C1 – Public

Borrisbeg Grid Connection

Chapter 3: Development Description

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Borrisbeg Grid Connection
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3 Development Description

3.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the Proposed Grid Connection and all its component parts. The planning application for the proposed development will be made to An Coimisiún Pleanála. Construction methodologies for the main infrastructural components of the Proposed Grid Connection are included in this chapter. The proposed development for the purposes of the accompanying Section 182A application corresponds to the Proposed Grid Connection comprising the following:

i. *A 110 kilovolt (kV) 'loop-in/loop-out' Air-Insulated Switchgear (AIS) electrical substation, including 2 no. single-storey control buildings with staff welfare facilities, underground wastewater storage tank, all associated electrical plant, cabling, equipment and apparatus, and security fencing, within a substation compound with a total footprint of approximately 1.41ha;*

ii. *2.1 kilometre 110kV underground cabling route, with 0.9km following the public road corridor and 1.2km along new proposed access track across agricultural grassland (including joint bays, communication and earth sheath link chambers and all ancillary works along the route);*

iii. *2 no. lattice-type end masts with a height of 16 metres to facilitate connection to the existing 110kV Ikerrin-Thurles overhead electricity transmission line;*

iv. *1 no. temporary construction compound (including offices and staff welfare facilities);*

v. *Vegetation removal and Spoil Management;*

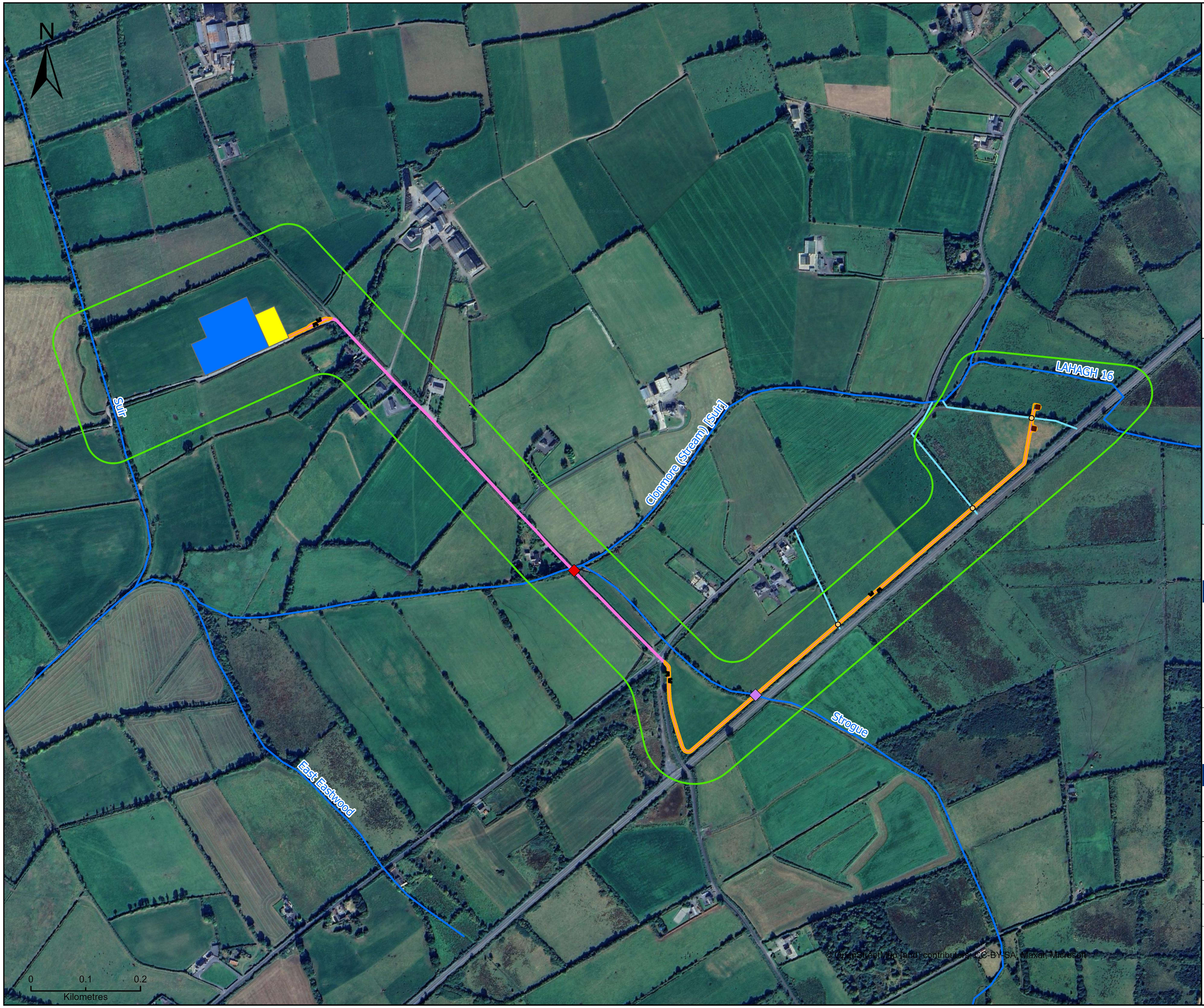
vi. *Site Drainage; and*

vii. *All ancillary works and apparatus.*

A ten-year planning permission is sought.

The layout of the Proposed Grid Connection is illustrated on Figure 3-1. Refer to Appendix 3-1 for Planning Drawings pertaining of the proposed infrastructure elements.

The construction and exact layout of electrical equipment in the on-site electricity substation will be to EirGrid/ ESB Networks specifications. The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers within the underground cabling route corridor assessed is subject to approval by EirGrid/ESB Networks. The Grid Connection infrastructure will remain in place as it will become part of the National Grid under the ownership and control of ESB Networks and EirGrid. The Proposed Grid Connection will connect the Consented Wind Farm (ABP Ref: 318704) to the national grid via a loop in loop out connection to the existing overhead Ikerrin to Thurles 110kV line.



Legend

- EIAR Boundary
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- Field Drain Culverts
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- Proposed Cabling Route in Public Road (to be upgraded)
- Field Drains
- EPA Watercourses

Data Sources: EPA

Client

Buirios Ltd

Borrisbeg Grid Connection

Title

Borrisbeg Grid Connection Design

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3.1.1 Statement of Authority

This section of the EIAR, has been prepared by Karen Mulryan and reviewed by Paul Chadwick, of RPS. Karen is a Senior Environmental Scientist with RPS with over 9 years' experience in the consultancy sector. Karen holds a BA in International in Archaeology from NUI Galway and a MSc in Archaeology from the University of Edinburgh. Karen's expertise is in project management, environmental impact assessment, wind energy site selection and feasibility assessment. Karen has experience managing wind farm Environmental Impact Assessment Report applications of various scales including SID applications across Ireland. Karen holds memberships with the Chartered Institute for Archaeologists (ACIfA) and the Institute of Archaeologists of Ireland (IAI).

Paul is a Technical Director with the Energy, Environment and Resources Sector and leads the team responsible for environmental, waste and resource management and assessment of infrastructural and industrial projects for RPS in Ireland. Paul specialises in the fields of air quality and climate. He has considerable experience, both academic and professional, in ambient air quality and a wide range of atmospheric pollutants from waste / wastewater, road traffic, air traffic, industrial and stationary sources. As a result of two years research in atmospheric chemistry, he has an in-depth knowledge of the chemical and physical transformations associated with local and regional air pollution and climate change. Paul is a trained and experienced expert witness and is supported by a team of multidisciplinary environmental experts across RPS in Ireland.

3.2 Proposed Grid Connection Component Parts

3.2.1 Electricity Substation

It is proposed to construct a 110 kV electricity substation within the Site, as illustrated in Figure 3-1. This substation will be situated in the northwest part of the Site, within the townland of Clonmore. The construction and arrangement of the electrical equipment in the substation will adhere to the specifications set by EirGrid/ESB Networks. Access to the substation will be provided from the Local Road L-70391, which runs along its southern boundary, as well as through the internal wind farm roads accessible from the L-3248 to the northwest of the Consented Wind Farm. After the decommissioning of the Consented Wind Farm, the proposed 110 kV substation in Clonmore will remain in place and become part of the national grid infrastructure.

The footprint of the proposed on-site 110 kV substation compound is approximately 11,600 m² and will feature two control buildings along with the necessary electrical components to consolidate the energy generated by each wind turbine of the Consented Wind Farm and facilitate its export to the national grid. The layouts and elevations of the proposed substation are depicted in Appendix 3-1 Planning Drawings.

The 110 kV substation compound will be enclosed by steel palisade fencing, approximately 2.6 meters high, or as otherwise specified by ESB. Additionally, internal fencing will separate different areas within the main substation. For details on the fencing, please refer to Appendix 3-1 Planning Drawings.

Further details regarding the connection between the on-site 110kV substation and the national electricity grid are provided in Section 3.7.2 below.

3.2.2 Substation Control Buildings

Two control buildings for the substation will be situated within the compound. The Independent Power Producer (IPP) Control Building will measure approximately 18 metres by 11 metres and approximately 7 metres in height. The Transmission System Owner (TSO) Control Building will measure approximately 18 metres by 25 metres and approximately 7.5 metres in height. Refer to Appendix 3-1 for Planning Drawings of the proposed 110kV substation.

The control buildings will include staff welfare facilities do operational phase. Bottled water will be available for drinking if needed. Toilet facilities will feature low-flush cisterns and low-flow wash basins. Given the specific requirements of the Proposed Grid Connection, the water demand for occasional toilet flushing and hand washing will be minimal, meaning a potable water source is not necessary. It is proposed to either collect rainwater from the roofs of the buildings or, alternatively, install a groundwater well adjacent to the substation, following the guidelines set by the Institute of Geologists Ireland 'Guidelines for Drilling Wells for Private Water Supplies' (IGI, 2007). The well will be flush with the ground and covered by a standard manhole. A pump house will not be needed, as an in-well pump will convey water to a tank located in the roof space of the control building.

