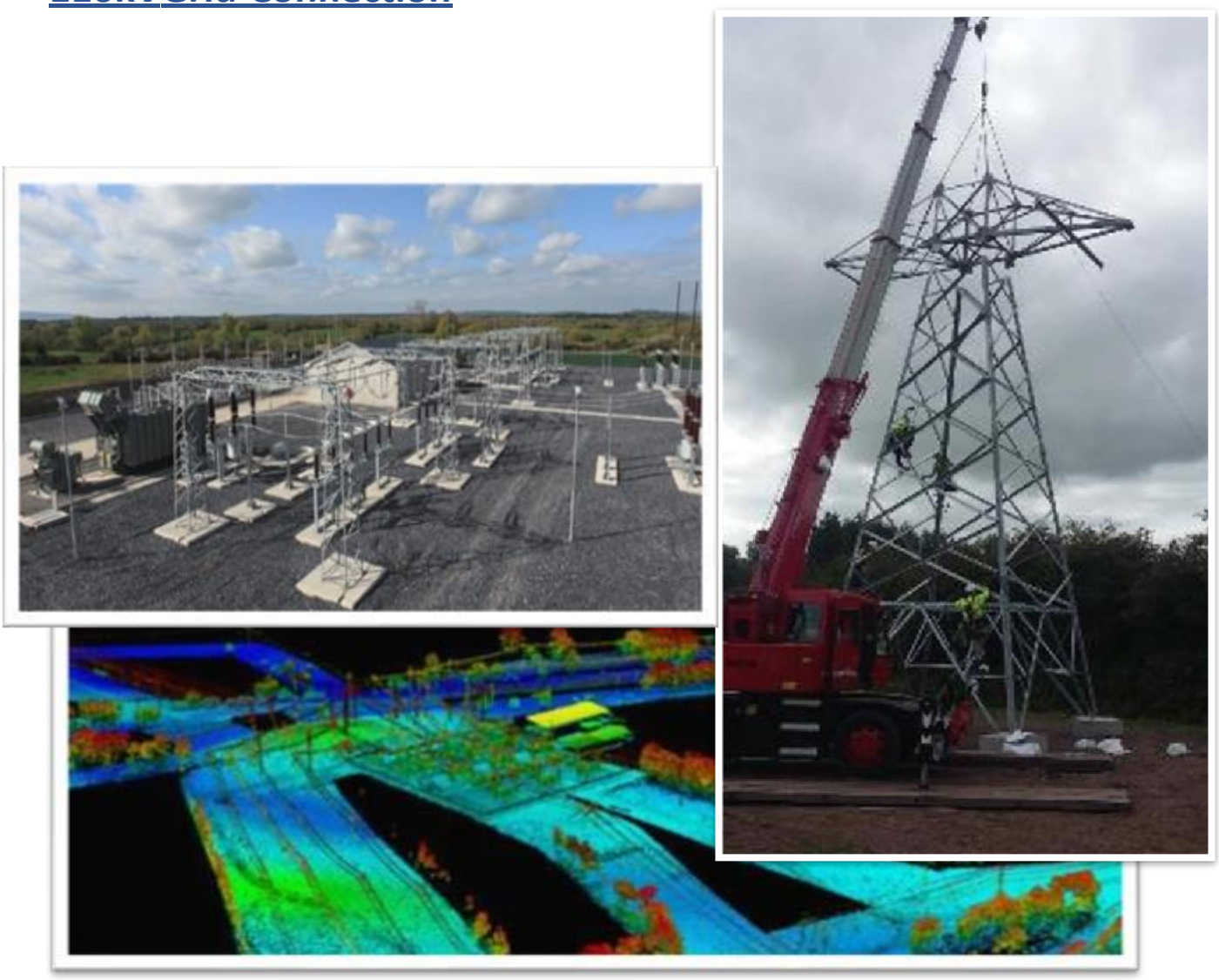
Appendix 2-4 – Outline Construction Methodology

Outline Construction Methodology

Clogherchor Wind Farm

110kVGrid Connection



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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 Clogherchor Wind Farm 110kV grid connection to the existing Tievebrack – Ardnagappary 110kV overhead line. The majority of the grid connection will consist of underground cabling (UGC) until it transitions onto the overhead line network via two cable sealing end masts. The 110kV connection will be used to connect the wind farm to the power grid through a 110kV "Loop-In" substation which is to be constructed at the Clogherchor Wind Farm site. The majority of the UGC along with the end masts will be installed in private land along with a small section being installed within the local secondary public road network.

The HV ducting route works will require a double circuit which entails that two trenches in parallel are required for a section of the ducting route with a minimum separation distance of 2000mm required between each circuit. Each trench will consist of the installation of 6 No. ducts in an excavated trench and 1 No. fibre communications cable to allow communications Clogherchor Wind Farm 110kV Substation, Tievebrack 110kV Substation and Ardnagappary 110kV Substation, 1 No. spare communications duct and 1 No. earth continuity conductor duct.

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 EirGrid 110kV AIS 8 Bay (Loop In Substation)

The proposed substation will be designed and constructed to meet all the required EirGrid standards. An area will be levelled and built to the required level with stone fill material, capped by high quality compacted stone. Two control buildings will be constructed using traditional techniques for constructing small buildings (i.e. concrete block walls, timber and slate tile roof). Foundations will be built for all of the proposed electrical infrastructure. All the electrical equipment will be installed to EirGrid requirements. Perimeter fencing will be constructed around the substation compound for security and safety purposes.

