CONSTRUCTION METHODOLOGY

Baldonnell 110kV Substation Grid Connection

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Table of Contents

1.0 Introduction 4
2.0 110kV Underground Cable Route 4
3.0 Preliminary Site Investigations 7
4.0 Access Routes to Work Area 8
5.0 Traffic Management 8
6.0 Road Opening Licence 9
7.0 Construction Hours 9
8.0 UGC Construction Methodology 9
8.1 Trenching Methodology 9
8.2 Ducting Installation Methodology 11
8.2.1 UGC Installation on Public Road 13
8.3 Cable Pulling 13
8.4. Surface Cable Markers & Marker Posts 13
8.5. Managing Excess Material from Trench 14
8.6. Storage of Plant and Machinery 14
9.0 Substation Construction 15
10.0 Construction Traffic 16
11.0 Relocation of Existing Services 17
12.0 HV Underground Cable (UGC) Crossings & Parallel Runs 17
12.1 Gas Networks 17
12.2 Water Mains 17
13.0 Reinstatement of Private Land 18
14.0 Best Practice Design and Construction & Environmental Management Methodology 18
15.0 Invasive Species Best Practice Measures 20
16.0 Waste Management 20
17.0 Programme 21

Table of Figures

Figure 1 – Grid Connection Route Location (See Drawings 05868-DR-002/003/004) 5
Figure 2 – Example of 110kV Underground Duct Installation 11
Figure 3 – 110kV Trefoil Trench in Roadway 12
Figure 4 - EirGrid Marker Posts Example 14
Figure 5 - Typical 110kV Electrical Infrastructure 16
Figure 6 – 110kV UGC Culvert/Service Undercrossing 18
Figure 7 – 110kV UGC Culvert/Service Overcrossing 18

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 Baldonnell 110kV Substation grid connection to the existing ESB Barnakyle 110kV Substation. The grid connection will consist entirely of underground cabling (UGC) with the majority of the UGC to be installed within the public road network.

The UGC works will consist of the installation of 6 No. ducts in an excavated trench to accommodate 3 No. power cables, 2 No. fibre communications cable to allow communications between the Baldonnell and ESB Barnakyle 110kV Substation and one earth continuity conductor (ECC).

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 110kV Underground Cable Route

The UGC route is approximately 0.3km in length and runs in a westerly direction from the proposed Baldonnell 110kV substation to the existing ESB Barnakyle 110kV substation utilising the existing road network.

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

Figure 1 below outlines the UGC route, with each section of the route being formulated in detail within Table 1.

This grid connection route is shown in the Overall Site Layout Plan in Drawing No. 05868-DR-004.

Figure 1 – Grid Connection Route Location (See Drawings 05868-DR-002/003/004)

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

Table 1 – Approximate Route Location of Preliminary Design:			
Substation/Access Roads	**Public Roads**	**Private Land**	**Total Route length**
30m	216m	20m	266m

Table 1: Proposed Baldonnell 110kV Substation to Barnakyle 110kV Substation – UGC Route Location Summary

Table 2 below gives a more detailed insight to the UGC (underground cable) route and describes the specific construction requirements of each individual section. All plant and equipment employed on the works will be subject to good site organisation and hygiene, particularly during construction activities.

Table 2 - Summary of 110kV Underground Cable Route	
Section	**Description**
Section 1 266m approx.	**UGC Route from the proposed Baldonnell 110kV Substation to the existing ESB Barnakyle 110kV Substation**  **Google earth Overlay** **(For reference see drawing 05868-DR-004)** The underground cable route exits the proposed Baldonnell 110kV Substation from the northside fence and heads in a westerly direction. The route follows the public road west for approx. 250m until it reaches the entrance to Barnakyle 110kV Substation. The cable then turns south to enter the Barnakyle substation through the station entrance. This section of the route is almost entirely within the public road with the exception of the crossover into the two substations. <u>Section 1 Features:</u> ▪ *UGC Exit Point from the proposed Baldonnell 110kV Substation* The initial exit point and position of the UGC route will be within the new Baldonnell 110kV substation where the cable will transition from the cable sealing end downwards through a sand pit before entering the ducted UGC route to the existing Barnakyle 110kV substation. The final location of the route will to be determined by the client in consultation and agreement with EirGrid as part of the design approval process. ▪ *Existing UGC Route* Third-party records show that the proposed Baldonnell UGC Grid connection route runs in parallel with a number of existing HV UGC routes for approximately 200 meters. These records indicate that the existing HV UGC route has one joint bay and associated chambers along the proposed route.

