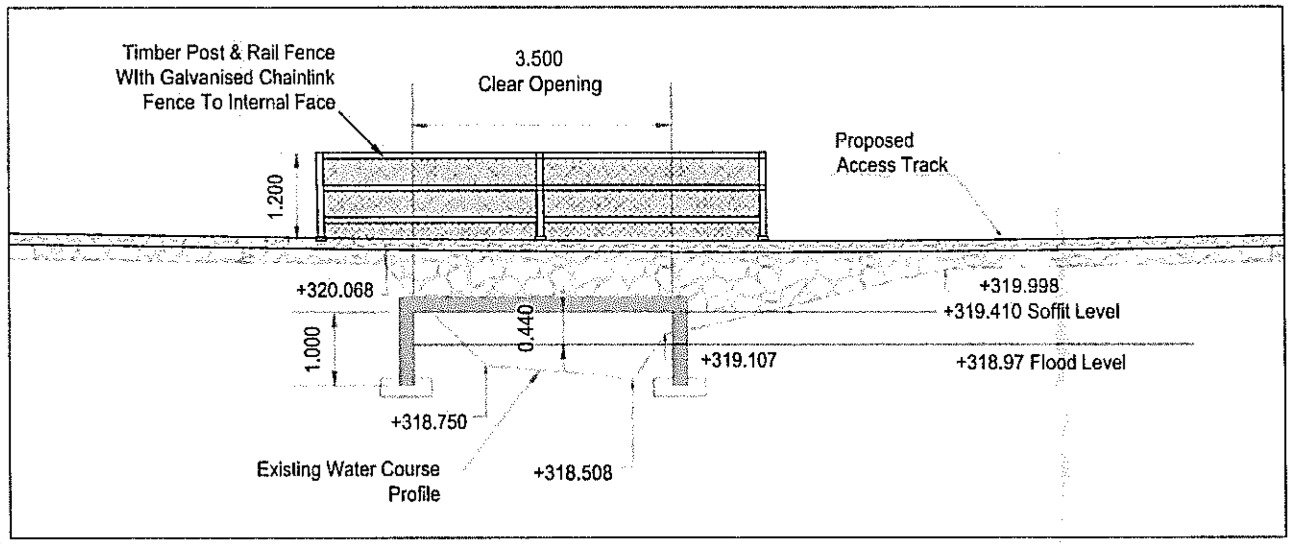
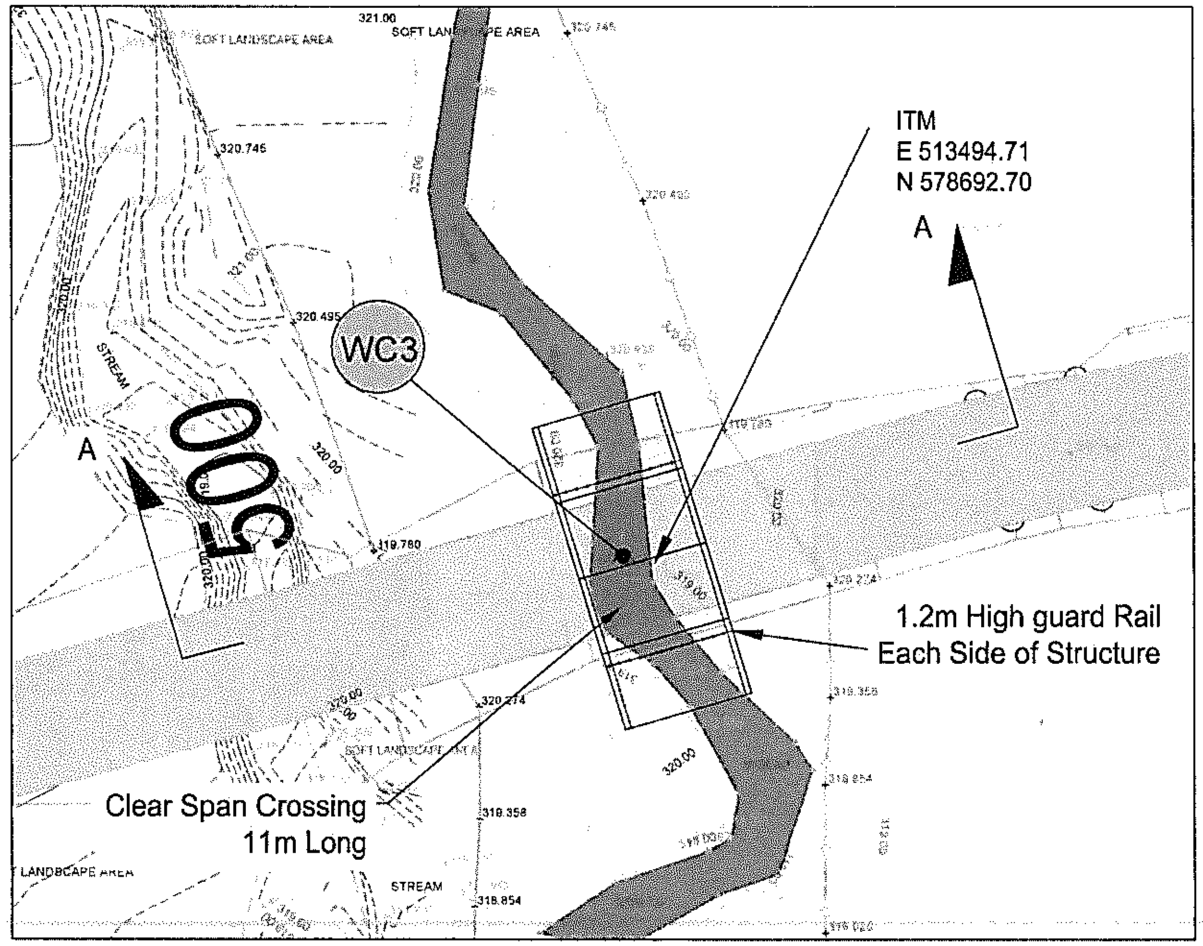
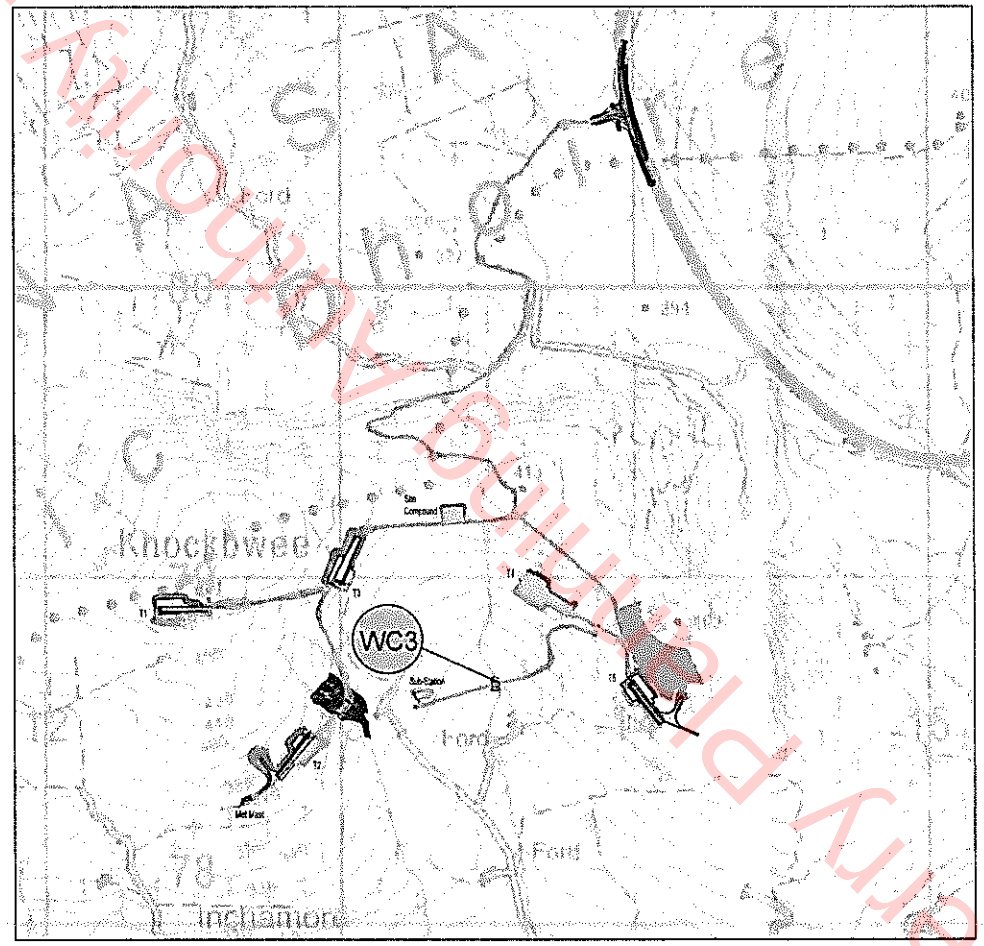
PHOTOGRAPH OF EXISTING WATERCOURSE



