APPENDIX 3

EIAR CHAPTER 4 DESCRIPTION OF THE PROPOSED DEVELOPEMNT

4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the development and its component parts which is the subject of a proposed application for planning permission to An Bord Pleanála in accordance with Section 37(E) of the Planning and Development Act 2000, (as amended) ('the Proposed Development').

The Proposed Development comprises:

i. *Construction of up to 17 No. wind turbines with a maximum overall blade tip height of up to 150 metres;*
ii. *1 no. Meteorological Mast with a maximum height of up to 112 metres;*
iii. *Construction of 1 no. staff welfare and storage facility including waste water holding tank;*
iv. *1 no. permanent 110 kV electrical substation with 2 no. control buildings with welfare facilities, 10 no. battery containers, battery switchgear building, all associated electrical plant and equipment, security fencing, all associated underground cabling, waste water holding tank and all ancillary works;*
v. *Underground cabling connecting the turbines to the proposed substation and connection from the proposed substation to the national grid via a 110 kV loop in connection.*
vi. *Upgrade of existing tracks, roads and provision of new site access roads and hardstand areas;*
vii. *Construction of an access track in the townlands of Breeda and Rearour South to facilitate turbine delivery;*
viii. *Junction improvement works in the townland of Killea to facilitate turbine delivery;*
ix. *3 no. borrow pits;*
x. *2 no. temporary construction compounds;*
xi. *Site Drainage;*
xii. *Forestry Felling;*
xiii. *Signage; and*
xiv. *All associated site development works.*

All elements of the proposed project as described in this chapter, including grid connection, forestry felling and replanting and any works required on public roads to accommodate turbine delivery, have been assessed as part of this EIAR.

This application seeks a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.

4.2 Development Layout

The layout of the Proposed Development has been designed to minimise the potential environmental effects of the wind farm, while at the same time maximising the energy yield of the wind resource passing through the site. A constraints study, as described in Section 3.6.1 of this EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site. The Proposed Development layout makes maximum possible use of the existing access roads and tracks within the site.

The overall layout of the Proposed Development is shown on Figure 4-1. This drawing shows the proposed locations of the wind turbines, electricity substation, borrow pits, construction compounds, internal roads layout and the main site entrance. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to this EIAR.

4.3 Development Components

This section of the EIAR describes the components of the proposed development. Further details regarding Site Drainage (Section 4.6), Constructing Phasing (Section 4.7) and Construction Methodologies (Section 4.8) are provided subsequently in this chapter.

4.3.1 Wind Turbines

4.3.1.1 Turbine Locations

The proposed wind turbine layout has been optimised using industry standard wind farm design software to maximise the energy yield from the site, while maintaining sufficient distances between the proposed turbines to ensure turbulence and wake effects do not compromise turbine performance. The Grid Reference coordinates of the proposed turbine locations are listed in Table 4-1 below.

The *'Wind Energy Development Guidelines for Planning Authorities'* (Department of the Environment, Heritage and Local Government, 2006) state at Section 5.3 that the extent of flexibility built into wind farm planning permissions with regard to turbine locations should not extend beyond 20 metres.

Table 4-1 Proposed Wind Turbine Locations and Elevations

Turbine No.	Irish Transverse Mercator Co-ordinates		Elevation (m OD)
	Easting (m)	Northing (m)	
1	603992	587718	167
2	603109	587386	174
3	603575	587412	156
4	603876	587091	146
5	603176	586974	174
6	604338	586514	142
7	603959	586377	152
8	603869	585916	167
9	603486	585581	178
10	603622	585230	181
11	603482	586139	168
12	599804	588402	176
13	599365	588089	197
14	599702	587808	187
15	600078	587585	183
16	599590	587320	191
17	600260	587156	172

Map Legend
Proposed 110 kV Substation
Proposed Compound
Proposed Borrow Pit
Collector Cabling Route
Proposed Met Mast
Proposed Turbine Location
Existing Road Proposed for Upgrade
Proposed New Road
Site Location
Regional Road
BP1
BP2
BP3
CPD1
CPD2
1
2
3
4
5
6
7
8
9
10
11
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13
14
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17
N
W
E
S
MAP TITLE: Proposed Layout
MAP NO.: Figure 4.1
SCALE: 1:20,000
PROJECT TITLE: 170749 - Lyrenacarriga Wind Farm
DATE: 18-11-2020
DRAWING BY: L Meehan
CHECKED BY: Michael Watson
ISSUE NO.: 170749-2020.11.18-D2
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4.3.1.2 Turbine Type

Wind turbines or wind energy convertors use the energy from the wind to generate electricity. A wind turbine, as shown in Plate 4-1 below, consists of four main components:

- Foundation unit
- Tower
- Nacelle (turbine housing)
- Rotor

Plate 4-1 Wind turbine components

The proposed wind turbines will have a tip height of up to 150 metres. Within this size envelope, various configurations of hub height, rotor diameter and ground to blade tip height may be used. The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed a tip height of up to 150 metres. Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics, with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times. The turbines will be grey matte in colour.

For the purposes of this EIAR, various types and sizes of wind turbines within the 150-metre tip height envelope have been selected and considered in the relevant sections of the EIAR to assess the worst-case scenario. Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds), as addressed elsewhere in this EIAR. In each EIAR section that requires the consideration of turbine parameters as part of the impact assessment, the worst-case turbine design parameters that have been used in the impact assessment are specified.

A drawing of the proposed wind turbine is shown in Figure 4-2. The individual components of a typical geared wind turbine nacelle and hub are shown in Figure 4-3.

Figure 4-4 shows a typical turbine base layout, including turbine foundation, hard standing area, assembly area, access road and surrounding works area.

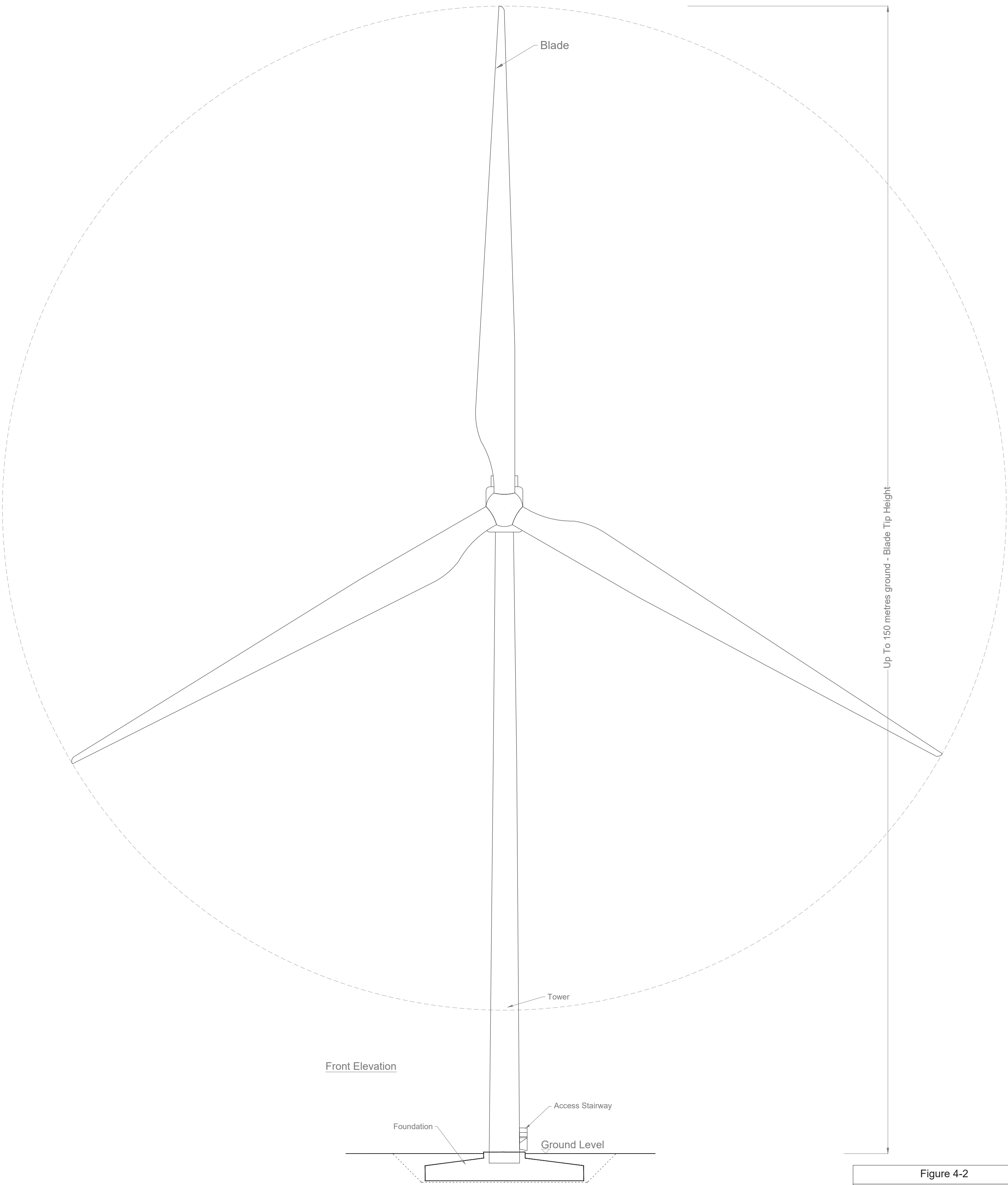

Figure 4-2

DRAWING TITLE:
Typical Wind Turbine Elevation

PROJECT TITLE:
Lyrenacarriga Wind Farm,
Co. Cork & Co. Waterford

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Lorraine Meehan**
PROJECT No.: **170749**	DRAWING No.: **170749 - 37**
SCALE: **1:500 @A3**	DATE: **04.01.2021**

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Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of up to 150m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.

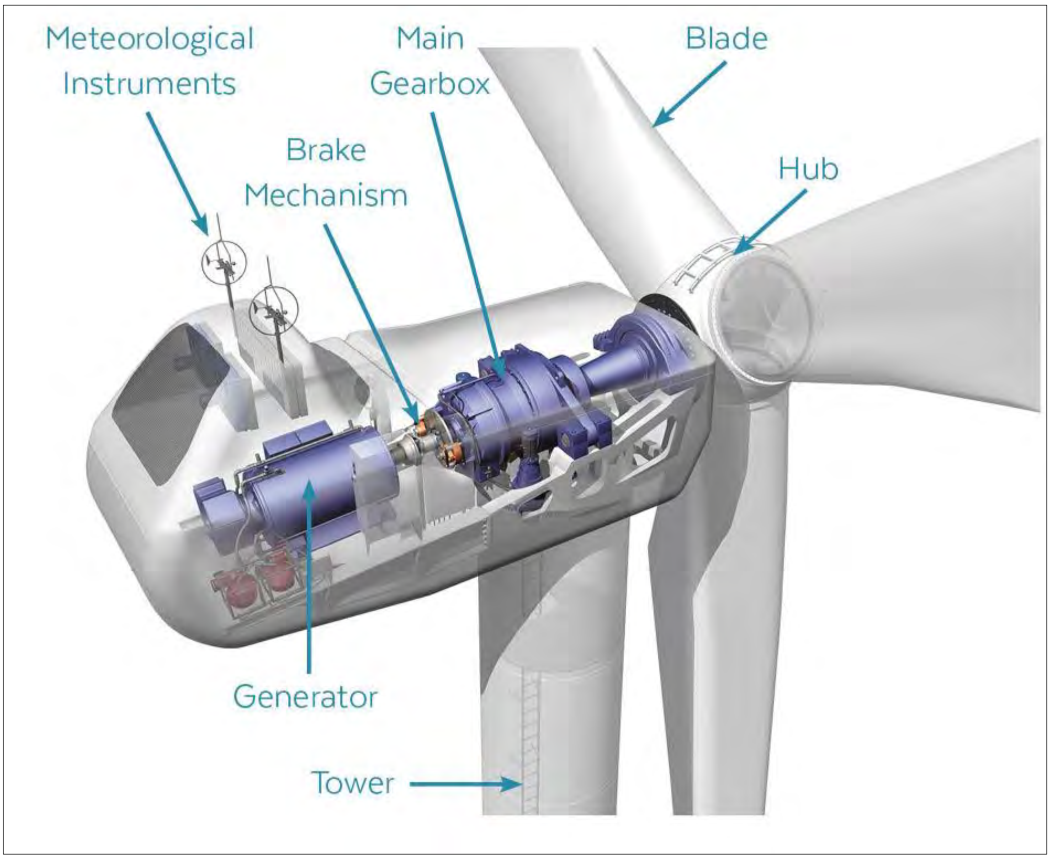

Figure 4-3 Turbine nacelle and hub components

Drawing Notes

1. Typical Layout, final dimensions and configuration will be based on manufacturer's specifications

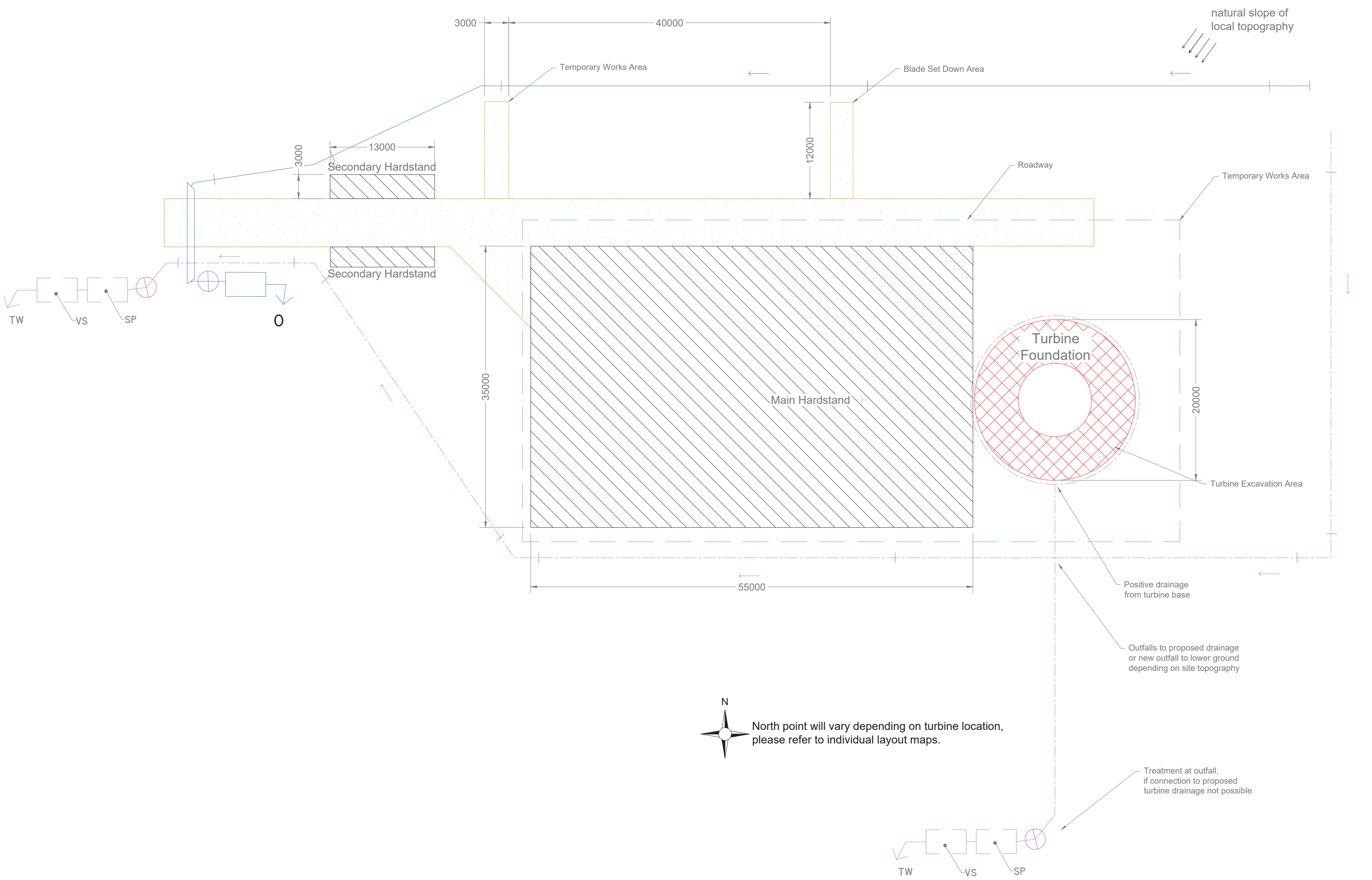

Figure 4-4

DRAWING TITLE:
Drawing Legend

- Upstream Interceptor Drain
- Swales/Downstream Collector Drain
- Direction of flow
- settlement pond - vegetation filter - level spreader
- Check Dam 'type A'
- Check Dam 'type B'
- Interceptor Ditch Culvert
- Collector Ditch Culvert
- O — Overland Flow Discharge
- TW — Treated Water Discharge
- SP — Settlement Pond
- VS — Semi-Natural Vegetation Swale / Filter Bed /secondary sp

Proposed Drainage

Typical Turbine Hardstand Layout Standard Detail

PROJECT TITLE: Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford	
DRAWING BY: Joseph O Brien	CHECKED BY: Lorraine Meehan
PROJECT No.: 170749	DRAWING No.: 170749 - 36
SCALE: 1:500 @A3	DATE: 04.01.2021

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4.3.1.3 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level. The size of the foundation will be dictated by the turbine manufacturer based on the site geotechnical characteristics, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier, and a foundation area large enough to accommodate these modern turbine models has been assessed in this EIAR. The turbine foundation transmits any load on the wind turbine into the ground. The typical horizontal and vertical extent of a turbine's foundation is shown above in Figure 4-2.

After the foundation level of each turbine has been formed on competent strata or using piling methods, the bottom section of the turbine tower "Anchor Cage" is levelled and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill or ballast to finished surface level (Plate 4-2 below). The reinstated ballast material can maintain a stoned running surface for maintenance vehicle access.

Plate 4-2 Turbine 'Anchor Cage' (left) and finished turbine base (right)

4.3.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are typically used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers, therefore this EIAR assesses an envelope area in which the hard-standings will be located. The hard-standing area is intended to accommodate a crane during turbine assembly and erection. The proposed hard standing areas shown on the detailed layout drawings included in Appendix 4-1 to this report are indicative of the sizes required, but the extent of the required areas at each turbine location may be optimised on-site within the design envelope assessed in this EIAR, depending on topography, position of the site access road, the proposed turbine position and the turbine supplier's exact requirements.

4.3.1.5 Assembly Area

Levelled assembly areas will be located on either side of the hard-standing area as shown on Figure 4-4. These assembly areas are required for offloading turbine blades, tower sections and hub from trucks until such time as they are ready to be lifted into position by cranes and to assist the main crane during turbine assembly. The exact location and number of assembly areas will be determined by the selected turbine manufacturer, therefore this EIAR assesses an envelope area in which the assembly areas will be located.

4.3.1.6 Power Output

It is anticipated the proposed wind turbines will have a rated electrical power output in the range of 3.5 to 5.0 Megawatts (MW) per turbine. Turbines of the exact same make, model and dimensions can also have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. For the purposes of this EIAR, a rated output of between 3.5 MW and 5.0 MW per turbine has been chosen to calculate the power output of the proposed 17-turbine wind farm, which would result in an estimated installed capacity of between 60 MW and 85 MW.

Assuming a minimum installed capacity of 60 MW, the Proposed Development therefore has the potential to produce approximately 183,960 MWh (megawatt hours) of electricity per year, based on the following calculation:

A x B x C = Megawatt Hours of electricity produced per year

where:

A = The number of hours in a year: 8,760 hours

B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc. A standard capacity factor of 35% is applied here

C = Rated output of the wind farm: 60 MW

The 183,960 MWh of electricity produced by the Proposed Development would be sufficient to supply 43,800 Irish households with electricity per year, based on the average Irish household using 4.2 MWh[1] of electricity.

The 2016 Census of Ireland recorded a total of 189,991 occupied households in Counties Waterford and Cork (excluding Cork City). Per annum, based on a capacity factor of 35%, the Proposed Development would therefore produce sufficient electricity for the equivalent of approximately 23% of all households in Counties Waterford and Cork (excluding Cork City).

4.3.2 Site Roads

4.3.2.1 Road Construction Types

To provide access within the site of the Proposed Development and to connect the wind turbines and associated infrastructure existing tracks will need to be upgraded and new access roads will need to be constructed.

The Proposed Development makes use of the existing forestry road network insofar as possible. It is proposed to upgrade approximately 10.7 kilometres of existing site roads and tracks, and to construct 4.1 kilometres of new access road on the site, plus 0.3 kilometres of temporary new access road on the turbine delivery route.

4.3.2.1.1 *Upgrade to Existing Roads or Tracks*

The existing tracks onsite were constructed using the excavate and replace construction technique. The general construction methodology for upgrading of existing sections of excavated roads or tracks, as

1 March 2017 CER (CRU) Review of Typical Consumption Figures Decision https://www.cru.ie/document_group/review-of-typical-consumption-figures-decision-paper/

presented in the Geotechnical Assessment Report prepared by Fehily Timoney engineering consultants (see Appendix 4-2 of this EIAR), is summarised below.

i. *Excavation will be required on one or both sides of the existing access track to a competent stratum.*
ii. *Granular fill to be placed in layers in accordance with the designer's specification.*
iii. *The surface of the existing access track will be overlaid with up to 300mm of selected granular fill.*
iv. *Access roads to be finished with a layer of capping across the full width of the road.*
v. *A layer of geogrid/geotextile may be required at the surface of the existing access road in areas of excessive rutting (to be confirmed by onsite engineer).*
vi. *For excavations in spoil, side slopes shall be not greater than 1 (v): 2. This slope inclination will be reviewed during construction, as appropriate.*
vii. *The finished road width will be approximately 5m.*
viii. *On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.*
ix. *A final surface layer shall be placed over the existing access track, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.*

A typical section of existing excavated road for upgrade is shown in Figure 4-5. .

4.3.2.1.2 Construction of New Excavated Roads

Due to the ground conditions, new access tracks proposed on site are proposed to be founded. The typical make-up of the founded access tracks is a minimum stone thickness of 500mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed during site engineering.

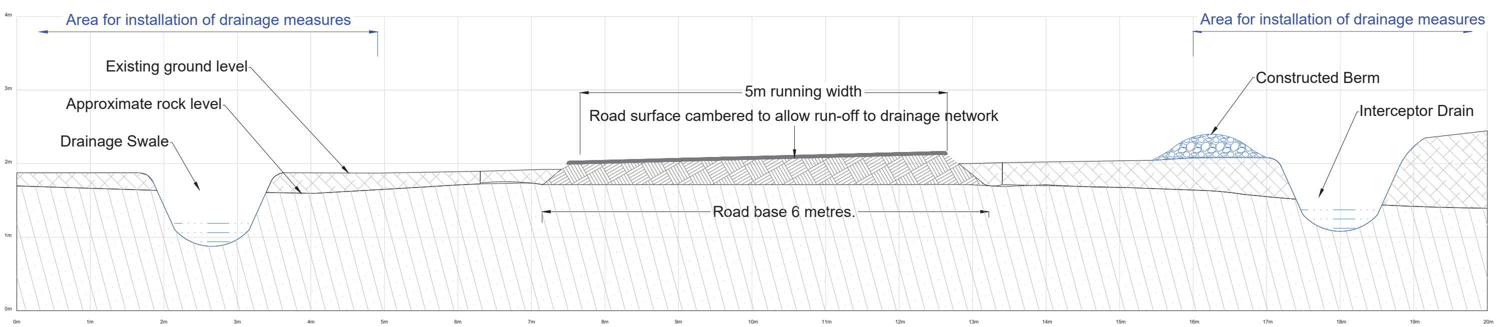
The general construction methodology for construction of excavated roads, as presented in the Geotechnical Assessment Report in Appendix 4-2 of this EIAR, is summarised below:

a. *Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.* (Typically, interceptor drains preserve existing watercourses as a 'clean water drainage system / network'; see Section 4.6.4.1 of this chapter under Drainage Design for further details.)
b. *Excavation will take place to a competent stratum beneath the topsoil (as agreed with the site designer and resident engineer).*
c. *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.*
d. *The surface of the excavated access roads will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer's specification.*
e. *Access roads to be finished with a layer of capping across the full width of the road.*
f. *A layer of geogrid/geotextile may be required at the surface of the competent stratum.*
g. *A final surface layer shall be placed over the excavated road, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.*

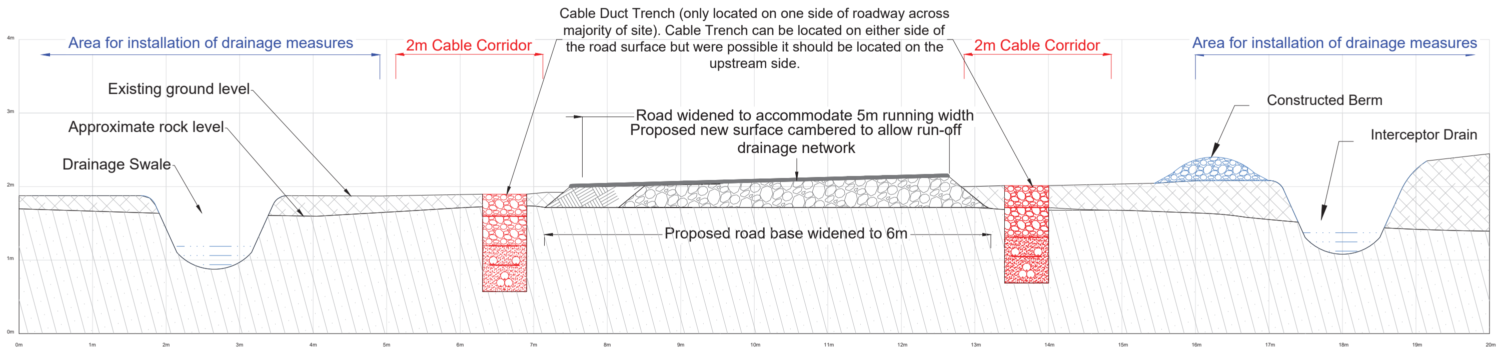
A typical section of a new excavated road is also shown in Figure 4-5.

