

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 (the ‘Proposed Development’) including the works subject of a proposed application for planning permission to Clare County Council. The Proposed Development comprises the provision of the following:

- i. 8 No. wind turbines with an overall ground-to-blade tip height in the range of 175 metres maximum to 173 metres minimum; a blade length in the range of 75 metres maximum to 66.5 metres minimum; and hub height in the range of 108.5 metres maximum to 100 metres minimum;*
- ii. A thirty-year operational life from the date of full commissioning of the development and subsequent decommissioning;*
- iii. A Meteorological Mast with a height of 30 metres;*
- iv. All associated underground electrical cabling (33kV) connecting the proposed turbines via Ring Main Unit (RMU) to the 110kV substation in the townland of Knockalassa;*
- v. Permanent extension to the 110kV substation at Knockalassa comprising extension to the existing substation compound, provision of a new control building with welfare facilities and all associated electrical plant and equipment for an additional 110kV bay and security fencing;*
- vi. Upgrade of access junctions;*
- vii. Upgrade of existing tracks/ roads and provision of new site access roads and hardstand areas;*
- viii. 2 no. borrow pits;*
- ix. 2 no. temporary construction compounds;*
- x. Site Drainage;*
- xi. Forestry Felling;*
- xii. Operational stage site signage; and*
- xiii. All associated site development ancillary works and apparatus.*

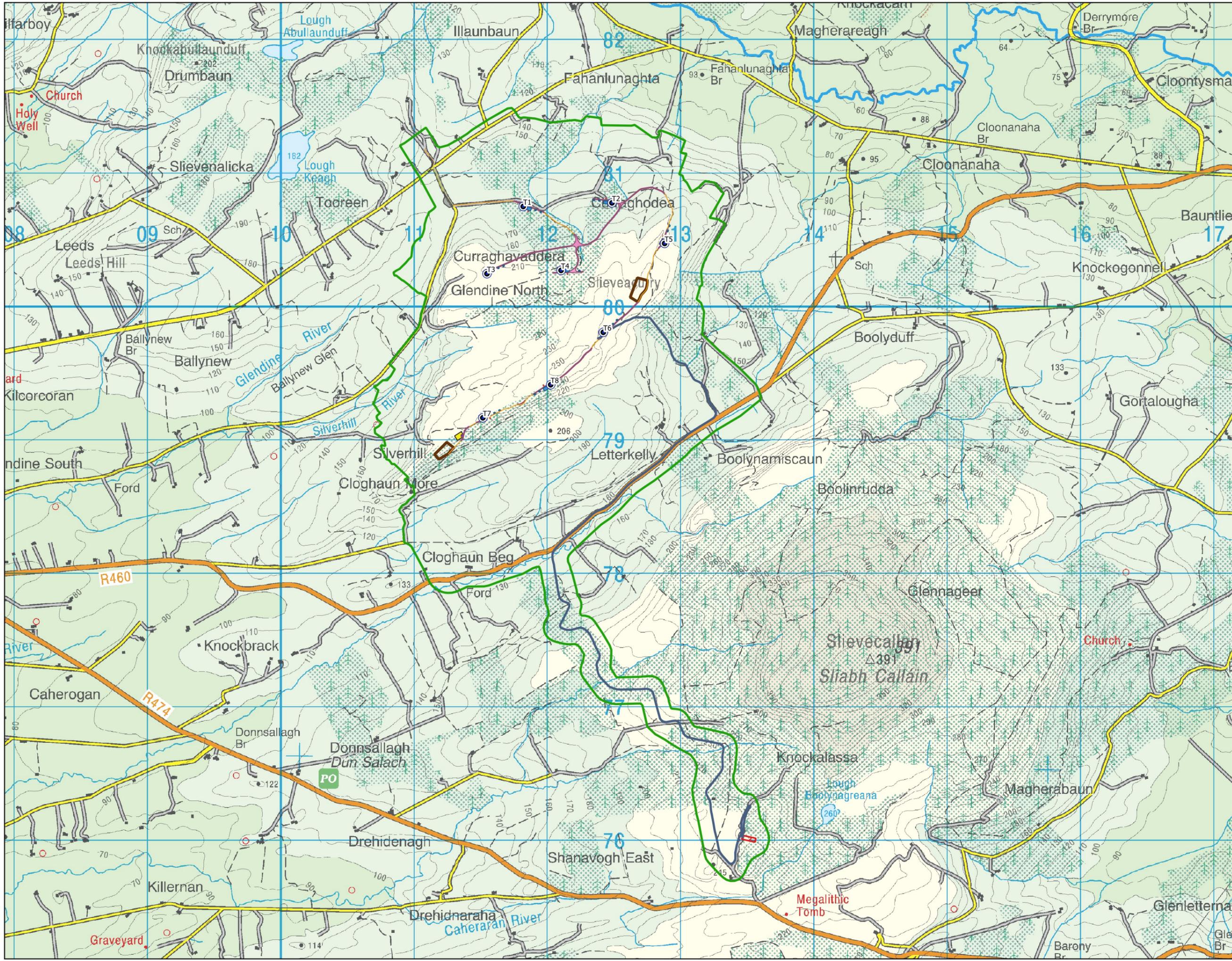
The Proposed Development will have an operational life of 30 years from the date of commissioning of the development and the application seeks a ten-year planning permission.

All elements of the overall project, including grid connection, substation extension, forestry felling, as well as the replanting have been assessed as part of this EIAR.

4.2 Development Layout

The layout of the Proposed Development has been designed to minimise the potential environmental effects of the development, while at the same time maximising the energy yield from the site. A constraints study, as described in Section 3.3.5 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 use of the existing access tracks within the site.

The overall layout of the Proposed Development is shown on Figure 4-1. This figure shows the Proposed Development infrastructure as outlined above. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to this EIAR.



- ### Map Legend
- EIAR Site Boundary
 - Proposed Turbine Locations
 - Existing Roads - Upgrade Proposed
 - Proposed New Site Roads
 - Proposed Turbine Foundations
 - Proposed Turbine Hardstands
 - Proposed Borrow Pits
 - Proposed Temporary Construction Compounds
 - Met Mast Location
 - Proposed Grid Connection Route
 - Proposed Extension to Existing Slievecallan Substation
 - Temporary Runover Area
 - County Road to be Maintained
 - Public Road Expansion Area
 - Soft Levelled Area

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Proposed Layout	
Project Title Slievecurry Renewable Energy Development, Co. Clare	
Drawn By Ellen Costello	Checked By Michael Watson
Project No. 170224c	Drawing No. Figure 4-1
Scale 1:25000	Date 29.10.2021

MKO
Planning and Environmental Consultants

Team Road, Galway
Ireland, H91 VV54
+353 (0) 91 735611
email@mkofireland.ie
Website: www.mkofireland.ie

4.3 Development Components

4.3.1 Wind Turbines

4.3.1.1 Turbine Locations

The proposed wind turbine layout has been optimised using wind farm design software (WindPro) 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 final ground level of the turbine foundations will be determined by the actual ground conditions at each proposed turbine location and may differ slightly from those levels listed in Table 4-1. Also, in accordance with the ‘Wind Energy Development Guidelines for Planning Authorities’ (Department of the Environment, Heritage and Local Government (DOEHLG), 2006) micro-siting of the turbine positions may be required within the criteria set out in the guidelines.

Table 4-1 Proposed Wind Turbine Locations and Elevations

Turbine	ITM Coordinates		Top of Foundation Elevation (m OD)
	Easting	Northing	
1	511790	680787	160
2	512456	680814	174
3	511518	680283	212
4	512074	680308	212
5	512851	680510	201
6	512391	679844	234
7	511487	679203	231
8	511996	679451	244

4.3.1.2 Turbine Type

Wind turbines 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



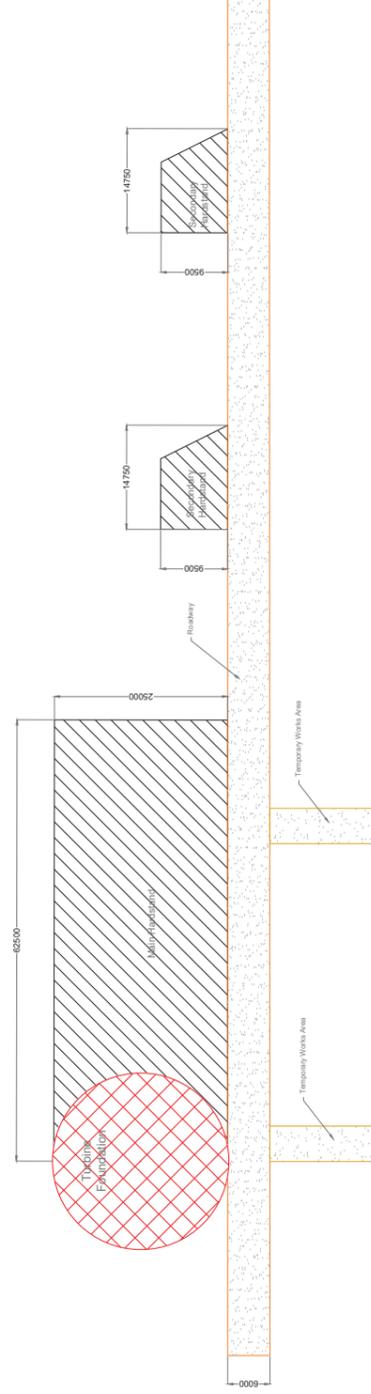
Plate 4-1 Wind turbine components

The turbine model to be installed on the site will have an overall ground-to-blade tip height in the range of 175 metres maximum to 173 metres minimum; blade length in the range of 75 metres maximum to 66.5 metres minimum and hub height in the range of 108.5 metres maximum to 100 metres minimum. 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.

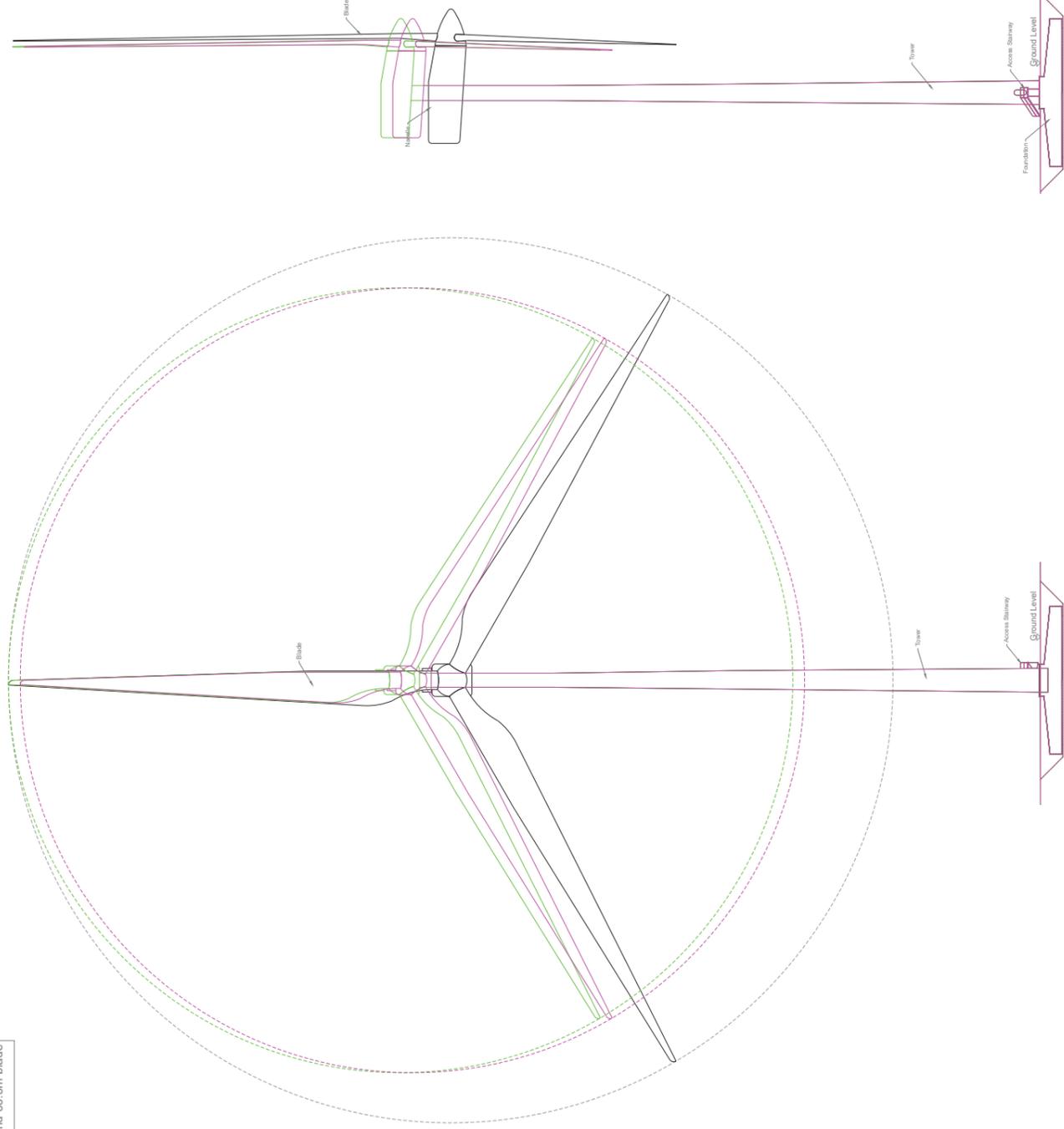
For the purposes of this EIAR, various types and sizes of wind turbines within the turbine range identified above have been selected and considered in the relevant sections of the EIAR. Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport 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 turbine design parameters that have been used in the impact assessment are specified.

At the turbine selection stage of the project, pre-construction, new turbines models or variants may be available that were not viable or on the market at the pre-planning and EIAR preparation stage, which would better suit the site and fit within the proposed size range. Should this circumstance arise, the specific parameters of the selected turbine will be assessed for compliance with the criteria set out and considered in this EIAR, the relevant guidance in place at the time and any conditions that may be attached to any grant of planning permission that might issue.

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

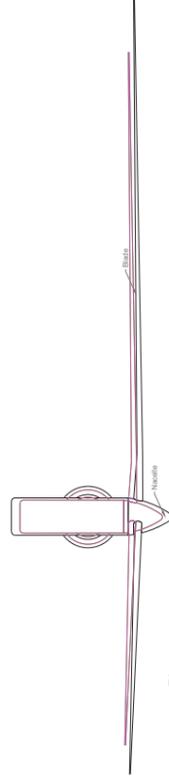


Turbine Legend	
	100m hub and 75m blade
	108.5m hub and 66.5m blade
	106.5m hub and 66.5m blade



Front Section/Elevation

Side Section/Elevation



Plan

Drawing Notes

- Drawing illustrates turbine dimensions of 175m tip to 75m blade length and 100m hub.
- Exact make and model of the turbine to be dictated by a competitive tender process.
- Installed turbines shall be within size range set out in any blade length/hub height combination
- Turbine Foundation to Manufacturers specifications
- Wind turbines with an overall ground to blade tip height in the range of 175 metres maximum to 173 metres minimum; a blade length in the range of 75 metres maximum to 66.5 metres minimum; and hub height in the range of 106.5 metres maximum to 100 metres minimum.

DRAWING TITLE: Wind Turbine Range & Hardstanding & Elevations	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O'Brien	CHECKED BY: Eoin O'Sullivan
PROJECT NO: 170224c	DRAWING NO: Fig 4-2
SCALE: 1:500 @ A1	DATE: 29.10.2021



MKO
 Tuam Road, Galway
 Ireland, H91 VV84
 +353 (0) 91 735611
 email: info@www.mkoireland.ie
 Website: www.mkoireland.ie

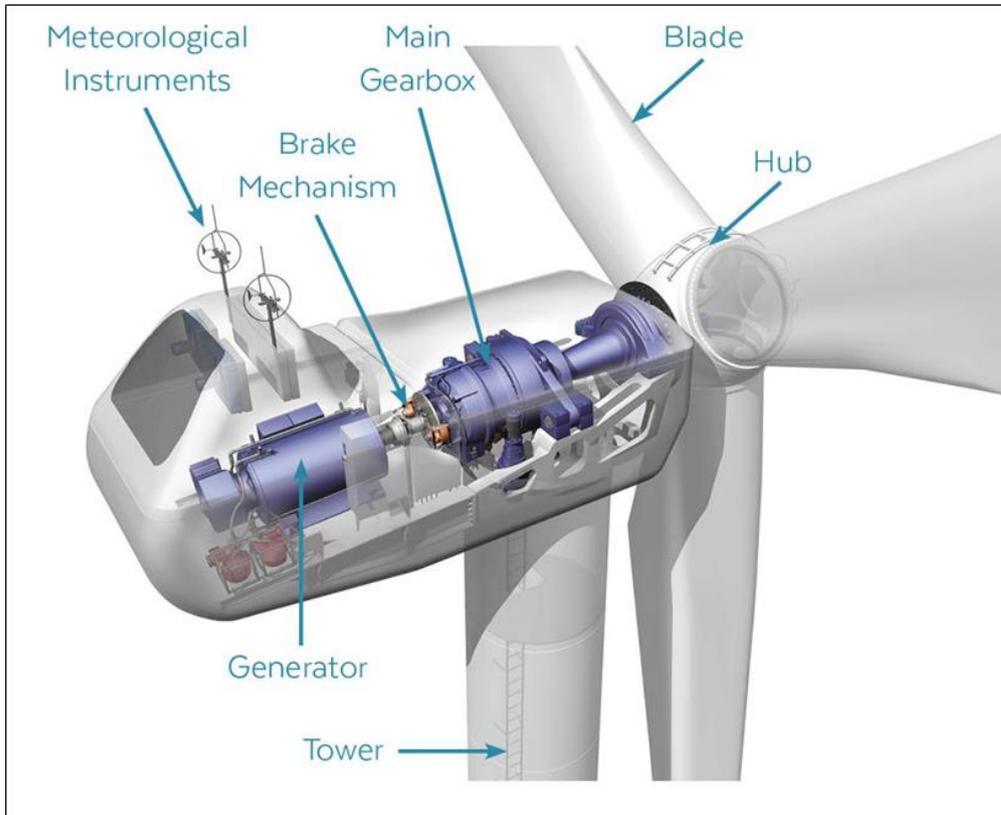


Figure 4-3 Turbine nacelle and-5 hub components

Figure 4-2 shows the turbine base layout, including turbine foundation, hard standing area, assembly area, access road and surrounding works area.