This substation will connect via underground cable circuits to accommodate a grid connection via the Tievebrack – Ardnagappary 110kV overhead line (OHL). Clogherchor 110kV substation will be made up of 1 No. Control building, 1 No. IPP MV Switch room, Transformer compound and Busbar compound.

The control building works will consist of foundation works, block work, roofing, low voltage electrical fit out, cladding and building finishing works. The transformer, gantry and structural steelwork will be installed in the transformer compound. Two cable sealing ends will be installed to incorporate the radial underground circuits in and out of the station. The busbar compound structural steelwork will be erected with lightning masts also installed. Substation electrical equipment will be installed once the control building and compound is complete. Fencing will be erected around the compound for security/protection. Permanent access roads will also be installed to allow trafficking in and out of the proposed substation compound, access road to loop in interface mast structures and internal access road for compound use.

The expected duration of works is expected to be approximately 12 months. The proposed construction scope will require the personal, machinery and materials as follows:-

Equipment

- Up to 10 Electrical/Civil Crews
- Excavators
- 360˚ tracked excavators (13 ton normally, 22 ton for rock breaker)
- Tracked dumpers / tractors and trailers
- Crane
- Hoist
- Power Tools
- Generator
- Scaffolding
- Substation Electrical Equipment

Materials:

- Stone
- Geotextile
- Lighting
- Paving.
- Fencing.
- Steel
- Concrete
- Timber
- Cladding
- Doors

The following section outlines the methodology to be followed during construction works of the new Clogherchor 110kV substation which will be constructed adjacent to the existing 110kV overhead line.

1. This new substation will be in a compound of circa 122m x 95m plan area secured by a 2.6m high palisadefence.
2. The substation compound and drainage will be marked out by a qualified engineer.
3. A drainage system will be excavated and installed around the compound area.
4. Topsoil and subsoil will be removed from the footprint of the compound using an excavator. The excavated material will be temporarily stored in adjacent berms for later use during reinstatement works
5. A layer of geotextile material will be laid over the footprint of the compound.
6. Using an excavator, a base layer of Clause 804 material will be laid followed by a 6F2 capping layer which will provide the finished surface.
7. Each layer will be compacted using a vibrating roller.
8. Earthing cable will be laid underground around the substation for connection to the various electricalcomponents during the electrical fit out phase.
9. The construction of an 11590m² substation compound comprising of approximately 450m² single storey 110kV substation control building, 300m² single storey MV building and associated outdoor electrical equipment, including 1 no. 33/110kV transformer, associated internal access road, including 2.6m high station perimeter fencing will be built.
10. Permanent access road will be constructed to allow site vehicular activity in and out of construction area
11. Adequate lighting will be installed around the compound on the lighting masts within the compound.
12. A 110kV cable sealing ends and associated accessories will be required to incorporate the Tievebrack to Ardnagappary 110kV line into the substation. The support structures will be located outdoors.
13. Transformers will be installed in bunded enclosures within the substation compound.

The electrical installation is expected to take 20 weeks and includes the following:

- Delivery and installation of 33/110kV transformer. These are unusually large, and the deliveries will be managed in accordance with regulations governing the movement of large loads.
- Delivery and installation of all other HV equipment.
- Wiring and cabling of HV/LV equipment, protection and control cabinets.
- Commissioning of all newly installed equipment.