Table 2 - Summary of 110kV Underground Cable Route	
Section	**Description**
	The exact location, depth and arrangement of the existing HV UGC and joint bays and associated chambers will need to be confirmed by detailed survey and site investigation works. Additionally, it should be further noted that along the length of the UGC grid connection (200m parallel section) it will be necessary to cross the existing HV UGC routes a number of times. Any crossing points will need to be identified by detailed survey and site investigation works. The EirGrid preferred undercrossing method will be used where possible. Where undercrossing of the existing UGC routes is not possible the EirGrid specified overcrossing method will be used. ▪ *Service Crossings* Third-party records show that the proposed Baldonnell UGC Grid connection route crosses a number of services. These records indicate that there is an existing medium pressure gas line, water pipes, wastewater and fibre cables along the proposed route. The exact location, depth and arrangement of these services will need to be confirmed by detailed survey and site investigation works. The UGC route will cross existing services using an undercrossing or overcrossing method mentioned above which will be selected based on the cover available above the service. Where it is not possible to cross under an existing culvert while maintaining the service in place, the service may need to be relocated. Service crossings have been designed in-line with the EirGrid specifications.
Note: The precise location of the cable route may be subject to change as result of existing services/utility locations, ground conditions and any environmental constraints.	

3.0 Preliminary Site Investigations

It will be required to carry out Preliminary site investigations along the cable route prior to construction in order to confirm design assumptions.

The following items may be carried out for the grid connection cable route:

- Slit trenches at locations of service crossings (Full road/track width).
- Trial holes along the route to ascertain ground conditions and thermal resistivity of the soil.
- Boreholes at HDD locations to ascertain ground conditions.

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 Access Routes to Work Area

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

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

5.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with South Dublin 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. The UGC will be usually installed in 100m sections, and no more than 100m will be excavated without the majority of the previous section being reinstated.

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 are set out in chapter 15 of the submitted EIAr and 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 South Dublin County Council, prior to the commencement of UGC construction.

6.0 Road Opening Licence

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

7.0 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.

8.0 UGC Construction Methodology

The UGC will consist of 3 No. 160mm diameter HDPE power cable ducts, 2 No. 125mm diameter HDPE communications duct and a 63mm Earth Continuity Conductor Duct to be installed in an excavated trench between both the proposed and existing substation. The standard trench is 825mm wide by 1315mm deep, with variations on this design to adapt to service crossings and watercourse crossings, etc where applicable. The power cable ducts will accommodate 1 No. power cable per duct. The communications duct will accommodate a fibre cable to allow communications between the proposed Baldonnell 110kV substation and the existing ESB Barnakyle 110kV substation. The ducts will be installed, and the trench reinstated in accordance with the landowner or South Dublin County Council specifications, the electrical cabling/fibre cable is then pulled through the installed ducts between the two substations. Construction methodologies implemented and materials used will ensure that the UGC is installed in accordance with the requirements and specifications of EirGrid.

8.1 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. Table 9-1 of Chapter 9 of the submitted EIAr provides a list of waterbodies within a 2km radius of the proposed development site.
- 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 EirGrid and Irish Water specifications.
- In the event that culverts require removal for ducting installation, 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 EIAR, and a detailed Traffic Management Plan will be prepared and agreed with South Dublin 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, with the jointing of cables taking approximately 1 week.

Figure 2 – Example of 110kV Underground Duct Installation

8.2 Ducting Installation Methodology

For the trenching and ducting works the following step by step methodology will apply for the standard trefoil trench design:

1. Grade, smooth and trim trench floor when the required 1315mm depth and 825mm 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 temporary/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 100mm 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.

12. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12mm 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 EirGrid Clerk of Works (CoW) as required.

