UWF Grid Connection
Environmental Management Plan (2019)

Tab 10
Outline Construction Methodologies

(Further methodologies post planning consent / pre-construction)

ECOPOWER

October 2019

Outline Construction Methodologies (OCMs) UWF Grid Connection

The Outline Construction Methodologies for all of the main works and activities of UWF Grid Connection are presented below to provide information to assist the evaluation and assessment of the cumulative effects of the UWF Grid Connection. All Outline Construction Methodologies (OCMs) for UWF Grid Connection are listed in Table 1 and then presented individually.

Table 1: List of Outline Construction Methodologies for the UWF Grid Connection

OCM Ref:	OCM Title
GC_OCM_01	Pre-Construction Activities
GC_OCM_02	Mountphilips Substation Compound
GC_OCM_03	New End Masts west of Mountphilips Substation
GC_OCM_04	Temporary Access Road to End Masts
GC_OCM_05	Instream Works and Temporary Bailey Bridge Crossing At W1
GC_OCM_06	New Permanent Access Road at Mountphilips Substation Site
GC_OCM_07	Installation of 110kV UGC and new crossing structures at W2 and W3
GC_OCM_08	Permanent Site Entrance at Mountphilips Substation Site
GC_OCM_09	Temporary Compound at Mountphilips Substation Site
GC_OCM_10	Formation of Overburden Storage Berms at Mountphilips Substation Site
GC_OCM_11	Reinstatement of Lands at Mountphilips Substation Site
GC_OCM_12	110kV Trenching & Ducting
GC_OCM_13	110kV Joint Bays and Associated Chambers
GC_OCM_14	110kV Cable Pulling
GC_OCM_15	110kV Cable Jointing
GC_OCM_16	Replacing existing culverts along the 110kV UGC
GC_OCM_17	Raising road level and parapet walls at Rockvale Bridge (W6), Tooreenbrien Bridge (W36) and Anglesey Bridge (W53)
GC_OCM_18	Horizontal Directional Drilling at W8 and W9

Outline Construction Methodology			
Title:	**Pre-Construction Activities**	**Ref:**	**GC-OCM-01**

General Description

Certain activities, will take place prior to the commencement of the main construction stage of the UWF Grid Connection, these include detailed design, management appointments and confirmatory surveys, along with the setting out of the construction works areas at Mountphilips Substation site.

Duration

Over a 6 month period prior to the commencement of the main construction stage

Personnel	**Machinery & Equipment**	**Materials**
▪ Main Contractor ▪ Project Manager ▪ Environmental Clerk of Works ▪ Specialist engineering Consultants ▪ Environmental Consultants ▪ Site engineer ▪ 2 civil works personnel	▪ GPS equipment ▪ Hand tools ▪ Survey equipment	▪ 4 x 4 vehicle and trailer ▪ Fencing posts ▪ Fencing wire ▪ Tape ▪ Portable electric fencer ▪ Goal posts ▪ Signage ▪ Wooden pegs ▪ Spray Paint

Design and Management Activities

- The Project Manager, Main Contractor, and the Environmental Clerk of Works will be appointed.
- The Environmental Management Plan will be reviewed and updated to include the planning permission details and conditions, the identification of key project personnel and the addition of the Contractors method statements,
- The Traffic Management Plan will be updated with details of other road works, road maintenance or traffic diversions, etc. that might be planned for the area at the same time as the construction works. This information will be obtained from the Roads Department of Tipperary County Council. The updated Traffic Management Plan will be submitted, along with road opening license applications to the Roads Department of Tipperary County Council,
- Method statements will be prepared by the Contractor. These method statements will be based on the Outline Construction Methodologies.
- Pre-construction monitoring and confirmatory surveys will be carried out by specialist engineering and environmental consultants, and will include public road condition monitoring surveys, water quality monitoring surveys, and ecological confirmatory surveys.
- At Mountphilips Substation site, the construction works area boundary will be temporarily fenced off with wooden posts and wire, or with electric fences if there is livestock present; the boundaries of any hydrological, ecological or environmental buffer zones, such as buffer zones around watercourses, will be fenced off with marker tape to prevent unauthorised access by construction crews, plant and machinery; goal posts will be erected under overhead lines; and the footprint of the widened site entrance, access road, substation compound, and end mast locations will be marked out by an engineer.

END

Outline Construction Methodology			
Title:	**Mountphilips Substation Compound**	**Ref:**	**GC-OCM-02**

General Description

The proposed 110kV Mountphilips Substation will facilitate a new looped-in substation connection to the existing Killonan – Nenagh 110kV overhead line (See also OCM-03). The new 110kV Mountphilips Substation will be constructed to the east of the existing 110kV overhead line in the townland of Mountphilips near Newport. The Mountphilips Substation compound will be c.10290m2 in area, and will contain a control building, surge arrestors, lightening masts, circuit breakers, busbars and other ancillary electrical equipment. The new substation compound secured by a 2.6m high palisade fence.

Duration

10 – 12 Months Approx.

Personnel	Machinery & Equipment	Materials
▪ 10 to 15 electrical personnel ▪ 10 to 15 civil works personnel ▪	▪ Excavators ▪ Tipper Trucks / loaders ▪ tractors and trailers ▪ Crane ▪ Hoist ▪ Teleporter ▪ Power Tools ▪ Generator ▪ Scaffolding ▪ Vibrating roller ▪	▪ Clause 804 stone ▪ 6F2 capping stone ▪ Paving. ▪ Fencing ▪ Geotextile ▪ Concrete and concrete blocks ▪ Roofing Timber and other general building materials ▪ Reinforcing steel ▪ Tiles and cladding ▪ Steel Doors ▪ Substation Electrical Equipment ▪ Cabling ▪ Ducting

Standard Methods

- A drainage system will be installed around the compound area.
- Topsoil and subsoil (including rock) will be removed to a depth of 350mm from the footprint of the compound using excavators. The excavated material will be temporarily stored in adjacent permanent berms, as per GC OCM-09: Formation of Overburden Storage Berms at Mountphilips Substation.
- A layer of geotextile material will be laid over the excavated footprint of the compound.
- Using an excavator, a base layer of crushed stone material will be laid on top of the geotextile followed by a 6F2 capping stone layer which will provide the finished surface.
- Each layer will be compacted using a 13 ton vibrating roller.
- The control building, electrical equipment, lightening protection and internal access roads within the compound will then be constructed. .
- Two sets of underground 110kV cables will be constructed between the two new end masts to be located along the Killonan to Nenagh 110kV overhead line and the substation compound, these underground cables will be connected into the substation at the western side of the compound.
- The underground Mountphilips – Upperchurch 110kV cables will run from Upperchurch Windfarm Substation and will be connected into the Mountphilips substation at the eastern side of the Mountphilips compound.
- Once the High Voltage (HV) and Low Voltage (LV) equipment is installed and the protection and control cabinets are commissioned and tested, the substation can then be energised and commissioned.

Photographs

Example of similar 110kV substation with end masts connecting to overhead 110kV line