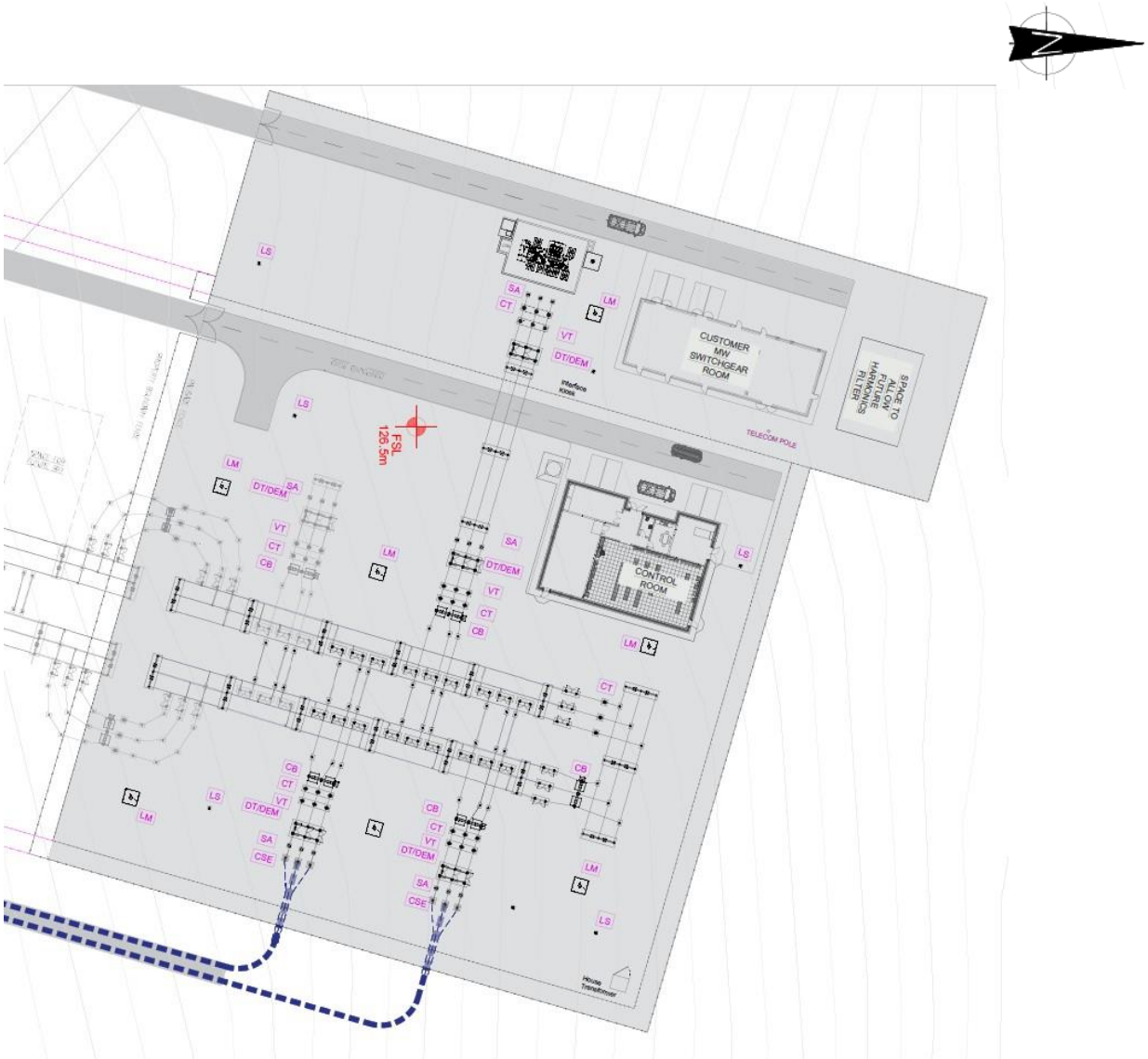

Figure 1 - Proposed 110kV AIS Loop In Station layout

3.0 Clogherchor Wind Farm 110kV Grid Route

The underground grid connection route is approximately 3.9km in length between two radial UGC circuits, from the proposed Clogherchor Wind Farm 110kV Substation location, carrying towards the interface points where the circuits split between Circuit A and Circuit B. It is proposed to transition from an overhead line (OHL) to UGC at two tower locations. These locations have been identified along the Tievebrack – Ardnagappary 110kV overhead line from a technical perspective. The identified locations will be mid span between polesets 147 & 148 respectively and polesets 162 & 163 within the southern periphery of the development site.

The exact location of the underground HV ducting through development lands may be subject minor modification following confirmatory site investigations, to be undertaken prior to construction and following consultation with Donegal 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 2) which outlines the underground HV ducting route, with each section of the route being formulated in detail within Table 1.

This underground HV ducting route is shown as an Overall Site Location Map in Drawing No. 05725-DR-100-P00.