On-site wastewater treatment is not planned. Wastewater from the staff welfare facilities in the control buildings will be managed using a sealed underground storage tank, with all wastewaters being transported off-site by a licensed waste collector to a permitted wastewater treatment facility.

This approach to wastewater management has become standard practice at wind farm sites, which are often located in areas where meeting the necessary percolation requirements for on-site treatment can be difficult. This method has been accepted by various Planning Authorities and An Coimisiún Pleanála as a viable solution.

The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. Full details of the proposed tank alarm system can be submitted to the Planning Authority in advance of any works commencing on-site. The wastewater storage tank alarm will be part of a continuous stream of data from the sites' turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the substation underground storage tank.

3.2.3 Substation Temporary Construction Compound

The proposed 110kV substation will require a dedicated temporary construction compound. This compound will cover an area of approximately 2,540 m² and will be situated adjacent to the proposed 110kv substation. The construction compound will feature a bunded refuelling and containment area for storing lubricants, oils, site generators, and other materials, as well as a full retention oil interceptor, a waste storage area, temporary site offices, staff facilities, and parking spaces for both staff and visitors. Temporary port-a-loo toilets within a staff portacabin will be used during the construction phase. Wastewater from the staff toilets will be directed to a sealed storage tank, with all wastewater being transported off-site by a licensed waste collector to wastewater treatment facilities. Additionally, there will be a water supply on-site for hygiene purposes, provided through a temporary storage tank. Refer to Appendix 3-1 Planning Drawings for details.

3.2.4 Underground Electrical 110kV and Communication Cabling

It is proposed to construct an underground cabling connection between the proposed onsite 110kV substation and the existing 110kV Ikerrin to Thurles overhead line (OHL). The route for the grid connection cabling will be approximately 2 km long, traversing a combination of local road (L-7039, L-7038), approx. 5m of the R433 and a new access track across agricultural land. This underground cabling route will intersect two watercourses: one located within the L-7039, which will be crossed using a Directional Drilling method, and the second, situated in agricultural land, will be crossed via a clear span culvert, meaning no in-stream work is proposed (refer to section 3.7.8 below). Six joint bays (described in section 3.7.7 below) are required along underground cabling connection.

The existing OHL will be broken by two new end masts (lattice-type towers) to facilitate the connection to the proposed on-site substation through the underground electrical cabling. The underground cabling route will consist of two parallel cable trenches, and once constructed, electricity on the Ikerrin-Thurles 110kV OHL will be transmitted through the proposed substation, hence the ‘loop-in/loop-out’ configuration of the substation.

The construction methodology for the Proposed Grid Connection underground electrical cabling is detailed in Section 3.7.2 below. The route for the underground electrical cabling is illustrated on Figure 3-1. The trench cross sections for the 110kV grid connection cabling are illustrated in Appendix 3-1 Planning Drawings.

3.2.5 New Access Tracks

Due to the ground conditions, new access roads within agricultural fields are proposed to be founded on competent stratum. The standard make-up of the founded access tracks will be a stone thickness of c.500mm. Cross section details of new excavated roads is shown in Appendix 3-1 Planning Drawings . The general construction methodology for construction of excavated roads is summarised in section 3.7.3.

3.2.6 End Masts

It is proposed to connect the on-site 110kV substation to the existing 110kV Ikerrin to Thurles overhead line (OHL). Two proposed end masts (lattice type towers) will be located immediately beneath the existing OHL. Please see Appendix 3-1 Planning Drawings for location details. The existing OHL conductor will be terminated at these masts to facilitate a new OHL loop connection following the proposed approx. 2.1km underground grid connection route leading to the on-site 110kV substation. Please see section 3.7.5 for the construction methodology for the new end masts. Please see Appendix 3-1 Planning Drawings for details.

3.2.7 Joint Bays

Six joint bays, in groups of two are proposed along the proposed underground grid connection cable route. Two joint bays are proposed under the new track located to the east of the proposed substation in the townland of Clonmore and the remaining four are located in groups of two, approximately 750m apart in two separate agricultural fields in the townland of Strogue. Therefore, public access/traffic will not be impacted during the placement or maintenance of the proposed joint bays. Please see Appendix 3-1 Planning Drawings for details and section 3.7.7 for construction methodology.

3.2.8 Watercourse Crossings

To facilitate the construction of the Proposed Grid Connection underground cabling route, it is required to cross the Clonmore River and Strogue Stream, and 3 no. field drains. The Clonmore Stream crossing will be by horizontal directional drilling (HDD) under an existing bridge on the L-7039, the Strogue Stream will be crossed by installing a new clear span crossing, and the 3 no. field drains will be crossed by installing new culverts using corrugated pipes. A general description of the various construction methods employed at watercourse crossings are described in section 3.7.8.

3.2.8.1 Watercourse Crossing No 1-Directional Drilling

It is proposed to cross the Clonmore watercourse on the L-7039 via the Horizontal Directional Drilling (HDD) method. This method comprises drilling under obstacles such as bridges, culverts, railways, water courses, etc. to install cable ducts under the obstacle. The HDD method will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, for the directional drilling at watercourse/culvert crossings. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep. The pits will be excavated with a suitably sized excavator. Refer to section 3.7.8 for the construction methodology and Appendix 3-1 Planning Drawings.

3.2.8.2 Watercourse Crossing 2- Clear Span Watercourse Crossing

It is proposed to cross the Strogue watercourse located in agricultural land, via the construction of a clear-span watercourse crossing. This watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Prior to the construction of the crossing, the Project Civil/Structural Engineer and the Project Hydrologist will conduct confirmatory inspections of the designated new watercourse crossing locations. Abutments will be built using precast units combined with in-situ foundations, which will be set in suitable backfill material. Refer to section 3.7.8 and Appendix 3-1 Planning Drawings for construction methodology and illustrative details, respectively.

3.2.8.3 Culvert Crossings

All new proposed culverts and proposed culvert upgrades at field drain crossings required for the Proposed Grid Connection will be suitably sized for the expected peak flows in the watercourse. Culverts will be constructed as per the methodology detailed in section 3.7.8.3. Refer to Appendix 3-1 Planning Drawings for details.

3.2.9 Sand and Stone Requirements

The volumes of granular fill (sand and stone) required for the construction of the Proposed Grid Connection will be locally sourced from licenced quarries. Please see Table 3-1 for required volumes and Figure 3-2 below for a map of all licenced quarries within 20km range of the Site that could potentially provide stone and concrete. Traffic movements generated by the Proposed Grid Connection are discussed in in Section 14.2 of Chapter 14, Material Assets. Sand and Stone volumes have been estimated using the following methodology:

- The soil beneath the substation, temporary construction compound and end masts will be excavated and replaced with construction grade granular fill up to the existing ground level.
- Roads will generally comprise approximately 500-600mm of granular fill (constructed in layers and finished with a capping layer). Geotextiles separators will be placed on the subgrade and geogrids will be installed within the road build-up, as required by the site engineer.

Table 3-1: Estimated sand and stone requirements for the Proposed Grid Connection

Component	Area m^2	Stone Fill Required m^3
Permanent 110kV Substation	11,600	6,960
Temporary substation construction compound	2,540	1,520
Access Roads: reinstatement of L-7039 and new road in agricultural lands, cable route and 2 no. end masts	8,500	4,860
Total Approx m^3 including 12.5% contingency factor		**15,000**

Note: A contingency factor of 12.5% has been applied and is included to the excavated spoil volumes above to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.

3.2.10 Spoil Management Plan

3.2.10.1 Quantities

The approximate quantity of spoil requiring management for the Proposed Grid Connection is presented in Table 3-2 below.

Table 3-2: Approximate Spoil Volumes Requiring Management

Component	Spoil Volume (m3) (approx.)
Permanent 110kV Substation and temporary construction compound	13,500
Grid Connection cabling Route and 2 no. end masts	3,600
Total Spoil to be managed m3 (including 10% contingency factor)	**18,810**

Note: A contingency factor of 10% has been applied and is included to the excavated spoil volumes above to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.

3.2.11 Spoil Management Areas

Some of the excavated materials from the Grid Connection underground electrical cabling route will go to an appropriate licenced facility as required. This is dependent on the road makeup at locations along the underground electrical cabling route. The remaining spoil will be managed into linear berms alongside the new access tracks proposed along the grid connection cable route within agricultural fields. A berm will also be provided at the substation, up to 4m high creating visual screening of the substation from the local roads during the operational phase. Refer to Appendix 3-1 Planning Drawings for details.

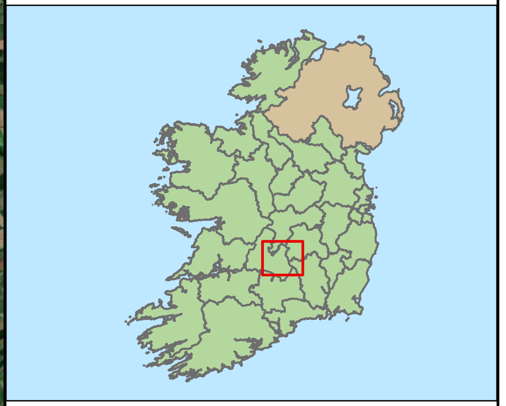
The following recommendations and best practice guidelines for the placement of spoil in alongside access roads (will be adhered to during the construction of the Proposed Grid Connection:

1. The placement of spoil will be restricted to a maximum height of 1 m for roadside berms and 4 m for the substation berm, subject to confirmation by the Geotechnical Engineer.
2. Where practical, the surface of the placed spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spoil will be carried out as placement of spoil within the area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed spoil.
3. The surface of the deposited spoil will be profiled to a gradient to be agreed with the Geotechnical Engineer and vegetated or allowed to vegetate naturally as indicated by the Project Ecologist.
4. All the above-mentioned general guidelines and requirements will be confirmed by the Geotechnical Engineer prior to construction.

Legend

- EIAR Boundary
- EIAR Boundary 20km Buffer
- Quarries

Data Sources: GSI



Client

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Title

Licenced Quarries Within 20km

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3.3 Environmental Management

A Construction and Environmental Management Plan (CEMP) has been prepared to manage all onsite activities for both the Consented Wind Farm and the Proposed Grid Connection. Refer to Appendix 3-2 of this EIAR.