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, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbine foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier. The turbine foundation transmits any load on the wind turbine into the ground. The maximum horizontal and vertical extent of the turbine foundation will be 25m (minimum of 20m) and 4m (minimum of 2.7m) respectively, which has been assessed in the EIAR, and shown in Figure 4-2.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the “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 to finished surface level (Plate 4-2 below).



Plate 4-2 Turbine 'Anchor Cage' and finished turbine base

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 used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and 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. The proposed hard standing areas are illustrated in the detailed drawings included in Appendix 4-1 of this report. The extent of the required areas at each turbine location may be optimised on-site 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 4-2. 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 extent of the area required for the assembly areas is shown on Figure 4-2 and the detailed drawing in Appendix 4-1.

4.3.1.6 Power Output

The wind turbines available within the proposed size range will have a potential generating capacity in the 3 to 5 Megawatts (MW) range. Turbines of the exact same make, model and dimensions can have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. The exact power rating of the installed turbine will be designed to match the wind regime on the site and will be determined by the selected manufacturer.

For the purposes of this EIAR, a rated output of 4.2 MW has been chosen (a mid-range capacity) to calculate the power output of the proposed 8-turbine renewable energy development, which would result in an estimated installed capacity of 33.6 MW.

Assuming an installed capacity of 33.6 MW, the Proposed Development therefore has the potential to produce up to 103,018 MWh (megawatt hours) of electricity per year, based on the following calculation:

$$A \times B \times C = \text{Megawatt Hours of electricity produced per year}$$

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 capacity factor of 35% is applied here

C = Rated output of the wind turbines: 33.6 MW

The 103,018 MWh of electricity produced by the Proposed Development would be sufficient to supply approximately 24,528 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity¹ (this latest figure is available from the March 2017 CER Review of Typical Consumption Figures Decision).

The 2016 Census of Ireland recorded a total of 43,469 occupied households in Co. Clare. Per annum, based on a capacity factor of 35%, the Proposed Development would therefore produce sufficient electricity for the equivalent of approximately 56% of all households in Co. Clare.

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 road construction design has taken into account the following key factors:

1. *Buildability considerations;*
2. *Maximising use of existing infrastructure;*
3. *Minimising excavation arisings;*
4. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles;*
5. *Requirement to minimise disruption to peat hydrology.*

Whilst the above key factors are used to determine the road design the actual construction technique employed for a particular length of road will be determined on the prevailing ground conditions encountered along that length of road.

4.3.2.1.1 Upgrade of Existing Access Roads or Tracks

The general construction methodology for upgrading of existing sections of access roads or tracks, as presented in Fehily Timoney & Company (FT) *Peat & Spoil Management Plan* in Appendix 4-2 of this EIAR, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

1. *Access road construction shall be to the line and level requirements as per the planning application drawings.*
2. *For upgrading of existing access roads the following guidelines apply:*
 - a) *Excavation of the widened section of access road should take place to a competent stratum beneath the peat, removing all peat and soft clay (as agreed with the designer) and backfilled with suitable granular fill.*
 - b) *Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.*

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

- c) *The surface of the existing access road should be overlaid with up to 500mm of selected granular fill.*
 - d) *Access roads to be finished with a layer of capping across the full width of the track.*
 - e) *A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road (to be confirmed by the designer).*
 - f) *For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.*
3. *The finished road width will have a running width of 5m, with wider sections on bends and corners.*
 4. *Where the ground is higher on one side of the access road than the other, any road widening works required will be done on the upslope side of the existing access road, where appropriate.*

Sections of existing road for upgrade are shown in Figure 4-4.

4.3.2.1.2 Construction of New Excavated Roads

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

The construction methodology for the construction of excavated roads, as presented in FT's *Peat & Spoil Management Plan* in Appendix 4-2 of this EIAR, is summarised below. This methodology includes the following procedures.

1. *Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.*
2. *Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.*
3. *Excavation of roads will be in accordance with the design requirements. Excavation will take place to a competent stratum beneath the peat, removing all peat and soft clay present beneath the road footprint.*
4. *Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pits. All temporary storage areas will be upslope of founded roads/hardstands and will be inspected by a suitably qualified person before material is stored in the area.*
5. *Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill.*
6. *Excavation of materials with respect to control of peat stability:*
 - a) *Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.*

- b) *Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.*
 - c) *All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated placement areas.*

- 7. *Side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.*

- 8. *The excavated access road will be constructed with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.*

- 9. *Access roads to be finished with a layer of capping across the full width of the road.*

- 10. *A layer of geogrid/geotextile may be required at the surface of the competent stratum.*

- 11. *Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.*

- 12. *A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.*

Section of a new excavated road is shown in Figure 4-5.

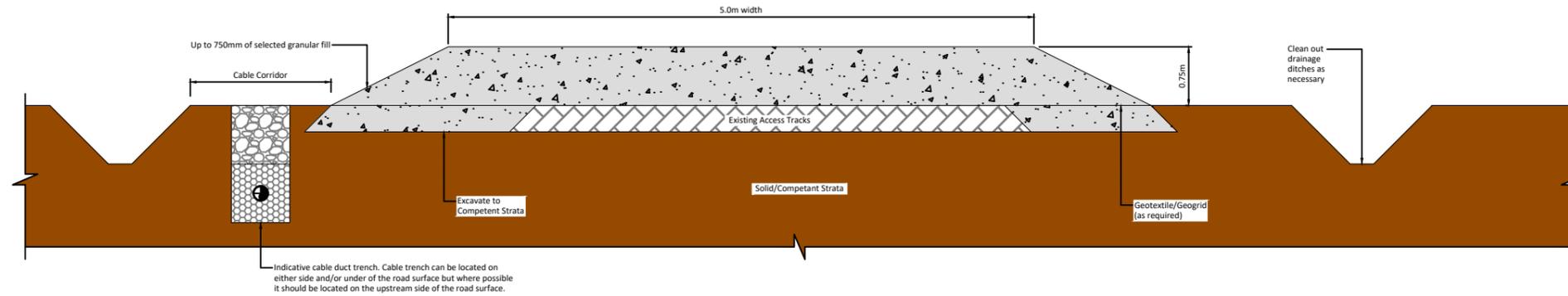
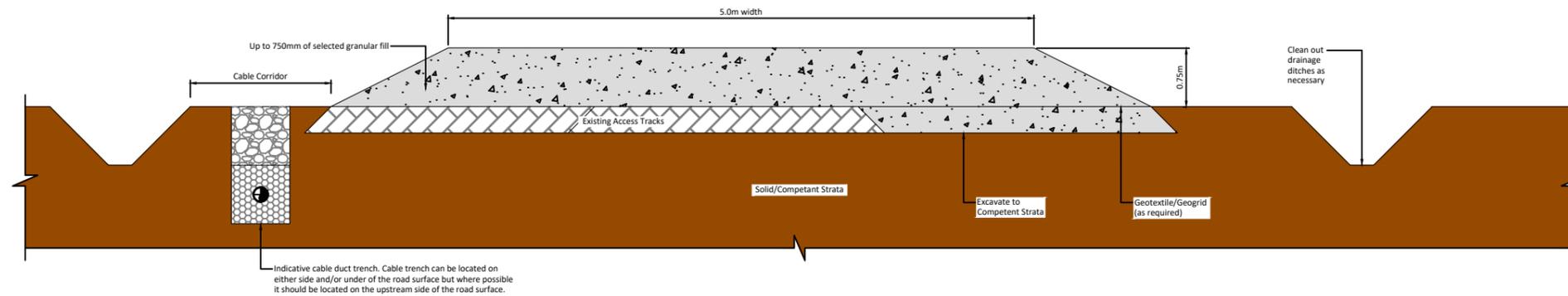


Figure 4-4

DRAWING TITLE: Type A Upgrade of Existing Excavated Access Tracks	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 170224c	DRAWING No.: 170224c - 37
SCALE: 1:50 @ A3	DATE: 09.11.2021
OS SHEET No.:	

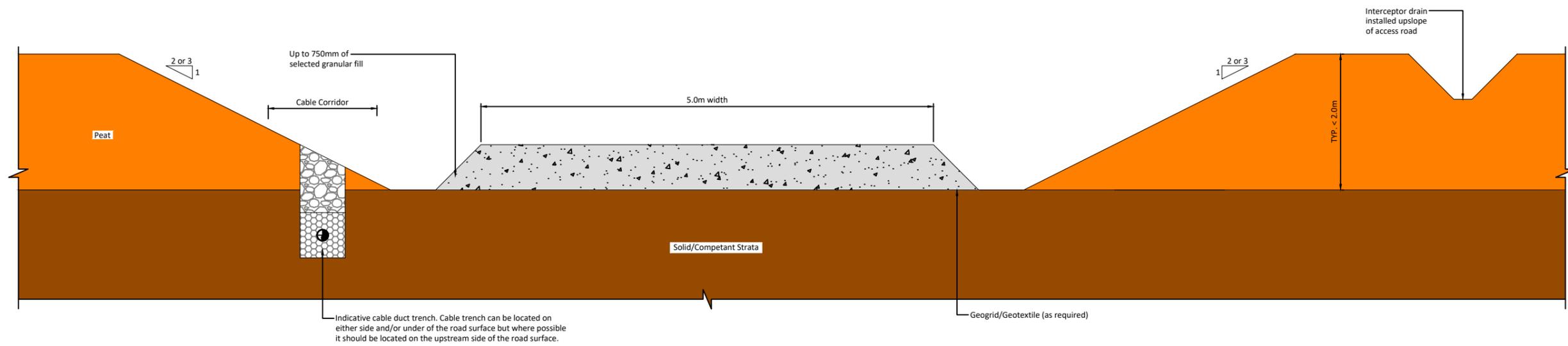
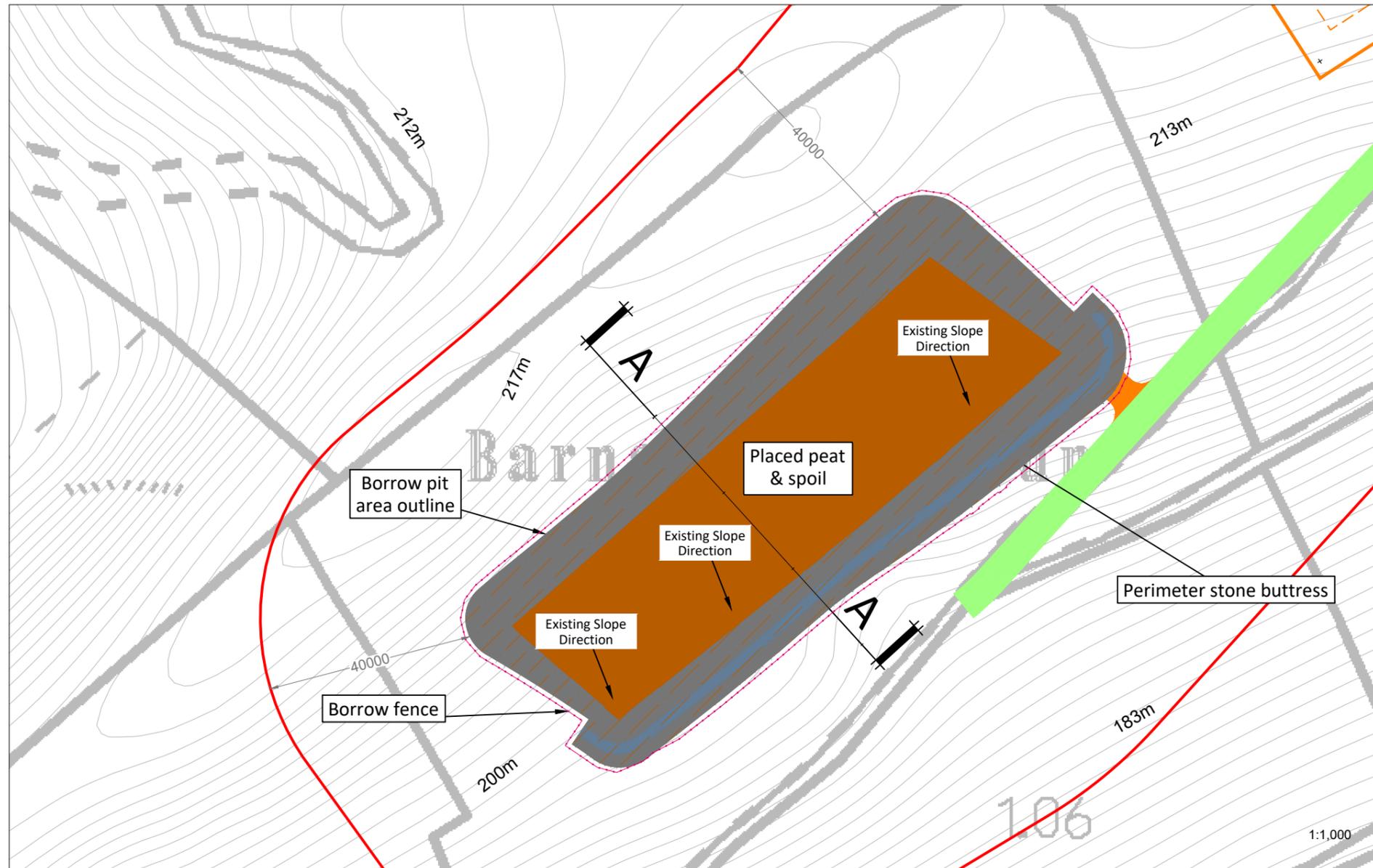
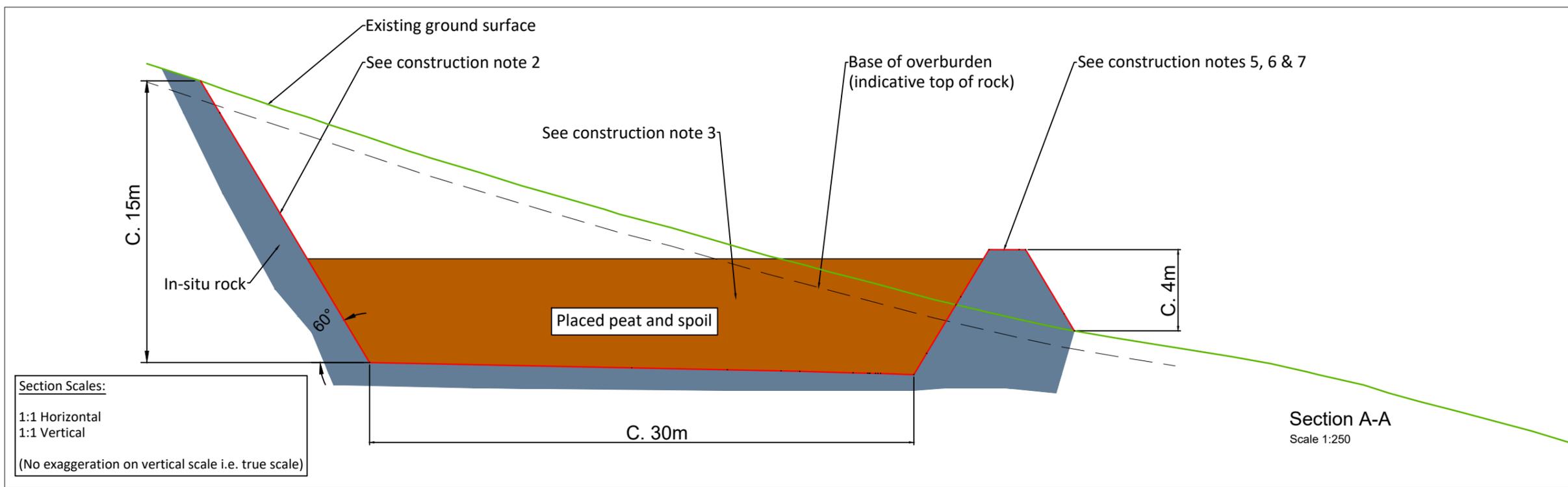


Figure 4-5

DRAWING TITLE: Type B New Excavate and Replace Access Road	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 170224c	DRAWING No.: 170224c - 38
SCALE: 1:50 @ A3	DATE: 09.11.2021
OS SHEET No.:	



- (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.
- (2) Slopes within the excavated rock formed around the perimeter of the borrow pit will 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. 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) 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 is likely to be required.
- (5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by the project geotechnical engineer.
- (6) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.
- (7) The surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.
- (8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.
- (9) All the above-mentioned general guidelines and requirements must be confirmed by the designer prior to construction.
- (10) Further guidelines on the construction of the borrow pit are included within Section 7.4 of the Peat & Spoil Management Plan



Section Scales:
 1:1 Horizontal
 1:1 Vertical
 (No exaggeration on vertical scale i.e. true scale)



