			
Employers Archaeologist	Project Archaeologist			
Safety (PSDP)	Overall Project PSDP			
Employers Public Liaison Officer	Project Liaison Officer			

5.3.3 Third Party Contacts

Organisation:	Position:	Name:	Phone:	Email Address:
Inland Fisheries Ireland				
National Parks and Wildlife Service				
Environmental Protection Agency				
Clare County Council				
Department of Culture, Heritage and the Gaeltacht				
Health and Safety Authority				
Emergency Services				
Other, as appropriate.				

6 ENVIRONMENTAL COMMITMENTS

6.1 ENVIRONMENTAL MANAGEMENT PLANS (EMP)

A number of environmental management plans (EMP) have been prepared for managing the impacts of Construction Activities associated with the wind farm development project. See Table 6—1 below and refer to Appendix 1. These plans are to be implemented by the Appointed Project Manager and/or Project Contractor(s) as relevant.

Once appointed, it is the Contractor(s)'s responsibility, to update and add (where required) project specific control measures relevant to the environmental management plans and procedures. The Appointed Contractor(s) will ensure that plans/procedures are communicated to all site staff, including sub-contractors, through induction, training and at relevant meetings.

Ref:	Procedure:
EMP-1	Managing of Excavations
EMP-2	Surface Water Management and Run-off Control (Sediment and Erosion Control)
EMP-3	Fuels and Oils Management
EMP-4	Management of Concrete
EMP-5	Construction Waste Management
EMP-6	Construction Traffic Management Plan
EMP-7	Wheel wash Management Procedure
EMP-8	Construction Dust Management
EMP-9	Construction Noise Management
EMP-10	Archaeological & Heritage Protection
EMP-11	Ecological Management Plan Protection of Habitats and Fauna
EMP-12	Invasive Species Management Plan
EMP-13	Emergency Response
EMP-14	Site Environmental Training and Awareness
EMP-15	Monitoring and Auditing
EMP-16	Environmental Accidents, Incidents and Corrective Actions
EMP-17	Environmental Complaints

Table 6—1 Plans for managing Impacts of Construction Activities

7 AUDITING, MONITORING AND RESPONSE

The Monitoring Schedule for construction will also provide for the checking of equipment, materials storage and transfer areas and specific environmental controls.

A *Preliminary Monitoring Schedule* is provided below and will be finalised pending appointment of the Contractor(s). The Contractor(s)'s developed daily Site Checklists must have the following information included at a minimum:

Aspect	Monitoring Required	Frequency	Note	Responsibility
Water	Sediment & Erosion Controls (Drainage Performance)	At least weekly during the construction phase as well as during and after significant rainfall events	-	Environmental Manager
Water	Fuel & Oil Storage inspection	Daily	-	Environmental Manager
Ecology	Material and Waste Storage	Daily	-	Environmental Manager
Water	Water quality monitoring	Monthly	Minimum parameters: pH, Suspended Solids, metals, nitrates, phosphates	Environmental Manager
Water	Concrete Pours	As Required	To be scheduled with pours	Environmental Manager
Archaeology	Archaeological Monitoring	As Required	Monitor ground works & excavations	Archaeologist

Table 7—1 Preliminary Monitoring Schedule

The Contractor(s) will assign an on-site Environmental Manager to monitor the construction activities on a day to day basis. The duties will include completing the required checklists and coordinating with the relevant personnel (e.g. Project Ecologist, Project Archaeologist and the Design Engineer as required) ensuring all environmental monitoring is carried out.

7.1 ENVIRONMENTAL PERFORMANCE INDICATORS

The appointed Project Contractor(s) will outline the key performance indicators for the site in gauging successful site management in the prevention of pollution and the protection of the environment.

Environmental performance indicators will include:

- Number of environmental accidents/incidents logged;
- Breach of procedure and corrective actions;
- Number of environmental complaints received;
- Results of monthly water quality monitoring;
- Results of noise and vibration monitoring, and
- Results of site audits.

The performance indicators will be communicated to all relevant personnel and sub-contractors. The review periods for analysing site performance indicators must also be specified.

7.2 RESPONSE PROCEDURE/CORRECTIVE ACTION

In the event of an environmental incident, or breach of procedure, or where a complaint is received, the contributing factors are to be investigated and remedial action taken as necessary. The Main Contractor(s) will ensure that the following respond actions will take place:

1) The Project Manager must be informed of any incident, breach of procedure and/or complaint received and details must be recorded in the incident/complaint register
2) The Project Manager is to conduct/co-ordinate an investigation to determine the potential influence that could have led to the non-compliance.
3) The Project Manager is to notify and liaise with the appropriate site personnel where required, e.g. Site Environmental Manager, Project Ecologist, Project Archaeologist
4) If necessary, the Project Manager will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
5) The details of the incident will be recorded on an Incident / Complaints Form which is to record information such as the cause, extent, actions and remedial measures used following the incident/complaint. The form will also include any recommendations made to avoid reoccurrence of the incident.
6) The Project Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor(s) as appropriate.
7) The Site Project Manager is to ensure that the relevant environmental management plans/procedures are revised and updated as necessary.

8 SUMMARY

This CEMP provides the information which will be contained in the final Contractor(s)-developed Plan at the construction stage of the project which will implement conditions attached to any planning permission granted for the project. The requirement on the Contractor(s) to update these details has been explained, and there is a particular requirement for an update to the roles and responsibilities of those appointed on the site for the construction of the project.

Appendix 1

Environmental Management Plans

EMP-1	Management of Excavations
EMP-2	Surface Water Management and Run-off Control (Sediment and Erosion Control)
EMP-3	Fuels and Oils Management
EMP-4	Management of Concrete
EMP-5	Construction Waste Management Plan
EMP-6	Construction Traffic Management
EMP-7	Wheel Wash Management Procedure
EMP-8	Construction Dust Management
EMP-9	Construction Noise Management
EMP-10	Archaeological and Heritage Protection
EMP-11	Ecological Management Plan for the Protection of Habitats and Fauna
EMP-12	Management of Invasive Species
EMP-13	Emergency Response Plan
EMP-14	Site Environmental Training and Awareness
EMP-15	Monitoring and Auditing
EMP-16	Environmental Accidents, Incidents and Corrective Actions
EMP-17	Environmental Complaints

EMP 1: MANAGEMENT OF EXCAVATIONS

Purpose

To describe measures for the management of all excavations and excavated peat and rock on the site

Peat

- To reduce the risk of peat failure in areas of deeper peat (>2m), an 'excavate and replace' system will be used. Shortly after an area has been excavated, it will be backfilled with crushed stone. This stone will provide support to the adjacent peat mass.
- To reduce the construction impact on peat, the movement of machinery throughout the site will be controlled by requiring that construction vehicles and machinery do not encroach onto cutover bog beyond the proposed development footprint. These vehicles will also be required to travel via the constructed roads when moving between works areas. To emphasise this requirement, the boundaries of the footprint of the development will be fenced off with post and wire. The Environmental Manager will monitor vehicle movements throughout the construction phase.
- Temporary engineered deposition areas will be designated where necessary at the turbine and crane hardstands locations to hold temporary stockpiles. In order to ensure the stability of the temporary stockpiles, acceptable slope angles will be specified as part of the temporary works designs. These will be completed on a case by case basis by a suitably qualified designer.
- To prevent sedimentation of local watercourses by excavated peat, excavation works in an area will not commence until the surrounding existing drainage regime is protected by interceptor drains and settlement ponds/silt fencing.
- Excavated peat will be reused where appropriate on site for re-grading or re-vegetation
- Surplus excavated peat remaining after localised landscaping requirements will be deposited in the peat deposition areas.
  Peat will be handled as little as possible. The peat will be handled three times in most instances; excavated into a dump truck, transported and dropped at its final position and shaped by an excavator. In order reduce the weight borne by excavated peat.
- Peat turves, where identified by the project ecologist, should be separated and stored with the vegetated side upwards, peat stacks should not be higher than 1m.

Rock

- To minimise the requirement for stockpiling rock and to reduce the volume of crushed stone imported onto site, excavated rock can be reused in the construction of the turbine hardstands.
- A rock rippability assessment should be carried out following completion of detailed ground investigation. This will inform the choice of excavation methodology for rock.
- A detailed, site specific method statement for excavation of rock will be required from the Contractor(s) prior to commencement of works.

Responsibility

- The Environmental Manager will monitor the bog and the excavation areas and associated drainage.
- The Construction Manager will monitor vehicle movements throughout the construction phase
- The Project Manager will oversee the phasing of the excavation and machinery movement across the site.

- Construction personnel will be informed of the measures to prevent pollution of water courses, particularly at stream crossings.
- The Design Engineer, Geotechnical Engineer and Sub-contractors will have responsibilities as appropriate.
- All responsibilities will be finalised by the Appointed Contractor(s).

EMP 2: SURFACE WATER MANAGEMENT AND RUN-OFF CONTROL (SEDIMENT AND EROSION CONTROL)

Purpose

To describe measures for the management of all surface water and run-off on the site, for the protection of watercourses and in particular, sediment and erosion control.

The plan will:

- Implement erosion control to prevent runoff flowing across exposed ground and become polluted by sediments;
- Intercept and divert clean water runoff away from construction site runoff to avoid cross-contamination of clean water with soiled water;
- Implement sediment control to slow down runoff allowing suspended sediments to settle in situ particularly on roads;
- Implement the erosion and sediment controls before starting site clearance works;
- Minimise area of exposed ground by maintaining existing vegetation that would otherwise be subject to erosion in the vicinity of the wind farm infrastructure and keeping excavated areas to a minimum;
- Delay clearing of soil and peat until before construction begins rather than stripping the entire site months in advance particularly during road construction;
- Avoid working near drains during or after prolonged rainfall or an intense rainfall event and cease work entirely near drains when it is evident that pollution is occurring;
- Install a series of silt fences or other appropriate silt retention measure where there is a risk of erosion runoff to watercourses from construction related activity particularly if working during prolonged wet weather period or if working during intense rainfall event;
- Implement sediment control measures that includes for the prevention of runoff from adjacent intact ground that is for the separation of clean and 'dirty' water;
- Install appropriate silt control measures such as silt-traps, check dams and sedimentation ponds;
- Provide recommendations for public road cleaning where needed particularly in the vicinity of drains; and
- Controls need to be regularly inspected and maintained otherwise a failure may result, such as a build up of silt or tear in a fence, which will lead to water pollution so controls must work well until the vegetation has re-established; inspection and maintenance is critical after prolonged or intense rainfall.

Monitoring

- The Environmental Manager will monitor the general level of suspended solids at designated sampling points in the rivers/streams downslope of the active construction areas using a turbidity meter.
- The Environmental Manager will walk the site each day and check the cross-drain pipes, dirty water drains and outlets, settlement ponds, interceptor drains and silt fences for any damage or blockages. Any damage or blockages will be repaired or cleared promptly.
- As detailed above, weather forecasts will be monitored during the construction phase. The 24 hour advance meteorological forecasting service from Met Éireann will be used.
- Water quality monitoring will take place prior to and during the construction phase and for the first 6 months of the operational phase. The location of sampling points and the programme of monitoring of water quality will be agreed with the Planning Authority prior to the commencement of construction. This monitoring, together with visual monitoring, will help to ensure that the mitigation measures that are in place to protect water quality are effective.
- Water Monitoring Programme to include monitoring of streams and from end points of Sediment and Erosion Control system and visual monitoring of Sediment and Erosion Control measures.

Responsibility

- The Environmental Manager is responsible for ensuring that appropriate water pollution prevention measures are put in place and that water sampling is carried out. Where standards are breached and remedial action is taken, an investigation must be carried out in conjunction with the Construction Manager, and further samples must be taken to verify that the situation has returned to normal.
- The Environmental Manager is responsible for ensuring spill kits are readily available in vulnerable locations and that booms for watercourses are long enough and have adequate anchorage.
- The Construction Manager (or a designate) is responsible for ensuring the spill kits are adequately stocked and should inform the Environmental Manager when items have been used.

Reference

Surface Water Management Plan
Planning Drawings 19107-5013 to 19107-5019

EMP 3: FUEL AND OILS MANAGEMENT

Purpose

To describe measures for the management of all fuel and oils on site for the protection of watercourses from any spills

Procedure

Construction machinery and vehicles

- The potential for hydrocarbons getting into the existing drains and local watercourses will be mitigated by only refuelling construction machinery and vehicles in designated refuelling areas using a prescribed re-fuelling procedure.
- Refuelling will be carried out using 110% capacity double bunded mobile bowsers. The refuelling bowser will be operated by trained personnel. The bowser will have spill containment equipment which the operators will be fully trained in using.
- Plant nappies or absorbent mats to be place under refuelling point during all refuelling to absorb drips. Plant nappies to be provided beneath small mobile plant (e.g. small generators, pumps etc).
- Mobile bowsers, tanks and drums should be stored in secure, impermeable storage area, away from drains and open water;
- To reduce the potential for oil leaks, only vehicles and machinery will be allowed onto the site that are mechanically sound. An up to date service record will be required from the main contractor(s).
- Potential leaks from delivery vehicles will be reduced by visually inspecting all delivery vehicles for major leaks. Contractors supplying concrete and crushed stone to the site will be contractually required to supply their products using roadworthy vehicles.
- Potential leaks from the cranes used for turbine erection will be mitigated by contractually requiring the crane suppler to supply cranes to site that are in good working order, up to date in servicing and free of leaks.
- Should there be an oil leak or spill, the leak or spill will be contained immediately using oil spill kits; the nearby dirty water drain outlet will be blocked with an oil absorbent boom until the fuel/oil spill has been cleaned up and all oil and any contaminated material removed from the area. This contaminated material will be properly disposed of in a licensed facility.
- The Environmental Manager will be immediately informed of the oil leak/spill, and will assess the cause and the management of the clean-up of the leak or spill. They will inspect nearby drains for the presence of oil, and initiate the clean-up if necessary.
- Immediate action will be facilitated by easy access to oil spill kits. An oil spill kit that includes absorbing pads and socks will be kept at the site compound and also in site vehicles and machinery.
- Correct action in the event of a leak or spill will be facilitated by training all vehicle/machinery operators in the use of the spill kits and the correct containment and cleaning up of oil spills or leaks. This training will be provided by the Environmental Manager at site induction.
- In the event of a major oil spill, a company who provide a rapid response emergency service for major fuel spills will be immediately called for assistance, their contact details will be kept in the site office and in the spill kits kept in site vehicles and machinery.