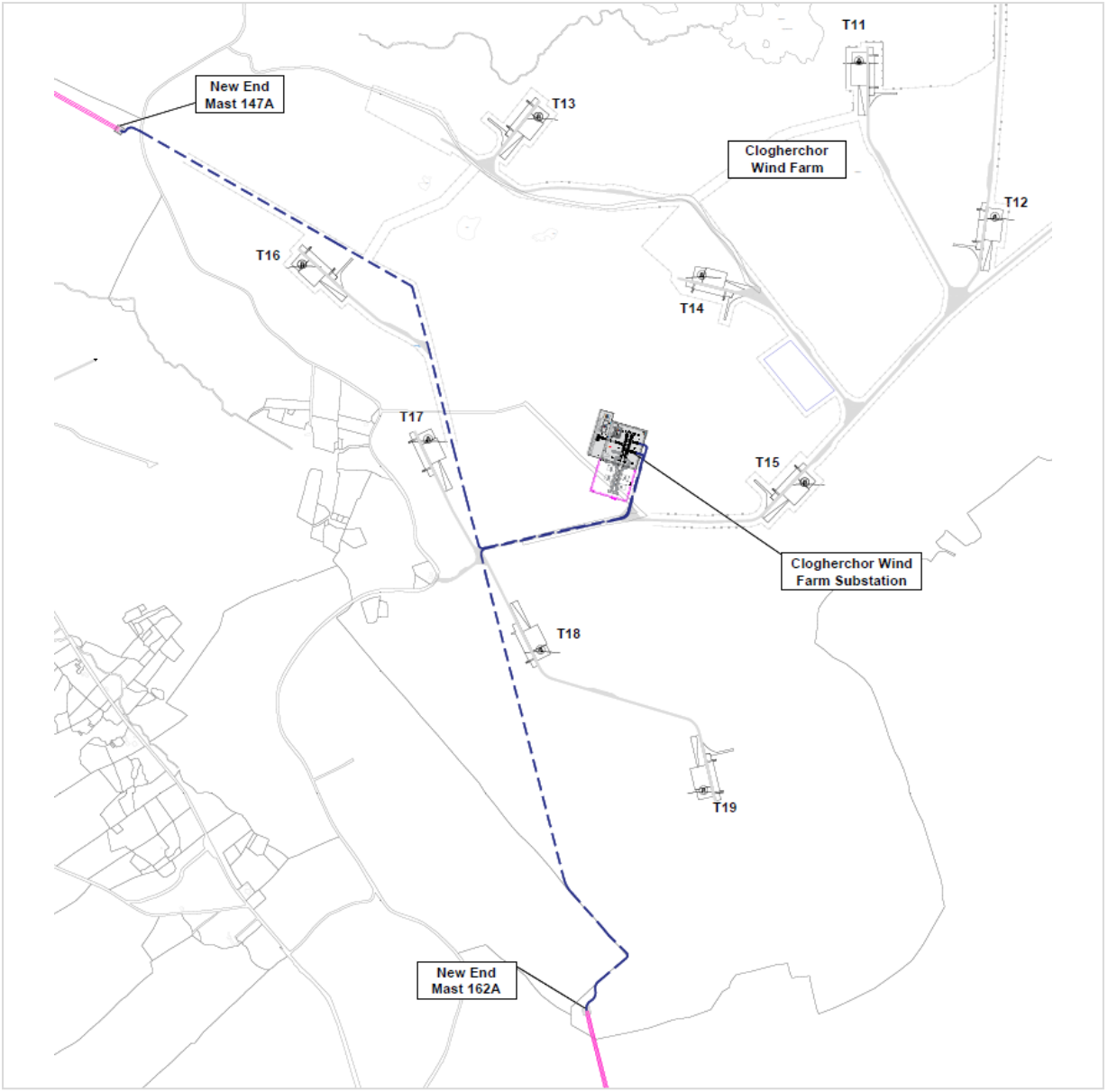

Figure 2 - Overall route location map

Table 1 of this report summaries the route location features of the underground ducting proposed route.

Table 1 – Approximate Route Location of Preliminary Design:	
Wind Farm Site (UGC)	**Public Roads (UGC)**
3878 m	12m

Table 1 -110kV Wind Farm Substation to Loop In Towers – Underground HV ducting Route Location Summary

Table 2 below separates the underground HV ducting route into a number of sections and describes the specific construction requirements of each individual section and identifies 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 Underground HV Ducting Design Route	
Section	**Description**
Circuit A 1848m	**UG ducting circuit A from OHL Tie in location to WF Substation location** The Overhead Line (OHL) Tie in Tower is located approximately 127m southeast of pole set 147. From here the OHL transitions to an Underground Cable (UGC). The UGC initially travels in a south-eastern direction for approximately 800m where it then turns and heads south fora further approximately 670m. From here the UGC circuit B is met by UGC circuit A. The two circuits travel in parallel in an easterly direction maintaining a minimum separation between circuits of 2000m for approximately 130m. The double circuit UGC then turns and travels north in parallel with the Clogherchor Wind Farm Substation boundary fence for approximately 160m where the cable is then terminated within the substation. ***Features*** Circuit A contains 2 no. joint bays. Joint bays will be located below ground and finished/reinstated to the local authority's/landowners satisfaction. Joint bays will have associated communication chambers and earth link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 A (JB-01A) will be located approximately 688m east of the Loop In Tower 147A. • Joint Bay 02 A (JB-02A) will be located approximately 746m south of JB-01A with a remainder of 618m to Clogherchor Wind Farm Substation location. 1 No. watercourse / stream will need to be crossed between JB01 and JB02 respectively. It is proposed to implement Horizontal Directional drilling (HDD) method as the preferred option to mitigate against any fluvial pollutants.

Circuit B 2093m	**UG ducting circuit B from OHL Tie in location to WF Substation location.** The Overhead Line (OHL) Tie in Tower is located approximately 99m north of pole set 162. From here the OHL transitions to an Underground Cable (UGC). The UGC travels in a north-western direction for approximately 270m where it then briefly changes course to the north in order to avoid an area of Deep Peat for approximately 210m. From here the UGC continues northwest for a further approximately 670m. From here the UGC circuit A is met by UGC circuit B. The two circuits travel in parallel in an easterly direction maintaining a minimum separation between circuits of 2000m for approximately 130m. The double circuit UGC then turns and travels north in parallel with the Clogherchor Wind Farm Substation boundary fence for approximately 160m where the cable is then terminated within the substation. ***Features*** Circuit B contains 2 no. joint bays. Joint bays will be located below ground and finished/reinstated to the local authority's/Landowners satisfaction and as per the Purple book road reinstatements specification. Joint bays will have associated communication chambers and earth link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 B (JB-01B) will be located approximately 745m southeast of the Loop In Tower 147A. • Joint Bay 02 B (JB-02B) will be located approximately 745m southeast of JB-02A. • Joint Bay 02 B (JB-02B) will be located approximately 603m west of Clogherchor Wind Farm Substation location. 1 No. watercourse / stream will need to be crossed between Poleset 162A and JB01B respectively. It is proposed to implement Horizontal Directional drilling (HDD) method as the preferred option to mitigate against any fluvial pollutants.
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.	

Table 2 - Summary of underground HV ducting design route.

4.0 Preliminary Site Investigations

It would be proposed to carry out Preliminary site investigations along the ducting route prior to construction toconfirm design assumptions.

The following items may be carried out:

3 No. Boreholes along the UGC route to ascertain ground conditions and thermal resistivity of the soil for HDD locationsand at the substation location to establish a piling design.

Soil conditions in the vicinity of the interface mast locations to be confirmed and recorded on site by contractor byconducting trial holes prior to installation.

Trial holes at all joint bay positions to ascertain ground conditions and thermal resistivity of the soil.

5.0 Loop-In Interface Mast Design Location

5.1 Existing 110kV OHL

The 110kV loop-in option is proposed to be carried out on the existing Ardnagappary – Tievebrack 110kV overheadtransmission line. The loop-in will be completed midspan between Polesets No. 147 and No.148, and Polesets No. 162 and No.163, located entirely within the confines of the development area. The new mast structures shall be referred to as New End Mast 147A and New End Mast 162A, as per drawing no. 05725-DR-100. Polesets surplus to requirement will be removed by ESBN once the UGC is energised. These poles will be recycled as part of Networks best practice procedures. They will be removed by a 13-tonne excavator, with no cutting involved, see Figure 3.