SECTION A - A THROUGH PROPOSED
WATERCOURSE CROSSING WC 3 Scale 1:100



PLAN : WATERCOURSE CROSSING WC 3
Scale 1:500



LOCATION PLAN : WATERCOURSE CROSSING WC 3
Scale 1:20,000

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rev.	modifications	by	date

Client: Inchamore Wind DAC

Project: Proposed Wind Farm at Inchamore, Coolea, Co. Cork

Stage: Planning

Title: Proposed Watercourse Crossing WC 3

Scales: As Noted (A3)

Surveyed	Prepared By	Checked	Date
	A.McC.	S.M.	28-04-2023

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Job No.	Drawing no.	Revision
6226	PL-307	

Inchamore WF - 38kV Grid Connection

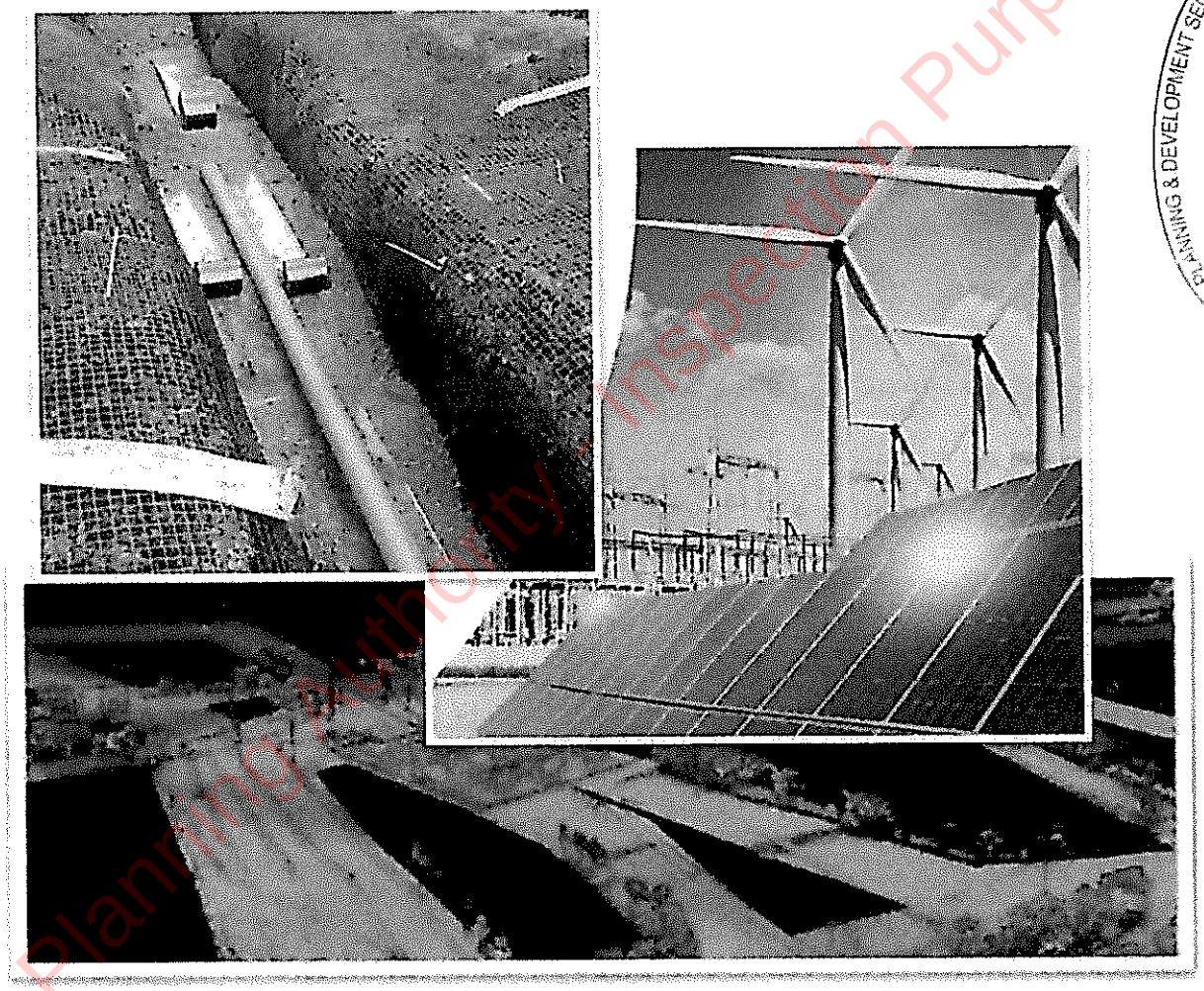
Route Summary & Joint Bay Locations

(28.10.22)

Section From	Section To	Section Length	Bonding Arrangement	No. of Watercourses	Watercourses	No. of Culverts	No. of Service Crossings	Comments
Ballyvouskill SS	JB-01	1098.7	Bonded Both Ends			-	1	*110kV Cable crossing and laid in parallel to Garrow UGC*
JB-1	JB-2	1039.6	Bonded Both Ends			9		*38kV laid in parallel to Garrow UGC*
JB-2	JB-3	1102.2	Bonded Both Ends			7		*38kV laid in parallel to Garrow UGC*
JB-3	JB-4	1096.5	Bonded Both Ends			12		*38kV laid in parallel to Garrow UGC*
JB-4	JB-5	1031.6	Bonded Both Ends	1	Str. 1 - Valley	10	2	*38kV laid in parallel to 20kV UGC, 20kV UG Cable Crossing, 1x HDD Crossing*
JB-5	JB-6	1098.9	Bonded Both Ends			11	2	*38kV laid in parallel to 20kV UGC, 20kV UG Cable Crossing, 38kV laid in parallel to 38kV UGC, 38kV UG Cable Crossing*
JB-6	JB-7	1090.9	Bonded Both Ends			-		
JB-7	JB-8	1059.0	Bonded Both Ends			4		
JB-8	JB-9	1174.3	Bonded Both Ends	2	Str.2, Str.3	10		
JB-9	JB-10	1015.2	Bonded Both Ends			8		
JB-10	JB-11	1158.0	Bonded Both Ends			11		
JB-11	JB-12	1182.9	Bonded Both Ends			9		
JB-12	JB-13	1093.4	Bonded Both Ends			9	1	*38kV UG Cable Crossing, 38kV laid in parallel to 38kV UGC*
JB-13	JB-14	1163.3	Bonded Both Ends			3		*38kV laid in parallel to 38kV UGC*
JB-14	JB-15	576.6	Bonded Both Ends			2		*38kV laid in parallel to 38kV UGC*
JB-15	JB-16	1160.0	Bonded Both Ends			2		*N22 HDD*
JB-16	JB-17	1122.0	Bonded Both Ends			5		
JB-17	JB-18	1183.6	Bonded Both Ends			1		
JB-18	WF SS	292.0	Bonded Both Ends			-		
Total:		**18,348**		**3**		**113**	**6**	

Outline Construction Methodology

Inchamore Wind Farm 38kV Grid Connection



Report Ref: 05934-R01-03

Client: Inchamore Wind DAC

Revision:	Author:	Checked:	Date:	Notes:
00	POS	DB	14.11.22	Issued for Planning
01	POS	DB	22.11.22	Issued for Planning
02	POS	DB	09.12.22	Correction to Typo Error
03	POS	DB	17.04.23	Revised as per Clients Comments

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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 Inchamore Wind Farm 38kV grid connection to the existing Ballyvouskil 220kV substation. The grid connection will consist entirely of underground cabling (UGC) with the majority of the UGC to be installed within internal forestry road networks.

The UGC works will consist of the installation of 4 No. ducts in an excavated trench to accommodate 3 No. power cables and 1 No. fibre communications cable to allow communications between the Inchamore Wind Farm Substation and Ballyvouskil 220kV substation.

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

2.0 38kV Underground Cable Route

The UGC route is approximately 19.872km in length and traverse in an east to south easterly direction from the existing Ballyvouskil 220kV substation to the Inchamore Wind Farm substation location utilising public local road networks, existing access tracks and private forestry access tracks.

The cable location will take into consideration Cork County Council, Kerry County Council and all other relevant stakeholders' requirements. Installation of the cable will consider all environmental protection measures forming part of the planning application for the development at Inchamore wind farm and accompanying technical reports.

Figure 1 outlines the UGC route, with the total length of each road type detailed in Table 1.

Figure 1 - Grid Connection Route Layout Plan

Table 1 – Approximate UGC Route Location of Preliminary Design:	
Wind Farm Site/Forestry Roads	**ESB Access Track**
18.8km	1km

Table 1: Inchamore Wind Farm to Ballyvouskil 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**
Section 1 UGC	**UGC from Ballyvouskil 220kV substation to N22 Road HDD Crossing (Chainage 17150m)** The underground cable route initially begins within the townland of Caherdowney, Co. Cork where from Ballyvouskil 220kV substation compound, the UGC departs the substation on the north western boundary, converging onto a permanent access track to be constructed as part of this development within agricultural lands and traverses on an upward trajectory for approximately 950m prior to entering into forested plantations propertied by Coillte. The UGC will establish a route for the majority within existing forestry access tracks and will traverse adjacent to existing ESB utility infrastructure that reside within these forestry tracks. The UGC remains within these tracks for the majority of the grid connection route, carrying for an approximate length of 15.7km whilst sporadically crossing between Cork county and Kerry county boundaries through denoted townlands Cummeenabuddogue, Clydaroe, Knocknagowen, Glashacormick across this plantation coverage. Subsequent to crossing through the forestry properties, the UGC will leave the forestry access track on the south westerly side within the townland of Cummeenavrick, Co. Kerry and converges onto first, a section of redundant regional roadway, adjacent to the N22 National carriageway prior to accessing consented third-party property (KY30186F). The UGC will traverse this parcel within a permanent access road to be constructed as part of this development. This access road entails a 4m wide track with load bearing capacity of 10 tonne to allow for Horizontal Directional Drilling (HDD) activities commence to drill beneath approximately 70m of the N22 carriageway with the remainder of the drill shot equating to approximately 580m. ***Features*** ***Section 1 contains 15 No. joint bays***. Joint bays will be located below ground and finished/reinstated as per Forestry Road Manual (Guidelines for the design, construction and management of forest road) and as per private landowner reinstatement requirements. Joint bays will have associated communication chambers which will have a surface access hatch which will match existing ground levels.

