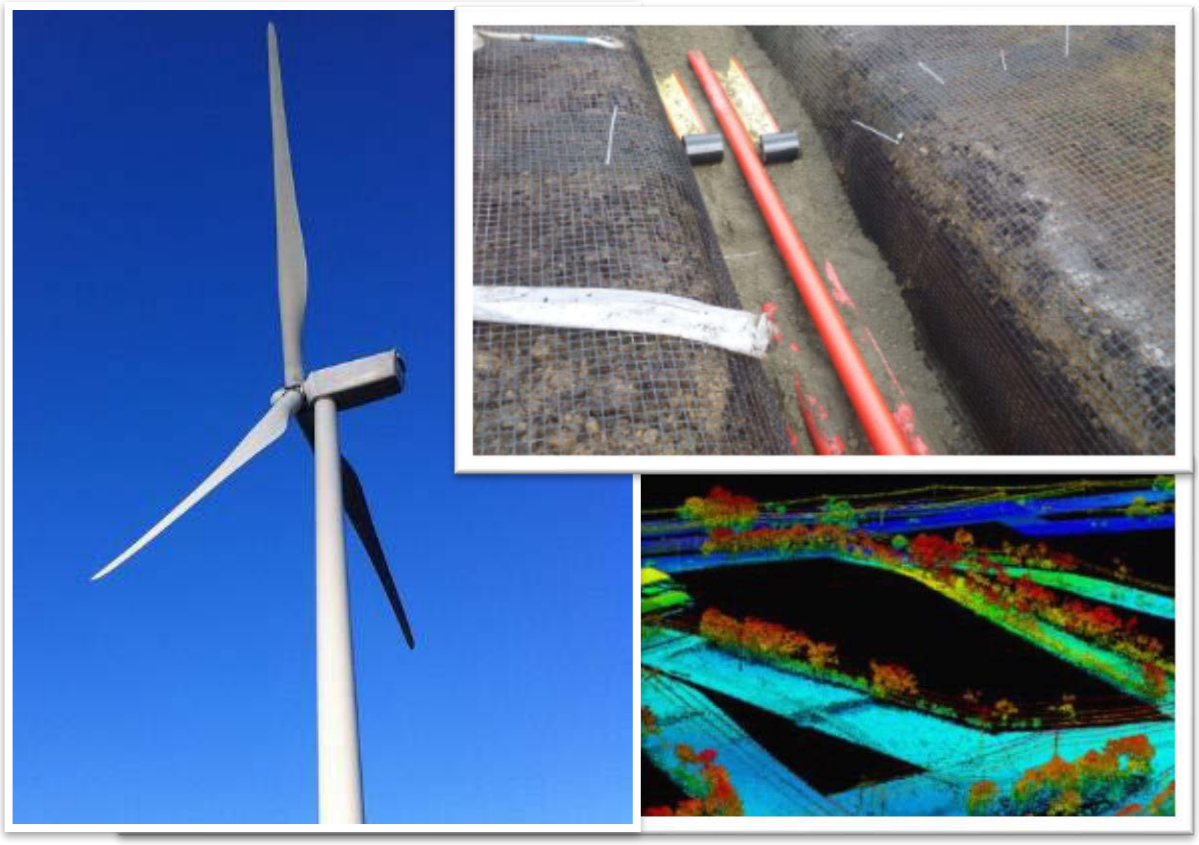
Outline Construction Methodology – 110kV Grid Connection

Castlebanny Wind Farm



Report Ref: 05699-R01-01

Client: Coillte c/o Tobin Consulting Engineers

Revision:	Author:	Checked:	Date:	Notes:
00	GH	DB	29.10.20	*Issued for Client Review*
01	GH	SK	07.12.20	*Issued for Planning*

Table of Contents

Table of Figures

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 Castlebanny Wind Farm 110kV grid connection to the existing Great Island – Kilkenny 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 Castlebanny 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 UGC works will require a double circuit which entails that two trenches in parallel are required for the entire length of the cable route with a minimum separation distance of 2000mm required between each circuit. Each trench will consist of the installation of 5 No. ducts in an excavated trench to accommodate 3 No. power cables and 1 No. fibre communications cable to allow communications between the Castlebanny Wind Farm Substation and the Great Island & Kilkenny 110kV substations.