Figure 4-6

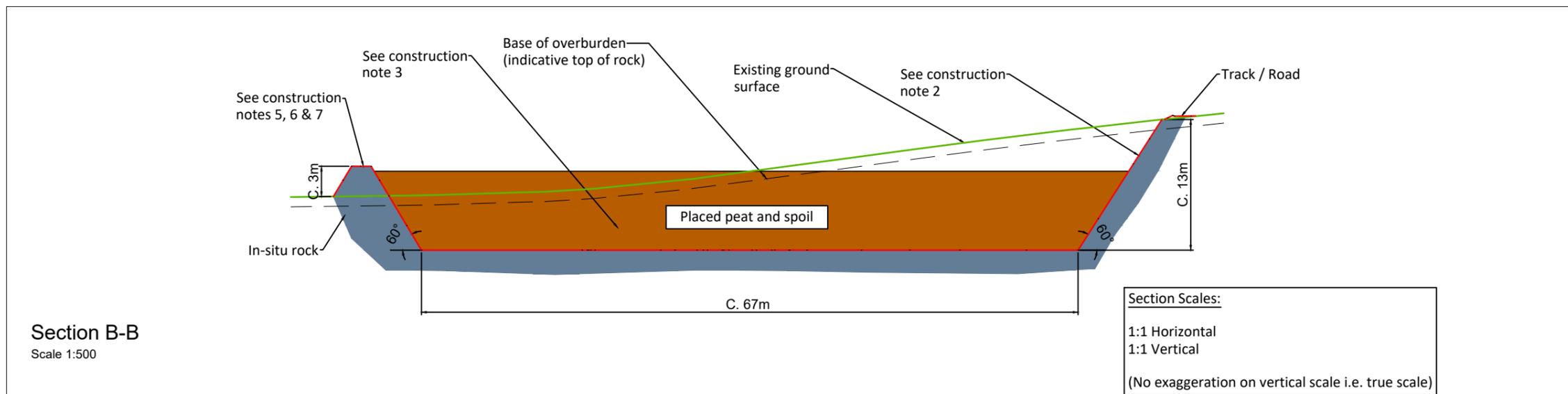
Borrow Pit 1 Layout & Section	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 170224c	DRAWING No.: 170224c - 22
SCALE: As Shown @ A3	DATE: 28.10.2021
O/S SHEET No.: 4200, 4201, 4202 4258, 4259, 4260, 4316, 4317, 4318, 4374, 4375, 4376	

Section A-A
Scale 1:250

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- 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.
- 2) Slopes within the excavated rock formed around the perimeter of the borrow pit will 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. 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) 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 is likely to be required.
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- 6) In order to prevent water retention occurring behind the buttresses, the buttresses should be constructed of coarse boulder fill with a high permeability.
- 7) The surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from the placed arising's.
- 8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.
- 9) All the above-mentioned general guidelines and requirements must be confirmed by the designer prior to construction.
- 10) Further guidelines on the construction of the borrow pit are included within Section 7.4 of the Peat & Spoil Management Plan



Section Scales:
 1:1 Horizontal
 1:1 Vertical
 (No exaggeration on vertical scale i.e. true scale)



Figure 4-7

**Borrow Pit 2
Layout & Section**

Slieveacurry Renewable Energy Development, Co. Clare

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 170224c	DRAWING No.: 170224c - 23
SCALE: As Shown @ A3	DATE: 28.10.2021
OS SHEET No.: 4200, 4201, 4202 4258, 4259, 4260, 4316, 4317, 4318, 4374, 4375, 4376	

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4.3.3 Rock Extraction

4.3.3.1 Description

It is proposed to develop 2 No. 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 excavations.

The location of the borrow pits are shown on Figure 4-1 and on the detailed site layout drawings included as Appendix 4-1 to this EIAR. Borrow Pit 1 is located approximately 300 metres southwest of Turbine No. 7 and measures approximately 6,350 square meters in area. Borrow Pit 2 is located approximately 330 metres northeast of Turbine No. 6 and measures approximately 13,157 square meters in area. It is intended that all hardcore materials required for the construction of the Proposed Development will be won on-site.

Figure 4-6 and Figure 4-7 below shows detailed sections through the proposed borrow pits. The borrow pits will, on removal of all necessary and useful rock, be reinstated with excavated peat and subsoils as described in Section 4.3.4 below.

Post-construction, any unsafe areas around the borrow pits areas will be permanently secured and a stock-proof fence will be erected around the borrow pit areas to prevent access to these areas. Appropriate health and safety signage will also be erected on this fencing and at locations around the fenced area.

Hardcore materials will be extracted from the borrow pits (and other infrastructure 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 will only be carried out after notifying any potentially sensitive local residents. The developer is committed to notifying all properties within 1km of any proposed blast location which is greater than the distance stated in in the quarry guidance of 500m, *Quarries and Ancillary Activities Guidelines for Planning Authorities April 2004* (DoEHG). The potential noise and vibration impact on sensitive receptors associated with the rock extraction measures, detailed below, are assessed in Chapter 11 of this EIAR.

The two proposed extraction methods are detailed below.

4.3.3.2 Rock Extraction Methods

The extraction of rock 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 there is a layer of overburden present within the area to be excavated, it will be stripped back and stockpiled using standard track mounted excavators. Two extraction methods have been assessed for breaking out the useful rock below; rock breaking and blasting.

4.3.3.2.1 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 30-40 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. The potential impacts associated with noise are assessed in Chapter 11 Noise.

4.3.3.2.2 **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. Where blasting is employed as the extraction method, it is more efficient to increase the depth of the excavation and thus minimise the excavation footprint.

The blast engineer would arrange for the necessary quantity of explosive to be brought to site to undertake a single blast. The management of explosives onsite and the actual blasting operation would be agreed in advance with and supervised by An Gardaí Síochána. 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.

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. Rock blasting will be undertaken in line with the Safety and Health Commission for the Mining and other Extractive Industries report on *Guidance on the Safe Use of Explosives in Quarries* to ensure the safe use of explosives on-site. Only authorised people will handle explosives for rock blasting at the site. Given the small quantities of explosives to be used on site, it is considered that there is negligible risk of a major accident occurring from the use of explosives on site. The potential impacts associated with noise are assessed in Chapter 11 Noise.

4.3.4 **Peat and Spoil Management Plan**

4.3.4.1 **Quantities**

The quantity of peat and non-peat material (spoil), requiring management on the site of the Proposed Development has been calculated, as presented in Table 4-2 below. These quantities were calculated by FT) as part of the *Peat and Spoil Management Plan* in Appendix 4-2 of this EIAR.

Table 4-2 Peat and Spoil Volumes requiring management

Development Component	Area (m ²) (approx.)	Peat Volume (m ³) (approx.)	Spoil Volume(m ³) (approx.)
8 no. Turbines and Hardstanding Areas	27m diameter excavation footprint for turbine foundation with 62.5 x 25m hardstand area.	18,700	18,600
Access Roads	5m running width	31,200	12,400
Meteorological Mast	10 x 10m foundation footprint and 30 x 30m hardstanding area	-	400
Temporary Construction Compounds	6,300	600	
2 no. Borrow Pits	19,729	4,000	18,000
Cable Trench	1.2m x 0.9m	1,300	5,300
Total		55,800	54,700
Total Peat & Spoil to be managed		110,500	

Note: A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied and is included to the excavated peat and spoil volumes above to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

Tree felling is proposed at various locations across the site; however this will not involve the excavation of tree stumps and as such does not affect the excavation volumes. Where tree stumps are removed along proposed access roads, the excavation volume has been included in the above table.

4.3.4.2 Peat and Spoil Usage in Restoration of Borrow Pits

Once excavated, peat and spoil will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pits. All temporary storage areas will be upslope of founded roads/hardstands and will be inspected by a suitably qualified person before material is stored in the area.

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

The general construction methodology for the construction of the borrow pits, as presented in FTs *Peat & Spoil Management Plan* in Appendix 4-2 of this EIAR, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

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 peat and spoil into the individual cells.

A temporary access track will be placed around the perimeter of the borrow pit area to allow for the tipping of material over the edge of the borrow pit area. The placement of peat and spoil within the borrow pits will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

The following particular recommendations/best practice guidelines for the placement of peat & in borrow pits should be considered and taken into account during construction.

- The borrow pits will be enclosed depressions and drainage from these areas will be managed effectively using temporary pumping arrangements and settlement ponds.
- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit areas.
- Silting ponds (settlement ponds) may be required at the lower side/outfall location of the borrow pits.
- The settlement ponds at the borrow pits will be designed to allow 24hr retention.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pits may be required.
- Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat & spoil to be placed safely.
- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

4.3.4.2.1 **Placement of Peat & Spoil alongside Access Roads**

In some areas of the site of the Proposed Development excavated materials will be placed alongside the access roads. The following recommendations/best practice guidelines for the placement of peat and spoil alongside the access road will be adhered to during the construction of the Proposed Development:

1. *The potential spoil placement area locations identified are alongside the proposed access roads in the northeast and east of the site where the topography is typically flat (<5°). The placement of spoil alongside the access roads should be restricted to areas where the peat depth is less than 1.5m.*
2. *Given the relatively flat topography present at the northeast and eastern part of the site, the placement of peat and spoil alongside the access roads is deemed appropriate.*
3. *The peat and spoil placed adjacent to the new proposed access roads will be restricted to a maximum height of 1m over a c.10m wide corridor on the upslope side of the access road, or both sides of the access road where the ground is flat (slope <2°).*
4. *The placement of excavated peat and spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat*

and spoil within the placement areas will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

- 5. Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.*
- 6. The surface of the placed peat and spoil will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat and spoil should be carried out as placement of peat and spoil within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat and spoil.*
- 7. Finished/shaped side slopes in the placed peat and spoil shall be not greater than 1 (v): 2 (h) (for spoil) or 1 (v): 3 (h) (for peat). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat and spoil are encountered then slacker slopes will be required.*
- 8. Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat and spoil within the placement areas.*
- 9. No peat or spoil shall be sidecast in buffer zones adjacent to watercourses.*
- 10. Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified by the designer on site.*
- 11. Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.*
- 12. An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.*
- 13. All the above mentioned general guidelines and requirements should be confirmed by the designer prior to construction.*

The management of excavated peat and overburden and the methods of placement and/or reinstatement are described in detail in FT's *Peat and Spoil Management Plan* in Appendix 4-2 of this EIAR.



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 5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
 6. Cable Route to be subject to final electrical specifications and location may vary within road corridor.
 7. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
 8. Final levels may vary depending on local ground conditions.
 9. Refer to HES Drainage Design Drawings for drainage design details.
 10. Layout plans show Maximum Turbine rotor diameter as per turbine drawing.

- Drawing Legend**
- Planning Application Boundary
 - Cable Route
 - Proposed Slievecallan Substation Extension
 - Existing Access Road Network



Figure 4-8

Slievecallan Substation Extension Layout

PROJECT TITLE: **Slieveacurry Renewable Energy Development, Co. Clare**

DRAWING BY: **Joseph O'Brien** CHECKED BY: **Eoin O'Sullivan**

PROJECT No.: **170224c** DRAWING No.: **170224c - 19**

SCALE: **1:500 @ A3** DATE: **15.11.2021**

OS SHEET No.: 4200, 4201, 4202 4258, 4259, 4260, 4316, 4317, 4318, 4374, 4375, 4376

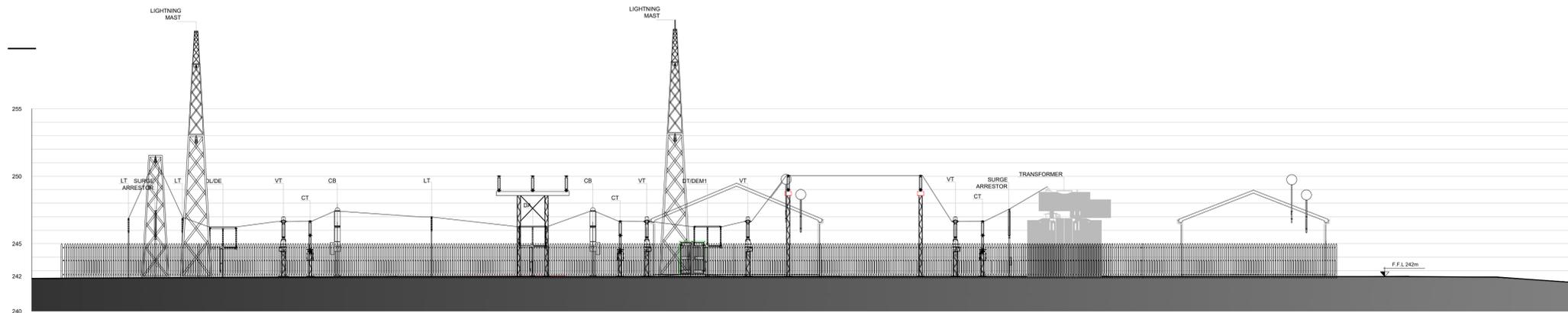


MKO
 Planning and Environmental Consultants
 Tuam Road, Galway
 Ireland, H91 VW84
 +353 (0) 91 735611
 email: info@www.mkofireland.ie
 Website: www.mkofireland.ie

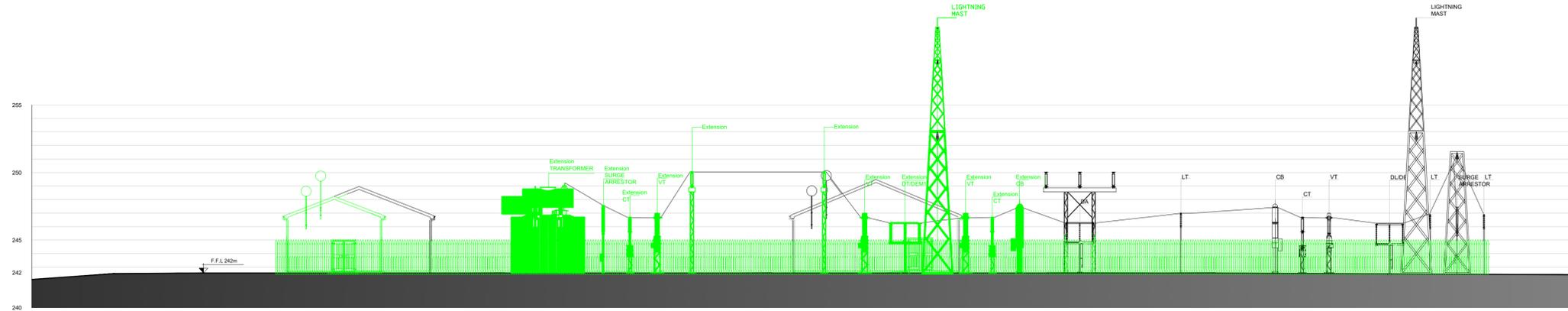
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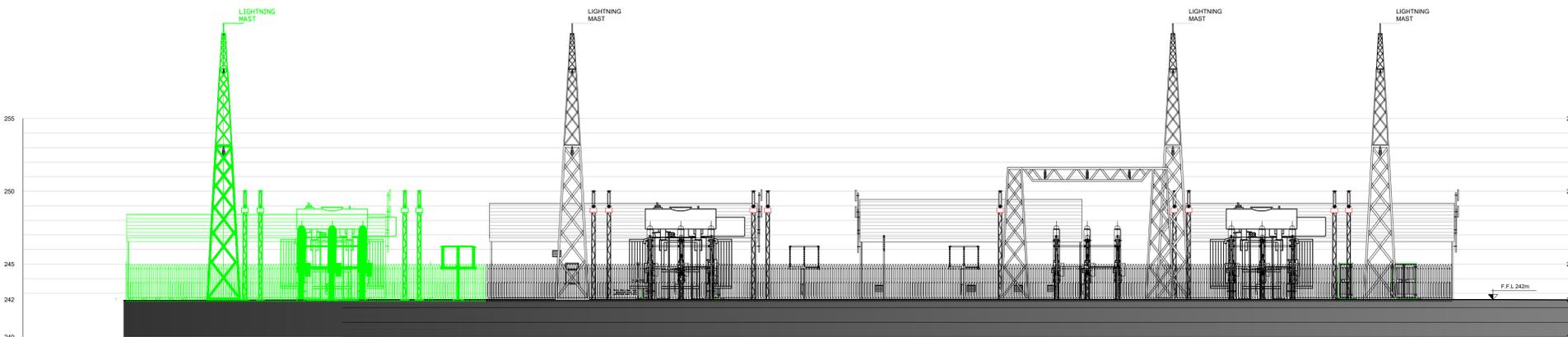
Existing Slievacallan 110kV Substation —
 Proposed Substation Extension —



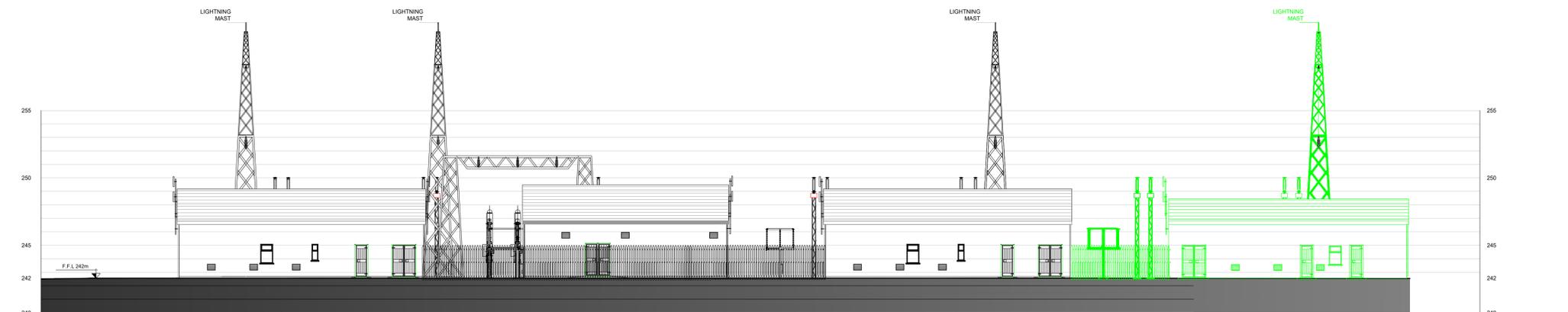
NORTH ELEVATION



SOUTH ELEVATION



EAST ELEVATION



WEST ELEVATION

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.