Relevant Drawings from Volume C3 EIAR Figures

Extracts from Figure GC 5.4: Plan of Mountphilips Substation Compound

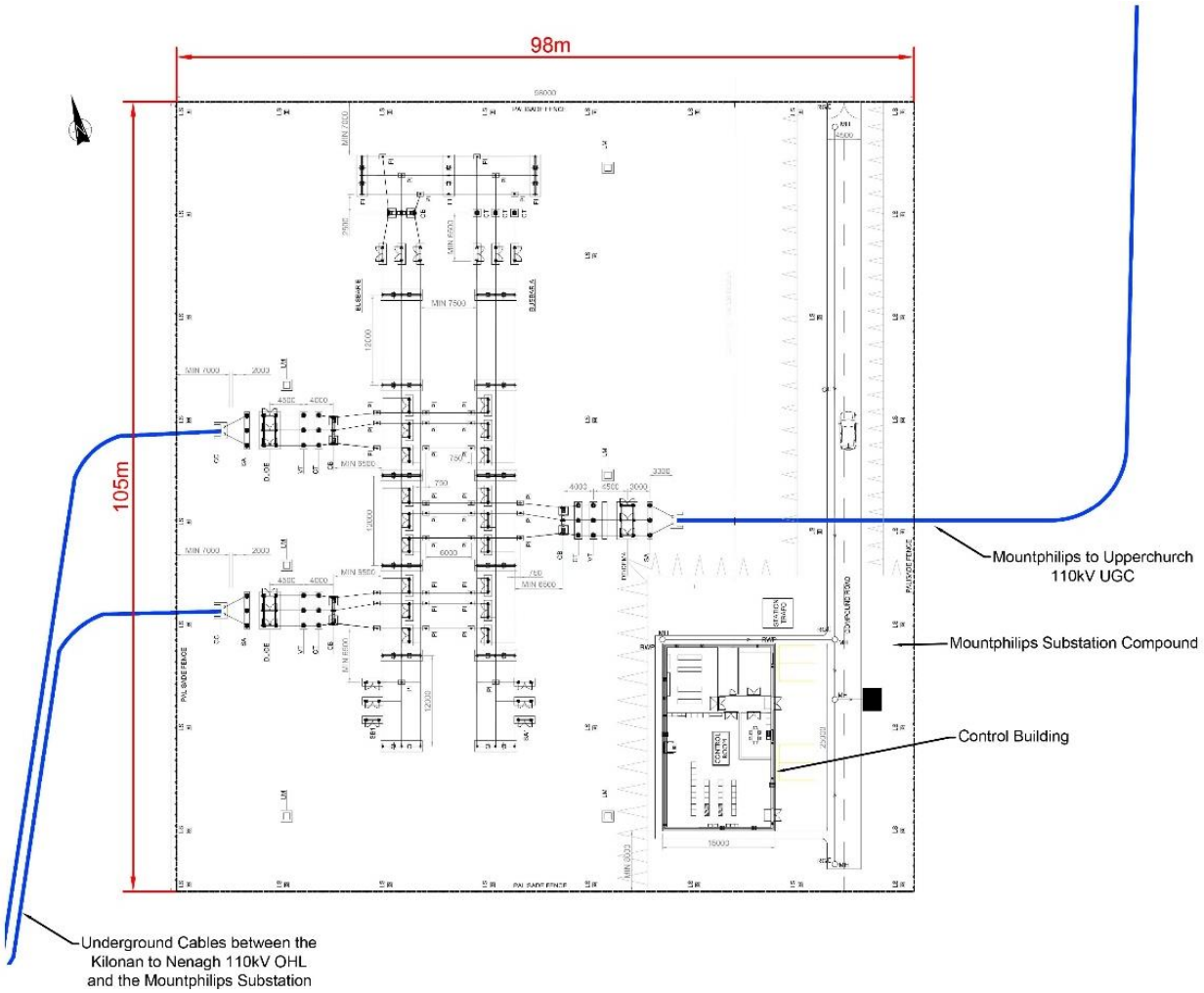


Figure GC 5.5: Elevation Mountphilips Substation Compound

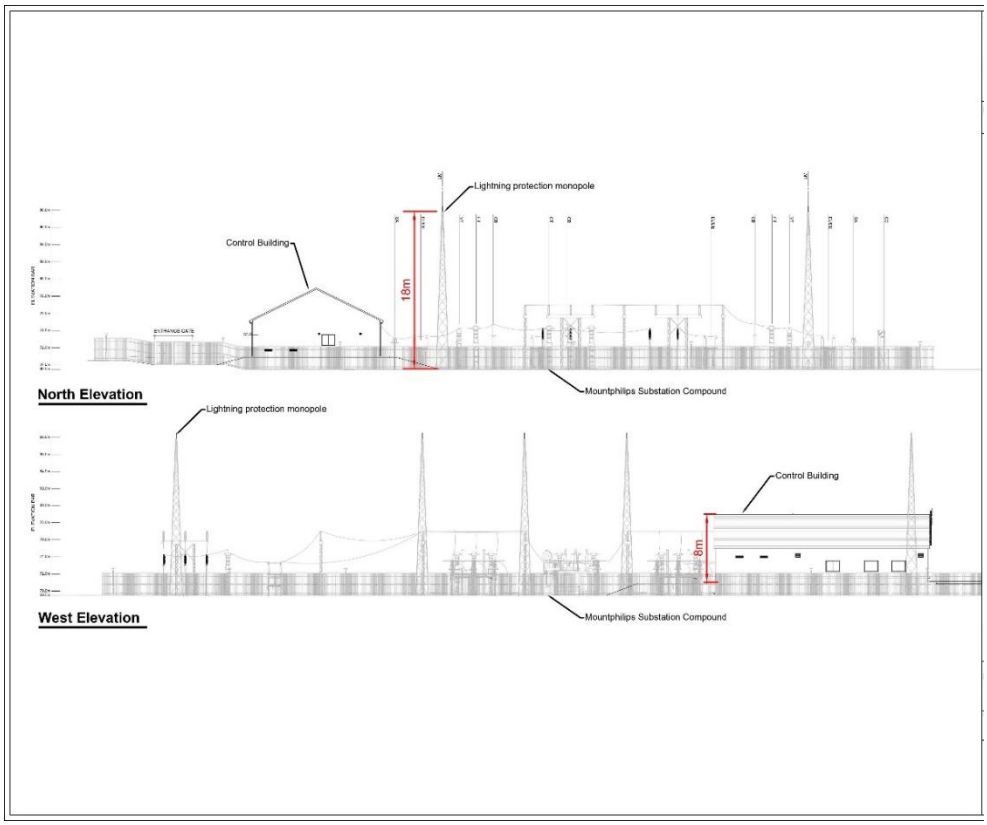
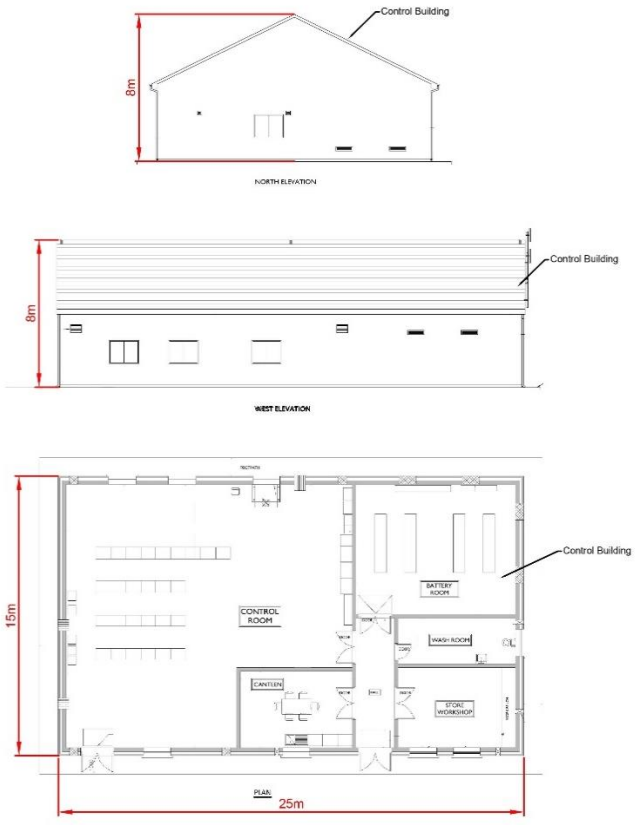


Figure GC 5.6: Plan and Elevation of the Control Building at Mountphilips Substation



END

Outline Construction Methodology			
Title:	**New End Masts west of Mountphilips Substation**	**Ref:**	**GC-OCM-03**

General Description

Two end masts will be constructed approximately 20m apart at a point along the existing Killonan – Nenagh 110kV Overhead Line, to the west of the 110kV Mountphilips Substation. The existing 110kV overhead line will be cut and connected to the End Masts. The End Masts will connect into the Mountphilips Substation Compound through underground cables. This will allow electricity to flow from the end masts, through Mountphilips Substation and back to the end masts thus forming a "loop-in" connection of the Mountphilips Substation to the National Grid.

Duration

- Construction of end mast foundations – 7 days.
- Erection of towers - 3 days, weather dependant
- Cable jointing – 5 days per tower.

Personnel	Machinery & Equipment	Materials
▪ 5 operatives	▪ 4x4 vehicle ▪ Tractor and trailer ▪ Crane Teleporter ▪ Chains / small tools ▪ Excavator ▪ Tipper Truck ▪ Teleporter	▪ Lattice steel towers sections ▪ Cable Interface platform ▪ Insulators ▪ Electrical Connections (Jumpering conductors) ▪ Cable sealing ends ▪ Concrete (foundation) ▪ Copper/Aluminum Conductor ▪ Aggregate ▪ Concrete pipes 1m high 1.5m diameter ▪ Reinforcing bars ▪ Cables and ducting

Standard Methods

- Each end mast will be assembled on four steel supporting legs. For each leg of the two End Masts (8 in total) a foundation c.3.3m x 3.3m and 3m deep will be excavated and the formation levels (depths) will be checked by the onsite foreman. The excavated material will be temporarily stored close to the excavation site.
- To aid construction, a concrete pipe, 1m high and 1.5m in diameter, will be placed into each excavation to allow operatives level the legs at the bottom of the excavation. Once the legs are levelled and are in situ, the frame of the reinforcing bars will be prepared and strapped to the concrete pipe with spacers as required.
- 1m x 1m shuttering will be installed around the individual legs of each tower and will protrude 300mm over ground level.
- Concrete will then be poured directly into the shuttering up to the required levels.
- Once the foundation concrete is set the shuttering will be removed and the concrete will be allowed to cure for approx. 28 days.
- The excavated area around the end mast foundations will be backfilled with the sub soil material already excavated at the location. The backfill will be placed and compacted in layers with excavated topsoil placed at surface level and any excess material will be permanently stored in the berms formed around the Mountphilips Substation compound.
- Once the concrete is sufficiently cured, work can commence on erecting the bases of the end masts.
- A temporary hardstand area for the crane will be constructed adjacent to the end mast foundations by laying geogrid material on the ground and overlaying this geogrid with a suitable grade of aggregate.

- When the bases for the masts are assembled and in place, the upper sections of the masts will be assembled horizontally on the ground beside the mast bases.
- The overhead line will then be switched out (de-energised).
- The overhead line will then be moved off center using stay wires and weights.
- The pre-assembled upper mast sections will then be lifted onto the base sections using the crane and guide ropes and bolted into position.
- When the masts are complete and secured to the bases, the overhead line will be centered and attached to the end masts. The section of the electric line between the two masts will then be cut and removed.
- Cable interface platforms will be lifted into place on the masts and all electrical equipment will be bolted down onto these platforms.
- Two sets of underground cables will be constructed from the Mountphilips Substation and will connect to the end masts, one cable set to each mast. The cables will be brought up in steel trunking along the front face of the masts to the cable interface platforms.
- Jumpering Conductors (for electrical connections) will be installed from the overhead line down onto the interface platform and jointed to the cables.
- Scaffolding will be erected at the side of both towers to enable the cable jointers to work in a controlled environment.
- Once all works have been completed on the platforms the scaffolding will be taken down and the area cleared of all work materials.
- The circuit will be tested in both directions before the overhead line is re-energised.
- The temporary crane hardstand will be removed and the area reinstated and reseeded.