The CEMP sets out the key environmental considerations to be considered by the contractor during construction of both the Consented Wind Farm and the Proposed Grid Connection. The CEMP includes details of drainage, spoil management and waste management, and details the mitigation and monitoring measures to be implemented in order to comply with the environmental commitments outlined in the EIAR. The contractor will be contractually obliged to comply with all such measures. In the event planning permission is granted for the Proposed Grid Connection, the CEMP will be updated prior to the commencement of the development, to address the requirements of any relevant planning conditions pertaining to the Consented Wind Farm and Proposed Grid Connection, including any additional mitigation measures which are conditioned and will be submitted to the Planning Authority for approval.

3.3.1 Refuelling

Where possible, vehicles will be refuelled off-site. On-site refuelling of machinery will take place in designated refuelling areas located throughout the Site. Heavy plant and machinery will be refuelled on-site by a fuel truck that will arrive to Site as required on a scheduled basis. Other refuelling will be carried out using a mobile double-skinned fuel bowser, which, when not in use, will be parked only on a level area within the Site.

Only trained and authorised personnel will be permitted to refuel equipment on-site. Mobile measures, such as drip trays and fuel absorbent mats, will be used during refuelling activities, as necessary. Additionally, all equipment will be supplied with fuel absorbent materials and pads to address accidental spills, should spills occur.

3.3.2 Concrete Deliveries

During the construction phase, only ready-mixed concrete will be used, with all concrete supplied by local batching plants via concrete delivery trucks. This approach will mitigate any potential environmental risks associated with on-site batching.

Before leaving the Site, the washing of delivery trucks will be kept to a minimum, specifically limited to the chute of the concrete lorry, and confined to designated washout areas. Concrete trucks will be washed out fully at the off-site batching plant, where appropriate facilities are already in place.

The small amount of water generated from washing the concrete lorry's chute will be directed into a temporary lined impermeable containment area or a Siltbuster-type concrete wash unit, or equivalent. This type of Siltbuster unit captures solid concrete and filters the wash liquid for pH adjustment and the further separation of solids. Residual liquids and solids will be removed from the Site by a licensed waste collector for disposal at an authorised waste facility. Where temporary lined impermeable containment areas are employed, these will typically be constructed using straw bales and lined with an impermeable membrane.

The areas are covered when not in use to prevent rainwater accumulation. During dry weather, the covers can be removed to allow for much of the water to be lost to evaporation. After the concrete pours are completed, any remaining liquid will be transported off-site in tankers to an authorised facility as needed. Any solid residue cleaned from the chute will have solidified and can be broken up and disposed of along with other construction waste. The risks of pollution arising from concrete deliveries will be further reduced by the following:

i. Concrete trucks bodies will be washed out at batching plants only.

ii. The arrangements for concrete deliveries to the Site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.

iii. Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted at the Site.

iv. Weather forecasting will be used to assist in planning large concrete pours and avoiding large pours where prolonged periods of heavy rain is forecast.

v. Restricting concrete pumps and machine buckets from slewing over watercourses (including drains and ditches) while placing concrete.

vi. Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.

vii. Ensuring that covers are available, and used, when necessary, for freshly placed concrete to avoid the surface washing away in heavy rain.

viii. The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit or equivalent.

ix. Disposing of any potential, small surplus of concrete after completion of a pour in suitable locations away from any watercourse or sensitive habitats.

3.3.3 Dust Suppression

In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the Site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and temporary construction compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, as this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

3.3.4 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. The site roads will be well finished with compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt. A road sweeper will be available if the public roads (L-7039/1, L-7038 and R433) require cleaning during the construction of Proposed Grid Connection.

Wheel wash facilities will also be provided at the temporary construction compound. Refer to **Plate 3-1** for a proposed self-contained wheel wash system for use during the construction phase of works. The contractor will be responsible for ensuring that all vehicles egressing the site have used the wheel wash facilities.

Plate 3-1: Example of self-contained wheel wash system. Source: https://www.glanaco.ie/product/wheel-wash-bath-system/

3.3.5 Waste Management

The accompanying CEMP includes a waste management plan (WMP) which outlines the best practice procedures during the construction phases of the Proposed Grid Connection (and the Consented Wind Farm). The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of both projects. Disposal of waste will be seen as a last resort. The WMP was produced in line with the EPA's 2021 document 'Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects'.

The Waste Management Act 1996 and its subsequent amendments establish measures to improve waste management, recycling, and recovery practices. Additionally, the Act provides a regulatory framework to comply with higher environmental standards set out by other national and EU legislation.

The Act requires that all waste-related activities must have the necessary licenses and authorisations. It is the responsibility of the Waste Manager on-site to ensure that all contractors hired to remove waste from Site hold valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. Both the hired waste contractors and the receiving facilities must comply with the conditions specified in their respective permits, licenses, and authorisations.

The Contractor will appoint a Construction Waste Manager before the commencement of the construction phase. The Construction Waste Manager will oversee the implementation of the WMP objectives, ensuring that all hired waste contractors have the necessary permits/licenses, and authorisations, and that the waste management hierarchy is followed. The Construction Waste Manager must have sufficient authority to ensure compliance with the WMP by all personnel involved in the development.

The WMP will include systems to record all construction waste generated, recycled, recovered and transported from the site. This system will enable the contractor to measure and record the quantity of waste being generated, identify the primary sources of waste, and assess waste generation against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

3.4 Site Access and Transportation

3.4.1 Site Entrances

The location of construction phase and operational phase Site access points are shown in Figure 3-3. A detailed Traffic Management Plan (TMP) will be prepared by the Applicant / Contractor and agreed with Tipperary County Council. Measures to be included in the TMP are detailed in Chapter 14 and the Appendix 3-2 CEMP of this EIAR. In the event planning permission is granted for the Proposed Grid Connection, an updated Traffic Management Plan will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.

3.4.2 Primary Grid Connection Site Entrance

The L-7039 and L-70391 runs along the eastern and southern boundary of the proposed onsite substation field, respectively. Access to the proposed substation field will be via two existing gated entrances immediately off the L-70391 and off the L-7039. Access to the end masts will be via an new entrance off the L-7038.

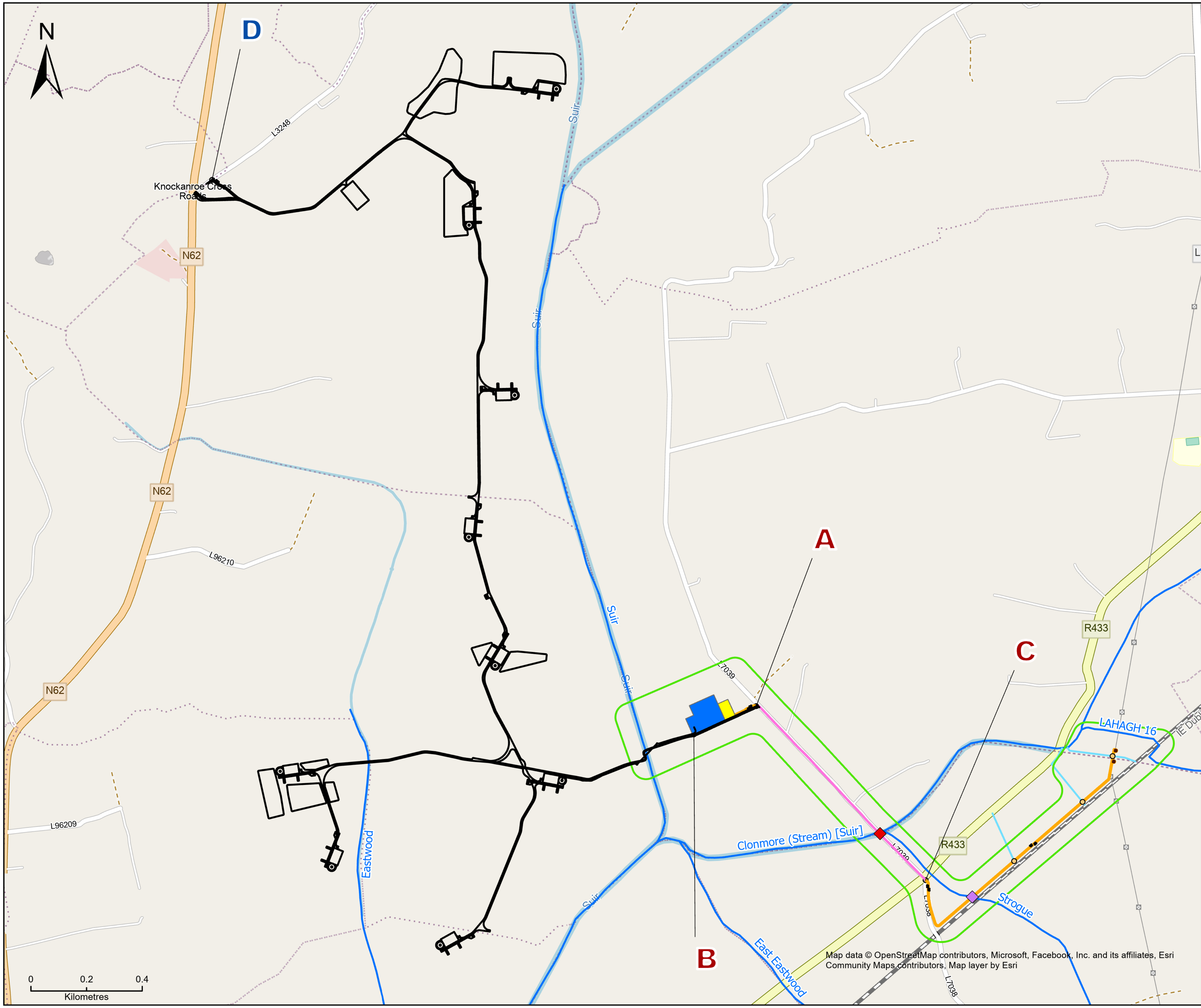
As part of the Consented Wind Farm design, approx. 460m of the L-70391 will be widened while its entire length, approx. 1.1km from its junction with the L-7039 running west into the Consented Wind Farm, will be resurfaced. This road upgrade will accommodate both construction and operational phase access for both the Consented Wind Farm and Proposed Grid Connection, as well as access to lands involved in both developments.