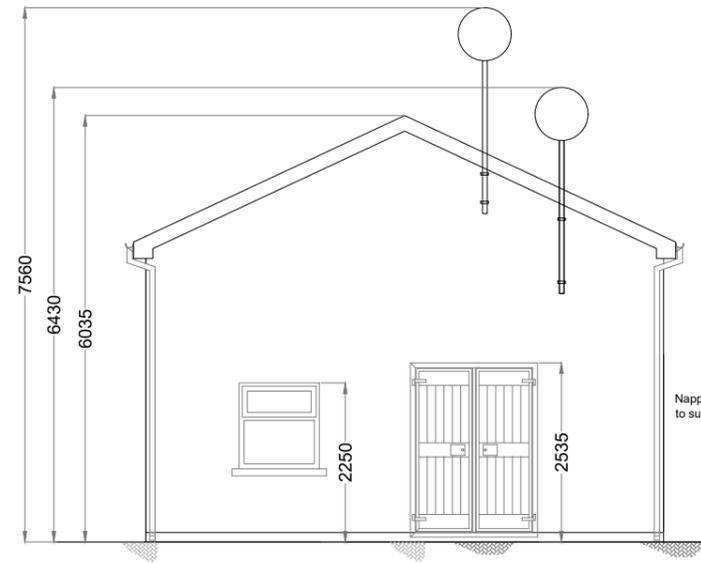
Figure 4-9

DRAWING TITLE: Slievacallan Substation Extension Elevations	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O Brien	CHECKED BY: Eoin O Sullivan
PROJECT No: 170224c	DRAWING No: 170224c - 19
SCALE: 1:200 @ A1	DATE: 26.10.2021

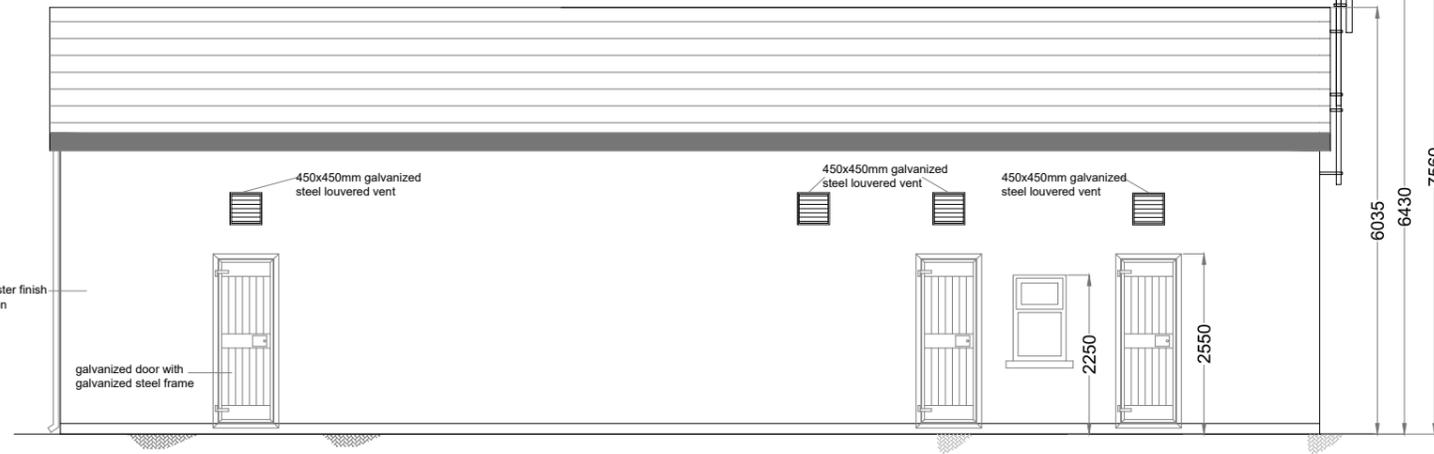
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 Planning and Environmental Consultants
 Tuam Road, Galway
 Ireland, H91 VW84
 +353 (0) 91 735611
 email: info@www.mkoireland.ie
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Drawing Notes

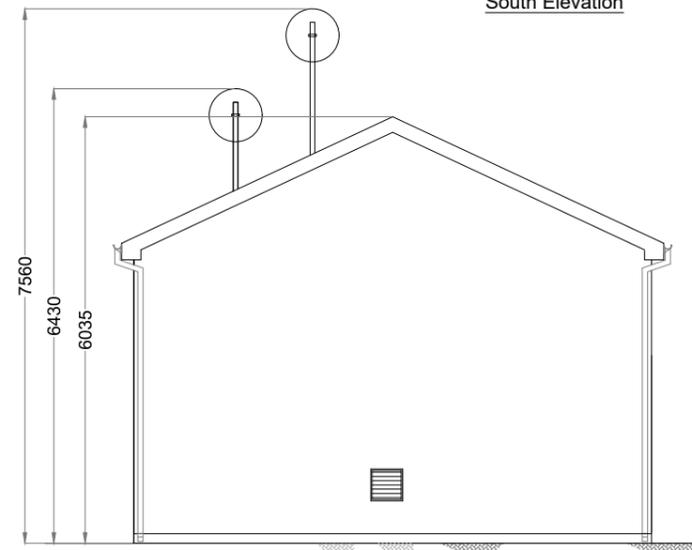
1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.



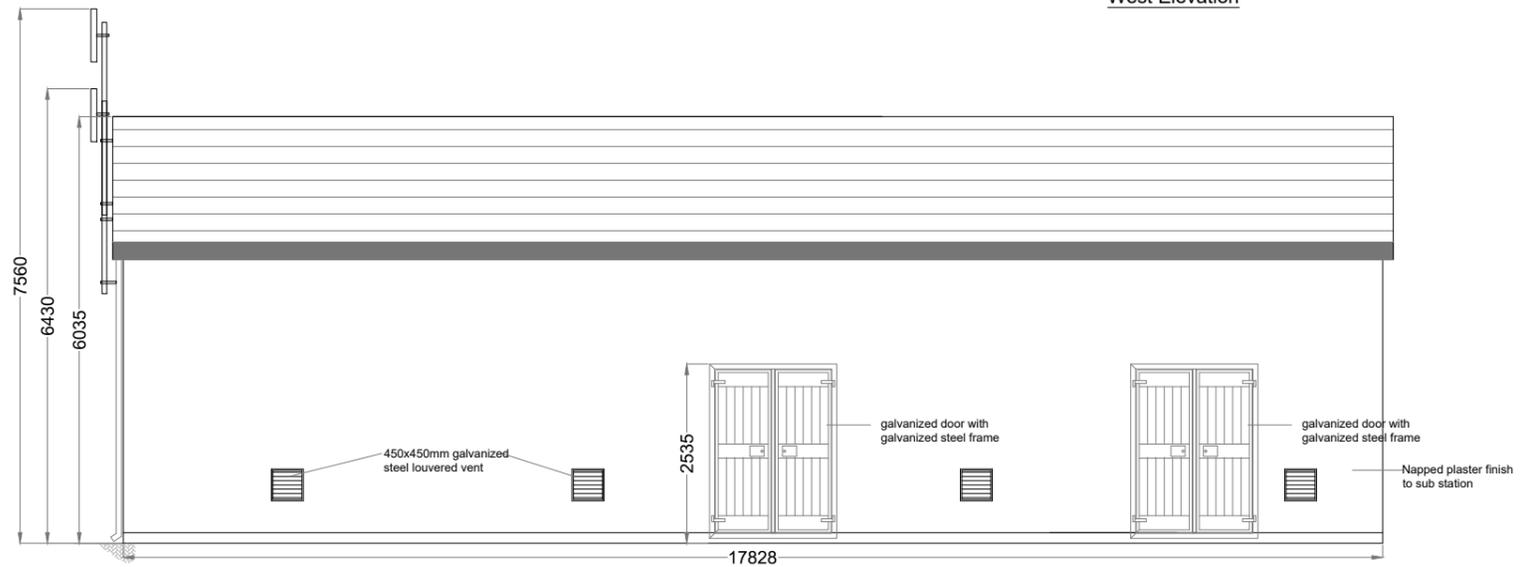
South Elevation



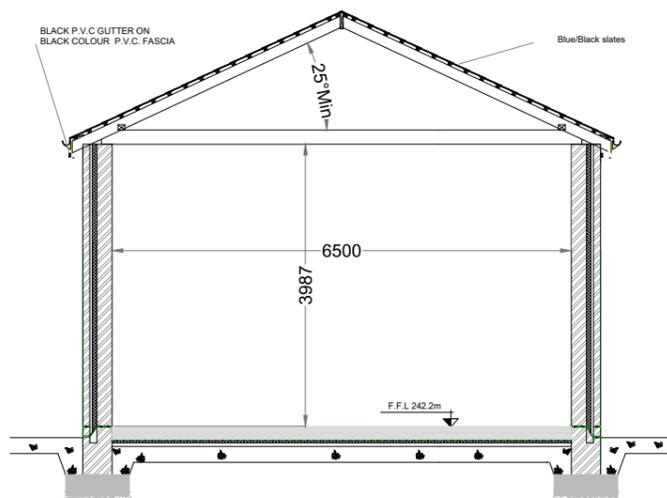
West Elevation



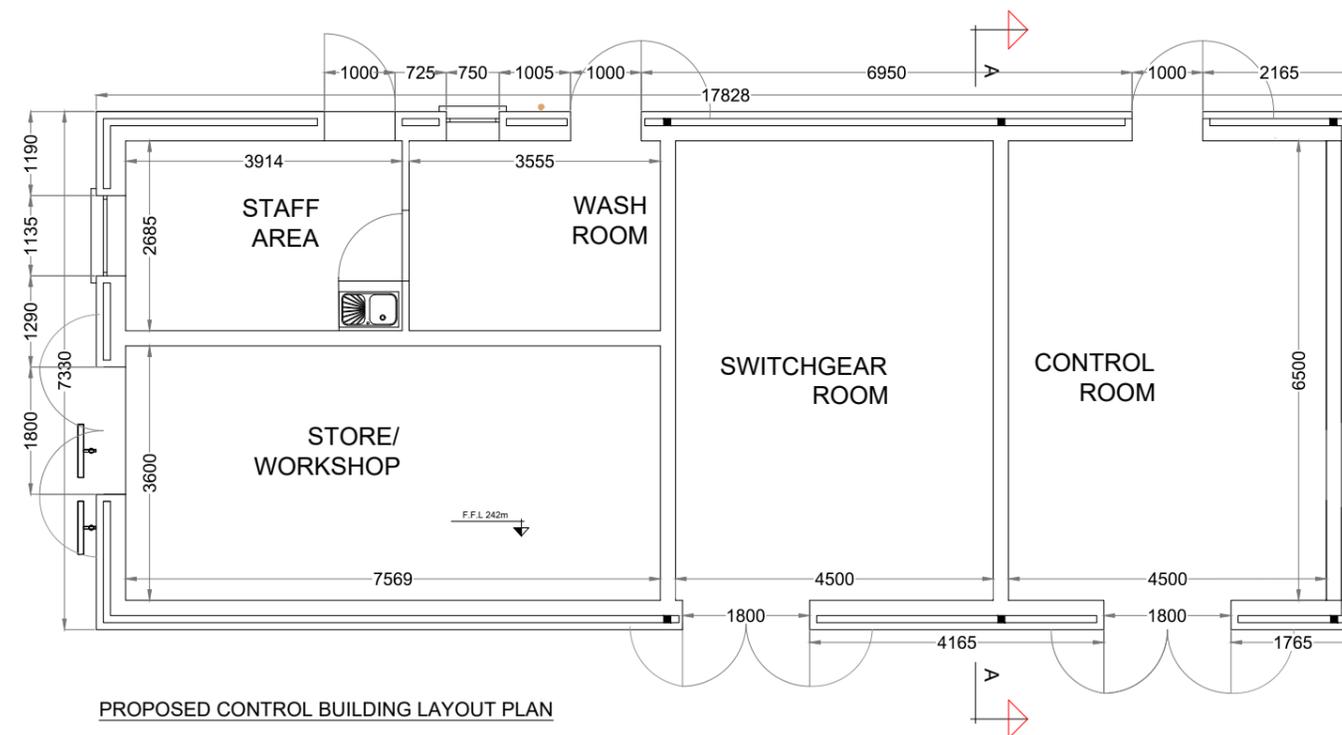
North Elevation



East Elevation



SECTION A-A



PROPOSED CONTROL BUILDING LAYOUT PLAN

Figure 4-10

DRAWING TITLE: Control Building	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O'Brien	CHECKED BY: Eoin O'Sullivan
PROJECT No.: 170224c	DRAWING No.: 170224c - 20
SCALE: 1:100 @ A3	DATE: 26.10.2021
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4.3.5 Substation Extension

It is proposed to extend the existing Slievacallan 110kV substation to accommodate the connection of the Proposed Development. The works will consist of the construction of a new control building with welfare facilities, associated electrical plant and equipment and security fencing.

The layouts and elevations of the proposed substation extension works are shown on Figure 4-8 and Figure 4-9. The construction and electrical components of the substation extension will be to Eirgrid specifications. Further details regarding the connection between the site and the national electricity grid are provided in Section 4.3.6 of this EIAR chapter. The footprint of the proposed substation extension compound measures approximately 2,461 square metres.

The substation compound will include an extension of the steel palisade fence (approximately 2.4 metre high or as otherwise required by ESB), and internal fences will also segregate different areas within the main substation.

4.3.5.1 Substation Control Building

A control building will be located within the substation extension. The control building will measure 17.8 metres by 7.3m and 6m in height. Layout and elevation drawings of the control building are included in Figure 4-10.

The substation control building will include staff welfare facilities for the staff that will work on the substation during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. There will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement for the substation extension 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 become almost standard practice on substation 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 sites turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site to a licensed facility.

4.3.6 Site Underground Cabling

Each turbine will be connected to the national grid via an underground electricity cable. The electricity generated from the turbines will connect to the substation extension in underground cable ducts within an approximately 1.2 metres deep trench. The route of the cable ducts will generally follow the access

track to each turbine location and are indicated on the site layout drawings included as Appendix 4-1 to this report. The position of the cable trench relative to the roadways is shown in section in Figure 4-4 to Figure 4-5 above. Figure 4-11 below shows a cable trench. The exact number and configuration of cable ducting may vary within the cabling trench. The cabling may be placed on either side of the roads, on both sides of the road or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

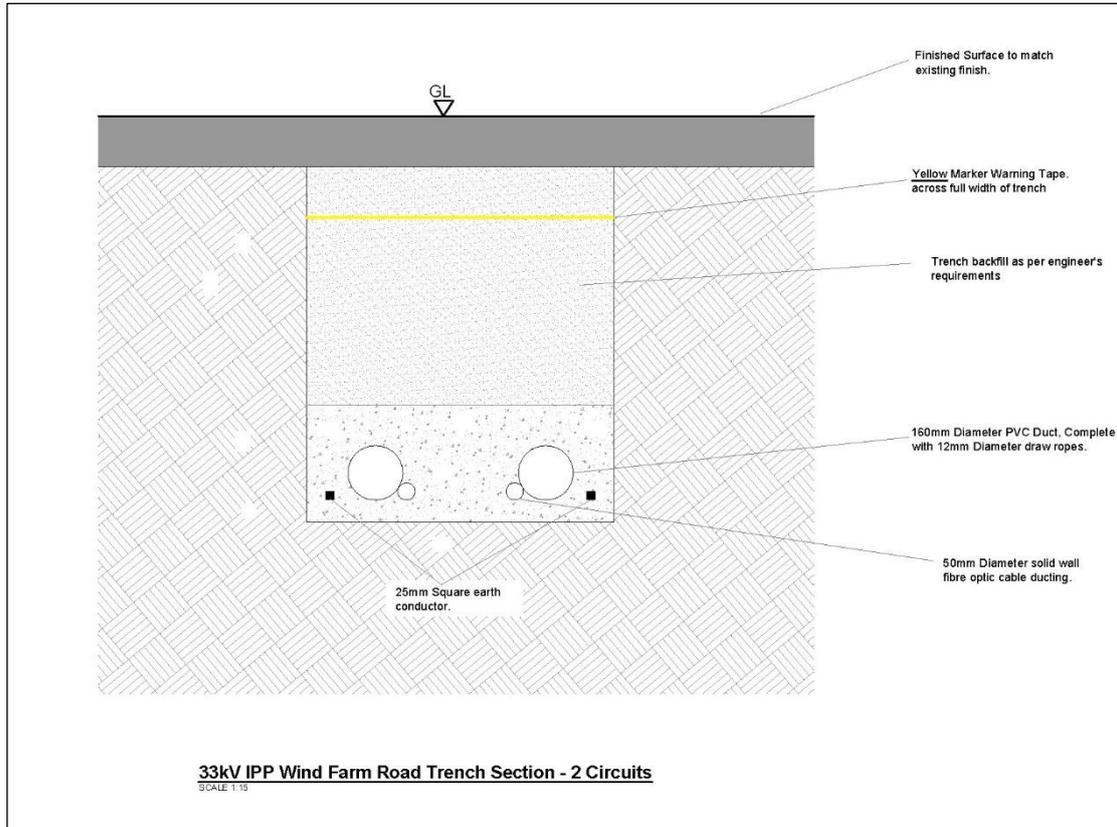


Figure 4-11 Cable trench cross section detail

Clay plugs (water flow barrier) will be installed at regular intervals of not greater than 50 metres along the length of the trenches where required to prevent the trenches becoming conduits for runoff water. Backfill material will be compacted in layers with approved engineer's specified material, which may be imported onto the site should sufficient volumes of suitable material not be encountered during the excavation phase of the proposed infrastructure. The electricity generated on site will be combined at the Ring Main Unit (RMU) located adjacent to turbine no. T6. The underground cabling will connect from this location to the substation located in the townland of Knockalassa, predominately following proposed and existing wind farm/ forestry roads measuring approximately 4.28km, with a short 0.94 km section over agricultural and forestry land, 0.28km along a local road and a 1.6 km section within the public road corridor (R460). The total length of cabling between the RMU and the proposed substation extension measures approximately 7.1km. A methodology for these works is provided in Section 4.7.5.