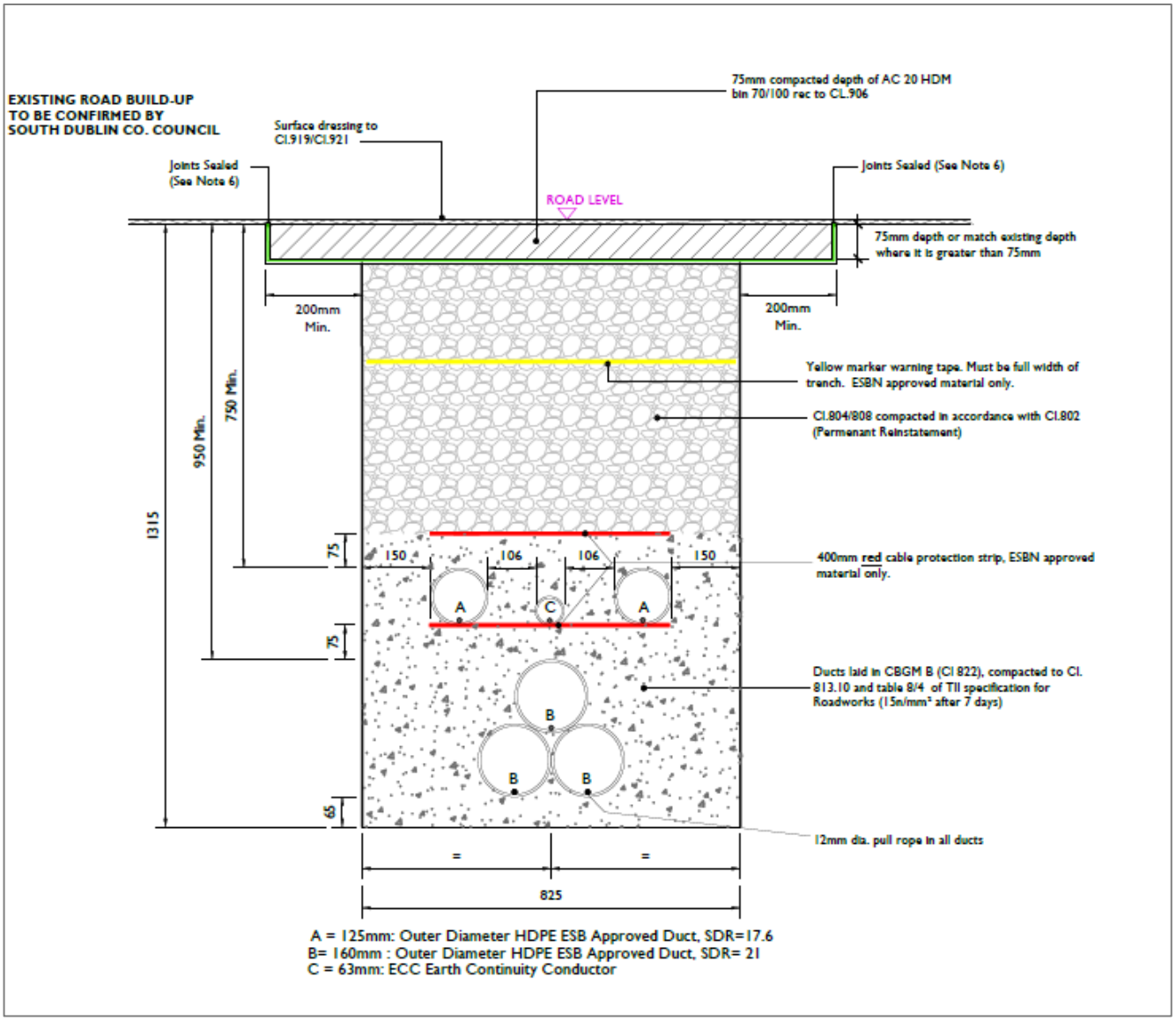

Figure 3 – 110kV Trefoil Trench in Roadway

Equipment:

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

Materials:

- Sand for pipe bedding;
- Ready-mix Concrete where necessary (delivered to site);
- Trench backfilling material (excavated material and aggregates) to relevant specifications;
- 160mm & 125mm diameter HDPE ducting;
- 63mm diameter HDPE ducting
- Temporary Surface Reinstatement Materials;

