



# CONSTRUCTION METHODOLOGY

## Lissinagroagh Wind Farm - 110kV Substation & Grid Connection

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**Client:** FuturEnergy Ireland (FEI) C/o Tobin Consulting

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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 Lissinagroagh Wind Farm 110kV substation and grid connection to the existing Srananagh 220kV 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 proposed 110kV substation and grid connection will be subject to a Strategic Infrastructure Development (SID) application to An Coimisiún Pleanála under Section 182A of the [Planning and Development Act 2000](#) (as amended).

This document outlines the methodologies and techniques to be employed during the construction of the substation and grid connection and should be read in conjunction with the Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) which accompany the planning application.

## 2.0 110kV Substation

The proposed 110kV substation will be designed and constructed to meet all the required EirGrid standards and specifications. The substation will be constructed in the southwest of the site near the L61801 site entrance within an area that is currently part of the commercial forestry plantation. The trees will be cleared and the required area will be levelled and built to the required level with stone fill material, capped by high quality compacted stone.

The IPP and EirGrid 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 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.

The Substation will comprise 1 No. Control building, 1 No. Independent Power Producer (IPP) Medium Voltage (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 tracks 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 track for compound use.

The expected duration of works is to be approximately 12 months.

The following section outlines the methodology to be followed during construction:

1. This new substation will be in a compound of circa 145m x 80m (9.854 m<sup>2</sup>) plan area secured by a 2.6m high palisade fence.
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 electrical components during the electrical fit out phase.
9. The construction of a 9,854m<sup>2</sup> substation compound comprising of approximately 450m<sup>2</sup> single story 110kV substation control 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 roads 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. 110kV cable sealing ends and associated accessories will be required to incorporate the Lissinagroagh UGC to Srananagh 220kV 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, within the overall 12-month construction programme, 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 2 outlines the UGC route, with the total length of each road type detailed in Table 1.

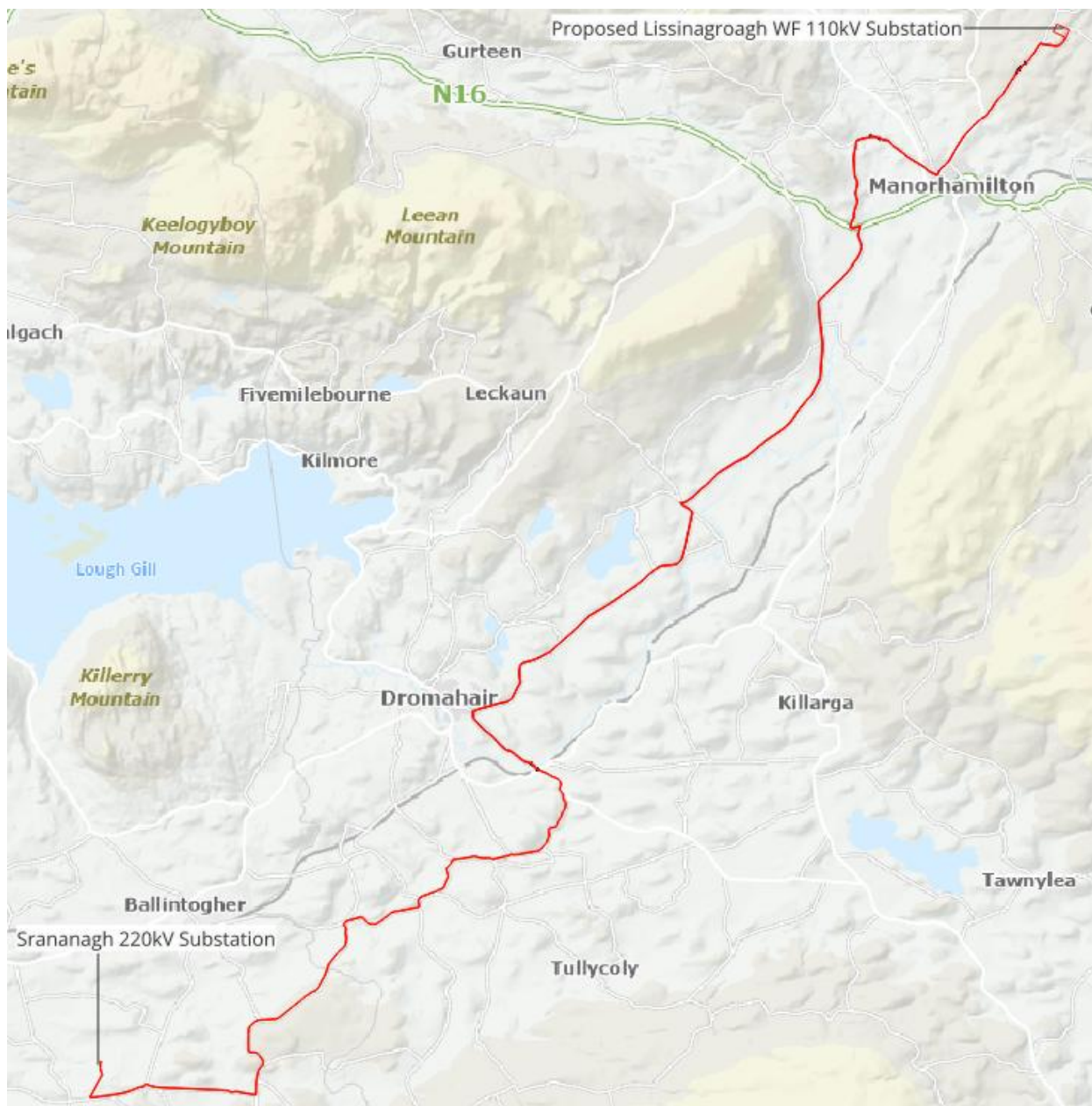


Figure 2 - Grid Connection Route Layout Plan

Table 1 – Approximate UGC Route Location of Preliminary Design:			
Srananagh Substation Access Rd	Public Roads	Wind Farm Site/Forestry Roads	Sections of Private Lands
230m	30,634m	557m	345.5m

Table 1: Lissinagroagh Wind Farm to Srananagh 220kV Substation – UGC Route Location Summary

Table 2 separates the UGC route into a number of sections and describes the specific construction requirements of each individual section along with assessment of access routes to the work areas.