Drawing Notes

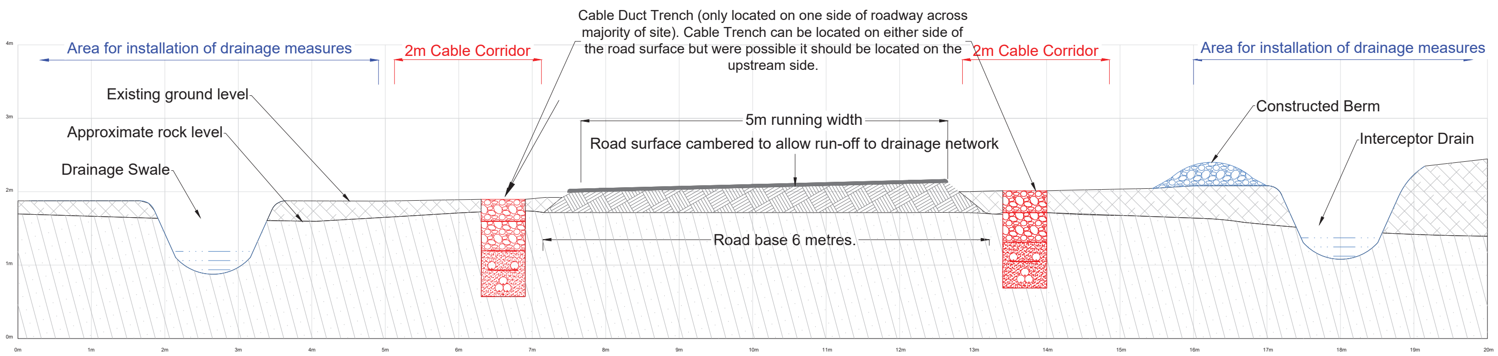
1. Widening can occur to either side of existing roads dependent on site conditions.
2. Depths of road fill to vary dependent on site conditions.



Typical new excavated access track section at Breeda Bridge.



Typical existing excavated road widening section.



Typical new excavated road section.

Figure 4-5

DRAWING TITLE:

Typical Excavated Road Sections

PROJECT TITLE: Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford

DRAWING BY: Joseph O Brien	CHECKED BY: Lorraine Meehan
PROJECT No.: 170749	DRAWING No.: 170749 - 39
SCALE: 1:75@A3	DATE: 04.01.2021

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4.3.2.2 Watercourse Crossings

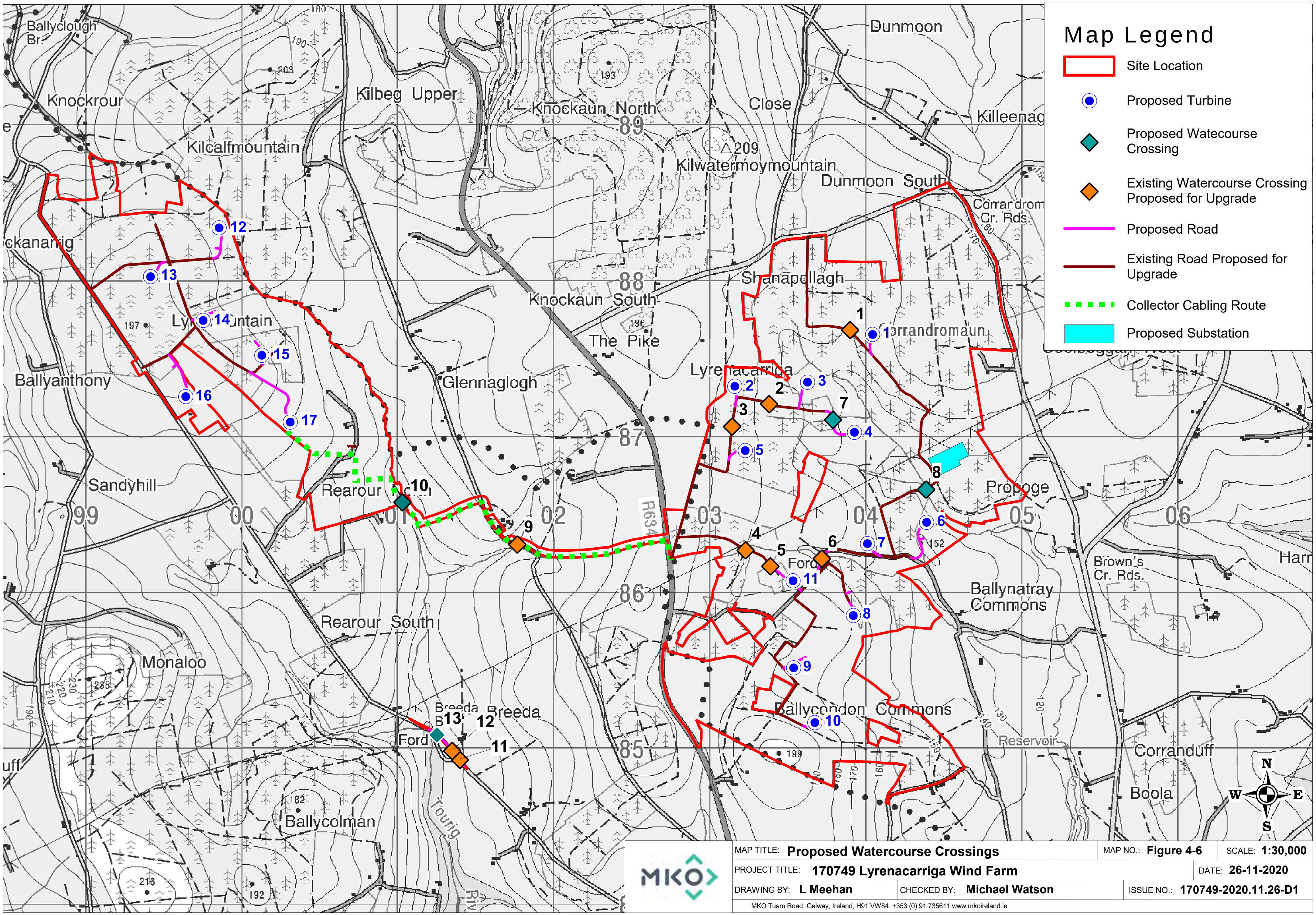
It is proposed that 2 no. new stream crossings and 6 no. existing stream crossing upgrades will be required as part of access road construction and upgrades on the wind farm site. In addition, a total of 3 no. existing crossings will be upgraded and 2 no. new crossings constructed on the proposed collector cabling route between the two turbine clusters and at the proposed new link road near Breeda Bridge.

The locations of the watercourse crossings are shown on Figure 4-6 and in the layout drawings in Appendix 4-1 of this EIAR. Watercourse crossings will be constructed using bottomless, pre-cast concrete structures, and avoid the requirement for in-stream works. Section 4.8.2.1 below presents further details on the construction methodology that will be utilised for crossings.

Table 4-2 below summaries the watercourse crossings proposed as part of the development, as shown on Figure 4-6:

Table 4-2 Proposed New Watercourse Crossings and Existing Crossings for Upgrade

No.	Description	ITM Coordinates (m)	
		Easting	Northing
Wind Farm Access Roads			
CR 1	Existing crossing proposed for upgrade	603,848	587,745
CR 2	Existing crossing proposed for upgrade	603,329	587,270
CR 3	Existing crossing proposed for upgrade	603,092	587,126
CR 4	Existing crossing proposed for upgrade	603,177	586,333
CR 5	Existing crossing proposed for upgrade	603,336	586,231
CR 6	Existing crossing proposed for upgrade	603,667	586,280
CR 7	Proposed new crossing	603,738	587,170
CR 8	Proposed new crossing	604,334	586,722
Collector Cabling Route Between Clusters			
CR 9	Existing crossing proposed for upgrade	601,715	586,371
CR 10	Proposed new crossing	600,979	586,641
Access Road on Turbine Delivery Route			
CR 11	Existing crossing proposed for upgrade	601,347	584,990
CR 12	Existing crossing proposed for upgrade	601,298	585,047
CR 13	Proposed new crossing	601,200	585,150



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4.3.3 Borrow Pits

4.3.3.1 Description

It is proposed to develop three on-site borrow pits as part of the Proposed Development. It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the proposed development from the on-site borrow pits. Usable rock may also be won from other infrastructure construction including the substation and the turbine base excavations. Following removal of the rock from a borrow pit, it is proposed to partially restore the borrow pit by storing excavated spoil generated from construction activities.

The locations of the proposed borrow pits are shown in Figure 4-1 above.

4.3.3.2 Borrow Pit Design

The borrow pits will typically be constructed as follows:

1. The rock within the proposed borrow pit footprint will be removed by either breaking or blasting depending on its suitability for excavation, which will be confirmed from a follow-up ground investigation carried out at the proposed borrow pit location prior to construction. The ground investigation shall comprise rotary core drilling with associated engineering logging including rock quality designation and strength testing, as required.
2. It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road. This may vary and as excavation progresses into the back edge of the borrow pit, the base of the borrow pit may be raised to suit local conditions. Localised deepening of the borrow pit floor may be required depending on extraction operations.
3. Depending on the depth and type of rock present in the borrow pits it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses.
4. Slopes within the excavated rock formed around the perimeter of the borrow pits will be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes will be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.
5. The stability of the rock faces within the borrow pit will be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock.
6. Where it is not possible to leave upstands/segments of intact rock in place it may be necessary to construct rock buttresses founded on in-situ rock within the borrow pits. The rock buttresses will be constructed of rock fill from the borrow pit excavation. The founding stratum for each rock buttress will be inspected and approved by a competent person.

Borrow pit No. 1 (BP1) located approximately 350 metres to the west of Turbine No. 12, measures approximately 5,850 m^2 in area and is intended to supply hardcore materials for the construction of turbines in the western cluster, access roads thereto, the grid connection, temporary construction compound and the anemometry mast.

Borrow pit No. 2 (BP2) located approximately 100 metres to the southwest of Turbine No. 14, measures approximately 14,220 m^2 in area and is intended to supply hardcore materials for the construction of turbines in the western cluster, access roads thereto, the grid connection, temporary construction compound and the anemometry mast.

Borrow pit No. 3 (BP3) located approximately 50 metres to the southeast of Turbine No. 10, measures approximately 25,900 m^2 in area and is intended to supply hardcore materials for the construction of the turbines in the eastern cluster, access roads thereto, the electricity substation and the temporary construction compound.

All borrow pits are shown on Figure 4-1 and on the detailed site layout drawings included as Appendix 4-1 to this EIAR. Figure 4-7 to 4-9 below show detailed sections through the proposed borrow pits. The borrow pits will, on removal of all necessary and useful rock, be reinstated with excavated subsoils as described in Section 4.3.4 below. Post-construction, the borrow pits areas will be reinstated using spoil excavated onsite, leaving no excessive embankments, leaning edges or angles of repose. The reinstated borrow pits will be capped with a 3-500 mm layer of topsoil and re-planted as appropriate.

At certain turbine foundation and hardstand locations, depending on local ground conditions, the extraction of rock may be required in order to obtain a level construction area. Any rock obtained from a turbine location will be used to supply the hardcore materials requirement for that turbine's hardstand and access road.

Hardcore materials will be extracted from the borrow pits (and some turbine locations, if necessary), principally by means of rock breaking. Depending on the hardcore volume requirements, blasting may also be used as a more effective rock extraction method, capable of producing significant volumes of rock in a matter of milliseconds. Blasting, if required, will only be carried out after notifying local residents. The potential noise and vibration impacts associated with the rock extraction measures, detailed below (i.e. rock breaking and rock blasting), are assessed in Chapter 13 of this EIAR. The two proposed extraction methods are detailed below.

4.3.3.3 Rock Extraction Methods

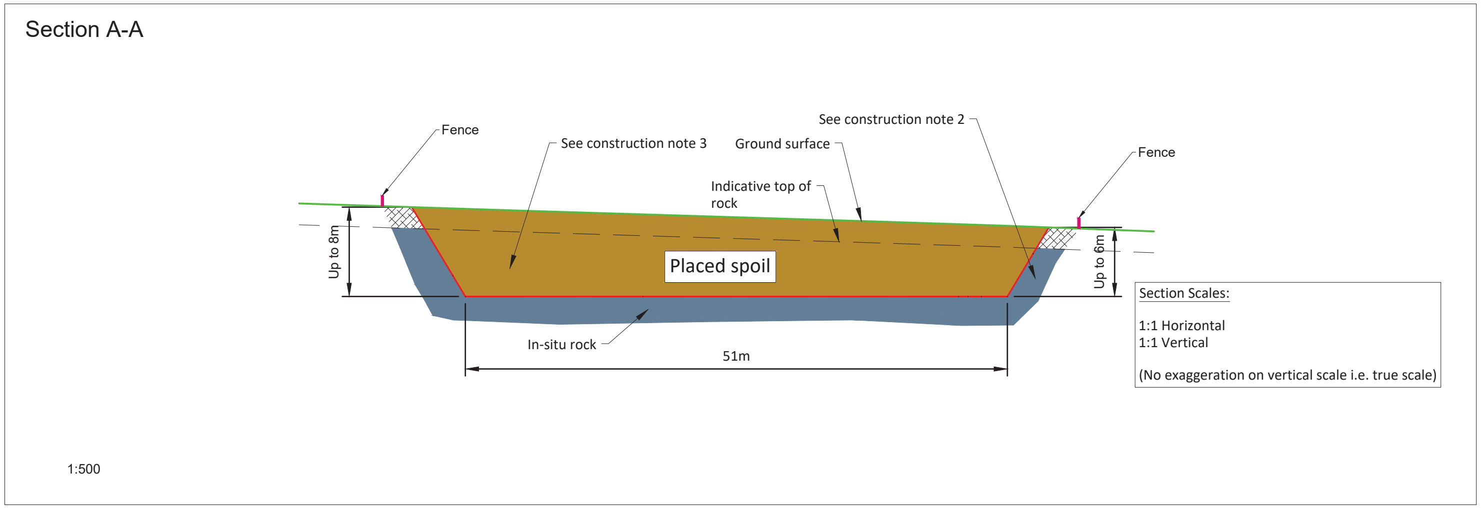
The extraction of rock from the borrow pit is a work stage of the Proposed Development which will be a temporary operation run over a short period of time relative to the duration of the entire project. Where present, overburden will be stripped back and stockpiled using standard tracked excavators. Any stockpiled material will be shaped and sealed to a suitable and safe height, with retaining bunds if required. Borrow pit drainage is addressed in Section 4.6.6 below.

Two extraction methods have been assessed for breaking out the useful rock; rock breaking and blasting, as described below.

4.3.3.3.1 *Rock Breaking*

Weathered or brittle rock can be extracted by means of a hydraulic excavator and a ripper attachment. This is a common extraction methodology where fragmented rock is encountered as it can be carefully excavated in layers by a competent operator. In areas where rock of a much higher strength is encountered and cannot be removed by means of excavating then a rock breaking methodology may be used. Where rock breaking is required, a large hydraulic 360-degree excavator with a rock breaker attachment is typically used. Given the power required to break out tight and compact stone at depth, the machines are generally large and in the 40-60 tonne size range. Even where rock might appear weathered or brittle at the surface, the extent of weathering can quickly diminish with depth resulting in strong rock requiring significant force to extract it at depths of only a few metres.

A large rock breaking excavator progressively breaks out the solid rock from the ground in the borrow pit area. The large rock breaker is typically supported by a smaller rock breaker which can often be in the 20-40 tonne size range, and works to break the rocks down to a size that they can be fed into a crusher. The extracted broken rock is typically loaded into a mobile crusher using a wheeled loading shovel, and crushed down to the necessary size of graded stone required for the on-site civil works. The same wheeled loader takes the stone from the crusher conveyor stockpile, and stockpiles it elsewhere away from the immediate area of the crusher until it is required elsewhere on the site of the Proposed Development.



Construction Notes Borrow pit

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat & spoil to be reinstated safely.

(5) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed should be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 7m (approx.) in height is likely to be required.

(6) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by a competent person.

(7) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.

(8) Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

(9) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(10) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

(11) Further guidelines on the construction of the borrow pit is included within Section 7.4 of the Peat & Spoil Management Plan

N

Figure 4-7

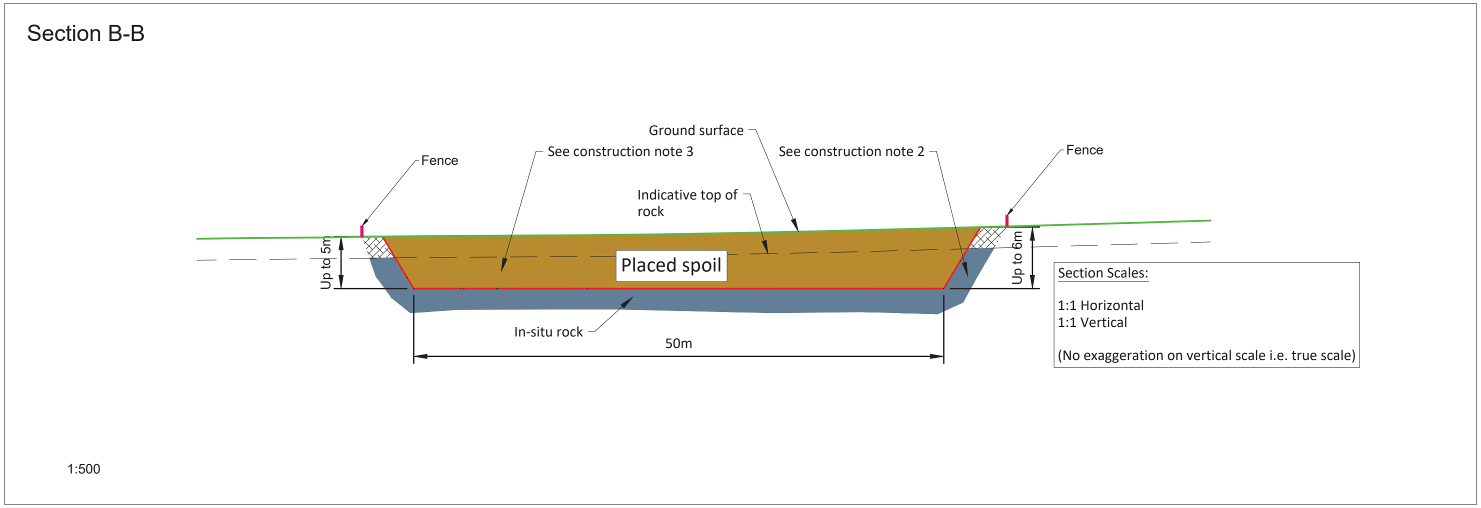
DRAWING TITLE:
Borrow Pit 1
Layout & Section

PROJECT TITLE:
Lyrenacarriga Wind Farm,
Co. Cork & Co. Waterford

DRAWING BY: **POR**	CHECKED BY: **IH**
PROJECT No.: **170749**	DRAWING No.: **170749 - 31**
SCALE: **As Shown @ A3**	DATE: **04.01.2021**

OS SHEET No.: 6108, 6109, 6110, 6111, 6112, 6154, 6155, 6156, 6157, 6158, 6201,6202,6203, 6204,6205, 6249, 6250, 6251, 6252, 6253

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie



Construction Notes Borrow pit

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat & spoil to be reinstated safely.

(5) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed should be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 7m (approx.) in height is likely to be required.

(6) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by a competent person.

(7) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.

(8) Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

(9) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(10) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

(11) Further guidelines on the construction of the borrow pit is included within Section 7.4 of the Peat & Spoil Management Plan

N

Figure 4-8

DRAWING TITLE:
Borrow Pit 2 Layout & Section

PROJECT TITLE:
Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford

DRAWING BY: **POR**	CHECKED BY: **IH**
PROJECT No.: **170749**	DRAWING No.: **170749 - 32**
SCALE: **As Shown @ A3**	DATE: **04.01.2021**

OS SHEET No.: 6108, 6109, 6110, 6111, 6112, 6154, 6155, 6156, 6157, 6158, 6201,6202,6203, 6204,6205, 6249, 6250, 6251, 6252, 6253

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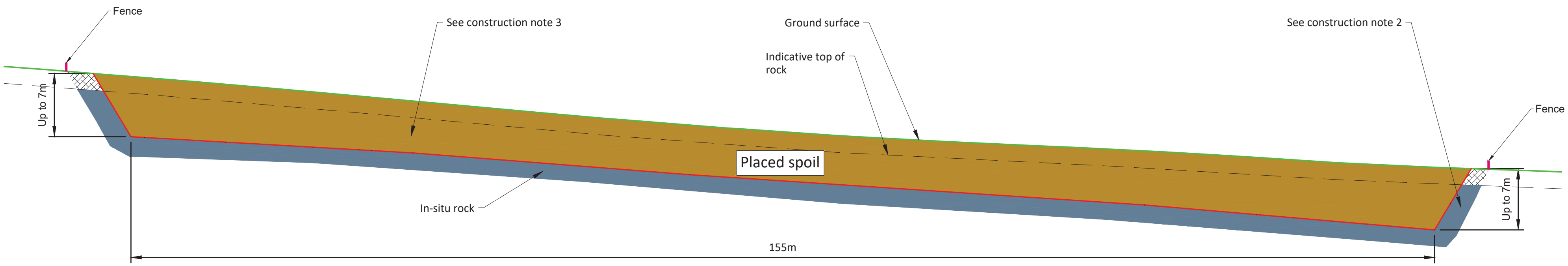
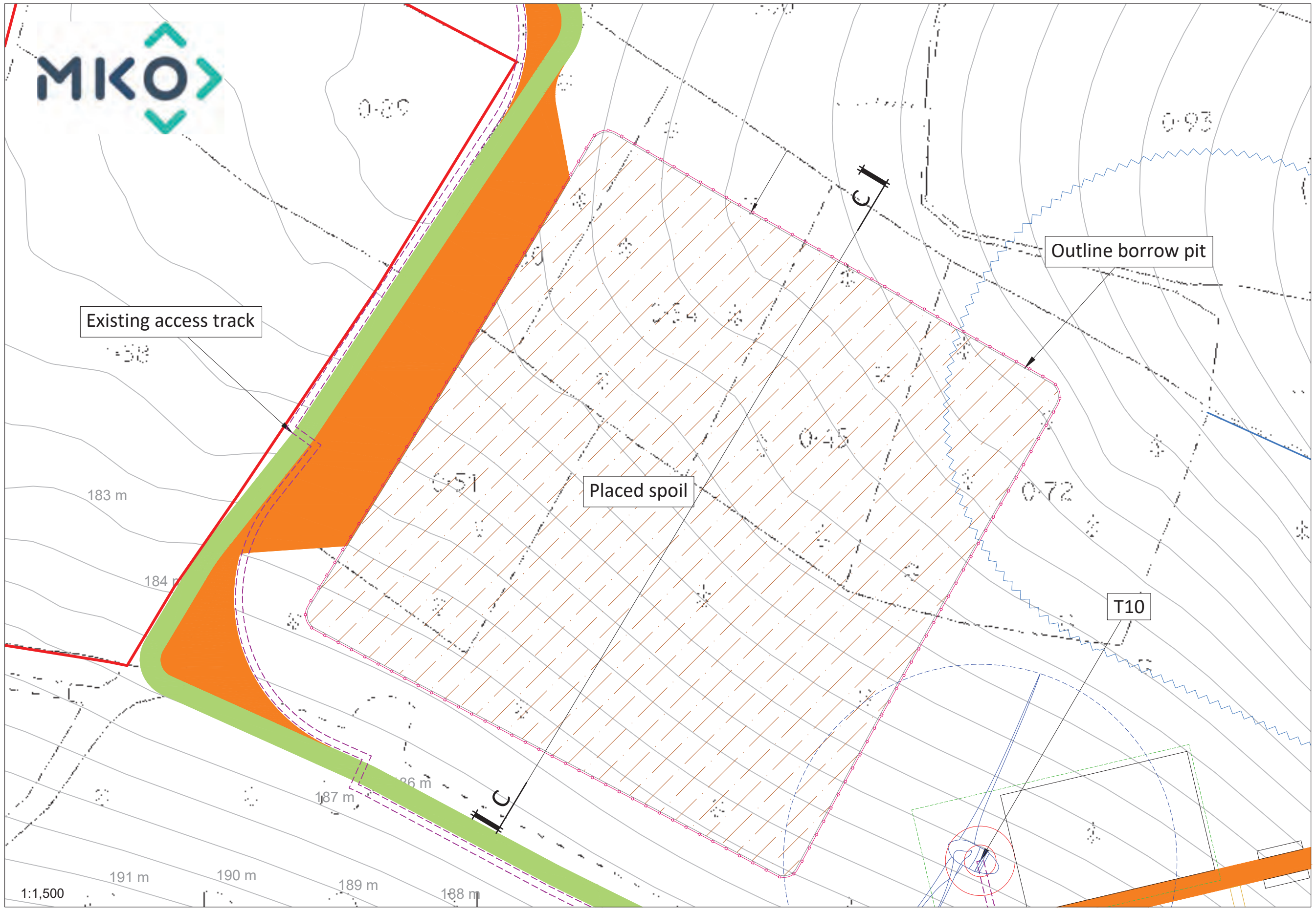


Section C-C



Construction Notes Borrow pit

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road. Depending on the type and condition of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. Excavation and infilling of the borrow pit will need to be sequenced and programmed. Leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat & spoil to be reinstated safely.

(5) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed should be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 7m (approx.) in height is likely to be required.

(6) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by a competent person.

(7) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.

(8) Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.