Figure 3 - Poleset removal with 13 Tonne excavator

5.2 Access Routes to Works Area

The proposed interconnector will be a combination of UGC. All of the proposed underground cable route is located on private lands, as such the contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise private farm tracks, where appropriate. Prior to the commencement of development, precise access arrangements will be agreed with the respective landowners.

A detailed Traffic Management Plan will be prepared, and agreed with Donegal County Council, prior to the commencement of construction. Temporary access roads on private land (if required due to ground conditions and/or landowner requirements) will consist of timber or aluminum bog mats (see Figure 4 & Figure 5) to spread the weight ofmachinery over a greater area to prevent damage to the ground. If necessary, a low ground pressure excavator may also be utilised. This machine is designed to spread its weight across a wider area thereby reducing the pressure exerted on the ground. No invasive works will be undertaken when placing the matting.

Upon completion of the works, all mats will be removed immediately. Access routes will be carefully selected to avoid any damage to land. Local consultation will be carried out with all relevant landowners to ensure that any potential disturbance will be minimised. Prior to the commencement of construction, the contractor will assess all access routes and determine the requirement for bog mats. Any such requirements will be incorporated into the relevant method statement.

Figure 4 - Temporary Aluminium Panel Track

Figure 5 - Temporary timber roadway (Bog matt)

Construction Equipment Required

- 4x4 vehicle
- Wheeled dumper or Track dumper (6 to 8 tons)
- 360˚ tracked excavator (13 ton normally, 22 ton for rock breaker)
- Vans
- Chains / hand tools
- Road material delivered by supplier to closest convenient point.
- Crew size: 3 workers
- Timber Bog Mats / Aluminium Panel Tracks

5.3 Loop-In Interface Mast Design

The proposed design for the 110kV Loop-In from the existing OHL will require two new Interface Mast structures which will be constructed under the existing Ardnagappary – Tievebrack 110kV OHL, on the boundary of the proposed Clogherchor Wind Farm 110kV Substation. The existing OHL conductor will be terminated at these two new structures in order to transition from an overhead line to an underground cable arrangement to facilitate the loop into Clogherchor Wind Farm 110kV Substation via cable chairs. The existing conductor will be removed between the Interface Mast structures with the new connection looped through to the new Clogherchor Wind Farm 110kV Substation.

The new interface mast structure locations have been selected based on ground surveys, ground profiles, allowable angles and ruling span checks. The expected duration of works is expected to be approximately 4 weeks. Construction of foundation circa. 7 days each, erection of the Interface masts circa 5 days, weather dependent,

The proposed construction scope will require the relative personal, machinery and materials which is as follows: -

Equipment

- 4x4 vehicle
- Winch
- Tractor and trailer
- Crane
- Teleporter
- Chains / small tools
- Tracked Excavator
- 5 operatives
- Tracked Dumper

Materials:

- Lattice steel tower
- Insulators
- Dropper conductors
- Connection clamps
- Surge Arrestors
- Electrical connections
- Concrete (foundation)
- Aggregate

The following section outlines the methodology to be followed during construction works of the new Interface Mast structures which will be constructed underneath the existing 110kV overhead line in the townland of Clogherchor in Co. Donegal.

- Interface Mast sites are scanned for underground services such as cables, water pipes etc. Consultation with the landowner will help to identify and ensure there are no unidentified services in the area.
- For each leg of 2 No. towers (8 in total) a foundation circa. 3m x 3.6m x 3.6m is excavated and the formation levels (depths) will be checked by the onsite foreman. The excavated material will be temporarily stored close to the excavation and excess material will be used as berms along the site access roads.
- To aid construction, a concrete pipe is placed into each excavation to allow operatives level the mast at the bottom of the excavation. The frame of the reinforcing bars will be prepared and strapped to a concrete pipe with spacers as required. The reinforcing bars will be lifted into each excavated foundation using the excavator and chains/slings. The base and body section of each tower will then be assembled next to excavation.
- Concrete trucks will pour concrete directly into each excavation in distinct stages.
- A third pour for the leg of the tower 1m x 1m and will be 300mm over ground level.
- Once the main concrete pour is cured after circa five days, a preformed metal panel is set in place to contain the concrete called shuttering while it sets. During each pour, the concrete will be vibrated thoroughly using a vibrating poker.
- Once the concrete is set after the five days the shuttering is removed.