8.2.1 UGC Installation on Public Road

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

8.3 Cable Pulling

Once the ducting is installed the electrical cables (situated on a drum) are pulled through the ducting by a specialised mechanical winch. The winch will also monitor the tension on the cables being pulled so as not to damage the cables. A guide rope is installed with the ducting to assist in the cable pulling process. The guide rope also is used for proving the ducts by attaching a mandrel, a sponge or brush, for cleaning the duct installed. Cable lubricant is applied to the outside of the cables being pulled through the duct. The lubricant assists in the pulling process by removing friction between the cable and the rollers. This not only speeds up the process but also prevents snagging and therefore damage to the cable.

8.4. 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 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 standard. Siting of marker posts to be agreed with EirGrid as part of the detailed design process *(Figure 4)*.

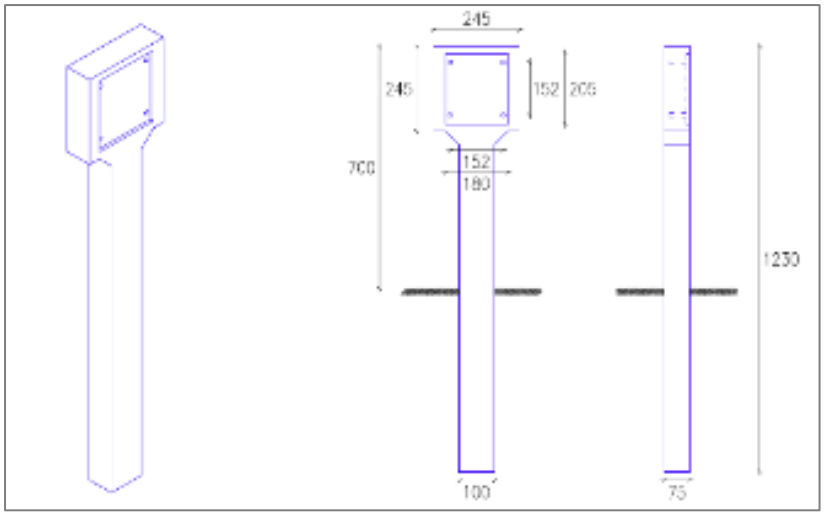

Figure 4 - EirGrid Marker Posts Example

8.5.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. Excess material and excavated tar, etc. will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility.

8.6.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 in an area to the south east of the permitted gas peaking plant and substation area. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

9.0 Substation Construction

Equipment	**Materials:**
• Up to 10 Electrical/Civil Crews • Tracked Excavators • 360˚ tracked excavators (13 ton normally, 22 ton for rock breaker) • Tracked dumpers / tractors and trailers • Crane • Hoist • Power Tools • Generator • Scaffolding	• Stone • Geotextile • Lighting • Paving • Fencing • Steel Uprights • Concrete • Timber • Cladding • Doors

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

1. The proposed 110kV substation will be in a compound of circa 87.78m x 22.25m plan area secured by a 2.6m high palisade fence.
2. The substation compound and drainage will be marked out by a qualified engineer.
3. A drainage system will be excavated and installed around the compound area.
4. Topsoil and subsoil will be removed from the footprint of the compound using an excavator. The excavated material will be temporarily stored in adjacent berms for later use during reinstatement works.
5. A layer of geotextile material will be laid over the footprint of the compound.
6. Using an excavator, a base layer of Clause 804 material will be laid followed by a 6F2 capping layer which will provide the finished surface.
7. Each layer will be compacted using a vibrating roller.
8. Earthing cable will be laid underground around the substation for connection to the various electrical components during the electrical fit out phase.
9. The construction of an 1954m² substation compound comprising of approx. 126m² EirGrid 110kV substation control building and all associated outdoor electrical equipment, including 1 no. 110kV transformer, associated internal access track and a 2.6m high station perimeter fencing around the station will be built.
10. Adequate lighting will be installed around the compound on the lighting masts.
11. Lightning protection masts of approximate height 18m will be installed to protect the station from direct lightning strikes.
12. A 110kV Cable sealing end and associated cable equipment will be required to connect the 110kV incoming underground cables into the substation.
13. A 110kV underground cable will be required through the substation site to connect the cable sealing ends in both IPP and EirGrid compounds

14. The electrical installation is expected to take 22 weeks and includes the following:
    - Delivery and installation of 33kV/110kV transformer. These are unusually large and the deliveries will be managed in accordance with regulations governing the movement of large loads.
    - Wiring and cabling of HV/LV equipment, protection and control cabinets.
    - Commissioning of all newly installed equipment.