4.3.7 Meteorological Mast

One meteorological mast is proposed as part of the Proposed Development. The meteorological mast will be equipped with wind monitoring equipment at various heights. The mast will be located at E511331, N679070 (ITM) as shown on the site layout drawing in Figure 4-1. The mast will be a slender structure up to 30 metres in height. The mast will be a free-standing structure. 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 design of the proposed meteorological mast is shown in Figure 4-12.

4.3.8 Temporary Construction Compounds

A temporary construction compound measuring approximately 2,305 square metres in area will be located in the southern section of the site, adjacent to the existing access road approximately 150 metres to the southwest of Turbine No. 7. The construction compound will consist of secondary car parking and storage. The layout of this construction compound is shown on Figure 4-13. The location of the proposed construction compound is shown on the site layout drawing in Figure 4-1.

There will be a second temporary construction compound located adjacent to turbine no. 1. This temporary compound will measure approximately 800 square metres in area. The construction compound will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors. Temporary port-a-loo toilets and 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 permitted waste collector to wastewater treatment plants. There will also be a water supply on site for hygiene purposes, by way of a temporary storage tank. The layout of this construction compound is shown in Figure 4-14.

Construction materials and turbine components will be brought directly to the proposed turbine locations following their delivery to the site.

4.3.9 Tree Felling and Replanting

4.3.9.1 Tree Felling

Some of the Proposed Development site is located on commercial forestry. As part of the Proposed Development, tree felling will be required within and around the development footprint to allow the construction of turbines and associated infrastructure. Turbulence felling may also be required in the vicinity of turbine locations, the purpose of which is to avoid turbulence that can be created by the forest canopy and which can affect the performance and efficiency of the turbines.

It should be noted that forestry on the site of the Proposed Development was originally planted as a commercial crop and will be felled in the future should the Proposed Development proceed or not.

A total of 26.59 hectares of forestry will be permanently felled within and around the footprint of the Proposed Development. An additional 1.9 hectares of trees will be required to be temporarily felled around all turbines to achieve the requirements of the bat mitigation proposal. Figure 4-15 shows the extent of the areas to be temporarily and permanently felled as part of the Proposed Development.

It is currently not anticipated that turbulence felling will be a requirement, however, for the purposes of this EIAR, an estimated additional 30 hectares of commercial forestry could be required to be temporarily felled in order to prevent the trees causing a turbulence effect. The actual requirement of turbulence felling will be determined by the selected turbine manufacturer. The total amount of tree felling potentially required on the site is therefore 58.49 hectares.

The tree felling activities required as part of the Proposed Development will be the subject of two Limited Felling Licence (LFL) applications to the Forest Service, 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 Proposed Development be submitted with the felling licence applications; therefore the felling licences cannot be applied for until such time as planning permission is obtained for the Proposed Development.

One LFL will be applied for to cover felling required around the footprint of the Proposed Development footprint, for example along access roads and at turbine bases. A second LFL will be applied for to cover temporary felling including any turbulence felling.

4.3.9.2 Tree Planting

In line with the Forest Service's published policy on granting felling licences for renewable energy developments, areas cleared of forestry for wind farm infrastructure will have to be replaced by replanting at an alternative site.

The Forest Service policy requires replanting on a hectare for hectare basis for the footprint of the turbines and the other infrastructure elements. In the case of the area to undergo temporary felling, there is a requirement for replanting on a hectare for hectare basis within the site plus an additional 10% offsite should the area to be temporary felled exceed 20ha.

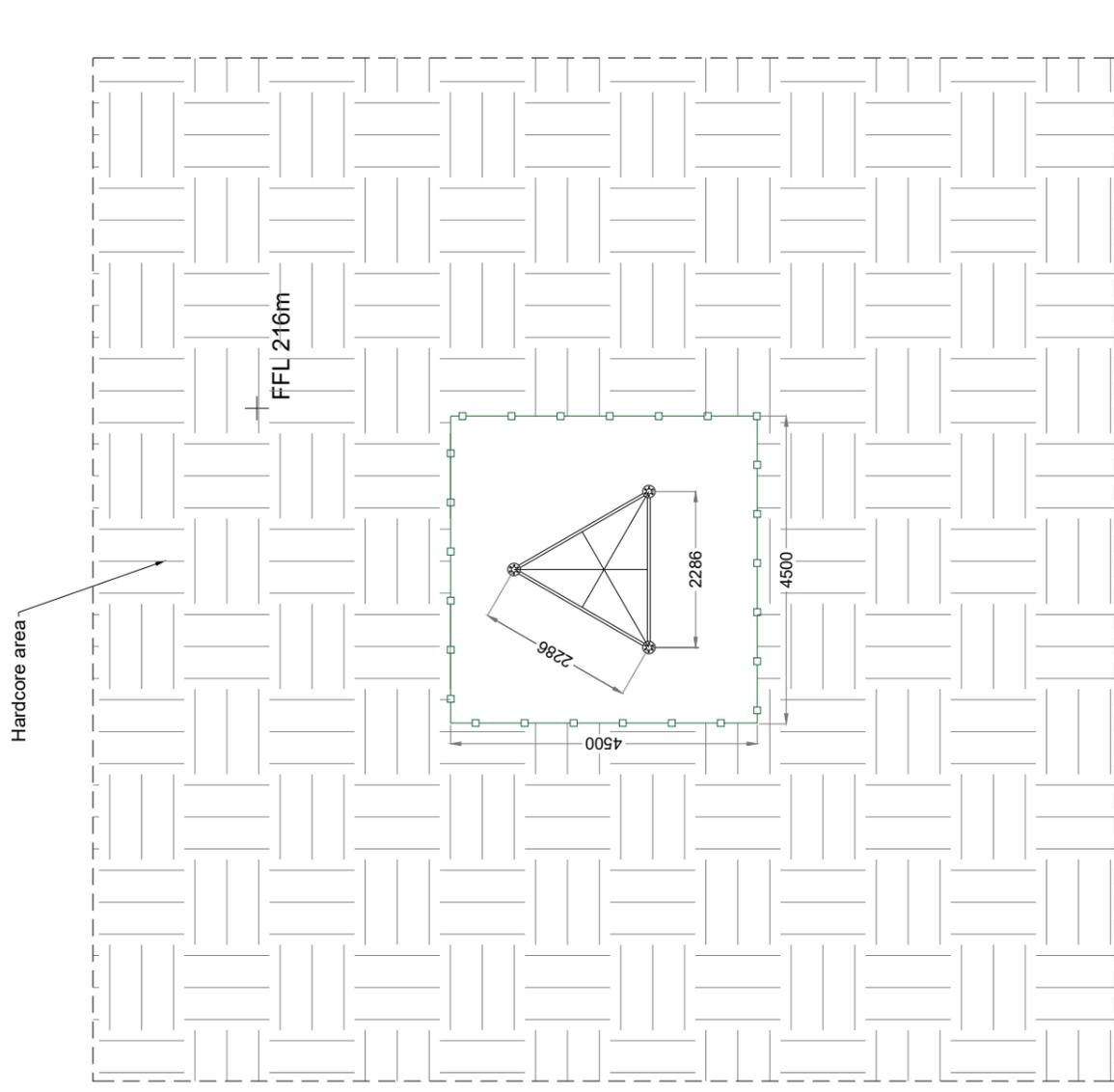
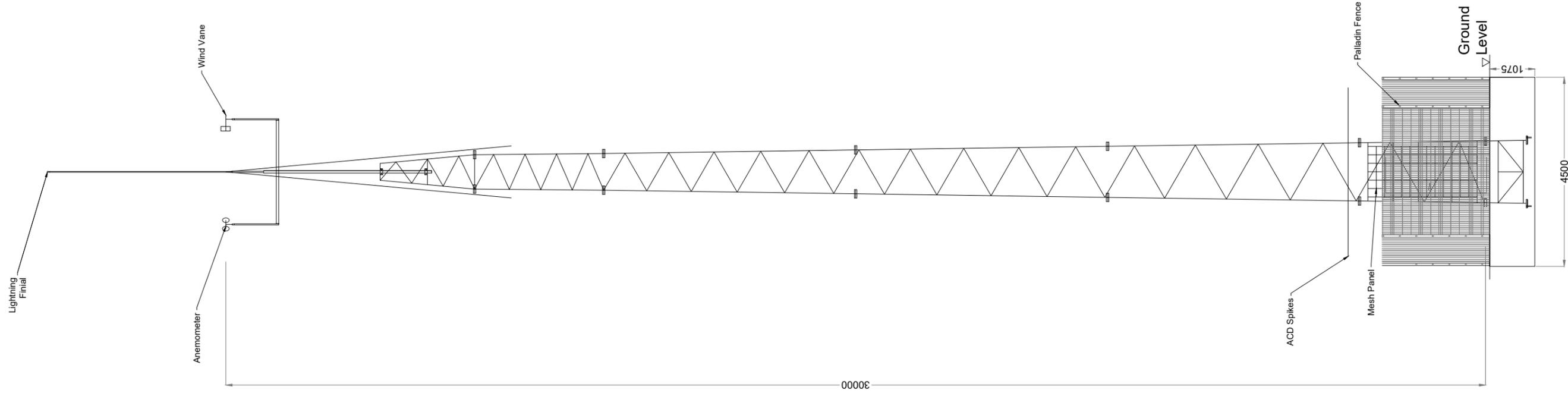
Approximately 29.78 hectares of forestry will be replanted offsite as a condition of any felling licences that might issue in respect of the Proposed Development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The Forest Service policy states that where temporary felling is necessary, a 'short rotation forestry' (SRF) approach will be made a condition of the felling licence. The SRF approach recommends the use of lodgepole pine or another suitable species as the replanting choice. The north coastal variety of lodgepole pine is preferred because it is unlikely to reach ten metres in height, the height at which the trees would again have to be felled to prevent turbine turbulence effects or for bat mitigation, over the 30-year lifetime of the project. In accordance with the Forest Service policy and requirements, the 31.83 hectares that may be temporarily felled for infrastructure construction, bat mitigation and possible turbulence, will be replanted in the same location with the north coastal variety of lodgepole pine or similar species.

The replacement replanting of the remaining 26.59 hectares of forestry and the 10% of the overall assumed turbulence and bat mitigation felling (c3.19 ha), totalling 29.78 ha can occur anywhere in the State subject to licence. Three replanting areas, located in Cloonbony, Co. Longford, Lisduff, Co. Mayo and Sheehaun, Co. Roscommon have been identified for assessment purposes, with a total availability of 31.29 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 Development receive planning permission. A description of the proposed replanting land 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.

Note:

1. Met Mast exact detail may differ depending on the selected manufacturer.
2. Finished level of the mast to match ground conditions.
3. Mast/foundation orientation to be confirmed with met mast supplier.
4. Earthing and ducting requirements to be confirmed with met mast supplier and forwarded to foundation designer
5. Met mast to be constructed towards final phase of wind farm construction within temporary site construction compound



Mast Plan
Extent of Mast Area indicated on DWG 170224a -16

Figure 4-12

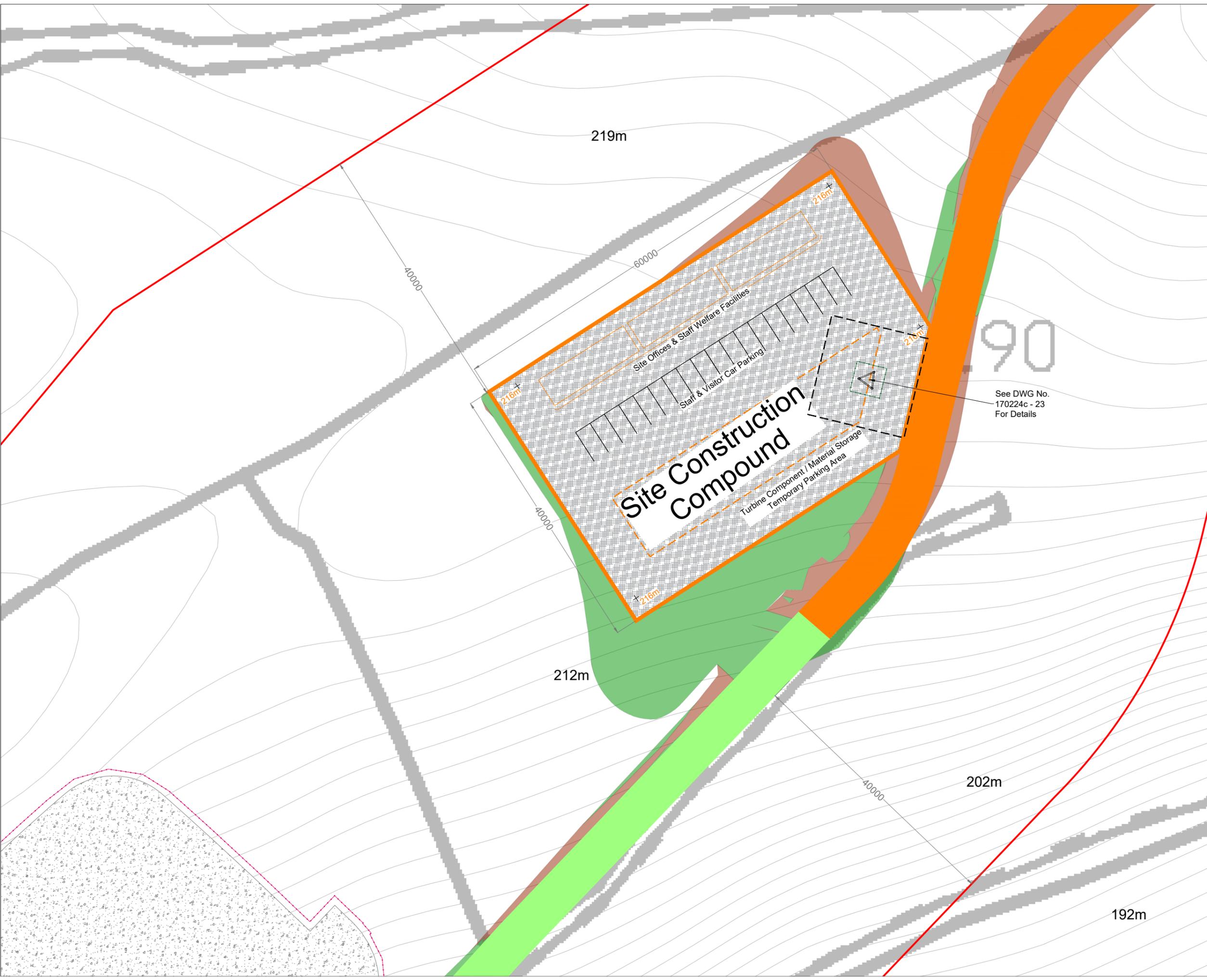
Met Mast

DRAWING TITLE	
PROJECT TITLE Slieveaureary Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O'Brien	CHECKED BY: Eoin O'Sullivan
PROJECT No: 170224b	DRAWING No: 170224c - 31
SCALE: 1:100 @ A3	DATE: 26.10.2021



MKO
Planning and Environmental Consultants
Tum Road, Galway
Ireland, H91VW84
+353 (0) 91 735611
email: info@www.mkoireland.ie
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Mast Elevation



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 8. Layout plans show Maximum Turbine rotor diameter as per turbine drawing.
 9. Final levels may vary depending on local ground conditions.
 10. Refer to HES Drainage Design Drawings for drainage design details.

Note:
Met mast to be constructed towards final phase of wind farm construction.