**Table 2 - Summary of Grid Connection Design Route**

Section	Description
<p><b>Section 1</b></p> <p>UGC</p> <p>6,276.8 m</p>	<p><b>UGC from Srananagh 220kV Substation to Leitrim County Boundary</b></p> <p>The initial section of the route is fully located within County Sligo for approx. 6.3km. The underground cable route (UGC) begins at the Srananagh 220 kV Substation and proceeds south along an access track. It then follows the L-52043 for approximately 0.4 km, where it reaches the junction with the L-5204 and turns east.</p> <p>From this point, the cable continues along the L-5204 for approximately 2.73 km. Within this section, the route encounters an existing bridge structure where insufficient clearance is available to install the cable using an open-cut methodology. Consequently, the crossing will be completed using Horizontal Directional Drilling (HDD), installed inline with the existing road carriageway. Refer to Section 1 details below.</p> <p>The UGC then arrives at the junction with the L-1201 and turns north. It continues along this road for approximately 1.46 km. Several areas within this section lack passing bays, overhead lines are within the vicinity of joint bay 05, with appropriate H.S.A safety precaution measures to be applied.</p> <p>The cable route then proceeds northeast along the L-12011 for approximately 0.26 km, where it crosses a culvert which signifies the Leitrim – Sligo County Boundary.</p> <p><u>Features</u></p> <p>Section 1 contains 8 no. joint bays and 1 No. bridge crossing.</p> <p><u>Joint Bays</u></p> <p>Joint bays, described in Section 6.6 below, will be located below ground, within the curtilage of the existing road and finished/reinstated to the required roads specification. All joint bays will have associated communication chambers and mentioned joint bays will also include earth link boxes which will have a surface access hatch which will match existing ground levels.</p> <ul style="list-style-type: none"> <li>• Joint Bay 01 (JB01) will be located within the (L-52043) roadway, approximately 576m south of Srananagh 220kV Sub. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 02 (JB02) will be located within the (L-5204) roadway, approximately 810m east of JB01. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 03 (JB03) will be located within the (L-5204) roadway, approximately 800m east of JB02. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 04 (JB04) will be located within the (L-5204) roadway, approximately 780m east of JB03. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 05 (JB05) will be located within the (L-1201) roadway, approximately 745m northeast of JB04. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 06 (JB06) will be located within the (L-1201) roadway, approximately 747m northwest of JB05. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 07 (JB07) will be located within the (L-12011) roadway, approximately 756m northeast of JB06. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 08 (JB08) will be located within the (L-12011) roadway, approximately 756m northeast of JB07. An earth link box will also be located at this joint bay location.</li> </ul>

	<p><b>Bridge Crossing:</b></p> <ul style="list-style-type: none"> <li>• Bridge 1 crosses over the Rathgeean River. Located within the L-5204 approximately 610m east of JB03. Insufficient clearance exists within the bridge structure and will cross this bridge utilising the HDD method. The HDD alignment will be positioned within the road corridor, maintaining a straight section of approximately 50 m on either side of the bridge.</li> </ul>
<p><b>Section 2</b>  UGC  7,926.6 m</p>	<p><b>UGC from Leitrim County Boundary to L-4165</b></p> <p>After crossing the Leitrim County boundary, the UGC crosses a stone clapper culvert with insufficient cover and continues northeast along the L-12011 for approximately 2.37 km. The route then proceeds onto the L-42621, passing an area where light water flow runs along the roadside.</p> <p>The UGC continues onto the L-4262 for approximately 1.43km, encountering two culvert locations, one of which is a shallow culvert with low flow. Along this section of road, space for passing places is limited or narrow.</p> <p>The route then turns east onto the L-4263, where Bridge 2 requires HDD due to insufficient clearance beneath the structure. The HDD crossing will be carried out inline within the road corridor. From here, the cable proceeds northeast along the L-82561, then east along the L-8256, continuing via the L-4260 and L-8260 to an additional joint bay location situated in an area without passing places.</p> <p>The UGC then follows the L-8269 northeast for approximately 1.04 km, where a culvert crossing is identified shortly before another joint bay location, before proceeding to join the R-289. Along this regional road, a joint bay is proposed on a sweeping bend where a passing place is available. Further along, the route reaches Bridge 03 over the Bonet River, which requires off-road HDD due to insufficient clearance beneath the structure. The launch pit and JB12 will be located on private land under Folio LM20069F. The section concludes at the junction with the L-4165 after exiting the private land.</p> <p><u>Features</u></p> <p>Section 2 contains 9 no. joint bays, 2 No. bridge crossings and 5 No. Culvert Crossings.</p> <p><u>Joint Bays:</u></p> <p>Joint bays, described in Section 6.6 below, will be located below ground, within the curtilage of the existing road and finished/reinstated to the required roads specification. All joint bays will have associated communication chambers and mentioned joint bays will also include earth link boxes which will have a surface access hatch which will match existing ground levels.</p> <ul style="list-style-type: none"> <li>• Joint Bay 09 (JB09) will be located within the (L- 42621) roadway, approximately 699m northeast of JB08. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 10 (JB10) will be located within the (L- 4262) roadway, approximately 797m northeast of JB09. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 11 (JB11) will be located within the (L- 4262) roadway, approximately 813m east of JB10. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 12 (JB12) will be located within the (L- 82561) roadway, approximately 788m northeast of JB11. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 13 (JB13) will be located within the (L- 8256) roadway, approximately 787m northeast of JB12. An earth link box will also be located at this joint bay location.</li> </ul>