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

2.0 Proposed 110kV Underground Cable Route

The proposed UGC route is approximately 4.4km in length and runs in a south westerly direction from the existing 110kV overhead line to the proposed Castlebanny Wind Farm substation location utilizing private lands, public local road networks, existing access tracks and private forestry access tracks.

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

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

This proposed grid connection route is shown as an Overall Site Layout Plan in Drawing No. 05699-DR-001.

Figure 1 - Grid Connection Route Location

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

Table 1 – Approximate Route Location of Preliminary Design:		
Wind Farm Site/Forestry Roads (UGC)	**Public Roads (UGC)**	**Private Land (UGC)**
1,240m	526m	2,632m

Table 1: Castlebanny Wind Farm Substation to 110kV OHL – UGC Route Location Summary

Table 2 below separates the UGC route into a number of sections and describes the specific construction requirements of each individual section 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 Grid Connection Design Route	
Section	**Description**
Section 1 UGC 1,931 m	**UGC from New Cable Sealing End Masts at 110kV OHL to Private Land after River Crossing** The proposed underground cable route initially begins from two overhead line cable sealing end masts where there will be a new break in the existing Great Island – Kilkenny 110kV overhead line. The UGC route exits the loop-in point and follows initially in a north westerly direction through private land, it then crosses a local secondary road before changing to a south westerly direction all within private land while maintaining sufficient clearance from a ringfort. The route then enters a local secondary road and continues along this in a southerly direction. It leaves this local secondary road and continues in a south westerly direction through private land. At the end of this section of private land it proposed to utilise a Horizontal Directional Drill (HDD) in order to cross under the Arrgile River which is designated as a Special Area of Conservation (SAC). <u>Features</u> Section 1 contains 6 no. joint bays (allocated between the two circuits). Joint bays will be located below ground and finished/reinstated to the required landowner specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay A-1 (JB-A1) will be located approx. 553m west of the new end mast connected to the existing 110kV overhead line. The joint bay will be installed within private land. • Joint Bay B-1 (JB-B1) will be located approx. 655m west of the new end mast connected to the existing 110kV overhead line. The joint bay will be installed within private land. • Joint Bay A-2 (JB-A2) will be located approx. 553m south of JB-A1 positioning the joint bay within private land. • Joint Bay B-2 (JB-B2) will be located approx. 553m south of JB-B1 positioning the joint bay within private land. • Joint Bay A-3 (JB-A3) will be located approx. 532m west of JB-A2 within private land at the location of the HDD launch/reception point. • Joint Bay B-3 (JB-B3) is located approx. 534m west of JB-A2 within private land at the location of the HDD launch/reception point. Section 1 contains 1 HDD which is required to cross under the Arrgile River, which is designated as a Special Area of Conservation, this will be completed within private land. This section of drilling will span for circa. 200m from a launch pit on private land where the HDD will cross under the river/SAC before reaching a receptor pit on private land on the opposite side.

Section 2 UGC 2,467 m	**Private Land after River Crossing to Castlebanny Windfarm Substation** After crossing the Arrigle River/Special Area of Conservation, the route continues in a south westerly direction through private lands. It then continues through forestry before entering back into private lands again. Upon leaving the private lands it enters Coillte land through forestry before entering the Castlebanny Windfarm substation. <u>Features</u> Section 2 contains 6 no. joint bays (allocated between the two circuits). Joint bays will be located below ground and finished/reinstated to the required landowner specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay A-4 (JB-A4) will be located approx. 605m south west of JB-A3 in private land at the location of the HDD launch/reception point. • Joint Bay B-4 (JB-B4) will be located approx. 603m south west of JB-B3 in private land at the location of the HDD launch/reception point. • Joint Bay A-5 (JB-A5) will be located approx. 713m south west of JB-A4 in Coillte forestry. • Joint Bay B-5 (JB-B5) will be located approx. 718m south west of JB-B4 in Coillte forestry. • Joint Bay A-6 (JB-A6) will be located approx. 716m south west of JB-A5 in Coillte lands within the windfarm boundary. • Joint Bay B-6 (JB-B6) will be located approx. 719m south west of JB-B5 in Coillte lands within the windfarm boundary. Section 2 contains 1 HDD crossing which is required to cross beneath a stream between private lands. This section of drilling will span for circa. 120m from a launch pit on private land at one side of the river where the HDD will cross under the river before reaching a receptor pit on private land on the opposite side.
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 Proposed UGC Design Route