- Drawing Legend**
- Planning Application Boundary
 - Existing Road to be Upgraded
 - Proposed Road
 - Borrow Pit
 - Temporary Construction Compound
 - Met Mast Location
 - Cut
 - Fill



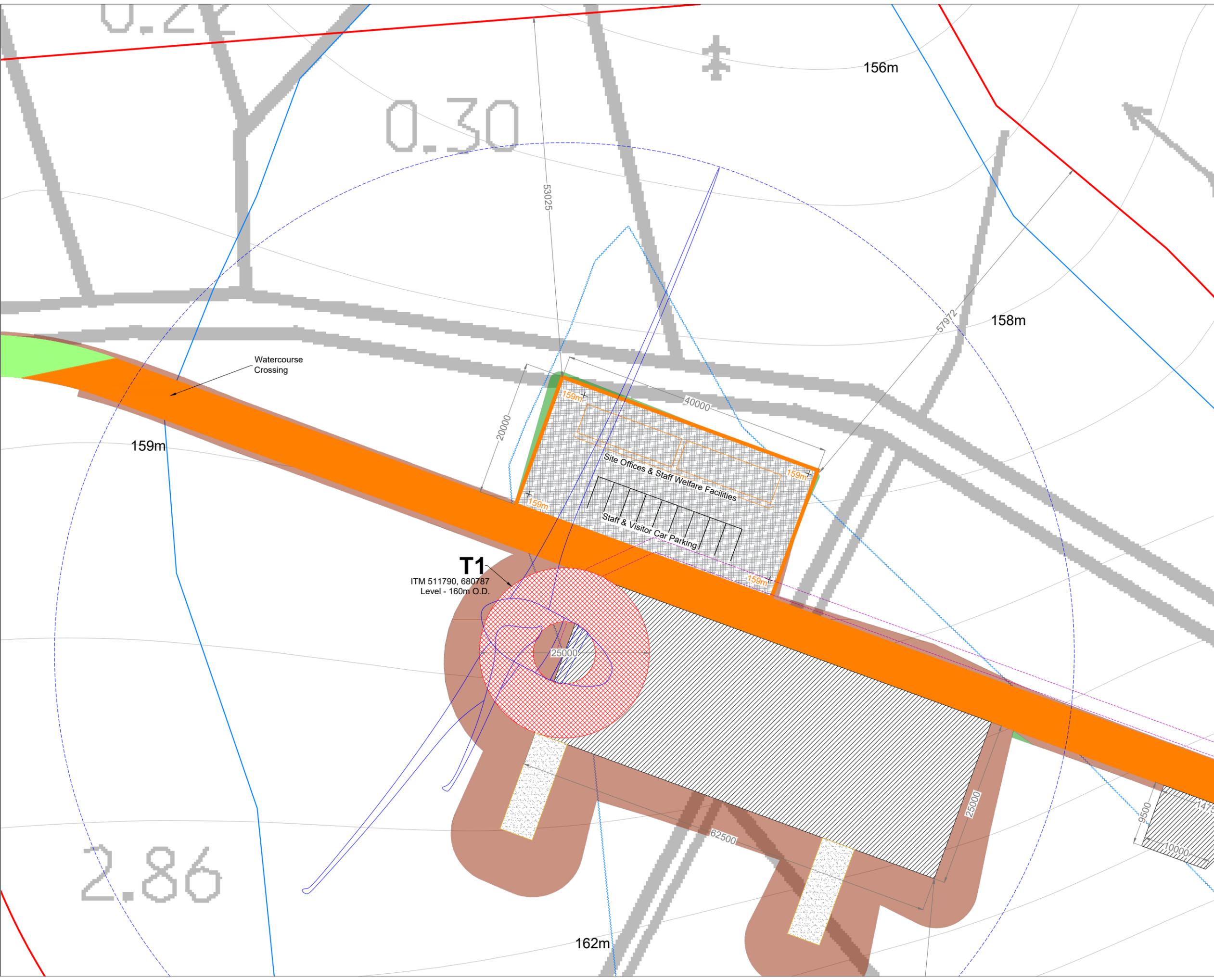
Figure 4-13

Temporary Construction Compound 1

PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O'Brien	CHECKED BY: Eoin O'Sullivan
PROJECT No.: 170224c	DRAWING No.: 170224c - 16
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MKO
Planning and Environmental Consultants
Team Road, Galway
Ireland, H91 YW84
+353 (0) 91 735611
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4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. Cable Route to be subject to final electrical specifications and location may vary within road corridor.
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8. Layout plans show Maximum Turbine rotor diameter as per turbine drawing.
9. Final levels may vary depending on local ground conditions.
10. Refer to HES Drainage Design Drawings for drainage design details.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- River/Stream
- River/Stream 50m Buffer
- Electrical Cable Trench
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Swept Area
- Temporary Construction Compound
- Cut
- Fill

Figure 4-14

Temporary Construction Compound 2

PROJECT TITLE: Slievecurry Renewable Energy Development, Co. Clare

DRAWING BY: Joseph O'Brien CHECKED BY: Eoin O'Sullivan

PROJECT No.: 170224c DRAWING No.: 170224c - 17

SCALE: 1:500 @ A3 DATE: 26.10.2021

OS SHEET No.: 4200, 4201, 4258, 4259, 4316, 4317

MKO
 Planning and Environmental Consultants
 Tuam Road, Galway
 Ireland, H81 VV84
 +353 (0) 91 735611
 email: info@www.mkofireland.ie
 Website: www.mkofireland.ie

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- ### Map Legend
- EIAR Site Boundary
 - Proposed Turbine Layout
 - Proposed Development Footprint
 - Temporary Forestry Felling (1.9ha)
 - Permanent Forestry Felling (26.59ha)



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Drawing Title	
Proposed Felling	
Project Title	
Slieveacurry Renewable Energy Development, Co. Clare	
Drawn By	Checked By
Ellen Costello	Michael Watson
Project No.	Drawing No.
170224c	Figure 4-15
Scale	Date
1:25000	29.10.2021

MKO
Planning and Environmental Consultants
Team Road, Galway
Ireland, H91 VV84
+353 (0) 91 735611
email@mkofireland.ie
Website: www.mkofireland.ie

4.3.10 Site Activities

4.3.10.1 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 includes details of drainage, peat and overburden management and waste management. 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 approval.

4.3.10.2 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 refilled 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 Development. 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.

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 available if necessary, during all refuelling operations.

4.3.10.3 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The quarries that could potentially provide stone and ready mix concrete for the proposed development are as follows;

1. Roadstone, Bunratty,
2. Roadstone, Toonagh,
3. McGraths O'Callaghan's Wills, Tulla.

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. 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 in Plate 4-4 and Plate 4-3 below.

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.



Plate 4-4 Concrete washout area



Plate 4-3 Concrete washout area

Alternatively, a Siltbuster-type concrete wash unit or equivalent (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) may be used. 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.

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 but will be directed back to their batching plant for washout.
- Site roads will initially be constructed with a subgrade and compacted with the use of a roller to allow concrete delivery trucks access all areas where the concrete will be needed. The final wearing course for the site roads will not be provided until all bases have been poured. 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, agreeing 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.

4.3.10.4 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's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) or equivalent.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

4.3.10.5 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.

4.3.10.6 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 facilities will be required as part of the construction phase of the Proposed Development because site roads will be 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 requires cleaning due to construction traffic associated with the Proposed Development.

4.3.10.7 Waste Management

The CEMP, Appendix 4-4 of this EIAR, provides a waste management plan (WMP) which outlines 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 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 must 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 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.

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

It is proposed to access the site of the Proposed Development via an existing access track off the local road to the northwest of the site. This entrance will be widened to facilitate the delivery of the construction materials and turbine components. The site entrance was subject to Autotrack assessment to identify the turning area required, as described in Section 14.1 of the Traffic and Transport Assessment. Appropriate sightlines will be established to the north and south of the proposed site entrance for the safe egress of traffic. The proposed works will result in a permanent upgrade of this current site access from the local road, which will also form the northern entrance to the Proposed Development during the operational phase. An existing road to the southwest will also facilitate non-HGV operational access to the site.

The location of the site access is shown on the site layout drawing in Figure 4-1 . A Traffic Management Plan is included in Appendix 14-2 of Chapter 14 Material Assets and 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.

4.4.2 Turbine and Construction Materials Transport Route

It is proposed that large wind turbine components will be delivered to the site of the Proposed Development, from Dublin Port , Foynes Port or Galway Port, via the N85 National Secondary Road. From Ennis the turbines will be transported northwest along the N85 National Secondary Road to Inagh before turning left on to the R460 Regional Road and transported west for 4.2km to the junction with the L1074 Local Road. The turbines will be transported west/northwest for 4.2km before turning left onto a local road at Fahabeg. At Fahabeg, the turbines will be transported southwest for 2km after which the route will take a sharp left onto a local road approaching the proposed renewable energy development site from the northwest. The proposed turbine transport route to the Proposed Development site is shown on Figure 4-16.

Construction materials such as concrete, steel and construction materials will follow the same transport route as the wind turbines from the National Road network to the Proposed Development site.

All deliveries of turbine components and other construction materials to the site will only be via the proposed transport routes outlined in Figure 4-16. No other public road route will be used as part of the construction phase of the Proposed Development for the transport of materials. The number of construction vehicles that will be generated during the construction phase of the Proposed Development is outlined as part of the traffic and transport assessment in Section 14.1 of this EIAR.

4.4.2.1 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 works are required along its length. Full details of the assessment are included as part of the traffic impact assessment set out in Section 14.1.8 of this EIAR and summarised below. There are sections on the L1074 where the vertical alignment may require specialist transport vehicles. These sections will be further considered by the appointed transport company following turbine procurement process. Accommodation works will be required at various locations on the national and regional road network between the port of arrival and Ennis. These will be limited to temporary measures including temporary local road widening, overruns of roundabout island and temporary relocation of some signs and street furniture.

Location 1 – N85 / R460 junction at Inagh

Minor temporary alterations will be required to the existing streetscape during the delivery of the abnormally sized loads.

Location 2 – Bend on R460

The swept path analysis undertaken for this location shows that the abnormally sized turbine vehicles will be accommodated at this location with minor impacts on sections of hedge (over-sail) and grass verges.

Location 3 – R460 / L1074 junction

The preliminary swept path analysis indicates that the wind farm turbine vehicles will be able to negotiate this bend junction.

Location 4 – Bend on L1074

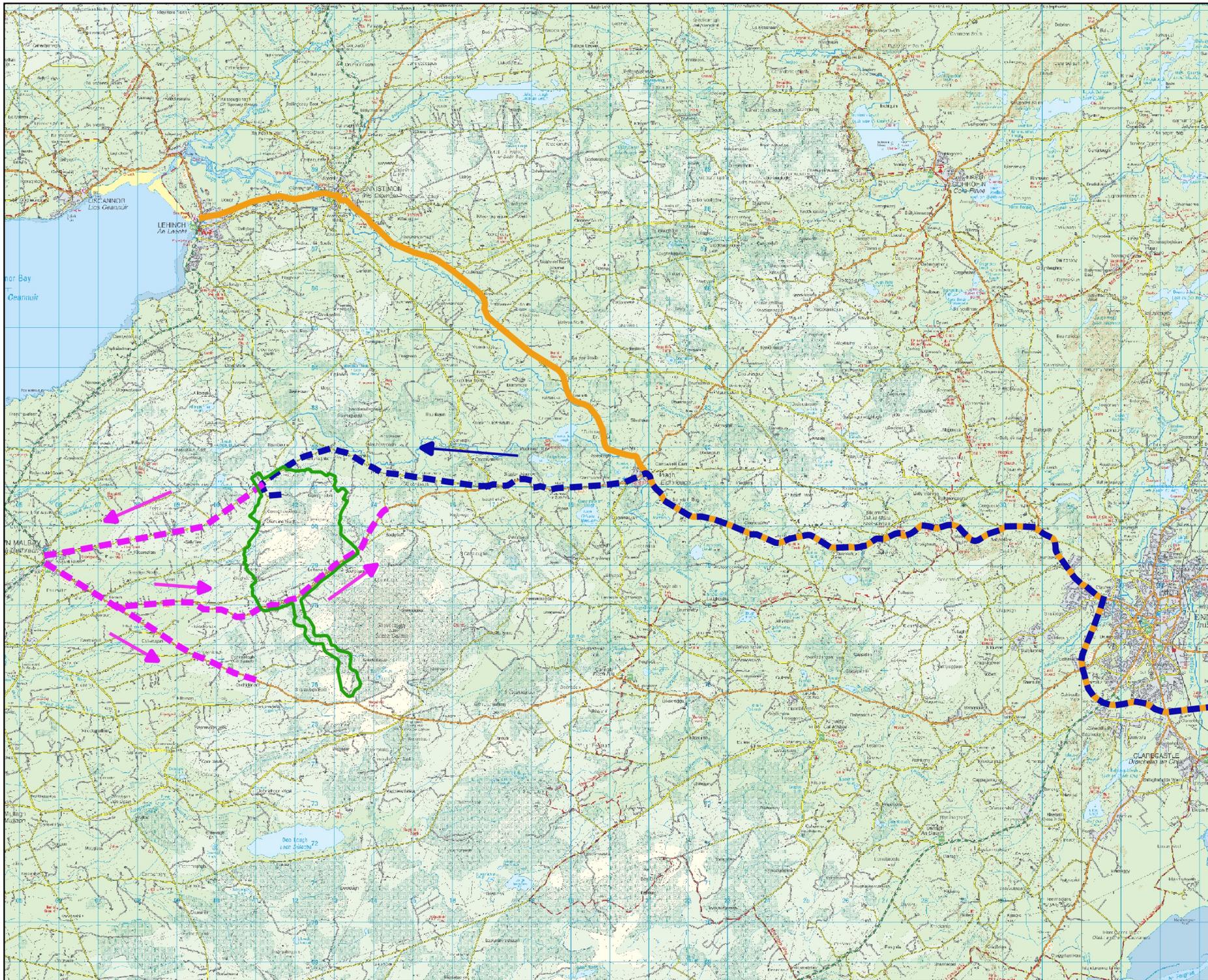
The preliminary swept path analysis indicates that the wind farm blade vehicle will require to have a shortened wheel base with an extended blade overhang to the rear (increased from a standard 10m to 18m) in order to negotiate this location.

Location 5 – L1074 / Fahanlunaghta More Road junction

The analyses indicate that temporary local road widening will be required at this junction in order to accommodate the wind turbine vehicles.

Location 6 – Fahanlunaghta More Road / forestry access road junction

The analyses indicates that a temporary run-over area and visibility splays will be required at this junction in order to accommodate the wind turbine vehicles.



Map Legend

- EIAR Site Boundary
- N85
- Turbine Delivery Route & Construction Haul Route
- Construction Haul Route



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Drawing Title

Turbine Delivery and Construction Haul Route

Project Title
Slieveacurry Renewable Energy Development, Co. Clare

Drawn By Ellen Costello	Checked By Michael Watson
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Project No. 170224c	Drawing No. Figure 4-16
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Scale 1:125000	Date 26.10.2021
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MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 YW84
+353 (0) 91 735611
enquiries@mkofireland.ie
Website: www.mkofireland.ie

4.4.3 Traffic Management

A turbine with the maximum blade length of 75 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 81 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 14.1 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. While 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 deliver oversized loads from origin to destination. With over 368 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 specialist transport sector has become particularly adept in finding solutions to.

As an alternative solution for transport of turbine blades, alternative delivery systems are available. For example, delivery vehicles fitted with blade adapters may be used in order to navigate the existing roads along the turbine delivery route. Blade adaptors allow the turbine blade to be transported at a suitable angle in order to navigate tight bends or obstacles along the delivery route. Plate 4-5 below shows an example of a blade adapter.



Plate 4-5 Blade adaptor transport system

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 four vehicles at a time, and 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, usually 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 potential routes 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 for agreement with the relevant Authorities. All turbine deliveries will be provided for in a Transport Management Plan which will be finalised in advance of oversized load deliveries, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. Such a transport management plan is typically submitted to the relevant Authorities 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 Gain Proposal

4.5.1 Background

The Proposed Development has the potential to have significant benefits for the local economy, by means of job creation, landowner payments and commercial rate payments. An important part of renewable energy development, which Slieveacurry Ltd. has been at the forefront of developing, is its Community Benefit Package. The concept of directing benefits from wind farms to the local community is promoted by the National Economic and Social Council (NESC) and the Irish Wind Energy Association (IWEA) among others. While it may be simpler and easier to put a total fund aside for a wider community area, Slieveacurry Ltd. is endeavouring to develop new ways to direct increased gain towards the local community with particular focus on those living closest to the Proposed Development.

The applicant company has given careful consideration to the issue of community gain arising from the Proposed Development, if permitted and constructed. Community gain from significant development proposals, including wind farms, whilst a relatively recent approach, is now a common consideration for developers and, indeed, planning authorities. This approach recognises that, with any significant wind farm proposal, the locality in which the site is situated is making a significant contribution towards helping achieve national renewable energy and climate change targets, and the local community should derive some benefit from accommodating such a development in their locality.

Community gain proposals can take a number of forms, generally depending on the nature and location of the Proposed Development and the nature and make-up of the local community. The nature of the community gain proposal will be subject to discussions with and input from the local community. In some instances, funds are paid by the developer, either annually or as a one-off payment, to a community fund that is administered as agreed by the community. These funds may then be used for a variety of projects, such as environmental improvements, local amenities and facilities, voluntary and sporting groups and clubs, educational projects and energy efficiency improvement works.

4.5.2 The Proposal

The Community Benefit Package which is being proposed for this project has been directed by feedback from ongoing consultation with the local community. Those spoken to in the local area felt that the project should bring with it enduring economic benefits for the local community and that these should be developed at an early stage from operation of the Proposed Development. It was also felt that there should be an opportunity for households in the area to receive a return from the project and that those closest to the Proposed Development should benefit most.

The types of projects and initiatives that could be supported by such a Community Gain proposal could include youth, sport and community facilities, schools, educational and training initiatives, and wider amenity, heritage, and environmental projects. Initial local suggestions for use of the fund included grants for Cloonanaha National School, water-mains connections for residents who relied on river water, local enterprise schemes, riparian planting of native species, energy retro-fitting of houses and contributions to electrical bills.

4.5.2.1 Financial Contributions

The community benefit scheme proposes to provide a fund of €100,000 per annum over the lifespan of the Proposed Development based on the current estimated generating capacity. This will equate to potential funding of €3 million to the local community which is a substantial contribution.

The number and size of grant allocations will be decided by a Community Fund liaison committee with various groups and project benefiting to varying degrees depending on their funding requirement.

4.5.3 Community and Voluntary Group Fund

A dedicated annual fund could be made available through the Community Gain Fund for local community groups and voluntary organisations to support their efforts and initiatives in the local communities around the Proposed Development. The types of projects and initiatives that could be supported by such a Community Gain proposal could include youth, sport and community facilities, schools, educational and training initiatives, and wider amenity, heritage, and environmental projects.

The Developer and the Community will set the final qualifying criteria for projects and initiatives seeking funding from the Community Gain Fund. Local community groups and not-for profit organisations around the Proposed Development site that promote the sustainable development of the area will all be considered for their projects and initiatives.

4.5.4 Renewable Energy Fund for Local Residents

As referred to in this EIAR above, the Proposed Development will make a significant contribution towards helping achieve national renewable energy and climate change targets. For a strategic renewable energy project of the scale proposed, a portion of the Community Gain Fund could be dedicated to local residents living within an agreed range of any proposed wind turbine through a Renewable Energy Fund. Such a proposal could see direct payments being made to local residents from the Renewable Energy Fund on an annual basis to contribute to the cost of their annual electricity bill from a renewable energy supplier of their choosing and may fund some renewable energy upgrades to their properties to improve energy efficiency, install domestic renewable energy technologies such as heat pumps or solar panels, and overall make them less reliant on fossil-fuel.

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 experience of the project team of other wind farm sites in peat-dominated environments, and the number of best practice guidance documents referred to in the References section of the EIAR.

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is 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.

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. It is proposed that 3 no. new stream crossings will be required to facilitate the renewable energy development infrastructure.

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

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

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

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 in Figure 4-17 below.