- Joint Bay 01 (JB-01) will be located within a permanent access track at *Chainage – 1100m*
- Joint Bay 02 (JB-02) will be located south west of JB-01 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 2150m]*
- Joint Bay 03 (JB-03) will be located south west of JB-02 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 3250m]*
- Joint Bay 04 (JB-04) will be located south west of JB-03 positioning the joint bay within a widened verge to the existing forestry track *[Chainage – 4350m]*
- Joint Bay 05 (JB-05) will be located south west of JB-04 positioning the joint bay within a widened verge to the existing forestry track *[Chainage – 5400m]*
- Joint Bay 06 (JB-06) will be located north west of JB-05 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 6500m]*
- Joint Bay 07 (JB-07) will be located south west of JB-06 positioning the joint bay at receptor location for the HDD activities required to cross stream 1. *[Chainage – 7550m]*
- Joint Bay 08 (JB-08) will be located north west of JB-07 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 8650m]*
- Joint Bay 09 (JB-09) will be located north west of JB-08 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 9800m]*
- Joint Bay 10 (JB-10) will be located west of JB-09 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage –10800m]*
- Joint Bay 11 (JB-11) will be located west of JB-10 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 11950m]*
- Joint Bay 12 (JB-12) will be located west of JB-11 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 13150m]*
- Joint Bay 13 (JB-13) will be located south of JB-12 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 14250m]*
- Joint Bay 14 (JB-14) will be located north west of JB-13 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 15400m]*
- Joint Bay 15 (JB-15) will be located south west of JB-14, within a new permanent access road to be constructed to allow HDD activities on the eastern side of the N22 *[Chainage – 16000m]*
- Joint Bay 16 (JB-16) will be located south west of JB-15 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 17150m]*

Section 1 has 3 No. watercourse crossings:

- Stream 1 has been surveyed with the result of insufficient clearance existing within this structure. To cross this stream, it will be required to utilise a Horizontal Directional Drill within the existing forestry track to cross beneath with a satisfactory clearance to the waterway. *[Chainage 5200m]*
- Stream 2 has been surveyed with the result of insufficient clearance existing within this structure. To cross this culvert, it will be required to utilise a Horizontal Directional Drill within the existing forestry track to cross beneath with a satisfactory clearance to the waterway. *[Chainage 9200m]*
- Stream 3 has been surveyed with the result of insufficient clearance existing within this structure. To cross this culvert, it will be required to utilise a Horizontal Directional Drill within

	the existing forestry track to cross beneath with a satisfactory clearance to the waterway. *[Chainage 9750m]* ***Section 1 will require 6 No. service crossings:*** Existing ESBN infrastructure will be encountered and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services. ***Section 1 has 107 No. culvert crossings:*** See section 8 of this report for Culvert crossing methods and drawings 05934-DR-217-P1 & 05934-DR-218-P1 for further details.
Section 2 UGC	**N22 Road HDD Crossing to Inchamore Windfarm site location (Chainage 19850m)** The receptor pit from the drill shot will be located, again within Folio KY30186F on the opposite side of the N22 carriageway within the townland of Derryreag. From here the UGC route travels south within an existing forestry track through lands propertied by Coillte for approx. 1500m. The UGC will establish the remainder of the route within the designation of county Cork, traveling through the townland of Derreenaling and Inchamore, mainly southwest for a further approx. 1200m where the UGC route enters into the proposed onsite 38kV substation for Inchamore Wind Farm. ***Features*** ***Section 2 contains 2 No. joint bays***. Joint bays will be located below ground and finished/reinstated as per Forestry Road Manual (Guidelines for the design, construction and management of forest road), finished/reinstated to the required roads specification and reinstated to landowner preference where applicable. Joint bays will have associated communication chambers which will have a surface access hatch which will match existing ground levels. • Joint Bay 17 (JB-17) will be located south of JB-16 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 18250m]* • Joint Bay 18 (JB-18) will be located south of JB-17, within consented third-party lands *[Chainage – 19400m]* ***Section 2 has 6 No. culvert crossings:*** See section 8 of this report for Culvert crossing methods and drawings 05934-DR-217-P1 & 05934-DR-218-P1 for further details.

3.0 Access Routes to Work Area

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

A detailed Traffic Management Plan has been prepared as part of the EIAR (Environmental Impact Assessment Report). 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 Cork County Council

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

4.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with both Cork County Council and Kerry County Council. All work on public roads will be subject to the approval of a road opening license application by both Cork County Council and Kerry County Council. The contractor will submit the 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 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 within the accompanying EIAR (Environmental Impact Assessment Report) and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with both Cork County Council and Kerry County Council, prior to the commencement of UGC construction.

5.0 Road Opening Licence

The UG grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from both Cork County Council and Kerry County Council. A Traffic Management Plan (TMP) will be agreed with both Cork County Council and Kerry 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 both Cork County Council and Kerry County Council in advance of the preparation of the Traffic Management Plan (TMP).

6.0 UGC Construction Methodology

The UGC will consist of 3 No. 110mm diameter HDPE power cable ducts and 1 No. 110mm diameter HDPE communications duct to be installed in an excavated trench, typically 600mm wide by 1,220mm 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. The communications duct will accommodate a fibre cable to allow communications between the Inchamore Wind Farm substation and Ballyvouskil 220kV substation. The ducts will be installed, the trench reinstated in accordance with the Forestry Road Manual (Guidelines for the design, construction and management of forest road), private third-party landowners and both Cork, Kerry County Council specifications. Once all are satisfied, then the electrical cabling/fibre cable is pulled through the installed ducts in approximately 1000/1200m sections. Construction method statements and templates will be implemented to ensure that the UGC is installed in accordance with the correct requirements, materials, and specifications of ESBN and EirGrid.

6.1 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 detailed 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 the EIAR, and a detailed Traffic Management Plan will be prepared and agreed with both Cork, Kerry County Councils;
- 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 on-site borrow pit;

- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- 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 38kV Underground Duct Installation

6.2 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 1220mm 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.