	<ul style="list-style-type: none"> <li>• Joint Bay 14 (JB14) will be located within the (L- 8260) roadway, approximately 784m east of JB13. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 15 (JB15) will be located within the (L- 8269) roadway, approximately 789m northeast of JB14. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 16 (JB16) will be located within the (R-289) roadway, approximately 705m north of JB15. An earth link box will also be located at this joint bay location.</li> <li>• Joint Bay 17 (JB17) will be located within the private land LM20069F-Harriet Devaney (immediately after the HDD receptor area for Bridge 03), approximately 723m northwest of JB16. An earth link box will also be located at this joint bay location.</li> </ul> <p>Bridge Crossings:</p> <ul style="list-style-type: none"> <li>• Bridge 2 crosses the Killanummary River and is located on the L-4263, approximately 530 m northeast of JB11. Due to insufficient clearance beneath the structure, this crossing will be completed using the HDD method. The HDD alignment will follow the road corridor, maintaining a straight section of approximately 50 m on either side of the bridge.</li> <li>• Bridge 3 crosses the Bonet River, where zero cover is available and an off-road HDD installation is therefore required. The launch pit will be located on private land under Folio LM20069F (Harriet Devaney), where a joint bay is also proposed immediately adjacent to the launch area. The receptor pit will be located on the R-289.</li> </ul> <p><u>Culvert Crossings</u></p> <p>Section 2 has 5 No. Culvert Crossings. A standard culvert crossing method is described in drawing no. 05773-DR-126.</p>
<p><b>Section 3</b></p> <p>UGC</p> <p>11,372.2 m</p>	<p><b>UGC from L-4165 to N16</b></p> <p>From the junction with the L-4165, the UGC continues along this roadway for approximately 0.80 km before reaching the location of JB18. The route then proceeds to the junction with the L-4166 and continues along this road for approximately 5.35 km, where a sequence of joint bays is proposed in areas generally constrained by narrow road widths and limited opportunities for passing places.</p> <p>Along the L-4166, the route encounters two bridges, Bridge 4 and 5, where insufficient clearance beneath the structures requires the use of HDD. After approximately 0.94km from the bridge 5 crossing, the UGC continues northeast along the L-4166 until it reaches the junction with the L-2169.</p> <p>The route continues along the L-2169 for approximately 5.86 km. This section contains several culvert crossings and two additional bridge crossings (Bridge 6 and Bridge 7), both of which require HDD installation due to insufficient cover.</p> <p>The UGC continues northeast along the L-2169, passing further culvert locations, before reaching the N16.</p> <p><u>Features</u></p> <p>Section 3 contains 13 no. joint bays, 4 No. bridge crossings and 2 No. culvert crossings.</p> <p><u>Joint Bays:</u></p> <p>Joint bays, described in Section 6.6 below, will be located below ground, within the curtilage of the existing road and finished/reinstated to the required roads specification. All joint bays will have</p>

associated communication chambers and mentioned joint bays will also include earth link boxes which will have a surface access hatch which will match existing ground levels.

- Joint Bay 18 (JB18) will be located within the (L- 4165) roadway, approximately 799m northwest of JB17. An earth link box will also be located at this joint bay location.
- Joint Bay 19 (JB19) will be located within the (L- 4166) roadway, approximately 750m northeast of JB18. An earth link box will also be located at this joint bay location.
- Joint Bay 20 (JB20) will be located within the (L- 4166) roadway, approximately 750m northeast of JB19. An earth link box will also be located at this joint bay location.
- Joint Bay 21 (JB21) will be located within the (L- 4166) roadway, approximately 750m northeast of JB20. An earth link box will also be located at this joint bay location.
- Joint Bay 22 (JB22) will be located within the (L- 4166) roadway, approximately 750m northeast of JB21. An earth link box will also be located at this joint bay location.
- Joint Bay 23 (JB23) will be located within the (L- 4166) roadway, approximately 750m northeast of JB22. An earth link box will also be located at this joint bay location.
- Joint Bay 24 (JB24) will be located within the (L- 4166) roadway, approximately 750m northeast of JB23. An earth link box will also be located at this joint bay location.
- Joint Bay 25 (JB25) will be located within the (L- 4166) roadway, approximately 750m northeast of JB24. An earth link box will also be located at this joint bay location.
- Joint Bay 26 (JB26) will be located within the (L- 2169) roadway, approximately 750m north of JB25. An earth link box will also be located at this joint bay location.
- Joint Bay 27 (JB27) will be located within the (L-2169) roadway, approximately 750m northeast of JB26. An earth link box will also be located at this joint bay location.
- Joint Bay 28 (JB28) will be located within the (L-2169) roadway, approximately 750m northeast of JB27. An earth link box will also be located at this joint bay location.
- Joint Bay 29 (JB29) will be located within the (L-2169) roadway, approximately 750m northeast of JB28. An earth link box will also be located at this joint bay location.
- Joint Bay 30 (JB30) will be located within the (L-2169) roadway, approximately 750m northeast of JB29. An earth link box will also be located at this joint bay location.
- Joint Bay 31 (JB31) will be located within the (L-2169) roadway, approximately 750m north of JB30. An earth link box will also be located at this joint bay location.
- Joint Bay 32 (JB32) will be located within the (L-2169) roadway, approximately 750m northeast of JB31. An earth link box will also be located at this joint bay location.
- Joint Bay 33 (JB33) will be located within the (L-2169) roadway, approximately 750m northeast of JB32. An earth link box will also be located at this joint bay location.

Bridge Crossings:

- Bridge 4 crosses the Rubbal River and is located on the L-4166, approximately 278 m northeast of JB21. Due to insufficient clearance beneath the structure, the crossing will be carried out using the HDD method. The HDD alignment will follow the road corridor, maintaining a straight section of approximately 50 m on either side of the bridge.
- Bridge 5 crosses the Lough Carrigeencor River and is located on the L-4166, approximately 609 m northwest of JB25. Due to insufficient clearance beneath the structure, this crossing will be carried out using the HDD method. The HDD alignment will follow the road corridor, maintaining a straight section of approximately 50 m on either side of the bridge.