(9) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(10) All the above-mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

(11) Further guidelines on the construction of the borrow pit is included within Section 7.4 of the Peat & Spoil Management Plan

Figure 4-9

DRAWING TITLE: **Borrow Pit 3 Layout & Section**	
PROJECT TITLE: Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford	
DRAWING BY: **POR**	CHECKED BY: **IH**
PROJECT No.: **170749**	DRAWING No.: **170749 - 33**
SCALE: **As Shown @ A3**	DATE: **04.01.2021**
OS SHEET No.: 6108, 6109, 6110, 6111, 6112, 6154, 6155, 6156, 6157, 6158, 6201,6202,6203, 6204,6205, 6249, 6250, 6251, 6252, 6253	

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4.3.3.3.2 Rock Blasting

Where blasting is used as an extraction method, a mobile drilling rig is used to drill vertical boreholes into the area of rock that is to be blasted. The drilling rigs used are normally purpose built, self-propelled machines, designed specifically for drilling blast boreholes. A drilling rig working for 3-4 days would typically drill the necessary number of boreholes required for a single blast. The locations, depth and number of boreholes are determined by the blast engineer, a specialist role fulfilled by the blasting contractor that would be employed to undertake the duties.

The blast engineer would then arrange for the necessary quantity of explosive to be brought to site to undertake a single blast. The safe management of explosives onsite and the actual blasting operation would be agreed in advance with and supervised by An Garda Siochána. The blast engineer sets the explosives in place in the boreholes, sets the charges, and fires the blast. The blast takes only a matter of milliseconds but may be perceived to take slightly longer as blast noise echoes around the area.

A properly designed blast should generate rock of a size that can be loaded directly into a mobile crusher, using the same wheeled loader description outlined above. From that point on, the same method is used for processing the rock generated from a blast, as would be used to process rock generated by rock breaking. It would be likely that a drilling rig would recommence drilling blast holes for the next blast as soon one blast finished. The potential impacts associated with blasting are assessed in Chapter 13 Noise and Vibration.

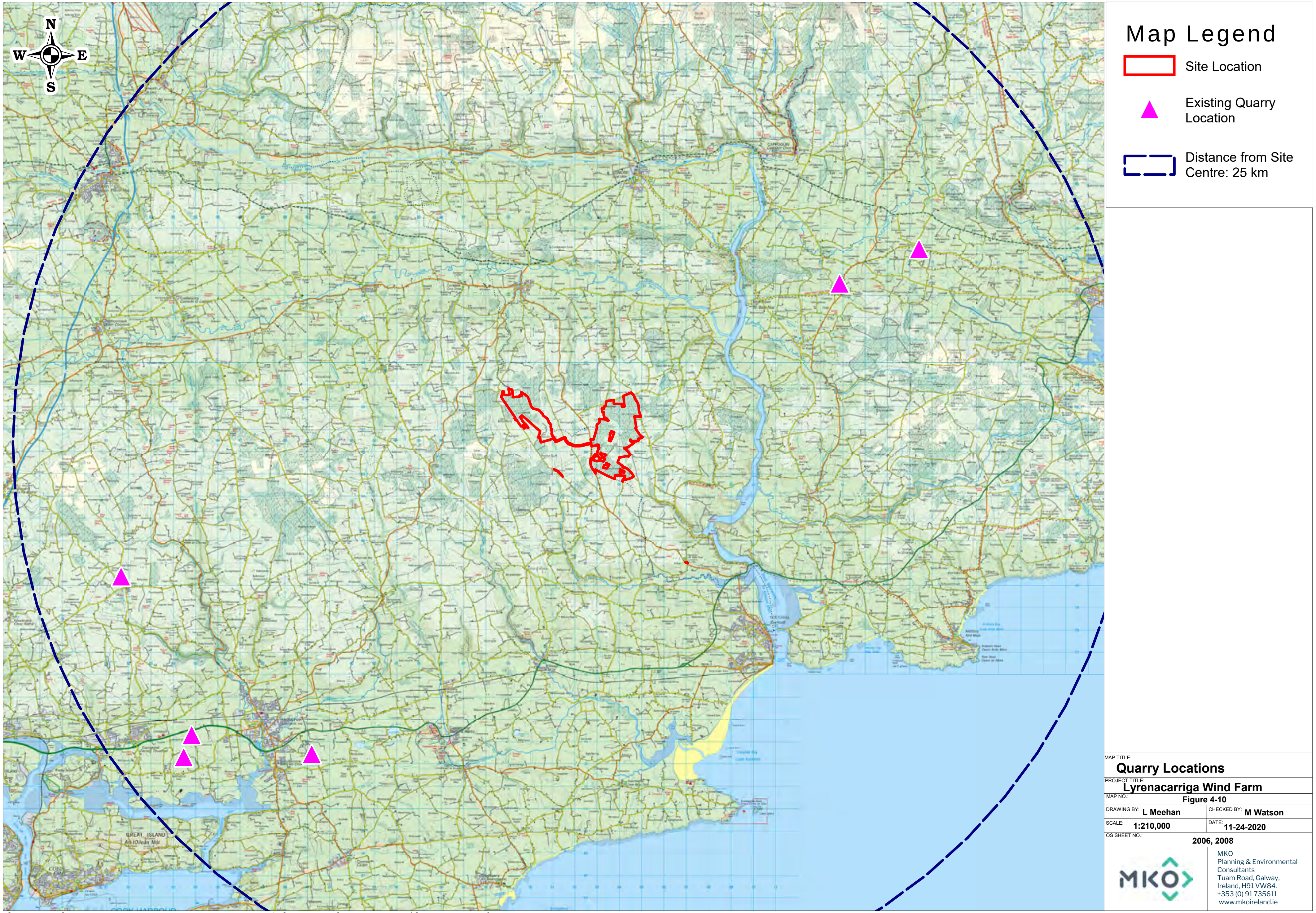
As with all works during the construction phase of the proposed development, the above rock extraction methods will be carried out in accordance with all relevant Health and Safety legislation, including:

- Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);
- Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007), as amended;
- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291 of 2013), as amended; and
- Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006).

A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared at the procurement stage and developed further at construction stage. All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. Further details on Health and Safety during all stages of the project are provided in Chapter 5 of this EIAR on Population and Human Health.

4.3.3.4 Offsite Material

It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the proposed development from the on-site borrow pits, as described above. Additional rock and hardcore material may be sourced from offsite and it is anticipated that a certain volume of finer, crushed stone, used to provide the final surface layer for site roads and hardstanding areas will also be brought to the site from local, appropriately authorised quarries. Six quarries located within 25 km of the proposed development have been selected for the purposes of assessment throughout this EIAR. The locations of these quarries are shown in Figure 4-10.



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4.3.4 Spoil Management Plan

4.3.4.1 Quantities

The quantity of spoil, requiring management on the site of the Proposed Development has been calculated, as presented in Table 4-3 below. These quantities were calculated as part of the Geotechnical Assessment Report in Appendix 4-2 of this EIAR.

Table 4-3 Spoil Volumes requiring management

Development Component	Typical Dimensions	Spoil Volume (m^3) (approx.)
17 no. Turbines and Hardstanding Areas	22m diameter excavation footprint for turbine foundation with hardstand area	42,890
Access Roads	Assumed 5m running surface with 6m wide development footprint	35,235
Substation	21,930 m^2	26,320
Temporary Construction Compound (2 no.)	Hardstanding area of 1,925m^2	4,420
Borrow Pits (3 no.)	Various	90,115
Total Spoil to be managed		**198,980**

Note a factor of 20% (bulking factor of 15% and contingency factor of 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.

4.3.4.2 Spoil Usage in Restoration of Borrow Pits

Once the required volume of rock has been extracted from the borrow pit areas, it is intended to reinstate these areas with overburden excavated from the works areas of the Proposed Development.

The general construction methodology for the construction of the borrow pits, as presented in the Geotechnical Assessment Report in Appendix 4-2 of this EIAR, is summarised below.

As rock is being extracted from the borrow pit, upstands of rock will be left in place, depending on the type of rock, to act as intermediate retaining buttresses. Where this is not achievable, stone buttresses will be constructed within the borrow pit. The upstands or buttresses will form individual restoration areas within the borrow pit which will be filled once the required volume of rock has been extracted from each individual area. The buttresses will be wide enough to allow construction traffic access for the tipping of spoil into the individual cells.

1. As rock is being extracted from the borrow pit, upstands of rock will be left in place, depending on the type of rock, to act as intermediate retaining buttresses. Where it is not possible to leave upstands/segments of intact rock in place it may be necessary to construct rock buttresses founded on in-situ rock within the borrow pits. The rock buttresses will be constructed of rock fill from the borrow pit

excavation. The founding stratum for each rock buttress will be inspected and approved by a competent person.

2. It may be necessary to construct the rock buttress within the borrow pit in stages as infilling of spoil behind the buttresses progresses. The buttress will be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed spoil, as necessary.
3. Infilling of the spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated spoil to be placed safely.
4. The height of the rock buttresses constructed will be greater than the height of the placed spoil to prevent any surface spoil run-off.
5. The use of temporary access ramps and long reach excavators during the placement of the excavated spoil is likely to be required.
6. Where possible, the surface of the placed spoil will be shaped to allow efficient run-off of surface water from borrow pit areas.
7. An interceptor drain will also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging on the re-instated borrow pit area.
8. Control of groundwater within the borrow pits may be required during construction, including a temporary pump and suitable outfall locations. Outfall controls are shown on the Drainage Design drawings which are included in the planning application drawings and presented in Appendix 4-6 of this EIAR.
9. Stilling ponds may be required at the lower side/outfall location of the borrow pit. Further details on stilling ponds are provided in Section 4.4.4.7 below.
10. Supervision by a geotechnical engineer or appropriately competent person will be carried out during works.

4.3.4.2.1 Placement of Spoil alongside Access Roads

In some areas of the site of the Proposed Development excavated materials will be placed temporarily alongside the access roads before movement to the borrow pit. The following best practice guidelines for the placement of spoil alongside the access road will be adhered to during the construction of the Proposed Development:

1. The potential spoil placement locations are alongside the existing excavated and proposed new access tracks with cross slopes of less than 10 degrees.
2. As a general guide, the spoil placed adjacent to the existing and proposed excavated access tracks will be restricted to a maximum height of 1.0m over a 3m wide corridor on both sides of the access tracks. It should be noted that the site engineer will define/confirm the maximum restricted height for the placed spoil.
3. The placement of excavated spoil will be avoided without first establishing the adequacy of the ground to support the load
4. Where there is any doubt as to the stability of the ground then no material will be placed on to the surface.
5. Where practical, it will be ensured that 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.
6. Finished/shaped side slopes in the placed spoil will be not greater than 1 (v): 2 or 3 (h).
7. Supervision by a geotechnical engineer or appropriately competent person will be carried out during this work.
8. An interceptor drain will be installed upslope of the designated spoil placement areas to divert any surface water away from these areas. This will help ensure stability of the placed spoil and reduce the likelihood of debris run-off.

9. All the above-mentioned general guidelines and requirements will be confirmed by the site engineer prior to construction.

The management of excavated overburden and the methods of placement and/or reinstatement are described in detail in the Geotechnical Assessment Report in Appendix 4-2 of this EIAR.

4.3.5 Electricity Substation

It is proposed to construct a 110 kV electricity substation within the site, as shown in Figure 4-1. The proposed substation site is located within an area of forestry adjacent to an existing access road.

The footprint of the proposed onsite electricity substation compound measures approximately 2.9 hectares, and will include two wind farm control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine, and export that electricity from the wind farm substation to the national grid. The layouts and elevations of the proposed substation are shown on Figure 4-1111 and 4-12. The construction and exact layout of electrical equipment in the onsite electricity substation will be to EirGrid / ESB Networks specifications.

Further details regarding the connection between the site substation and the national electricity grid are provided in Section 4.3.7 below.

The substation compound will be surrounded by an approximately 2.4-metre high steel palisade fence in line with standard ESB requirements, and internal fences will also segregate different areas within the main substation.

4.3.5.1 Wind Farm Control Buildings

The wind farm control buildings will be located within the substation compound. Control building 1 (the substation control building) will measure approximately 375 square metres in area and 8 metres in height. Control building 2 (switchgear room) will measure approximately 215 square metres in area and 7 metres in height. Layout and elevation drawings of the control buildings are included in Figures 4-13 and 4-14.

The wind farm control buildings will include staff welfare facilities for the staff that will work on the Proposed Development during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the Proposed Development there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the Proposed Development does not necessitate a potable source. It is proposed to harvest rainwater from the roofs of the buildings, and if necessary, bottled water will be supplied for drinking.

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site, and therefore the EPA's 2009 '*Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses (p.e. 10)'* does not apply. Similarly, the EPA's 1999 manual on *'Treatment Systems for Small Communities, Business, Leisure Centres and Hotels'* also does not apply, as it too deals with scenarios where it is proposed to treat wastewater on-site.

Such a proposal for managing the wastewater arising on site has essentially become standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment would be challenging, and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal.

The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the site's 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 site to a licensed facility. There are licenced wastewater treatment facilities at Youghal and Midleton, located approximately 7.8 km southeast and 18.7 km southwest respectively from the proposed wind farm site.

4.3.5.2 Battery Storage

A Battery storage compound is proposed to be located adjacent to the substation. This compound is proposed to include 10 No. battery modules contained within steel units with dimensions of approximately 12.2 m x 2.4 m x 2.8 m high. The enclosures will be similar in appearance to standard shipping containers and shall be placed on concrete foundations or plinths.

The system proposed includes lithium-ion batteries, connected to inverters that convert direct current (DC) to alternating current (AC), which are in turn connected to step up/down MV/LV (medium voltage/low voltage) unit transformers feeding a common busbar located in the Independent Power Producer's (IPP) control building within the substation. Depending on the size and type of the transformers they may be bunded with drainage via an oil interceptor unit.

The battery storage compound includes a switchgear (control) room which measures approximately 135 square metres and 7 metres in height.

The battery storage compound is shown on the substation layout and elevation drawings in Figure 4-11 and 4-12 above. The layout and elevation of the battery switchgear room are shown in Figure 4-15.

Figure 4-11

NOTES :

1. This drawing is to be used only for the purpose of the planning application and is subject to detailed design.
2. Layout and Arrangements of Substation Building and Electrical Equipment is shown indicatively and for illustration purposes only.
3. Dimensions shown are as per current Eirgrid Specifications at the time of submission. Dimensions may vary at time of construction to reflect any revisions to Eirgid Speciffications.
4. Final Specifications of Buildings and Electrical Equipment is to be as per Eirgid and ESB Specifications.

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PROJECT

Innogy Lyre Wind Farm OHL Front End Engineering

CLIENT

INNOGY

innogy

CONSULTANTS

MKO

NOTES: -

LEGEND: -

Description	
SA	Surge Arrester.
DL/DE	Line / Earth Disconnect.
DT/DEM1	Trafo / Earth Disconnect.
VT	Voltage Transformer.
CT	Current Transformer.
CB	Circuit Breaker.
DA	Busbar Disconnect.
PI	Post Insulator.
LM	Lighting Mast.

Proposed UGC Cable
CCTV Camera
Existing Road to be Upgraded
Proposed Road
Electrical Cable Trench

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P01	15.12.20	Issued for Planning
P00	26.05.20	Issued for Planning

Drawn By : Ger Donnellan

Approved : Ruairi Geary

PROJECT NUMBER

05-664

SHEET TITLE

Loop in Station Battery Storage & Layout Plan

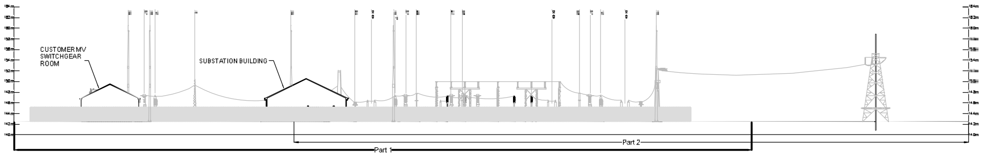
SHEET NUMBER

170749-22 _ (05664-DR-202)

ISO A1 594mm x 841mm

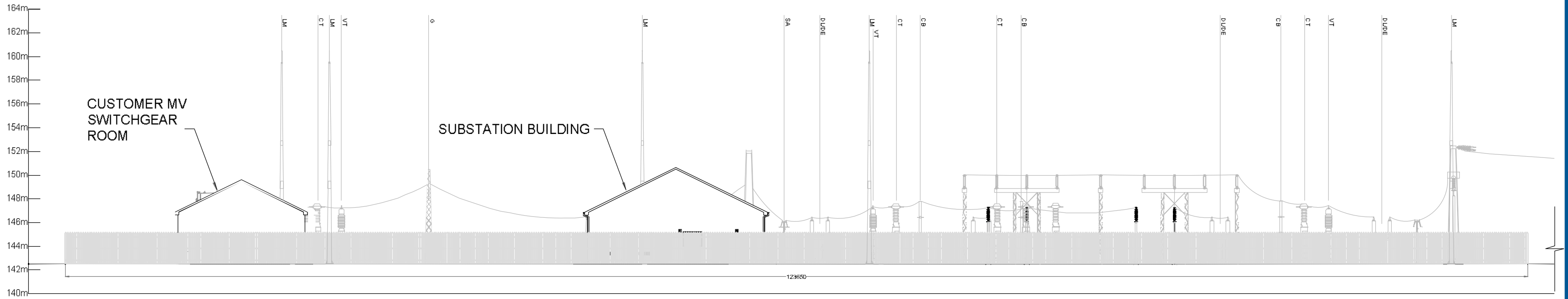
Project Management Initials: Designer: GD Checked: DT Approved: RG

ISO A1 594mm x 841mm



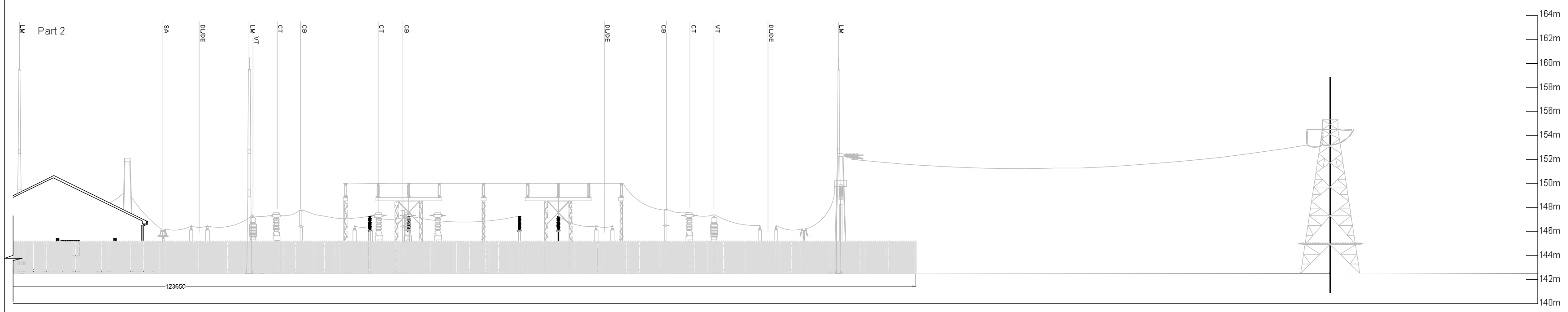
North East Elevation
SCALE 1:500

ELEVATION - Part 1



North East Elevation
SCALE 1:200

ELEVATION - Part 2



North East Elevation
SCALE 1:200

Figure 4-12a

Approved: RG
Checked: DT
Designer: GD
Project Management Initials:

tli GROUP

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PROJECT

Innogy Lyre Wind Farm OHL Front End Engineering

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CONSULTANTS

MKO

NOTES: -

1. Layout and Arrangements of Substation Building and Electrical Equipment is shown indicatively and for illustration purposes only.
2. Dimensions shown are as per current Eirgrid Specifications at the time of submission. Dimensions may vary at time of construction to reflect any revisions to Eirgrid Specifications.
3. Final Specifications of Buildings and Electrical Equipment is to be as per Eirgrid and ESB Specifications.
4. The Elevation of the Compound will be depicted by localized Topography such that Cut/Fill Earthworks associated with the construction of the Compound are balanced.

LEGEND: -

	Description
G	Gantry.
SA	Surge Arrester.
DL/DE	Line / Earth Disconnect.
DT/DEMI	Trafo / Earth Disconnect.
VT	Voltage Transformer.
CT	Current Transformer.
CB	Circuit Breaker.
DA	Busbar Disconnect.
PI	Post Insulator.
LM	Lighting Mast.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P00	15.12.20	Issued for Planning

Drawn By : Ger Donnellan

Approved : Ruairi Geary

PROJECT NUMBER

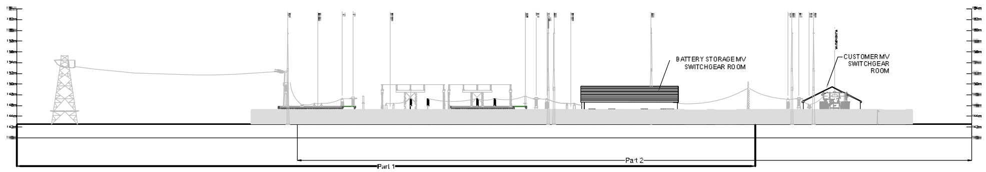
05-664

SHEET TITLE

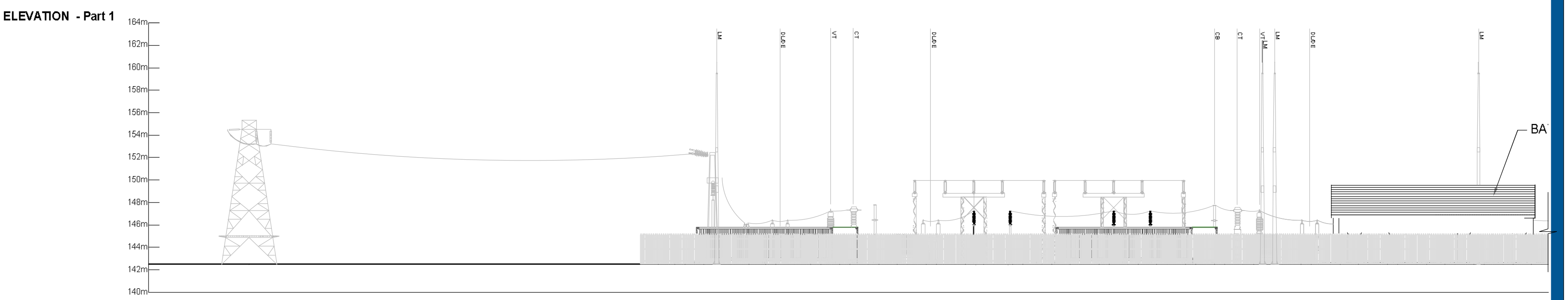
Loop in Substation - Northeast Elevations

SHEET NUMBER

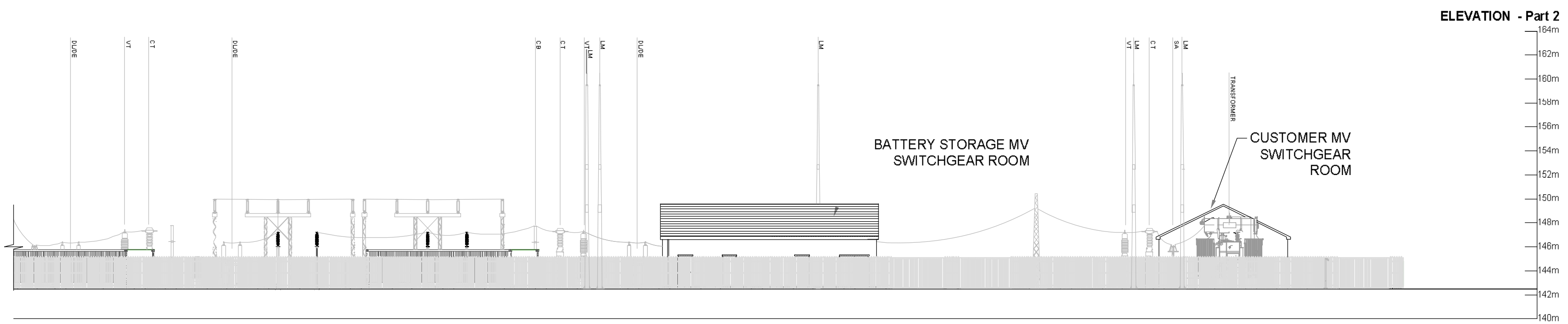
170749 - 24 _ (05664-DR-219)



North East Elevation
SCALE 1:500



Southwest Elevation
SCALE 1:200



Southwest Elevation
SCALE 1:200

Figure 4-12b

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PROJECT

Innogy Lyre Wind Farm
OHL Front End
Engineering

CLIENT

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CONSULTANTS

NOTES: -

1. Layout and Arrangements of Substation Building and Electrical Equipment is shown indicatively and for illustration purposes only.
2. Dimensions shown are as per current Eirgrid Specifications at the time of submission. Dimensions may vary at time of construction to reflect any revisions to Eirgrid Specifications.
3. Final Specifications of Buildings and Electrical Equipment is to be as per Eirgrid and ESB Specifications.
4. The Elevation of the Compound will be depicted by localized Topography such that Cut/Fill Earthworks associated with the construction of the Compound are balanced.