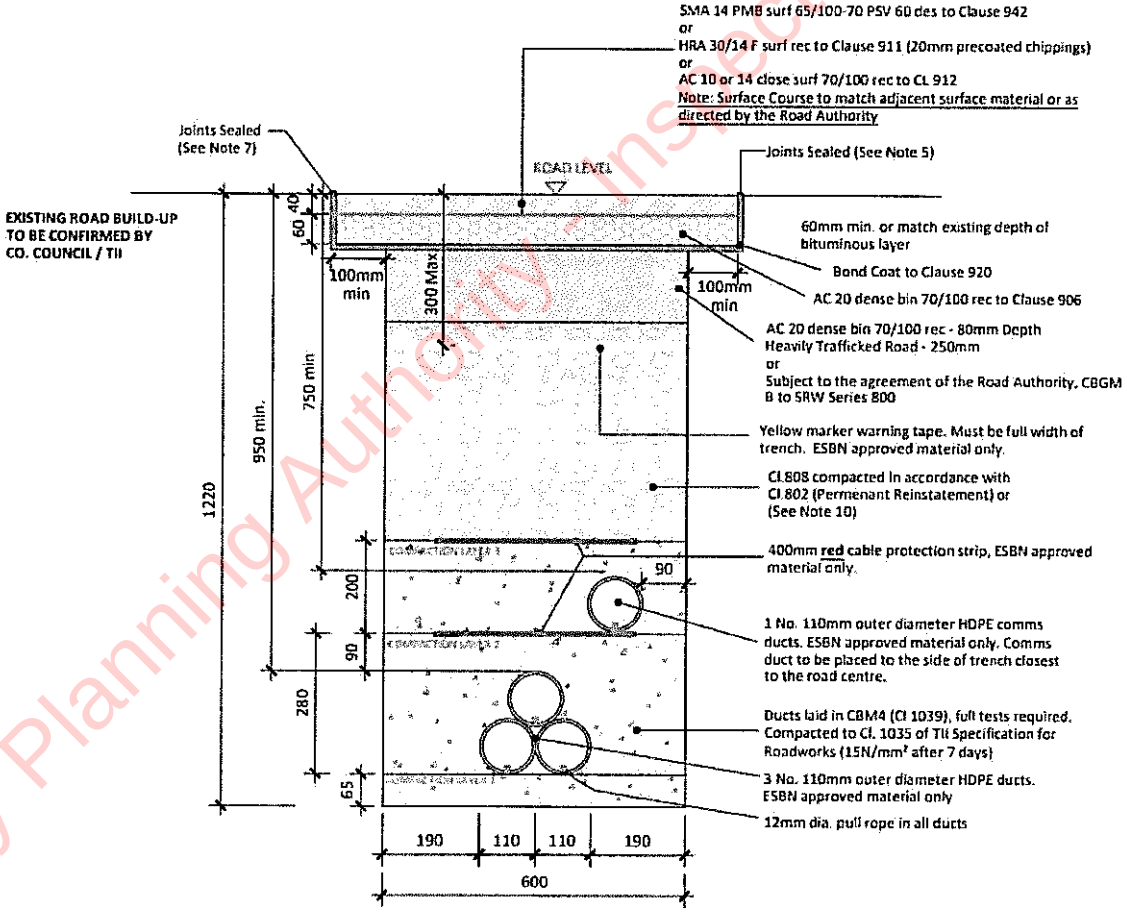


Figure 3 - Typical Trench in Roadway

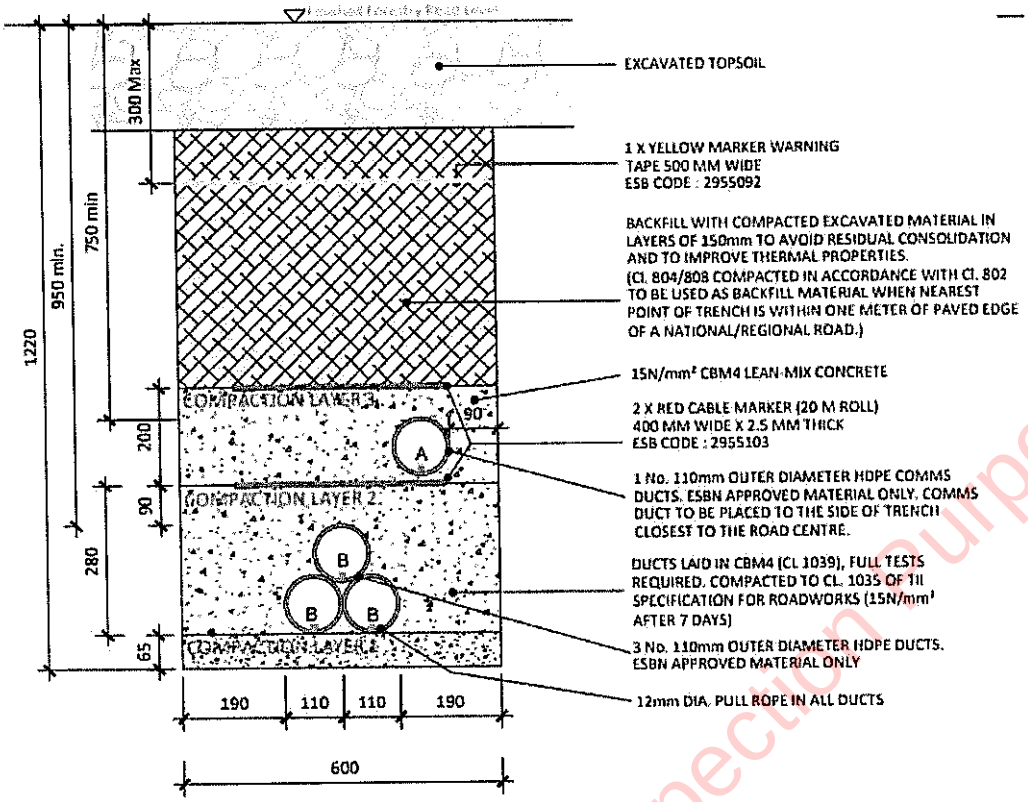


Figure 4 - Typical Trench in Forestry Road Section

6.2.1 UGC Installation on Public Road

Where the ducting is installed 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.

6.2.2 UGC Installation on Tracks

The majority of the 38kV route is located within existing forestry access 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.

6.3 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 ESBN 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. Siting of marker posts to be dictated by ESBN as part of the detailed design process (Figure 5).

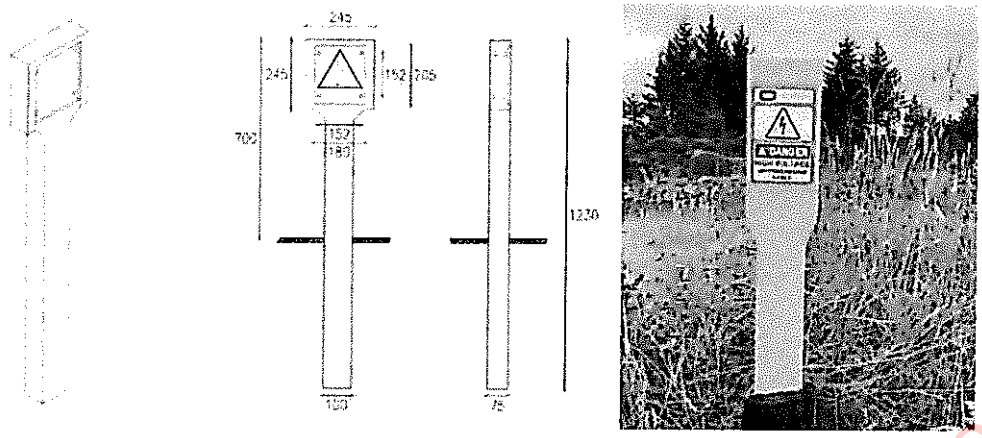


Figure 5 - Typical ESB Marker Posts Example

6.4 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 material exists, it may be used in the reinstatement of the borrow pit as part of the Inchamore 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.

6.5 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 Inchamore Wind Farm. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

6.6 Joint Bays and Associated Chambers

Joints Bays are to be installed approximately every 1000m - 1200m along the UGC route to facilitate the jointing of 2 No. lengths of UGC. Joint Bays are typically 4.5m x 2.03m x 1.475m 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 Inchamore Wind Farm substation and the existing 220kV node at Ballyvouskil.

The precise siting of all Joint Bays 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.