3.0 Preliminary Site Investigations

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

The following items may be carried out:

3.1 UGC Route:

Slit trenches at locations of major service crossings (Full road/track width).

5 No. trial holes along the route to ascertain ground conditions and thermal resistivity of the soil.

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

Traffic Management – Single lane Closure with Stop/Go system in place as required.

Equipment:

- 4x4 vehicle
- Concrete vibrator
- Wheeled dumper
- Soil compactor
- 360° tracked excavator (only rubber tracked machines will be allowed on public roads)

4.0 UGC Construction Methodology

The proposed UGC will consist of 2 No. trenches with a minimum of 2m separation distance between each circuit. Each trench will contain 3 No. 160mm diameter HDPE power cable ducts and 2 No. 125mm diameter HDPE communications duct to be installed in an excavated trench, typically 600mm wide by 1,315mm deep, with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings, etc. The power cable ducts will accommodate 3 No. power cables. The communications duct will accommodate a fibre cable to allow communications between the Castlebanny Wind Farm substation and the adjoining Great Island and Kilkenny 110kV substations. The ducts will be installed, the trench reinstated in accordance with landowner/Kilkenny County Council specification, and then the electrical cabling/fibre cable is pulled through the installed ducts in approximately 550/750m sections. Construction methodologies to be implemented and materials to be used will ensure that the UGC is installed in accordance with the requirements and specifications of EirGrid and ESB.

4.1 Trenching Methodology

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

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures included within the planning application and accompanying reports and as required by planning conditions where relevant;
- All existing underground services shall be identified on site prior to the commencement of construction works;
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the planning application and accompanying reports, the detailed Construction Environmental Management Plan (CEMP) to be prepared prior to the commencement of construction, and best practice construction methodologies;
- Where the cable route intersects with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESB and Irish Water specifications;
- In the event that culverts require removal for ducting installation, it is proposed that a suitable method of damming the water source and pumping the water around the work area would be set out in a method

statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland in advance of works;

- Traffic management measures will be implemented in accordance with those included in the Traffic Management Report, and a detailed Traffic Management Plan will be prepared and agreed with Kilkenny County Council;
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature;
- Where required, grass will be reinstated by either seeding or by replacing with grass turves;
- No more than a 100m section of trench will be opened at any one time. The second 100m will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;
- Following the installation of ducting, pulling the cable will take approximately 1 no. day between each joint bay, with the jointing of cables taking approximately 1 week per joint bay location.

Figure 2 - Typical 110kV Underground Duct Installation

4.2 Ducting Installation Methodology

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

1. Grade, smooth and trim trench floor when the required 1315mm depth and 600mm width have been obtained.
2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
3. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
4. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
5. Place cable protection strips on compacted CBGM B directly over the ducts.
6. Lay the top row of ducts onto the freshly compacted CBGM B including the cable protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.
7. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
8. Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
9. Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified and place warning tape at the depth shown on the drawings.
10. For concrete and asphalt/bitmac road sections, carry out immediate permanent reinstatement in accordance with the specification and to the approval of the local authority and/or private landowners, unless otherwise agreed with local authorities **(Figure 3)**.
11. For unsurfaced/grass sections, backfill with suitable excavated material to ground level leaving at least 100 mm topsoil or match existing level at the top to allow for seeding or replace turves as per the specification of the local authority or landowner **(Figure 4)**.
12. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