	<ul style="list-style-type: none"> <li>• Bridge 6 crosses the BOIHY River and is located on the L-2169, approximately 327 m northeast of JB27. As insufficient clearance exists beneath the structure, the crossing will be completed using the HDD method. The HDD alignment will follow the road corridor, maintaining a straight section of approximately 50 m on either side of the bridge.</li> <li>• Bridge 7 crosses the Shanvaus 35 River and is located on the L-2169, approximately 549 m northeast of JB31. Due to inadequate clearance beneath the structure, this crossing will be installed using the HDD method. The HDD alignment will follow the road corridor, maintaining a straight section of approximately 50 m on either side of the bridge.</li> </ul> <p>Culvert Crossings:                  Section 3 has 2 No. Culvert Crossings. A standard culvert crossing method is described in drawing no. 05773-DR-127</p>
<p><b>Section 4</b>                   UGC                  6,179.9 m</p>	<p><b>UGC from N16 to Lissinagroagh WF Substation</b></p> <p>From the entrance on the N16, the UGC proceeds west along the national road, where the verge is generally suitable for construction purposes. The route continues for approximately 0.16 km before reaching the entrance to the L-21361 (north direction). From this junction, the UGC follows the L-21361 for approximately 0.12 km, where the first joint bay in this section, JB34, is proposed.</p> <p>Continuing along the L-21361, the cable route progresses for approximately 1.31 km to reach the junction with the L-2136, where it continues east for approximately 0.03 km before entering private land under Folio Number LM13453F. At this location a HDD undercrossing of the bridge is required. This location will accommodate the launch pit for Bridge 8, with the receptor pit situated on the L-2136. After the bridge crossing, the route continues along the L-2136 for approximately 0.81 km before reaching the R-280.</p> <p>The UGC proceeds to cross the R 280, continuing southeast toward the junctions with the L 2643 and L 2128. The route then exits to the northeast, joining the R 282, along which it continues for approximately 1.1 km. Along this section, Bridge 9 is encountered on the R-282, where measurements indicate 2200 mm from the top of the slab to the top of the parapet and 1200 mm from the parapet top to road level, confirming sufficient cover for a standard crossing method.</p> <p>The UGC then transitions south onto the L-6180. This section includes two bridge crossings: Bridge 10 and Bridge 11. Both crossings require HDD due to insufficient clearance beneath their structures. For each bridge, launch and receptor pits are located on the L-6180 immediately adjacent to the structures.</p> <p>Continuing north along the L-6180 for approximately 0.40 km after Bridge 11, the cable route proceeds west toward the Wind Farm access road, where a culvert crossing is required before finally reaching the Lissinagroagh Wind Farm Substation.</p> <p><u>Features</u></p> <p>Section 3 contains 8 no. joint bays, 4 no. bridge crossings and 1 no. culvert crossing.</p> <p><u>Joint Bays:</u></p> <p>Joint bays, described in Section 6.6 below, will be located below ground, within the curtilage of the existing road and finished/reinstated to the required roads specification. All joint bays will have associated communication chambers and mentioned joint bays will also include earth link boxes which will have a surface access hatch which will match existing ground levels.</p>

- Joint Bay 34 (JB34) will be located within the (L- 21361) roadway, approximately 750m north of JB33. An earth link box will also be located at this joint bay location.
- Joint Bay 35 (JB35) will be located within the (L- 21361) roadway, approximately 750m north of JB34. An earth link box will also be located at this joint bay location.
- Joint Bay 36 (JB36) will be located within the (L- 2136) roadway, approximately 750m northeast of JB35. An earth link box will also be located at this joint bay location.
- Joint Bay 37 (JB37) will be located within the (L- 2136) roadway, approximately 762m southeast of JB36. An earth link box will also be located at this joint bay location.
- Joint Bay 38 (JB38) will be located within the (R-282) roadway, approximately 750m east of JB37. An earth link box will also be located at this joint bay location.
- Joint Bay 39 (JB39) will be located within the (R-282) roadway, approximately 750m northeast of JB38. An earth link box will also be located at this joint bay location.
- Joint Bay 40 (JB40) will be located within the (L- 6180) roadway, approximately 750m northeast of JB39. An earth link box will also be located at this joint bay location.
- Joint Bay 41 (JB40) will be located within the (L- 6180) roadway, approximately 800m northeast of JB39. An earth link box will also be located at this joint bay location.

Bridge Crossings:

- Bridge 8 crosses the Bonet River and is located on the L-2136 road, approximately 139m east of JB36. Due to insufficient clearance beneath the structure, this crossing will be carried out using the HDD method. The launch pit will be located on private land under Folio LM13453F (Mirror Controls International Ireland Limited), and the receptor pit will be located on the L- 2136.
- Bridge 9 crosses the Brackary River and is located on the R-282 road, approximately 718 m east of JB37. There is sufficient cover beneath the structure for a standard crossing method.
- Bridge 10 crosses the Curraghfore River and is located on the L-6180, approximately 376 m northeast of JB40. Due to insufficient clearance beneath the structure, this crossing will be carried out using the HDD method. The HDD alignment will follow the road corridor.
- Bridge 11 crosses the Curraghfore River and is located on the L-6180, approximately 110 m northeast of Bridge 10. As insufficient clearance exists beneath the structure, this crossing will be completed using the inline HDD method. The HDD alignment will follow the road corridor.

Culvert Crossings:

Section 4 has 1 No. Culvert Crossing, located on the Wind Farm access road. A standard culvert crossing method is described in drawing no. 05773-DR-127

Note: The precise location of the UGC route within the curtilage of the existing access tracks, public roads and forestry tracks may be subject to minor modifications following confirmatory site investigations prior to the construction phase of the proposed wind farm development.

## 4.0 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. The contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise existing forestry/farm access tracks, where appropriate.

In the event planning permission is granted for the proposed development, the Traffic Management Plan included with the EIAR will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned. 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 Leitrim County Council and Sligo County Council.

Careful and considered local consultation will be carried out, to minimise the amount of disturbance caused during works. 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 dust and/or invasive aquatic / riparian species.

## 5.0 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, the project Traffic Management Plan and in agreement with Leitrim County Council and Sligo County Council. All work on public roads will be subject to the approval of a road opening license application by Leitrim County Council and Sligo County Council. The contractor will prepare a detailed traffic management plan 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 150m 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 appropriately within the works area so as not to cause additional obstruction or inconvenience to road users or local 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. Access for local residents can be accommodated, although traffic flows during works may have to be minimised.

All traffic management measures will comply with those outlined in Section 14.1 of the EIAR and the Project Traffic Management Plan (TMP), which is being submitted as part of the EIAR for planning. These measures will be implemented in consultation with Leitrim County Council and Sligo County Council prior to and during the commencement of UGC construction.

## 6.0 Road Opening Licence

The grid connection works, along the public road network, will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Leitrim County Council and Sligo County Council. A Traffic Management Plan (TMP) has been prepared for the project and will be agreed with Leitrim County Council & Sligo 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 Leitrim County Council and Sligo County Council in advance of the preparation of the detailed TMP.

## 7.0 UGC Construction Methodology

The UGC will consist of 3 No. 160mm diameter HDPE power cable ducts, 2 No. 125mm diameter HDPE communications ducts and 1 No. 125mm earth continuity conductor duct to be installed in an excavated trench, typically 825mm 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 1 No. power cables per duct. One of the communications ducts will accommodate a fibre cable to allow communications between the Lissinagroagh Wind Farm substation and Srananagh 220kV substation. The inclusion 1 No. 125mm earth continuity conductor duct will also be required. The ducts will be installed, the trench reinstated in accordance with landowner or Leitrim County Council & Sligo County Council specification, and then the electrical cabling/fibre cable is pulled through the installed ducts in approximately 700 to 850m section lengths. 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 ESBN and EirGrid standards.