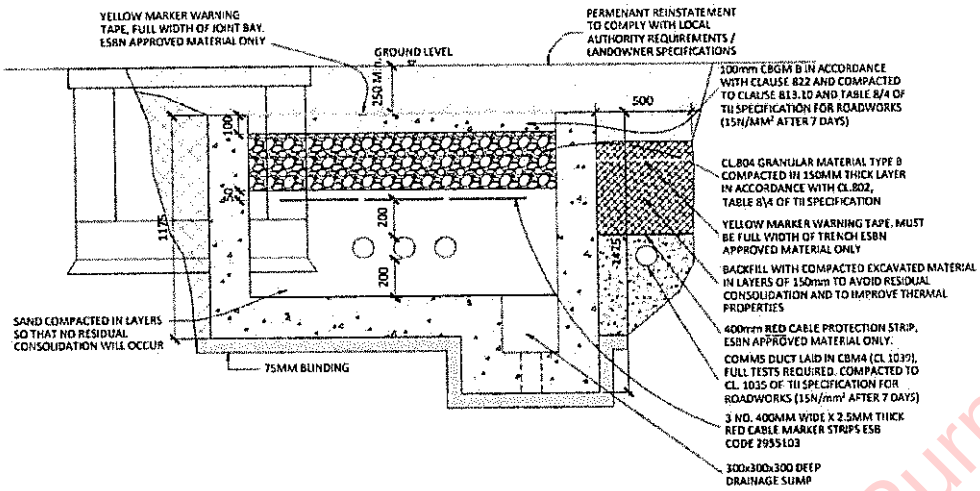


Figure 6 - Typical Section through Joint Bay

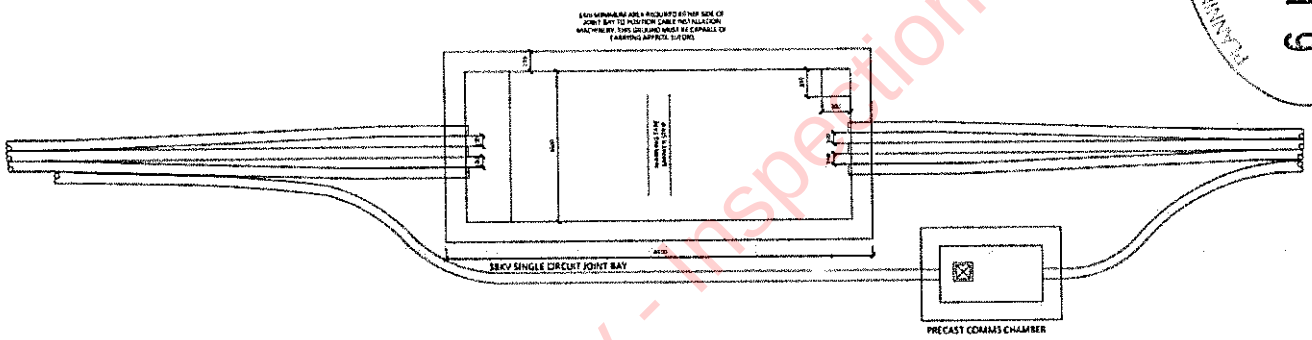


Figure 7 - 38kV Joint Bay Plan Layout

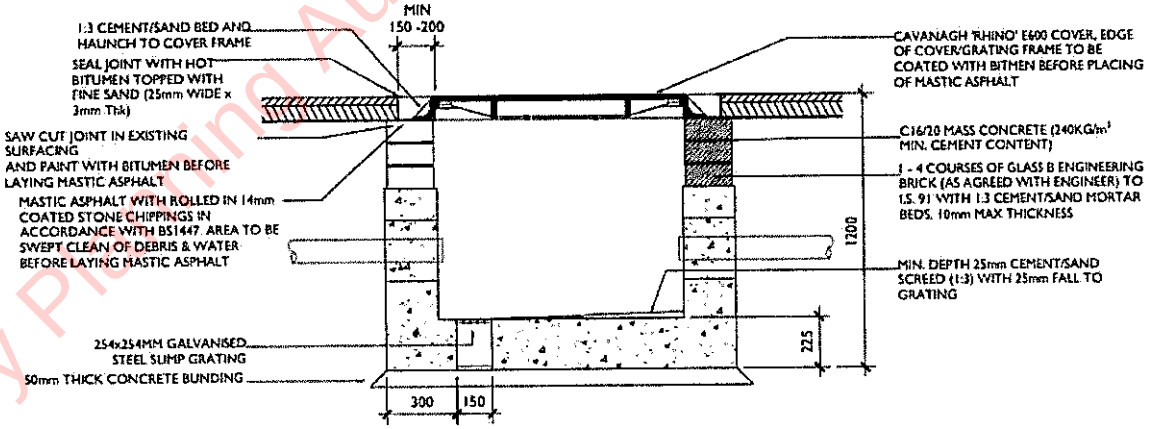


Figure 8 - Typical Section through Communications Chamber

6.7 Joint Bay Construction and Cable Installation

Before starting 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 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 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.

Equipment:

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

Materials:

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

7.0 Relocation of Existing Services

In order to facilitate the installation of the underground cable, it may be necessary to relocate existing underground services within the curtilage of the road such as water mains, telecom networks or existing cables. In advance of any construction activity, the contractor will undertake detailed surveys and scans of the UGC 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.

8.0 Major Watercourse Crossings

The cable route will involve 3 No. waterbody 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.

Crossing existing culverts will be implemented using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. The cable route will involve 3 No. culvert crossings locations which will require the mobilisation of HDD. The culvert crossing methods are detailed in Figure 9 and Figure 10 below with more detail seen in 05934-DR-217-P1 & 05934-DR-218-P1.

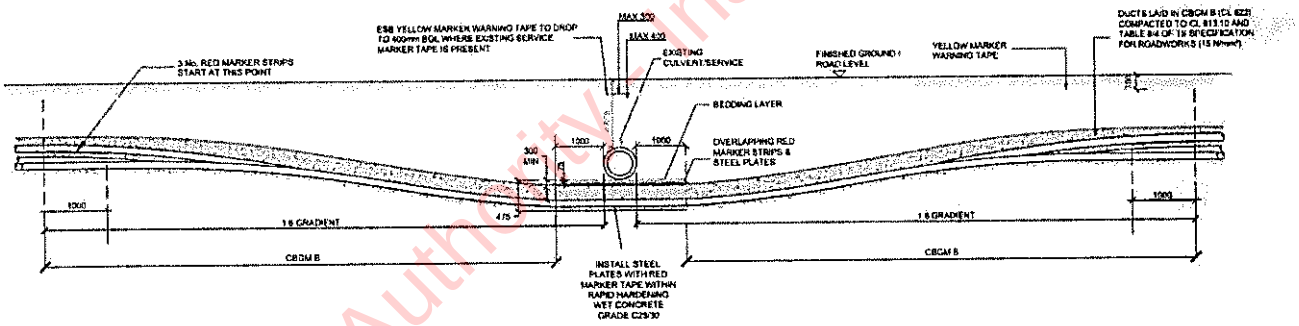


Figure 9 - 38kV UGC Culvert Undercrossing

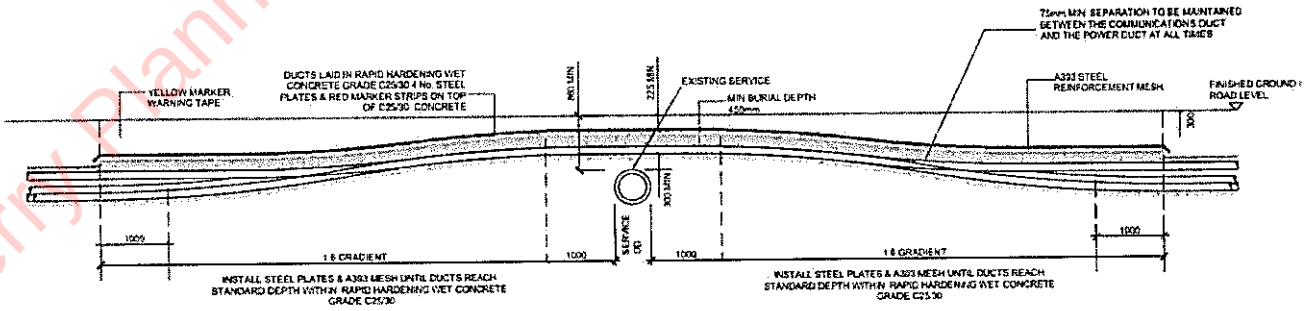


Figure 10 - 38kV UGC Culvert Overcrossing

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 development.

8.1 Stream 1 - Horizontal Directional Drilling

ITM Coordinates: 521705.04, 583153.2

Stream 1 is located approx. 174m east of JB05 crossing over a large stream within a valley. This steam flows in a northern direction. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway. 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 forestry access track carriageway. The methodology for HDD is outlined in Section 9 below. Ref drawing 05934-DR-222.

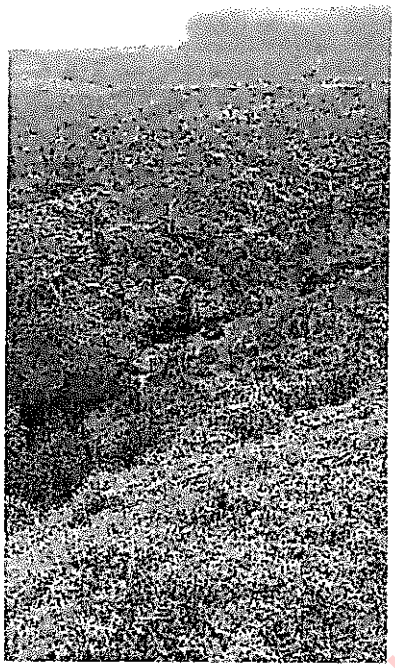


Figure 11 - Stream 1 Valley Crossing

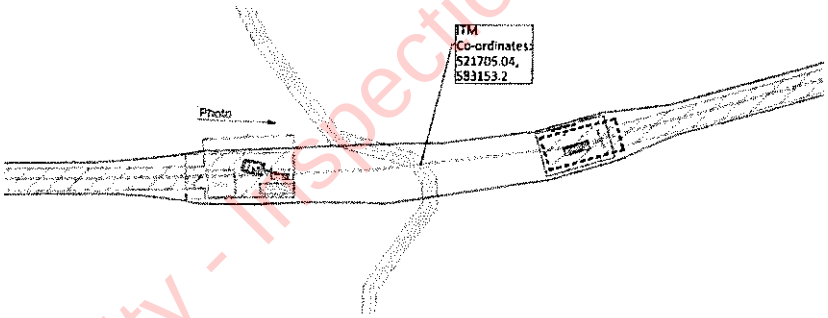


Figure 12 - Stream 1 Valley Crossing on OSI Background

8.2 Stream 2 (Culvert 56 & Culvert 57) - Horizontal Directional Drilling

ITM Coordinates: 518279.2, 583469.4

Stream 2 is located on a forestry access track approx. 580m east of JB09 crossing over a large Stream. This steam flows in a north direction and into the River Clydagh. This stream also flows into Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (Special Area of Conservation).

Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway. 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 forestry access track carriageway. The methodology for HDD is outlined in Section 9 below. Ref drawing 05934-DR-223.