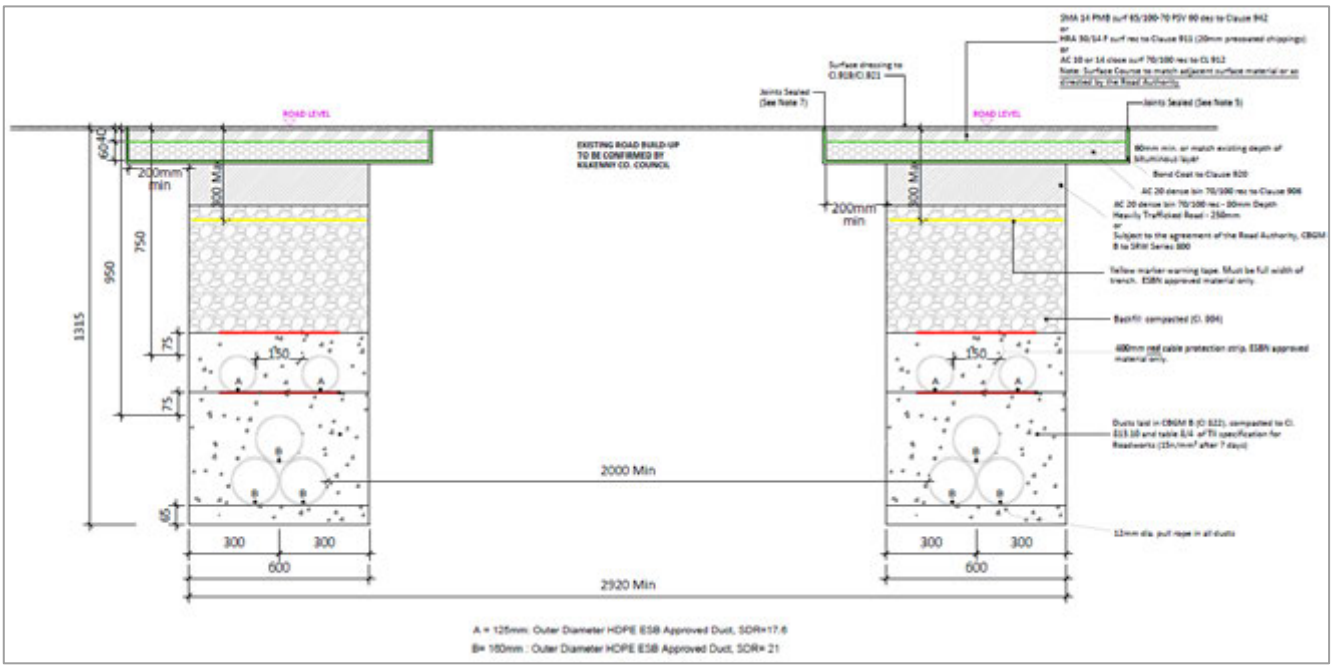


Figure 3 - Typical Trench in Roadway

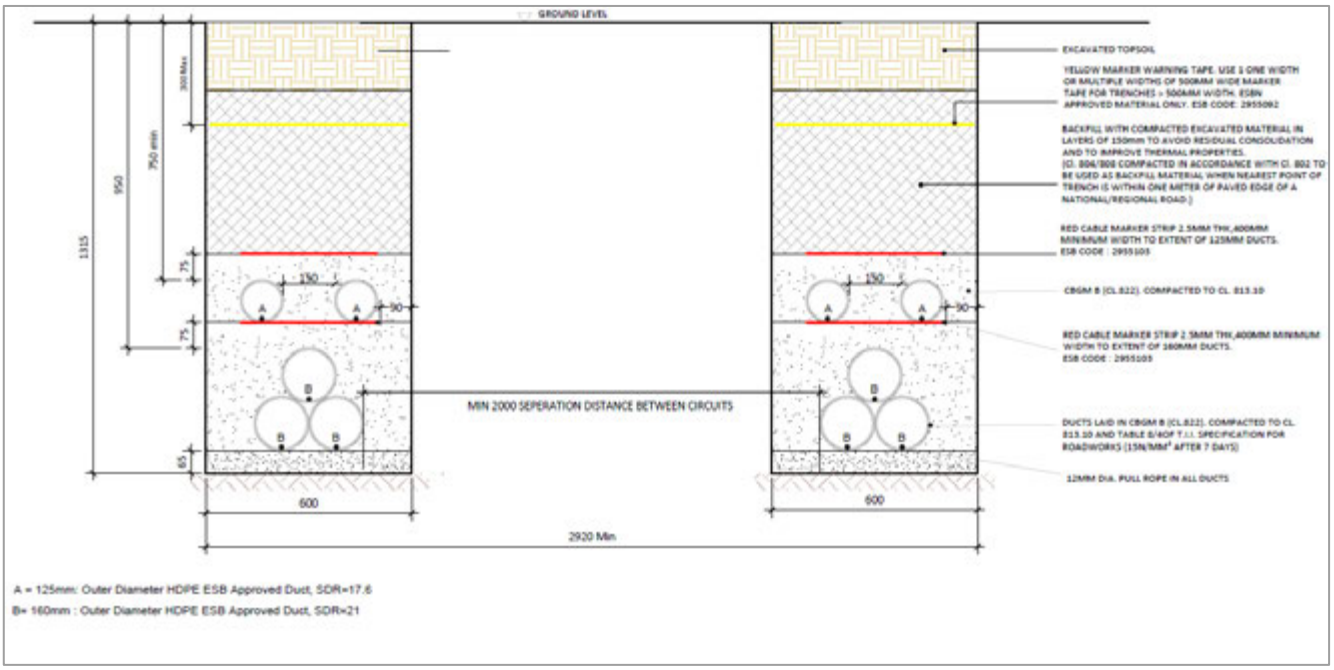


Figure 4 - Typical Trench in Off Road Section

Equipment:

- 1 no. tracked excavator (only rubber tracked machines will be allowed on public roads);
- 1 no. dumper or tractor and trailer.

Materials:

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

4.2.1 On Public Road

One section of the 110kV route is located within road carriages and where applicable the trench will be in the non-trafficked strip between the wheel marks on the road, the presence of exiting utilities and the nature of the road and the adjoining terrain will be assessed in selecting the final position of the cables. 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. However, given the narrow profile of local roads this may not always be possible.

4.2.2 On Private Tracks

Where the cable is installed in private tracks the location where the cable is laid will depend on several factors, width of track, bends along the track and crossings. Where the track needs to be widened stone will be brought in to build up the area to the same level of the track. The excess material from the track will be used elsewhere on reinstatement works where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site.

4.3 Surface Cable Markers & Marker posts

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

Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700mm base, and with centred lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker 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 5)**