LEGEND: -

	Description
G	Gantry.
SA	Surge Arrester.
DL/DE	Line / Earth Disconnect.
DT/DEMI	Trafo / Earth Disconnect.
VT	Voltage Transformer.
CT	Current Transformer.
CB	Circuit Breaker.
DA	Busbar Disconnect.
PI	Post Insulator.
LM	Lighting Mast.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P00	15.12.20	Issued for Planning

Drawn By : Ger Donnellan

Approved : Ruairi Geary

PROJECT NUMBER

05-664

SHEET TITLE

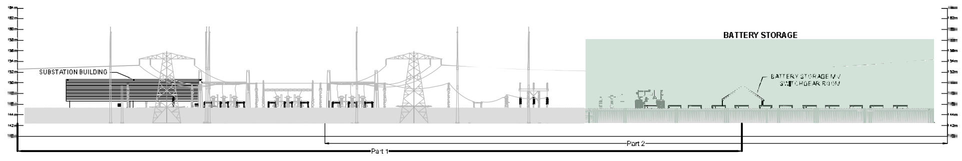
Loop in Substation - Southwest Elevations

SHEET NUMBER

170749 - 25 _ (05664-DR-220)

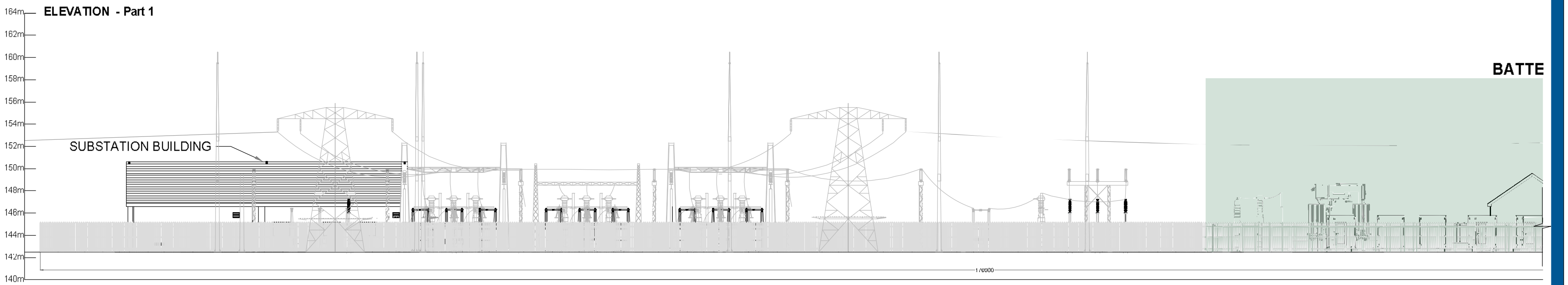
Project Management Initials: Designer: GD Checked: DT Approved: RG

ISO A1 594mm x 841mm



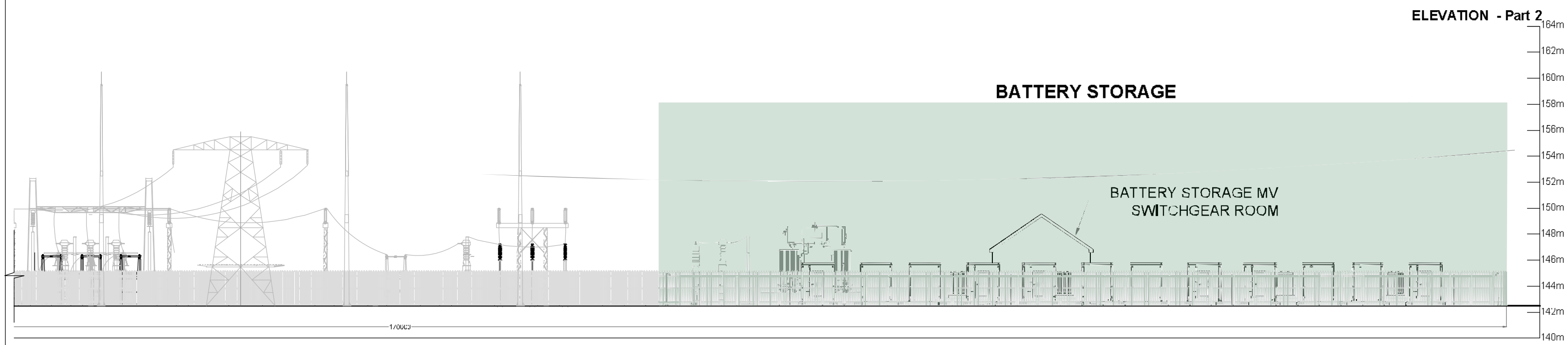
Northwest Elevation

SCALE 1:500



Northwest Elevation

SCALE 1:200



Northwest Elevation

SCALE 1:200

Figure 4-12c

Approved: RG
Checked: DT
Designer: GD
Project Management Initials:

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PROJECT

Innogy Lyre Wind Farm
OHL Front End
Engineering

CLIENT

INNOGY

innogy

CONSULTANTS

MKO

NOTES: -

1. Layout and Arrangements of Substation Building and Electrical Equipment is shown indicatively and for illustration purposes only.
2. Dimensions shown are as per current Eirgrid Specifications at the time of submission. Dimensions may vary at time of construction to reflect any revisions to Eirgrid Specifications.
3. Final Specifications of Buildings and Electrical Equipment is to be as per Eirgrid and ESB Specifications.
4. The Elevation of the Compound will be depicted by localized Topography such that Cut/Fill Earthworks associated with the construction of the Compound are balanced.

LEGEND: -

	Description
G	Gantry.
SA	Surge Arrester.
DL/DE	Line / Earth Disconnect.
DT/DEMI	Trafo / Earth Disconnect.
VT	Voltage Transformer.
CT	Current Transformer.
CB	Circuit Breaker.
DA	Busbar Disconnect.
PI	Post Insulator.
LM	Lighting Mast.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P00	15.12.20	Issued for Planning

Drawn By : Ger Donnellan

Approved : Ruairi Geary

PROJECT NUMBER

05-664

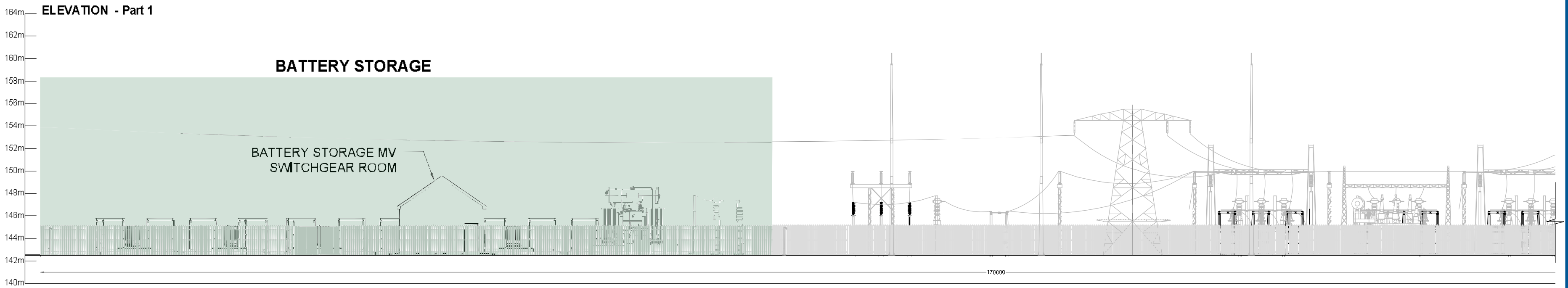
SHEET TITLE

Loop in Substation -
Northwest Elevations

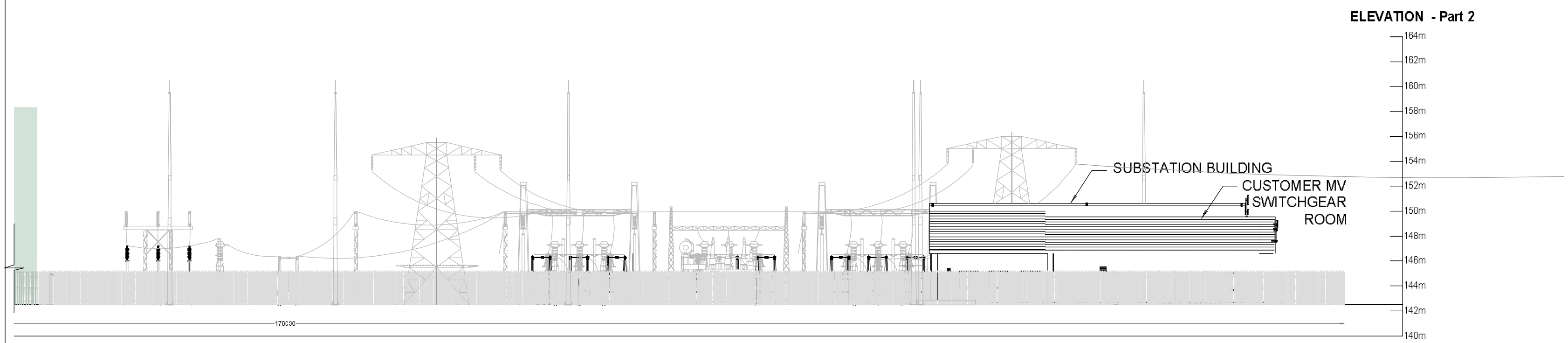
SHEET NUMBER

170749 - 26 _ (05664-DR-221)

Southeast Elevation
SCALE 1:500



Southeast Elevation
SCALE 1:200



Southeast Elevation
SCALE 1:200

Figure 4-12d

ISO A1 594mm x 841mm

Project Management Initials: Designer: GD Checked: DT Approved: RG

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PROJECT

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OHL Front End
Engineering

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NOTES: -

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4. The Elevation of the Compound will be depicted by localized Topography such that Cut/Fill Earthworks associated with the construction of the Compound are balanced.

LEGEND: -

	Description
G	Gantry.
SA	Surge Arrester.
DL/DE	Line / Earth Disconnect.
DT/DEMI	Trafo / Earth Disconnect.
VT	Voltage Transformer.
CT	Current Transformer.
CB	Circuit Breaker.
DA	Busbar Disconnect.
PI	Post Insulator.
LM	Lighting Mast.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P00	15.12.20	Issued for Planning

Drawn By : Ger Donnellan

Approved : Ruairi Geary

PROJECT NUMBER

05-664

SHEET TITLE

Loop in Substation -
Southeast Elevations

SHEET NUMBER

170749 - 27 _ (05664-DR-222)

Drawing Notes

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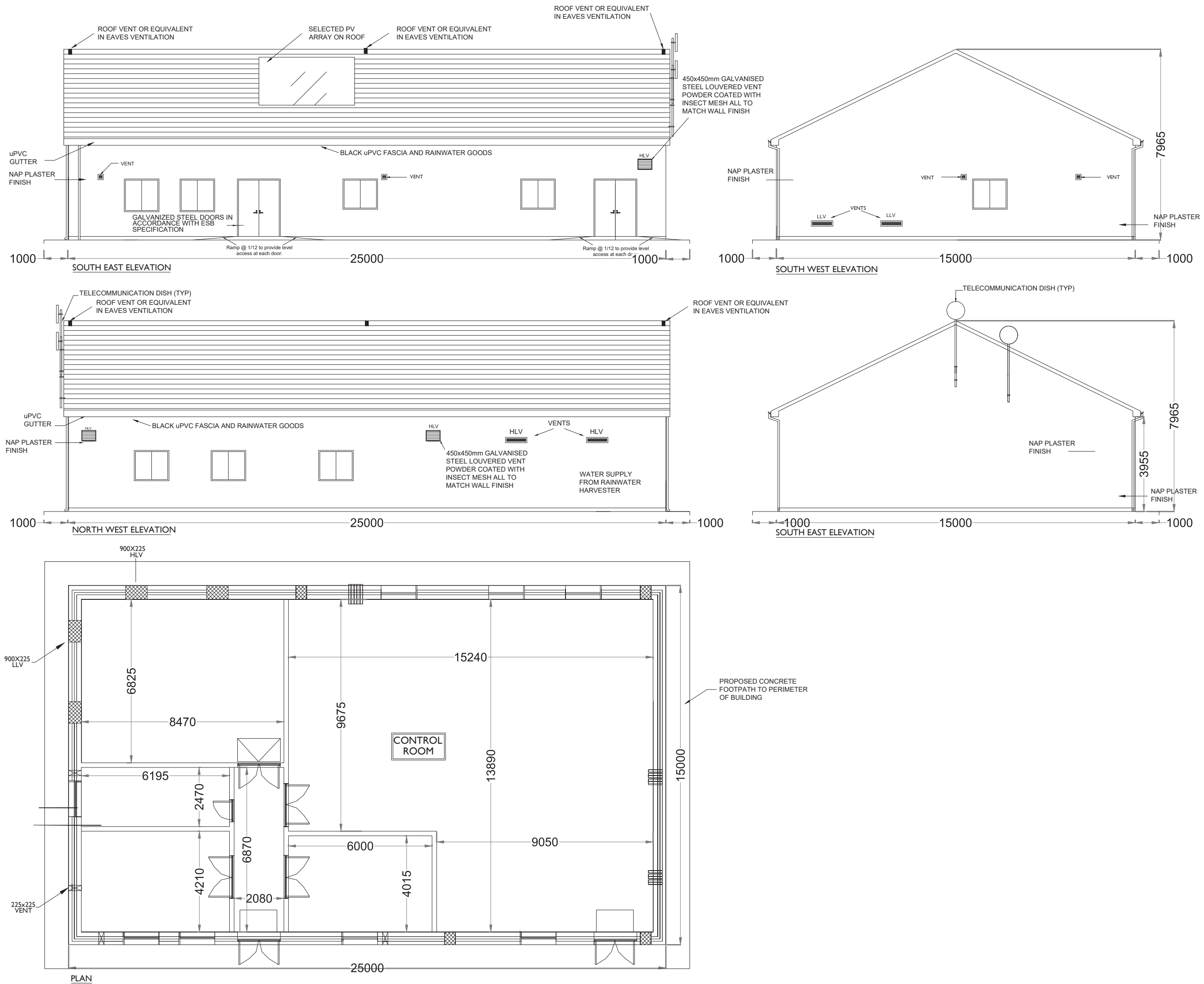

Figure 4-13

DRAWING TITLE: **Substation Control Building**	
PROJECT TITLE: **Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford**	
DRAWING BY: CH	CHECKED BY: DG
PROJECT No.: 170749	DRAWING No.: 170749 - 27
SCALE: 1:200 @ A3	DATE: 05.01.2021

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Drawing Notes

1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.

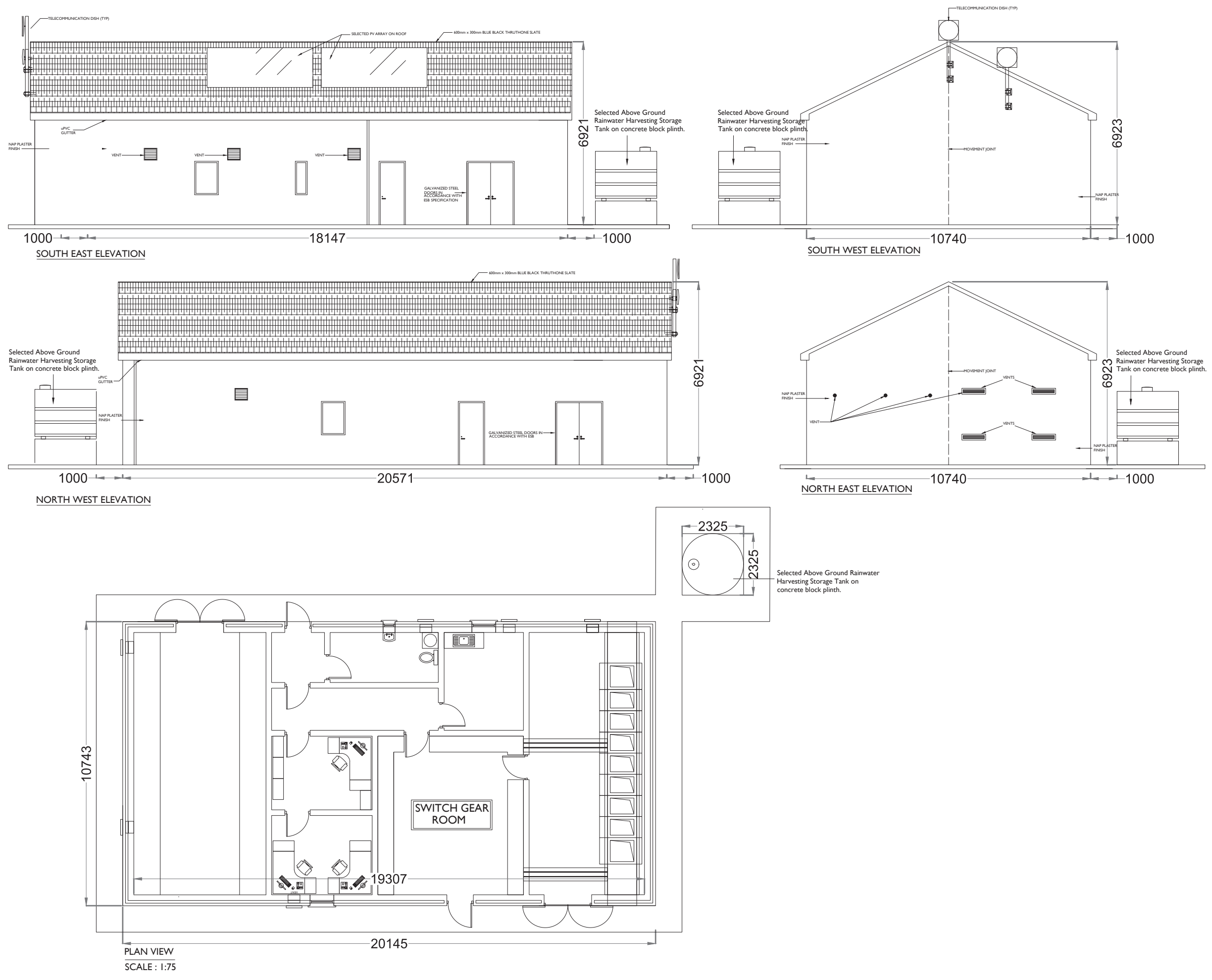

Figure 4-14

DRAWING TITLE: **Substation Switchgear Building**	
PROJECT TITLE: **Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford**	
DRAWING BY: CH	CHECKED BY: DG
PROJECT No.: 170749	DRAWING No.: 170749 - 28
SCALE: 1:200 @ A3	DATE: 05.01.2021

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Drawing Notes

1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.

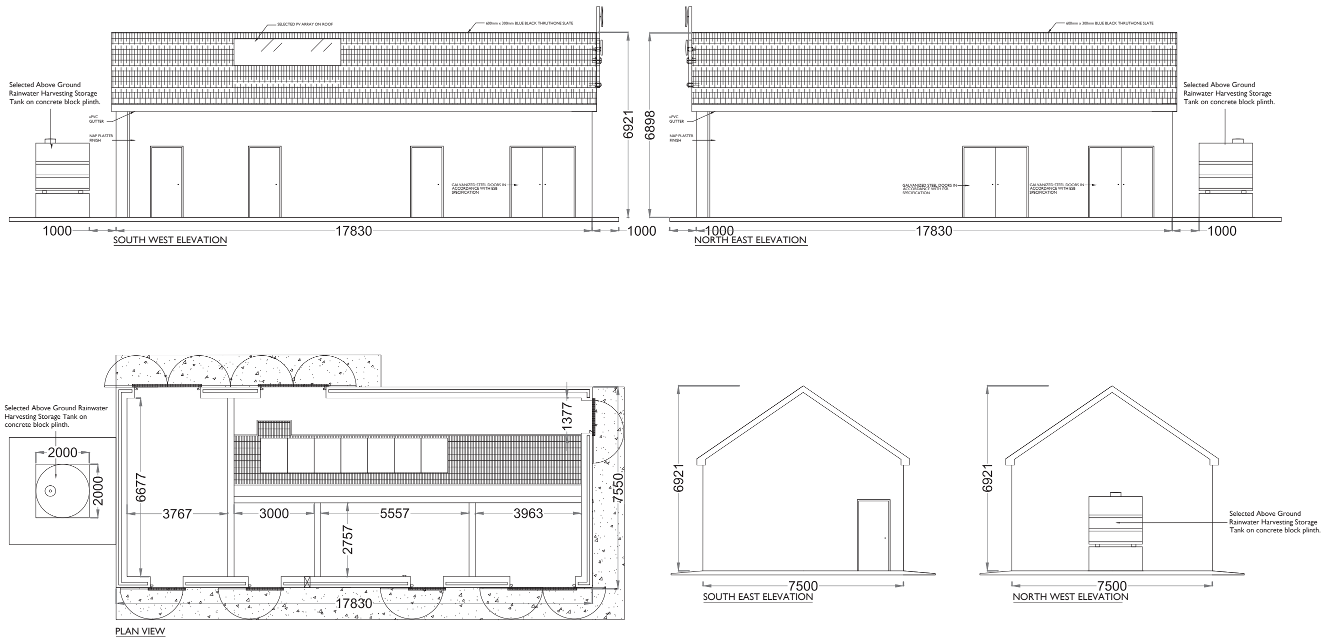

Figure 4-15

DRAWING TITLE: **Battery Switchgear Building**	
PROJECT TITLE: **Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford**	
DRAWING BY: **CH**	CHECKED BY: **DG**
PROJECT No.: **170749**	DRAWING No.: **170749 - 29**
SCALE: **1:200 @ A3**	DATE: **05.01.2021**

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4.3.6 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 20 or 33 kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in cable ducts approximately 1.3 metres below the ground surface, along the sides of roadways. The route of the cable ducts will follow the access track to each turbine location and are visible on the site layout drawings included as Appendix 4-1. Figure 4-16 below shows two variations of a typical cable trench, one for off-road trenches (to be installed on areas of soft ground that will not be trafficked) and one for on-road trenches (to be used where trenches run along or under a roadway).

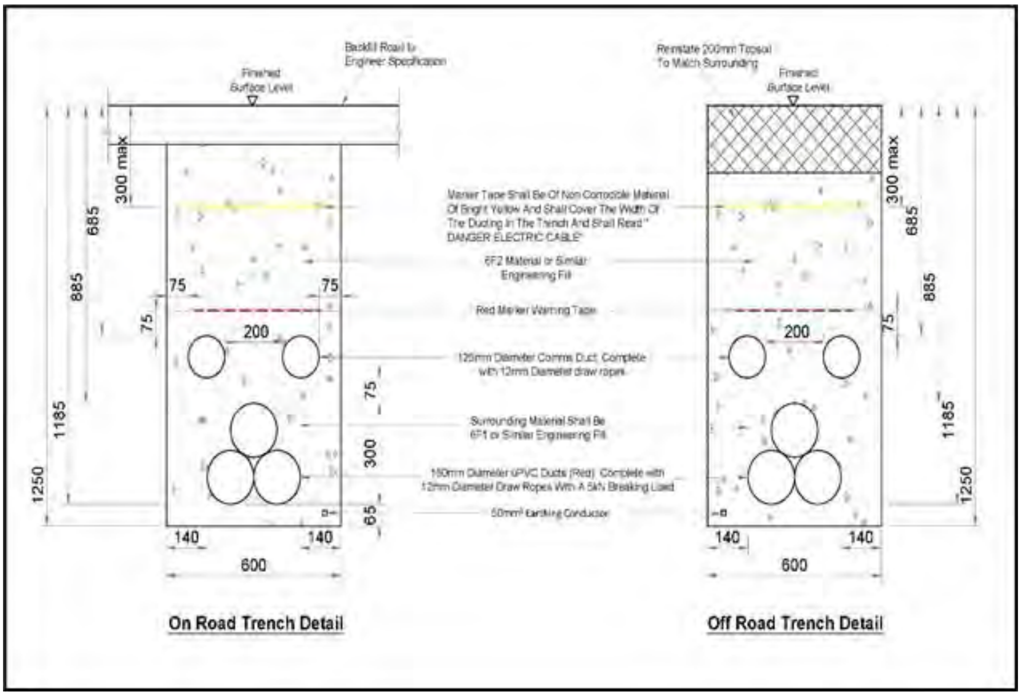
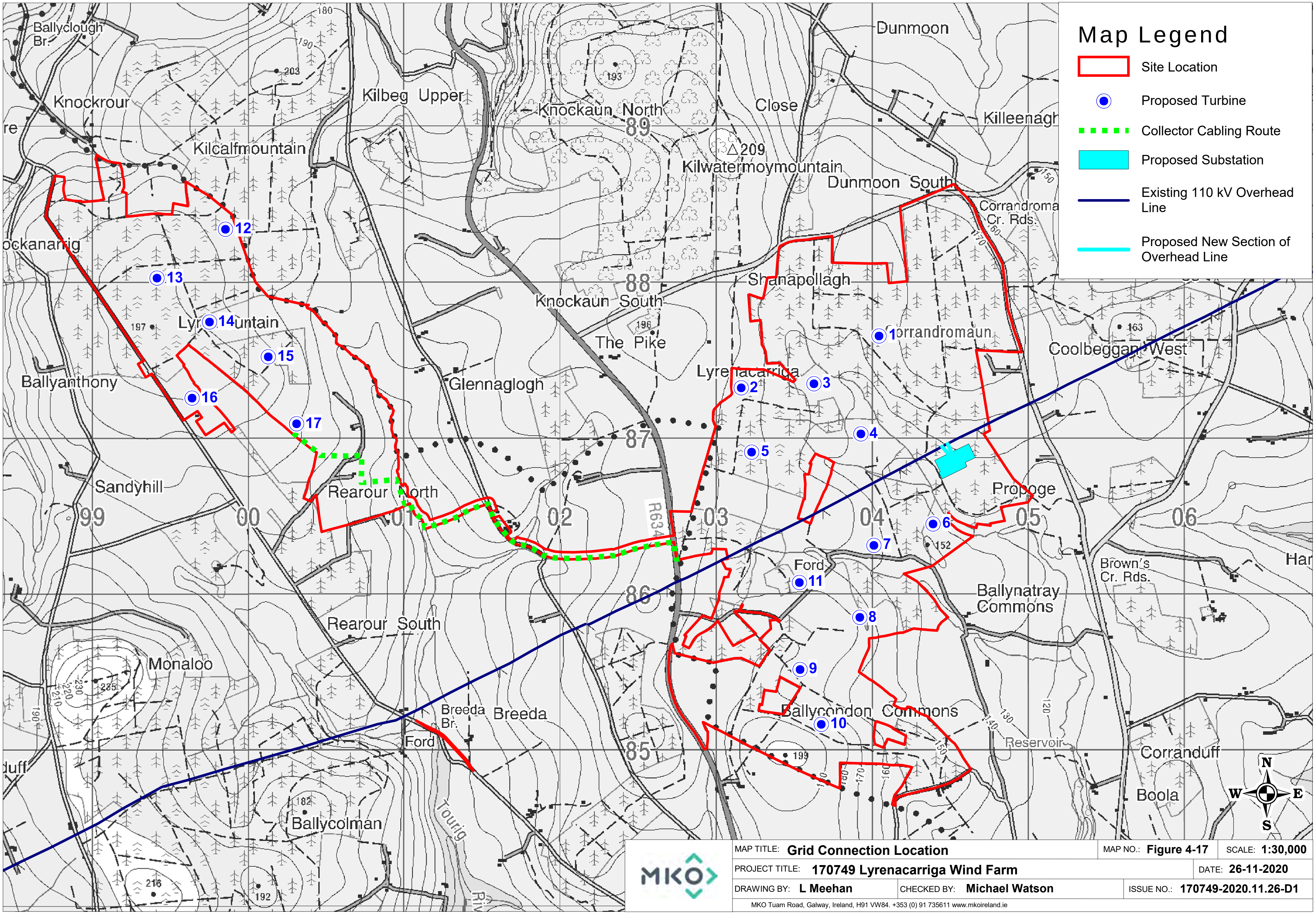


Figure 4-16 Typical Cable trench cross-section detail

Clay plugs will be installed at regular intervals of not greater than 50 metres along the length of the trenches to prevent the trenches becoming conduits for runoff water. While the majority of the cable trenches will be backfilled with native material, clay subsoils of low permeability will be used to prevent conduit flow in the backfilled trenches. This material will be imported onto the site should sufficient volumes not be encountered during the excavation phase of roadway and turbine foundation construction.