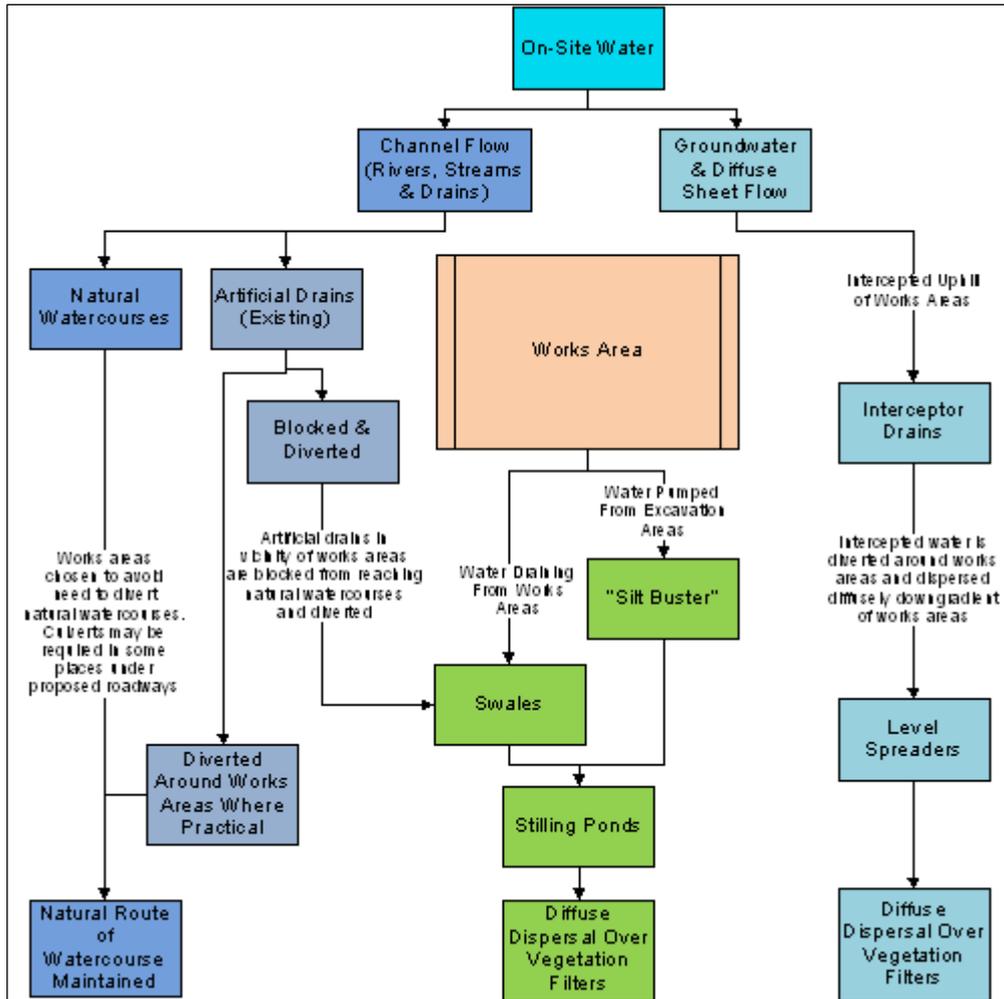


Figure 4-17 Proposed Development Drainage Process Flow

4.6.4 Drainage Design

A 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 4-5 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 of 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. Figure 4-18 below shows an illustrative drawing of an interceptor drain.

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. Figure 4-18 below, shows an illustrative example of a drainage swale.

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

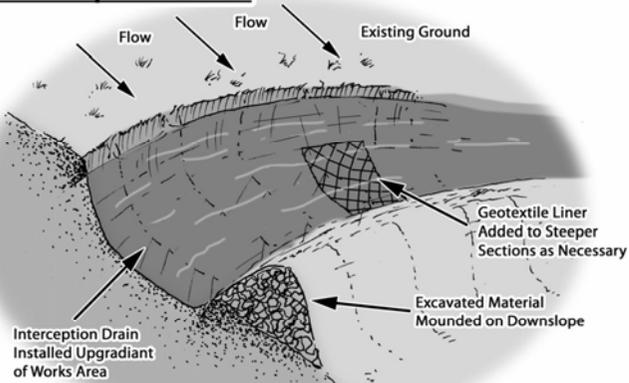
The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4-6 inch stone will be built up 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. Figure 4-18, below, shows illustrative examples of check dams.

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

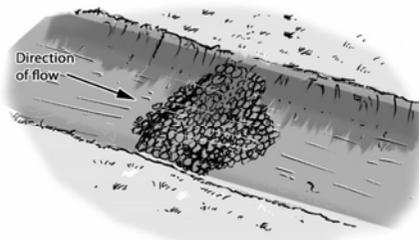
Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

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

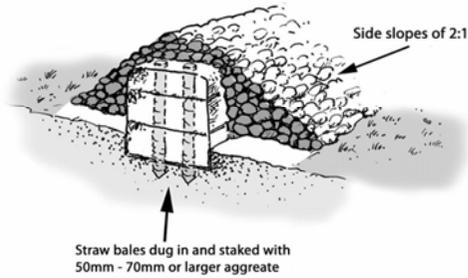
Interceptor Drain



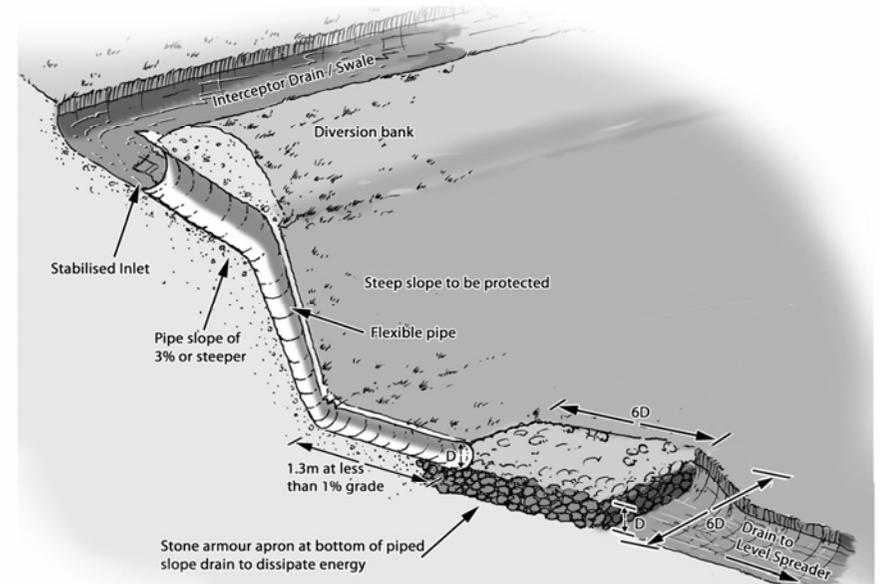
Check Dam (Stone Dam in Drain)



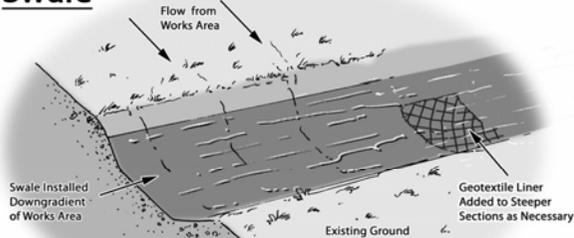
Check Dam (Straw Bale & Stone Dam - Cross Section)



Slope Pipe Drain

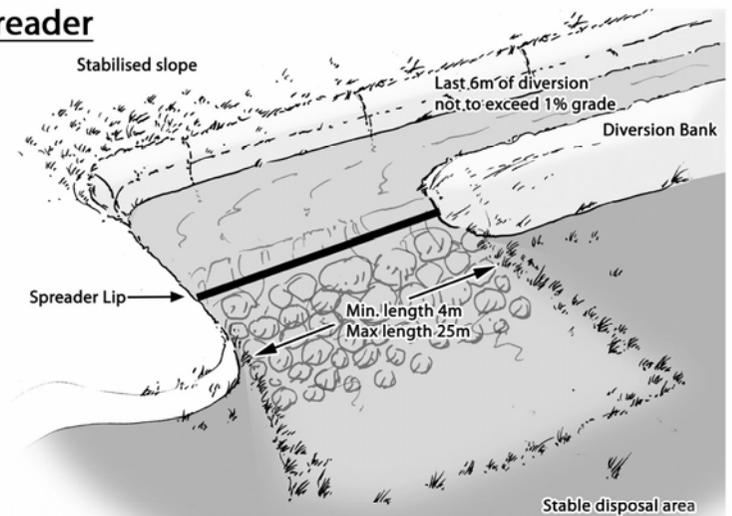


Swale

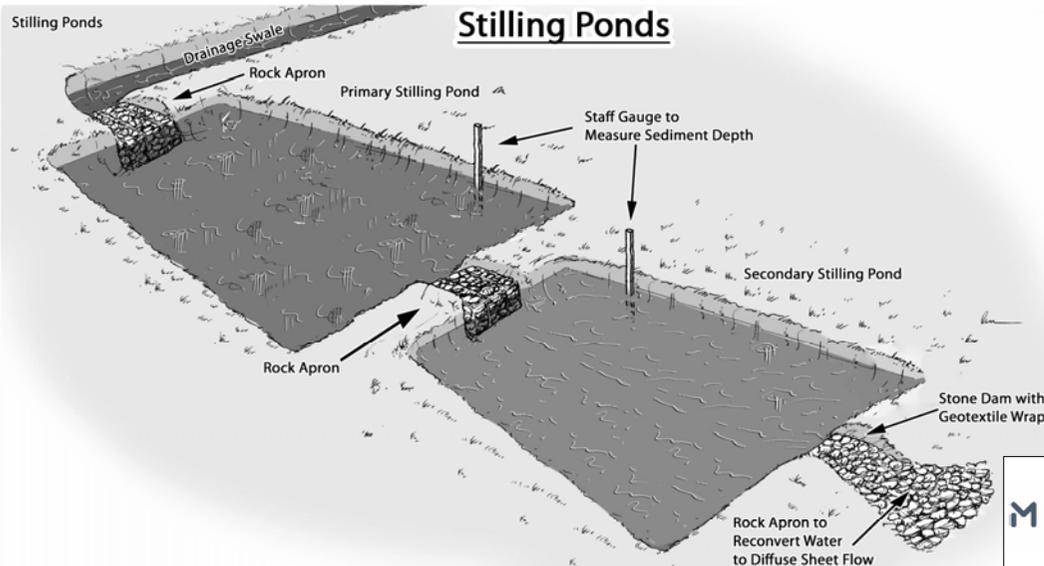


Drainage Design Measures

Level Spreader



Stilling Ponds



MAP TITLE: Drainage Design Measure Illustrations	MAP NO.: Figure 4-18	SCALE: NTS
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	DATE: 28-04-2020	
DRAWING BY: Ellen Costello	CHECKED BY: Michael Watson	ISSUE NO.: 170224- 2020.09.22 F
McCarthy Keville O'Sullivan Ltd., Block 1, G.F.S.C. Moneenageisha Road, Galway, Ireland. Email: info@mccarthykos.ie Tel: +353 (0)91 735611 Fax: +353 (0)91 771279		

4.6.4.4 Level Spreaders

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 level 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 reconcentrated 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 4-18, 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 4-18, above, 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 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 (Settlement 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. Figure 4-18, above, shows an illustrative example of a stilling pond system.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area 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. All material excavated during pond construction will be used locally for landscaping and berm construction around these ponds.

Stilling ponds will be located towards the end of swales, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a swale will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

Stilling ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

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 4-19 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.

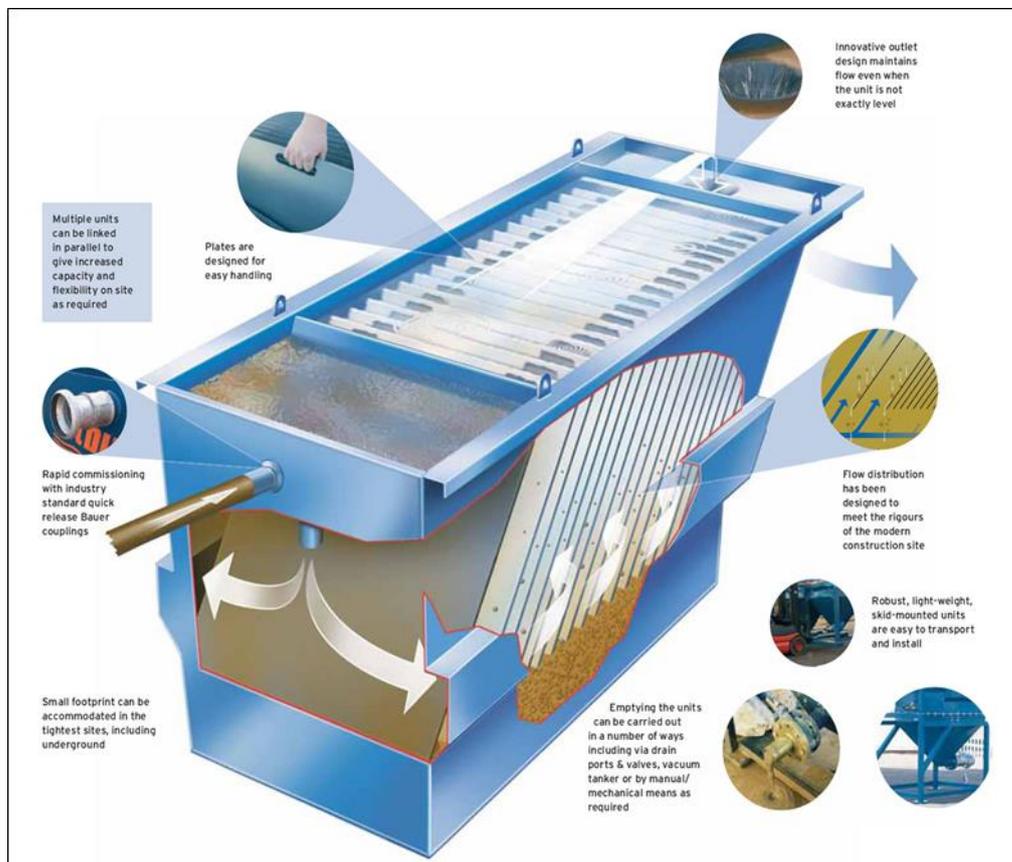


Figure 4-19 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

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 peaty 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 4-6 and Plate 4-7 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 4-6 Silt Bag with water being pumped through



Plate 4-7 Silt bag under inspection

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 some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately

sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure 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 an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone of a stream or 100m buffer zone of a lake, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the Proposed Development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the drainage design drawings included in Appendix 4-5.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document '*Control of Water Pollution from Linear Construction Projects*' published by Construction Industry Research and Information Association (CIRIA, No. C648, 1996). Up to three silt fences may be deployed in series.

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

Silt fences will be inspected regularly to ensure water is continuing to flow through the fabric, and the fence is not coming under strain from water backing up behind it.

4.6.4.13 Forestry Felling Drainage

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 turbulence felling may take place after all groundworks have been completed but while turbines are being commissioned (depending on the requirements of the selected turbine manufacturer). A Harvest Management Plan is included in Appendix 4-6.

Permanent felling will be undertaken in and around the footprint of the proposed development (i.e. access roads, turbines etc). Temporary felling will be carried out around all turbines to reduce turbulence effects or bat mitigation. Tree stumps will only be removed in areas around the proposed development footprint. During tree felling there is a potential to generate peat particles and silts in surface water runoff due to tracking of machinery and disturbance of the peat surface etc, however mitigation is provided in Section 9.5.2.1 of Chapter 9 Water with regard surface water quality protection for this activity which is summarised below. Also, prior to the commencement of tree felling for subsequent road construction the following key temporary drainage measures will be installed:

- All existing dry forestry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using forestry check dams/silt traps;
- Clean water diversion drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing forestry drains that have surface water flows and also along existing forestry roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

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*.
- 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, EC, TSS, BOD, Total P, Ortho-P, Total N, 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 demarcated with markings 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 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.
- Please refer to Harvest Management Plan included in Appendix 4-6.

4.6.5 **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 with a level spreader, siltbuster or equivalent, which will receive the water from the single outlet.

4.6.6 **Cable Trench Drainage**

Cable trenches are 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 the on-site borrow pit, used for landscaping and reinstatements of other areas elsewhere on site or disposed off-site at an appropriate licensed soil recovery facility.

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.

4.6.7 Site and Drainage Management

4.6.7.1 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 straw bales, clean stone, terram, stakes, 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.

4.6.7.2 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, working under a schedule of works operation system (SOWOR) system as proposed in the planning application. 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.

4.6.7.3 Reactive Site Drainage Management

The final drainage design prepared for the Proposed Development prior to commencement of construction will provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the 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 on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground as a particular time.

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

4.6.8 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 insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the Proposed 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 by reinforcement of the check dam.

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

Silt traps will be inspected weekly during the construction phase of the Proposed 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. The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system.

4.6.9 Construction Phasing and Timing

It is estimated that the construction phase of the Proposed Development will take approximately 12-18 months from starting on site to the commissioning of the electrical system. In the interest of breeding birds, construction will not commence during the bird breeding season which runs from the 1st of March to the 31st of August inclusive. Construction may commence at any stage from September onwards to the end of February, so that construction activities are ongoing by the time the next breeding bird season comes around, and can continue throughout the next breeding season.

4.6.10 Construction Sequencing

The construction phase can be broken down into three main phases, 1) civil engineering works - 10 months, 2) electrical works - 6 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

- 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.
- Construct bases/plinths for transformer.
- Excavate trenches for site cables, lay cables and backfill. Provide ducts at road crossings.
- Backfill tower foundations and cover with previously stored topsoil.
- Complete site works, reinstate site.
- Remove temporary site offices. Provide any gates, landscaping, signs etc. which may be required.