Reference Documents

ESB specification Drawing PE610-D005-024-001-000

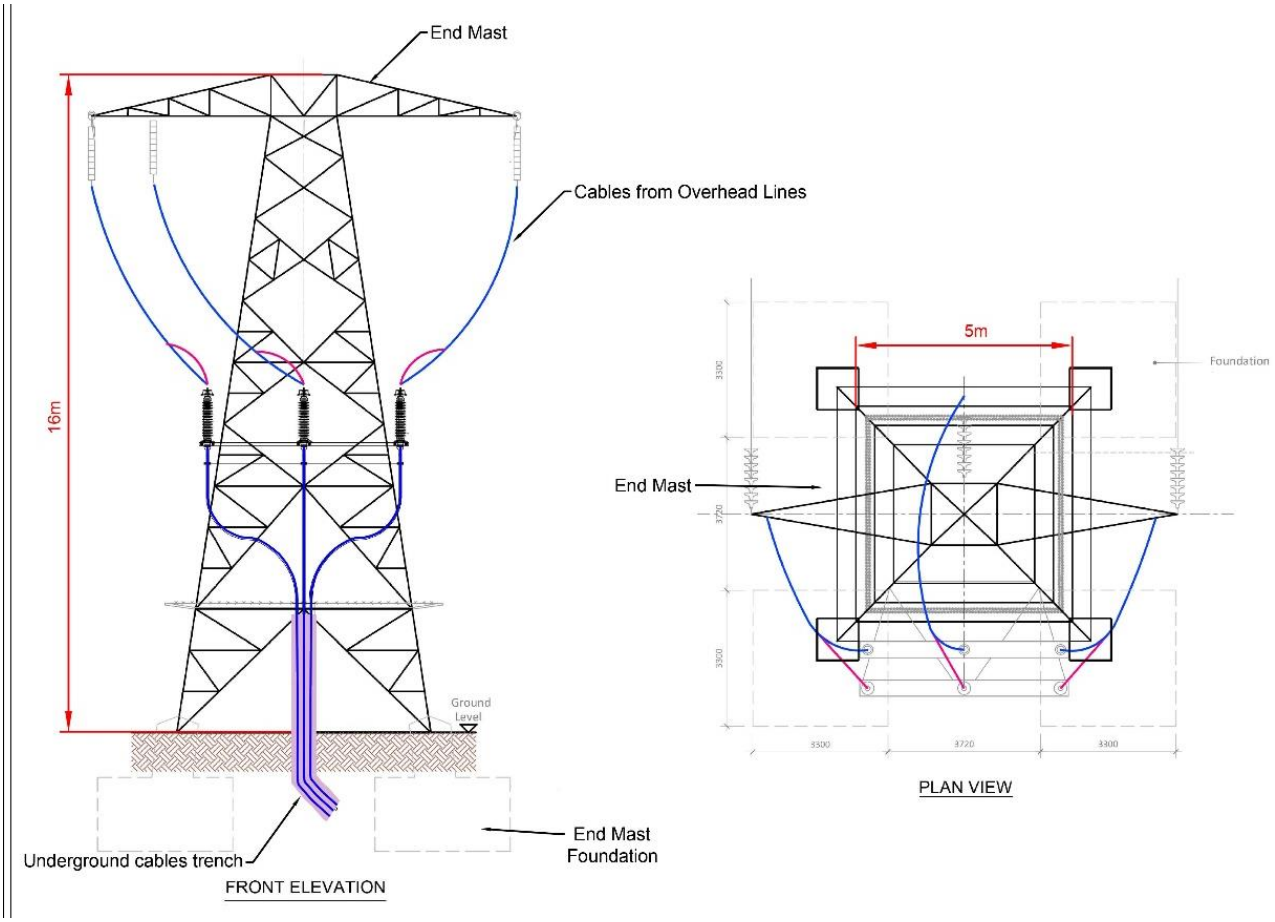
Photographs

Typical tower base

Cont..

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.7: Plan and Elevation of the End Masts at Mountphilips Substation



END

Outline Construction Methodology			
Title:	**Temporary Access Road to End Masts**	**Ref:**	**GC-OCM-04**

General Description

A temporary access road will provide access to End Mast No.1 and No2 at Mountphilips. The temporary access road will be circa 3.5m in width.

Duration

3 days

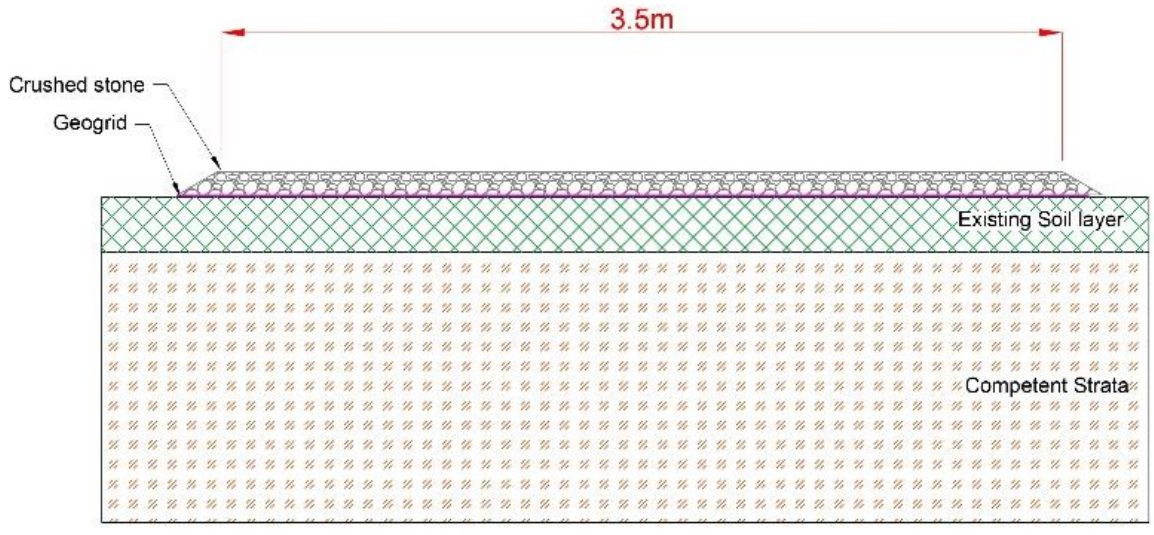
Personnel	Machinery & Equipment	Materials
▪ Site Engineer ▪ 3 General Operatives ▪ 1 Excavator Operator	▪ 4x4 vehicle ▪ Tipper Truck ▪ 360˚ excavator ▪ Vibrating roller	▪ Geotextile ▪ 50mm crushed stone

Standard Method - 3.5m wide excavated and stoned temporary access road

- A layer of geotextile material will be laid over the existing ground.
- A layer of 200mm deep of 50mm crushed stone will then be overlaid on the geotextile and compacted in suitable layers using a vibrating roller.
- Reinstatement will take place when the End Mast works are completed. The layer of stone and geogrid will be removed and either re-used at the Mountphilips Substation compound or along the new permanent access road at the Mountphilips Substation site.
- The area will be reinstated and reseeded as per GC_OCM_10: Reinstatement of Land at Mountphilips Substation Site.

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.11: Cross Section of Temporary Access Road at Mountphilips Substation



Cross Section of Temporary Access Road

END

Outline Construction Methodology			
Title:	**Instream Works and Temporary Bailey Bridge Crossing At W1**	**Ref:**	**GC-OCM-05**

General Description

Instream works will be required at Mountphilips Substation Site in order to install the underground cables across the local stream at W1. A temporary crossing will also be constructed at this location.

To facilitate the works, these watercourses will be dammed and the water diverted through a flume pipe. Following the completion of works at the watercourse, the dam and flume will be removed and the watercourse reinstated.

Duration

1-2 Days

Personnel	Machinery & Equipment	Materials
• Site engineer • 3-4 operatives • 1 Excavator Operator	• Tipper Truck • 360˚ excavator • Mobile water pumps and hoses • 4 x 4 vehicle and trailer	• Sand Bags containing washed sand • Geotextile membrane • Straw bales • Flume pipes • Splash plate • Silt Buster • Washed round stones • Silt trap material

Standard Method: Dam & Flume for Cables Trench

- The flume pipe(s) will be set out on the bed of the watercourse.
- A dam will be constructed using sand bags so that all the flow is diverted through the flume pipe(s).
- A splash plate will be placed at the downstream end of the flume pipe where the water re-enters the water-course in order to prevent erosion of the stream bed.
- Silt traps, such as geotextile membrane. will be placed downstream of the in-stream works location to mini-mise sedimentation
- The works will be carried out under/around the flume pipe(s).
- If required, a temporary sump will be established and used to collect any additional water. This water will be removed by pumping to an infiltration trench or settlement pond if the soil is not saturated, otherwise the water will be pumped to a suitably sized water treatment train, such as a Siltbuster, where any sediment will be allowed settle before the water is released.
- A cables trench will be excavated in the dry stream bed, under the flume, and cable ducts will be laid and the trench backfilled with existing material.
- Following the completion of works at the watercourse, the dam and flume pipes will be removed and the watercourse reinstated as per Instream Reinstatement outlined below.

Standard Method: Temporary Crossing (Temporary Bailey Bridge)

- A temporary access road will be constructed in advance of the arrival of the Bailey bridge.
- On each side of the watercourse, a 4m x 4m area of top soil will be removed and the area will be laid with geotextile. Clause 804 stone will then be in-filled and compacted to form a bearing pad which will support each end of the bailey bridge.
- The bridge will be delivered to the crossing point on a low loader.
- The bridge will be assembled using hand tools and lifted into place using the Hi-Ab mounted on the delivery truck.
- When the End Mast works are complete, the temporary Bailey bridge will be removed.

- The bridge will be dismantled, loaded onto a low loader and removed from site.
- The stone will be removed from the bearing pads and the excavated soil reinstated and reseeded.

Standard Method: Instream Reinstatement

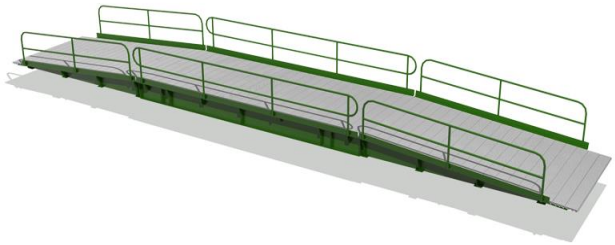
- Following the completion of works at W1 and the End Masts, the dam and flume will be removed – deflector plates will be used during the restoration of flow in the watercourse.
- The watercourse will be reinstated by reinstating the bank slopes and character and stabilizing the banks using boulder armour or willow/brush bank protection, and reinstating instream flow features such as boulder substrates, pool / riffle sequences, or spawning cobbles; and planting will be carried out along the riparian margins.

Reference Documents

Groundforce Bridge – Temporary Bridge (https://www.vpgroundforce.com/ire/temporary-bridges/)

Photographs

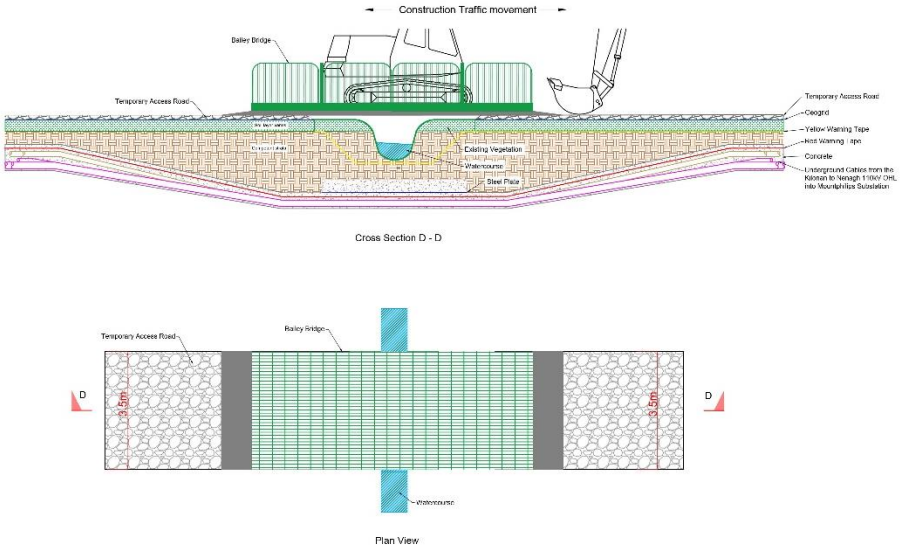
PVC Flume Pipes



Bailey Bridge

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.12: Cross Sections of Temporary Bailey Bridge Crossing at Mountphilips Substation Site



END

Outline Construction Methodology			
Title:	**New Permanent Access Road at Mountphilips Substation Site**	**Ref:**	**GC-OCM-06**