It is proposed to connect the two sections of the site via underground cabling located within existing agricultural land and within the public road corridor. This collector cabling route measures approximately 3.3 km and is shown on Figure 4-17. The cable, ducting and trenching specifications provided within this application (see Section 4.8.5 below) are in accordance with ESB and EirGrid standard specifications. The exact final specification for the cable, ducting and trench to be lain within the proposed route as shown on Figure 4-17 will be agreed with ESB/EirGrid, subject to the securement of planning permission.



MAP TITLE: **Grid Connection Location**		MAP NO.: **Figure 4-17**	SCALE: **1:30,000**
PROJECT TITLE: **170749 Lyrenacarriga Wind Farm**			DATE: **26-11-2020**
DRAWING BY: **L Meehan**	CHECKED BY: **Michael Watson**		ISSUE NO.: **170749-2020.11.26-D1**

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4.3.7 Grid Connection

A connection between the proposed development site and the national electricity grid will be necessary to export electricity from the proposed wind farm. It is proposed to construct a 110 kV substation within the site and to connect from here via a 110 kV loop-in connection to the existing 110kV network which runs through the site. This will entail the construction of two sections of approximately 40 metres of overhead line to connect the substation to the existing overhead line, via two angle masts (13 metres in height). The methodology for this is presented in Section 4.9.5 below. The grid connection route is illustrated in Figure 4-17.

4.3.8 Meteorological Mast

One permanent meteorological (met) mast is proposed as part of the Proposed Development. The met mast will be equipped with wind monitoring equipment at various heights. The mast will be located approximately 410 metres southeast of Turbine 17, as shown on the site layout drawing in Figure 4-1.

The mast will be a self-supporting slender structure up to 112 metres in height. The mast will be constructed on a hard-standing area sufficiently large to accommodate the crane that will be used to erect the mast, adjacent to an existing track. The met mast structure is shown in Figure 4-18.

A proposed welfare and storage one-storey building measuring approximately 54 square metres and 4.3 metres in height will be located adjacent to the met mast, as shown on Figure 4-18 also. This building will comprise space for parts storage, and welfare facilities for use by maintenance staff. A 2.4-metre palisade fence will encompass the met mast and storage building.

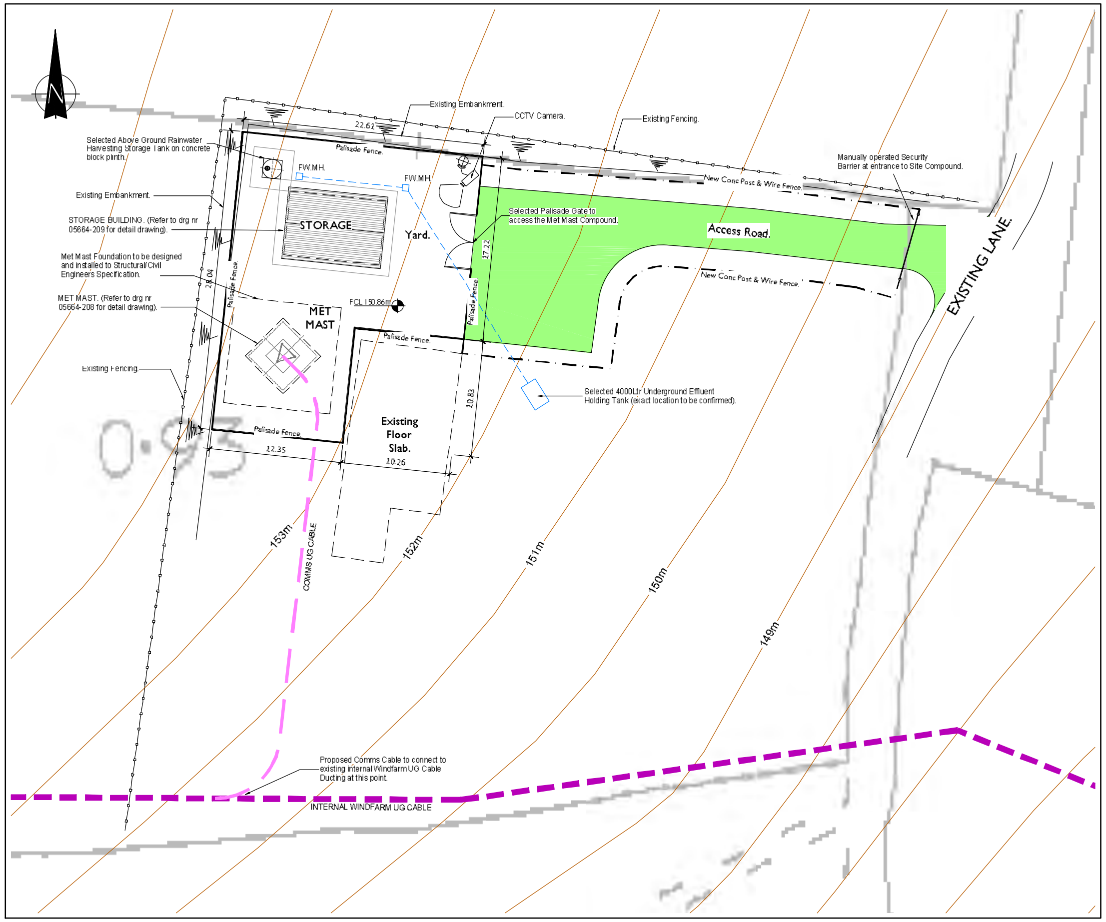
4.3.9 Temporary Construction Compounds

Two temporary construction compounds are proposed as part of the proposed development. They are located approximately 150 metres northeast of Turbine 13 (compound 1 or CPD1) and 600 metres southeast of Turbine 1 (compound 2 or CPD2) respectively.

Each compound measures 80 metres by 50 metres, with a footprint of 4,000 m^2 in area. The location of the proposed construction compounds is shown on the site layout drawing in Figure 4-1.

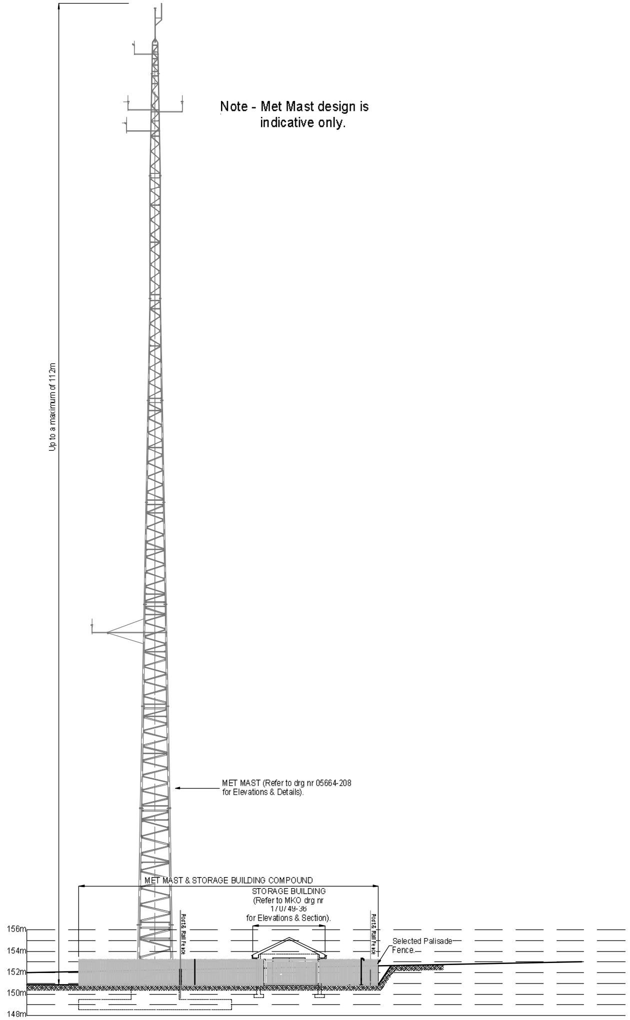
The construction compounds will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors. The layout of the construction compounds is shown on Figures 4-19 and 4-20. Construction materials and turbine components will be brought directly to the proposed turbine locations following their delivery to the site.

Temporary port-a-loo toilets located within a staff portacabin will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by an appropriately consented waste collector to wastewater treatment plants. There are licenced wastewater treatment facilities at Youghal and Midleton, as referred to in Section 4.3.5 above.



SITE LAYOUT PLAN

Scale: - 1:250



EAST ELEVATION

Scale: - 1:250

Figure 4-18

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PROJECT

Innogy Lyre Wind Farm OHL Front End Engineering

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NOTES: -

LEGEND: -

Proposed UGC Cable	(pink dashed line)
CCTV Camera	(symbol)
Existing Road to be Upgraded	(green fill)

ISSUE/REVISION

I/R	DATE	DESCRIPTION
01	15.12.20	Issued for Planning
00	26.05.20	Issued for Planning

Drawn By : Ger Donnellan

Approved : Ruairi Geary

PROJECT NUMBER

05-664

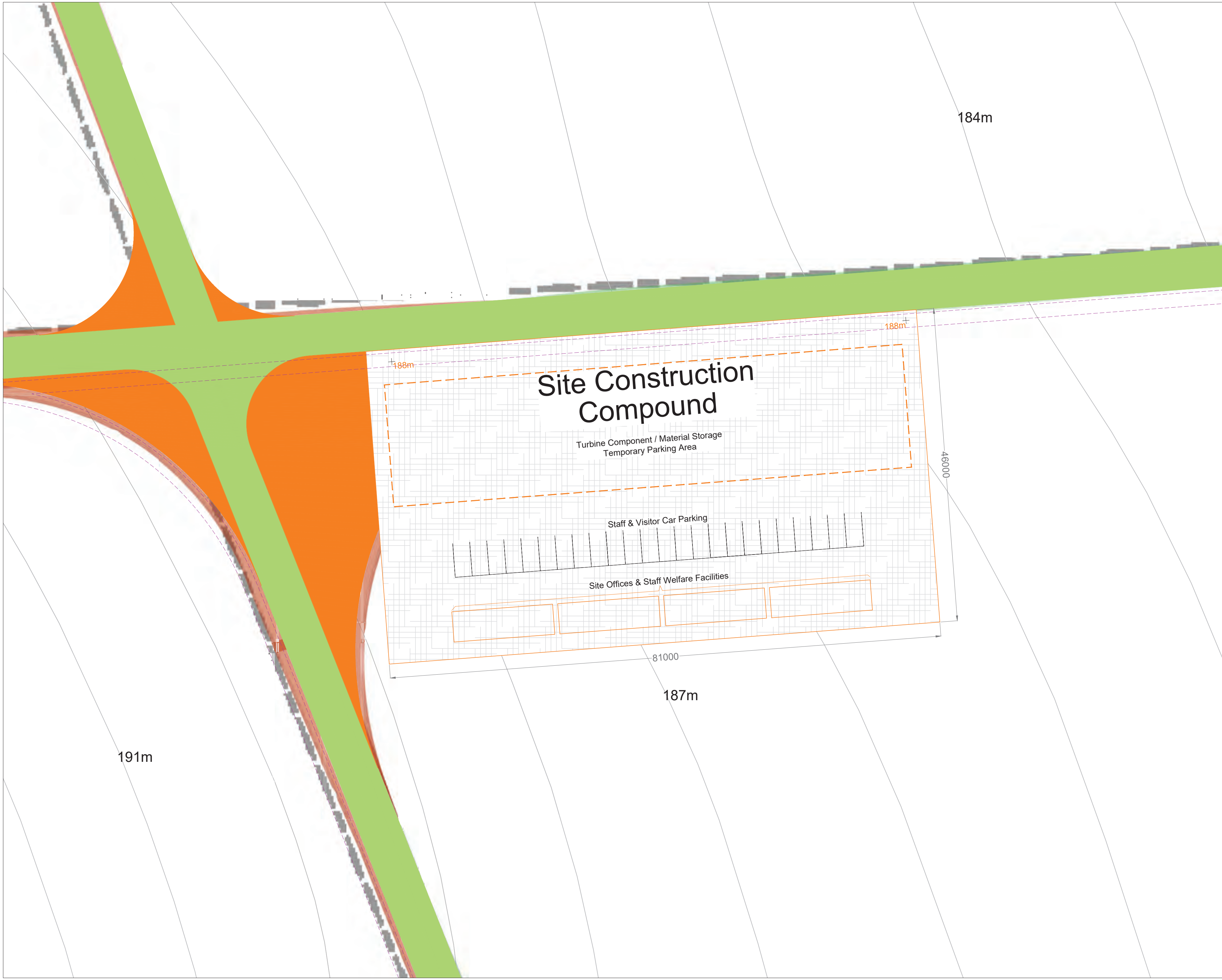
SHEET TITLE

Proposed Met Mast - Site Layout Plan & Site Elevation

SHEET NUMBER

170749-34 _ (05664-DR-207)

Project Management Initials: Designer: GD Checked: RG Approved: RG



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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Electrical Cable Trench
- Cut
- Fill

N

Figure 4-19

DRAWING TITLE:
Temporary Construction Compound 1

PROJECT TITLE:
Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Lorraine Meehan**
PROJECT No.: **170749**	DRAWING No.: **170749 - 20**
SCALE: **1:500 @ A3**	DATE: **05.01.2021**

OS SHEET No.: 6108, 6109, 6110, 6111, 6112, 6154, 6155, 6156, 6157, 6158, 6201,6202,6203, 6204,6205, 6249, 6250, 6251, 6252, 6253

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Electrical Cable Trench
- Cut
- Fill

Figure 4-20

DRAWING TITLE:
Temporary Construction Compound 2

PROJECT TITLE:
Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford

DRAWING BY: Joseph O Brien	CHECKED BY: Lorraine Meehan
PROJECT No.: 170749	DRAWING No.: 170749 - 21
SCALE: 1:500 @ A3	DATE: 05.01.2021

OS SHEET No.: 6108, 6109, 6110, 6111, 6112, 6154, 6155, 6156, 6157, 6158, 6201,6202,6203, 6204,6205, 6249, 6250, 6251, 6252, 6253

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4.3.10 Tree Felling and Replanting

4.3.10.1 Tree Felling

The majority of the proposed wind farm site is occupied by commercial forestry. As part of the Proposed Development, tree felling will be required within and around the development footprint to allow the construction of turbine bases, access roads and the other ancillary infrastructure.

It should be noted that forestry on the site of the proposed wind farm is a commercial crop and will be felled in the future should the proposed wind farm proceed or not.

A total of 45.6 hectares of forestry is required to be permanently felled within and around the footprint of the Proposed Development. An additional 5.4 hectares will be temporarily felled. Figure 4-21 shows the areas to be felled as part of the Proposed Development.

The tree felling activities required as part of the Proposed Development will be the subject of a Felling Licence application to the Forest Service, in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments. The policy requires that a copy of the planning permission for the wind farm be submitted with the felling licence applications; therefore, the felling licenses cannot be applied for until such time as planning permission is obtained for the Proposed Development.

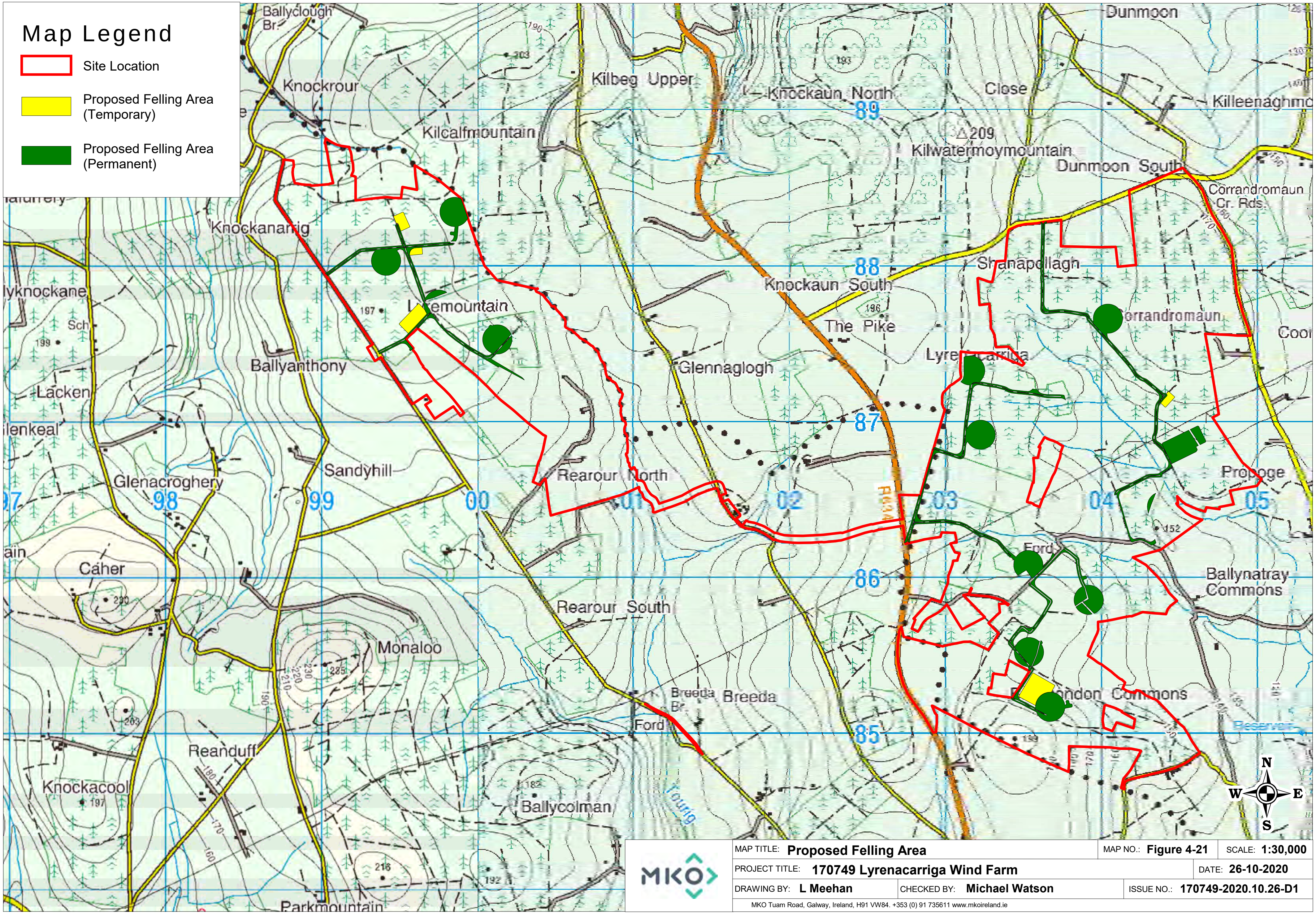
4.3.10.2 Forestry Replacement

In line with the Forest Service's published policy on granting felling licences for wind farm developments, areas cleared of forestry for turbine bases, access roads, and any other wind farm-related uses will have to be replaced by planting at an alternative site.

The Forest Service policy requires replacement or replanting on a hectare for hectare basis for the footprint of the turbines and the other infrastructure developments.

The estimated 45.6 hectares that will be permanently felled for the footprint of the turbines and the other infrastructure will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that might be issued in respect of the proposed wind farm development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement of the felled forestry can occur anywhere in the State subject to licence. A potential replanting site has been identified in County Sligo with an approved area for planting of 49.9 hectares. These lands have been granted Forest Service Technical Approval for afforestation, and these or similarly approved lands will be used for replanting should the proposed wind farm receive planning permission. A description of the proposed replanting lands and an assessment of the potential impacts including cumulative impacts associated with afforestation at this location are provided in Appendix 4-3 of this EIAR.



MAP TITLE: **Proposed Felling Area** | MAP NO.: **Figure 4-21** | SCALE: **1:30,000**

PROJECT TITLE: **170749 Lyrenacarriga Wind Farm** | DATE: **26-10-2020**

DRAWING BY: **L Meehan** | CHECKED BY: **Michael Watson** | ISSUE NO.: **170749-2020.10.26-D1**

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4.3.11 Site Activities

4.3.11.1 Environmental Management

All proposed activities on the site of the Proposed Development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Development and is included in Appendix 4-4 of this EIAR. The CEMP sets out the key environmental considerations to be taken into account by the contractor during construction of the proposed development. The CEMP also details the mitigation 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. The CEMP includes a Waste Management Plan and Emergency Response Plan. Further details on waste management are provided in Section 4.3.12.7 below.

In the event planning permission is granted for the Proposed Development, the CEMP will be updated prior to the commencement of the development, 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.

4.3.11.2 Refuelling

Wherever possible, vehicles will be refuelled off-site. This will be the case for regular, road-going vehicles. However, for construction machinery that will be based on-site continuously, a limited amount of fuel will have to be stored on site in bunded areas.

On-site refuelling of machinery will be carried out at dedicated refuelling locations using a mobile double skinned fuel bowser. The fuel bowser, a double-axle custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. There will be no re-fuelling carried out within 75m of watercourses.

Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays, spill kits and fuel absorbent mats will be used during all refuelling operations.

4.3.11.3 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from offsite batching plants in sealed concrete delivery trucks. Existing concrete suppliers within 25 kilometres of the proposed development site are located at Cappagh and Midleton; final suppliers will be subject to procurement agreements ahead of construction.

The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be washed out fully at the batching plant, where facilities are already in place.

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 located on flat areas at least 50 metres from any watercourses, or directed into a Siltbuster-type concrete wash unit or equivalent. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility. see Appendix 4-5 for product specification

Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown below.


Plate 4-3 Concrete washout area


Plate 4-4 Concrete washout area

The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents will be tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

Due to the volume of concrete required for each turbine foundation, and the requirement for the concrete pours to be continuous, deliveries are often carried out outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally complete in a single day per turbine.

The risks of pollution arising from concrete deliveries will be further reduced by the following:

- Concrete trucks will not be washed out on the site (save for chute washout as described above), but will be directed back to their batching plant for washout.
- Site roads will be constructed to a high standard to allow transport of the turbine components around the site, and hence, concrete delivery trucks will be able to access all areas where the concrete will be needed. No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport. All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, confirming routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site.

4.3.11.4 Concrete Pouring

Because of the scale of the main concrete pours that will be required to construct the Proposed Development, the main pours will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These may include:

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- The small volume of water that will be generated from washing of the concrete lorry chutes will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (see Appendix 4-5 for product specification) or equivalent. Section 4.6.4.8 under Drainage Design below also provides further details on mobile silt traps such as the Siltbuster.
- Disposing of surplus concrete after completion of a pour in suitable off-site locations away from any watercourse or sensitive habitats.

4.3.11.5 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 site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because 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.

4.3.11.6 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. It is not anticipated that vehicle or wheel washing will be required as part of the construction phase of the Proposed Development because site roads will be already formed using on-site materials before other road-going trucks begin to make regular or frequent deliveries to the site (e.g. with steel or concrete). 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 any section of the public roads were to be dirtied by trucks associated with the Proposed Development.

4.3.11.7 Waste Management

The CEMP, in Appendix 4-4 of this EIAR, provides a waste management plan (WMP) which describes the best practice procedures during the construction phase of the project. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the proposed development. Disposal of waste will be seen as a last resort.

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation. The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations. There are licenced waste facilities at Fermoy, Cork and Dungarvan, located within 25 kilometres of the proposed development site.

Prior to the commencement of the development, a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the development adheres to the management plan.