Figure 5 - Typical 110kV Electrical Infrastructure

10.0 Construction Traffic

It should be noted the construction vehicle movements will be dependent on the activities being undertaken during the construction phase.

Based on the overall size of the construction compound it is estimated approximately 240 two way vehicle movements (120 accessing the site and 120 egress heavy goods vehicles will be required to access the site during the constructions phase of the overall substation, this estimation includes deliveries of electrical equipment and building materials but does not include an potential waste soil or waste material from a cut and fill.

As noted within section “5.0 Traffic Management”, The 110kV transformer has an approximate transport weight of 80,000kg and requires a special transport and lifting solution that needs to be assessed as part of the detailed design phase.

Based on previous experience with similar substation developments it is estimated the proposed 110kV substation will generate 2800 two-way light vehicle movements (1400 arrivals and 1400 departures). These movements will estimate the staff movements during the construction/commissioning stage of the project, It is also worth noting that these trips will cease following the construction compound.

11.0 Relocation of Existing Services

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

12.0 HV Underground Cable (UGC) Crossings & Parallel Runs

As mentioned in Table 2 above, there are a number of locations where the Baldonnell 110kV UGC route will have to cross other existing HV UGC routes. These crossing and parallel runs occur in a number of points along the route (see Table 2 for details)**.** Each individual crossing and parallel run will need to be individually assessed on a case-by-case basis. Site investigation works along with detailed surveying techniques and consultation with EirGrid will be required to determine the locations depths and configurations and ratings of the existing UGC routes. Once these details are determined then cable rating studies and system modelling can be carried out to determine how best to proceed with the UGC route design in these areas.

Due to the proximity (both in parallel and in crossing) of the existing HV UGC routes there is a high probability that it may have a mutual de-rating effect on both UGC circuits. The de-rating effect will be minimised by setting and maintaining a minimum separation distance between the cables. The scale of the de-rating effect will need to be considered by detailed design calculation and system modelling. The EirGrid preferred undercrossing method will be used where possible. A crossing method can be seen in Figure 6 below. Where undercrossing of the existing UGC routes is not possible an overcrossing method seen in Figure 7 will be used. All UGC crossings will need to be agreed with EirGrid as part of the design approval process. The UGC crossings have been designed in-line with the EirGrid specifications.

12.1 Gas Networks

Consultation with Gas Networks Ireland must take place before starting works where gas pipes are present. Gas Networks Ireland will advise on the safety measures required and will arrange for the exact location of the pipe to be marked out on site.