### 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 EIAR and as required by planning conditions where relevant;
- All existing underground services along the UGC route shall be confirmed 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 EIAR, the Construction Environmental Management Plan (CEMP) 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;
- Traffic management measures will be implemented in accordance with those included in Section 14.1 of the EIAR, and the Traffic Management Plan submitted with the EIAR for planning, and will be agreed with Leitrim County Council & Sligo 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 to the proposed on-site borrow pits;
- 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 (please refer to Chapter 8-Appendix 2.7 of the EIAR);
- 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. week to complete a 250m 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 3 - 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 825mm width have been obtained.
2. Place bedding layer of Thermal Sand 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 Thermal Sand in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
5. Place cable protection strips on compacted Thermal Sand directly over the ducts.
6. Lay the top row of ducts onto the freshly compacted Thermal Sand 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 Thermal Sand material in accordance with the drawings and thoroughly compact without damaging ducts.
8. Place red cable protection strip on top of compacted Thermal Sand over each set of ducts as shown on the drawings.
9. Place and thoroughly compact Thermal Sand 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 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 ESNB Clerk of Works (CoW) as required.

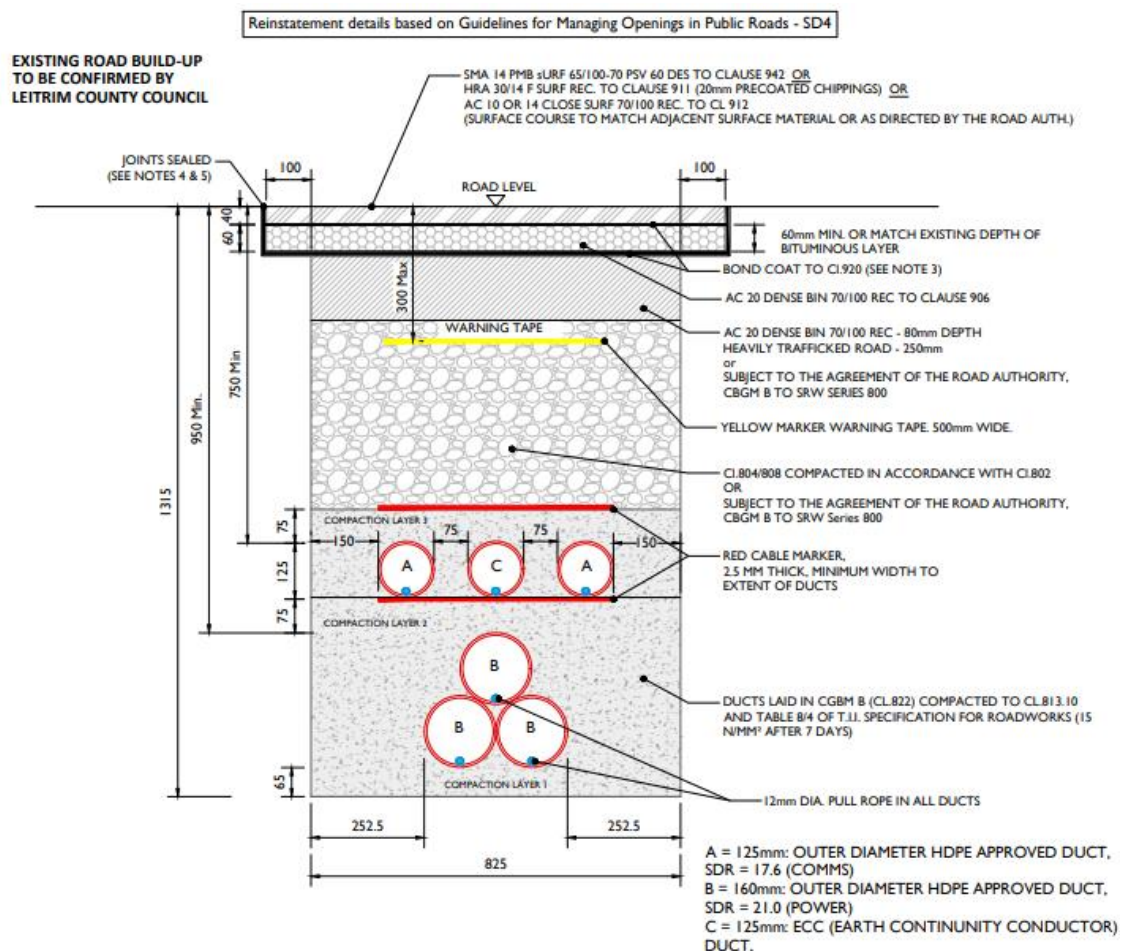


Figure 4 – Typical 110kV Section Through Permanent Reinstatement of Longitudinal Opening in Roadway