3.4.3 Secondary Grid Connection Site Entrance

The Consented Wind Farm design includes for the construction of a new entrance off the L-3248 which will act as the main entrance for the construction of the Consented Wind Farm. On completion of the construction phase, this Site entrance will be reduced in size and gated for security and will continue to provide operational phase access to both the Consented Wind Farm and the Proposed Substation, as well as agricultural access in lieu of the closure of an adjacent existing field gate.

3.4.4 Construction Materials Transport Route

Construction materials will be delivered to the Site via selected haul routes that will be determined based on the source of the construction material. Quarries within a 20km range of the Site that could potentially provide stone and concrete are illustrated on Figure 3-2. Traffic movements generated by the Proposed Grid Connection are discussed in Section 14.2 of Chapter 14, Material Assets.



Legend

Consented Wind Farm

Entrances

- Primary Construction and Operation Entrances
- Secondary Operation Entrance
- EIAR Boundary
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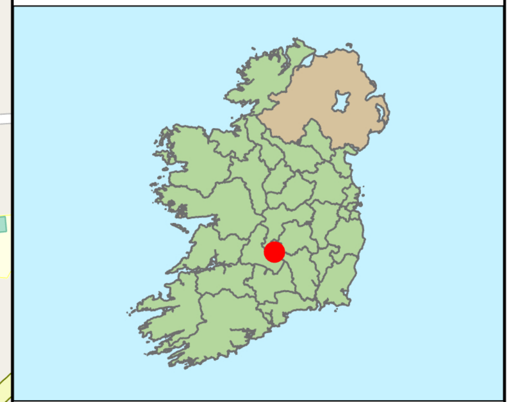

Client

Buirios Ltd

Borrisbeg Grid Connection

Title

Site Entrances

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NOTE:

3.5 Site Drainage

3.5.1 Introduction

The drainage design for the Proposed Grid Connection has been prepared by Hydro-Environmental Services Ltd (HES). The drainage design has been prepared based on experience of the project team on other grid connection infrastructure projects and the best practice guidance documents referred to in the References section of the EIAR.

The protection of the watercourses within and surrounding the Site and downstream catchments is important to establish the most appropriate drainage proposals for the Proposed Grid Connection.

The drainage design for the Proposed Grid Connection has been developed to ensure that there is no significant adverse effect on the water quality of the Site and its associated rivers, thereby preventing any impact on downstream catchments and ecological systems. The assessment of potential impacts on hydrology and hydrogeology due to the construction, operation and decommissioning (where relevant) of the Proposed Grid Connection is included in Chapter 8: Hydrology and Hydrogeology.

No natural drainage routes will be modified as part of the Proposed Grid Connection. The foundations for the substation and end mast, as well as the proposed new tracks, are designed to avoid crossing natural watercourses. Where the cabling route for the underground grid connection crosses watercourses, this will be undertaken via horizontal directional drilling (HDD) and clearspan crossings, thereby avoiding in-stream work, as outlined in section 3.7.8. There will be no direct discharges into any natural watercourses or land drains; instead, all drainage water will be managed as overland flows. All discharges from the proposed work areas will be directed over vegetation filters at an appropriate distance from natural watercourses and drains.

3.5.2 Existing Drainage Features

As discussed above, the routes of any natural drainage features will remain unchanged as part of the Proposed Grid Connection. One new clear span watercourse crossing is necessary, along with the requirement to upgrade or install 3 no. drain crossings. These drains are typically field drains that run alongside hedgerows and field headlands.

There will be no direct discharges into natural watercourses or drains. All discharges from the proposed work areas or interceptor drains will be directed over vegetated ground at a suitable distance from watercourses. Buffer zones surrounding existing natural drainage features have influenced the layout of the Proposed Grid Connection and are marked on the drainage design drawings. Refer to Appendix 3-1 for detailed design drawings including the proposed drainage design.

Where artificial drains currently exist near the proposed work sites, these drains may need to be redirected to minimize water accumulation in the vicinity of the work areas. If it is not feasible to divert the artificial drains, drains will be blocked to prevent sediment-laden water from flowing directly into other watercourses. Blocking of the drains will only occur after an alternative drainage system to manage the same water has been established.

Existing artificial drains near the L-7039/1, L-7038 and R433 will be preserved in their existing locations where possible. If it is expected that these artificial drains will receive drainage water from works areas post treatment, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

3.5.3 Drainage Design Principles

The key principles of drainage design that will be implemented and adhered to as part of the Proposed Grid Connection are as follows:

i. Keep clean water clean by intercepting it where possible, upgradient of works areas, and divert it around the works areas for discharge as diffuse overland flow or for rewetting of land.
ii. Collect potentially silt-laden runoff from works areas via downgradient collector drains and manage via series of avoidance, source, in-line, treatment and outfall controls prior to controlled diffuse release as overland flow or for rewetting of land.
iii. No direct hydraulic connectivity from construction areas to watercourses or drains connecting to watercourses.
iv. Where possible, maintain 50-metre watercourse buffer zones for all watercourses.
v. No alteration of natural watercourses.
vi. Maintain the existing hydrology of the Site.
vii. Blocking of existing manmade drainage as appropriate.
viii. Daily inspection and recording of surface water management system by on-site Environmental Clerk of Works and immediate remedial measures to be carried out as required and works temporarily ceased if a retained stormwater/sediment load is identified to have the potential to migrate from the Site.
ix. Use of siltbuster or equivalent system if required.

Drainage water from any work areas on the Site will not be directed into any natural watercourses. Two distinct methods will be used to manage drainage water within the Site. The first method involves keeping clean water clean by avoiding disturbances to natural drainage features, minimising activities around artificial drainage features, and redirecting clean surface water flow away from excavations and construction zones. The second method involves collecting drainage water from work areas that may contain silt or sediment, allowing for attenuation and settlement before controlled diffuse release. The drainage design aims to maximise erosion control, which is more effective than managing sediment during periods of heavy rainfall and requires less maintenance. The area of exposed ground will be minimised, and the drainage measures will prevent runoff from adjacent areas from entering the work sites, thereby reducing the volume of sediment-laden water that needs to be managed. Discoloured run-off from any construction area will be kept separate from natural clean run-off. A schematic line drawing of the proposed drainage design is shown in Figure 3-4 below.

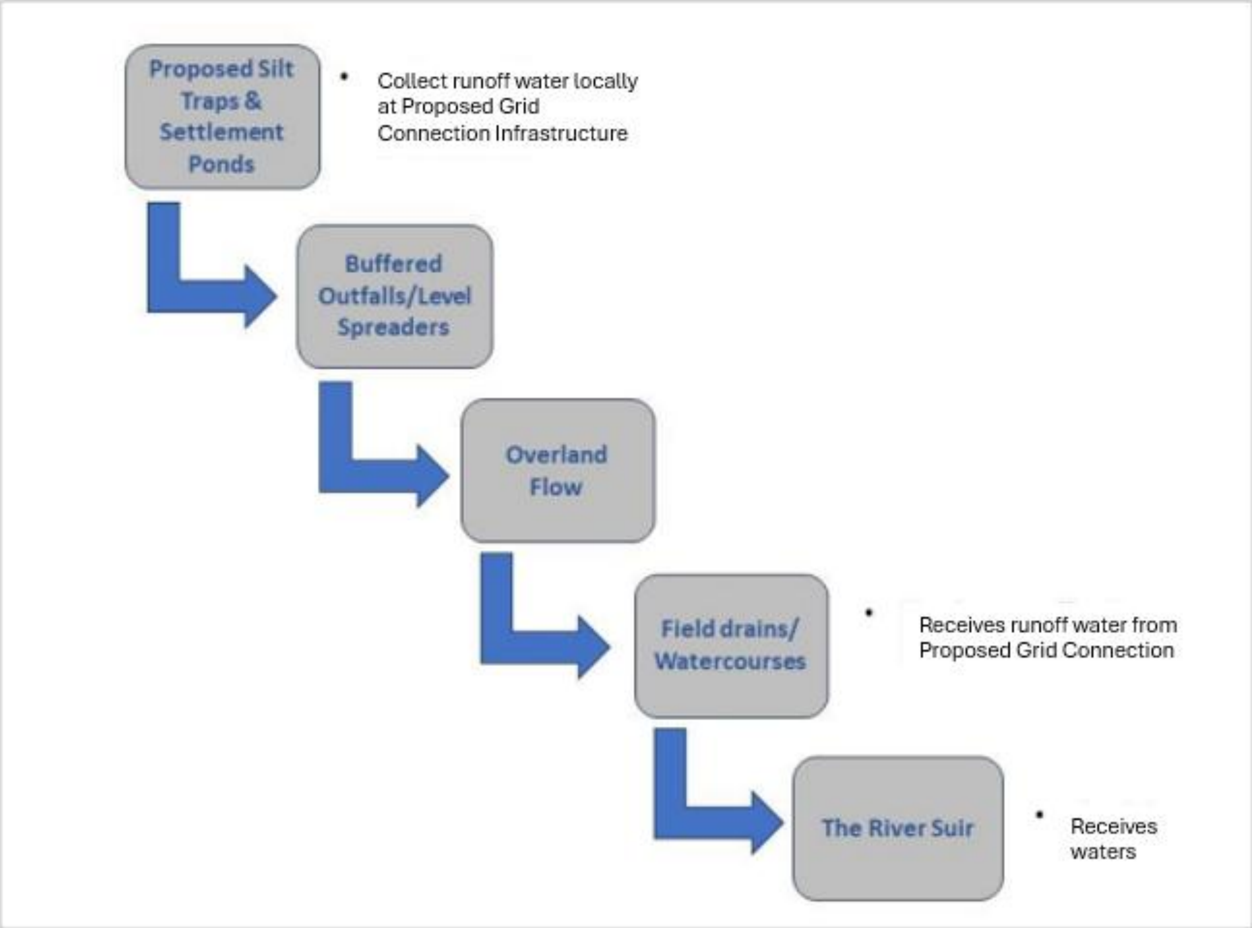

Figure 3-4: Proposed Grid Connection Drainage Process Flow

3.5.4 Drainage Design

A drainage design for the Proposed Grid Connection, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 3-1 to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission, 2011. Forests and Water: UK Forestry Standard Guidelines, Fifth Edition. Edinburgh: Forestry Commission.
- Coillte Forest, 2013. Operations and Water Protection Guidelines.
- Forest Services, (Draft). Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures.
- Forest Service, 2000. Forestry and Water Quality Guidelines. Johnstown Castle Estate, Co. Wexford: Department of Agriculture and Food.
- COFORD, 2004. Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads.
- Inland Fisheries Ireland, 2016. Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses.
- Scottish Natural Heritage, 2019. Good Practice During Wind Farm Construction.