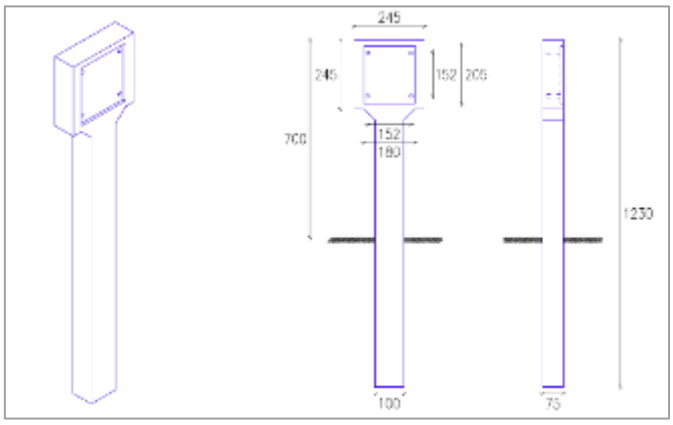


Figure 5 - Typical ESB Marker Posts Example

4.4 Horizontal Direction Drilling (HDD)

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. There is 1 river and 1 stream on this UGC route which will require HDD in order to get across them. The proposed drilling methodology is as follows: -

1. A works area of circa .40m^2 will be fenced on both sides of the watercourse crossing,
2. The drilling rig and fluid handling units will be located on one side of the watercourse and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
3. Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
4. A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
5. The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
6. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
7. The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
8. Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
9. Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
10. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
11. The ducts will be cleaned and proven and their installed location surveyed.
12. The entry and exit pits will be reinstated to the specification of ESB Networks and the landowner.
13. A transition coupler or joint bay will be installed at either side of the watercourse following the horizontal directional drilling as per ESB requirements, this will join the HDD ducts to the standard ducts.