General Description

New permanent access road 4.5m in width, will be constructed to provide vehicular access to Mountphilips Substation

Duration

5 days, c.100m/day

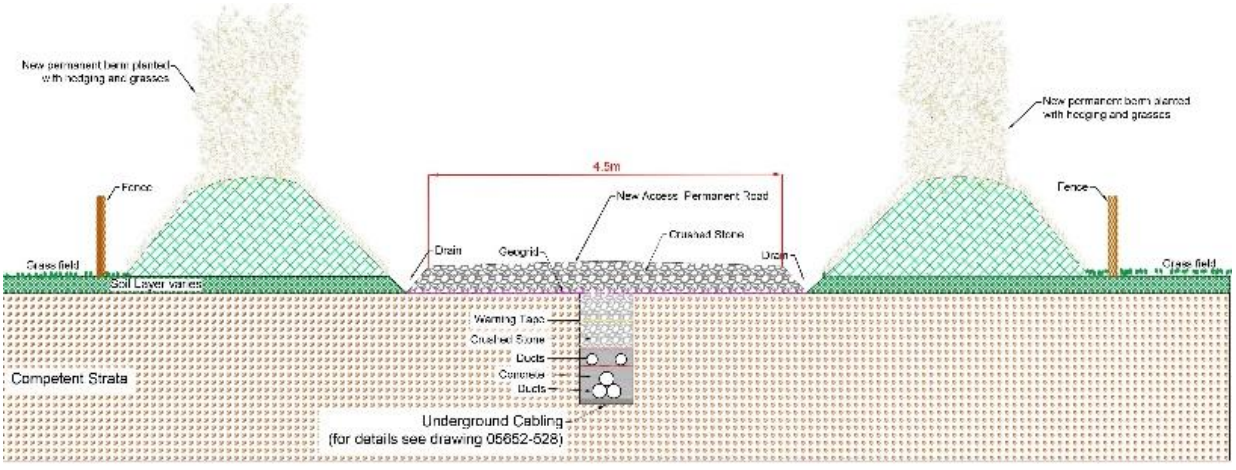
Personnel	Machinery & Equipment	Materials
▪ Site Engineer ▪ 3 General Operatives ▪ Excavator Operator	▪ 4x4 vehicle ▪ Wheeled Tipper Trucks ▪ 360˚ excavator. ▪ Vibrating Roller ▪ Chainsaws	▪ Pre-cast culverts ▪ 50mm crushed stone ▪ Geotextile ▪ Granular fill as per design

Standard Method

- An excavator will excavate the width of the new access road which will include a roadside drainage channel. All organic material and soft subsoil will be removed to formation level. Soft spots will be excavated and filled with suitable granular material. Excess material will be stored in permanent berms alongside the new access road to Mountphilips Substation.
- Geotextile material will be laid where necessary (subject to site conditions).
- A minimum sub-base will be laid which will consist of 250mm of crushed stone and compacted in layers.
- A surface layer of granular fill will then be laid and compacted. A 13 ton vibrating roller will compact each layer.
- The surface of the new road will be finished with a 1% gradient to allow water run-off.
- Land will be reinstated and reseeded with grasses and flower species common to the surrounding vegetation. Local provenance native wildflower seed of flowering plants like Clovers, Vetches and Knapweed will be sown.

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.10: Cross Sections of New Permanent Access Road at Mountphilips Substation



Cross Section of New Permanent Access Road to Mountphilips Substation

END

Outline Construction Methodology			
Title:	**Installation of 110kV UGC and new crossing structures at W2 and W3**	**Ref:**	**GC.OCM-07**

General Description

Instream works will be required at Mountphilips Substation site in order to install the 110kV UGC and new permanent crossing structures at W2 and W3.

Duration

1-2 Days per location

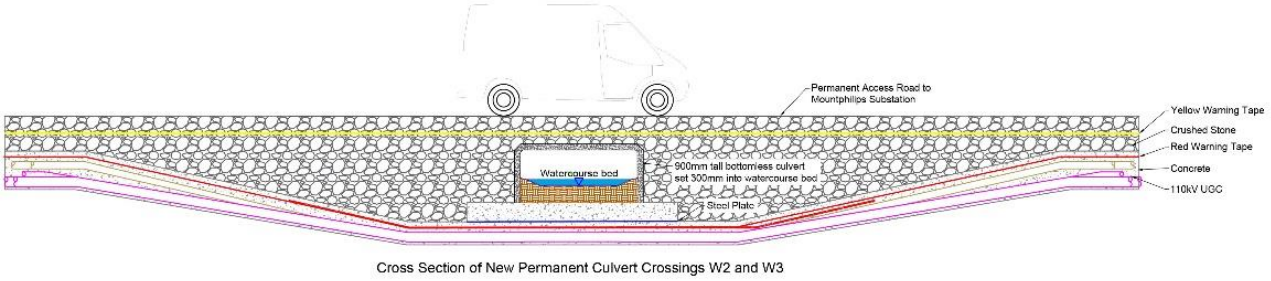
Personnel	**Machinery & Equipment**	**Materials**
▪ 6 general operatives ▪ 2 excavator operators ▪ 1 engineer ▪ Hydrologist ▪	▪ 13 ton excavator ▪ 1 tipper truck ▪ Vibrating compaction plate ▪ Consaw ▪ Hand tools ▪ Cones ▪ Compressor and airspades ▪ Steel plates ▪ Cable detector	▪ Pre-cast bottomless culverts ▪ Clause 804 Material ▪ 150mm rock fill ▪ 160mm and 125mm diameter uPVC ducting ▪ Red cable marker strip ▪ Yellow marker warning tape ▪ CGBM4 semi dry lean mix concrete ▪ Duct spacers ▪ Boulder armour, sandbags, willow

Installation of a new culvert structure or replacing an existing culvert structure

- A dam will be constructed, upstream of the works location, using sand bags containing washed sand.
- A mobile pump will be set up beside the watercourse and will pump the water through hoses, from the up-stream side of the dam to a point downstream below the works. The pumped water from the hose will be released downstream onto a suitable splash plate to prevent erosion.
- Silt traps, such as geotextile membrane, will be placed upstream and downstream of the in-stream works to minimise sedimentation effects.
- The cable trenching and crossing structure works can then be carried out in the dry bed.
- If required, a temporary sump will be established and used to collect any leakages of water from the dam. This water will be removed by pumping to an infiltration trench or settlement pond if the soil is not saturated, otherwise the water will be pumped to a suitable water treatment train, such as a Siltbuster, where any sediment will be allowed settle before the water is released.
- A trench will be excavated in the dry stream bed and cable ducts will be laid and trench backfilled with existing bed material.
- A precast bottomless box culvert will be installed at watercourse crossing W2 and W3, the walls of the bottomless culvert will be placed at the sides of the watercourse, 300mm into the streambed
- Following the completion of works at W2 and W3, the dam will be removed – deflector plates will be used during the restoration of flow in the watercourse.
- The watercourse will be reinstated by reinstating the bank slopes and character and stabilizing the banks using boulder armour or willow/brush bank protection, and reinstating instream flow features such as boulder substrates, pool / riffle sequences, or spawning cobbles; and planting will be carried out along the riparian margins.

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.13: Cross Sections of New Permanent Culvert at Mountphilips Substation Site



Cross Section of New Permanent Culvert Crossings W2 and W3

END

Outline Construction Methodology			
Title:	**Permanent Site Entrance at Mountphilips Substation Site**	**Ref:**	**GC-OCM-08**

General Description

The site entrance to Mountphilips 110kV Substation at Coole will be permanently widened and roadside hedgerows will be removed to achieve sightlines at this entrance.

Duration

3 days

Personnel	Machinery & Equipment	Materials
▪ Site Engineer ▪ 6 General Operatives ▪ 2 Excavator Operator	▪ 4x4 vehicle ▪ 3 Tipper Trucks ▪ 3 excavators. ▪ Chains / hand tools ▪ Vibrating rollers ▪ Chainsaws	▪ 50mm Crushed Stone ▪ Geotextile ▪ Fencing materials – Gates, Timber posts, Rail fence ▪ Granular fill ▪ Hedging ▪ Silt fences

Standard Method - Permanent Site Entrances, E1 at Coole

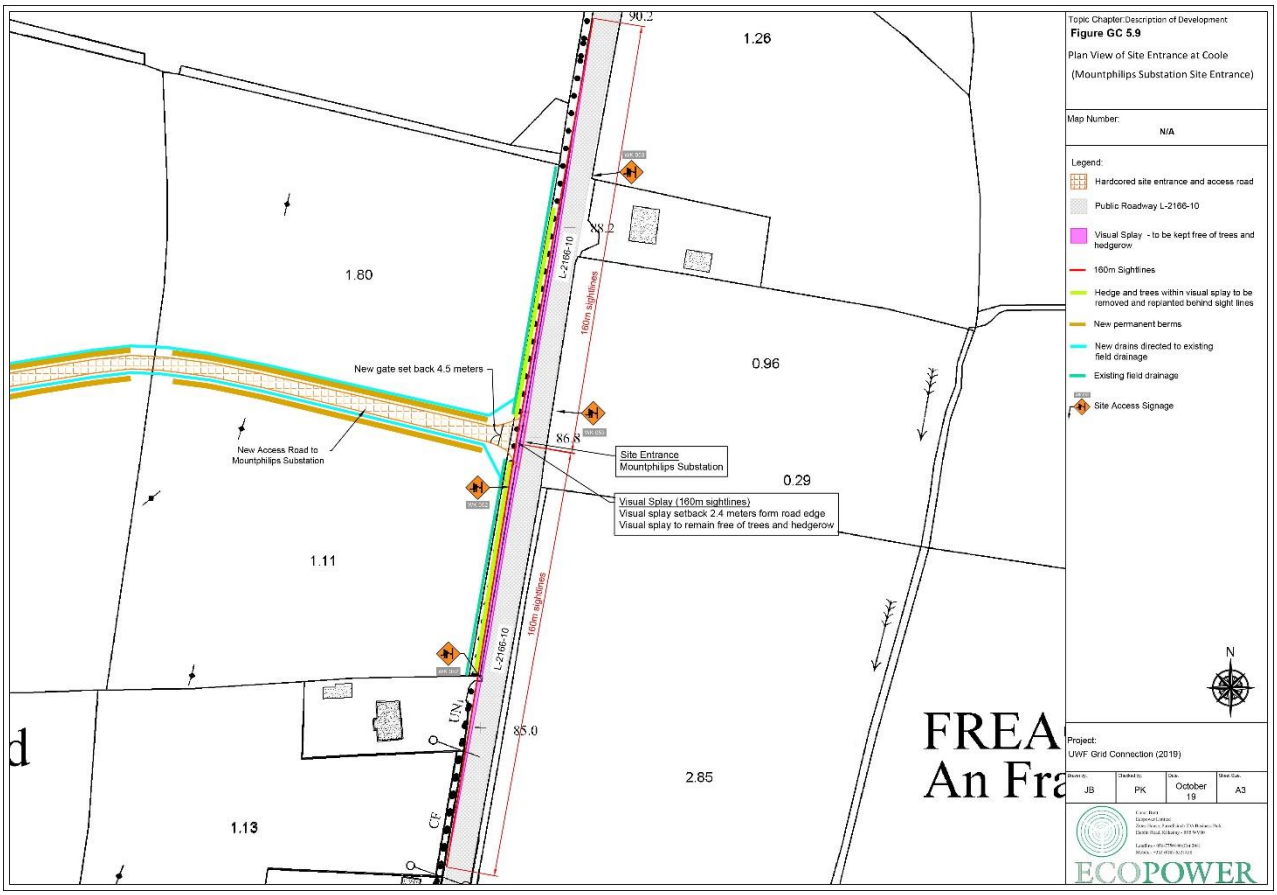
- Prior to works at the entrances commencing, traffic management controls will be put in place on the public road and flagmen deployed.
- The roadside fencing, hedgerows and trees will be cleared back until adequate sightlines are achieved,
- Permanent fencing will be erected and boundary wire mesh fencing will be used to improve visibility if necessary.
- The existing site entrance will be widened and soil and subsoil excavated. A concealed drain will be installed;
- A base layer of stone, followed by subsequent layers of smaller graded stone and a final layer of capping stone will be laid over the excavated area. A vibrating roller will be used to compact each layer.
- The final capping layer will be profiled to the new access road to Mountphilips Substation and will provide a suitable surface to accommodate the delivery of materials, plant or equipment.
- Any hedgerows or trees removed during widening of the entrance will be replaced with an equivalent length of new hedgerow and equivalent number of semi mature trees behind the new sightlines along the line of the new permanent fencing.
- The new verge at each side of the widened site entrance will covered with soil and reseeded. Excess material will be stored in permanent berms alongside the new access road to Mountphilips.