- UK Guidance Note, 2020. GPP1 - General Guide to Prevention of Pollution.
- UK Guidance Note, 2018. GPP5 – Works or Maintenance in or Near Watercourses.
- Construction Industry Research and Information Association (CIRIA), 2006. Guidance on Control of Water Pollution from Linear Construction Projects. CIRIA Report No. C648.
- Construction Industry Research and Information Association (CIRIA), 2006. Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London.

3.5.4.1 Interceptor Drains

Interceptor drains will be installed upgradient of any work areas to collect surface runoff and prevent it from reaching excavations and construction zones where it could come into contact with exposed surfaces and pick up silt and sediment.

The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow, thereby minimising the volume of potentially silty runoff that needs to be managed within the construction area.

The interceptor drains will be installed prior to the commencement of any main construction activities. The material excavated to create the drains will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is anticipated that the majority of the interceptor drains can be removed as there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads or hardstands, will have been built up with large grade hardcore, which when compacted in place, will retain enough void space to allow water to infiltrate into the subsurface of these constructed areas.

It is not expected that roadways or other installed site infrastructure will significantly intercept ground-conveyed surface water runoff to the extent that it would cause scouring, overtopping, or spillage. When the drains are removed, each drain will be backfilled with material from the diversion dike. In some locations, such as where tracks are installed on slopes, interceptor drains may need to be retained to prevent the tracks from acting as conduits for water that could infiltrate the roadway sub-base. In these instances, interceptor drains will be maintained in localized areas along the tracks, with culverts under the roadway to allow intercepted water to be discharged to vegetative filters downgradient of the roadway. Similarly, in localized depressions where water is likely to be concentrated more than on broader slopes, interceptor drains and culverts may remain in place after construction. An illustrative drawing of an interceptor drain is shown in Figure 3-5 below.

The velocity of flow in the interceptor will be controlled by check dams (discussed in section 3.5.4.3), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel. Interceptor drains will be installed horizontally across slopes, running parallel to the natural contour lines. The intercepted water will flow along the drains to areas downgradient of the work sites, where the drains will terminate at a level spreader (discussed in section 3.5.4.4). Across the entire length of the interceptor drains, the design elevation of the water surface along the drains will not be lower than the design elevation of the water surface at the outlet of the level spreader.

3.5.4.2 Swales

Drainage swales are shallow drains designed to intercept and collect runoff from construction areas during the construction phase. A swale is an excavated drainage channel situated along the downgradient perimeter of construction areas, intended to collect and transport any sediment-laden runoff to a sediment-trapping facility and a stabilised outlet, thus preventing it from reaching natural watercourses.

Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike. These swales will remain in place to manage runoff from roads and hardstanding areas of the Proposed Grid Connection during the operational phase. Refer to Figure 3-5 for details.

3.5.4.3 Check Dams

The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the swale is non-erosive. Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the Site, downstream of where drainage swales connect.

The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, bales will be secured to the bottom of the drainage swale with stakes. Clean 4–6-inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator. Figure 3-5 shows illustrative examples of check dams.

The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Check dams will not be used in any natural watercourses; only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

3.5.4.4 Level Spreaders

A level spreader will be installed at the end of each interceptor drain to convert concentrated water flows into a diffuse sheet flow on areas of vegetated ground. These level spreaders will be positioned downstream of any proposed work areas to minimise the risk of additional water entering construction zones within the Site.

The water in the interceptor drains will not have come in contact with the construction areas, therefore ensuring it remains free of silt and sediment. The level spreaders will channel clean drainage water onto vegetated areas, preventing the immediate reconcentration of flow below the discharge point. The discharge will occur on level or gently sloping ground to avoid erosion, as illustrated in Figure 3-5.

The slope of the channel leading to the spreader will be less than or equal to 1%, while the slope downstream of the spreader will be less than 6%. The availability of slopes with a grade of 6% or less will determine the placement of the level spreaders. If a suitable slope is not available immediately downstream of a work area at the end of a diversion drain, a piped slope drain (as discussed below) will be used to direct the water to an appropriate location.

The spreader lip over which the water will spill will be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level at both the top and bottom to prevent channelised flow from leaving the spreader or ponding behind it. The top of the spreader lip will be set 150mm above the ground behind it. Each spreader will have a minimum length of four meters and a maximum of 25 meters, with the actual length determined by the size of the contributing catchment, slope, and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area.

3.5.4.5 Piped Slope Drains

Piped slope drains will be used to safely convey surface runoff from diversion drains down slopes to flat areas, without causing erosion. Once the runoff reaches these flat areas, it will be converted back into diffuse sheet flow. Level spreaders will only be installed on slopes of less than 6% in grade. Piped slope drains will be used to transfer water away from areas where slopes are too steep to use level spreaders.

The piped slope drains will consist of semi-rigid corrugated pipes with a stabilised entrance and a rock apron at the outlet to capture sediment and dissipate water energy. The base of the drains leading into the top of the piped slope drain will be compacted and concavely formed to channel the water into the corrugated pipe. If necessary, the entrance at the top of the pipe will be stabilised with sandbags. The pipe will be secured in place by staking it at intervals of approximately 3-4 metres or by weighing it down with compacted soil. The bottom of the pipe will be placed on a slope with a grade of less than 1% for a length of 1.5 metres before discharging onto a rock apron.

The rock apron at the outlet will consist of a 6-inch stone to a depth equal to the diameter of the pipe a length six times the diameter of the pipe. opens onto the apron and will fan out to six times the diameter of the pipe over its length. Figure 3-5 shows a diagrammatic example of a piped slope drain and rock apron.

Piped slope drains will remain in place only for the duration of the construction phase of the Proposed Grid Connection. Upon completion of the works, the pipes and rock aprons will be removed, and all channels will be backfilled with the original excavated material.

Piped slope drains will be inspected weekly and after rainfall events. Inlets and outlets will be checked for sediment accumulation and blockages. Stake anchors or fill over the pipe will be checked for settlement, cracking, and stability. Any seepage holes where pipe emerges from the drain at the top of the pipe will be repaired promptly.

3.5.4.6 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of appropriate locations for these vegetation filters will depend on factors such as the size of the contributing catchment, slope, and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling ponds prior to diffuse discharge to the vegetation filters via a level spreader.

3.5.4.7 Stilling Ponds (Settlement Ponds)

Stilling ponds will be used to attenuate runoff from works areas of the Site during the construction phase and will remain in place during the operational phase to handle runoff from roads and hardstanding areas. The purpose of these stilling ponds is to capture runoff that may contain sediment and to minimise the sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed at each required location as two separate ponds in sequence, a primary pond and a secondary pond. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out. Figure 3-5 shows an illustrative example of a stilling pond system.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area the ponds will be receiving water from but will be sufficiently large to accommodate peak flows storm events. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area. All material excavated during pond construction will be used locally for landscaping and berm construction around these ponds.

Stilling ponds will be located towards the end of swales, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a swale will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow. Stilling ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