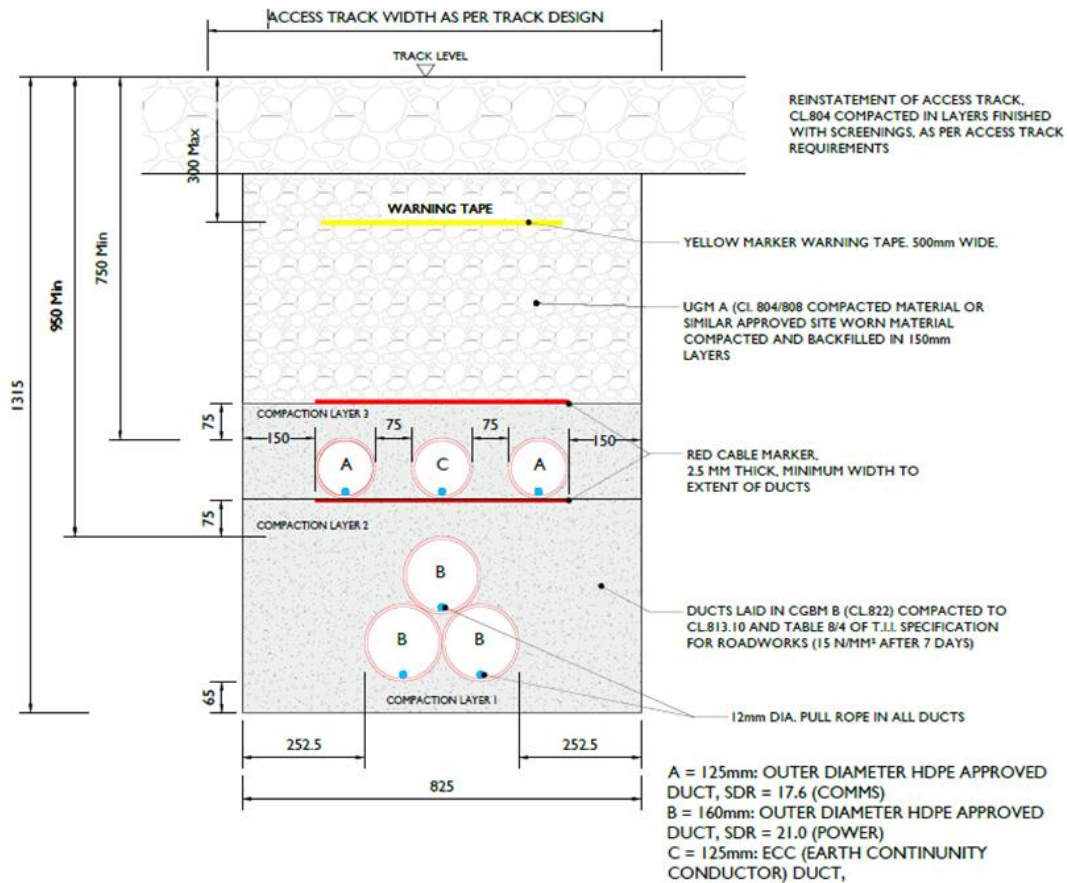


Figure 5 - Typical 110kV Section Through Off Road Sections

**Equipment and Personnel:**

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

**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;
- 63mm diameter HDPE duct;
- Temporary Surface Reinstatement Materials

**7.2.1 UGC Installation on Public Road**

The majority of the 110kV UGC route is located within public road carriages and where applicable the trench will be installed in the non-trafficked strip between the wheel marks on the road. The cable will be micro-sited based on the 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 UGC Installation on Private Assess Tracks

Where the cable is installed in private tracks the location where the cable is laid will depend on several factors such as; 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 ESNB and EirGrid 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 (*Figure 5*).

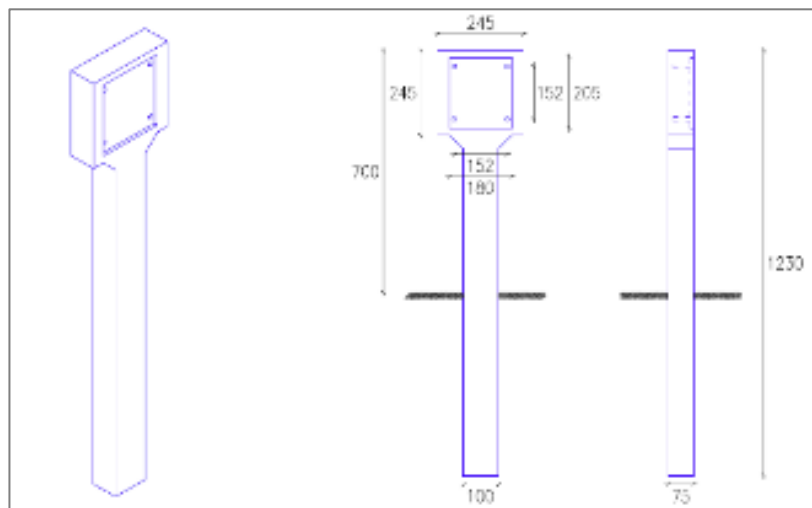


Figure 6 - Typical ESB Marker Posts Example

### 7.4 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 peat and spoil material exists, it may be used in the reinstatement of borrow pits within Lissinagroagh Wind Farm. Excavated tar from the public road network will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility.

### 7.5 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the UGC works area or within the temporary construction compounds to be located within the Lissinagroagh Wind Farm. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

### 7.6 Joint Bays and Associated Chambers

Joint Bays are to be installed approximately every 700m to 850m lengths along the UGC route to facilitate the jointing of 2 No. lengths of UGC. Joint Bays are typically 2.6m 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 Lissinagroagh Wind Farm substation and the existing 220kV substation at Srananagh. Earth Sheath Link Chambers are also required at every joint bay along the cable route where the cables are to be Single Point Bonded. These locations have been detailed in Section 2 Table 2 (Summary of Grid Connection Design 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 as seen in Figure 6. 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, within the curtilage of the public road, is subject to approval by EirGrid.

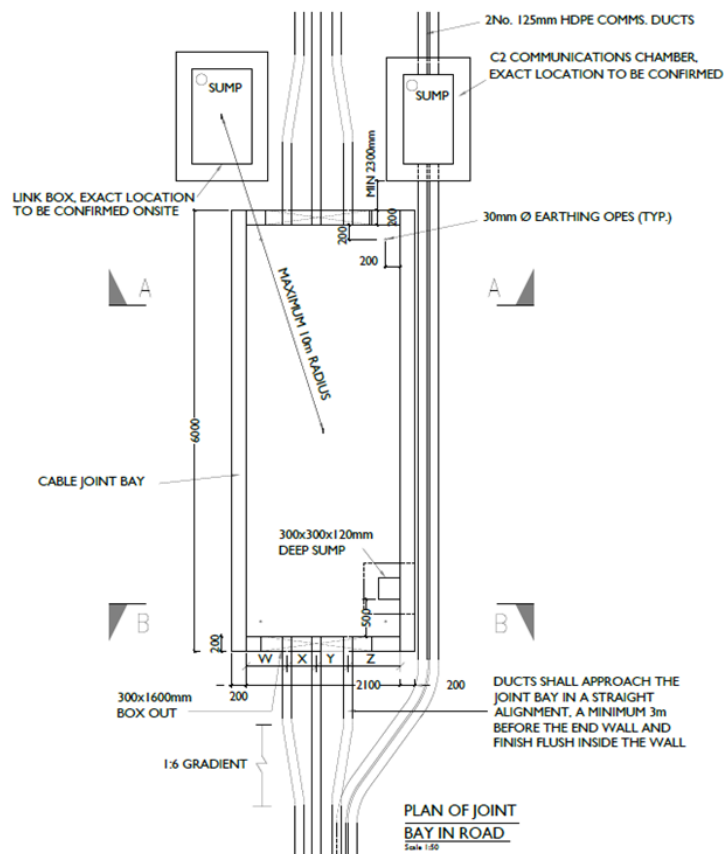


Figure 7 - 110kV Joint Bay Plan Layout

### 7.7 Joint Bay Construction and Cable Installation

In advance of commencing construction, the area around the edge of the 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 away 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 environmental control measures.

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 environmental control measures.