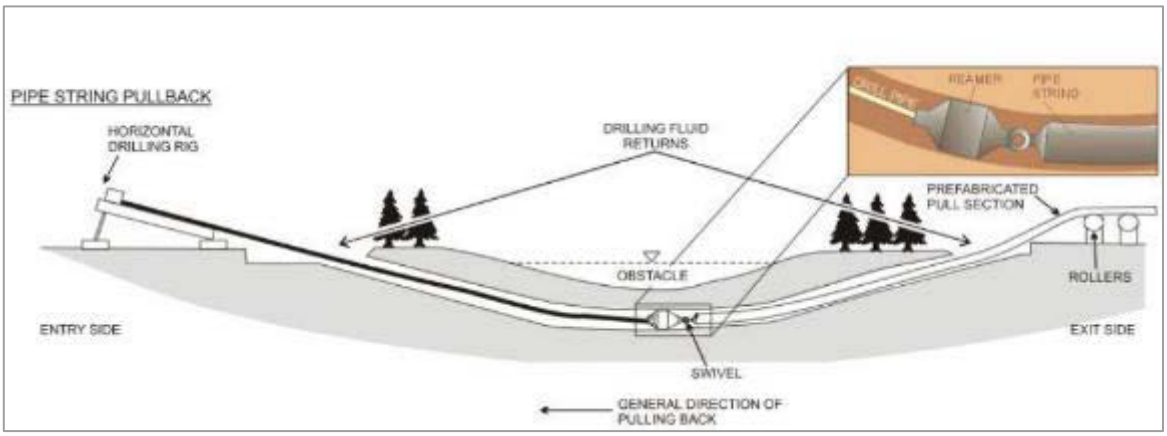


Figure 6 - Typical HDD Installation

4.5 Managing Excess Material from Trench

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

4.6 Storage of Plant and Machinery

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

4.7 Joint Bays and Associated Chambers

Joints Bays are to be installed approximately every 550m - 750m along the UGC route to facilitate the jointing of 2 No. lengths of UGC. Joint Bays are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level.