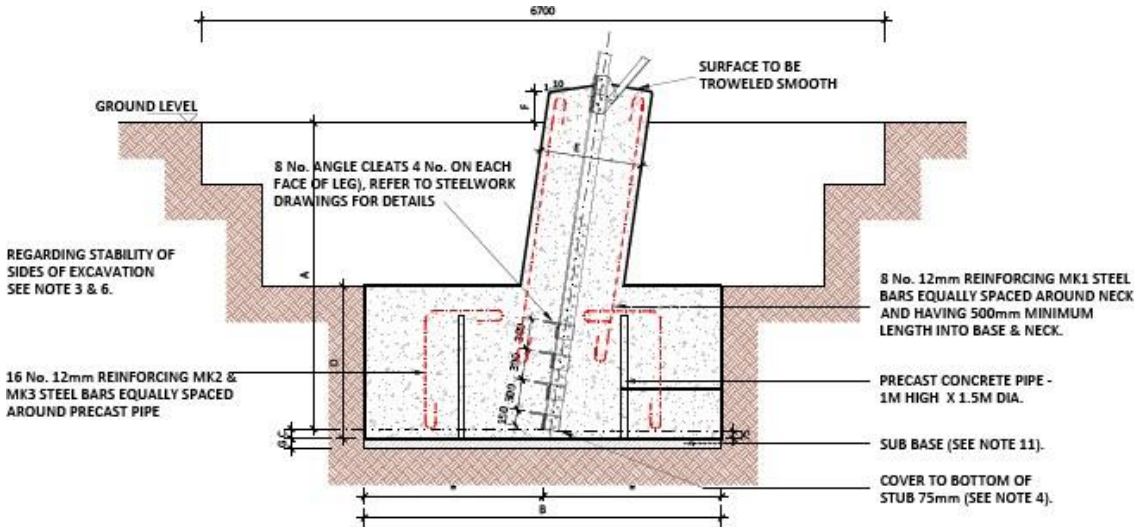

Figure 6 - End mast foundation details

Figure 7 - 110kV Interface Mast foundation complete

- The Interface Mast foundations will be backfilled one leg at a time with the material already excavated at the location. The backfill will be placed and compacted in layers. All dimensions will be checked following the backfilling process. If the excavated material is deemed unsuitable for backfilling other excavated material from the footprint of the Clogherchor Wind Farm 110kV Substation or from the new permanent access road in Clogherchor will be used. All surplus excavated material and removed from the tower locations and stored in berms adjacent to the substation compound

Figure 8 - Base of Interface Mast structure backfilled

- The existing overhead line will be de-energised by ESB so work can commence on the construction of the towers.
- An earth mat consisting of copper or aluminum wire will be laid circa 400mm below ground around thetower. This earth mat is a requirement for the electrical connection of the equipment on the tower structure.
- Once the base section of each tower is completed and the concrete sufficiently cured, it is ready to receive the tower body.
- A hardstand area for the crane will be created by laying geogrid material on the ground surface and overlaying this geogrid with a suitable grade of aggregate.
- A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close tothe OHL.
- The tower will be constructed lying flat on the ground beside the recently installed tower base.
- The conductor will be moved off center using a stay wire and weights to anchor the stay wire to ground.
- The tower section will be lifted into place using the crane and guide ropes.
- The body sections will be bolted into position.
- The conductor will be centered over the towers and held in place. Once the conductor is secured at both ends it is then cut and attached onto each tower. The section of conductor in between the two towers will be removed and utilised as connector wire for the new towers.
- Down dropper conductors (For Electrical Connections, Insulators, Surge arrestors), shackles and all associated accessories required for transition from line to cable will be installed on the interface towers.
- The circuit will be tested in both directions before the line is re-energised.

Figure 9 - Completed Line/Cable Interface Mas

6.0 New Permanent Access Roads – within the Wind Farm

Prior to the construction of any access roads on site a detailed design will need to be carried out. The access roads will be marked out by the Site Engineer. Permanent access roads will have widths of 5m/5.5m to allow all machinery to access all work areas.

6.1 Excavated Road Construction Methodology

Given the flat topography and relatively shallow peat on site, excavated access roads are deemed an appropriate construction technique.

Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m. An excavator will excavate the width of the new access road which will include a roadside drainage channel with silt traps, soakage areas, interceptor drains along the access road alignment which will be designed in accordance with BRE guidelines.

All organic material and soft subsoil will be removed to formation level with excavated material to be reused and stored on site. Layers of geogrid/geotextile will be required at the surface of the competent stratum, a minimum sub-base will be laid on the geotextile membrane which will consist of 200mm of crushed granular material. A surface layer will be laid which will consist of 75mm compacted 40mm material to accommodate HGV traffic.

Figure 10 - Typical Windfarm Access Road.

7.0 Underground HV ducting Construction Methodology

The underground HV ducting will consist of 2 No. trenches, each trench will contain 3 No. 160mm diameter HDPE power ducts and 2 No. 125mm diameter HDPE communications ducts to be installed in an excavated trench, typically 825mm wide by 1315mm deep, with variations on this design to adapt to service crossings and watercourse crossings, etc. The ducts will be installed, the trench reinstated in accordance with landowner/ Donegal County Council specification. Construction methodologies to be implemented and materials to be used will ensure that the underground HV ducting are installed in accordance with the requirements and specifications of EirGrid and 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.
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the planning application and accompanying reports, the construction contractor will prepare a detailed Construction Environmental Management Plan (CEMP) prior to the commencement of construction, the CEMP will be used to clearly document for construction staff the proposed mitigation, as set out in the application, and any subsequent planning conditions that may be imposed. The CEMP document will be prepared in line with best practice construction methodologies including the following measures;
- Where the ducting routes intersect 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 Donegal 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 willbe 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 ducting is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;

Figure 11 - Typical HV Underground Ducting Installation with geotextile membrane

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 825mm width have been obtained.
2. Carefully unroll and place the Geotexile membrane and the Tensar geogrid membrane at the base of excavated trench, whilst lining the side walls of the trench,
3. 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.
4. 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.
5. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
6. Place protection strips on compacted CBGM B directly over the ducts.
7. Lay the top row of ducts onto the freshly compacted CBGM B including the protection strips above the bottomrow of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.
8. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughlycompact without damaging ducts.
9. Place red protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
10. Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified,
11. Carefully unroll and place the SecuGrid 40/40 membrane along the backfilled trench, overlapping the Tensar Geogrid membrane. A layer of granulated crushed stone will form a base for the access road to be exercised above,
12. Place yellow warning tape above the layer of crushed stone at the depth shown on the drawings.
13. A new layer of crushed stone will be placed above the warning tape creating a sub layer before the permanent wearing course layer is instated, in accordance with the local authority and/or private landowners.
14. 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. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