Photographs

Existing farm field entrance at Coole for Mountphilips Substation

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.09: Plan View of Permanent Site Entrance at Coole (Mountphilips Substation Site Entrance)



END

Outline Construction Methodology			
Title:	**Temporary Compound at Mountphilips Substation Site**	**Ref:**	**GC-OCM-09**

General Description

A temporary construction compound is a secure fenced area that will be used to store construction materials, equipment, machinery, fuel and waste, and will provide facilities for construction crews including offices, canteen and toilet facilities and parking. A temporary construction compound will be set up at the Mountphilips Substation site.

Duration

2 days

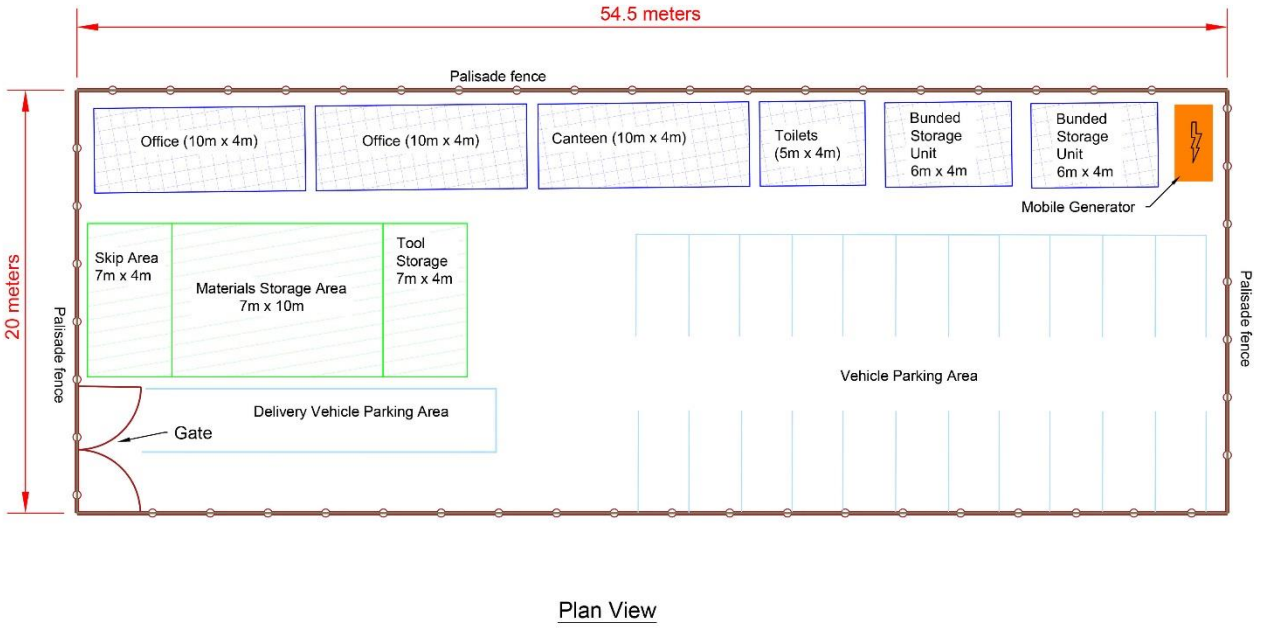
Personnel	Machinery & Equipment	Materials
▪ Site Engineer ▪ 6 General Operatives ▪ 2 Excavator Operator	▪ 4x4 vehicle ▪ 3 Tipper Trucks ▪ 3 excavators ▪ Hand tools ▪ Vibrating rollers ▪ Teleporter	▪ Stone ▪ Geotextile ▪ Security Fencing ▪ Lighting ▪ Portable Cabins ▪ Bunded Storage Units ▪ Generators

Standard Methods

- A drainage system will be excavated and installed around the compound area.
- A layer of geotextile material will then be laid over the footprint of the compound,
- Using an Excavator, a base layer of 100mm to 250mm of granular fill will be laid on the geotextile material and compacted followed by a capping layer of 100mm of Clause 804 which will provide the finished surface.
- Security fencing will be erected around the compound and access gates will be installed at the entrances.
- Portable cabins to be used for site offices, canteen and toilets will be delivered to the compound and set up.
- Bunded storage units will be installed in the compound.
- Parking areas will be marked out and signage will be erected.
- Cowled lighting will be installed around the compound area
- Once all works have been completed on the UWF Grid Connection, the Temporary Compound will be cleared of all work materials, cabins, storage units and fencing. The area will be reinstated and reseeded with grasses and flower species common to the surrounding vegetation.

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.8: Plan View of the Temporary Construction Compound at Mountphilips Substation



Plan View

END

Outline Construction Methodology			
Title:	**Formation of Overburden Storage Berms at Mountphilips Substation Site**	**Ref:**	**GC-OCM-10**

General Description

Overburden will result from excavations for the UWF Grid Connection works at Mountphilips, mainly from the footprint of the substation compound, and also from the permanent access road. This overburden will be permanently stored in berms adjacent to the new permanent access road and around the Mountphilips Substation. Temporary storage will also take place at the End Mast locations.

Duration

For the duration of the construction works

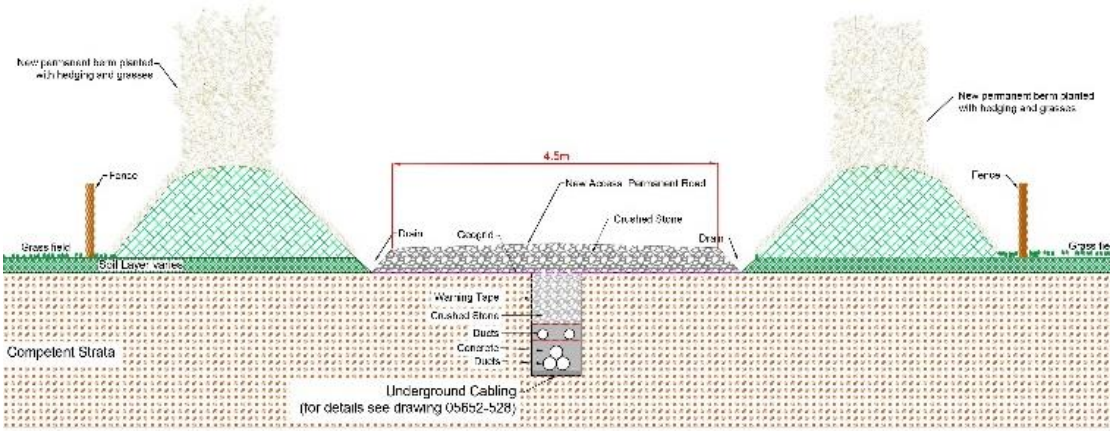
Personnel	**Machinery & Equipment**	**Materials**
▪ Site engineer ▪ 2-3 general operatives ▪ 1 Excavator Operator	▪ Tipper Truck. ▪ 360˚ excavator	▪ Grass seed ▪ Hedging ▪ Geotextile material/tarpaulin

Standard Methods

- The excess overburden resulting from excavations at the Mountphilips Substation site will be loaded onto a dump truck and transported to the overburden storage berm location.
- When the overburden material is tipped from the dump truck an excavator will place the material along the selected berm path and shape it to a height of circa 1.6m.
- The sides will be battered at angles of 45 degrees or less and a light covering of topsoil/subsoil will be added.
- Permanent berms will be reseeded with grasses and flower species common to the surrounding vegetation. Local provenance native wildflower seed of flowering plants like Clovers, Vetches and Knapweed will be sown.
- The permanent berms alongside the new access road will also be planted with hedgerow.
- Berms will be covered if there is a risk of erosion.

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.10: Cross Sections of New Permanent Access Road at Mountphilips Substation



Cross Section of New Permanent Access Road to Mountphilips Substation

END

Outline Construction Methodology			
Title:	**Reinstatement of Lands at Mountphilips Substation Site**	**Ref:**	**GC-OCM-11**

General Description

During construction works, vegetation, topsoil and subsoil will be removed from lands at the Mountphilips substation site to facilitate the construction of the UWF Grid Connection. Following the completion of construction works, these lands will be reinstated.