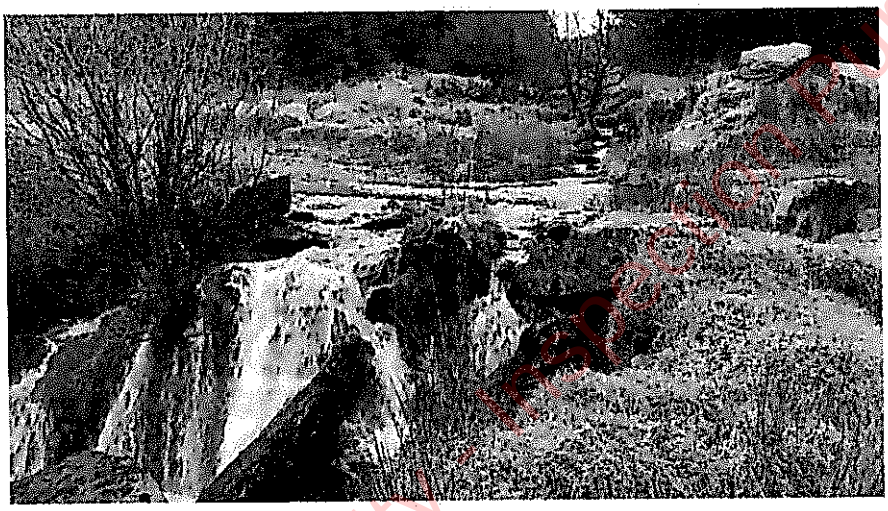


Figure 13 - Stream 2

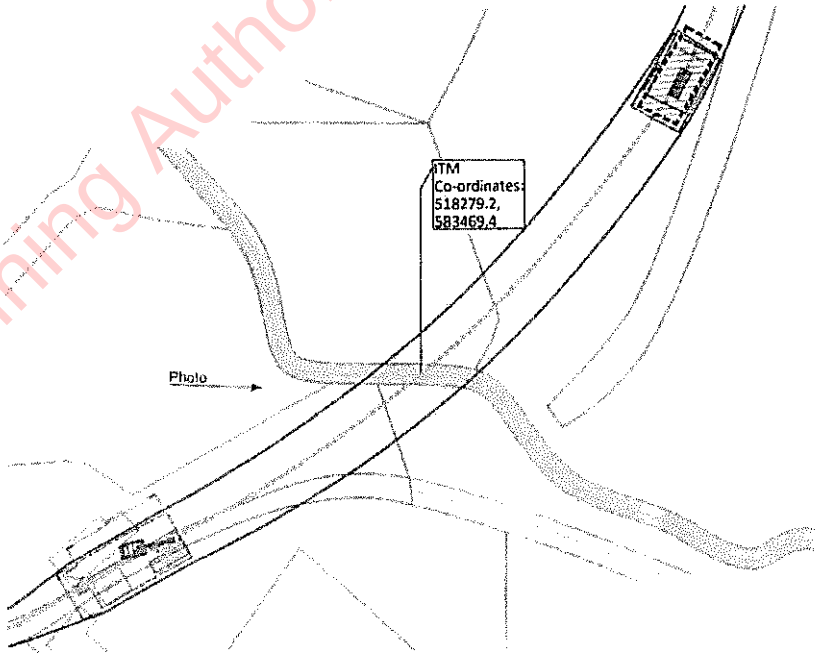


Figure 14 - Stream 2 within Forestry Road on OSI Background

8.3 Stream 3 (Culvert 59 to 63) - Horizontal Directional Drilling

ITM Coordinates: 517802.26, 583246.3

Stream 3 is located on a forestry access track approx. 44m east of JB09 crossing over a large Stream. This steam flows in a north direction and into the River Clydagh. This stream also flows into Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (Special Area of Conservation).

Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway. 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 forestry access track carriageway. The methodology for HDD is outlined in Section 9 below. Ref drawing 05934-DR-224.

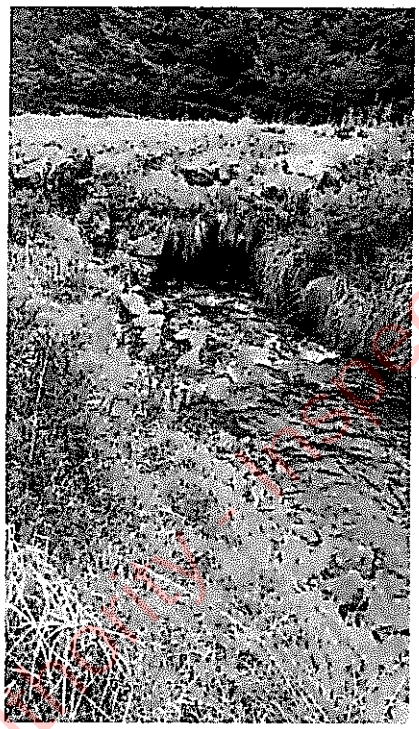


Figure 15 - Stream 3

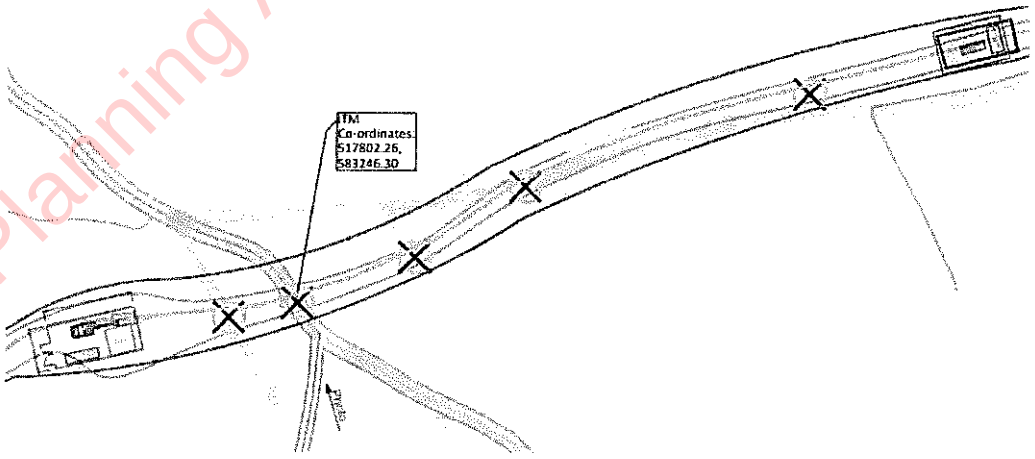


Figure 16 - Stream 3 within Forestry Road on OSI Background

9.0 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. The drilling methodology is as follows: -

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

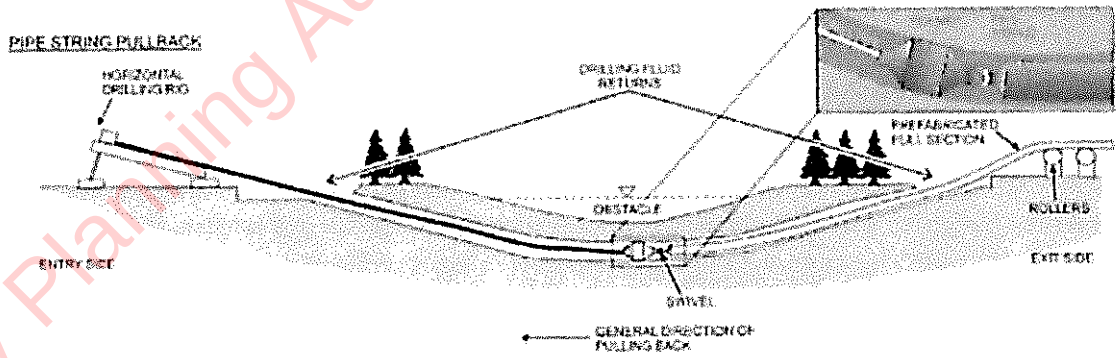


Figure 17 - Typical HDD Installation

10.0 Reinstatement of Private Land

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

11.0 Best Practice Design and Construction & Environmental Management Methodology

Prior to commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Outline Construction Methodology, environmental protection measures included within the 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.

- All materials shall be stored at the temporary compound within the Inchamore 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 Inchamore Wind Farm site; remote from watercourses, drainage channels and other surface water features;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or waste water into watercourses;
- Cabins, containers, workshops, plant, materials storage and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times.

12.0 Implementation of Environmental Protection Measures

All environmental protection measures contained within the EIAR (Environmental Impact Area Report) and NIS (Natura Impact Statement) which accompanies the planning application will be incorporated into the final CEMP (Construction Environmental Management Plan) and construction method statements prior to the commencement of development and will be implemented in full during the construction phase. The proposed UGC grid route does not form part of the wind farm planning application but is being assessed as part of the EIAR and NIS. The Project Manager and Site Manager will be responsible for the implementation of measures following consultation with the Environmental Manager and ECoW where necessary.

13.0 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 the 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.

14.0 Waste Management

All waste products (general waste, plastic, timber, etc.) arising during the construction phase will be managed and disposed of in accordance with the provisions of the Waste Management Act 1996 and associated amendments and regulations, and a Waste Management Plan will be prepared by the contractor before the commencement of construction. All waste material will be disposed of at a fully licensed facility.

15.0 Archaeology

The following are the mitigation measures which will be carried out during construction where required;

- Any specific mitigation measures outlined in the Cultural Heritage Report will be adopted.
- If required a project archaeologist will be appointed to oversee the project.
- Demarcation of protective buffer zones around cultural heritage sites where there is a potential for disturbance during the construction phase and inclusion of the same in site induction.

TECHNICAL NOTE 01

Project:	Inchamore WF – 38kV Grid Connection	Ref:	rev-00
Section:	Cable Rating Check	Job No:	05-934
		Date:	11.11.22
Made By:	POS	Checked By: DB	Sheet No: 1 of 9

Instruction

Technical Lead:	Ruairi Geary - TLI Group
Date of Writing:	07.11.2022
Scope of Note:	Review of the 38kV grid connection cable loading based on the proposed MEC for the project.
Documents & Data Issued for Review:	n/a

Overview

TLI Group (the Consultant) were engaged by Future Energy Ireland ("the Client") on the development of Inchamore Windfarm in counties Cork and Kerry. The Consultant was engaged to assist the Client in selecting and preparing a planning application for the 38kV grid connection for Inchamore Windfarm. The Client is currently working on the development of the windfarm.