Oil storage during the construction phase

- The scale of potential impacts on downstream water quality will be reduced by only storing the required volume of oils for the works taking place at the time.

- Fuel containers must be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
- Access to oil stores will be controlled by the storage of oils within a locked steel container within the site compound. The site compound will be surrounded by a palisade fence and locked when there are no site personnel present.
- Collision with oil stores will be prevented by locating oils within a steel container in a designated area of the site compound away from vehicle movements.
- Leakages of oil from oil stores will be prevented by storing these oils in bunded tanks which have a capacity of 110% of the total volume of the stored oil. Ancillary equipment such as hoses and pipes will be contained within the bunded storage container. Taps, nozzles or valves will be fitted with a lock system.
- The volume of leakages will be prevented through monitoring oil storage tanks/drums for leaks and signs of damage. This will be carried out daily by the Environmental Manager.
- Long term storage of waste oils will not be allowed on site. These waste oils will be collected in leak-proof containers and removed from the site for disposal or re-cycling by an approved service provider.

Responsibilities

The Construction Manager and Environmental Manager are responsible for ensuring Fuel and Oils are managed in line with this procedure. The Appointed Contractor(s), in updating the CEMP, must designate personnel to the tasks relating to Fuels and Oil, as outlined below.

_____ is the designated person for _____ area responsible for being present during tanker refilling operations of oil storage tanks.

_____ is the designated person responsible for checking bunds weekly.

_____ is the designated person authorised to pump from the bund only when accumulated rainwater is clear.

Reference

Best Practice Guidelines BPGCS005 – Oil Storage Guidelines (Enterprise Ireland).

EMP 4: MANAGEMENT OF CONCRETE

Purpose

To describe measures for the management of concrete on site for the protection of watercourses from any spillages

Procedure

Supervision of concrete pours

- To reduce the potential for cementitious material entering watercourses, concrete pours will be supervised by the Construction Manager, a suitably qualified Engineer and the Environmental Manager
- The Construction Manager will ensure that the area of the pour is completely drained of water before a pour commences.
- Pours will not take place during forecasted heavy rainfall.
- Incidental rainfall from light showers during the period of a pour is typically absorbed into the concrete matrix but heavier showers can result in some run off from the top surface of the concrete pour. If run-off is encountered the Environmental Manager will block the outflow from the drains to retain or treat the run-off until the pH is neutral before discharge to the drainage network.
- In the event of a spillage on site, the Environmental Manager will temporarily block the dirty water drains in the immediate area and monitor the pH levels of the water in the associated settlement ponds and if necessary will adjust the pH levels using CO_2 entrainment. Any spillage will be cleared immediately and deposited in the Chute wash down area.

Concrete Water

- Pours will not take place during heavy rainfall.
- To reduce the volume of cementitious water, washout of concrete trucks will not take place on site. Concrete trucks will be washed out off site at the source quarry.
- To reduce the volume of cementitious water, only concrete truck chutes will be washed down on site. The concrete trucks will wash down their chutes at a designated chute wash down area in the site compound. The wash down area will consist of a polythene lined bunded area with a capacity of about $20m^3$. This capacity will be sufficient to accommodate the chute wash down for two turbine base pours.
- The environmental manager will monitor the pH of the water in the chute wash down bund and can dose with CO_2 or acidic water from the drains until the wash out water achieves neutrality before discharge.

Responsibilities

- All concrete pours will be supervised by suitable personnel.
- The Environmental Manager is responsible for ensuring that appropriate water pollution prevention measures are put in place and that water sampling is carried out. Where standards are breached he/she should carry out an investigation and in conjunction with the Construction Manager, he/she should ensure remedial action is taken and further samples taken to verify that the situation has returned to normal.
- The Environmental Manager is responsible for ensuring spill kits are readily available in vulnerable locations and that booms for watercourses are long enough and have adequate anchorage.

EMP 5: CONSTRUCTION WASTE MANAGEMENT PLAN

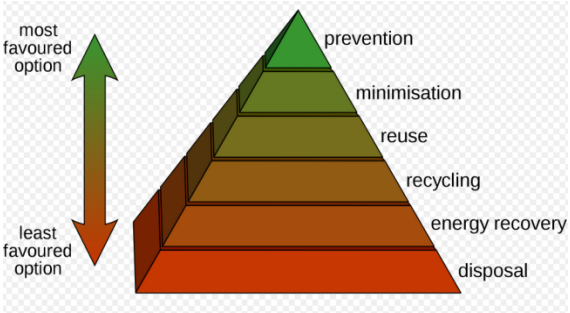
Purpose

To describe measures for the management of all wastes associated with the construction of the wind farm.

Procedure

Waste Management Plan

- The Waste Management Hierarchy (illustrated below) will be assessed and applied in the preparation and maintenance of the Construction Phase Waste Management Plan.
- The Construction Phase Waste Management Plan will address the following aspects of the Project:
- Analysis of the waste arising/material surpluses;
- Specific waste management objectives for the project;
- Methods proposed for prevention, reuse and recycling of wastes, and
- Material handling procedures.



Construction Methodology and Raw Materials

The construction phase of the wind farm will require a variety of construction methodologies. The anticipated phasing of the construction phase will be as follows;

Activity
Prepare site, Pre-construction activities, Site entrance
Access road construction + Drainage plan implementation
Crane hardstand construction
Turbine foundation construction
Substation construction
Internal trenching and ducting
External grid connection trenching and ducting
Turbine delivery
Turbine erection
Permanent meteorological mast erection
Reinstatement/Landscaping
Wind farm commissioning
Project closeout

Construction

Contractors working on site during the works will be responsible for the collection, control and disposal of all waste generated by the works. Construction phase waste may consist of hardcore, stone, concrete, steel reinforcement, shuttering timber, food waste from the canteen and unused oil, diesel and building materials. This waste will be collected at the end of the construction phase and taken off site to be reused, recycled and disposed of in accordance with best practice procedures at an approved facility. Domestic wastewater from the on-site holding tank will be collected on a regular basis by approved contractors and disposed of in an authorised facility in accordance with best practice. Plastic waste will be taken for recycling by an approved contractor(s) and disposed or recycled at an approved facility.

General Waste Management on Site

To manage waste effectively, focus on the following:

- Ordering the correct amount of materials to be delivered when needed.
- Ensuring materials are not delivered to site damaged and unusable
- Reducing the amount of packaging used by suppliers
- Where possible, establish a 'take back' system with suppliers
- Ensuring wastes are handled and stored correctly
- Limiting the amount waste going to landfill by reusing and recycling where possible.

Construction Compound(s)

Construction compound(s)/waste storage area(s) will be created for storage of waste materials, plant, and equipment and for site offices, and welfare facilities.

Wastes Generation

Best practice procedures in general will minimise waste generated on-site. Measures including good site management will be taken to limit the quantity of waste generated during construction phase. Waste such as excavated material on-site will be recycled where possible.

Surplus materials will include materials generated by the excavation/extraction works during construction of tracks, construction compounds and turbine foundations, mainly comprising excavated excess peat and sub-soils.

Waste streams will include wastes generated by plant, machinery and construction workers over the period of the works, for example waste oils, sewage, refuse (paper, carton, plastic etc), wooden pallets, waste batteries, fluorescent tubes etc.

Minimisation, Reuse, Recycling, and Management of Construction Waste

The primary aim of this Waste Management Plan is to ensure that wastes generated during the course of the project are managed in a systematic manner in accordance with Waste Management Legislation and the principles of the waste Hierarchy, i.e. Prevention, Minimisation, Reuse, Recovery, and Recycling.

Wastes generated during the construction phase will be identified and segregated according to their category as described by the European Waste Catalogue (EWC). In order to effect this designated waste storage areas will be created at Construction Compound(s), other suitable locations, for storage and segregation of wastes prior to transport for recovery/disposal at suitably licensed/permitted facilities. Suitably sized containers for each waste stream will be provided and will be supervised by the Waste Management Coordinator (WMC). The WMC will be responsible for the management of wastes during the entire project. The numbers and sizing of the containers will be agreed with the Waste Contractors/Hauliers

in advance of the commencement of the road improvement works. Source segregation of the wastes generated will result in cost savings, in addition to providing an environmentally sound route for the management of all the Construction and Demolition Waste.

Under Waste Management Regulations 2007 a waste collection permit, for appropriate waste codes and destinations is required by the waste haulier, to transport the waste from one site to another. The contractor(s) will ensure the movement of all wastes are carried out in compliance with relevant waste regulations.

Wastes will only be treated or disposed of at waste facilities to carry out a specific activity (i.e. chemical treatment, landfill, incineration etc.) for the specific waste types. Records of all waste movements and associated documentation will be held on site. It is planned that all waste activities at the site will comprise of;

- source,
- segregation,
- storage, and
- collection

In order to prevent/minimise the generation of wastes, the contractor(s) will ensure that raw materials are ordered so that the timing of the delivery/quantity delivered, and the storage is not conducive to the creation of unnecessary waste.

The Contractor(s) will continuously seek to improve the waste management process on the site during all stages of the construction phase and maximise opportunities for reuse/recycling where ever they exist. For example in relation to waste packaging, the contractor(s) will seek to negotiate take back of as much packaging waste as possible at source, to ensure maximum recycling. The Construction Waste Management Plan will be included in the team weekly meetings. In addition the plan will be communicated to the whole construction team regularly on site, including any updates form earlier revisions of the plan.

An overview of the methods to manage the primary waste streams is presented in the following sections;

<u>Soils and Spoil</u>

Any materials excavated on site in the course of the construction works (i.e. soil/peat stripping for track construction, turbine foundations/hardstanding areas) will be stored on site and re-used on site. As such, off-site disposal of this material is not expected.

Excavated materials from all construction activities will be temporarily stockpiled at hardstand locations during construction and subsequently reused on site for backfill/re-grading or re-vegetation while surplus peat soils will be segregated and replaced within the designated 3 no. on-site deposition areas.

The deposited peat will be bound by engineered berms constructed from surplus excavated rock. The geometry of the bunds has been designed to withstand the equivalent hydraulic loading of the peat. These berms will also act as a means of access to place the peat with the width at the top of the berm being 3m. There will be a dirty water drain at the down slope side of the deposition area. Peat will also be deposited in engineered berms. These berms will be up to 2m high.

No waste soils, subsoils, bedrock will require disposal outside the overall boundary of the Carrownagowan development site. All excavated material will be reused within the site.

Concrete

Concrete waste may potentially occur. There shall be no washout of trucks at site. Excess concrete will be returned to the supplier for reuse. Concrete trucks will be washed out off site at the source quarry. To reduce the volume of cementitious water, only concrete truck chutes will be washed down on site. The concrete trucks will wash down their chutes at a designated chute wash down area in the site compound. The wash down area will consist of a polythene lined bunded area with a capacity of about 20m³. This capacity will be sufficient to accommodate the chute wash down for two turbine base pours.

The environmental manager will monitor the pH of the water in the chute wash down bund(s) and can dose with CO_2 or acidic water from the drains until the wash out water achieves neutrality before discharge.

Waste-Water Treatment / Effluent disposal

During the construction time period, the maximum wastewater production is estimated to be the same as the maximum water consumption (3,000 litres per day). The project will include an enclosed wastewater management system at the temporary compound capable of handling the demand during the construction phase when as many as 100 people will be working on site. A holding tank is proposed for wastewater management.

During the construction phase, staff facilities will be provided at the site compound/other suitable locations. A cabin comprising a canteen, washroom and toilets will be provided. This cabin will contain three integrated holding tanks; one for clean water, one for waste water and the third for sewage. The waste water tank and sewage tank will be emptied as required by a vacuum tanker and removed from site to a licensed facility. These staff facilities will be removed at the end of the construction phase.

Hazardous and Other Waste

The following Table lists some of the waste types that may be generated during the construction works. Although some waste types may be generated in locations other than the construction compounds (for example if absorbent filters are required at foundation/track locations etc., such waste materials will be stored within the construction compounds only. Waste materials generated out with the construction compounds will be taken to the compounds on a daily basis.

Common Construction Wastes					
Concrete	Wood	Cables	Ducting	Metallic packaging/tins	Cardboard Packaging
Paper packaging	Plastic packaging	Wooden packaging	Office paper	Non hazardous detergent	Plastic containers
Plastic bottles	Mixed waste	Septic tank sludge	Ferrous metal	Non hazardous waste electrical(s)	

Hazardous Waste, as categorised by the European Waste Catalogue	
13 01 10: Used mineral hydraulic oil (non-chlorinated)	13 02 08: Other waste engine, gear or lube oil
13 02 05: Waste engine, gear or lube oil (non-chlorinated)	13 02 08: Other waste engine, gear or lube oil
16 01 07: Oil filters	20 01 23: Discarded equipment containing CFCs
16 06 01: Lead batteries	16 07 08: Oily waste from transport and storage tanks
16 10 01: Hazardous liquid wastes to be treated off-site	20 01 21: Fluorescent tubes and other mercury-containing waste
20 01 33: Hazardous batteries and accumulators that are collected separately	15 02 02: Absorbents, filter materials, wiping cloths, clothing contaminated by dangerous substances

If hazardous waste is encountered, then appropriate handling, storage, transportation, and disposal will be carried out. Prior to being removed from the site, the waste will undergo a comprehensive waste assessment and classification by suitably trained/qualified person(s), in accordance with the European Waste Catalogue hazardous waste list. If non hazardous waste becomes contaminated with hazardous waste, the entire load will be considered hazardous. At the site every effort will be made to segregate waste, and properly segregate hazardous waste from non hazardous and inert waste arising. Hazard wastes will be identified, removed and kept separate from other wastes in order to avoid cross contamination. Specific method statement detailing the necessary mitigation measures during the excavation/handling, transportation, and disposal of hazardous materials encountered at the site will be prepared as required.

Oils, paints, adhesives and chemicals will be kept in a separate contained secured storage area. Lids will be kept on containers to avoid spillage/evaporation. Waste oils, adhesives etc will handled, and disposed of appropriately. Every effort will be made at the site for no long term storage of hazardous materials/fuels/oils/chemicals, etc. There shall be no long term storage of waste oils etc. at the site.