12.2 Water Mains

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

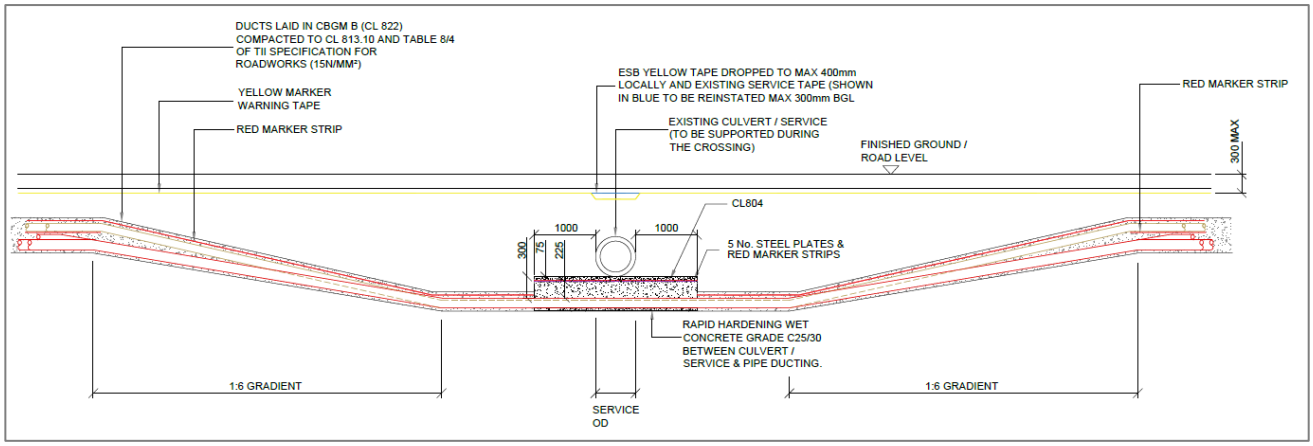

Figure 6 – 110kV UGC Culvert/Service Undercrossing

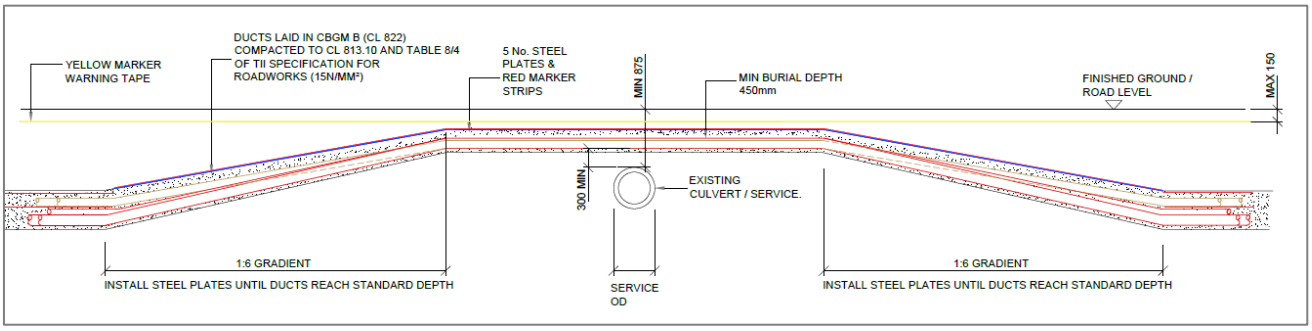

Figure 7 – 110kV UGC Culvert/Service Overcrossing

13.0 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.

14.0 Best Practice Design and Construction & Environmental Management Methodology

Prior to commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Construction Methodology, environmental protection measures included within the planning application, 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 permitted gas peaking plant and substation areas 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 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, remote from watercourses, drainage channels and other surface water features.
- A designated trained operator experienced in working with concrete will be employed during the concrete pouring phase.
- Concrete wastewater can be pumped into a skip to settle out; settled solids will need to be appropriately disposed of off-site;
- Wash-down water from exposed concrete surfaces, will be trapped to allow sediment to settle out and reach neutral pH before clarified water is released to the drain system or allowed to percolate into the ground.
- Where dust suppression is considered to be required by the Contractor, such requirements and methodology shall be subject to the agreement with the Ecological Clerk of Works.
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or wastewater into watercourses;
- Cabins, containers, workshops, plant, materials storage, and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times.

15.0 Invasive Species Best Practice Measures

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

- The contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within.
- Plant and machinery will be inspected upon arrival and departure from site and cleaned/washed as necessary to prevent the spread of invasive aquatic / riparian species such as Japanese knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*. A sign off sheet will be maintained by the contractor to confirm the implementation of measures;
- Site hygiene signage will be erected in relation to the management of non-native invasive material.

16.0 Waste Management

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

17.0 Programme

Estimates for the duration of the construction works are included in the table below. Please note that some of the elements are likely to happen concurrently, therefore the overall start-to-finish duration is estimated to be 18 months.

Table 3: Estimated Construction Duration (Activities Run Concurrently)	
Development Element	Estimated Construction Duration
Construct 110kV Substation	18 months
Construct 110kV Underground Cable	2 months
Commissioning	6 weeks
Total	18 Months