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

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

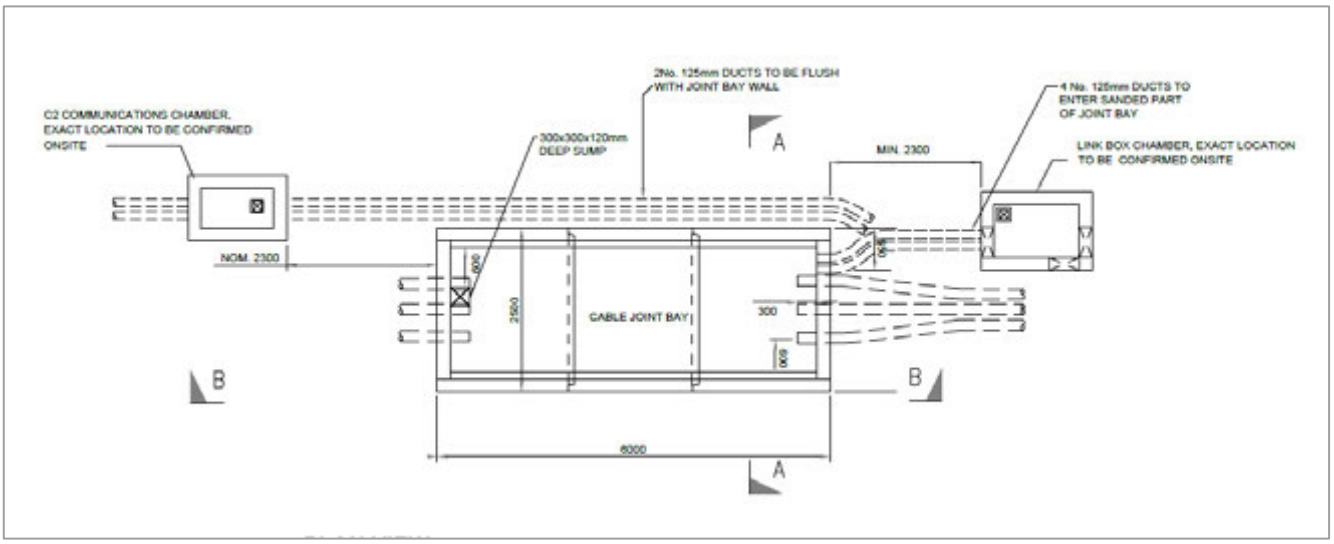


Figure 7 - 110kV Joint Bay Plan Layout

4.8 Joint Bay Construction and Cable Installation

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

All excavated material will be stored near the excavations and reused for reinstatement works. Any soil required for reinstatement that will be temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing and be regularly monitored by a designated competent person for signs of solids escape. In which case an additional line of silt fencing with straw bales will be added in line with the relevant ECM.

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

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

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

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

1. The contractor will excavate a pit for joint bay construction, including for a sump in one corner.

2. Grade and smooth floor; then lay a 75 mm depth of blinding concrete (for in situ construction) or 50 mm thick sand (for pre-cast concrete construction) on 200 mm thick Clause 804 granular material.
3. In situ construction. Construct 200 mm thick reinforced concrete floor slab with sump and starter bars placed for walls as detailed on the drawings.
4. In situ construction. Construct 200 mm thick reinforced concrete sidewalls as detailed on the drawings. (**Figure 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 11**). Installing "one section" of cable normally involves pulling three individual conductors into three separate ducts. The cable pulling winch must be set at a predetermined cut off pulling tension as specified by the designer. The cable will be connected to the winch rope using approved suitably sized and rated cable pulling stocking and swivel or the pulling head fitted by the cable manufacturer**.** A sponge may also be secured to the winch rope to disperse lubricant through the duct. Lubrication is also applied to the cable in the joint bay before it enters the duct.

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

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

Figure 12 - HV cable jointing container

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

Equipment:

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

Materials:

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

5.0 Loop-In Interface Mast Design Location

5.1 Existing 110kV OHL

The 110kV loop-in is proposed to be carried out on the existing Great Island – Kilkenny 110kV overhead transmission line. The loop-in will be completed in the proximity of Poleset structures No. 135 and No. 136 located within the land parcel Folio No. KK11513F.

5.2 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 Great Island – Kilkenny 110kV OHL, connecting from the UGC route from the proposed Castlebanny Windfarm 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 Castlebanny Windfarm 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 Castlebanny Windfarm 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 approx. 4 weeks. Construction of foundation circa. 7 days each, erection of the Interface masts circa 5 days, weather dependant.

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

Equipment	**Materials:**
5 operatives	Lattice steel tower
4x4 vehicle	Insulators
Winch	Dropper conductors
Tractor and trailer	Connection clamps
Crane	Surge Arrestors
Teleporter	Electrical connections
Chains / small tools	Concrete (foundation)
Tracked Excavator	Aggregate
Tracked Dumper	

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 Ballyvool in Co. Kilkenny.

1. 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.
2. 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.
3. 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.
4. Concrete trucks will pour concrete directly into each excavation in distinct stages.
5. A third pour for the leg of the tower 1m x 1m and will be 300mm over ground level.

6. 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.
7. Once the concrete is set after the five days the shuttering is removed.