Gravel/Stone/Asphalt/ Bituminous Materials

There will be no requirement for the storage of Asphalt/bitumen materials on site. Road surface materials will be delivered to site as required, with excess returned to supplier.

Metals

It is now common practice to segregate metals for reuse and recycling, however there are still sites where waste metal is thrown away in the general rubbish. One of primary sources of metal on sites is rebar. Waste of rebar will be reduced by ordering 'made to measure' from the source, and detailed scheduling of all reinforced concrete structural elements.

Timber

Timber waste will be stored separately. Any pallets will be returned to the supplier for reuse. Off-cuts/trimmings will be used in formwork where at all possible. A container for waste wood, covered where possible will be located at compound/other storage areas. This waste will be collected by the waste contractor and will forward it for wood recycling.

- A 40 cubic metre open skip will be put in place to collect at the temporary site construction compounds.
- Special care will be taken to segregate the timber into treated and untreated fractions.

- The following timber materials are considered as waste by timber recyclers - plywood, painted timber and pressure treated timber. This waste timber fraction will be disposed of to mixed waste skip.
- This material will be collected by the contracted and licensed non-hazardous waste collectors and brought to a licensed waste recycling facility.

Blocks, Bricks, and Tiles

The careful storage of these materials will significantly reduce the volumes of wastes occurring at the site. Every effort will be made to use broken blocks/off-cuts. Final quantities of these wastes generated will be stockpiled (possibly crushed/screened), and reused at the site as sub base materials for road/other suitable hardstanding locations.

Packaging/Plastic

Double handling will be avoided by segregating packaging wastes immediately after un-wrapping. Waste packaging will be segregated and in separate containers, at storage area for collection by the waste contractor for disposal to licensed facility.

Mixed Waste

- This waste stream will arise from waste packaging of electrical and engineering components.
- A 40 cubic metre open skip will be put in place to collect mixed waste within a designated waste area at the temporary site construction compounds.
- This skip will accept plastic packaging, plastic piping, cardboard and timber waste.
- Special care will be taken to ensure that no green waste or food waste will be disposed of in this skip. The purpose of this arrangement is to stop birds scattering food items across the site and therefore prevent vermin infestation.
- This material will be collected by contracted and licensed non-hazardous waste collectors.

Mixed Waste/Canteen Waste

Staff canteens have the potential to generate food waste and packaging waste. Designated receptacles will be provided at the canteen(s) to allow for segregation, and storage of individual waste streams. These will include receptacles for food waste, dry recyclables, and residual bin. All offices and canteens will be equipped with black plastic refuse bags and wheelie bins for the purpose of collecting and delivering this waste stream to the compactor. This material will be collected by the contracted waste management company/transported to licensed facility.

Dry recyclable collection from welfare facilities

- All offices and canteens will be equipped with clear plastic bags and wheelie bins for the purpose of collecting dry recyclables. This will be strictly managed to prevent any food waste entering the dry recyclable stream.
- Recycling wheelie bins will be located at all welfare facilities and offices associated with the wind farm project.
- This material will be collected by the contracted and licensed non-hazardous waste collectors.

Other waste

Other wastes which may be generated may include residual non recyclable waste such as paper, cloth, some cardboards, or plastics. Others may include fibreglass and geotextiles, and polystyrene. These types

of materials will be stored in a dedicated container at the site compound. All residual wastes will be dispatched to suitably licensed facility for disposal. Other construction and demolition waste will be collected and disposed of appropriately.

Management of General Waste

- Access to materials will be controlled. A dedicated storage area will be provided in the site construction compounds for building materials such as cables, plastic piling for the settlement ponds, geotexile matting, blocks, tools and equipment, fence posts and wire, booms, pipes.
- Access to stored materials will be restricted; the site compound will be securely fenced from the outset and will be locked when there are no site personnel present.
- To contain and manage construction phase waste, multiple skips will be provided at the temporary site construction compounds; one for recyclable waste and others for various construction waste. These skips will be emptied when required by a licensed waste management company. Waste oil and waste oil drums will be collected and stored in containers and on a bunded tray within the storage container.
- At the end of each phase, the completed works areas will be tidied of any unused material or waste; this material will be brought to the site compound for storage and reuse or placed in the appropriate skip for disposal.

Construction Phase General Waste

- Construction waste (timber, steel, concrete) These elements will be segregated and stored in dedicated bins on site for recycling.
- Timber waste will be kept to a minimum through the re-use of shutters throughout the job. At the end of the job, the majority of timber will be sent onto a new site for re-use. Any timber that cannot be re-used because of poor quality will be recycled.
- All waste steel reinforcing will be stockpiled and at the end of each work unit, it will be collected for recycling by Licensed Facility.
- Plastics and packaging will be segregated and stored in dedicated bins on site for recycling.
- Waste oil stored on site will be stored in labelled containers and will be collected by licensed facility/licensed oil-recycling contractor as necessary. Records will be maintained on the volumes of waste oil generated.
- Paper / cardboard, this material will be recycled.
- Wastewater from office and welfare facilities. These facilities will be regularly emptied by licensed/suitable contractors.

Assignment of Responsibilities

A Waste Management Coordinator (WMC) will be assigned at the wind farm site, to have an overall responsibility for the management of waste that may be generated at the site. As part of the record keeping procedures, the WMC will keep records of all waste being removed from site. This information will be recorded in a standard format. The effectiveness and accuracy of the documentation will be monitored on a regular basis. The Waste Management Plan will be updated on a regular basis where required and made available as required (i.e. sub contractors). The WMC will be appropriately trained/suitably qualified in all aspects of materials wastes management, and the site personnel will be in a position to;

- Distinguish reusable materials from materials suitable for recycling
- Ensure maximum segregation at source

- Cooperate with Site Management, on locations for stockpiling reusable materials
- Separate materials for recovery
- Identify and liaise with operators for recovery outlets

The WMC will be responsible for educating site personnel, sub contractors, and suppliers, about the best alternatives to conventional waste disposal/Waste Management Regime at the Carrownagowan Wind Farm site. Training will also be given to site personnel in materials management on site. The WMC will continually identify waste minimisation actions on site and these will be updated in the plan.

Training

Copies of the Waste Management Plan will be available to all site personnel. All site personnel and sub contractors will be instructed about the objectives of the Waste Management Plan for the site, and informed of the responsibilities which fall upon them as a consequence of its provisions. This will be carried out during the site induction process for all site personnel. Where source segregation and materials reuse techniques apply, each member of the construction team will be given instructions on how to comply with the Waste Management Plan for the site. Site notices will be designed to reinforce the key messages of the waste management plan, and will be displayed prominently for the benefit for all on site personnel.

Waste Records

All details of wastes (arising/generated/movement, etc) will be recorded during the project. Each consignment of waste removed from the site will be documented in the form of a waste management movement record form which will ensure full traceability of the material to its final destination. All records will be retained at a designated location at the site office/construction compound and made available for auditing of the waste management plan.

Carrownagowan Wind Farm Waste Management Plan Summary

Wastes will inevitably be generated during the construction phase of the project. There shall be no requirement to remove peat/spoil etc from the site. A certain amount of surplus soils/materials will be generated. These materials will be reused as backfill/landscaping around turbine bases and hardstands and permanently stored at the 3 no. on-site deposition areas.

Other than spoils from excavations, waste arising during the construction phase will be minimised by site management, by timing the ordering of materials required at the site, in a manner which reduces the likelihood of over ordering, or damaging during storage. Furthermore several of the traditional waste streams arising maybe used at the site where appropriate. Waste will be segregated and stored on site at designated locations/in containers prior to transport to appropriate licensed facilities.

A Waste Management Coordinator will be appointed to ensure the Waste Management Plan is followed. Training will be given to all site personnel, so that they are aware of the Waste Management Regime at the site, and know their responsibilities.

Records will be kept to trace the inputs and outputs of the construction works at the site. These records will be made available to relevant authorities, should it be required.

The design and implementation of the Waste Management Plan will provide for the optimum planning/management and handling of wastes generated during the construction phase of the Carrownagowan Wind Farm Development.

References

Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (DoEHLG, July 2006).

EMP 6: CONSTRUCTION TRAFFIC MANAGEMENT

Purpose:-

To describe Measures for the management of all traffic, including construction traffic and oversized loads, for the minimization of disturbance and nuisance to the local community.

Scope:-

All Site Construction Areas, approach roads to the site and internal road traffic.

Procedure:

General

The Appointed Contractor(s) will prepare a detailed Traffic Management Plan prior to the works commencing. This Plan will be finalised in agreement with An Garda Síochána and Clare County Council.

The plan will include provision for:

- Communicating with the community, An Garda Síochána and Clare County Council.
- Details of site access and any site traffic rules, including security, parking, loading and unloading, required speed or other relevant details.
- Details of the turbine component delivery and any road closures.
- Programme of maintenance and upkeep of public roads.
- Site operating hours (including delivery) to be outlined.

Public Roads

- In order to mitigate from a significant impact during peak traffic hours, the majority of staff will either arrive on-site before or after the peak morning traffic and finish work before or after the evening peak traffic hours.
- The condition of the public roads will be monitored on an on-going basis and a road sweeper provided to clean the public roads if required.

Site Entrance

- There will be no parking of any vehicles on the public road near the wind farm site entrance.
- Adequate parking will be provided on site for both employees and visitors.
- The condition of the site entrance will be monitored on an on-going basis and a road sweeper provided to clean the public road if required.

Responsibility

Project Manager
Construction Manager
Construction personnel
Sub-contractors as appropriate
Delivery personnel

References

Preliminary Traffic Management Plan

EMP 7: WHEEL WASH MANAGEMENT PROCEDURE

Purpose:
To describe Measures for the protection of Watercourses and the Public Roads from dirty water from vehicles.

Responsibility:-
Construction Project Manager

Procedure:-
The Appointed Contractor(s) will reduce the potential for the roads being dirtied by heavy vehicle traffic, by including the following:

- A dry Wheel Wash facility will be provided at the Site Entrance
- Wheel washes will be cleaned as required

Dry Option: At assigned locations at the site entrance a wheel wash will be installed for wheel washing prior to vehicles leaving site. A dry wheel wash (vibrating) will be used to remove any mud from the vehicle's wheels, with excess mud / etc. being collected and treated/disposed of following treatment.

The wheel wash station will remain on site until the development is complete. The wheel cleaning procedure will consist of;

1) Before leaving the site, vehicles will enter the wheel wash and be inspected for any heavy deposits left on wheels. If present, these will be removed manually.
2) Following inspection, all wheels are to be cleaned down with the vibration system, until clear of all deposits.
3) Vehicles will be permitted to leave site following approval of the operating manager/ site representative that the above steps have been completed to a satisfactory standard.

Daily inspections of the wheel wash will be completed to check it is operating as described above, and to make sure there is no excess material collected posing risk during periods of rain. The washout area will be cleaned as required, with excess material disposed of appropriately (Deposition area), or used as back fill within the site. If required, drainage ditches/berms will divert dirty water to sedimentation pond for treatment, prior to outfall to vegetated area (preventing sedimentation (runoff /rainwater washing material away).

On site roads/local roads will be kept as free of mud as is practicable during ground working operations. Machine trafficking around the site will be kept to a minimum in order to reduce the effects of rain on 'broken' ground.

If wheel wash facility is not sufficient, a road sweeper will also be used in the immediate area which will be ordered directly via the site manager.

Responsibility

The Construction Manager/Environmental Manager will monitor the Wheel Wash Area/Sediment Controls, and carry out corrective action where required.

Details of Site Wheel Wash to be finalised by Appointed Contractor(s).

EMP 8: CONSTRUCTION DUST MANAGEMENT

Purpose

To describe the measures for the management of nuisance impacts on air quality from construction generated dust

Procedure

A dust minimisation plan has been formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented:

- Site roads will be regularly cleaned and maintained as appropriate.
- Hard surface roads will be swept to remove mud and aggregate materials from their surface.
- Furthermore, any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions.
- Speeds will be restricted on hard surfaced roads as site management dictates.
- Public roads in the vicinity of the site will be regularly inspected for cleanliness, and cleaned as necessary.
- A temporary vehicle wheel wash facility will be installed in proximity to the site entrance.

The dust minimisation plan will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

Responsibility

- The Environmental Manager is responsible for reviewing the site Dust Minimisation Plan.
- The Construction Manager is responsible for organising dust suppression through use of bowsers and cleaners.

References

Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (Consultation Draft, National Roads Authority, October 2006).
Control of Dust from Construction and Demolition Activities (BRE, 2003).

EMP 9: CONSTRUCTION NOISE MANAGEMENT

Purpose

To describe measures for the management of impacts from construction noise.

Procedure

Control of Noise at Source

- Only sound plant/equipment will be permitted on site.
- No unnecessary revving of machinery on site.
- Plant will be properly used and regularly maintained.
- Compressors, if needed, will be 'sound related' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever machines are in use.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers.

Responsibility

- The Construction Manager will be familiar with the noise sensitive receptors and alert the Environmental Manager in good time prior to work commencing in the areas closest to any noise sensitive receptors.
- The Environmental Manager will review any relevant planning conditions in updating this plan.

References

BS5228 –1&2:2009, Code of Practice for the Control of Noise and Vibration on Construction and Open Sites

EMP 10: ARCHAEOLOGICAL AND HERITAGE PROTECTION

Purpose

To describe measures for the management and protection of archaeological and cultural heritage on the site

Procedure

- During the course of development, all excavations will be monitored by a suitably qualified archaeologist, under licence to the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht.
- In the event of archaeological material being uncovered consultation will take place with the National Monuments Service and the National Museum of Ireland to decide on an appropriate course of action.

Responsibility

Project Manager
Environmental Manager
Construction Manager
Project Archaeologist

EMP 11: ECOLOGICAL MANAGEMENT PLAN FOR THE PROTECTION OF HABITATS AND FAUNA

To describe measures for the management and protection of habitats and fauna on the site

Purpose

To describe measures for the management and protection of flora and fauna on the site

Procedure

- ensuring implementation of ecological protection measures outlined below
- advising on re-vegetation onsite
- monitoring of success of re-vegetation

Ecological Protection Measures

General Habitats

- Habitat degradation will be limited by controlling the movement of construction vehicles and machinery. Construction vehicles and machinery will not encroach onto habitats beyond the proposed development footprint and will be required to travel via the constructed roads when moving between works areas. To emphasise this requirement, the boundaries of the footprint of the development will be fenced off with post and wire. The Environmental Manager will also monitor vehicle movements.