Duration

1 – 4 days per location

Personnel	Machinery & Equipment	Materials
▪ Site engineer ▪ 2-3 general operatives ▪ 1 Excavator Operator	▪ 4x4 vehicle ▪ Tipper Truck. ▪ 360˚ excavator ▪ Sub-soiler plough ▪ Levelling harrow	▪ Native grass and flower seeds ▪ Native semi-mature trees ▪ Native fruiting hedgerow species

Standard Methods

- Following the completion of works, any remaining building materials and any wastes and excess material will be removed to a licensed facility.
- The construction works area will, where required, be sub-soiled using a sub-soil plough to loosen any compacted areas.
- Sub-soil will be spread using the excavator.
- Topsoil will be spread evenly over the subsoil to surface level using an excavator.
- The ground will be levelled using a levelling harrow so as to present a level surface and to ensure that the restored area will follow the contours of the surrounding undisturbed ground after restoration is completed.
- All stones in excess of 50mm will be removed from the surface.
- The soil will be reseeded with grasses and flower species common to the surrounding vegetation. Local provenance native wildflower seed of flowering plants like Clovers, Vetches and Knapweed will be sown.
- Fertilizer will be spread on any sections of improved grassland.
- The lands will remain fenced until sufficiently revegetated, at which time all fencing will be removed off-site.

Reinstating hedgerows and trees

- New hedgerows and trees will be planted along the new permanent berms adjacent to the new access road and around the Mountphilips Substation.
- New hedgerows and trees will be planted behind the visual splay at the Mountphilips Substation site entrance.
- New hedgerow and trees will be fenced to protect from livestock.

END

Outline Construction Methodology			
Title:	**110kV Trenching & Ducting**	**Ref:**	**GC-OCM-12**

General Description

A trench of c.1.25m deep, 0.6m wide will be dug in the road to accommodate 5 No. ducts necessary for the grid connection works. Three of these ducts will be used to contain the grid connection electrical cables and 2 of them will be used to house the telecommunications cables and copper cables.

Duration

- The civil contractor will complete 80-100 linear meters of trench per crew per day depending on the site conditions.
- Circa 4 crews will work at any one time. It is anticipated that multiple trenching and ducting crews will be working on the cable route simultaneously during the construction period. At times some crews will be completing joint bays and road reinstatement and will be coordinated intermittently with the trenching and ducting crews throughout the construction phase.
- Approximate duration 6 - 8 months for trenching & ducting, 10 – 12 months in total for 110kV UGC works outside the Mountphilips Substation site, with 110kV UGC works taking place over an 18 month period.

Personnel	Machinery & Equipment	Materials
▪ 6 general operatives per crew ▪ 2 Excavator Operators per crew ▪ 1 Engineer per crew	▪ 13 ton excavators ▪ Small excavator/Teleporter ▪ Tipper trucks ▪ Vibrating compaction plates ▪ Brush & mandrel ▪ Consaw ▪ Hand tools ▪ Traffic Cones and traffic signage ▪ Compressor and airspades ▪ Cable detector	▪ Blinding Concrete where necessary ▪ Bedding sand ▪ Clause 804 Material ▪ 150mm rock fill ▪ 160mm & 125mm diameter uPVC ducting ▪ Red cable marker strip ▪ Yellow marker warning tape ▪ CGBM4 lean mix concrete ▪ Duct spacers ▪ Nylon ropes ▪ Road surface dressing ▪ Sand (clean) bags

Standard Methods for Trenching & Ducting

- Along public road sections, traffic management plans will be implemented. Each work area will be secured with adequate protective barriers and traffic signs and traffic management controls to the approval of the Engineer and as outlined in "Guidance for the Control and Management of Traffic at Road Works" and "Chapter 8 - Temporary Traffic Measures and Signs for Roadworks.
- A surface check will be carried out for underground services with appropriate equipment. Service owners will be contacted to confirm service locations.
- Along public road sections, the road surface will be saw cut to the depth of existing asphalt/bitmac layers and/or concrete surfacing.
- The cable trench will be excavated to a distance of circa 50m ahead of the ducting works. Once the ducting is installed the trench will be backfilled using a mini digger so that only circa 100m of trench is open per crew at any one time along the cable route.
- All material removed from the trench will be loaded immediately and taken away to licenced landfill.
- The trench floor will be graded, smoothed and trimmed when the required 1250mm depth and 600mm width has been achieved.
- A bedding layer of lean mix concrete or bedding sand will be placed at the bottom of the trench.
- Three ducts, through which the electrical cables will be pulled, will be installed by hand in trefoil formation as detailed on the design drawings. Spacers will be used as appropriate to establish horizontal duct spacing.
- The ducts will be surrounded and covered with the lean mix concrete and concrete will then be compacted.

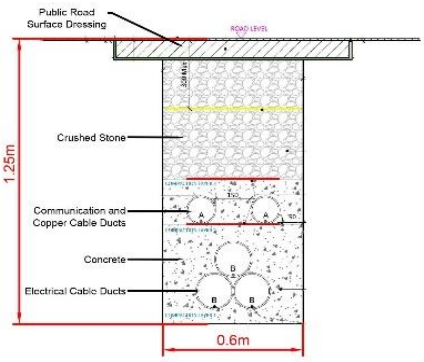
- Red cable marker warning strips will be placed on the compacted lean mix concrete directly over the three ducts which will contain the electrical cables.
- The top two ducts, which will contain the telecommunication cables and copper cables, will then be placed on top of the red cable marker.
- The top ducts will then be surrounded and covered with lean mix concrete material and compacted.
- Another layer of red cable protection strip will then be placed on top.
- A layer of Clause 804 backfill as specified will then be laid to within 300mm of ground surface and compacted.
- Yellow warning tape, will be placed over the compacted Clause 804 backfill.
- Immediate reinstatement will be carried out using road surfacing material to surface level in accordance with arrangements with Tipperary County Council Roads Section and the Road Opening Licence for the works.

Reinstatement of New Permanent Access Road at Mountphilips

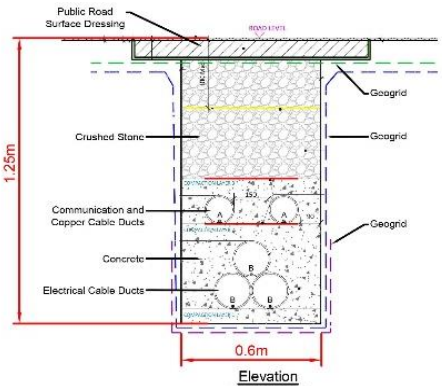
- At Mountphilips Substation site, the 110kV UGC will be backfilled with crushed stone to ground level.

Relevant Drawings from Volume C3 EIAR Figures

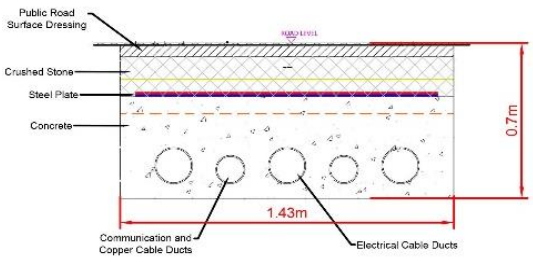
Extract from Figure GC 5.14: Cross Section of 110kV UGC in the Public Road



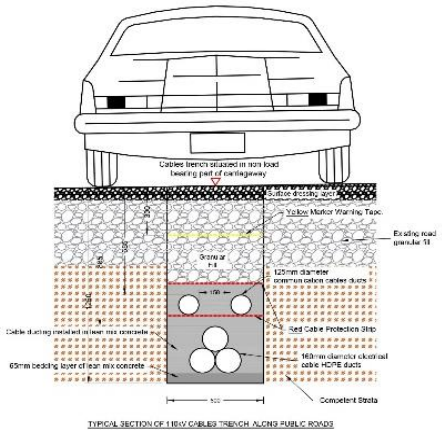
Elevation
110kV UGC
(along majority of UGC route)



Elevation
110kV UGC
(Supported trench through peat, if required)



Elevation
110kV UGC
(in Flat Formation over Bridges / Culverts / Services, if required)



TYPICAL SECTION OF 110kV CABLES TRENCH ALONG PUBLIC ROADS

Reference Documents

ESB Specification

Standard Trench Cross Section Trefoil Formation (PE424-D7001-001-003-005)

Standard Trench Cross Section Flat Formation (PE424-D7001-001-005-002)

END

Outline Construction Methodology			
Title:	**110kV Joint Bays and Associated Chambers**	**Ref:**	**GC-OCM-13**

General Description

Joint bays are locations where lengths of cable are joined. Bays are required approximately every 550m-850m and will be located within the bounds of the road. Joint bay dimensions are typically in the order of 6m long, 2.5m wide and 2m deep and are designed to be covered over and the road above reinstated to its original surface. The communication chamber and link box chamber are smaller in size.

Duration

2-3 days per joint bay location

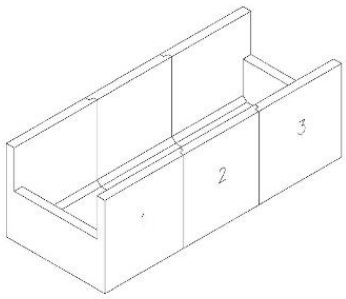
Personnel	Machinery & Equipment	Materials
▪ 2-3 General Operatives per crew ▪ 1 Excavator Operator per crew	▪ 360˚ excavator ▪ 1 no. tipper truck/tractor and trailer ▪ Water Pump & Hoses ▪ Compactor ▪ Consaw ▪ Hand tools ▪ Traffic Cones ▪ Compressor and airspades ▪ Cable detector ▪ Hi Ab	▪ Bedding sand ▪ Clause 804 Material ▪ HDPE ducting ▪ Precast Chamber Units ▪ Link Box Chamber ▪ Copper cable (for earthing of the link box and joint bay chamber) ▪ Earth Rods

Standard Methods

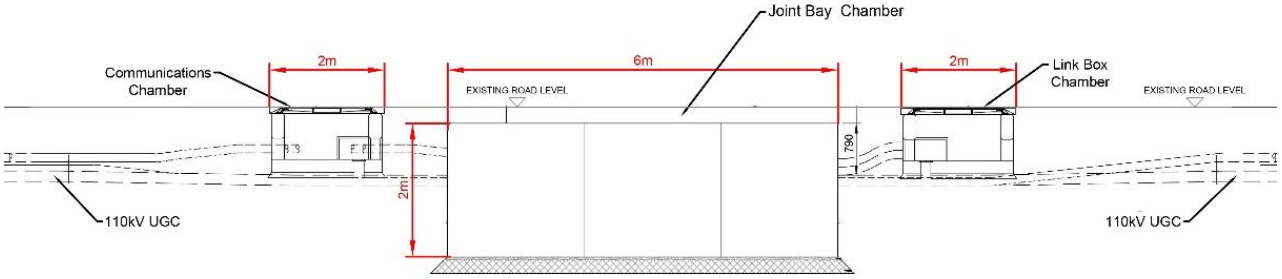
- A pit will be excavated to a depth of c.2.3m, deep enough to accommodate the joint bay chamber, c.6m long and 2.5m wide.
- A layer of 200 mm deep Clause 804 granular material will be placed on the bottom of the excavation. A 75mm layer of sand will be then be laid on top of the Clause 804 to provide a level base for the pre-cast joint bay chamber. The joint bay will then be lifted and placed on the sand layer using the excavator or a Hi Ab if fitted on the delivery truck. The level of bottom of the joint bay will adjusted so that the finished level of the top of the joint chamber will match the surrounding ground surface level.
- 2 smaller pits will be excavated adjacent to the joint bay pit for the communication chambers and earth sheath link chambers. These pits are c.1m deep, c.1.5m long and c.1.1m wide. The pre-cast concrete sections for the communication chambers and earth sheath link chambers will also be placed on sand bedding and installed so that the top of the chambers will be level with the surface ground levels.
- Earthing rods and earthing cables will be installed as per design. Typically, steel rods are driven into the ground and connected back to the chambers using copper conductor or wire.
- The excavations around the precast concrete joint bays will be backfilled with granular fill and compacted in layers up to the existing ground level. The chambers will be covered temporarily filled with sand with steel plates or concrete lids on top until the cable installation works commence.
- Following the completion of works the area will cleared of all equipment, machinery, materials and traffic management measures.
- Along the 110kV UGC where the chambers are being installed in a public roadway, or in the private paved road at the eastern end of the route, temporary road surface reinstatement will be carried out.