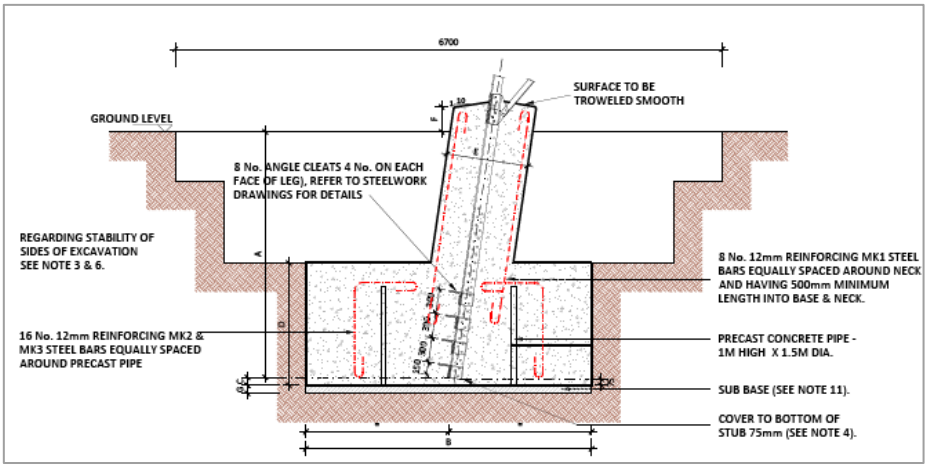


Figure 13 - New Interface Mast Foundation

Figure 14 - 110kV Interface Mast Foundation Complete

8. 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 Castlebanny Windfarm 110kV Substation may be used. All surplus excavated material will be removed from the tower locations and stored in berms adjacent to the Substation Compound.

Figure 15 - Base of Interface Mast Structure Backfilled

9. The existing overhead line will be de-energised by ESB so work can commence on the construction of the towers.
10. An earth mat consisting of copper or aluminium wire will be laid circa 600mm below ground around the tower. This earth mat is a requirement for the electrical connection of the equipment on the tower structure.
11. Once the base section of each tower is completed and the concrete sufficiently cured, it is ready to receive the tower body.
12. 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.
13. A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close to the OHL.
14. The tower will be constructed lying flat on the ground beside the recently installed tower base.
15. The conductor will be moved off centre using a stay wire and weights to anchor the stay wire to ground.
16. The tower section will be lifted into place using the crane and guide ropes.
17. The body sections will be bolted into position.
18. The conductor will be centred 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.
19. 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.
20. The circuit will be tested in both directions before the line is re-energised.

Figure 16 - Completed Line/Cable Interface Mast

6.0 Access Routes to Work Area

A portion of the proposed underground cable will be installed within the public road network and therefore will be accessed via the existing road network. Where the cable route is located on private lands, contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise private access tracks, where appropriate. Prior to the commencement of development, precise access arrangements will be agreed with the respective landowners.

Temporary access roads on private land (if required due to ground conditions and/or landowner requirements) will consist of timber or aluminium bog mats (Figure 17) to spread the weight of machinery 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 17 - Temporary Aluminium Panel Tracks

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

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

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

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

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

9.0 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.

10.0 Relocation of Existing Services

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

11.0 Major Watercourse Crossings

The proposed cable route contains 2 No. major watercourse crossings which will be completed using horizontal directional drilling. 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.

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

Numerous other minor watercourses crossing locations have been noted along the proposed cable route i.e. culverts, pipe drains and minor field drains. These minor watercourses will be identified and surveyed as part of the detailed design process prior to construction. A culvert crossing schedule will be prepared identifying all major culverts and the proposed crossing method.

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

Access tracks may be installed along the cable route as to be agreed with ESB at design stage in order to provide suitable and safe access for maintenance and cable pulling vehicles at all joint bay locations and along any areas of the cable route that is not located within the public road.

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 Outline Construction Methodology, environmental protection measures included within the planning application, measures proposed within the CEMP, and the guidance documents and best practice measures listed below. This method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager and ECoW where relevant.

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

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

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

- All materials shall be stored at the temporary compound within the Castlebanny Wind Farm site and transported to the works zone immediately prior to construction;
- Where minor field drains and watercourses are crossed with underground cables, the release of sediment will be prevented through the implementation of best practice construction methodologies. The watercourse/minor field drain crossing works will only be carried out in dry weather periods.

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