Monitoring

- The following pre-construction surveys will be undertaken:
- Pre construction bird surveys breeding season.
- Pre construction terrestrial mammal survey, particularly, for badgers.
- Bird surveys will be carried out prior to, during the construction phase and post construction in accordance with the approved Bird Monitoring Programme.
- Water quality monitoring will take place prior to, during the construction phase and post construction in accordance with the approved Water Quality Monitoring Programme.
- Routine inspections and maintenance of sediment and erosion control measures will take place regularly during the construction phase and during the operational life of the project. Silt traps and settlement ponds will be cleaned on a regular basis to ensure their effectiveness.
- To reduce the level of disturbance to fauna, construction activities will be restricted to between 8.00am and 6.00pm, Monday to Friday and between 8am and 1pm on Saturdays. Construction work will not take place outside of these hours unless in exceptional circumstances.
- In the unlikely event that protected faunal species are found actively using the Site for breeding/roosting during the construction phase, works will cease immediately, and the area will be cordoned off until advice is sought from a suitable qualified expert/NPWS.

Responsibility

Environmental Manager
Construction Manager
Project Ecologist

EMP 12: MANAGEMENT OF INVASIVE SPECIES

Purpose

To describe measures for the management of invasive species on site

Procedure

Areas where invasive species are present will be identified and demarcated prior to commencement of construction:

Invasive Species Control

The following principles will be applied during the management of Invasive Species at the Development site:

- Prevention/Bio-security: Preventing invasive species from arriving on site/preventing spread of invasive species.
- Response: Regular monitoring combined with a rapid response to treat/ eradicate invasive species that are identified encroaching on the site, to ensure that they do not become established.
- Eradication: Aiming to eradicate invasive species on site will prevent the problem increasing.
- Containment: It may not be realistic to completely eradicate invasive species from a particular site. This could be due to level of infestation or the species involved, and resourcing limitations (both financial and personnel required).

Informing

- Invasive Species 'Tool Box Talks'/Site Inductions will be delivered to ensure all site personnel are of aware of/what invasive species looks like that are potentially at the location/greater area, i.e. Japanese Knotweed/Zebra Mussel, and issues associated with the same. To reduce the likelihood of invasive species spreading, the construction personnel involved in works will be trained in basic relevant invasive species prevention and management ('Tool Box talk').
- Prior to the commencement of construction, the development footprint will be surveyed for the presence of invasive species. If invasive species are present, the Project Manager/Environmental Manager will manage their control. The control methods will be specific to the local site conditions as well as the invasive species being managed. Control methods can include physical and/or chemical control methods and monitoring.
- Where any non-native species is present, a management plan will be put in place, to manage the risks, the risks and implications of the species, along with legal requirements.
- A distribution map of the invasive alien plant species at the development site has been developed, and will be incorporated into the CEMP.
- Where a non-native species is identified as a risk of being introduced, spread within, or moved off site, mitigation measures will be in place to prevent spread of the species.
- If required, the project will be phased, to allow time to deal with the presence and/or risk of spread of non-native species.
- Where a species requires long-term management (e.g. Japanese knotweed), a site management plan will be developed that addresses all issues associated with it.
- Locations of invasive species within the overall site will be highlighted and excluded from the works.
- To reduce the likelihood of invasive species being introduced to the site from quarries, the aggregate will be crushed stone which will be biologically inert and would not be expected to have a seed bank.

- No machinery will be permitted to park within demarcated/exclusion areas.
- If excavations are required/movement of invasive species such as Japanese Knotweed, relevant licenses will be obtained, and any excavations/movement of the same will be in line with current beast practice.

Bio-security

- To reduce the likelihood of invasive species being introduced to the site from construction works on other sites, it will be required that vehicles and tools will arrive on site clean. Work boots will be dipped in or scrubbed with a disinfectant solution and thoroughly dried afterwards before being used on the site for the first time (Also requirement during water quality sampling between different catchments). All PPE will be visually inspected and any attached vegetation or debris removed. PPE and tools will remain on site for the duration of construction. Any machinery or equipment returning from a different construction site will cleaned, power washed/steam washed and visually inspected again before re-entering the site.

Equipment/Machinery

To maintain good site hygiene when dealing with any non-native species:

- A fence/signage that can be clearly seen will mark out any area of issue. Signs should be erected to warn people working there that the area is infested / contaminated. No entry signage will be put in place.
- Where contaminated soil, materials or water are located, signage should be erected to indicate them.
- Personnel working on or between sites will ensure their clothing and footwear are cleaned where appropriate to prevent spread.
- Tracked vehicles should not be used within the area of infestation.
- All vehicles leaving the infested area and / or transporting infested soil/materials must be thoroughly pressure-washed in a designated wash-down area before being used for other work.
- Where cross-contamination is possible (i.e. from one site to another), vehicles or machinery will be designated to specific sites where possible to prevent spread.
- Material / water left after vehicles have been pressure-washed must be contained, collected and disposed of appropriately.
- All chemicals used for the control of non-native species should be stored and used in an appropriate manner carried out by specialist/suitability trained personnel.

Methodologies

- Invasive species management methodologies and plans outlining Best Available Techniques (BAT) will be sourced from the National Invasive Species Database, from previously published documents/current best practice, and from the Invasive Species Ireland and Inland Fisheries Ireland websites.

A Site Specific Invasive Species Management Plan will be developed, and will be incorporated into the Appointed Contractor(s) CEMP.

Responsibility

Project Manager

Environmental Manager

Construction Manager
Project Ecologist

References

Information on invasive species is provided in the National Road Authority (NRA) (now Transport Infrastructure Ireland (TII))[1], and Invasive Species Ireland (ISI)[2] documents provided in Annexes I and II, in relation to identification, control and eradication of Japanese Knotweed.

[1] http://www.tii.ie/technical-services/environment/construction/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf

[2] http://invasivespeciesireland.com/

EMP 13: EMERGENCY RESPONSE PLAN

Purpose

To describe measures for the prevention of an environmental accident or incident and the response required to minimise the impact of such an event.

Procedure

In the event of an environmental emergency, all personnel will react quickly and adhere to this procedure. All site personnel will be inducted in the provisions of the **Emergency Response Plan.**

The following outlines some of the information, on the types of emergency, which must be communicated to site staff;

- Release of hazardous substance – Fuel and oil spill,
- Concrete spill or release of concrete or silt
- Flood event – extreme rainfall event
- Environmental buffers and exclusion zones breach
- Housekeeping of materials and waste storage areas breach
- Stop works order due to environmental issue or concern (threat to archaeological or ecological feature)
- Fire on site (cross-reference site Safety Emergency Plan as appropriate)

If any of the above situations occur; the Emergency Response Plan is activated. The Environmental Manager will most likely be responsible for overseeing the Emergency Response Plan (to be confirmed by the Appointed Contractor(s)) and will be prepared and ready to implement the plan at all times. The Environmental Manager will be immediately informed and report to the scene. He/she must be aware of the;

- Nature of the situation – brief description of what has happened
- Location of the incident
- Whether any spill has been released
- Whether the situation is under control

Oil Spillages

The following list outlines issues likely to be appropriate for inclusion the plan:

- Site staff will report the spillage immediately to the Environmental Manager or Construction Manager;
- Where relevant, the Environmental Manager will report the spillage to Inland Fisheries Ireland and Clare County Council;
- Where possible, the source of pollution will be identified;
- Switch off all sources of ignition;
- Stop the spillage spreading:
- Use absorbent materials from the spill kit to mop up the spill (sand or absorbent materials should be used rather than detergents);
- Place boom across watercourse or in nearby downstream existing drains as a precaution;
- Do not wash spillage into drainage system. Washing will only make the situation worse and extend the pollution to other water bodies/drainage systems;

- If the spill has already reached drains, block the inlet of the dirty water cross pipes in the nearby drainage outflow points on the roadside drains with oil absorbent booms, which will prevent oils flowing into the existing drains;
- Shovel contaminated sand/earth/absorbent granules into sacks or skips;
- A specialist oil removal company should remove pooled oil.

Concrete Spillages

The following list outlines issues likely to be appropriate for inclusion in such a plan:

- Site staff will report the concrete spillage immediately to the Environmental Manager or Construction Manager;
- Where relevant, the Environmental Manager will report the spillage to Inland Fisheries Ireland and Clare County Council;
- If there is a risk of concrete spreading into the drainage system, the inlet of the dirty water cross pipes in the nearby drainage outflow points on the roadside drains will be blocked using the absorbent booms, which will prevent concrete flowing into the existing drains
- Do not wash spillage into drainage system. Washing will only make the situation worse and extend the pollution to other water bodies/drainage systems;
- If the spill has already reached drains, acid may be added to the drains by the Environmental Manager to neutralise the alkalinity of the concrete;
- Shovel contaminated concrete granules into sacks or skips for treatment in the Roadside Concrete Wash unit.

Contacts

As an Environmental Control Measure, the Environmental Manager will append the relevant contact details to the Emergency Response Plan document. Examples of such contact details include:

- Environmental Manager
- Specialist oil removal Company
- Clare County Council
- Inland Fisheries Ireland
- National Parks and Wildlife Service

Location of Emergency Spill Kits

- A map indicating the location of all emergency spill kits will be attached to the Emergency Response Plan document.
- Emergency oil spill kits will also be carried in all site vehicles and machinery and in the site office.

Responsibility

- The Environmental Manager will prepare and finalise an Emergency Response Plan to be ready to respond to any incident.
- All site personnel will report any spillages of oil or chemicals to the Environmental Manager and Construction Manager immediately.

As appropriate, the Environmental Manager will report the spillage to the Regional Fisheries Board, Clare County Council and any other relevant authority.

EMP 14: SITE ENVIRONMENTAL TRAINING AND AWARENESS

Purpose

To describe measures for the training of all site personnel in the protection of the environment and the relevant controls.

Scope

All site personnel and construction teams which may influence environmental impacts.

Procedure

An initial site environmental induction and ongoing training will be provided to communicate the main provisions of the CEMP including this EMP to all site personnel. Two-way communication will be encouraged to promote a culture of environmental protection.

The following outlines some of the information which will be communicated to site staff;

- Environmental procedures of the CEMP
- Environmental buffers and exclusion zones
- Housekeeping of materials and waste storage areas
- Environmental Emergency Response Plan

Housekeeping and Storage of hazardous materials

- Hazardous materials marked with the following symbols will only be stored in the secure storage container in the temporary site construction compounds.

- Subcontractors will provide a copy of the Material Safety Data Sheets for all hazardous substances brought on site.

All finalised CEMP policies will be adhered to, in the management of fuels and oils, concrete, and installation of sediment and erosion controls and drainage features. All finalised details will be communicated with site personnel. Environmental Training including spill kit training, installation of silt fence training is to be provided by the Appointed Contractor(s). Environmental training records will be retained in the site office.

Responsibility

Construction Manager
Environmental Manager
All site personnel

Details of Induction and Training to be finalised by Appointed Contractor(s)

EMP 15: MONITORING AND AUDITING

Purpose

To describe measures for environmental monitoring during the construction works and audit of control measures to ensure environmental protection.

Procedure

All mitigation measures, any planning conditions and relevant construction methods will be monitored on site. The Appointed Contractor(s) will nominate an Environmental Manager for the works. The Environmental Manager will provide Audit Checklists to ensure regular checks of the site's control measures for the ongoing protection of the environment.

Monitoring will be carried to ensure adherence with the following;

EMP-2	Surface Water Management and Run-off Control (Sediment and Erosion Control)
EMP-3	Fuels and Oils Management
EMP-4	Management of Concrete
EMP-5	Construction Waste Management Plan
EMP-6	Construction Traffic Management
EMP-7	Wheel Wash Management Procedure
EMP-8	Construction Dust Management
EMP-9	Construction Noise Management
EMP-10	Archaeological & Heritage Protection
EMP-11	Ecological Management Plan Protection of Habitats and Fauna

Checklists for daily, weekly or monthly site audits will be finalised by the Environmental Manager and the relevant personnel informed of their duties. Checklists will include (but are not limited to) confirmation that fuel is stored appropriately, waste management rules are adhered to, all environmental buffers are maintained, Surface water and run-off control measures of the are in place and functioning, and concrete chute wash-out procedure is being followed. Checklists will be finalised with the Final Contractor(s)'s EOP.

All environmental records, including completed checklists, will be retained at the site office.

Responsibility

Project Manager
Environmental Manager
Construction Manager
Project Ecologist
Project Archaeologist

Details of Monitoring Procedure and Checklists to be finalised by Appointed Contractor(s)'s Environmental Manager

EMP 16: ENVIRONMENTAL ACCIDENTS, INCIDENTS AND CORRECTIVE ACTIONS

Purpose

To describe measures for the recording, investigating and close-out of any environmental accidents or incidents on the site

Procedure

- The Environmental Manager or Construction Manager will be contacted as soon as possible where there is any incident that carries the possibility of negative environmental consequences (e.g. minor oil leakage or blockage of drainage pipe).
- The Emergency Response Plan and standard emergency procedures will be applied to get the incident under control and prevent injury or loss of life in the first instance.
- Work in the area will be halted and the Environmental Manager will be called to the scene to assess the situation and to decide on initial responses and remedial measures.
- Once the situation is under control, the environmental accident or incident will be recorded and the cause investigated.
- Any remedial action required will be taken to mitigate any damage and prevent a reoccurrence.
- Corrective actions will be communicated to personnel and sub-contractors where relevant – particularly where it results to a change in procedure.

Example list of environmental accidents & incidents

- Accidents involving large spill of fuel or concrete from delivery truck (emergency response required)
- Spills of fuel and oil (minor)
- Waste or rubbish left around the site (not in dedicated waste areas)
- Breach of any buffers (archaeological, ecological, watercourse)
- Failure of any control measures (silt fences collapsed in a storm)
- Concrete chute wash out in a non-dedicated area
- Unplanned vehicle movement off the access tracks
- Unplanned vehicle movement within a buffer zone

Responsibility

- Site staff will contact the Environmental Manager or Construction Manager as soon as possible where there is any incident that carries the possibility of negative environmental consequences.
- The Environmental Manager is responsible for alerting the relevant authorities.