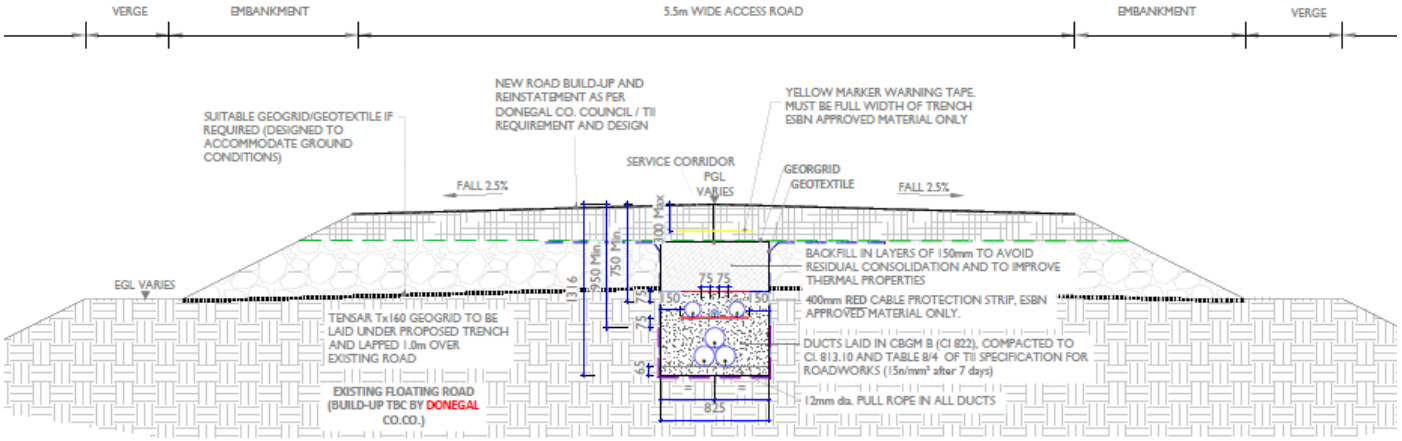

Figure 12- Ducting Through Access Road

Equipment

- Tracked Excavator
- Tracked Dumper or tractor and trailer.

Materials:

- Ready-mix Concrete where necessary(delivered to site);
- Trench backfilling material to relevant specifications;
- 160mm diameter HDPE ducting;
- 125mm diameter HDPE ducting;
- 63mm diameter HDPE ducting
- Temporary Surface Reinstatement

7.1 Windfarm / Forestry / Clogherchor Substation Access Tracks

The majority of the 110kV route is located within existing Coillte lands. with access tracks will be laid or upgraded as part of the proposed development. Where the cable is installed in windfarm / forestry / Clogherchor Substation access tracks, the location where the cable is laid will depend on several factors, width of track, bends along the track and crossings. As per the Coford Forest Road Manual, standard forest tracks are designed to carry vehicles conforming to maximum legal weights and dimensions applicable to public roads. However economic and external factors will sometimes result in the design of a track to less than full standard roadway. In locations 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.

New and upgraded tracks should be designed to:

- Comply with the standards;
- Accommodate the anticipated frequency, type and speed of traffic;
- Take cognisance of soil and sub-grade conditions.
- Provide for drainage and water quality requirements; and
- Incorporate landscape and environmental values.

The final design will be designed in conjunction with Coillte guideline requirements and will be evaluated carefully on its merits. The upgrade of internal access roads will be classified by soil type and by cross slope.

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 consultation with the landowner and in line with any relevant measures outlined in the planning application, CEMP and planning conditions.

7.2 Surface Markers & Marker posts

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

Marker posts will be used on non-roadway routes to delineate the ducting route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700mm base, and with centered lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker posts 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 11 - Typical ESB Marker Posts)

Figure 13 - Typical ESB Marker Posts

7.3 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 will be disposed of to a licensed facility.

7.4 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 the Clogherchor Wind Farm construction compound. Oils and fuels will not be stored on site and will be stored in an appropriately bunded area within the temporary storage compound.

7.5 Joint Bays and Associated Chambers

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the proposed Clogherchor Wind Farm 110kV substation and the existing 110kV Tievebrack and 110kV Ardnagappary Substations. Earth Sheath Link Chambers are also required along the duct route. 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.