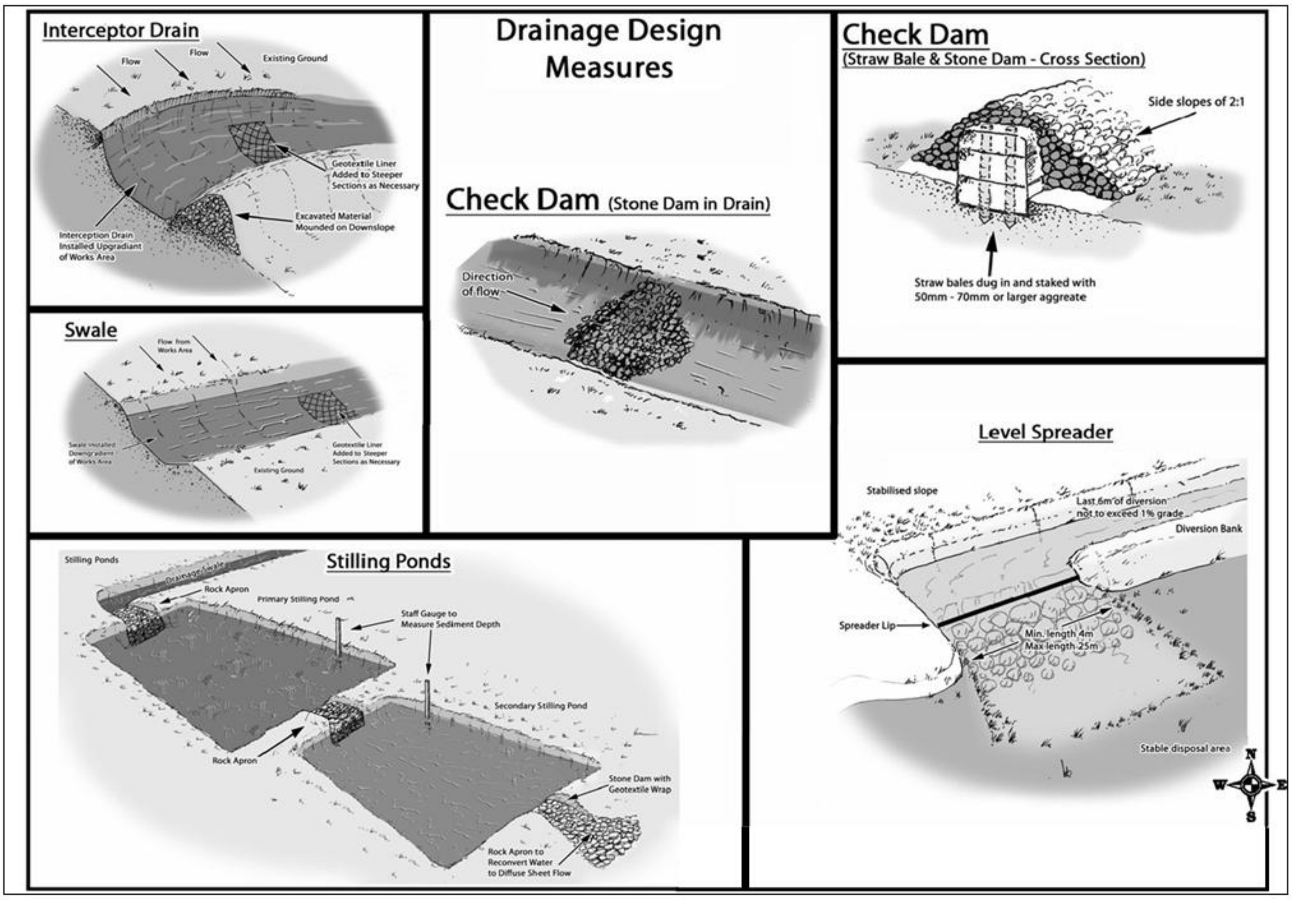

Figure 3-5: Examples of Drainage Design Measures

3.5.4.8 Siltbuster

A "siltbuster" or a similar equivalent piece of equipment will be on hand to filter any water pumped from excavation areas, if necessary, before it is discharged into stilling ponds or swales.

Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. These mobile units are specifically engineered for construction sites.

The unit stills the incoming water/solids mix and directs it upward between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, while the treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates significantly increase the effective settling area of the unit, all giving it a very small footprint on site and making it highly mobile. Refer to Figure 3-6 for an example of a Siltbuster.

These units are now regarded as best practice for managing contaminated water pumped from construction sites, and both the UK Environment Agency and the Scottish Environmental Protection Agency have recommended or specified their use in construction projects.

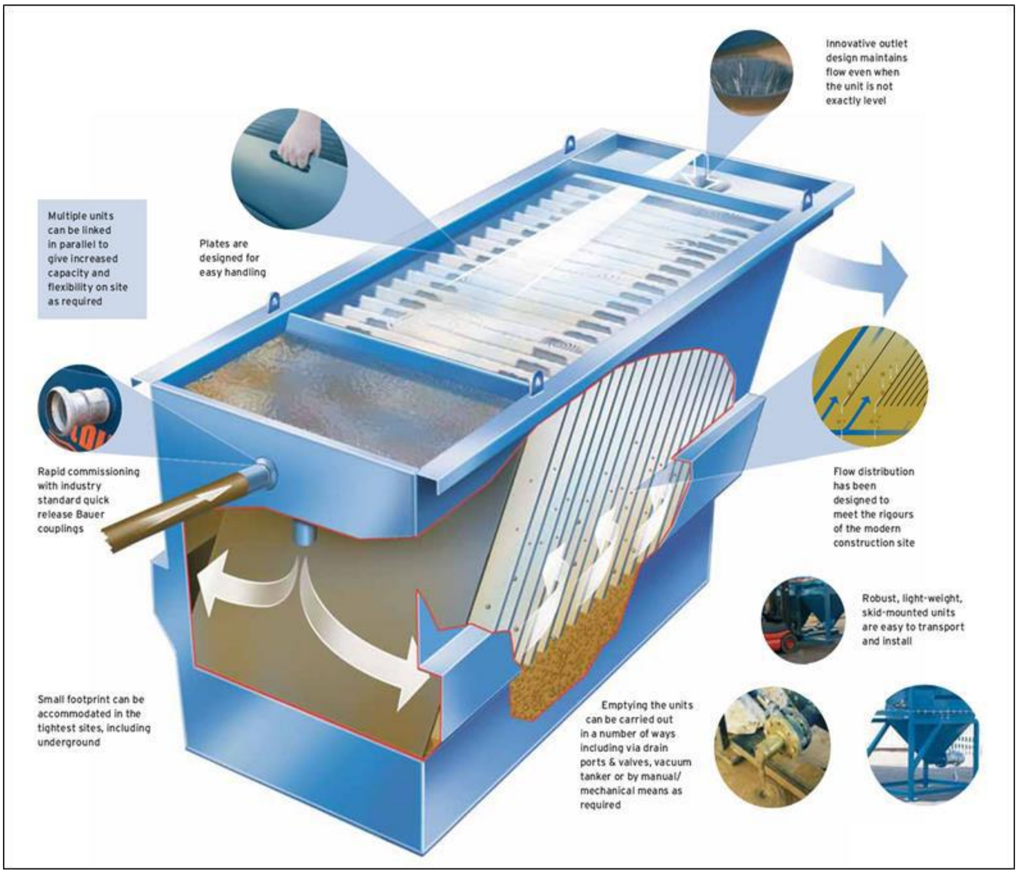

Figure 3-6: Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

3.5.4.9 Silt Bags

Dewatering silt bags permit water to flow through while capturing any silt or sediment suspended in it. These bags offer a passive, non-mechanical approach to eliminating any residual silt present in the potentially silt-laden water collected from work areas on the Site.

Dewatering silt bags are an additional drainage measure that can be used downgradient of the stilling ponds at the end of the drainage swale channels and will be located, wherever it is deemed appropriate, throughout the Site. The water will flow, via a pipe, from the stilling ponds into the silt bag. The silt bag will allow the water to flow through the geotextile fabric and will trap any of the finer silt and sediment remaining in the water after it has gone through the previous drainage measures. The dewatering silt bags will ensure that there will be no loss of silt into the stream.

The dewatering silt bag that will be used will be approximately 3 metres in width by 4.5 metres (see Plate 3-2 below) in length and will be capable of trapping approximately four tonnes of silt. The dewatering silt bag, when full, will be removed from Site by a waste contractor with the necessary waste collection permit, who will then transport the silt bag to an appropriate, fully licensed waste facility. Silt Bag with water being pumped through.

Plate 3-2: Example of Silt Bags in use. Source: [Ultra-Dewatering Bags® Oil & Sediment Model | Contain Sediment and Oil — Consolidated Containment]

3.5.4.10 Sedimats

Sediment entrapment mats made of coir or jute matting will be installed at the outlet of the silt bag to provide further treatment of the water discharging from the silt bag. These mats will be anchored to the ground using stakes or pegs. The mats will cover the entire width of the outfall to ensure that all water flows through this additional treatment system.

3.5.4.11 Culverts

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse. Some culverts may be installed to manage drainage waters from works areas of the Proposed Grid Connection, particularly where the waters have to be taken from one side of a roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow, as necessary. All culverts will be inspected regularly to ensure there is no blockage by debris, vegetation or any other material that may impede conveyance.

3.5.4.12 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone of a stream. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the drainage design drawings included in Appendix 3-1.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document ‘Control of Water Pollution from Linear Construction Projects’ published by Construction Industry Research and Information Association (CIRIA, No. C648, 1996). Up to three silt fences may be deployed in series. All silt fencing will be formed using Terrastop Premium or equivalent silt fence product. Silt fences will be inspected regularly to ensure water is continuing to flow through the fabric, and the fence is not coming under strain from water backing up behind it.

3.5.4.13 Cable Trench Drainage

Cable trenches are typically constructed in short, controlled sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences. This operation normally occurs over a period of 2-4 hours.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the up-gradient side of the trench and is temporarily sealed/smoothed over, using the back of the excavator bucket. Should any rainfall cause runoff from the excavated material, the material is therefore collected and contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation, and in the case of the Proposed Grid Connection would be transported to one of the on-site designated spoil management areas or used for landscaping and reinstatement of other areas elsewhere on-site.

3.5.5 Site Drainage Management

3.5.5.1 Preparative Site Drainage Management

All materials and equipment needed to implement the drainage measures outlined above will be delivered to the site in phases as required, during the construction process. A sufficient supply of straw bales, clean drainage stone, terram, stakes etc will be maintained on-site at all times to facilitate the implementation of the drainage design measures as needed. The drainage measures described above will be installed either before or concurrently with the works the measures are intended to drain.

3.5.5.2 Pre-emptive Site Drainage Management

The works programme for the groundworks phase of the Proposed Grid Connection will take account of weather forecasts and predicted rainfall. If heavy rain is predicted, large excavations, significant movements of overburden, or extensive soil stripping will be paused or scaled back. The degree to which these activities are scaled back or suspended will be directly proportional to the amount of rainfall forecast.

3.5.5.3 Reactive Site Drainage Management

The final drainage design prepared for the Proposed Grid Connection prior to commencement of construction will provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the Environmental Clerk of Works (ECoW) or supervising hydrologist on- site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the construction phase progresses to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be adapted on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground as a particular time.

In the event that works are giving rise to siltation of watercourses, the ECoW or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

3.5.5.4 Drainage Maintenance

An inspection and maintenance plan for the on-site drainage system will be developed prior to the commencement of any work on the Proposed Grid Connection. Regular inspections of all installed drainage features will be necessary, particularly after heavy rainfall, to check for blockages and to ensure there is no build-up of standing water in certain areas of the system where it is not intended. The Environmental Clerk of Works (ECoW) or the Project Hydrologist will be responsible for inspecting the drainage system. The drainage inspection and maintenance plan is included in the CEMP (Appendix 3-2).

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the Proposed Grid Connection to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the Proposed Grid Connection and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified by reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

Silt traps will be inspected weekly during the construction phase of the Proposed Grid Connection and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the Proposed Grid Connection. The Project Hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system.

3.6 Construction Management

3.6.1 Construction Timing

It is anticipated that the Proposed Grid Connection construction works will take approximately 9-12 months, spread across an 18 to 24 month period (the anticipated Consented Wind Farm construction programme), with small scale grid connection works occurring in most seasons. Where vegetation removal is required, e.g. segments of hedgerow, this will be done outside of breeding season, which runs from March 1 to August 31, in order to minimise any potential for impacts on nesting birds. Construction may commence from September to March so that construction activities are ongoing by the time the next bird breeding season comes around and can continue throughout that bird breeding season.