The proposed grid connection will be a 38kV UGC from the existing Ballyvouskil 220kV Substation to a new 38kV substation serving Inchamore Windfarm which will consist of an approximate grid connection length of 19.3km. This cable rating study was completed to assess the suitability of the proposed cable size and cable trench designs for the 38kV UGC grid connection circuit.

The cable ratings which have been completed as part of this study include:

- Standard Trefoil Trench Design
- Flat Formation Trench Design
- HDD Crossings – Direct Buried Trefoil Formation (Depth 5000mm)
- Parallel Trench Design

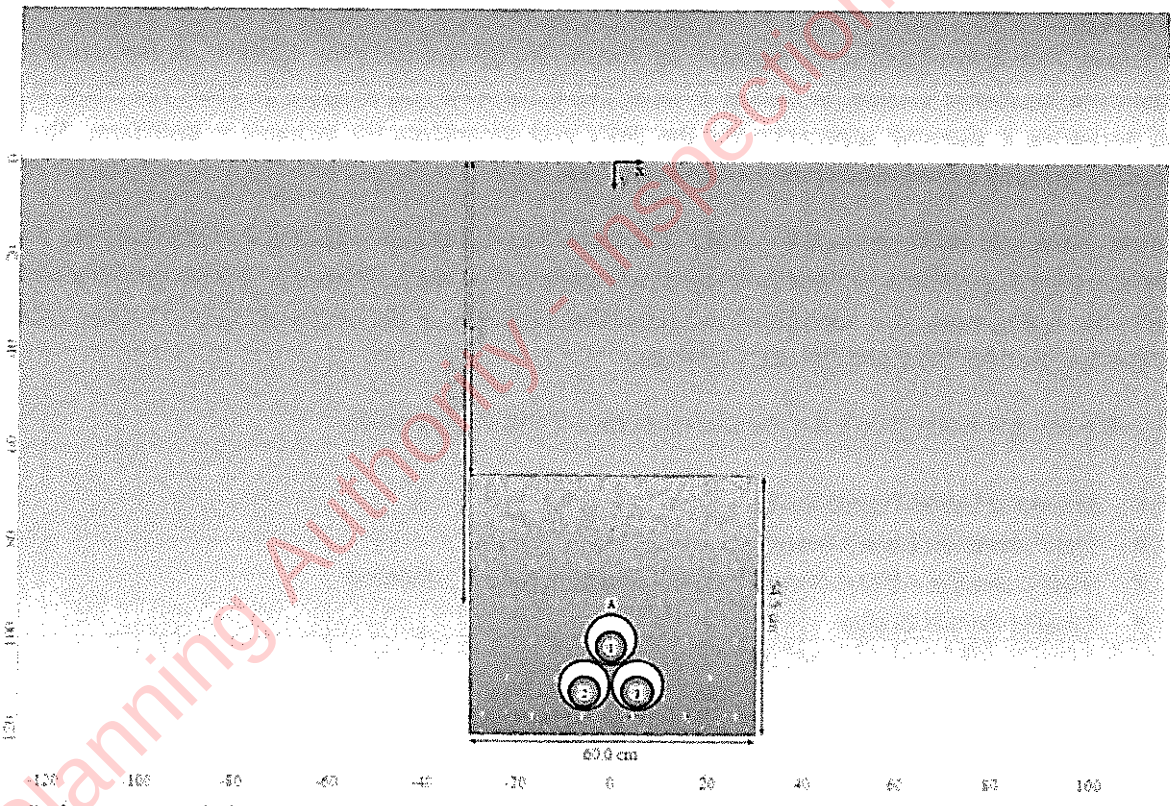
Table 1 - Cable Study General Parameters

Cable Study Parameters	
Cable Size:	1000mm² Al Cable
Nominal Voltage:	38kV assumed *(Range 30kV to 52kV)*
Power:	Required 39.6 MW
Power Factor:	0.95 assumed *(Range 0.85 lag to 0.93 lead)*
Avg. Cable Section Length:	1000/1200m *(trefoil), 100m (flat)*
Cable Trench Design:	See Appendix A
Ambient Temp (Soil)	20°C *(Summer rating)*
Soil Thermal Resistivity	1.2 K·m/W *(Summer rating)*
Backfill Thermal Resistivity	1 K·m/W *(Summer rating)*
Cable Screen Bonding:	Bonded Both Ends
Power Duct Size:	110mm

Cable Study Analysis

1000mm² Al Cable - 38kV Standard Trefoil Trench (Depth 950mm) Design:

A cable rating study was completed for a **SolidAl 1000mm² AL XLPE (38kV) UGC** over a distance of 1km using the **standard trefoil trench design in 110mm ducts** as detailed in Appendix A. Using this arrangement, the circuit is capable of carrying a maximum full load current of **758.4A** without exceeding the cables max insulative property of 90°C. Therefore, 1000mm² Al XLPE (38kV) UGC when installed using the standard trefoil trench design is capable of achieving the required maximum full load (39.6 MW).



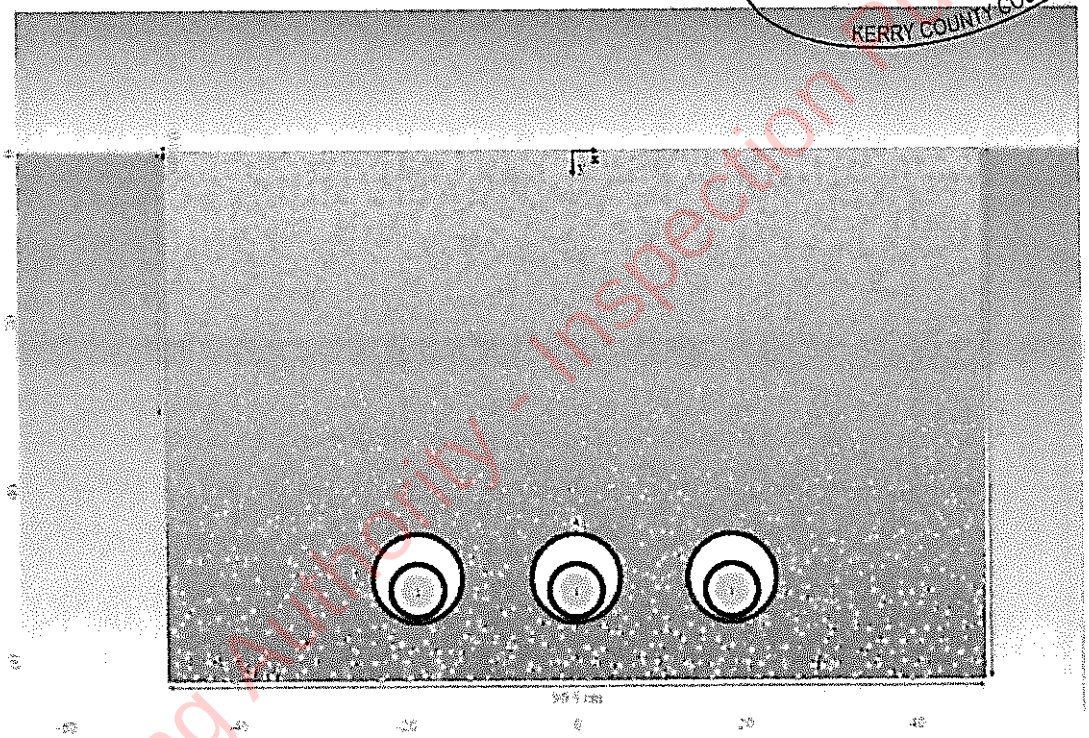
Following systems are active in the arrangement:

System	Object	Current I_c [A]	max Temp. θ_c | θ_e (θ_{de}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	758.4	90.0 | 82.4 (69.8)	87.7

Figure 1 - Cable Rating Model, Standard Trench Design, 1000mm.sq Al

1000mm² Al Cable - 38kV Flat Formation Trench (Depth 450mm) Design:

A cable rating study was completed for a **SolidAl 1000mm² AL XLPE (38kV)** over a distance of 100m using the **Flat Formation Trench design in 110mm ducts** as detailed in Appendix B. Using this arrangement, the circuit is capable of carrying a maximum full load current of **778A** without exceeding the cables max insulative property of 90°C. Therefore, 1000mm² Al XLPE (38kV) UGC when installed using the standard trefoil trench design is capable of achieving the required maximum full load (39.6 MW).