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 8)



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 9)



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 10)



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



Figure 12 - HV cable jointing container

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 and Personnel:**

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

#### **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

To facilitate the installation of the proposed UGC, it may be necessary to relocate existing underground services such as water mains, telecoms, or existing cables. In advance of any construction activity, the contractor will undertake additional surveys 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 to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

### 8.1 Underground Cables

If existing underground cables are found to be present, a trench will be excavated, and new ducting and cabling will be installed along the new alignment and connected to the network on either end. The trench will be backfilled with suitable material to the required specification. Warning strip and marking tape will be laid at various depths over the cables as required. Marker posts and plates will be installed at surface level to identify the new alignment of the underground cable, and the underground cables will then be re-energised.

### 8.2 Water Mains

Uisce Eireann will be consulted and advised on details of the project proposals in the form of a completed Building-over or Near an Irish Water Asset Application Form and associated technical information largely comprising drawings and schedules with details of proposed crossings etc with as much available information as possible. Uisce Eireann will be involved in the early engagement on projects that may involve any infrastructure which may be located near their assets with the intention of identifying as early as possible, if bespoke design measures or diversions are necessary.

The water supply will be turned off by the utility provider so work can commence on diverting or crossing the service. The section of the existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the utility standards.

## 9.0 Major Watercourse Crossings

The cable route will involve 11 No. bridge crossings including 10 No. HDD crossings. 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 preferred cable installation location is within the bridge deck where there is sufficient depth and width available on the bridge, however from onsite surveys 9? of the 11 bridges detailed below (Section 8.1 to 8.11) have insufficient depth and width available therefore horizontal directional drilling (HDD) will be employed as an alternative.

Existing culverts will be crossed using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. A confirmatory site survey of all culverts will be completed as part of the next phase of the project prior to construction to confirm the findings of the design phase surveys. The proposed culvert crossing methods are detailed in *Figures 12 and 13* and can be found in drawing *05773-DR-126 and 05773-DR-127, respectively*.

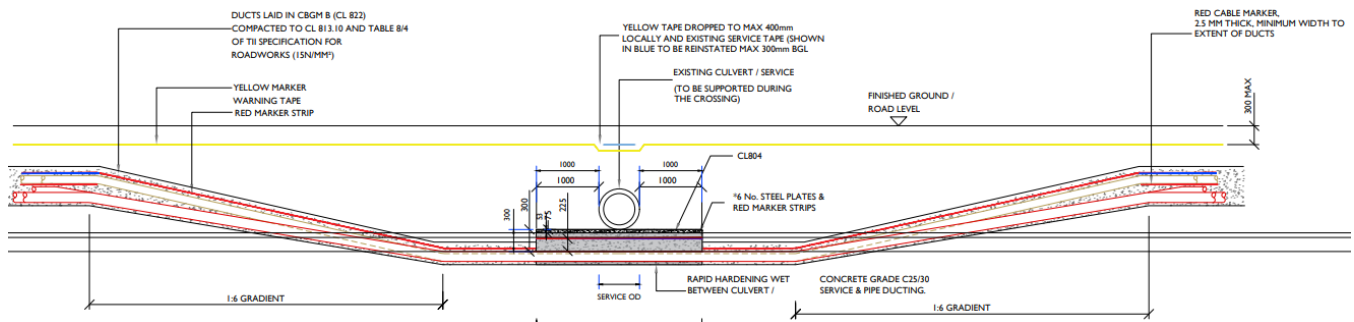


Figure 13 - 110kV UGC Culvert Undercrossing

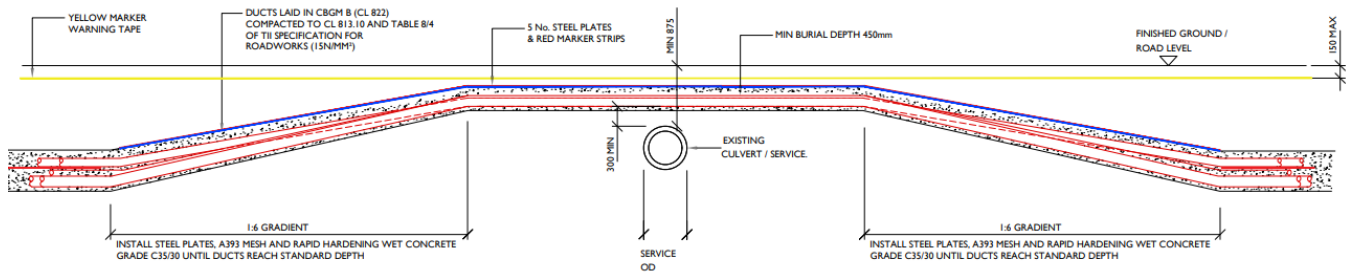


Figure 14 - 110kV UGC Culvert Overcrossing

Inland Fisheries Ireland (IFI) 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 development.

The bridge and culvert crossing locations are shown on the drawings included in Appendix 2-2 of the EIAR.

## 10.0 Horizontal Directional Drilling (HDD)

Horizontal Directional 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 drilling methodology is as follows: -

1. A works area of circa. 40m<sup>2</sup> 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 ESN, EirGrid and Leitrim County Council & Sligo County Council.
13. A reducing coupler will be installed at either side of the bridge/ following the horizontal directional drilling as per EirGrid requirements, this will join the HDD ducts to the standard ducts.