Details of Environmental Accidents, Incidents and Corrective Actions Procedure, including a chain of responsibility, to be finalised by Appointed Contractor(s) and communicated to all personnel and sub-contractors

EMP 17: ENVIRONMENTAL COMPLAINTS

Purpose

To describe measures for the recording and resolving complaints by third parties, including local residents or members of the public

Procedure

Any environmental complaints received, whether internal or external, will be recorded and investigated. It is recommended that immediate action is taken as relevant to resolve environmental complaints to avoid any nuisance to the local community or any environmental damage.

This procedure includes;

- Recording of any complaints to a Site Log
- Follow up by the relevant site representative – Environmental Manager
- Remedial measures where required
- Ongoing communication with complainant to confirm resolution
- Any required training or communication with site personnel and sub-contractors as a result

Responsibility

Project Manager
Environmental Manager
Construction Manager

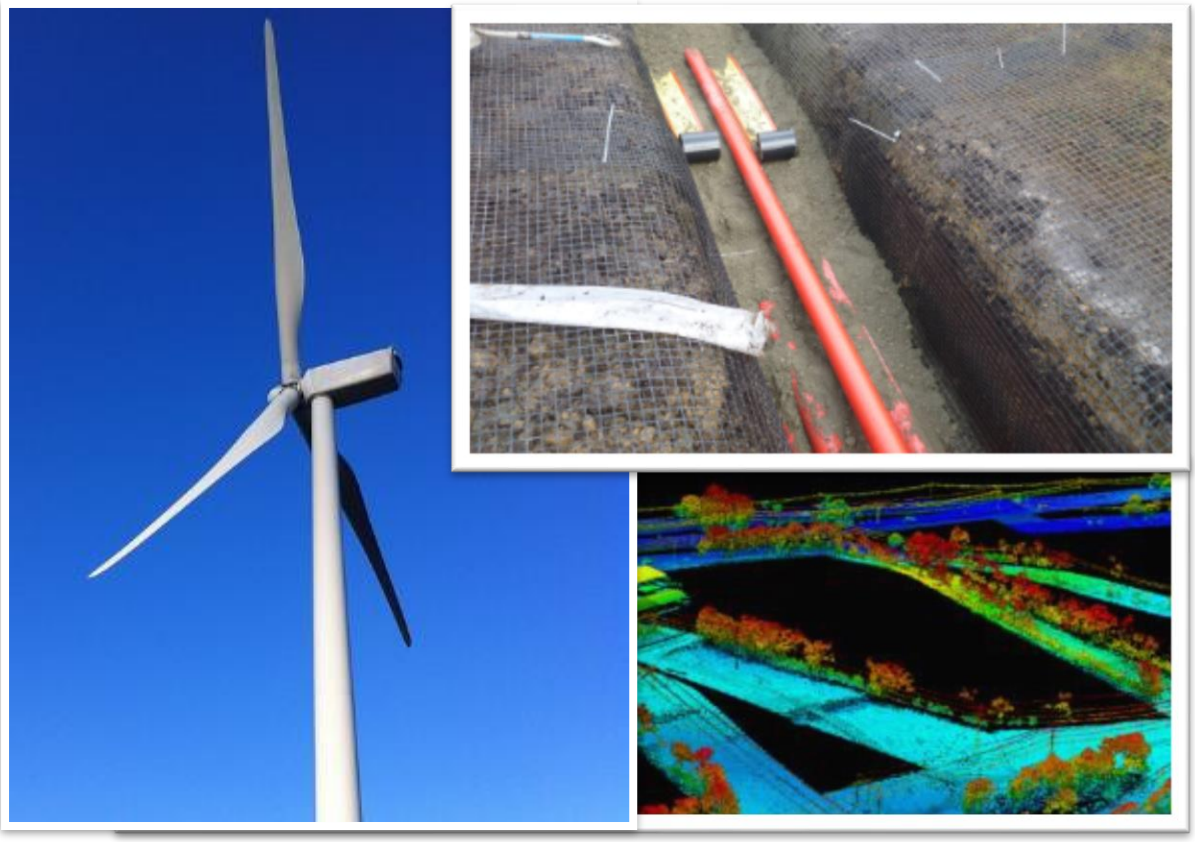
Details of Environmental Complaints Procedure to be finalised by the Appointed Contractor(s)

Appendix 2

Construction Methodology 110kV Grid Connection – Carrownagowan Wind Farm

Outline Construction Methodology – 110kV Underground Cable Connection

Carrownagowan Wind Farm
Grid Connection



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Client: Coillte C/o Malachy Walsh Partners

Malachy Walsh and Partners
Engineering and Environmental Consultants

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01	SK	RG	29.11.19	*Revised Substation Location*
02	SK	RG	27.03.20	Revised following Client Review
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1.0 Introduction

The purpose of this document is to outline and explain the construction techniques and methodologies which will be implemented during construction of the proposed Carrownagowan Wind Farm 110kV grid connection to the existing ESB Ardnacrusha 110kV substation. The grid connection will consist entirely of underground cabling (UGC) with the majority of the UGC to be installed within the public road network.

The UGC works will consist of the installation of 5 No. ducts in an excavated trench to accommodate 3 No. power cables, and 1 No. fibre communications cable to allow communications between the Carrownagowan Wind Farm Substation and Ardnacrusha 110kV substation.

This document is intended to be used as an aid to understand the methodologies to be employed during construction and should be read in conjunction with all other specialist reports which accompany the planning application. In addition, this document is in outline form only and will be revised and updated prior to the commencement of any construction activities, detailed Method Statements will be prepared in respect of each aspect of the proposed development.

2.0 Proposed 110kV Underground Cable Route

The proposed UGC route is approximately 25km in length and runs in a northerly direction from the existing ESB Ardnacrusha 110kV substation to the proposed Carrownagowan Wind Farm substation location utilizing public local road networks, existing access tracks and private forestry access tracks.

The exact location of the UGC within the proposed site boundary is subject to minor modification following a further detailed assessment to be undertaken prior to construction and following consultation with Clare County Council and all other relevant stakeholders, having regard to all environmental protection measures outlined in the planning application and accompanying technical reports.

Below **(Figure 1)** which outlines the proposed UGC route, with each section of the route being formulated in detail within Table 1.

This proposed grid connection option is shown as an Overall Site layout Plan in Drawing No. 05641-200.

Figure 1 -Grid Connection Route Location

Table 1 of this report summaries the route location features of the underground cable connection and proposed route.

Table 1 – Approximate Route Location of Preliminary Design:		
Wind Farm Site/Forestry Roads (UGC)	**Public Roads (UGC)**	**ESB Access Track (UGC)**
5,504 m	18,875 m	585 m

Table 1: Carrownagowan Wind Farm to Ardnacrusha 110kV Substation – UGC Route Location Summary

Table 2 below separates the UGC route into a number of sections and describes the specific construction requirements of each individual section with access routes to the work areas. All plant and equipment employed

on the proposed works will be subject to good site organisation and hygiene, particularly during construction activities.

Table 2 - Summary of Preliminary Grid Connection Design Route	
Section	**Description**
Section 1 UGC 3,538 m	**UGC from Ardnacrusha 110kV substation to R-471 Road** The proposed underground cable route initially begins within the Ardnacrusha substation compound exiting the confines northerly provisionally turning right onto the local public route of the (L-3056). Approaching a crossroad junction, the UGC turns left opposite the main entrance of Ardnacrusha Power Station onto Lackyle Heights Rd and continuing along this route for approx. 2.8km. The UGC will predominantly be installed in the carriageway until encountering another road junction at which point the UGC will turn right onto an unpaved section of roadway. The UGC will continue north on this unpaved road where it will encounter the first proposed bridge crossing within the proposed route over the River Blackwater (Bridge 1). This bridge will be crossed using a horizontal directional drill method (HDD) before continuing along this unpaved section of roadway for approx. 1.37km. <u>Features</u> Section 1 contains 7 no. joint bays. Joint bays will be located below ground and finished/reinstated to the required roads specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 (JB01) will be located approx. 542m north of Ardnacrusha 110kV Substation. The joint bay will be installed within the local public network west of the Power Station entrance road. • Joint Bay 02 (JB02) will be located approx. 570m north of JB01 within the local road network situated within Lackyle Road • Joint Bay 03 (JB03) will be located approx. 561m north of JB02 positioning the joint bay within the Lackyle Rd network. • Joint Bay 04 (JB04) will be located approx. 554m north of JB03. The position of JB04 will be located approx. 415m after departing Lackyle road positioned to an entrance to agricultural grassland. • Joint Bay 05 (JB05) will be located approx. 673m north of JB04 within the local authority carriageway. The joint bay will be situated adjacent to an uninhabited dwelling with the positioning within the shoulder of the roadway. • Joint Bay 06 (JB06) is located 638m northwest of JB05 within the shoulder of an unpaved section of roadway.

	• Joint Bay 07 (JB07) will be located approx. 673m north of JB06 adjacent to a gated agricultural entrance within this unpaved carriageway. JB07 is located immediately south of the first proposed Bridge crossing. Section 1 has 1 bridge crossing: • The proposed route crosses over the River Blackwater. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding towards the (R-471). The HDD crossing will require a transition coupler to be installed at either side of the drill following the works, the location of these couplers is to be determined by the drilling contractor following site investigation.
Section 2 UGC 7,206 m	**UGC within R-471 and L-3046 Carriageway** Subsequent to this unpaved section of roadway, the UGC comes upon the regional road (R-471) with the prospective installation merging and turning right onto the regional carriageway heading in an eastward direction. The underground cable will continue eastwards passing first the church of Truagh before encountering a junction that will require the UGC to cross both lanes of a merging roadway after circa 372m before continuing along the (R-471). Within the regional road, the first of two-bridge crossings in this section exists after 172m (Bridge 2). Continuing on for a further circa 664m prior to approaching the regional road (R-465). At this junction the UGC will be required to cross underground services (Water, Telecoms, etc) which are evident within the surrounding layout and the lanes of carriageway proceeding straight along the (R-471). Subsequent to cable trenching along this route for circa. 453m, the UGC reaches the second proposed bridge crossing of the Glenmora Wood Stream (Bridge 3) which will be crossed using HDD. Once the UGC crosses this structure, the route continues for a further circa 905m before turning left onto a local route (L-3046) leaving the (R-471) carriageway. The underground cable will carry along this route on the (L-3046) for approximately 4.24km. <u>Features</u> Section 2 contains 10 no. joint bays. Joint bays will be located below ground and finished/reinstated to the required national roads specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 08 (JB08) will be located 689m after JB07 on the regional road (R-471) within the shoulder of this roadway prior to entering Truagh. An existing ESB MV OHL crosses this (R-471) roadway 107m east of JB07 • Joint Bay 09 (JB09) will be located within the (R-471) roadway, approx. 620m east of JB08. Noted is an OHL MV line running parallel to the (R-471)

	• Joint Bay 10 (JB10) will be located within the (R-471) roadway, approx. 660m east of JB09 and 208m subsequent to crossing the regional carriageway (R-465). • Joint Bay 11 (JB11) will be located within the (R-471) roadway approx. 640m southeast of JB10. The Joint bay will reside within a gated agricultural entrance. • Joint Bay 12 (JB12) will be located within the (L-3046) local roadway, approx. 807m east of JB11. JB11 is located north of the (R-471) post a road junction. • Joint Bay 13 (JB13) will be located within the (L-3046) local roadway, approx. 782m north of JB12. • Joint Bay 14 (JB14) will be located within the (L-3046) local roadway, approx. 789m north of JB13. • Joint Bay 15 (JB15) will be located within the (L-3046) roadway approx. 782m north east of JB14. The Joint bay will reside adjacent to a gated forestry access entrance. • Joint Bay 16 (JB16) will be located within the (L-3046) local roadway, approx. 764m north of JB15. Section 2 has 2 bride crossing: • The first bridge crosses over the Glenmora Wood Stream within the (R-471) approx. 160m prior to encountering JB09. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge utilizing the HDD method. • The second bridge crossing again exists within the (R-471) carriageway and is situated approx. 238m subsequent to JB10. The structure is twin arched and crossing by means of HDD will be utilized.
Section 3 OHL 6,140 m	**UGC within R-466 Carriageway, local roadway, Kilbane Village** Section 3 of the grid connection route joins onto the regional route (R-466) which requires passing two lanes of roadway at this junction before continuing for another circa 644m of carriageway before leaving this regional route onto a local public route. The UGC route carries for circa 474m, before encountering a fourth bridge (Bridge 4). This crossing will be carried out by means of installing the UGC within the bridge deck as it has been found that sufficient cover exists in the structure. Continuing along the proposed route for approx. 1.06km, a fifth proposed bridge (Bridge 5) crossing over the Glenomra River which will be crossed using HDD. On passing this structure the UGC continues for another circa. 903m to encounter a sixth bridge crossing over the along the proposed route which is situated within the small village area of Kilbane (Bridge 6), this bridge will also be crossed using HDD. Once passed the bridge structure over the crossed over the Kilbane stream, the UGC exits the Kilbane village and heads in a north-westerly direction past the townland of Upper Kilbane until the proposed route encounter a seventh bridge crossing over the Clonagaheen east stream (Bridge 7), it is proposed to cross this bridge by raising the level in the road in order to achieve sufficient depth to install the cable trench. Another bridge structure is situated circa

443m after the subsequent which crosses over the Clonagaheen west stream (Bridge 8), it is proposed to cross this bridge using HDD. The final bridge structure is situated circa 215m after the previous which crosses over O'Shea's Acres stream (Bridge 9).

Features

Section 3 contains 7 No. joint bays. Joint bays will be located below ground and finished/reinstated to the required national roads specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels.

- Joint Bay 17 (JB17) will be located approx. 768m north east of JB16 on the regional road of the (R-466)
- Joint Bay 18 (JB18) will be located within a paved local roadway, approx. 768m north east of JB17 and approx. 360m subsequent to the regional road (R-466). The Joint Bay will reside within a gated entrance to agricultural parcel.
- Joint Bay 19 (JB19) will be located within this paved local roadway, approx. 762m north of JB18. Prior to encountering this Joint Bay location, the UGC route will be required to cross beneath an existing TSO 400kV OHL transmission line, approx. 115m before JB19.
- Joint Bay 20 (JB20) will also be located within this paved local roadway, approx. 730m north of JB19.
- Joint Bay 21 (JB21) will also be located within this paved local roadway, approx. 822m north west of JB20. JB21 is located approx. 260m north of Kilbane village.
- Joint Bay 22 (JB22) will also be located within this paved local roadway, approx. 789m west of JB21. The Joint bay will reside within a shouldered road junction within this paved carriageway.
- Joint Bay 23 (JB23) will also be located within this paved local roadway, approx. 798m west of JB22.