Following systems are active in the arrangement:

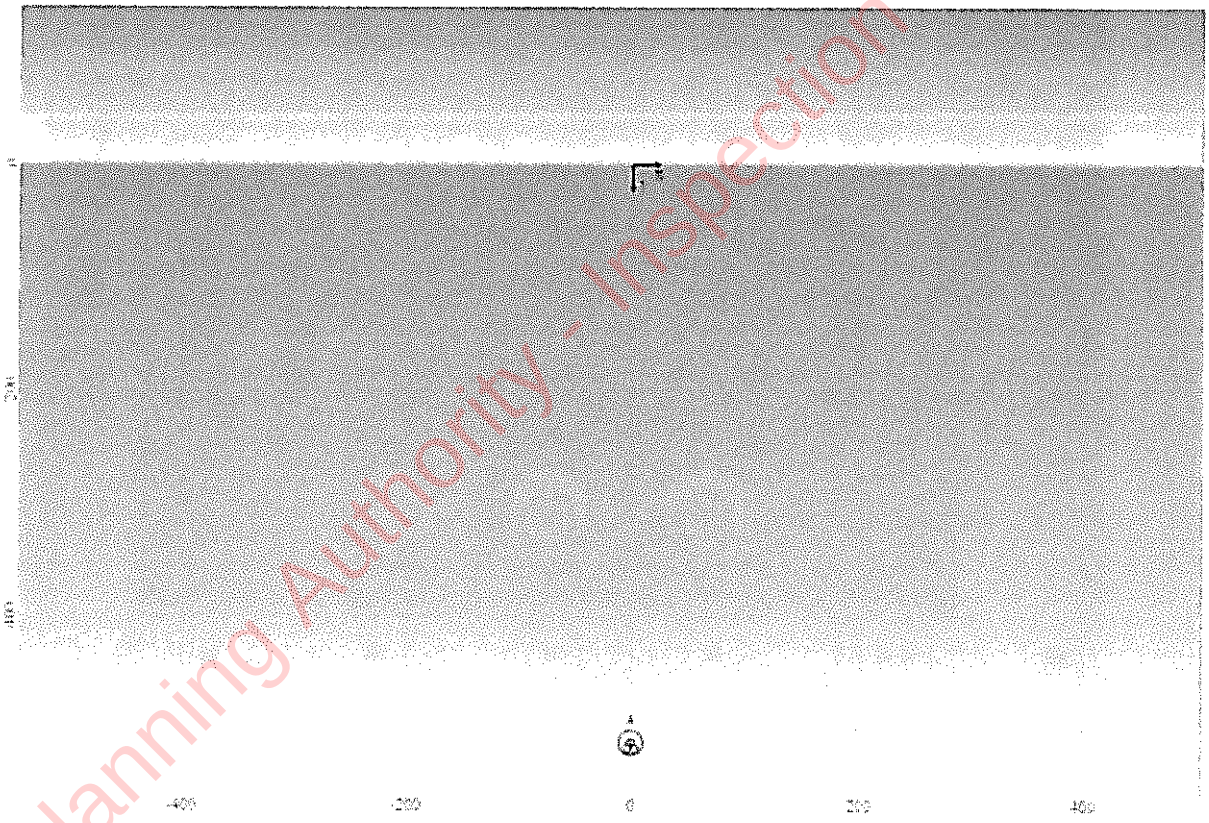
System	Object	Current I_c [A]	max Temp. θ_c | θ_e (θ_{de}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	778.0	90.0 | 81.3 (61.2)	120.0

Figure 2: Cable Study Results – 38kV 1000mm.sq Al Flat Formation (450mm Depth)

Horizontal Directional Drill - Trefoil Formation (Depth 5000mm):

A cable rating study was completed for a **SolidAl 1000mm² AL XLPE (38kV)** over a distance of 200m utilising a HDD in a trefoil formation, at a **depth of 5000m.** It should be noted that 180mm or 225mm ducts (SDR = 11) will be utilised for HDD crossings.

Using this arrangement, the circuit is capable of carrying a maximum full load current of **692.2A** without exceeding the cables max insulative property of 90°C. Therefore, 1000mm² Al XLPE (38kV) UGC when installed using this HDD trench design is capable of achieving the required maximum full load (39.6 MW).



Following systems are active in the arrangement:

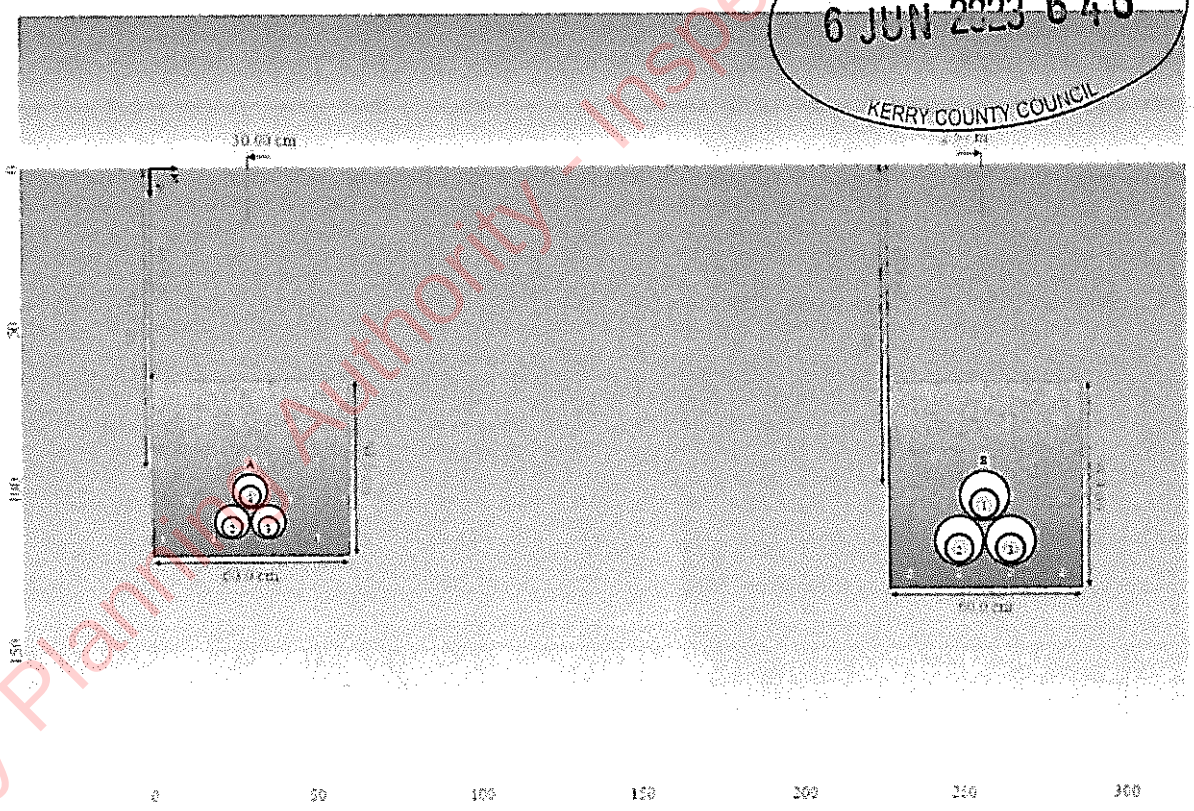
System	Object	Current I_c [A]	max Temp. θ_c | θ_e (θ_{de}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	1x 692.2	90.0 | 83.7 (67.0)	65.5

Figure 3: Cable Study Results – 38kV 1000mm.sq Al HDD Formation (5000mm Depth)

Inchamore WF 38kV Trefoil parallel run Ballyvouskill – Garrow 110kV Trefoil Formation (Separation 2000mm duct to duct) Design:

A cable rating study was completed for the parallel run of an existing **1000mm² Cu XLPE (110kV) UGC** in operation to conduct flow between Garrow GIS to Ballyvouskil Node ***(System A).*** Running parallel with ***(System B – Ballyvouskil to Inchamore WF 38kV UGC)*** over a distance of 1000m whilst implementing a trefoil formation trench arrangement with a separation of 2000mm between duct to edge of duct trenches and supplying a load without compromising the insulative properties of the selected cable.

The consultant believes that the use of **1000mm² AL XLPE (38kV)** should be sufficient to be installed at 38kV - 110kV parallel intervals to achieve the 178MVA rating for 110kV UGC and the desired MEC of Inchamore WF (39.6MW). As seen below in Figure 5, System B (Inchamore to Ballyvouskil) will conduct in excess of full load carrying capacity.



Following systems are active in the arrangement:

System	Object	Current I_c [A]	max Temp. θ_c | θ_e (θ_{de}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	731.8	90.0 | 83.0 (71.2)	81.6
System B	NKT 1600mm2 Al XLPE (110kV)	935.0	82.9 | 74.1 (65.2)	77.6

Figure 4: Cable Study Results – 38kV 1000mm.sq Al trefoil formation parallel 110kV 1000mm.sp Cu trefoil formation

Cable Study Results Summary

The Cable Rating Study Checks completed have indicated that it should be possible to carry the maximum export capacity of the cable at ***39.6MW*** on a standard 38kV single circuit **1000mm² Al cable** for the majority of the grid connection without exceeding the proposed recommended maximum conductor temperature of 90°C when using the proposed trench designs with the exception of the existing cable crossing intervals and HDDs at a depth greater than 5000mm.

It should be noted that any crossings or parallel runs with other underground cable MV/HV circuits or other services may result in a derating of the Inchamore Grid Connection Cable. This derating effect will further decrease the available loading capacity of the cable. Two further existing service routes, both a 38kV UGC circuit and a 20kV cable route exist within forestry access tracks west of Garrow GIS substation but a derating study hasn't been concluded on these circuit owing to minimal circuit rating information.

All results at this stage are indicative only, further analysis will be required at the detailed design phase in order to accurately calculate the final loading on the cables.