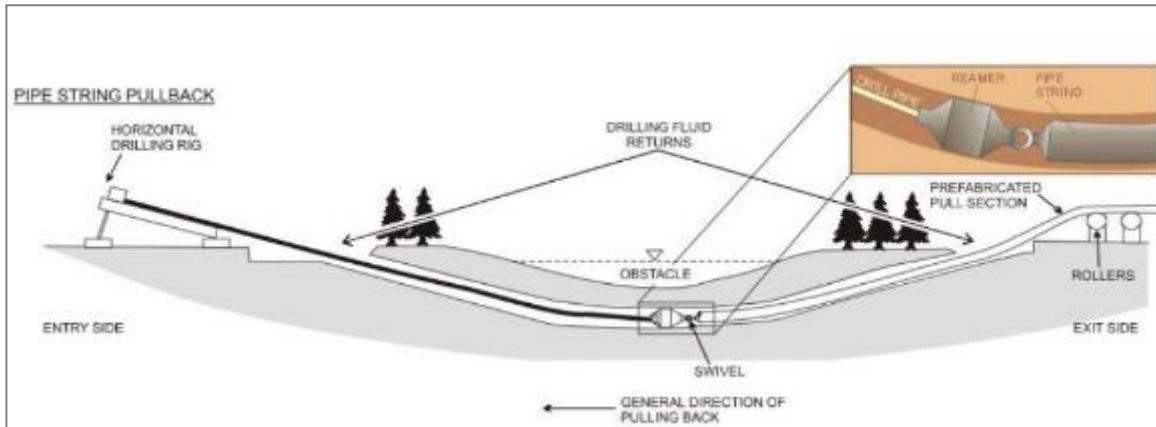


Figure 15 - Typical HDD Installation

### 10.1 Bridge 1 - Horizontal Directional Drilling

ITM Coordinates: 576811.49, 825036.44

Bridge 1 is located on the L-5204 approx. 610m east of JB03 crossing over the Rathgeean River. The Bridge has insufficient room to install the cable to ESN and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the works. Horizontal directional drilling (HDD) will be implemented to bore 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. The methodology for HDD is outlined in Section 9 below.



Figure 16 - Bridge 1 within L-5204

### 10.2 Bridge 2 - Horizontal Directional Drilling

ITM Coordinates: 580131.58, 828212.11

Bridge 2 is located on the L-4263 approx. 530m northeast of JB11 crossing over the Killanummery River. The Bridge has insufficient room to install the cable to ESN and EirGrid specifications (450mm cover to top of ducts) and the

suitability of the bridge is inadequate to accommodate the scope of works. Horizontal directional drilling (HDD) will be implemented to bore 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.



Figure 17 - Bridge 2 within L-4263

### 10.3 Bridge 3 - Horizontal Directional Drilling

ITM Coordinates: 581781.21, 830238.62

Bridge 3 is located on the L-4165 approx. 648m northwest of JB16 crossing over the Bonet River. Bridge 3 has insufficient room to install the cable to ESBN and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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. The launch pit for this HDD crossing will be located on private land under Folio LM20069F (Harriet Devaney), and the receptor pit will be situated on the R-289.



Figure 18 - Bridge 3 within L-4165

#### 10.4 Bridge 4 - Horizontal Directional Drilling

*ITM Coordinates: 582215.02, 832248.48*

Bridge 4 is located on the L-4166 approx. 278m northeast of JB21 crossing over the Rubbal River. Bridge 4 has insufficient room to install the cable to ESNB and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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.



*Figure 19 - Bridge 4 within L-4166*

#### 9.5 Bridge 5 - Horizontal Directional Drilling

*ITM Coordinates: 584209.01, 834422.74*

Bridge 5 is located on the L-4166 approx. 609m northwest of JB25 crossing over the Lough Carrigeencor River. Bridge 5 has insufficient room to install the cable to ESNB and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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.



*Figure 20 - Bridge 5 within L-4166*

### 10.6 Bridge 6 - Horizontal Directional Drilling

*ITM Coordinates: 585075.11, 835148.49*

Bridge 6 is located on the L-2169 approx. 327m northeast of JB27 crossing over the BOIHY River. Bridge 6 has insufficient room to install the cable to ESNB and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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.



*Figure 21 - Bridge 6 within L-2169*

### 10.7 Bridge 7 - Horizontal Directional Drilling

*ITM Coordinates: 586403.94, 837764.09*

Bridge 7 is located on the L-2169 approx. 549m northeast of JB31 crossing over the Shanvaus 35 River. Bridge 7 has insufficient room to install the cable to ESNB and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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.



*Figure 22 - Bridge 7 within L-2169*

### 10.8 Bridge 8 - Horizontal Directional Drilling

*ITM Coordinates: 587242.82, 840345.5*

Bridge 8 is located on the L-2136 approx. 139m east of JB36 crossing over the Bonet River. This bridge has insufficient room to install the cable to ESN and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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. The launch pit will be located on private land under Folio LM13453F and the receptor pit will be located on the L-2136.



*Figure 23 - Bridge 8 within L-22136*

### 10.9 Bridge 9 - Horizontal Directional Drilling

*ITM Coordinates: 588395.62, 839917.27*

Bridge 9 is located on the R-282, approximately 718 m east of JB37, crossing over a tributary of the Brackary River. Bridge 9 provides sufficient clearance to achieve the required 450 mm cover to the top of ducts in accordance with ESN and EirGrid specifications and is therefore suitable to accommodate the proposed UGC installation. Site measurements record 2200 mm from the top of the slab to the parapet top, and 1200 mm from the parapet top to road level, confirming adequate cover for a standard crossing method.



*Figure 24 - Bridge 9 within R-282*

### 10.10 Bridge 10 - Horizontal Directional Drilling

*ITM Coordinates: 589554.12, 841421.74*

Bridge 10 is located on the L-6180 approx. 376m northeast of JB40 crossing over the Curraghfore River. This bridge has insufficient room to install the cable to ESNB and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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.



*Figure 25 - Bridge 10 within L-6180*

### 10.11 Bridge 11 - Horizontal Directional Drilling

*ITM Coordinates: 589530.20, 841497.35*

Bridge 11 is located on the L-6180 approx. 110m northeast of Bridge 10 crossing over the Curraghfore River. This bridge has insufficient room to install the cable to ESNB and EirGrid specifications (450mm cover to top of ducts) and the suitability of the bridge is inadequate to accommodate the proposed works. Horizontal directional drilling (HDD) will be implemented to bore 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.



*Figure 26 - Bridge 11 within L-6180*

## 11.0 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.

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

## 13.0 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 Construction Methodology, environmental protection measures included within the EIAR, measures 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 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 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. These method statements will be prepared prior to the construction phase of the proposed wind farm and will incorporate all of the mitigation measures identified in the EIAR and NIS as well as the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.

- All UGC construction materials shall be stored at the temporary construction compounds within the Lissinagroagh 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 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 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 Lissinagroagh 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.

## 14.0 Implementation of Environmental Protection Measures

All environmental protection measures, invasive species management and waste management measures will be implemented in accordance with the measures set out in Section 14.0 of this report, the EIAR, NIS and the CEMP.

## 15.0 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.

## 16.0 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.

## 17.0 Construction Programme

Estimates for the duration of the construction works are included in the table below. Please note that some of the elements are likely to happen concurrently, therefore the overall start-to-finish duration is estimated to be thirty months.

Table 3: Estimated Construction Duration	
Development Element	Estimated Construction Duration
110kV Wind Farm Substation	18 months
Underground Cable route	30 months

Table 3 - Estimated Construction Duration