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.15: Views of 110kV UGC Joint Bays



ISOMETRIC VIEW OF PRECAST CHAMBER



COMMUNICATION CHAMBER / JOINT BAY CHAMBER / LINK BOX CHAMBER ELEVATION

END

Outline Construction Methodology			
Title:	**110kV Cable Pulling**	**Ref:**	**GC-OCM-14**

General Description

Cables will be pulled, from one joint bay to the next joint bay along the cable route, through the ducting installed in the cable trench using a cable pulling winch. Three electrical cables and two communication cables will be pulled into the ducts, one cable to each duct. The electrical and communication cables will be supplied on steel or timber cable drums.

Duration

Site specific, 1 day per cable section between joint bays depending on conditions

Personnel	Machinery & Equipment	Materials
• 2-4 electrical personnel	• Wire Rope Cable Winch and four wheel drive vehicle. • Nylon Ropes & Rope Guide Roller. • Swivel Link. • Drum trailer and tractor.	• Cable attachment lugs • 110kV Electrical Cable • Fibre optical cable • Cable Pulling stockings • Road surface dressing, if required.

Standard Methods for Cable Pulling

- Prior to cable installation, traffic management signage will be reinstated and the works area secured.
- Three consecutive joint bays will be opened and the sand material removed and stored appropriately for reuse.
- The cable is supplied in pre-ordered lengths on large cable drums. The cable drums will be transported from the temporary compound to the Joint Bay locations using a truck and low loader or tractor and drum trailer.
- The cable pulling winch will be transported to the next joint bay location along the route using a tractor or four wheel drive vehicle.
- The winch will be parked and anchored at the mouth of the joint bay and the winch wire rope will be pulled, using nylon ropes, through the ducts to the next joint bay along the cable route where the cable drum is parked.
- When the winch rope emerges from the duct at the joint bay where the cable drum is parked, it will be connected to the cable using approved suitably sized and rated cable pulling stockings and swivels or alternatively using a pulling head fitted to the cable by the manufacturer**.**
- Rope guide rollers will be placed at the duct opening to guide the cable into the duct.
- If required, lubrication will be applied to the cable coating before it enters the duct. Lubricants will be stored in designated bunded storage areas in the temporary construction compound.
- The winch will pull the cable from the cable drums through the ducts until it reaches the joint bay where the winch is located.
- Once the pulled cable has reached the winch, the cable is cut, coiled and placed back into the joint bay chamber in preparation for Cable Jointing.
- Where the cable jointing work is not scheduled to take place immediately after the cable has been pulled into the joint bay, the joint bay will be covered until the jointing works can take place. Along public road sections, temporary reinstatement of the road surface will be carried out over the joint bay.

END

Outline Construction Methodology			
Title:	**110kV Cable Jointing**	**Ref:**	**GC-OCM-15**

General Description

Cable jointing is carried out at the joint bays in order to join two lengths of cable.

Duration

Circa 2 days per joint bay

Personnel	Machinery & Equipment	Materials
▪ 2 Cable Jointers ▪ 1 Excavator Operator	▪ Tractor Unit and trailer with Hi-Ab or City Crane ▪ Heating blankets ▪ Hand tools ▪ Jointing Container ▪ 360˚ excavator ▪ 1 no. Tipper Truck or tractor and trailer	▪ Sand for pipe bedding ▪ Cement-bound sand ▪ Sand bags ▪ Road surface dressing, if required.

Standard Method

- Prior to cable installation, traffic management signage will be reinstated and the works area secured.
- A jointing container will be transported to the joint bay location and lifted into place and positioned over the joint bay using a Hi-Ab or city crane,
- The jointing container will provide a controlled environment in the joint bay where the cables will be heated for several hours using heating blankets.
- After the cables are heated the cable jointing procedure will be carried out,
- Jointing works will involve the joining of the cables and the sealing of ducts in the joint bay using hand held equipment ensuring the area and cable is kept clean from any dust or dirt.
- Following the completion of jointing and duct sealing works in the joint bay, the cable joints will be supported by placing compacted cement-bound sand in c. 200 mm layers up to the level of the cable joint.
- Testing will then be carried out on the joint once it is fully supported by the sand base.
- Once testing is complete additional layers of cement-bound sand will be laid and compacted in the joint bay chamber until the cement-bound sand is 100mm above the level of the top of the joint,
- A cable protection strip is then placed over the compacted sand 100mm above the joint.
- The surface over the chambers are then permanently reinstated using manhole type covers and road surfacing material to surface level in accordance with arrangements with Tipperary County Council Roads Section and the Road Opening Licence for the works.

Photographs

Typical HV cable jointing container

END

Outline Construction Methodology			
Title:	**Replacing existing culverts along the 110kV UGC**	**Ref:**	**GC.OCM-16**

General Description

Up to 13 No. old masonry culverts may require replacement during 110kV UGC construction works. These crossings locations are W13, W14, W15, W17, W19, W20, W32, W34, W55, W57, W60, W61 and W64.

Duration

1-2 Days per location

Personnel	**Machinery & Equipment**	**Materials**
▪ 6 general operatives ▪ 2 excavator operators ▪ 1 engineer ▪ Hydrologist	▪ 13 ton excavator ▪ 1 tipper truck ▪ Vibrating compaction plate ▪ Consaw ▪ Hand tools ▪ Cones ▪ Compressor and airspades ▪ Steel plates ▪ Cable detector	▪ Pre-cast bottomless culverts (for W14) ▪ Precast concrete pipe culverts ▪ Clause 804 Material ▪ 150mm rock fill ▪ 160mm and 125mm diameter uPVC ducting ▪ Red cable marker strip ▪ Yellow marker warning tape ▪ CGBM4 semi dry lean mix concrete ▪ Duct spacers ▪ Road Dressing surface material

Installation of a new culvert structure or replacing an existing culvert structure

1. A new HDPE culvert or precast pipe culvert will be installed in the watercourse.
2. Minimum 900mm culverts will be used and will be set 300mm into the stream bed. A precast bottomless box culvert will be used at watercourse crossing W2, W3 and W14, the walls of the bottomless culvert will be placed at the sides of the watercourse, 300mm into the streambed.
3. The trench will be backfilled with crushed stone and the road surface reinstated

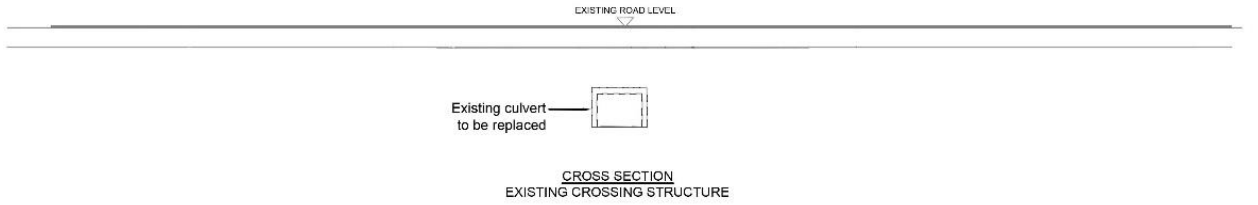
- A dam will be constructed, upstream of the works location, using sand bags containing washed sand.
- A mobile pump will be set up beside the watercourse and will pump the water through hoses, from the upstream side of the dam to a point downstream below the works. The pumped water from the hose will be released downstream onto a suitable splash plate to prevent erosion.
- Silt traps, such as geotextile membrane, straw bales etc. will be placed upstream and downstream of the in-stream works to minimise sedimentation effects.
- The cable trenching and crossing structure works can then be carried out in the dry bed.
- If required, a temporary sump will be established and used to collect any leakages of water from the dam. This water will be removed by pumping to an infiltration trench or settlement pond if the soil is not saturated, otherwise the water will be pumped to a suitable water treatment train, such as a Siltbuster, where any sediment will be allowed settle before the water is released.
- A trench will be excavated in the dry stream bed and cable ducts will be laid and trench backfilled with existing bed material.
- At W14, a precast bottomless box culvert will be installed at watercourse crossing W2 and W3, the walls of the bottomless culvert will be placed at the sides of the watercourse, 300mm into the streambed.
- At the remaining locations, precast concrete culverts, (sized for peaked flood flows) will be set 300mm into the watercourse bed.
- Following the completion of works at the watercourses, the dam will be removed – deflector plates will be used during the restoration of flow in the watercourse.

- The watercourse will be reinstated by reinstating the bank slopes and character and stabilizing the banks using boulder armour or willow/brush bank protection, and reinstating instream flow features such as boulder substrates, pool / riffle sequences, or spawning cobbles; and planting will be carried out along the riparian margins.
- The road above the works area will be backfilled and a road surface dressing will be laid.