Section 3 has 6 bridge crossings:

- The first bridge crossing within this section is (Bridge 4). This crossing will be carried out by means of installing the UGC within the bridge deck as it has been found that sufficient cover exists in the structure.
- The second bridge in this section is (Bridge 5) where the bridge crosses over the Glenmora River. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding.
- The third bridge crossing within this section is (Bridge 6), where the proposed route crosses over a watercourse within the village of Kilbane. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding.
- The forth bridge crossing within the section is (Bridge 7), where the UGC route crosses over the Clonagaheen east stream. Sufficient clearance exists within

	the bridge structure and it is proposed to cross this bridge within the deck of a new raised road level. • The fifth bridge crossing within this section is (Bridge 8), where the roadway crosses over the Clonagaheen west stream. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding. • The sixth bridge crossing within this section is (Bridge 9), this structure is the crossing point over O'Shea's Acres stream. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method before proceeding towards the Windfarm site.
Section 4 UGC 8,080 m	**UGC within Access Roadway to Windfarm** The UGC route continues along the local road subsequent to Joint bay 23 for an additional 600m in a westerly direction until reaching a local roadway on the right-hand side. Thus, the UGC accesses this route and continues uphill for approximately 1.74km before the road becomes unpaved. From this point on, the unpaved roadway forms a forestry access track continuing in a northerly direction. On this route, the cable accesses the proposed Carrownagowan Wind Farm site boundary within, carrying on the use of these forestry access tracks further for approximately 5km until reaching the proposed location for the Independent Power Provider (IPP) substation. <u>Features</u> Section 4 contains 13 no. joint bays. Joint bays will be located below ground and finished/reinstated to the required roads specification or landowner requirements. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 24 (JB24) will be located approx. 703m after JB23 on this access roadway heading in a north westerly direction. • Joint Bay 25 (JB25) will be located within the access roadway, approx. 701m north of JB24. • Joint Bay 26 (JB26) will be located within this access roadway also the joint bay will be set up approx. 681m after JB25 in a north westerly direction heading towards the Windfarm. • Joint Bay 27 (JB27) will be located approx. 670m after JB26, at this point the roadway will have become unpaved prior to accessing the privately-owned forestry lands. • Joint Bay 28 (JB28) will be located within this unpaved section and will have accessed the privately-owned forestry. Its location will exist approx. 674m north of JB27. • Joint Bay 29 (JB29) will be located within the privately-owned forestry access trackway approx. 681m north after JB28.

	• Joint Bay 30 (JB30) will be located within the windfarm access track approx. 749m north east of JB29. • Joint Bay 31 (JB31) will exist within the proposed windfarm access track approx. 751m north east of JB30. • Joint Bay 32 (JB32) will exist within the proposed windfarm access track approx. 752m north east of JB31. • Joint Bay 33 (JB33) will exist within the proposed windfarm access track approx. 749m north east of JB32. • Joint Bay 34 (JB34) will exist within the proposed windfarm access track approx. 752m north east of JB33. • Joint Bay 35 (JB35) will exist within the proposed windfarm access track approx. 749m north east of JB34. JB35 is approx. 267m outside of the windfarm substation.
Refer to Figure 1 and to the planning drawings submitted for location details. Note: The precise location of the proposed route within the planning application boundary is subject to change as result of existing services/utility locations, ground conditions and any environmental constraints.	

3.0 Access Routes to Work Area

The majority of the proposed underground cable will be installed within the public road network and therefore will be accessed via the existing road network. Where the cable route is located on private lands, contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise private access tracks, where appropriate.

A detailed Traffic Management Plan will be prepared, and agreed with Clare County Council, prior to the commencement of construction. Some work areas will require a road closure where it is not possible to safely implement a Stop/Go system. Where road closures are necessary, a suitable diversion will be implemented using appropriate signage, following consultation with Clare County Council.

Careful and considered local consultation will be carried out, to minimise the amount of disturbance caused during works. Prior to the commencement of construction, the contractor will assess all access routes and determine any additional access requirements which will be incorporated as part of the method statement. All plant and equipment employed during the proposed works (e.g. diggers, tracked machines, footwear etc.) will be inspected prior to arrival on site and on leaving site and cleaned where necessary to prevent the spread of invasive aquatic / riparian species.

4.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Clare County

Council. All work on public roads will be subject to the approval of a road opening license application. The contractor will prepare detailed traffic management plans for inclusion as part of the road opening applications. Where road widths allow, the UGC installation works will allow for one side of the road to be open to traffic at all times by means of a 'Stop/Go' type traffic management system, where a minimum 2.5m roadway will be maintained at all times. Where it is not possible to implement a 'Stop/Go' system a full road closure will be required. Temporary traffic signals will be implemented to allow road users safely pass through the works area by channelling them onto the open side of the road. Typically, the UGC will be installed in 100m sections, and no more than 100m will be excavated without the majority of the previous section being reinstated. Where the construction requires the crossing of a road, works on one carriageway will be completed before the second carriageway is opened, to maintain traffic flows.

All construction vehicles will be parked within the works area so as not to cause additional obstruction or inconvenience to road users or residents. The traffic signals will be in place prior to the works commencing and will remain in place until after the works are completed. The public road will be checked regularly and maintained free of mud and debris. Road sweeping will be carried out as appropriate to ensure construction traffic does not adversely affect the local road condition.

In the event of emergency; steel plates, which will be available on site, can be put in place across the excavation to allow traffic to flow on both sides of the road.

All traffic management measures will comply with those outlined in the accompanying Traffic Management Report and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with Clare County Council, prior to the commencement of development.

5.0 Road Opening Licence

The proposed grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Clare County Council. A Traffic Management Plan (TMP) will be agreed with Clare County Council prior to the commencement of the development. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with Clare County Council in advance of the preparation of the TMP.

6.0 Construction Hours

Standard working hours for construction will be 8.00am to 8.00pm Monday to Friday and 8.00am to 6.00pm on Saturday (if required), with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency. All site personnel will be required to wear project notification labelling on high visibility vests and head protection so that they can be easily identified by all workers on-site.

7.0 UGC Construction Methodology

The proposed UGC will consist of 3 No. 160mm diameter HDPE power cable ducts and 2 No. 125mm diameter HDPE communications duct to be installed in an excavated trench, typically 600mm wide by 1,315mm deep, with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings, etc. The

power cable ducts will accommodate 3 No. power cables. The communications duct will accommodate a fibre cable to allow communications between the Carrownagowan Wind Farm substation and Ardnacrusha 110kV substation. The ducts will be installed, the trench reinstated in accordance with landowner/Clare County Council specification, and then the electrical cabling/fibre cable is pulled through the installed ducts in approximately 650/750m sections. Construction methodologies to be implemented and materials to be used will ensure that the UGC is installed in accordance with the requirements and specifications of ESB.

7.1 Trenching Methodology

The following section outlines the methodology to be followed during trenching works:-

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures included within the planning application and accompanying reports and as required by planning conditions where relevant;
- All existing underground services shall be identified on site prior to the commencement of construction works;
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the planning application and accompanying reports, the detailed Construction Environmental Management Plan (CEMP) to be prepared prior to the commencement of construction, and best practice construction methodologies;
- Where the cable route intersects with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESB and Irish Water specifications;
- In the event that culverts require removal for ducting installation, it is proposed that a suitable method of damming the water source and pumping the water around the work area would be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland in advance of works;
- Traffic management measures will be implemented in accordance with those included in the Traffic Management Report, and a detailed Traffic Management Plan will be prepared and agreed with Clare County Council;
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature;

- Where required, grass will be reinstated by either seeding or by replacing with grass turves;
- No more than a 100m section of trench will be opened at any one time. The second 100m will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;
- Following the installation of ducting, pulling the cable will take approximately 1 no. day between each joint bay, with the jointing of cables taking approximately 1 week per joint bay location.

Figure 2 Typical 110kV Underground Duct Installation

7.2 Ducting Installation Methodology

For the trenching and ducting works the following step by step methodology will apply:

1. Grade, smooth and trim trench floor when the required 1315mm depth and 600mm width have been obtained.
2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
3. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
4. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
5. Place cable protection strips on compacted CBGM B directly over the ducts.
6. Lay the top row of ducts onto the freshly compacted CBGM B including the cable protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.

7. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
8. Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
9. Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified and place warning tape at the depth shown on the drawings.
10. For concrete and asphalt/bitmac road sections, carry out immediate permanent reinstatement in accordance with the specification and to the approval of the local authority and/or private landowners, unless otherwise agreed with local authorities **(Figure 3)**.
11. For unsurfaced/grass sections, backfill with suitable excavated material to ground level leaving at least 100 mm topsoil or match existing level at the top to allow for seeding or replace turves as per the specification of the local authority or landowner **(Figure 4)**.
12. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

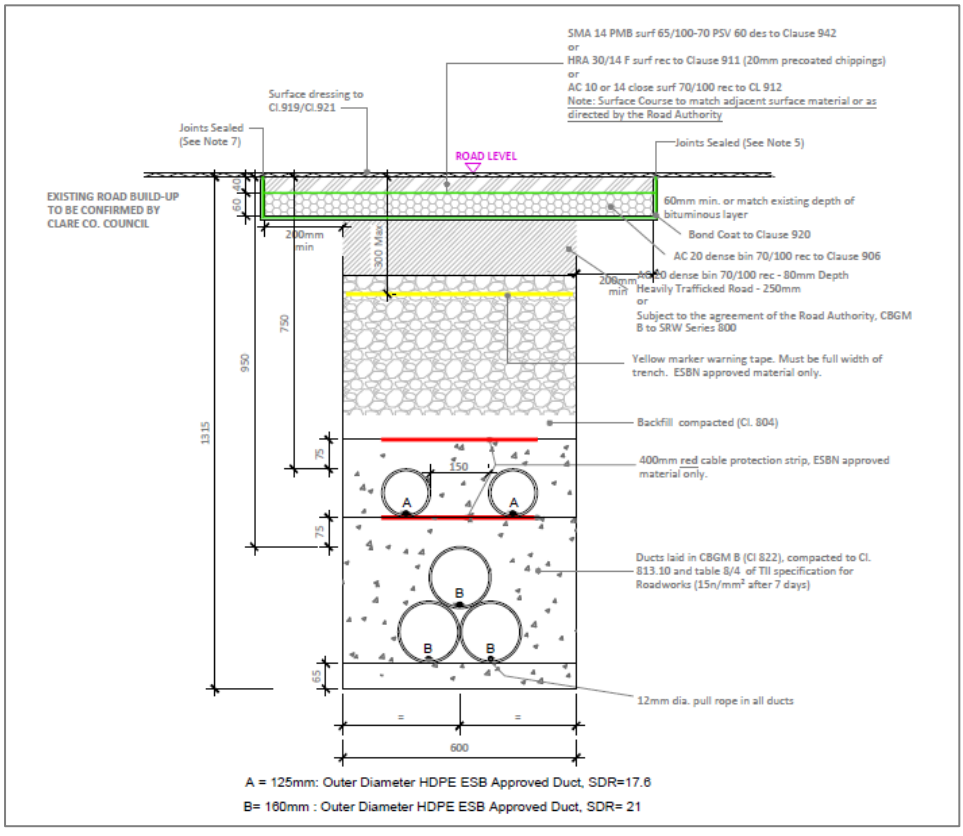

Figure 3 Typical Trench in Roadway

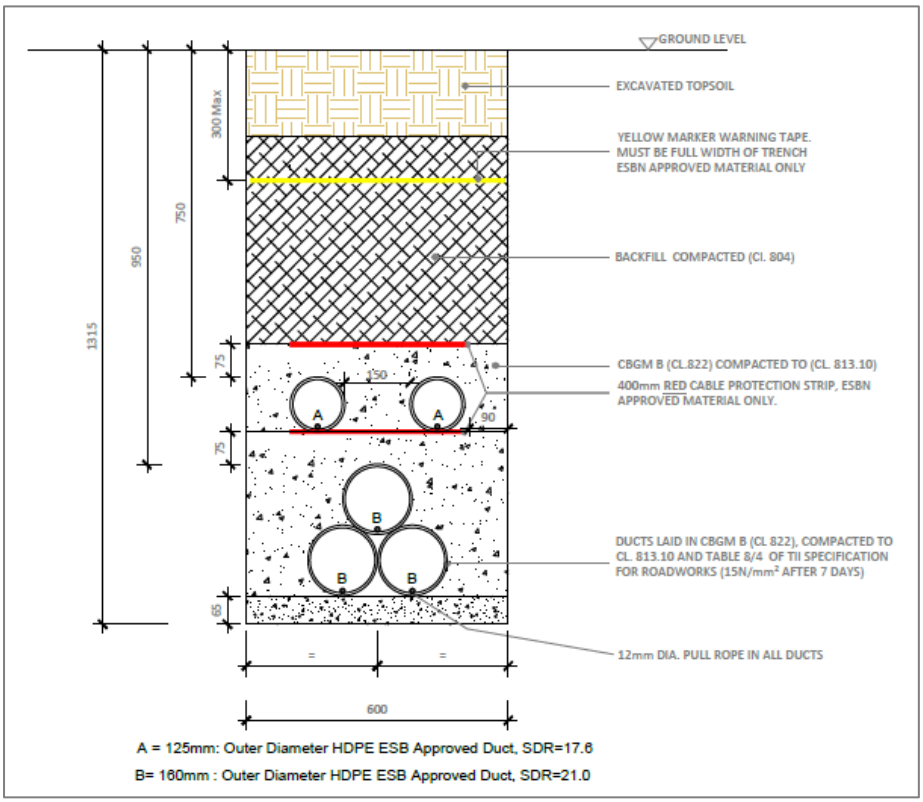

Figure 4 Typical Trench in Off Road Section

Equipment:

- 2-3 General Operatives;
- 1 Excavator Operator;
- 1 no. tracked excavator (only rubber tracked machines will be allowed on public roads);
- 1 no. dumper or tractor and trailer.