Construction activities will be carried out during normal daytime working hours (i.e., 0700 – 1900hrs Monday to Saturday). However, to ensure that optimal use is made of good weather period or at critical periods within the programme, it could be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with the Local Authority.

The main tasks required for the Proposed Grid Connection construction works are outlined below and an indicative construction schedule is illustrated in Table 3-3.

1. Upgrade existing site entrances.
2. Construct new Site roads to temporary compound.
3. Clear and hardcore area for temporary Site offices. Install same
4. Clear and hardcore area for substation footprint
5. Construct bases/plinths for substation building.
6. Install external electrical equipment at substation.
7. Install transformer at compound.
8. Erect stock proof and palisade fencing around substation area.
9. Install internal collector network and communication cabling.
10. Construct grid connection cabling.

Table 3-3: Indicative Construction Schedule

Construction Activity	Year 1				Year 2			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Health and Safety								
Environmental Monitoring								
Temporary Construction Compound, site access, fencing, gates								
Substation and Electrical Works: Construction of substation and underground cabling through road/new tracks								
Backfilling and Landscaping								
Substation Commissioning								

3.6.2 Construction Phase Monitoring and Oversight

A CEMP has been prepared for the Proposed Grid Connection, refer to Appendix 3-2 for details. The CEMP includes details of drainage management, spoil management, waste management etc, and details all the recommended mitigation and monitoring measures to be implemented during the construction phase. Should the Proposed Grid Connection receive a consent, the CEMP will be updated prior to the commencement of the construction phase to address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned and will be submitted to the Planning Authority for written approval.

The Contractor will be responsible for implementing the mitigation and monitoring measures detailed in the updated CEMP. The Contractor will also be responsible for ensuring that all construction staff understand the importance of implementing the measures. The implementation of the measures will be overseen by the ECoW or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. A system of auditing ensures that the measures are maintained for the duration of the construction phase, and into the operational phase where necessary.

3.7 Construction Methodologies

3.7.1 On-site Electricity Substation and Control Buildings

The Proposed on-site 110kv electricity substation and control buildings will be constructed as follows:

1. The area of the on-site substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and temporary stockpiled for the construction of a berm beside the substation following the reinstatement of the temporary compound.
2. 2 no. control buildings will be built within the on-site substation compound;
3. The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix;
4. The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
5. The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
6. The roof slabs will be lifted into position using an adequately sized mobile crane;
7. The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on-site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
8. The electrical equipment will be installed and commissioned.
9. Perimeter fencing will be erected.
10. The construction and components of the substation will be built to EirGrid specifications.

3.7.2 Underground Electrical (110kV) and Communication Cabling

The underground cabling works will consist of the installation of ducts in an excavated trench to accommodate electrical and fibre communications cables to facilitate a loop connection between the proposed 110kV on-site substation and the existing110kV Ikerrin to Thurles OHL. The underground electrical cabling will be laid beneath the surface of new tracks in agricultural land and the public roads (L-7039, L-7038 and R433) using the following methodology:

1. Before works commence, updated surveying will take place along the proposed cable route, with all existing culverts and services identified. All relevant bodies i.e., ESBN, Tipperary County Council etc. will be contacted and all up to date information for all existing services sought.
2. When the cable is located on public roads, a traffic management plan will be prepared prior to any works commencing. A road opening licence will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
3. A tracked 360-degree excavator will then proceed to dig out the proposed trench, typically to a depth of 1300mm, within which the ducts will be laid.

4. The cable ducts will be concrete surrounded where ducts pass under the public road and under drains or culverts.
5. Trench supports will be installed, or the trench sides will be benched or battered back where appropriate and any ingress of ground water will be removed from the trench using submersible pumps, fitted with appropriate silt filtration systems, to prevent contamination of any watercourse.
6. Once the trench has been excavated, a base-layer will be laid and compacted, comprising Clause 804, or 15 Newton CBM4 concrete as required.
7. The ducting will be installed as per specification, with couplers fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions, the ends of the ducts will be shimmed up from the bed of the trench, to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected. Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
8. Six pre-cast concrete joint bay chambers typically 2.5m x 6m x 1.75m will be installed below finished ground level, approximately 750metres apart or as otherwise required by ESB/EirGrid and electrical requirements. Please see section 3.7.7 below for details.
9. As the works progress, the as-built location of the ducting will be recorded using a total station or GPS.
10. As per the associated base-layer (Clause 804 material or 15 Newton CBM4 concrete) will be installed and compacted as per approved detail, with care not to displace the ducting.
11. Spacers will be used to ensure that the correct cover is achieved at both sides of the ducting.
12. The remainder of the trench will be backfilled in two compacted layers with approved engineer's specified material.
13. Yellow marker warning tape will be installed across the width of the trench, at 300mm depth,
14. The finished surface is to be reinstated, as per original specification.
15. Marker posts will then be placed at regular intervals (generally at joint bays and any change in direction) to denote the location of the underground cabling.

3.7.3 Temporary Construction Compound

One temporary construction compound will be located adjacent to the proposed 110kV substation and will be constructed as follows:

1. The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds will be installed around the perimeter;
2. The compound platform will be established using a similar technique as the construction of the substation platform as discussed below in section 3.7.1;
3. A layer of geo-grid will be installed where deemed necessary by the designer and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for Site offices and storage containers;
4. A limited amount of fuel will have to be stored in appropriately bunded containers and a designated area for oil storage will be constructed within the compound;
5. A waste storage area will be provided within the compound;

6. The compound will be fenced and secured with locked gates if necessary; and,
7. Upon completion of the Proposed Grid Connection, the temporary construction compound will be decommissioned and allowed to vegetate naturally.

3.7.4 Proposed Access Tracks

Where the grid connection and communication cables are laid in agricultural fields, the following steps will be undertaken:

1. Excavation will take place to a competent stratum beneath the topsoil (as agreed with the site designer and resident engineer).
2. Road construction will be carried out in sections of approximately 50m lengths i.e., no more than 50m of access road to be excavated without re-placement with stone fill.
3. The proposed new roads will be constructed at the same level as existing ground levels in order to ensure natural flow paths are maintained in areas within the floodplain.
4. Existing drains will be culverted under the proposed access track which will provide a drainage outlet for flood water following a significant flood event, preventing any damming effect from the proposed access roads within the site-specific flood zones.
5. Placement of spoil berms along the proposed access roads shall be avoided within the site-specific flood zones.
6. The road build-up will be approximately 500mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer’s specification.
7. Access roads to be finished with a layer of capping material across the full width of the road.
8. A layer of geogrid/geotextile may be required at the surface of the competent stratum.

3.7.5 End Masts

The proposed on-site 110kV substation will connect to the existing 110kV Ikerrin to Thurles overhead line (OHL). Two proposed end masts (lattice type towers) will be located immediately beneath the existing OHL. The existing OHL conductor will be terminated at these masts to facilitate a new OHL loop connection following the proposed approx. 2.1km underground grid connection route leading to the on-site 110kV substation. The following section outlines the construction methodology for the new loop in tower structures which will be constructed underneath the existing 110kV Ikerrin to Thurles OHL:

1. The Steel lattice tower sites are scanned for underground services such as cables etc.
2. A foundation c.4m x 4m is excavated and the formation levels (depths) will be checked by the on-site foreman The excavated material will be temporarily stored close to the excavation and excess material will be used as berms along the grid access track. See Plates 3-3 and Plate 3-4.
3. To aid construction, a concrete pipe is placed into each excavation to allow operatives level the mast at the bottom of the excavation. The frame of the reinforcing bars will be prepared and strapped to a concrete pipe with spacers as required. The reinforcing bars will be lifted into each excavated foundation using the excavator and chains/slings. The base and body section of each tower will then be assembled next to excavation.
4. Concrete trucks will pour concrete directly into each excavation in distinct stages.

5. A third pour for the leg of the tower 1m x 1m and will be 300mm over ground level.
6. Once the main concrete foundation pour is cured after circa five days, metal shuttering is installed to accommodate the placement of concrete around the tower legs. During each pour, the concrete will be vibrated thoroughly using a vibrating poker. Refer to section 3.3.2 for during concrete delivery details.
7. Once the concrete is set after the five days the shuttering is removed.
8. The tower foundations will be backfilled one leg at a time with the material already excavated at the location. The backfill will be placed and compacted in layers. All dimensions will be checked following the backfilling process.
9. The existing overhead line will be de-energised by ESB so work can commence on the construction of the towers.
10. An earth mat consisting of copper or aluminium wire will be laid circa 400mm below ground around the tower. This earth mat is a requirement for the electrical connection of the equipment on the tower structure.
11. Once the base section of each tower is completed and the concrete sufficiently cured, it is ready to receive the tower body. Temporary hardstands may be removed and disposed of off site where necessary.
12. A hardstand area for the crane will be created by laying geogrid material on the ground surface and overlaying this geogrid with a suitable grade of aggregate.
13. A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close to the OHL.
14. The towers will be constructed lying flat on the ground beside the recently installed tower base.
15. The conductor will be moved off centre using a stay wire and weights to anchor the stay wire to ground.
16. The tower section will be lifted into place using the crane and guide ropes.
17. The body sections will be bolted into position.
18. The conductor will be centred over the towers and held in place. Once the conductor is secured at both ends it is then cut and attached onto each tower. The small section of conductor in between the two towers will be removed and utilised as connector wire for the new towers. Refer to Plate 3-5 for a constructed tower.