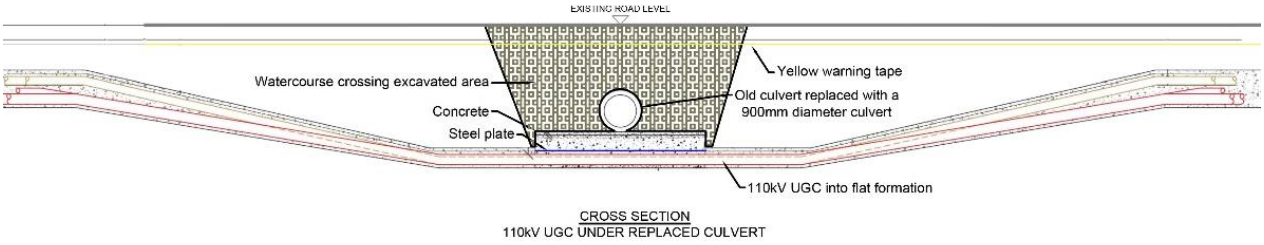
Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC 5.20: Cross Sections of Replaced Culvert along the 110kV UGC

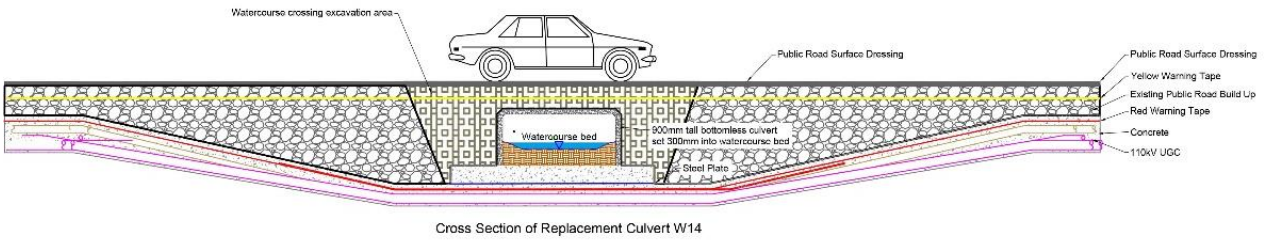
Existing culvert



Replaced culvert



Bottomless culvert at W14



END

Outline Construction Methodology			
Title:	**Raising road level and parapet walls at Rockvale Bridge (W6), Tooreenbrien Bridge (W36) and Anglesey Bridge (W53)**	**Ref:**	**GC-OCM-17**

General Description

Following the installation of the 110kV UGC over watercourse bridge crossing W7, W36 and W53, the parapets walls and road surface level will be raised slightly.

Duration

1-3 days per location

Personnel	Machinery & Equipment	Materials
• Site engineer • 2-3 stone masons • Engineer • Conservation archaeologist • Conservation engineer	• Masonry tools • Hand tools • Surface dressing machine	• Pre-mixed mortar • Cut stone • Stainless steel railings and posts • Debris netting • Surface dressing

Standard Method: Raising Parapet Walls at W36 and W53

- Works to bridge parapet walls at watercourse crossings W7, W36, W53 will be carried out during dry weather, and debris netting will be fixed to the outside of the walls in order to prevent any debris falling into the watercourse below. (Project Design Measure)
- Cut stone and pre-mixed mortar will be delivered to the works location as required.
- The existing coping stones will be removed, existing parapet walls will be repaired and then built up to 1.25m above the final road level. The wall will be capped with the original coping stones.
- Care will be taken to ensure no debris falls into the debris netting.
- Following the completion of works the area will cleared of all equipment, machinery and materials.

Standard Method: Installation of Stainless Steel Rail at W7 and W53

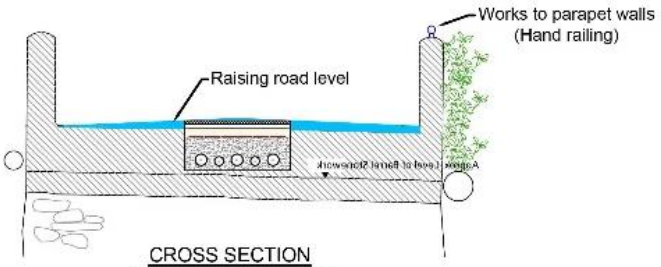
- At bridge crossing W7, a 150mm high stainless steel railing will be installed along the top of one parapet wall. At bridge crossing W53 there is an option to install a 250mm high stainless steel railing on top of both parapet walls.
- Works to bridge parapet walls at watercourse crossings W7, W36, W53 will be carried out during dry weather, and debris netting will be fixed to the outside of the walls in order to prevent any debris falling into the watercourse below. (Project Design Measure)
- The railing will be installed by core drilling the top of the parapet wall and setting the railing posts in concrete in the cores. The rails will then be attached to the posts once set in place.
- Following the completion of works the area will cleared of all equipment, machinery and materials.
-

Raising Road Surface Levels at W7, W36 and W53

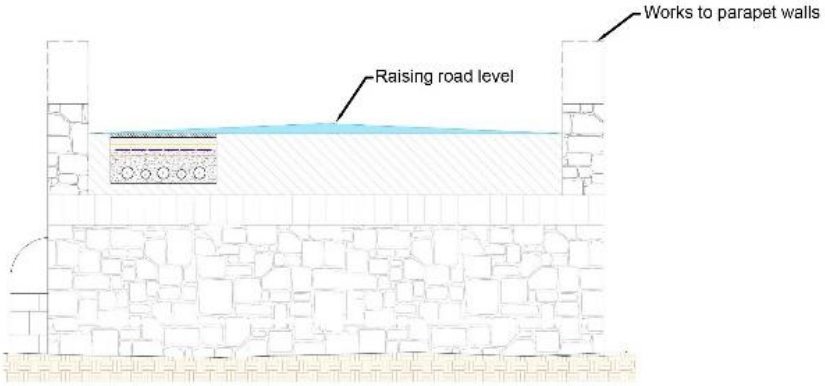
- The full road surface over bridge crossings W7, W36 and W53 will be surface dressed after the completion of all works at these locations. Surface dressing will be carried out using road surfacing material in accordance with arrangements with Tipperary County Council Roads Section and the Road Opening Licence for the works.
- The final road surface level will be c.23cm, c.14cm and c.35cm higher than existing levels over bridge crossings W7, W36 and W53 respectively.

Relevant Drawings from Volume C3 EIAR Figures

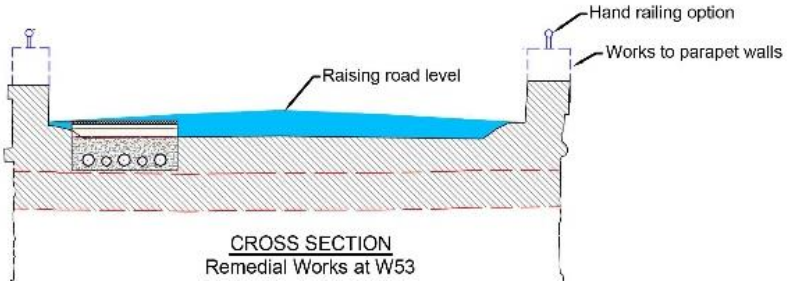
Extract from Figure GC 5.17: Remedial Works to Bridges at W7, W36 and W53



CROSS SECTION
Remedial Works at W7



CROSS SECTION
Remedial Works at W36



CROSS SECTION
Remedial Works at W53

END

Outline Construction Methodology			
Title:	**Horizontal Directional Drilling at W8 and W9**	**Ref:**	**GC-OCM-18**

General Description

Horizontal Directional Drilling (HDD) will be used to install the 110kV UGC under the 2 no. bridges at watercrossing W8 and W9.

Duration

2-3 days per location

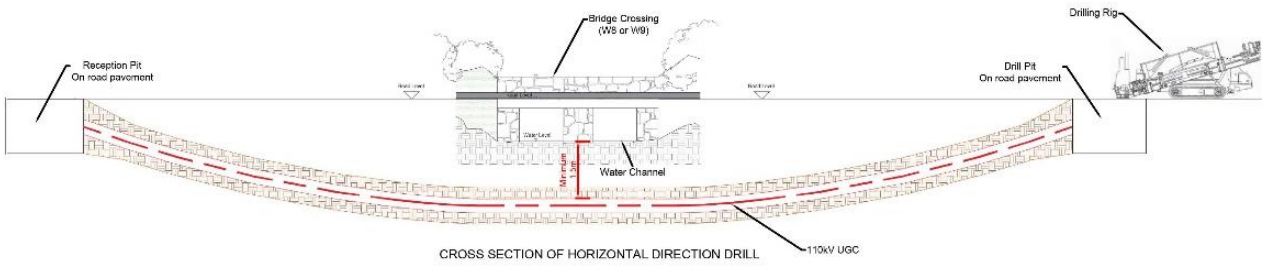
Personnel	Materials	Machinery & Equipment
▪ 1 Mud Engineer ▪ 1 Watercourse watcher ▪ 2-3 Drillers ▪ 1 Excavator Operator ▪	▪ Fencing materials ▪ 50mm crushed Stone ▪ Ducting ▪ Bentonite ▪ Silt fencing ▪ Sand Bags containing washed sand ▪ Straw bales ▪	▪ Horizontal Directional Drilling Rig ▪ Drilling fluid recycling system ▪ 360˚ excavator ▪ 1 no. Tipper Truck or tractor and trailer ▪ Tractor and vacuum tank ▪ Siltbuster ▪ Plastic or timber mats ▪ PVC bunds. ▪

Standard Methods

- Drilling activities will be carried out at least 10m from the watercourse crossings W8 and W9 along the public road. Silt fencing and Sand Bags containing washed sand will be set up between the drilling rig and the watercourse.
- A launch pit and a reception pit (5m wide x 2m long x 1.5m deep) will be excavated within the public road, all excavated material will be loaded and taken away to licenced landfill.
- An overflow pit will be created beside the launch pit to cater for any excess drilling fluid. All runoff from the construction works area will be directed into a suitable water treatment train such as a Siltbuster and treated for sediment. This will also mean that any contaminated water can be contained and removed off-site to a licensed waste facility.
- The location assembly will be fitted in the drill head by the system operator, and the driller will push the drill string into the ground and will steer a bore path beneath the bed of the water course.
- The drill head will be fitted with a sensor to allow early detection of an obstruction across the drilling path. This will allow the drilling rods to be retracted and steered around the obstacle avoiding the potential for pressure to build up inside the borehole.
- The system operator will constantly monitor fluid volume, pressure, pH, weight and viscosity during the drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
- The cutting material will be flushed back by drilling fluid. The excess material will be collected in a container and removed off site to a licensed waste facility.
- While the drilling is in progress below the river bed, a mud engineer will be deployed in the watercourse to monitor the watercourse bed, in order to alert the driller at the earliest time of a developing frac out.
- When the pilot bore reaches the reception pit at the other side of the river, the drill head will be removed and a reamer will be fitted. The reamer will be drilled back enlarging the borehole to the desired size. The ducting is then attached to the swivel behind the reamer and pulled back to the rig through the borehole. At all times the driller engineer monitors the pulling forces and pressures down hole.
- The duct will then be cleaned and proven and its as-laid location recorded.
- On completion of the works, the drilling rig will be removed from the launch pit and all equipment will be removed from site.
- The pits will be backfilled and road surface reinstated, the silt fences and sand bags will then be removed.

Relevant Drawings from Volume C3 EIAR Figures

Extract from Figure GC5.18: Horizontal Directional Drilling at W8 and W9



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