Materials:

- Sand for pipe bedding;
- Ready-mix Concrete where necessary (delivered to site);
- Trench backfilling material (excavated material and aggregates) to relevant specifications;
- 160mm diameter HDPE ducting;
- 125mm diameter HDPE ducting;
- Temporary Surface Reinstatement Materials

7.2.1 On Public Road

The majority of the 110kV route is located within road carriages and where applicable the trench will be in the non-trafficked strip between the wheel marks on the road, presence of exiting utilities and the nature of the road and the adjoining terrain. It is preferable to excavate a trench within the middle of the lane, or the middle of the roadway to reduce load on the cable.

7.2.2 On Private Tracks

Where the cable is installed in private tracks the location where the cable is laid will depend on several factors, width of track, bends along the track and crossings. Where the track needs to be widened stone will be brought in to build up the area to the same level of the track. The excess material from the track will be used elsewhere on reinstatement works.

7.3 Marker posts

Surface cable markers will be placed along the route where cable depth is unavoidably shallow, due to constraints such as existing services, to indicate the precise location of the UGC. These markers will be metallic plates in accordance with ESB standards.

Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700mm base, and with centred lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker post shall also be placed in the event that burial depth is not to standard. Siting of marker posts to be dictated by ESBN as part of the detailed design process. **(Figure 5)** below

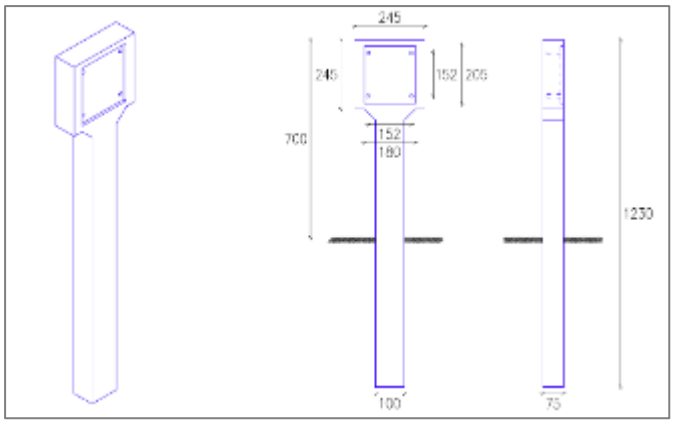

Figure 5 Typical ESB Marker Posts Example

7.4 Horizontal Direction Drilling (HDD)

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. There are a number of bridges on this UGC route which will require HDD due to there being insufficient cover and depth in the bridge to cross within the bridge deck. The proposed drilling methodology is as follows: -

1. A works area of circa .40m^2 will be fenced on both sides of the river crossing,
2. The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
3. Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
4. A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.

5. The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
6. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
7. The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
8. Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
9. Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
10. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
11. The ducts will be cleaned and proven and their installed location surveyed.
12. The entry and exit pits will be reinstated to the specification of ESB Networks and Clare County Council.
13. A transition coupler will be installed at either side of the bridge/ following the horizontal directional drilling as per ESB requirements, this will join the HDD ducts to the standard ducts.

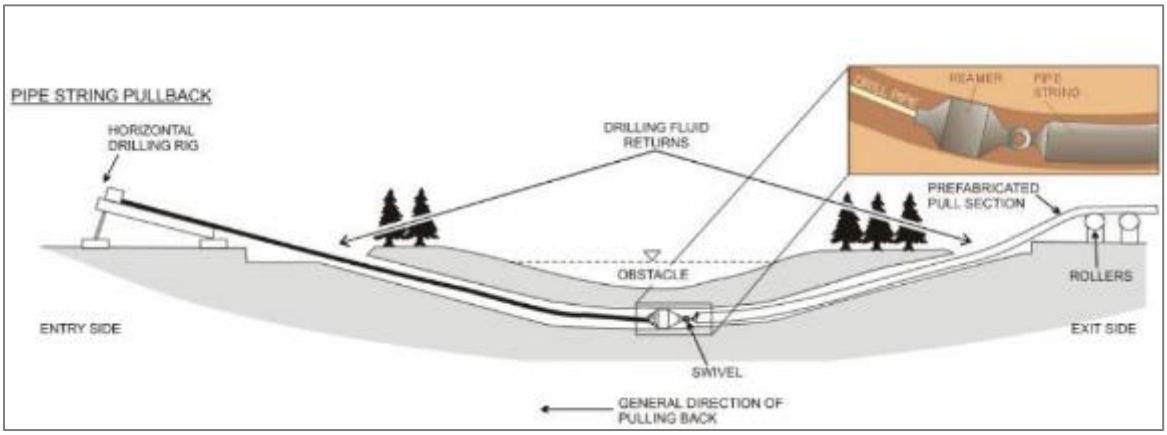

Figure 6 - Typical HDD Installation

7.5 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2m in height. Where excess material exists, it may be used in the reinstatement of the Carrownagowan Wind Farm site or disposed of to a licensed facility.

7.6 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the works area or within the temporary construction compound to be located within Carrownagowan Wind Farm. Oils and fuels will not be stored on site and will be stored in an appropriately bunded area within the temporary storage compound.

7.7 Joint Bays and Associated Chambers

Joints Bays are to be installed approximately every 650m - 750m along the UGC route to facilitate the jointing of 2 No. lengths of UGC. Joint Bays are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level. Joint Bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the Carrownagowan Wind Farm substation and the existing 110kV substation at Ardnacrusha. Earth Sheath Link Chambers are also required at every joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will typically be pre-cast concrete structures with an access cover at finished surface level.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers is subject to approval by ESBN. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions.

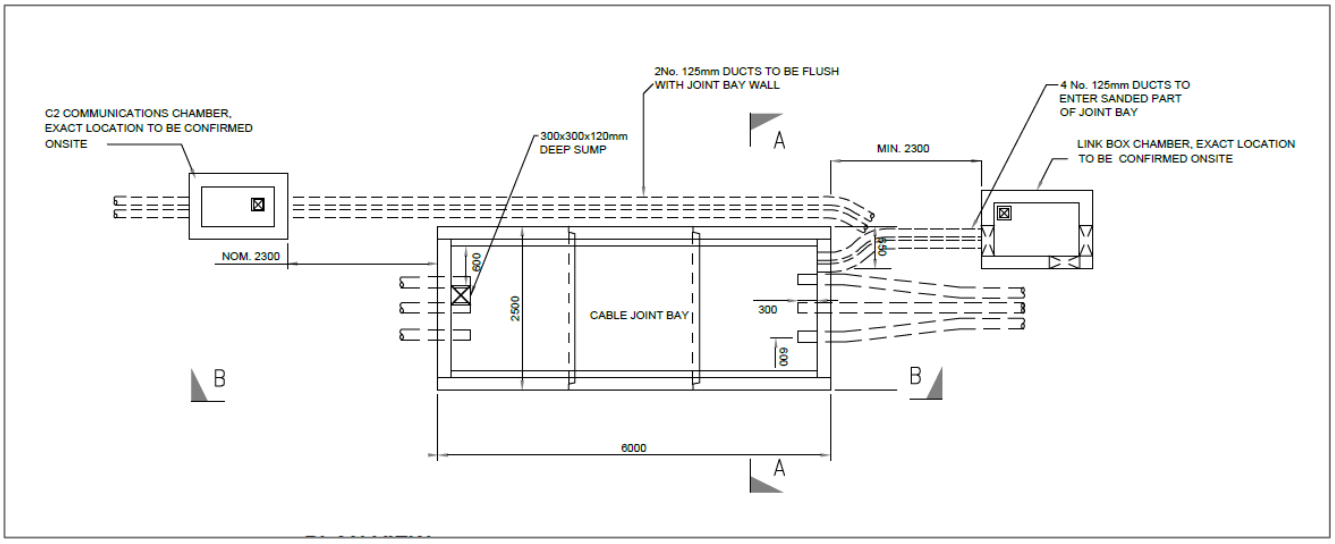

Figure 7 - 110kV Joint Bay Plan Layout

7.8 Joint Bay Construction and Cable Installation

Before starting to construct, the area around the edge of the proposed joint bay which will be used by heavy vehicles will be surfaced with a terram cover if required and stone aggregate to minimise ground damage. Any roadside drains within the temporary works area will be culverted and check dams made from stone or sandbags covered with terram will be inserted upstream and downstream of these culverts to intercept any solids generated during the insertion or which wash out during the works. If the ground slopes from the working area toward a watercourse or if there is evidence of solids washing off the works area toward nearby watercourses or drains, a silt fence with straw bales, will be interposed between the works area and the watercourse.

All excavated material will be stored near the excavations and reused for reinstatement works. Any soil required for reinstatement that will be temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing and be regularly monitored by a

designated competent person for signs of solids escape. In which case an additional line of silt fencing with straw bales will be added in line with the relevant ECM.

If the joint bay needs to be dewatered, this will be pumped to a percolation area if the soil is not saturated, otherwise a settlement tank will be used to remove any solids from the dewatering process to comply with the ECM.

The risk of concrete reaching surface waters is considered very low given that all concrete will be poured into the pit excavated for the joint bay so that spills will be contained. The basic requirement therefore is that all pouring operations be constantly supervised to prevent accidental spillages occurring outside the pit.

Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g. using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.

The following steps outline the methodology for joint bay construction and reinstatement:

1. The contractor will excavate a pit for joint bay construction, including for a sump in one corner.
2. Grade and smooth floor; then lay a 75 mm depth of blinding concrete (for in situ construction) or 50 mm thick sand (for pre-cast concrete construction) on 200 mm thick Clause 804 granular material.
3. In situ construction. Construct 200 mm thick reinforced concrete floor slab with sump and starter bars placed for walls as detailed on the drawings.
4. In situ construction. Construct 200 mm thick reinforced concrete sidewalls as detailed on the drawings. (**Figure 7**)

Figure 8 - Typical joint bay under construction (in-situ)

5. In situ construction. Remove formwork and backfill with suitable backfill material in grassed areas or Clause 804 material once ducting has been placed in the bay. Backfill externally with granular material to Co. Council/TII Specification for Roadworks. (**Figure 8**)

Figure 9 - Completed joint bay prior to cable installation (in-situ)

6. Pre-cast concrete construction. Place pre-cast concrete sections on sand bedding. (**Figure 9**)

Figure 10 - Typical joint bay under construction (pre-cast)

7. Where joint bays are located under the road surface the joint bay will be backfilled with compacted layers of Clause 804 and the road surface temporarily reinstated as specified by the local authority.

8. Precast concrete covers may be used as temporary reinstatement of joint bays at off road locations. These covers are placed over the constructed joint bay and are then removed at the cable installation stage of the project.

9. At a later date to facilitate cable installation and jointing, reinstate traffic management signage, secure individual sites, re-excavate three consecutive joint bays and store excavated material for reuse.

10. The cable is supplied in pre-ordered lengths on large cable drums (**Figure 10**). Installing "one section" of cable normally involves pulling three individual conductors into three separate ducts. The cable pulling winch must be set at a predetermined cut off pulling tension as specified by the designer. The cable will be connected to the winch rope using approved suitably sized and rated cable pulling stocking and swivel or the pulling head fitted by the cable manufacturer**.** A sponge may also be secured to the winch rope to disperse lubricant through the duct. Lubrication is also applied to the cable in the joint bay before it enters the duct.

Figure 11 - HV cable pulling procedure (Typical drum set-up)

11. Once the "two sections" of cable (total of 6 conductors) are pulled into the joint bay, a jointing container is positioned over the joint bay and the cable jointing procedure is carried out in this controlled environment. (**Figure 12**)

Figure 12 - HV cable jointing container

12. Following the completion of jointing and duct sealing works in the joint bay, place and thoroughly compact cement-bound sand in approximately 200 mm layers to the level of the cable joint base to provide vertical support. Install additional layers of cement-bound sand and compact each layer until the cement-bound sand is level with the top of the joint. Install an additional 100 mm cement-bound sand layer. Install cable protection strip. Backfill with cement-bound sand to a depth of 250 mm below surface and carry out permanent reinstatement including placement of warning tape at 400 mm depth below finished surface.

Equipment:

- 2-3 General Operatives
- 1 Excavator Operator
- 360˚ tracked excavator (13 ton normally, 22 ton for rock breaker)
- 1 no. tracked dumper or tractor and trailer

Materials:

- Sand for pipe bedding
- Blinding Concrete where necessary
- Clause 804 Material
- 160mm diameter HDPE ducting;
- 125mm diameter HDPE ducting;
- Precast Chamber Units / Relevant construction materials for chambers
- Link Box

8.0 Relocation of Existing Services

In order to facilitate the installation of the proposed underground cable, it may be necessary to relocate existing underground services such as water mains, gas networks or existing cables. In advance of any construction activity, the contractor will undertake detailed surveys and scans of the proposed route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

9.0 Major Watercourse Crossings

The proposed cable route will involve 9 No. bridge crossings including 7 No. HDD crossings and 2 No. crossings in the road on the bridge. Where the cable route intersects with existing watercourses, a detailed construction method statement will be prepared by the Contractor prior to the commencement of construction and is to be approved by the Local Authority and relevant environmental agencies. The cable will be located within the bridge deck where there is sufficient depth and width available on the bridge, where there is insufficient depth and width available horizontal directional drilling (HDD) may be employed as an alternative.

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled 'Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites", and these guidelines will be adhered to during the construction of the proposed development.

Numerous other minor watercourses crossing locations have been noted along the proposed cable route i.e. culverts, pipe drains. The majority of these minor watercourses have been identified as part of the survey works and a proposed crossing schedule has been included as part of this report, see Appendix A.

9.1 Bridge 1 - Horizontal Directional Drilling

Coordinates: 52.740281, -8.616893

Bridge 1 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to horizontal directional drill (HDD) approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 05641-231 for further details.