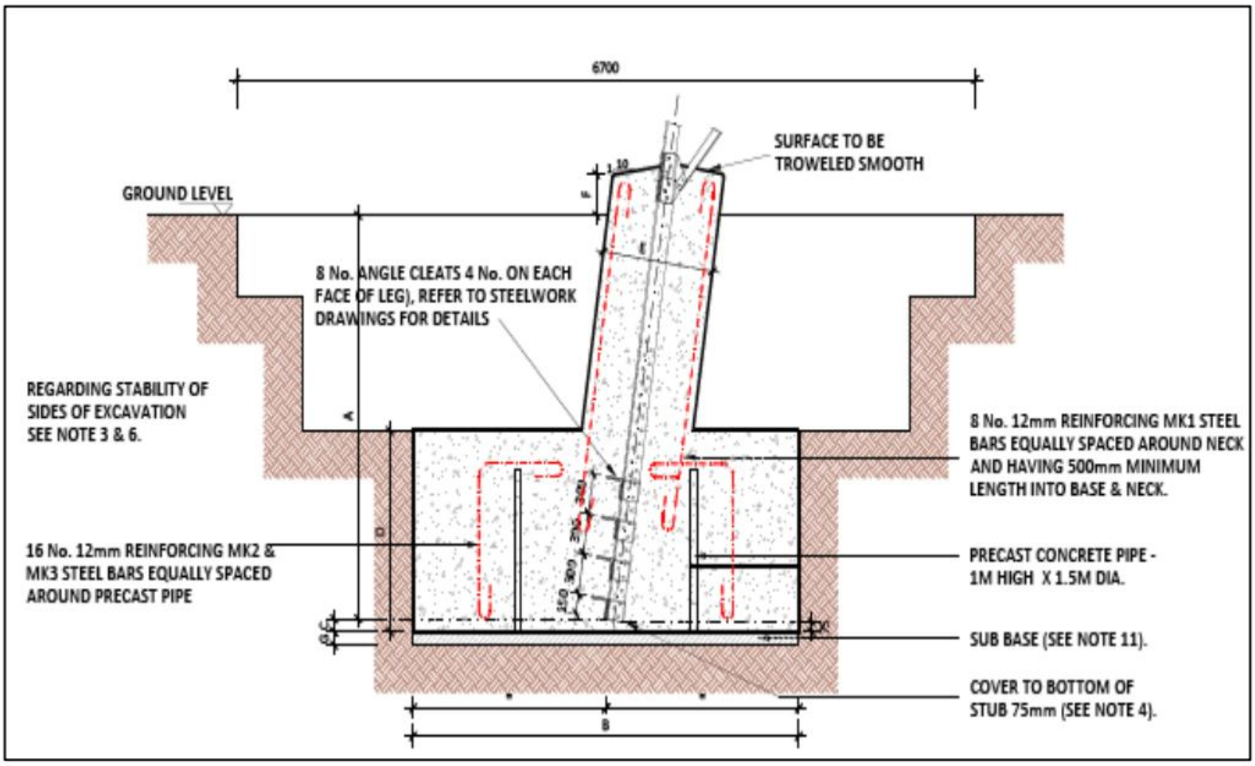

Plate 3-3: New Mast Foundation: Source: Tli Group

Plate 3-4: Standard 110kV mast foundation excavation. Source: Tli Group

Plate 3-5: Steel Lattice Tower Complete. Source: Applicant, Ardderroo Wind Farm, Co. Galway.

3.7.6 Existing Underground Services

Any underground services encountered along the cable route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300 mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations an additional layer of marker tape will be installed between the communications duct and top-level yellow marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35N concrete surrounding the proposed ducting, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate.

3.7.7 Joint Bays

Joint bays are typically pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. Bays are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level. Six joint bays, in groups of two are proposed along the proposed underground grid connection cable route, at approximately 750 metres apart or as otherwise required by ESB/EirGrid and electrical requirements. Two joint bays are proposed to be located in a new track adjacent to the L7039-1 third class road northeast of the proposed 110kV substation. The four remaining joint bays are proposed to be located in a new track in an agricultural field in the townland of Strogue. Therefore, public access/traffic will not be impacted during the placement or maintenance of the proposed joint bays. During construction, the joint bay locations will be completely fenced off once constructed and will be covered until cables are being installed. Once the cabling is installed the joint bays will be permanently backfilled with the existing surface re-instated and there will be no discernible evidence of the joint bay on the ground.

In association with joint bays, Communication Chambers are required at every joint bay location to facilitate jointing of the communication cabling. Earth Sheath Link Chambers are also required approximately every second joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground electrical cabling, installed in a flat formation, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will be pre-cast concrete structures with a steel access cover at finished surface level. The locations of the joint bays and chambers are shown on Figure 3-1. Refer to Appendix 3-1 Planning Drawings for a standard joint bay.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers within the underground cabling route corridor assessed is subject to approval by ESBN and EirGrid.

3.7.8 Watercourse Crossings

3.7.8.1 Horizontal Directional Drilling

The Clonmore watercourse crossing is located in the L-7039 road. It is proposed to cross this watercourse via the Horizontal Directional Drilling (HDD) method as described in section 3.2.8.1. This method comprises drilling under obstacles such as bridges, culverts, railways, water courses, etc. to install cable ducts under the obstacle. The directional drilling methodology for the underground grids connection cabling route is further detailed in Appendix 3-1 Planning Drawings.

1. The HDD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, for the directional drilling at watercourse/culvert crossings. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep.
2. The pits will be excavated with a suitably sized excavator.
3. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.
4. During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer

head and is forced in to void and enables the annulus which has been created to support the surrounding subsoil and thus prevent collapse of the reamed length.

5. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.
6. The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus.
7. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the Site in the same manner as other subsoil materials associated with the drilling process to a licensed recovery facility.
8. Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits.
9. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits.

3.7.8.2 Clear Span Watercourse Crossing

It is proposed to construct a clear-span watercourse crossing over the Strogue Stream along the grid connection cable route. The clear-span watercourse crossing methodologies presented below will ensure that no instream works are necessary. The standard construction methodology for the installation of a clear-span watercourse crossing is as follows:

1. The access road on the approach either side of the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of each watercourse crossing.
2. All drainage measures along the proposed road will be installed in advance of the works.
3. A foundation base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
4. Once the foundation base has been completed, the pre-cast clear span crossing will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse.
5. Where the clearspan is installed in sections, the joints will be sealed to prevent granular material entering the watercourse,
6. Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations.
7. Underground cabling ducting will be contained within the road make-up of the proposed crossing.

This watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Confirmatory inspections of the proposed new watercourse crossing location will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing Refer to Appendix 3-1 Planning Drawings for details.

3.7.8.3 Culvert Crossing

Three field drains will require new culverts/culvert upgrades. All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse. All culverts will be inspected regularly to ensure there is no blockage by debris, vegetation or any other material that may impede conveyance. Refer to Appendix 3-1 for details. The culverts will be constructed or upgraded as follows:

1. The access road on the approach to the channel will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the culvert crossing.
2. The installation of the culvert will take place in low flow conditions.
3. Where a flow exists, the water running through the drain will be pumped around the crossing location and back into the drain downstream of the works area.
4. Where over pumping is required, measures will be taken to ensure that the pumped water discharge does not disturb the stream bed with the force of water from the discharge. A steel plate to reduce the force of the flow will be used where appropriate.
5. The Project Engineer will determine the required gradient of the culvert. The pipe must be laid at a gradient that will ensure water is contained within the pipe at all times.
6. The bed of the drain will be excavated, if necessary, to achieve the correct line and to allow the pipe to be embedded 300mm into the base of the existing drain.
7. The embedded section will be allowed to fill naturally with existing material within the base of the drain or with suitable drainage material such as gravel or round shingle, where deemed applicable.
8. The culvert will be lowered into place using an excavator with a lifting mechanism.
9. Smaller 50mm stone, sourced on site will be placed upon the sub-base to construct the road over the water crossing.

3.8 Operation

A condition of the Consented Wind Farm's grant includes for an operational lifespan of 30 years from the date of full operational commissioning of the Consented Wind Farm. The proposed 110kV substation will consolidate the energy generated by each wind turbine of the Consented Wind Farm and facilitate its export to the national grid. Following the end of the Consented Wind Farm's operational lifespan, the equipment may be replaced with a new technology, subject to planning permission being obtained, or the Consented Wind Farm will be decommissioned fully. However, the Proposed Grid Connection infrastructure will remain in place as it will become part of the National Electricity Grid under the ownership and control of the ESB and EirGrid.

3.8.1 Maintenance

The electricity substation and access tracks will require periodic maintenance. The Substation will be operational 24 hours per day, 7 days a week throughout the year. Substations can be operated remotely and manually. Supervisory operational and monitoring activities will be carried out remotely using a SCADA system, with the aid of computers connected via a telephone modem link. The following maintenance procedures will also be adhered.

- Periodic service and maintenance work which include some vehicle movement.
- For operational and inspection purposes, substation access is required.
- Servicing of the substation equipment will be carried out in accordance with the manufacturer's specifications, which would be expected to entail the following:
    - Six-month service – three-week visit
    - Annual service – six-week visit
    - Weekly visits as required.

It is estimated that 1-2 daily visits will be made to the substation for authorised persons and vehicles to undertake inspections. Occasional technical problems may require maintenance visits by technical staff. During the six-month and annual service visits, some waste (lubricating and cooling oils, packaging from spare parts or equipment, unused paint, etc.) will arise. This will be recorded and removed from the site and reused, recycled or disposed of in accordance with the relevant legislation in an authorised facility. Authorised persons and vehicles (personnel cars) will periodically visit the Site to undertake minor routine maintenance and inspection, if and when required. Although the level of activity required for the maintenance of the Proposed Grid Connection infrastructure is minimal, the impacts associated with traffic volumes for this period are assessed in Chapter 14 Material Assets: Traffic and Transport.

3.8.2 Monitoring

Section 8 of the CEMP sets out a programme of monitoring required for the operational phase of the project. The CEMP should be consulted for detailed information on the monitoring requirements during the operational phase; however, a summary of the key information is provided below:

i. The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.

ii. Post-construction linear habitat restoration monitoring: Monitoring of minor segments of restored hedgerow which was removed to facilitate the construction of the access track within agricultural lands in the townland of Strogue. Monitoring will occur following the main growing season (i.e., in September) in a given year for the first five years of growth.

3.9 Decommissioning

The Grid Connection infrastructure will remain in place as it will become part of the National Electricity Grid under the ownership and control of the ESB and EirGrid.

3.10 References

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