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

4.4 Access and Transportation

4.4.1 Site Entrance

Three site entrances are proposed for the construction stage of the proposed development in order to transport turbine components, materials and equipment to the site. The locations of the access junctions are shown in Figure 4-22 and are described as follows:

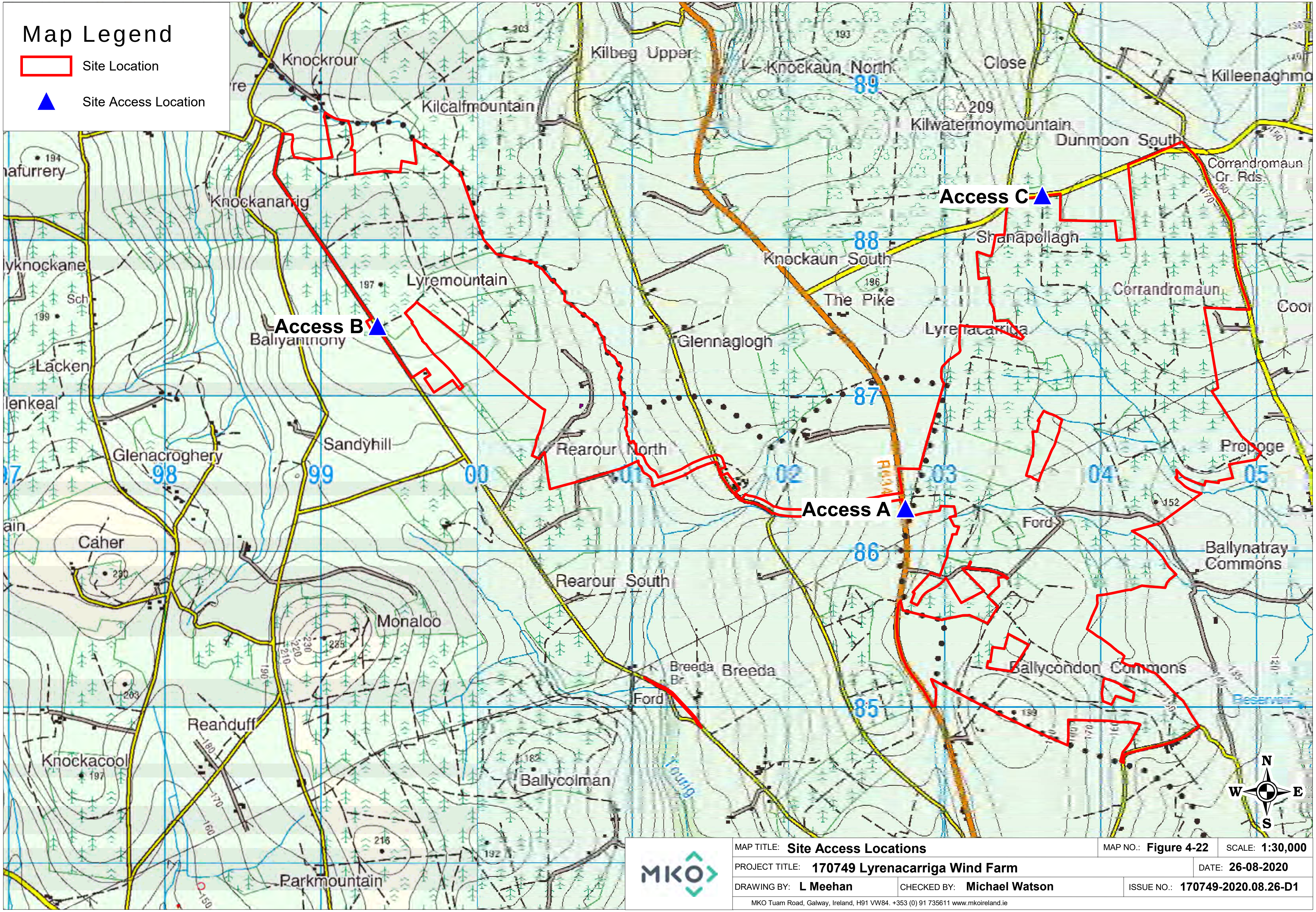
- Access A on the R634 Regional road, into the eastern cluster of turbines
- Access B on the L7806 Local road, into the western cluster of turbines, and
- Access C on the L2003 Local road into eastern cluster (for on-turbine construction traffic).

Access junction A is on the east side of the R634 Regional road and is at the location of an existing forestry access. It is proposed that this junction will provide access and egress to the eastern cluster of turbines (T1 to T11) for the abnormal loads only. All of these movements will be made with the assistance of escort vehicles and traffic management staff. This junction will be closed at all other times. Following the construction phase of the Proposed Development, the upgraded area of this entrance will be closed by erecting fencing, however this may be reopened during the lifetime of the development should replacement blades or other abnormal loads be required to access the site.

Access junction B located on the L7806 will be the sole access to the western cluster of turbines (T12 to T17) and will provide for the delivery of abnormal loads, the delivery of general construction materials, and all construction traffic. It will also provide access for maintenance staff to the western cluster once the wind farm is operational.

Access junction C located on the L2003 is also an existing forestry access and will provide for all general construction traffic (i.e. non-turbine components), including construction staff. It will also provide for maintenance staff to the eastern cluster when operational.

Upgrade works will be required at these existing access locations in order to accommodate access and egress of turbine vehicles and general construction traffic. Further details are provided in Section 15.1.8.2 in Chapter 15 of this EIAR: Material Assets – Traffic and Transportation. An outline Construction Traffic Management Plan is included in the CEMP in Appendix 4-4 of this EIAR. In the event planning permission is granted for the Proposed Development, the final Traffic Management Plan will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.


Map Legend
Site Location
Site Access Location
Access A
Access B
Access C
Knockrour
Kilbeg Upper
Knockaun North
Close
Killeenaghmo
Kilcalfmountain
Kilwatermoymountain
Dunmoon South
Corrandromaun Cr. Rds.
Knockanarrig
Shanapollagh
Knockaun South
The Pike
Lyremountain
Corrandromaun
Ballyanthony
Glennaglogh
Lyrenacarriga
Lacken
Sandyhill
Rearour North
Propoge
Glenacroghery
Ford
Caher
Ballynatray Commons
Rearour South
Monaloo
Breeda
Ballycondon Commons
Reservoir
Reanduff
Knockacool
Ballycolman
Parkmountain
R634
N
W
E
S
MAP TITLE: Site Access Locations
MAP NO.: Figure 4-22
SCALE: 1:30,000
PROJECT TITLE: 170749 Lyrenacarriga Wind Farm
DATE: 26-08-2020
DRAWING BY: L Meehan
CHECKED BY: Michael Watson
ISSUE NO.: 170749-2020.08.26-D1
MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

4.4.2 Turbine and Construction Materials Transport Route

The proposed turbine transport route from the N25 National Primary Road to the proposed development site is shown Figure 4-23. From Waterford the turbines will be transported southwest along the N25 National Primary Road for approximately 30 kms to a roundabout just north of Youghal. The route then travels northwest on the R634 Regional Road to the proposed access to the eastern cluster, situated on the eastern side of the R634. Approximately 3 kms to the south on the R634 Regional Road there is a fork in the road, with the road heading northwest on the L7806. This road provides access to the western site approximately 6 kms to the northwest of the junction with the R634 (Access B).

The delivery route for general HGV construction traffic may vary depending on the location of the suppliers of concrete and other general construction materials required to construct the proposed development. For the purpose of this assessment it is assumed that deliveries of smaller component parts for the wind turbines will travel to the site via the port at Waterford and the N25 followed by the R634 and, in the case of the western site, the L7806, and for the eastern site, the L2003. In practice the delivery route for these component parts could change but as the associated traffic volumes are low, as established in Section 15.1.4 of this EIAR, the impacts will be minimal regardless of the route selected.

The Traffic and Transport assessment is set out in Chapter 15: Section 15.1 of this EIAR.

4.4.3 Turbine Delivery Route Accommodation Works

Works such as road widening are sometimes required along proposed turbine transport routes to accommodate the large vehicles used to transport turbine components to wind farm sites. The proposed transport route for the proposed development has been the subject of a route assessment to determine if any widening works are required along its length; see Section 15.1.8 of this EIAR.

Works are proposed at two locations on the turbine delivery route as part of the proposed development. The locations of these works are shown on Figure 4-23 and are described below. Other works on the route will be minor only, for example the temporary removal of some street signs or furniture, or the temporary levelling of the centre island of some roundabouts.

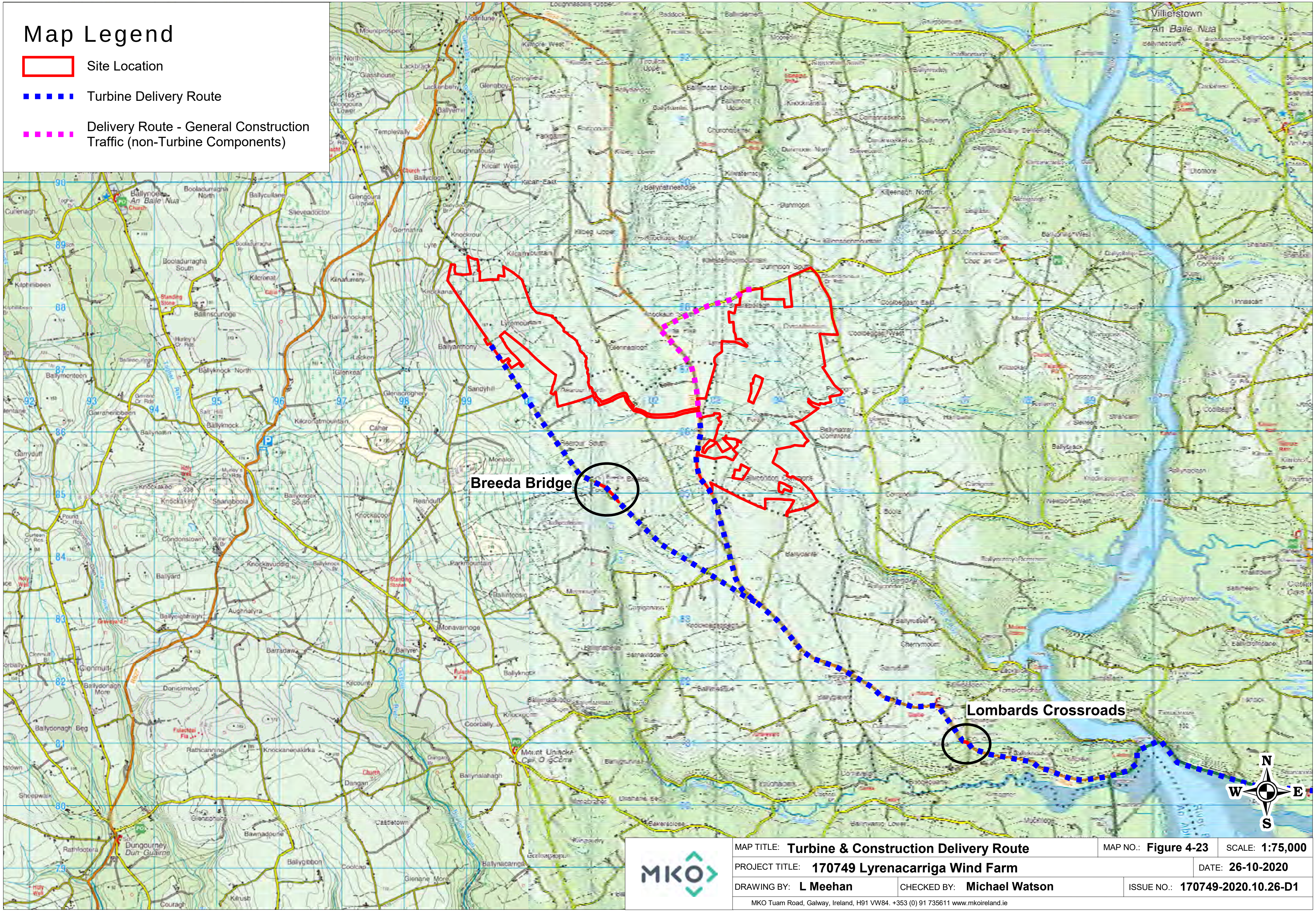
4.4.3.1 Lombard's Cross Roads

Minor road widening is proposed on the southeast corner of Lombard's Cross Roads. This widening will comprise an area of hard-surfacing to be temporarily installed, measuring approximately 70 square metres.

The proposed area for surfacing is currently occupied by road verge and agricultural land. The works will require clearing back the existing road verge and field vegetation at the junction, and excavation of material to allow the placing of stone/hard surfacing within the proposed area. A series of removable bollards will be placed along the existing road edge in order to preserve the structure of the junction outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the area and boundaries will be reinstated restoring the junction to its existing configuration.

4.4.3.2 Breeda Bridge

A section of access road measuring approximately 300 metres in length is proposed off the local road L7806, in order to allow the turbine delivery vehicles to avoid a bend in the public road and to avoid the removal of mature roadside trees at this location. The proposed road will be constructed on agricultural land.



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The access road will have a running width of 5 metres and will be constructed in the same manner as the proposed wind farm site roads, as described in Section 4.3.2 above and Section 4.8.2 below.

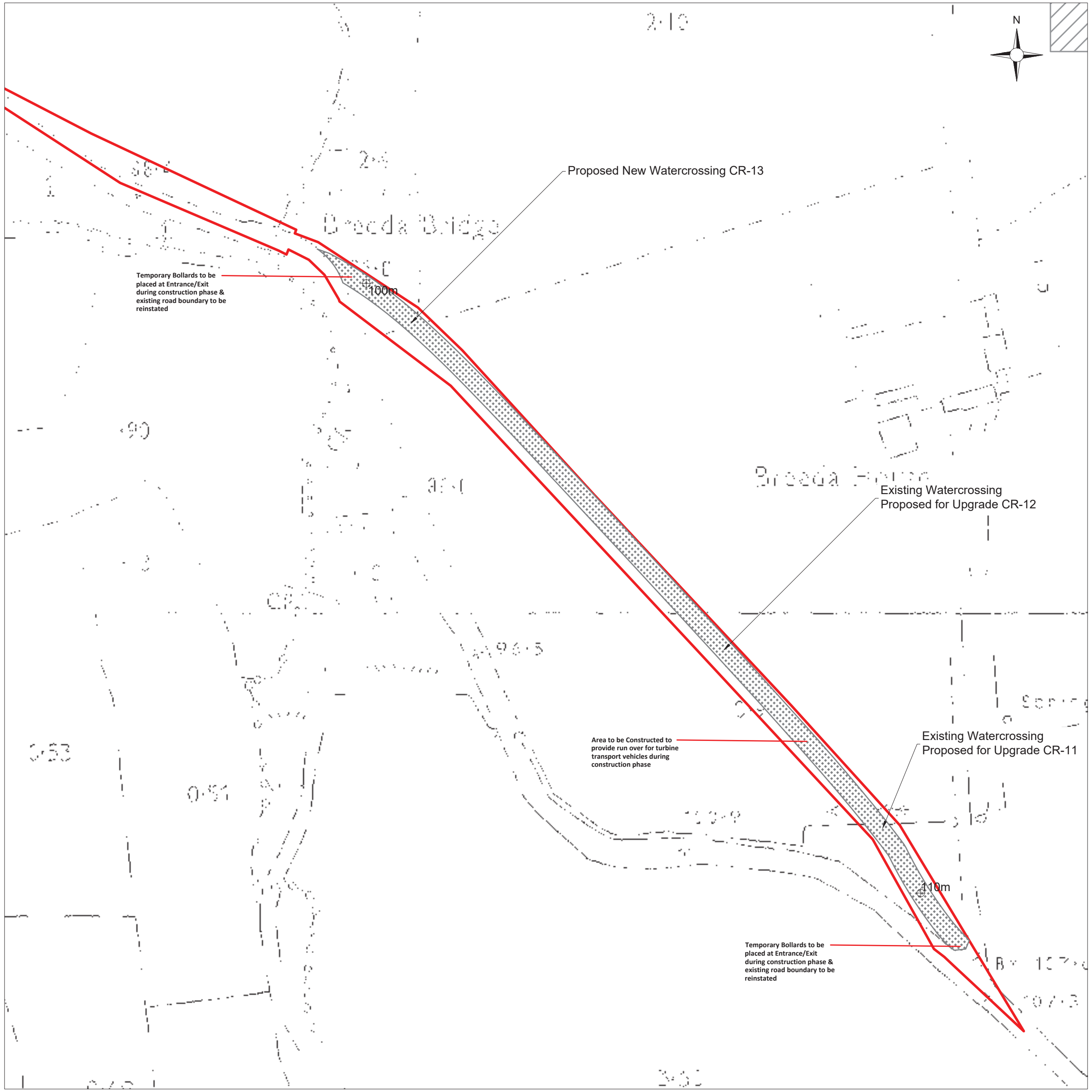
The proposed new access road will be used by turbine delivery vehicles only, with the exit and re-entry points onto the L7806 to be subject to traffic management measures, as presented in Section 15.1 of this EIAR.

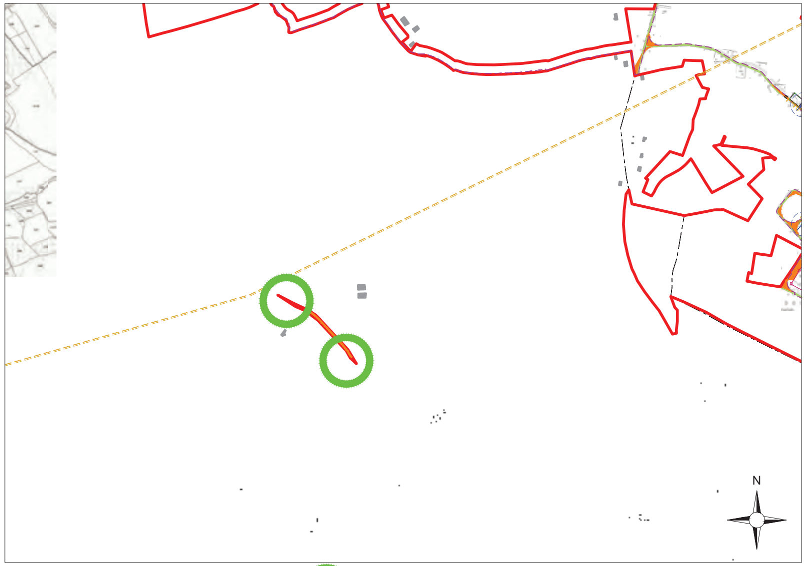
The proposed link road will be constructed using the same methodology as per the wind farm site roads. The construction methodology for the proposed access road is summarised as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The accommodation works when not in use during the construction phase will be cordoned off from the public road, using bollards/fencing.
- Upon completion of the turbine delivery phase of the proposed wind farm the proposed access road will be removed and the grass re-seeded.
- Gates/berms will be left in situ post construction to prevent access from the public road.

Drawing Legend

Hardsurfaced Area





1:25,000 Location on Context Map

Figure 4-24

DRAWING TITLE:
Proposed Access Junction

PROJECT TITLE:
Lyrenacarriga Wind Farm,
Co. Cork & Co. Waterford

DRAWING BY: Joseph O Brien	CHECKED BY: Lorraine Meehan
PROJECT No.: 170749	DRAWING No.: 170749 - 40
SCALE: 1:1,500 @ A3	DATE: 05.01.2021

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4.4.4 Traffic Management

A turbine with a blade length of 66.5 metres has been used in assessing the traffic impact of the Proposed Development. The blade transporter for such a turbine blade would have a total vehicle length of 71.9 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is 46.7 metres with the axles located at the front and rear of the load with no overhang. The vehicles used to transport the nacelles will be similar to the tower transporter. All other vehicles requiring access to the site of the Proposed Development will be smaller than the design test vehicles. The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the site access junctions, as detailed in Section 15.1 of this EIAR.

The need to transport turbine components on the public roads is not an everyday occurrence in the vicinity of the site of the Proposed Development. However, the procedures for transporting abnormal size loads on the country's roads are well established. Whilst every operation to transport abnormal loads is different and requires careful consideration and planning, escort vehicles, traffic management plans, drive tests, road marshals and convoy escorts from the Garda Traffic Corps are all measures that are regularly employed to gets unusual loads from origin to destination. With over 350 No. wind farms already built and operating in Ireland (Republic and Northern Ireland combined, as per latest available figures on www.iwea.com), transport challenges are something the wind energy industry and the specialist transport sector have become particularly adept in finding solutions to.

An outline Traffic Management Plan has been prepared as set out in the CEMP in Appendix 4-4 of this EIAR. In the event planning permission is granted for the Proposed Development, the final Traffic Management Plan will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.

The plan will include:

- A delivery schedule.
- Details of works or any other minor alteration identified.
- A dry run of the route using vehicles with similar dimensions.

The deliveries of turbine components to the site may be made in convoys of three to five vehicles at a time, and mostly at night when roads are quietest. Convoys will be accompanied by escorts at the front and rear operating a "stop and go" system. Although the turbine delivery vehicles are large, they will not prevent other road users or emergency vehicles passing, should the need arise. The delivery escort vehicles will ensure the turbine transport is carried out in a safe and efficient manner with minimal delay or inconvenience for other road users.

It is not anticipated that any section of the public road network will be closed during transport of turbines, although there will be some delays to local traffic at pinch points. During these periods it may be necessary to operate local diversions for through traffic. All deliveries comprising abnormally large loads where required will be made outside the normal peak traffic periods, at night, to avoid disruption to work and school-related traffic.

Prior to the Traffic Management Plan being finalised, a full dry run of the transport operation along the proposed route will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the Traffic Management Plan submitted for agreement with Waterford and Cork County Councils ahead of turbine delivery. All turbine deliveries will be provided for in the Transport Management Plan which will be finalised in advance of the construction stage, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. The finalised Transport Management Plan will be submitted to the Planning Authority for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

4.5 Community Benefit Fund

Should Lyrencarriga Wind Farm be consented, it has the potential to provide significant additional investment into community projects that will benefit local residents and businesses. Following the publication of the Department of Communications, Climate Action & Environment's (DCCAE) Renewable Energy Support Scheme (RESS) and the outcome of the first auction under the scheme, RESS1 which took place this year (August 2020), it is anticipated that based on the requirement for all wind energy projects to contribute €2 per MWh of output, a community fund in the region of €6,000 per MW of installed capacity per annum could be available from the proposed wind farm.

This means that a wind farm at Lyrenacarriga of 60 MW to 85 MW capacity could result in a fund upward of €360,000 per year for the local community, subject to the final installed capacity (MW) and output (MWh) of the wind farm. This represents a dependable source of income for the communities local to Lyrenacarriga.

RWE Renewables Ireland supports the development of a funding process that puts decision-making on what funds are spent where in the hands of local people. The flexibility of the investment that could come from Lyrenacarriga Wind Farm would mean that a panel of local community representatives would decide how to invest the income in a variety of projects that will benefit residents, local businesses and the community as a whole including creating job opportunities and skills development, tourism initiatives and area regeneration projects.

RWE has demonstrable experience in the delivery of large community benefit funds in other jurisdictions and are committed to ensuring that their projects meet or exceed emerging best practice from the DCCAE and the Department of Housing, Planning and Local Government (DHPLG) on Community Benefit.

In addition, a further potential income stream could come via RWE Renewables Ireland offering the local community the opportunity to participate in a community shared ownership scheme whereby they invest in the wind farm in return for a share of future revenue.

Further details regarding other potential economic benefits of the proposed wind farm, including local employment opportunities and Local Authorities rates payments are presented in Section 5.8.2.2 in Chapter 5 of this EIAR. In addition, pending receipt of planning approval, amenity and recreation facilities utilising the onsite road infrastructure within Coillte forestry can be designed and integrated within the operational site. This would be progressed on the basis of community interest and input, and in conjunction with utilisation of the Coillte open forest policy.

4.6 Site Drainage

4.6.1 Introduction

The drainage design for the Proposed Development has been prepared by Hydro Environmental Services Ltd. (HES). The drainage design has been prepared based on the extensive experience of the project team of afforested wind farm sites, and the number of best practice guidance documents referred to in the References section of the EIAR.

There are two public surface water supplies downstream of the Proposed Development site: the Tallow Public Water Supply and the Youghal Public Water Supply. The protection of the watercourses within and surrounding the site, and downstream catchments that they feed has been of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development.

Further details on the Tallow and Youghal public water supplies are provided in Section 10.3.7: Surface Water Abstractions in Chapter 10 of this EIAR on Water.

4.6.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Development. Turbine locations have been selected to avoid natural watercourses. There will be no direct discharges to natural watercourses. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at an appropriate distance from natural watercourse and lakes. Buffer zones around the existing natural drainage features have informed the layout of the Proposed Development and are indicated on the drainage design drawings.

Where artificial drains are currently in place in the vicinity of proposed works areas, these drains may have to be diverted around the proposed works areas to minimise the amount of water in the vicinity of works areas. Where it may not be possible to divert artificial drains around proposed work areas, the drains will be blocked to ensure sediment laden water from the works areas has no direct route to other watercourses. Where drains have to be blocked, the blocking will only take place after an alternative drainage system to handle the same water has been put in place.

Existing artificial drains in the vicinity of existing site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas, 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.

4.6.3 Drainage Design Principles

Drainage water from any works areas of the site of the Proposed Development will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented Figure 4-25 below.

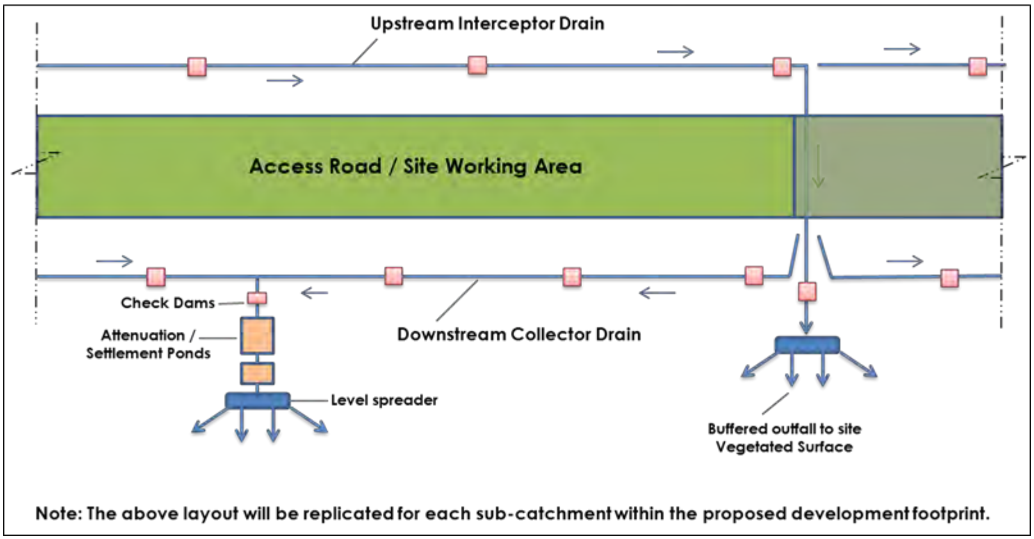


Figure 4-25 Proposed Wind Farm Drainage Process Flow

4.6.4 Drainage Design

A detailed drainage design for the Proposed Development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-6 to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & 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. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- 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;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on ‘Control of Water Pollution from Linear Construction Projects’ (CIRIA Report No. C648, 2006); and,
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

4.6.4.1 Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked 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. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, 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, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting as conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.6.4.3 below), 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 to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 4.6.4.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.6.4.2 Swales

Drainage swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above.

Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it 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.

4.6.4.3 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 will also be installed in some of the existing artificial drainage channels on the site, downstream of where drainage swales connect in.

The proposed check dams will be made up of stone or straw bales, 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, they 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.

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.

4.6.4.4 Level Spreader

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.

The water carried in interceptor drains will not have come in contact with works areas of the site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be re-concentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. Figure 4-26 above, shows an illustrative example of a level spreader.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders. If a slope grade of less than 6% is not available in the immediate area downgradient of a works area at the end of a diversion drain, a piped slope drain (see Section 4.6.4.5 below) will be used to transfer the water to a suitable 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 across the top and bottom to prevent channelised flow leaving the spreader or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be 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.

4.6.4.5 Piped Slope Drains

Piped slope drains will be used to convey surface runoff from diversion drains safely down slopes to flat areas without causing erosion. Once the runoff reaches the flat areas it will be reconverted to diffuse sheet flow. Level spreaders will only be established 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 be semi-rigid corrugated pipes with a stabilised entrance and a rock apron at the outlet to trap sediment and dissipate the energy of the water. The base of drains leading into the top of the piped slope drain will be compacted and concavely formed to channel the water into the corrugated pipe. The entrance at the top of the pipe will be stabilised with sandbags if necessary. The pipe will be anchored in place by staking at approximately 3-4 metre intervals or by weighing 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 outflowing onto a rock apron.

The rock apron at the outlet will consist of 6-inch stone to a depth equal to the diameter of the pipe, a length six times the diameter of the pipe. The width of the rock apron will be three times the diameter of the pipe where the pipe opens onto the apron and will fan out to six times the diameter of the pipe over its length. Figure 4-26 shows a diagrammatic example of a piped slope drain and rock apron.

Piped slope drains will only remain in place for the duration of the construction phase of the Proposed Development. On completion of the works, the pipes and rock aprons will be removed and all channels backfilled with the material that was originally excavated from them.

Piped slope drains will be inspected weekly and following rainfall events. Inlet 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 drain at the top of the pipe will be repaired promptly.

4.6.4.6 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 suitable areas to use as vegetation filters will be determined by 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 potentially 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.

4.6.4.7 Stilling Ponds

Stilling ponds will be used to attenuate runoff from works areas of the site of the Proposed Development during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of 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.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area they 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.

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 to 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.

A water level indicator such as a staff gauge will be installed in each stilling pond with marks to identify when sediment is at 10% of the stilling pond capacity. Sediment will be cleaned out of the still pond when it exceeds 10% of pond capacity. 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.

4.6.4.8 Siltbuster

A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to 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. The mobile units are specifically designed for use on construction sites.

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4-26 below shows an illustrative diagram of the Siltbuster.

The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of Siltbuster units on construction projects.

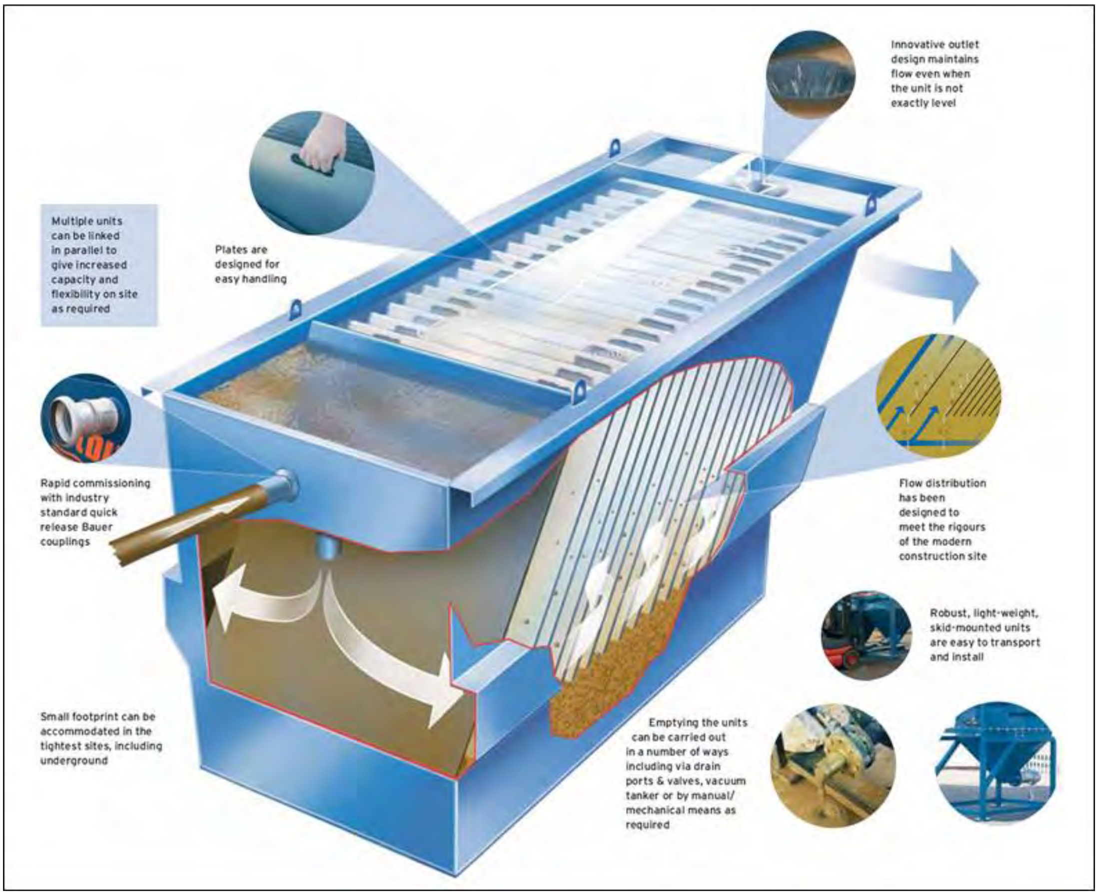


Figure 4-26 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

4.6.4.9 Silt Bags

Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within 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 4-5 and Plate 4-6 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.

Plate 4-5 Silt Bag under inspection

Plate 4-6 Silt bag with water being pumped through

4.6.4.10 Sedimats

Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

4.6.4.11 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 development, particularly where the waters have to be taken from one side of an existing 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 doesn't occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

4.6.4.12 Silt Fences

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 CIRIA (CIRIA, No. C648, 1996). Up to three silt fences may be deployed in series.

The Stage 1 (Coarse) silt fence will consist of a geotextile fabric such as Terram 1000 attached by staples to fixed stakes. The Terram sheets will be folded in an L shape with one metre extending horizontally in towards the works area. This horizontal section will be buried at a distance of approximately 150mm beneath a clean stone surface. Terram 1000 is a permeable fabric through which water can pass, but through which sediment particles cannot. It does however, impede water flow and can lead to the backing up of water and sediment, which reduce its effectiveness.

The Stage 2 (Medium) silt fence will consist of straw bales, embedded 100mm into the soil/ground and fixed in place with stakes. A geotextile fabric will be pegged and stapled to the straw bales and stakes.

The Stage 3 (Fine) silt fence will be similar to the Stage 1 fence, with the addition of a coarse sand and/or fine gravel at the base of the geotextile.

All silt fencing will be formed using Terrastop Premium or equivalent silt fence product.

Site 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.

4.6.5 Forestry Felling Drainage Measures

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Keyhole felling to facilitate construction works will take place prior to groundworks commencing. Some further felling may take place after all groundworks have been completed but while turbines are being commissioned.

Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) shall be appointed to oversee the keyhole and extraction works. The ECoW shall be experienced and competent, and shall have the following functions and operate their record using a Schedule of Works Operation Record (SOWOR), as proposed in the planning application:

- Attend the site for the setup period when drainage protection works are being installed, and be present on site during the remainder of the forestry keyhole felling works.
- Prior to the commencement of works, review and agree the positioning by the Operator of the required Aquatic Buffer Zones (ABZs), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below).
- Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in site operations, prior to the commencement of the works.
- Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix 3 (Site Monitoring Form (Visual Inspections)) of the *Forestry & Freshwater Pearl Mussel Requirements* (Forest Service, 2008). (*Note* There is no surface water connectivity between the proposed wind farm site and any Freshwater Pearl Mussel sensitive catchments).
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
    - Surface water samples shall be collected upstream and downstream of the keyhole felling site at suitable sampling locations.
    - Sampling shall be taken from the stream / river bank, with no in-stream access permitted.
    - The following minimum analytical suite shall be used: pH, Electrical Conductivity, Total Suspended Solids, Biochemical Oxygen Demand, Total Phosphorus, Ortho-Phosphate, Total Nitrogen, and Ammonia.
- Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions.
- Prepare and maintain a contingency plan.
- Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed.

- Prepare and maintain a Water Protection Measure Register. This document is to be updated weekly by the ECoW.

All relevant measures set out in the Forestry & Freshwater Pearl Mussel Requirements, Forestry & Water Quality Guidelines, Forest Harvesting & the Environment Guidelines and the Forest Protection Guidelines will apply. To protect watercourses, the following measures will be adhered to during all keyhole/tree felling activities.

- Works will be overseen by an ECoW as described above.
- The extent of all necessary tree felling will be identified and physically demarcated on the ground in advance of any felling commencing.
- All roads and culverts will be inspected prior to any machinery being brought on site to commence the felling operation. No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt traps (which may include a combination of the drainage components outlined in Section 4.6.4) will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed. No direct discharge of such drains to watercourses will occur from within felling areas.
- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- All silt traps will be sited outside of buffer zones and have no direct outflow into the aquatic zone. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of away from all aquatic zones.
- All new collector drains will taper out before entering the aquatic buffer zone to ensure the discharging water gently fans out over the buffer zone before entering the aquatic zone.
- Machine combinations, such as mechanical harvesters or chainsaw felling, will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance;
- Mechanised operations will be suspended during and immediately after heavy rainfall.
- Where brash is required to form brash mats, it is to be laid out at harvesting stage to prevent soil disturbance by machine movement.
- Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations.
- Felling of trees will be pointed directionally away from watercourses.
- Felling will be planned to minimise the number of machine passes in any one area.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone. Straw bales and check dams to be emplaced on the down gradient side of timber storage sites.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but removing of natural debris deflectors will be avoided.

4.6.6 Borrow Pit Drainage

While surface water will be contained in the borrow pit areas, the design proposal is to control the level of water in the borrow pit area by creating a single point outlet from the basin-like area that will ensure the water does not overtop the pit area. Run-off from the proposed borrow pit areas will be controlled via a single outlet that will be installed at the edge of the borrow pit. The single outfall point will be constructed to control runoff from the borrow pit and its immediate surrounds. Interceptor drains will already have been installed upgradient of the borrow pit area before any extraction begins.

During the construction phase of the project, it will be necessary to keep the borrow pit area free of standing water while rock is still being extracted. This will be achieved by using a mobile pump, which will pump water into the same series of drains, settlement ponds and level spreader, which will receive the water from the single outlet.

4.6.7 Cable Trench Drainage

Cable trenches are typically developed in short 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.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is 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 Development, would be transported to one of the on-site borrow pits or used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 4.6.4.12, above, will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

4.6.8 Site and Drainage Management

4.6.8.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing.

An adequate amount of clean stone, terram, stakes, straw bales, etc will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

4.6.8.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the Proposed Development will also take account of weather forecasts, and predicted rainfall in particular. Large excavations, large movements of overburden or large-scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

4.6.8.3 Reactive Site Drainage Management

The final drainage design prepared for the Proposed Development prior to commencement of construction will provide for adaptive 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 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 project proceeds, 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 modified (by improvement) 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 the situation on the ground at a particular time.

In the event that works give rise to siltation of watercourses, the ECoW or supervising hydrologist will immediately 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.

4.6.9 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works on the Proposed Development. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the ECoW or the supervising hydrologist.

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 project to ensure 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 Development 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 be 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.

A water level indicator such as a simple staff gauge or level marker will be installed to a number of silt traps with marks to identify when sediment is at 50% of the trap's capacity. Sediment will be cleaned out of the silt trap when it exceeds 50% of trap capacity. Silt traps will be inspected weekly during the construction phase of the Proposed Development 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 Development. Weekly inspections during the construction phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase up until the site has revegetated and the natural silt controls regenerate. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

4.7 Construction Phasing and Timing

It is estimated that the construction phase of the Proposed Development will take approximately 18-24 months from commencement onsite to the commissioning of the electrical system.

In the interest of the protection of breeding birds, should the planned construction programme commencement coincide with the Breeding bird season (April to July inclusive), an early breeding season survey by a qualified ornithologist will be commissioned and, subject to confirmation of no nesting or breeding activity in any areas for works to be undertaken, works will proceed, with ongoing monitoring in parallel to ensure adherence of protection protocols throughout the season. Hedgerow cutting and disturbance of any other confirmed nesting habitat would be prohibited during the breeding season in line with legislation and best practice. The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Any required removal of vegetation will be undertaken following inspection by a suitable qualify ornithologist to ensure no nesting birds are affected.

4.7.1 Construction Sequencing

The construction phase can be broken down into three main phases, which overlap partially: 1) site preparation and civil engineering works - 10 months, 2) electrical works - 12 months, and 3) turbine erection and commissioning - 8 months. The main task items under each of the three phases are outlined below.

Civil Engineering Works:

- Erect all necessary safety signage
- Create new entrance(s) and hardcore existing entrances (where required).
- Clear and hardcore area for temporary site offices. Install same.
- Construct bunded area for oil tanks.
- Construct new site roads and hard-standings and crane pads.
- Construct drainage ditches, culverts etc. integral to road construction.
- Excavate for turbine bases. Place blinding concrete to turbine bases. Fix reinforcing steel and anchorage system for tower section. Construct shuttering. Fix any ducts etc. to be cast in. Pour concrete bases. Cure concrete. Remove shutters after 1-2 days.
- Install meteorological masts.

Electrical Works:

- Construct bases/plinths for substation building.
- Excavate trenches for site cables, lay cables and backfill. Provide ducts at road crossings.
- Erect transformers at compound.
- Install Ring Main Units
- Erect fencing at transformer compound.

Turbine Erection and Commissioning:

- Erect towers, nacelles and blades.
- Backfill tower foundations and cover with previously stored topsoil.
- Complete electrical installation.
- Grid connection.
- Commission and test turbines.
- Complete site works, reinstate site.
- . Provide any gates, landscaping, signs etc. which may be required. Remove temporary site offices.

The phasing and scheduling of the main construction task items are outlined in Figure 4-27 below, where 1st January has been selected as an arbitrary start date for construction activities.

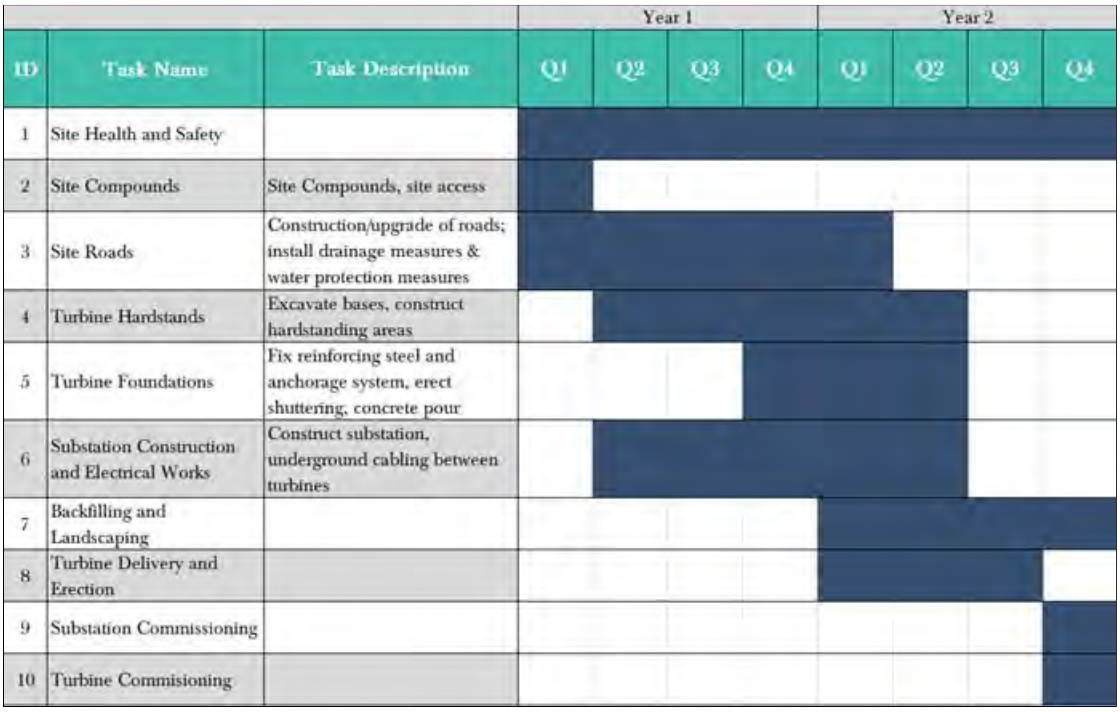


Figure 4-27 Indicative Construction Schedule

4.7.2 Construction Phase Monitoring and Oversight

The requirement for a Construction and Environmental Management Plan (CEMP) to be prepared in advance of any construction works commencing on any wind farm site and submitted for agreement to the Planning Authority is now well-established. The proposed procedures for the implementation of the mitigation measures outlined in such a CEMP and their effectiveness and completion is typically audited by way of a Construction and Environmental Management Plan Audit Report.

The CEMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation and all conditions attached to the grant of planning permission and allows them to be audited on a systematic and regular basis. The first assessment is a simply Yes/No question, has the mitigation measure been employed on-site or not? Following confirmation that the mitigation measure has been implemented, the effectiveness of the mitigation measures must be the subject of regular review and audit during the full construction stage of the project. If remedial actions are needed to improve the effectiveness of the mitigation measure, then these are notified to the site staff immediately during the audit site visit, and in writing by way of the circulation of the audit report. Depending on the importance and urgency of rectifying the issue, the construction site manager is given a timeframe by when the remedial works need to be completed.

A Construction Environmental Management Plan (CEMP) has been prepared for the Proposed Development, and is included in Appendix 4-4 of this EIAR. The CEMP includes details of drainage, overburden management, waste management etc, and describes how the above-mentioned Audit Report will function and be presented. In the event planning permission is granted for the Proposed Development, the CEMP will be updated prior to the commencement of the development, 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 on-site construction staff will be responsible for implementing the mitigation measures specified in the EIAR and compiled in the Audit Report. Their implementation 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. The system of auditing referred to above ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary.

4.8 Construction Methodologies

4.8.1 Turbine Foundations

Each of the turbines to be erected on site will have a reinforced concrete base. If there is a requirement for piling at any of the turbine bases, this will be confirmed by geotechnical investigations. The exact dimensions and types of foundations will be confirmed by pre-construction structural design calculations incorporating appropriate factors of safety.

Where the foundation of the turbine is founded on competent strata, overburden will be stripped off the foundation area to a suitable formation using a 360° excavator and will be placed across the site as close to the excavation as practical. A five-metre wide working area will be required around each turbine base, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be sealed using the back of the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur.

The formation material will have to be approved by an engineer as meeting the turbine manufacturer's requirements. If the formation level is reached at a depth greater than the depth of the foundation, the ground level will be raised with clause 804 or similar hardcore material, compacted in 250 millimetres (mm) layers, with sufficient compacted effort (i.e. compacted with seven passes using 12 tonne roller). Drainage measures will be installed to protect the formation by forming an interceptor drain around the perimeter of the base which will outfall out at the lowest point level spreader or settlement pond.

In the case where a piled foundation is required; the piles will be constructed by coring and inserting a steel sleeve which will be filled with reinforced concrete prior to sleeve removal.

An embankment approximately 600 mm high will be constructed around the perimeter of each turbine base and a fence will be erected to prevent construction traffic from driving into the excavated hole and to demarcate the working area. All necessary health and safety signage will be erected to warn of deep excavations etc. Access to and from excavated bases will be formed by excavating a pedestrian walkway to 1:12 grade.

There will be a minimum of 100 mm of blinding concrete laid on the formation material positioned using concrete skip and 360° excavator to protect ground formation and to give a safe working platform.

The anchor cage is delivered to site in 2 or more parts depending on the turbine type. A 360° excavator or crane with suitable approved lifting equipment will be used to unload sections of the anchor cage and reinforcing steel. The anchor cage is positioned in the middle of the turbine base and is assembled accordingly. When the anchor cage is in final position it is checked and levelled by using an appropriate instrument. The anchor cage is positioned 250mm – 300mm from formation level by use of adjustable legs. Reinforcement bars are then placed around the anchor cage, first radial bars, then concentric bars, shear bars and finally the superior group of bars. Earthing material is attached during the steel foundation build up. The level of the anchor cage will be checked again prior to the concrete pour and during the concrete pour.

Formwork to concrete bases will be propped/supported sufficiently so as to prevent failure. Concrete for bases will be poured using a concrete pump. Each base will be poured in three stages. Stage 1 will see the concrete being poured and vibrated in the centre of the anchor cage to bring the concrete up to the required level inside the cage. Stage 2 will see the centre of the steel foundation being poured and vibrated to the required level. Stage 3 will see the remaining concrete being poured around the steel foundation to bring it up to the required finished level. After a period of time when the concrete has set sufficiently the top surface of the concrete surface is to be finished with a power float.

Once the base has sufficient curing time it will be filled with suitable fill up to existing ground level. The working area around the perimeter of the foundation will be backfilled with the original material that was excavated.

4.8.2 Site Roads and Crane Pad Areas

Site roads will be constructed to each turbine base and at each base a crane hard standing will be constructed to the turbine manufacturer's specifications. Tracked excavators will carry out excavation for roads with appropriate equipment attached. The excavations shall follow a logical route working away from the borrow pit locations. Excavated material will be transported back to the borrow pits in haul trucks. A two to three metre wide working area will be required around each hard standing area, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be sealed using the back of the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur.

When the formation layer has been reached, stone from the on-site borrow pit shall be placed to form the road foundation. In the event of large clay deposits being encountered in sections of road, a geotextile layer will be required at sub-base level. The sub grade will be compacted with the use of a roller. The final wearing course will not be provided until all bases have been poured. This prevents damage to the wearing course due to stone and concrete trucks movements. The road will be upgraded prior to the arrival of the first turbine. All roads will be maintained for the duration of the operation of the Proposed Development.

4.8.2.1 Watercourse Crossings

Proposed new stream crossings will be bottomless box culverts or clear span bridges and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the watercourse at the proposed crossing locations. Where the proposed underground onsite cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road.

The design of the proposed crossings follows Inland Fisheries Ireland's *'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters'* (2016). During near stream construction work, double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed within 50 metres of the crossing construction areas.

The 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. New watercourse crossings will require a Section 50 application (Arterial Drainage Act, 1945), which will be obtained prior to works. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

The typical construction methodology for the installation of a pre-cast concrete clear-span bridge is presented below:

- The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The 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.
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of pre-cast concrete slab across the watercourse to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams 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.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.

The typical construction methodology for the installation of a pre-cast concrete bottomless box culvert is presented below:

- 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 the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- 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.
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of pre-cast concrete slab across the watercourse to provide temporary access for the excavator. Plant and equipment will not be permitted to track across the watercourse.
- Once the foundation base has been completed, the pre-cast concrete box culvert 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.
- Where the box culvert is installed in sections, the joints will be sealed to prevent granular material entering the watercourse.
- Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations.

When the pre-cast concrete box culvert is cured as per the manufacturer's specification, the filling and compaction of the road will be completed. The road finish level will be decided by the Project Engineer.

The proposed upgrade of existing crossings will be completed as follows:

- The access road on the approach watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- The installation of the culvert will take place in low flow conditions.
- Where a flow exists, the water running through the watercourse channel will be pumped around the water crossing location and back into the watercourse channel downstream of the works area.
- Where over pumping is required, measures will be taken to ensure that the pumped water discharge does not disturb the channel bed with the force of water from the discharge. A steel plate to reduce the force of the flow will be used where appropriate.

- The project engineer will determine the required gradient of the culvert. The culvert must be laid at a gradient that will ensure water is contained within the culvert at all times. Where necessary a rock armour dam will be installed within the channel to reduce flow and ensure an acceptable depth of water remains within the culvert. Where a gradient of 1 – 1.5% is identified, the use of a baffle has been recommended.
- The bed of the watercourse channel will be excavated, if necessary, to achieve the correct line and to allow the culvert to be embedded 300mm into the base of the existing drain.
- 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.
- The culvert will be lowered into place using an excavator with a lifting mechanism.
- Large stone boulders (approx. 400mm), sourced from the on-site borrow pits, will be placed over the culvert to create a headwall for the culvert and a suitable sub-base for road construction.
- Smaller 50mm stone sourced on site will be placed upon the sub-base to construct the road over the water crossing.