Figure 14 - Bridge 1

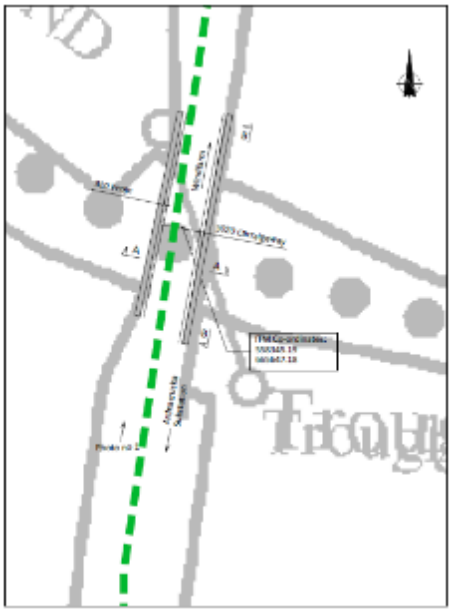

Figure 13 - Bridge 1 Location

9.2 Bridge 2 - Horizontal Directional Drilling

Coordinates: 52.743186, -8.60830

Bridge 2 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to horizontal directional drill (HDD) approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 05641-232 for further details.

Figure 15 Bridge 2

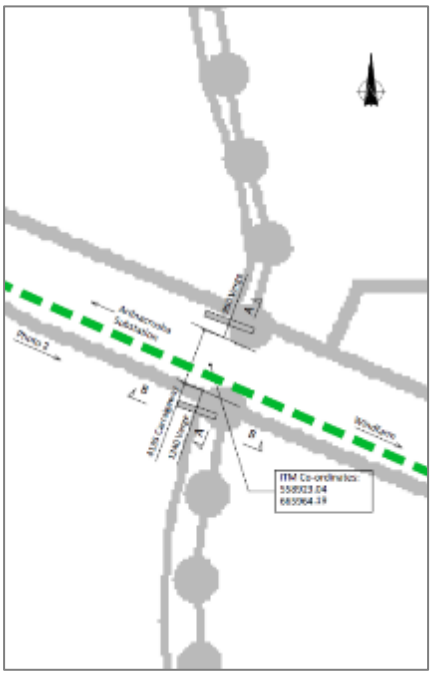

Figure 16 Bridge 2 Location

9.3 Bridge 3 - Horizontal Directional Drilling

Coordinates: 52.742639, -8.592507

Bridge 3 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to horizontal directional drill (HDD) approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.**

See Drawing 05641-233 for further details.

Figure 17 Bridge 3

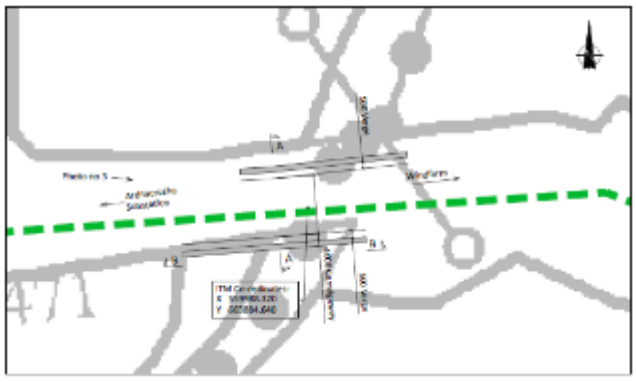

Figure 18 Bridge 3 Location

9.4 Bridge 4 – Instatement within Road deck

Coordinates: 52.786869, -8.558068

Bridge 4 has been found to have sufficient deck cover within the structure to accommodate UGC to comply with specifications. The installation can be carried out within a Trefoil arrangement with a depth of 1315mm. This permanent reinstatement of a local route can be seen as per Drawing No. 05441-222 with reinstatement of the bridge deck to be carried and will be completed to the specification of the Local Authority.

See Drawing 05641-234 for further details.

Figure 19 Bridge 4

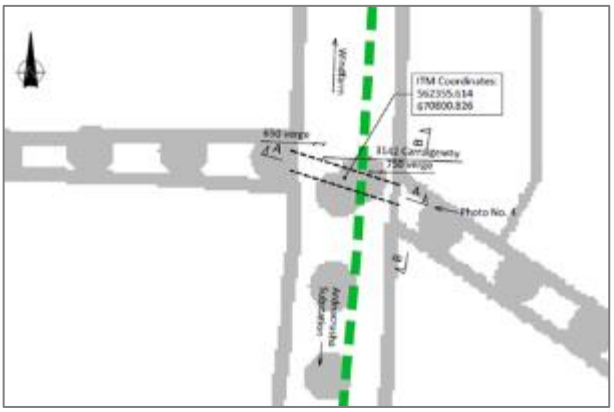

Figure 20 Bridge 4 Location

9.5 Bridge 5 - Horizontal Directional Drilling

Coordinates: 52.796315, -8.557663

Bridge 5 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to horizontal directional drill (HDD) approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway.

See Drawing 05641-235 for further details.

Figure 21 - Bridge 5

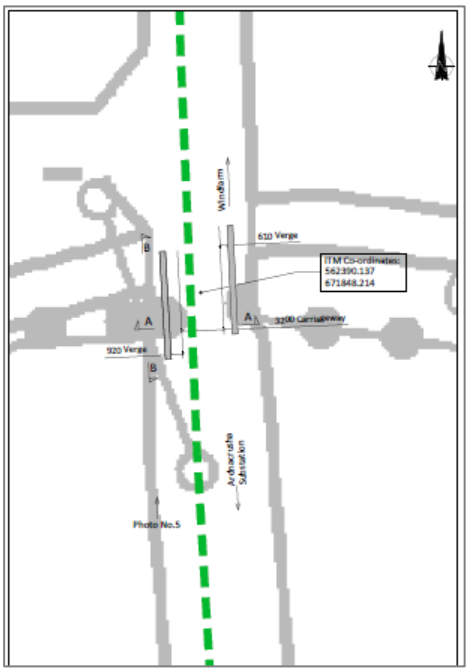

Figure 22 - Bridge 5 Location

9.6 Bridge 6 - Horizontal Directional Drilling

Coordinates: 52.803452, -8.563740

Bridge 6 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to horizontal directional drill (HDD) approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway.

See Drawing 05641-236 for further details.

Figure 24 Bridge 6

Figure 23 Bridge 6 location

9.7 Bridge 7 – Raise Road Level

Coordinates: 52.805521, -8.569268

It is proposed to cross Bridge 7 by installing the cable ducts in a trench on the deck of the bridge. Initial visual surveys have indicated insufficient room to install the cable to ESB specification (450mm cover to ducts) as per the current bridge design. The road finish will therefore need to be raised over the length of the bridge in order to achieve the required cover for the ducts. The height of the bridge parapets will also need to be raised in order to achieve 1250mm high guarding with the need road height. Reinstatement of works will be completed to the specification of the Local Authority.

A surface cable marker (metallic plate; 300mm x150mm to ESB standard) will be placed on the bridge where cable depth is unavoidably shallow.

Further consultation with the County Council's Roads Department will be necessary to agree if a handrail is required at 1100mm in height from the highest surface on the bridge.

See Drawing 05641-237 for further details.

Figure 26 Bridge 7

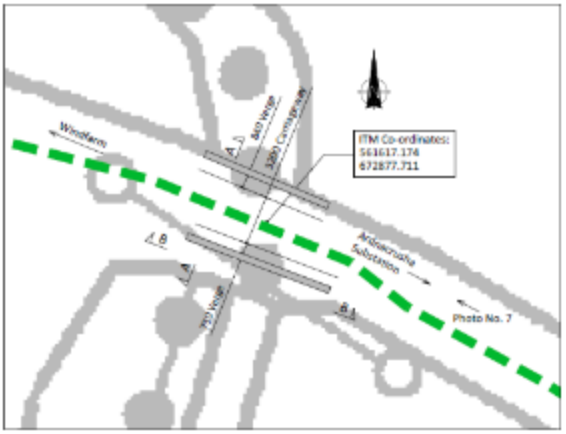

Figure 25 - Bridge 7 Location

9.8 Bridge 8 - Horizontal Directional Drilling

Coordinates: 52.806140, -8.583065

Bridge 8 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to horizontal directional drill (HDD) approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway.

See Drawing 05641-238 for further details.

Figure 27 - Bridge 8

Figure 28 - Bridge 8 Location

9.9 Bridge 9 - Horizontal Directional Drilling

Coordinates: 52.805843, -8.586053

Bridge 9 has insufficient room to install the cable to ESB specification (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. It is proposed to horizontal directional drill (HDD) approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway.

See Drawing 05641-239 for further details.

Figure 29 - Bridge 9

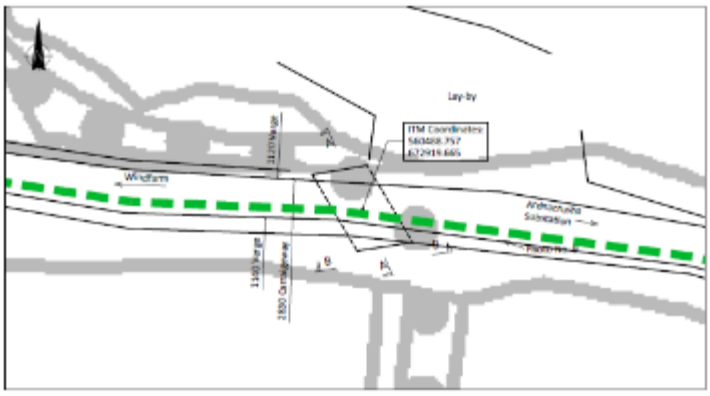

Figure 30 - Bridge 9 Location

10.0 Reinstatement of Private Land

Once all construction works are complete, the work areas will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in in consultation with the landowner and in line with any relevant measures outlined in the planning application, CEMP and planning conditions.

11.0 Best Practice Design and Construction & Environmental Management Methodology

Prior to commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Outline Construction Methodology, environmental protection measures included within the planning application, measures proposed within the CEMP, and the guidance documents and best practice measures listed below. This method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager and ECoW where relevant.

The following documents will contribute to the preparation of the method statements in addition to those measures proposed below: -

- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland*, Dublin,*
- *National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*. National Roads Authority, Dublin;
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects.* Technical guidance (C648). CIRIA;
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects*. Site guide (C649). CIRIA.
- Murphy, D. (2004) Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin;
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors* (C532);
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines;*
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocket book*. (C762) 4th edition. CIRIA;
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The proposed works will be carried out by employing accepted good work practices during construction, and environmental management measures such as those discussed below. Please note that the following measures will be supplemented by further specific environmental protection measures that will be included in method statements prepared for specific tasks during the works and will form part of the detailed CEMP.

- All materials shall be stored at the temporary compound within the Carrownagowan Wind Farm site and transported to the works zone immediately prior to construction;
- Where drains and watercourses are crossed with underground cables, the release of sediment will be prevented through the implementation of best practice construction methodologies.

- Weather conditions will be considered when planning construction activities to minimise risk of run off from site;
- Provision of 50m exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;
- If dewatering is required as part of the proposed works e.g. in trenches for underground cabling or in wet areas, water must be treated prior to discharge;
- The contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;
- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during winter months;
- The contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, with the Contractor required to prepare a contingency plan for before and after such events;
- The contractor will carry out visual examinations of local watercourses from the proposed works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted;
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.
- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available;
- Concrete or potential concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within the Carrownagowan Wind Farm site; remote from watercourses, drainage channels and other surface water features;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or waste water into watercourses;
- Cabins, containers, workshops, plant, materials storage and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times.

12.0 Invasive Species Best Practice Measures

Invasive species can be introduced into a location by contaminated plant, machinery and equipment which were previously used in locations that contained invasive species. Good site organisation and hygiene management shall be maintained always on site, and best practice measures will be implemented, as follows:

- The contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within;
- Plant and machinery will be inspected upon arrival and departure from site and cleaned/washed as necessary to prevent the spread of invasive aquatic / riparian species such as Japanese knotweed

Fallopia japonica and Himalayan Balsam *Impatiens glandulifera*. A sign off sheet will be maintained by the contractor to confirm the implementation of measures;

- Site hygiene signage will be erected in relation to the management of non-native invasive material.

13.0 Waste Management

All waste arising during the construction phase will be managed and disposed of in a way that ensures the provisions of the Waste Management Act 1996 and associated amendments and regulations and the Waste Management Plan. Soil will be reinstated into trenches where possible. In the event, there is excess material with no defined purpose, it will be transported to an authorised soil recovery site.

Appendix A – Culvert Crossings

Culvert Crossing Schedule					
Culvert No.	Dimensions (mm)	Material	Approx. Cover (mm)	Proposed Crossing Methodology	Photo
1.	350 Ø	Concrete	900	UNDERCROSSING	
2.	300 Ø	HDPE	200	UNDERCROSSING	
3.	2x600 Ø	Concrete	1800	OVERCROSSING	
4.	600 wide x 800 deep	Stone	1000	UNDERCROSSING	
5.	600 Ø	HDPE	200	UNDERCROSSING	
6.	250 Ø	Concrete	500	UNDERCROSSING	
7.	600 Ø	Concrete	700	UNDERCROSSING	
8.	400 wide x 500 deep	Stone	900	UNDERCROSSING	
9.	600 wide x 500 deep	Stone	900	UNDERCROSSING	

Culvert Crossing Schedule					
Culvert No.	Dimensions (mm)	Material	Approx. Cover (mm)	Proposed Crossing Methodology	Photo
10.	600 Ø	HDPE	500	UNDERCROSSING	
11.	300 Ø	HDPE	600	UNDERCROSSING	
12.	2x750 Ø	HDPE	2000	OVERCROSSING	
15.	300 Ø 375 Ø	HDPE HDPE	600 700	UNDERCROSSING	
16.	375 Ø	HDPE	700	UNDERCROSSING	
17.	375 Ø	HDPE	650	UNDERCROSSING	
18.	375 Ø	HDPE	350	UNDERCROSSING	
19.	600 Ø	HDPE	800	UNDERCROSSING	

Culvert Crossing Schedule					
Culvert No.	Dimensions (mm)	Material	Approx. Cover (mm)	Proposed Crossing Methodology	Photo
22.	600 Ø	Concrete	550	UNDERCROSSING	
23.	300 Ø	Concrete	600	UNDERCROSSING	
24.	250 Ø	HDPE	100	UNDERCROSSING	
25.		NEW CONCRETE ARCH CULVERT TO BE INSTALLED OVER RIVER		OVERCROSSING	
26.	450 Ø	CONCRETE	1000	UNDERCROSSING	
27.	300 Ø	CONCRETE	750	UNDERCROSSING	
28.	900 (Width per span)	Two Span Masonry	700	UNDERCROSSING