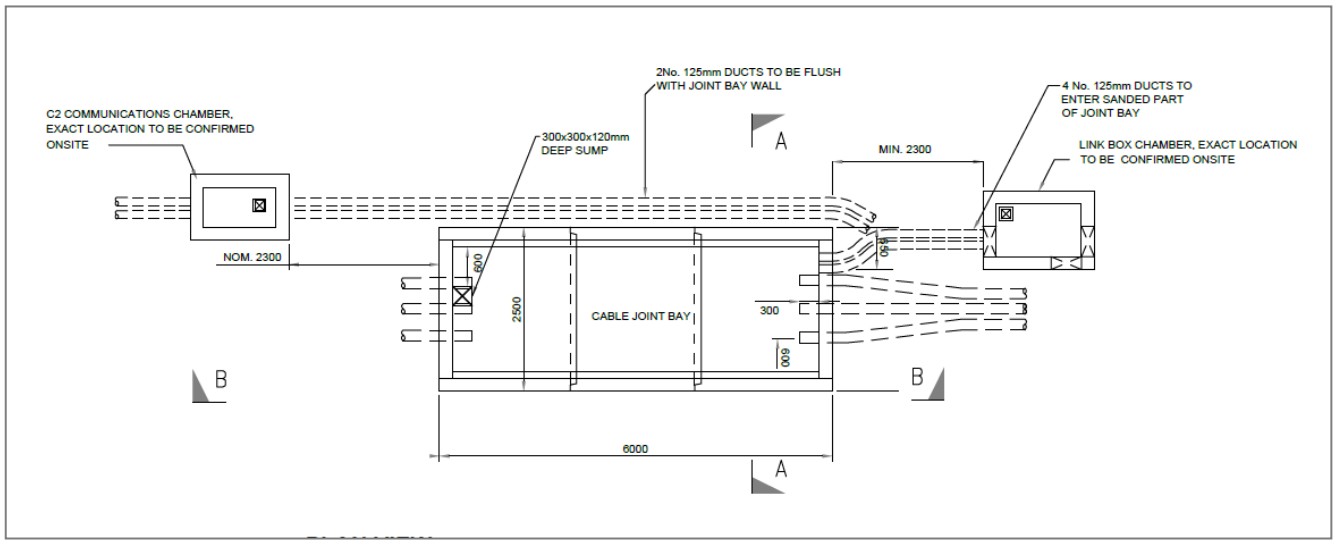

Figure 14 - Joint Bay Plan Layout

7.6 Joint Bay Construction and 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 forreinstatement 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 siltfencing 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 or 50 mm thicksand (for pre-cast concrete construction) on 200 mm thick Clause 804 granular material.
3. Construct 200 mm thick reinforced concrete floor slab with sump and starter bars placed for walls as detailed on the drawings.
4. Construct 200 mm thick reinforced concrete sidewalls as detailed on the drawings, see Figure 15 - Typical joint bay under construction (in-situ))

Figure 15 -Typical joint bay under construction (in-situ)

5. 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, see Figure 17.

Figure 16 – Typical Joint Bay under construction (pre cast)

Figure 17 - Place pre-cast concrete sections on sand bedding.

6. 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.

7. 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.

8. 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 joint base to provide vertical support. Install additional layers of cement-bound sand and compact each layer until the cement-bound sand is level withthe top of the joint. Install an additional 100 mm cement-bound sand layer.

9. Install 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:

- 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;
- 63mm diameter HDPE ducting
- Precast Chamber Units / Relevant construction materials for chambers
- Earth Link Box

8.0 Design and Construction & Environmental Management Methodology

Before 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, any subsequent planning conditions that may be imposed, and the guidance documents and 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 Adjacentto Waters*. Inland Fisheries Ireland*, Dublin,*
- *National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of NationalRoad 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 DevelopmentWorks at River Sites. Eastern Regional Fisheries Board, Dublin;
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants andcontractors* (C532);
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines;*
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocketbook*. (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 set out in the application documents, and described further 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 Clogherchor Wind Farm 110kV Substation site and transported to the works zone immediately before construction;

- Where drains or watercourses are crossed with underground ducts, 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 the risk of runoff from the site;
- 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 before 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 very wet periods;
- 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, and the Contractor is 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 Clogherchor Wind Farm substation 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 wastewater into watercourses.
- Cabins, containers, workshops, plant, materials storage, and storage tanks shall not be located near any surface water channels.

9.0 Horizontal Direction Drilling (HDD)

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, culverts, 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. The proposed HDD methodology is as follows: -

1. A works area of circa .40m^2 will be fenced on both sides of a 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 ESBN, EirGrid and the landowner.
13. A joint bay or transition chamber will be installed on either side of the obstacle following the horizontal directional drilling as per ESBN and EirGrid requirements.

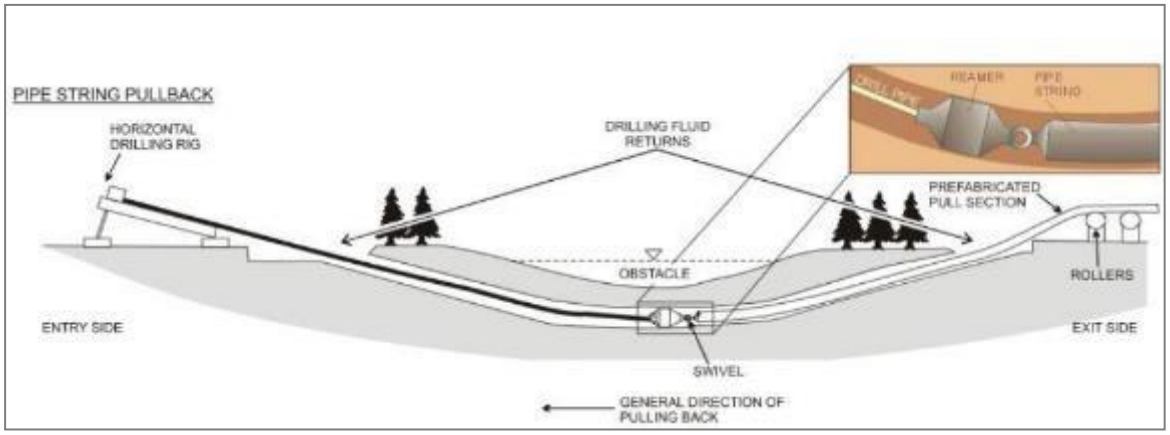

Figure 18 - Typical HDD Installation

Figure 19 - Typical HDD Installation

10.0 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 Donegal 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. Typically, the underground HV ducting 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 Donegal County Council, prior to the commencement of development.

11.0 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 Donegal County Council. A Traffic Management Plan (TMP) will be agreed with Donegal 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 Donegal County Council in advance of the preparation of the TMP.

12.0 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.

13.0 Reinstatement of 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, any subsequent planning conditions that may be imposed.

14.0 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.

15.0 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.