The works will be undertaken in line with NRA *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.*

4.8.3 Onsite Electricity Substation and Control Building

The proposed electricity substation will be constructed by the following methodology:

- The area of the onsite substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to nearby temporary storage area for later use in landscaping. Any excess material will be sent to one of the proposed borrow pits, for reinstatement purposes.
- The dimensions of the onsite substation area have been designed to meet the requirements of the ESB or Eirgrid and the necessary equipment to safely and efficiently operate the permitted wind farms;
- Two control buildings will also be built within the onsite substation compound;
- 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;
- The block work walls will be built up from the footings to damp proof course level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- 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;
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- 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.
- The electrical equipment will be installed and commissioned.
- Perimeter fencing will be erected.
- The construction and components of the substation have been designed to ESB/Eirgrid specifications.

4.8.4 Temporary Construction Compounds

The temporary construction compounds will be constructed as follows:

- 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;
- The compound platform will be established using a similar technique as the construction of the substation platform discussed above;
- A layer of geo-grid will be installed 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;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- The compound will be fenced and secured with locked gates if necessary; and,
- Upon completion of the Proposed Development the temporary construction compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required.

4.8.5 Grid Connection

The proposed wind farm will be connected to the National Grid via a 110 kV loop-in connection from the proposed onsite substation to the existing 110kV network which runs through the site (as per Figure 4-17 above). This will entail the construction of two sections of 40 metres of overhead line to connect the substation to the existing overhead line. The methodology for this grid connection will encompass the following:

- The existing 110 kV overhead line will be modified to allow the line to turn into the new 110 kV substation in a loop-in – loop-out configuration. This will involve the removal of one number double pole set and the installation of two number turning angle masts (13 metre height) and two number end masts within the substation area.
- Temporary access roads will be required from the substation road to the angle mast location to enable the delivery of stone and concrete required for the angle mast foundations.
- An outage of the existing overhead line will be sought and will beprogrammed by Eirgrid on their annual grid outage programme.
- The angle and end mast foundations will then be excavated, blinded, stoned up, prior to concrete shuttering, steel fixing and pouring of base and each angle mast leg.
- After completion of concrete pouring the ground surrounding the mast will be reinstated and landscaped.
- After a sufficient concrete curing period the angle and end masts will be fully assembled on the ground before being lifted into place using a mobile crane.
- Crews will fix and bolt the masts in place and attach the lightning rod.
- Dead man stays will be installed to support the existing polesets prior to the breaking overhead line at the location of the new angle masts.
- The installation of 3 no conductors and 2 no shield wires will then tie the existing overhead line into the new station at two points or bays.
- Bird diverters, dampers and vibration monitors are also proposed to be installed on the new conductor. It is also common for a fibre-optic cable which may wrapped around one of the conductors to be terminated into the new substation.

4.8.6 Collector Cabling

The transformer in each turbine is connected to the substation through a network of buried electrical cables. The ground is trenched typically using a mechanical excavator. The top layer of soil is removed and saved so that it is replaced on completion. The cables are bedded with suitable material unless the ground conditions are such that no bedding is required. The cables will be laid at a depth that meets relevant national and international requirements, and will generally be approximately 1.3m below ground level; a suitable marking tape is installed between the cables and the surface (see Plate 4-7 below). On completion, the ground will be reinstated as previously described above. The route of the cable ducts will follow the access track to each turbine location and are shown on the site layout drawings included as Appendix 4-1 of the EIAR.

Plate 4-7 Typical Cable Trench View

It is proposed to connect the western cluster of turbines to the proposed onsite substation within the eastern cluster of turbines via a section of underground collector cabling measuring approximately 3.3 kilometres in length, as shown above in Figure 4-16. Approximately 620m of the collector cabling is located on existing roads, with the remaining 2.68 kilometres to be installed on agricultural land. The collector cabling to connect the two clusters of turbines will be laid beneath the surface of the site and public road using the following typical methodology:

- The area where excavations are planned will be surveyed, prior to the commencement of works to confirm the conditions predicted in this EIAR, with a cable-avoiding tool and all existing underground services will be confirmed.
- Two teams consisting of two tracked excavators, two dumpers and a tractor and stone cart with side-shoot will dig the trench for and lay approximately 300m of the underground cable ducting per day.
- Both teams will start approximately 150m apart with the team behind finishing at the starting point of the team ahead.
- The excavators will open a trench at the edge of the road surface or on agricultural land as appropriate, the trench will be a maximum of approximately 600mm wide and 1,250mm deep.
- Clay plugs will be installed at 50m intervals to prevent the trench becoming a conduit for surface water runoff.
- Cable joint pits will be located at approximately 500m intervals or as otherwise required by ESB requirements along the proposed cable route, each joint pit will be approximately 2.6m x 8m in size and contain a communications chamber, an earth link box and a cable joint bay, all of which will be located in the road edge and accessible for cable pulling and future maintenance.
- The excavated material will be loaded into the dumpers to be transported to a designated temporary stockpiling area to be reused as backfilling material where appropriate.
- Once the trench has been excavated, a base layer of blinding will be installed by the tractor and cart and compacted by the excavators.

- The ducting along with marker strips will then be placed in the trench as per relevant specifications.
- Blinding will be installed to approximately 75mm above the cable ducting and compacted.
- The remainder of the trench will be backfilled with granular material and compacted.
- The trench will be surfaced as per the road surface specifications of the local public road.
- An unbound surface layer shall be placed over the grid connection route where it transverses forestry and agricultural land, as per ESB design requirements, in order to provide a road profile and graded to accommodate maintenance vehicles.

4.8.6.1 Existing Underground Services

Any underground services encountered along the cable routes 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 ESB ducts where adjacent services are within 600mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate.

4.8.6.2 Joint Bays (Connection Chambers)

Joint bays are pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They will be located at various points along the ducting route generally between 600 to 1000 metres intervals or as otherwise required by ESB requirements.

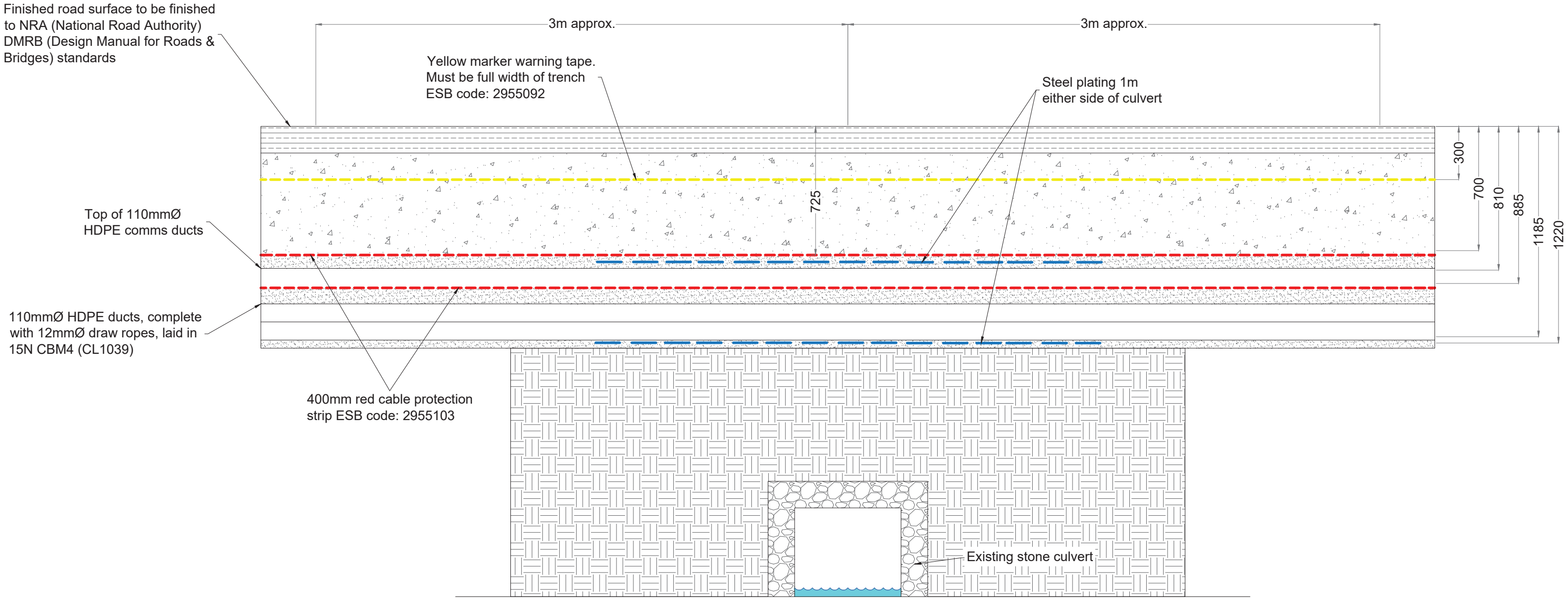
Where possible, joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction the joint bay locations will be completely fenced off once they have been constructed they will be backfilled until cables are being installed.

4.8.6.3 Watercourse Crossings on Collector Route

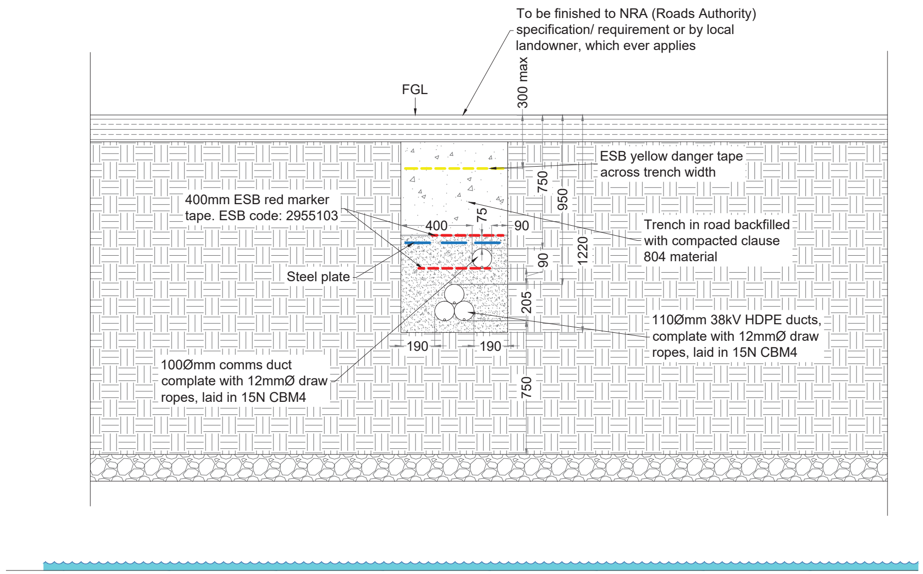
There is a total of 2 no. watercourse crossings along the collector cable route; 1 no. existing culvert crossing and 1 no. open channel stream/watercourse crossing. The locations of these crossings are shown above in Figure 4-6. The watercourse crossing methodologies for the provision of the grid connection at these locations is set out below with the most appropriated option being selected for each crossing. Instream works are not required at any watercourse crossing along the proposed collector route.

4.8.6.3.1 *Crossing Using Standard Trefoil Formation – Option 1*

Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where adequate cover exists above an bridge/culvert or where a new bottomless box culvert or clear-span structure has been installed, the standard ESB approved trefoil arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert or water course. The cable trench will pass over the culvert in a standard trench as outlined in Figure 4-28.



Longitudal section at watercourse crossing



Cross section at watercourse crossing

DRAWING TITLE:
Typical Cable Trench Over Culvert

PROJECT TITLE: Lyrenacarriga Wind Farm

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 170749	DRAWING No.: Figure 4-28
SCALE: 1:30 @ A3	DATE: 28.08.2019

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4.8.6.3.2 *Flatbed Formation over Bridges/Culverts – Option 2*

Where cable ducts are to be installed over an existing bridge/culvert crossing where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert or the depth of excavatable material over a bridge. The ducts will be laid in this trench in a flatbed formation over the existing culvert and will be incased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification. This method of duct installation is further detailed in Figure 4-29.

Where a bridge or culvert has insufficient cover depth to fully accommodate the required trench, the ducts can be laid in a flatbed formation partially within the existing road surface. Where this option is to be employed, the ducts will also be encased in steel with a concrete surround as per EirGrid and/or ESB Networks specifications. In order to achieve cover over these ducts and restore the carriageway of the road, it may be necessary to raise the pavement level locally to fully cover the ducts. The increase road level will be achieved by overlaying the existing pavement with a new wearing course as required. Any addition of a new pavement will be tied back into the existing road pavement at grade. After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench. This method of duct installation is further detailed in Figure 4-30.

4.8.6.3.3 *Directional Drilling – Option 3*

The directional drilling method of duct installation is carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant. 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. 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.

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. 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.

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. 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.

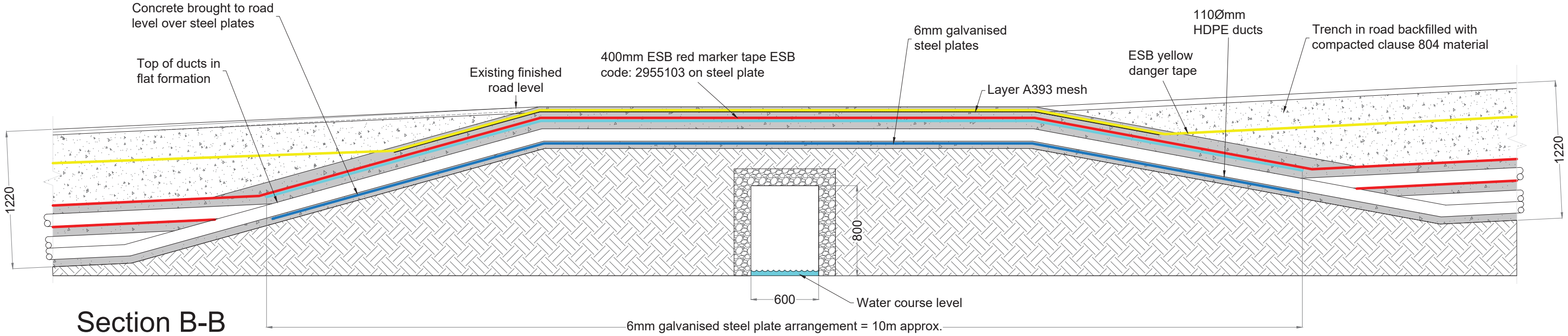
Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring, as listed below, will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits.

- The area around the Clear Bore™ batching, pumping and recycling plants shall be bunded using terram and sandbags in order to contain any spillages;
- One or more lines of silt fences shall be placed between the works area and adjacent rivers and streams on both banks;

- Accidental spillage of fluids shall be cleaned up immediately and transported off site for disposal at a licensed facility; and,

Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

The directional drilling methodology is further detailed in Figure 4-31.



Section B-B
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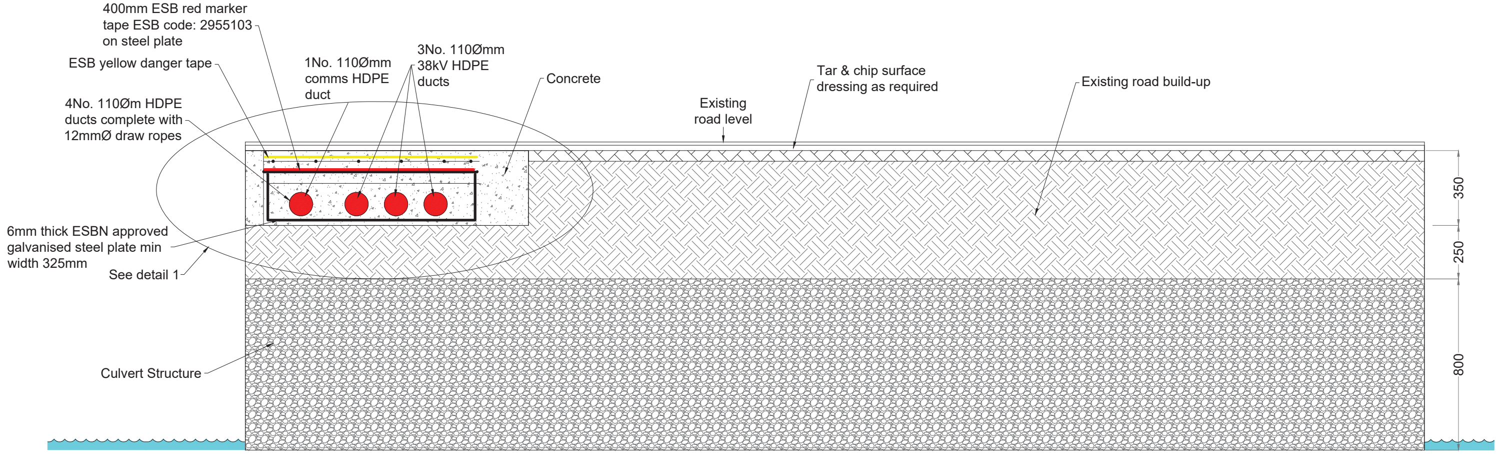

Section A-A
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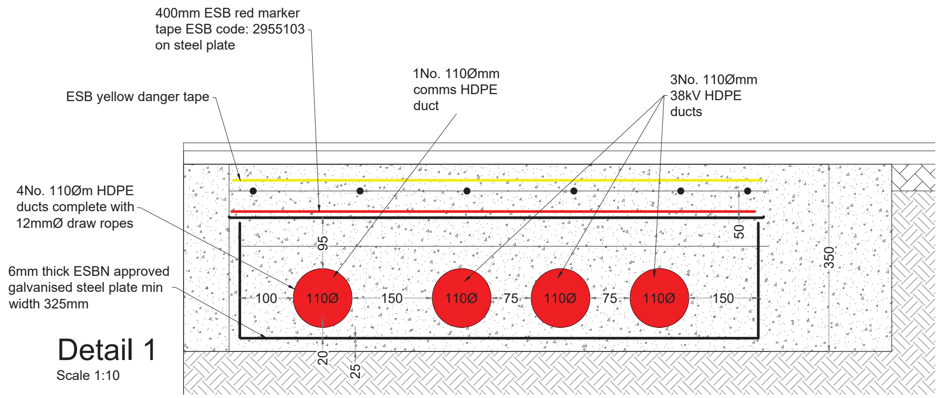

Detail 1
Scale 1:10

DRAWING TITLE: **Typical Cable Trench Flatbed Formation Over Culvert**	
PROJECT TITLE: Lyrenacarriga Wind Farm	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **170749**	DRAWING No.: **Figure 4-29**
SCALE: **As Shown @ A3**	DATE: **28.08.2019**

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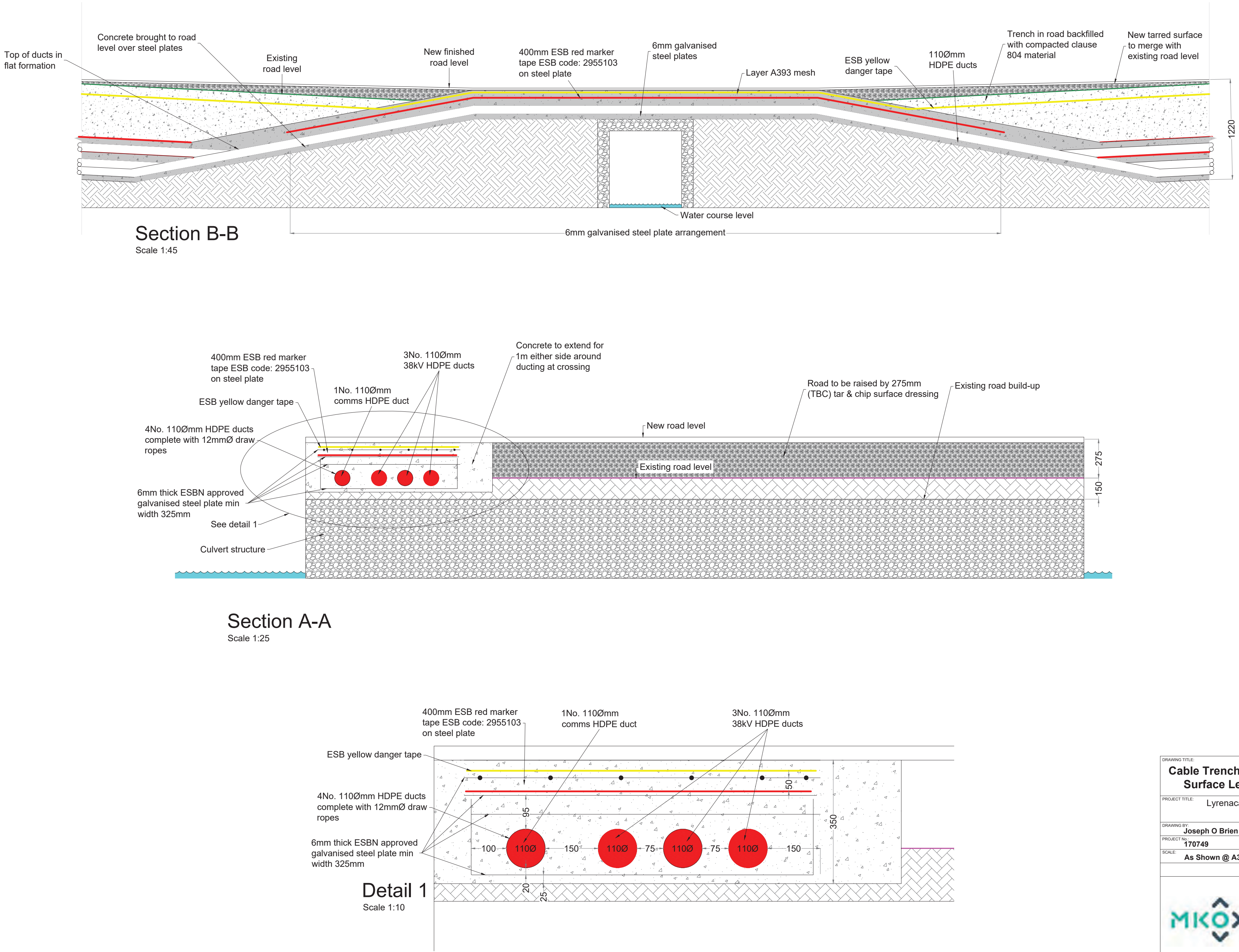

DRAWING TITLE:
Cable Trench Flatbed at Road Surface Level - Option 3

PROJECT TITLE: Lyrenacarriga Wind Farm

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 170749	DRAWING No.: Figure 4-30
SCALE: As Shown @ A3	DATE: 28.08.2019

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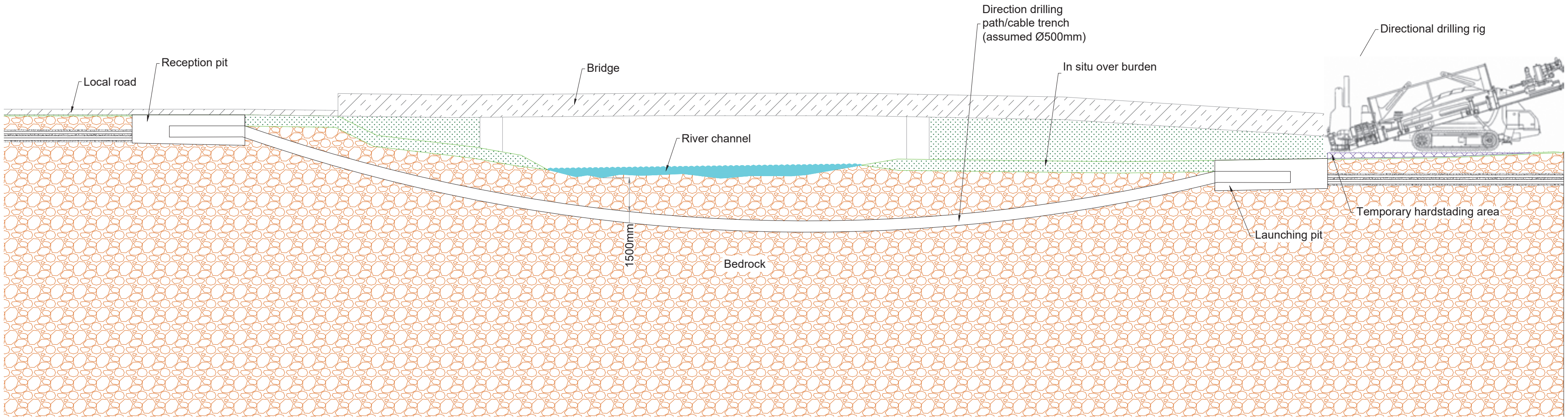

Typical Directional Drilling Rig

Typical Drilling Rig & Launch Pit

DRAWING TITLE:
Typical Directional Drilling

PROJECT TITLE: Lyrenacarriga Wind Farm

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 170749	DRAWING No.: Figure 4-31
SCALE: 1:200 @ A3	DATE: 28.08.2019

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4.9 Operation

The Proposed Development is expected to have a lifespan of approximately 30 years. Planning permission is being sought for a 30-year operation period commencing from the date of full operational commissioning of the wind farm. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction.

The wind turbines will be connected and data relayed to an off-site control centre. Each turbine will also be monitored off-site by the wind turbine supplier. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at an off-site control centre 24-hours per day.

Each turbine will be subject to a routine maintenance programme involving visits to undertake a number of checks and changing of consumables, including oil changes.

In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically, maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substation and site tracks will also require periodic maintenance.

4.10 Decommissioning

The wind turbines proposed as part of the Development are expected to have a lifespan of approximately 30 years and ongoing research shows that this is likely to increase with improvements in turbine technology, site design and maintenance measures. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to fulfilment of planning requirements at that time, or the Proposed Development may be decommissioned fully. The onsite substation will remain in place as it will be under the ownership of the ESB/EirGrid and will form a permanent part of the electricity grid.

Upon decommissioning of the Proposed Development, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration. Site roadways will be left in situ, as appropriate. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required. Underground cables, including grid connection, will be removed and the ducting left in place. A decommissioning plan will be agreed with the local authorities three months prior to decommissioning the Proposed Development. The principles that will inform the final decommissioning plan are contained in the CEMP in Appendix 4-4.