Electrical Works

- > Construct bases/plinths for substation extension building.
- > Install external electrical equipment at substation.
- > Install transformer at compound.
- > Erect stock proof and palisade fencing around substation area.
- > Install internal collector network and communication cabling.
- > Construct grid connection.

Turbine and Meteorological Mast Erection

- > Erect towers, nacelles and blades.
- > Complete electrical installation.
- > Grid connection.
- > Install meteorological mast.
- > Commission and test turbines.
- > Complete site works, reinstate site.
- > Remove temporary site offices. Provide any gates, landscaping, signs etc. which may be required.

The phasing and scheduling of the main construction task items are outlined in Figure 4-20 below, where the 1st January has been selected as an arbitrary start date for construction activities.

ID	Task Name	Task Description	Q1			Q2			Q3			Q4			Q1			Q2		
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	Site Health & Safety		[Blue bar spanning all months]																	
2	Site Compound	Site Compound, Site Access, Fencing, Gates	[Blue bar]																	
3	Site Roads	Excavate/upgrade roads; Install drainage measures; Install culvert; Install water protection measures;	[Blue bar]																	
4	Turbine Hardstands	Excavate base; construct hardstanding areas				[Blue bar]														
5	Turbine Foundations	Fix steel; Erect shuttering; Concrete pour							[Blue bar]											
6	Electrical Works	Underground cabling between turbines;	[Blue bar]																	
7	Backfilling & Landscaping														[Blue bar]					
8	Turbine Delivery & Erection														[Blue bar]					
9	Turbine Commissioning														[Blue bar]					

Figure 4-20 Indicative Construction Schedule

4.6.11 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 development 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 has to be the subject of regular review and audit during the full construction stage of the project. If some 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 CEMP has been prepared for the Proposed Development, and is included in Appendix 4-4 of this EIAR. The CEMP includes details of drainage, peat and 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.

4.7 Construction Methodologies

4.7.1 Turbine Foundations

Each of the turbines to be erected on site will have a reinforced concrete base. Overburden will be stripped off the foundation area to a suitable formation using a 360° excavator with most being removed to the onsite borrow pit while some will be stored locally for later reuse in backfilling around the turbine foundation. A two-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 have to 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.

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 backfilled with suitable fill up to existing ground level and finished with the original material that was excavated.

4.7.2 **Site Roads and Hardstand Areas**

Site roads will be constructed to each turbine base and at each base 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 not required for localised landscaping will be transported back to the borrow pit 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 covered with polythene sheets or sealed with 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.

4.7.3 **Electricity Substation Extension and Control Building**

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

- The dimensions of the substation extension area have been designed to meet the current requirements of the ESB or Eirgrid;
- One control building will be built within the 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 substation plinths will be shuttered and poured with reinforced concrete. An anti-bleeding admixture will be included in the concrete mix.
- The electrical equipment will be installed on a concrete plinth and commissioned
- Perimeter fencing will be erected.
- The construction and components of the substation extension have been designed to ESB/Eirgrid specifications.

4.7.4 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 and allowed to vegetate naturally.
- A section of the temporary construction compound in the southern section of the site will be repurposed to facilitate the construction of the meteorological mast.

4.7.5 Underground Cable Trench

The underground cable will be laid beneath the surface of the site and/or public road using the following methodology:

- Before works commence, surveying will take place along the proposed cable route, with all existing culverts identified. All relevant bodies i.e. ESB, Clare County Council etc. will be contacted and all drawings for all existing services sought.
- When the cable is located on public roads, a traffic management plan will be set up prior to any works commencing. A road opening licence will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- The cable ducts will be concrete surrounded where they pass under the public road and under drains or culverts.
- A tracked 360-degree excavator will then proceed to dig out the proposed trench, typically to a depth of 1200mm, within which the ducts will be laid.

- Trench supports will be installed, or the trench sides will be benched or battered back where appropriate and any ingress of ground water will be removed from the trench using submersible pumps, fitted with appropriate silt filtration systems, to prevent contamination of any watercourse.
- Once the trench has been excavated, a base-layer will be laid and compacted, comprising Clause 804, or 15 Newton CBM4 concrete as required.
- The ducting will be installed as per specification, with couplers fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions, the ends of the ducts will be shimmed up off of the bed of the trench, to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected. Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- As the works progress, the as-built location of the ducting will be recorded using a total station or GPS.
- As per the associated base-layer (Clause 804 material or 15 Newton CBM4 concrete) will be installed and compacted as per approved detail, with care not to displace the ducting.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the ducting.
- The remainder of the trench will be backfilled in two compacted layers with approved engineer's specified material.
- Yellow marker warning tape will be installed across the width of the trench, at 300mm depth,
- The finished surface is to be reinstated, as per original specification. Off-road cabling may be finished with granular fill to facilitate access to the trench for any potential maintenance that is required during the operational phase of the Proposed Development.
- Marker posts will then be placed at regular intervals (generally at joint bays and any change in direction) to denote the location of the underground power cables.



Plate 4.8 Typical Cable Trench View

4.7.5.1 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 proposed ducting 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.

4.7.5.2 Joint Bays

Joint bays are typically 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/ electrical 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. The proposed location of joint bays along the grid connection route are included in Appendix 4-1 to this EIAR

4.7.5.3 Underground Cable Watercourse/Culvert Crossings

There are a total of 14 watercourse and culvert crossings along the proposed cable route, of which 4 no. are stream crossings. The remaining crossings are classified as culverts. The construction methodology has been designed to eliminate the requirement for in-stream works. A general description of the various construction methods employed at watercourse/ culvert crossings are described in the following paragraphs below. A list of the stream crossings along the underground cable route and the proposed crossing method at each location is provided in Table 4-3 below.

The crossing methodologies employed at the other culvert crossings along the underground cable route, will be selected from the suite of watercourse crossing options outlined below, as appropriate, depending on culvert type, depth, size and local ground conditions.

The stream crossing locations are shown in Figure 4-21. The crossing locations for all culvert crossings are also shown on the underground cable route drawings included as Appendix 4.1. Details of all culvert crossing are also provided in Appendix 4-7 of this EIAR.

Should an alternative methodology option be required for individual crossings during the construction process this will be agreed with the relevant authorities including Clare County Council prior to works commencing.

Where culverts require upgrading, the Applicant will commission a survey of culverts, the results of which will be forwarded to the Planning Authority. Having regard to the duration of the consent requested (10 years) it is considered best practice that any such surveys be carried out prior to construction to facilitate accuracy and timely reporting of the surveys.

4.7.5.3.1 **Standard Formation Crossing over Culvert – Option 1**

Where adequate cover exists above a culvert, the standard aforementioned trench 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 4-22.

4.7.5.3.2 **Standard Formation Crossing under Culvert – Option 2**

Where the culvert consists of a socketed concrete or sealed plastic pipe and sufficient depth is not available over the crossing, a trench will be excavated beneath the culvert and cable ducts will be installed in the standard formation 300mm below the existing pipe, as outlined in Figure 4-23.

4.7.5.3.3 **Shallow Formation Crossing over Culvert – Option 3**

Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location. The ducts within the shallow formation trench will be encased in 6mm thick steel galvanized plates and backfilled with 35N concrete.

Where sufficient deck cover is not available to fully accommodate the required ducts, it may be necessary to locally raise the pavement level. Any addition of a new pavement will be tied back into the existing road pavement at grade. This method of duct installation is further detailed in Figure 4-24.



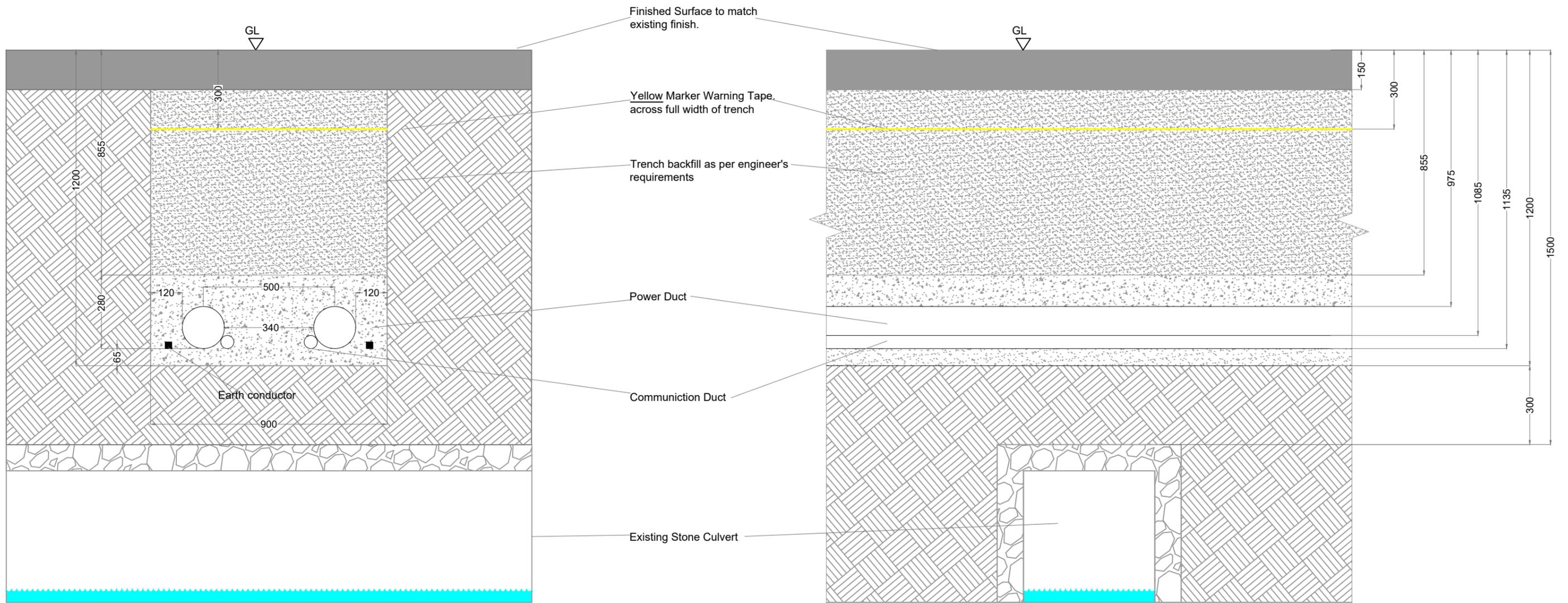
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- EIAR Site Boundary
 - Proposed Turbine Locations
 - Proposed Grid Connection Route
 - Proposed Extension to Existing Slieveacallan Substation
 - Watercourse Crossings



Drawing Title Cable Route Watercourse Crossings	
Project Title Slieveacurry Renewable Energy Development, Co. Clare	
Drawn By Ellen Costello	Checked By Michael Watson
Project No. 170224c	Drawing No. Figure 4-21
Scale 1:25000	Date 29/10/2021

MKO
 Planning and Environmental Consultants
 Team Road, Galway
 Ireland, H91 VW84
 +353 (0) 91 735611
 email: info@mkofireland.ie
 Website: www.mkofireland.ie

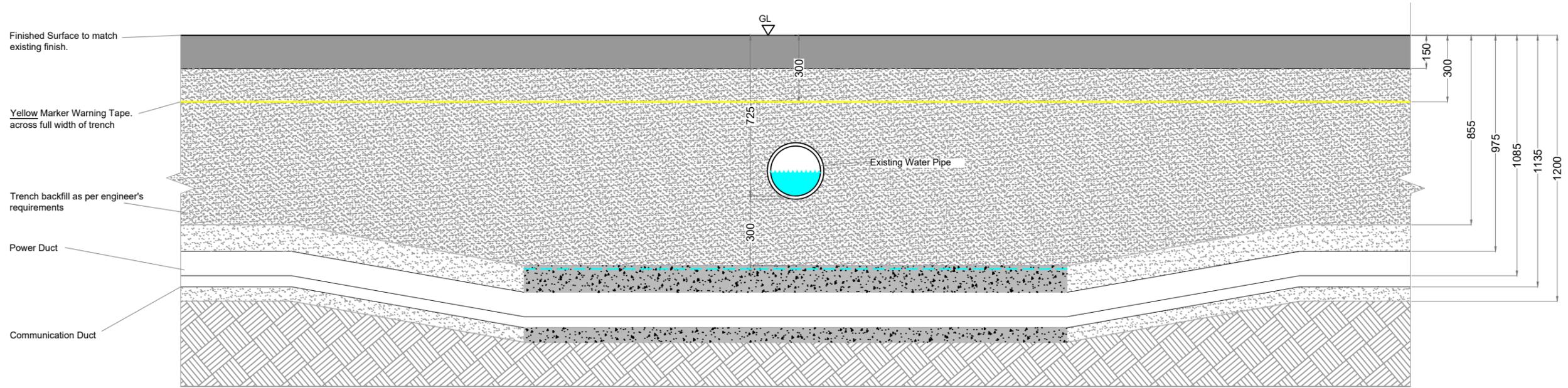
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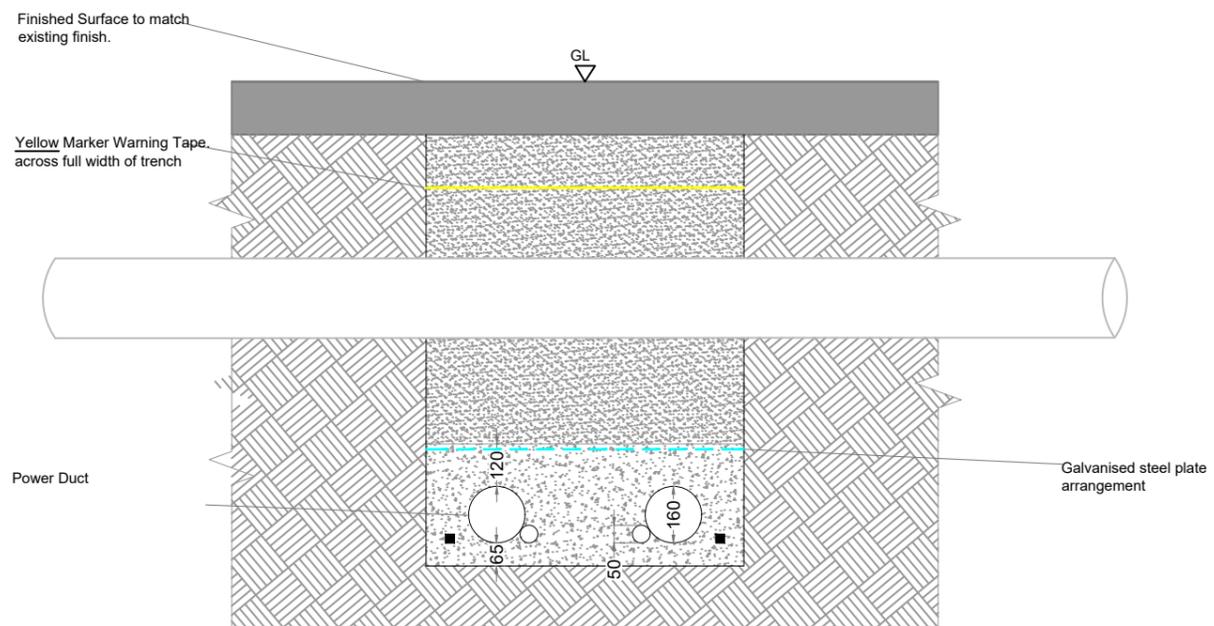
**33kV IPP Trench Section - 2 Circuits
Culvert Crossing Option 1**

**33kV IPP Trench Elevation - 2 Circuits
Culvert Crossing Option 1**

Figure 4-22	
Standard Formation Crossing Over Culvert - Option 1	
Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O'Brien	CHECKED BY: Michael Watson
PROJECT No.: 170224c	DRAWING No.: 170224c - 42
SCALE: 1:15 @ A3	DATE: 26.10.2021
	
MKO Planning and Environmental Consultants Tuam Road, Galway Ireland, H91 VW84 +353 (0) 91 735611 email: info@www.mkofireland.ie Website: www.mkofireland.ie	



**33kV IPP Trench Section - 2 Circuits
Culvert Crossing Option 2**

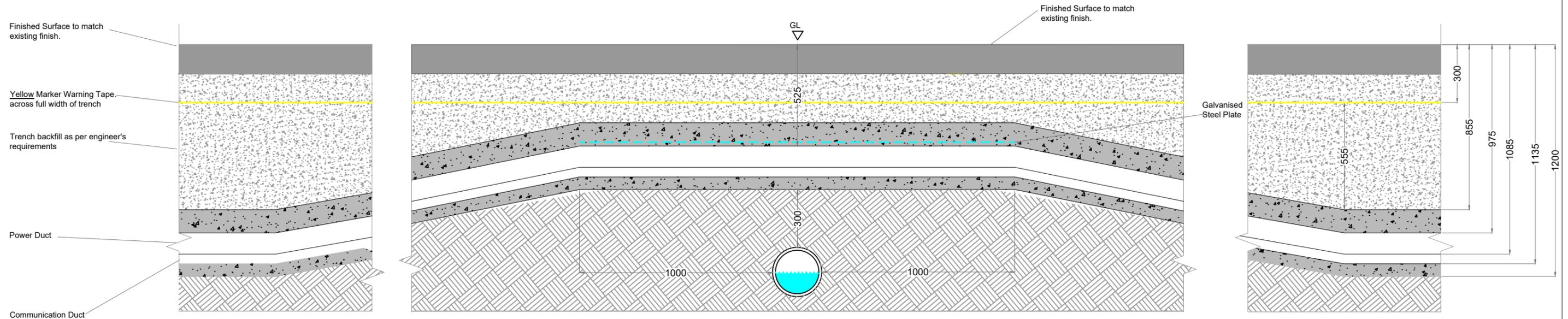


**33kV IPP Trench Elevation - 2 Circuits
Culvert Crossing Option 2**

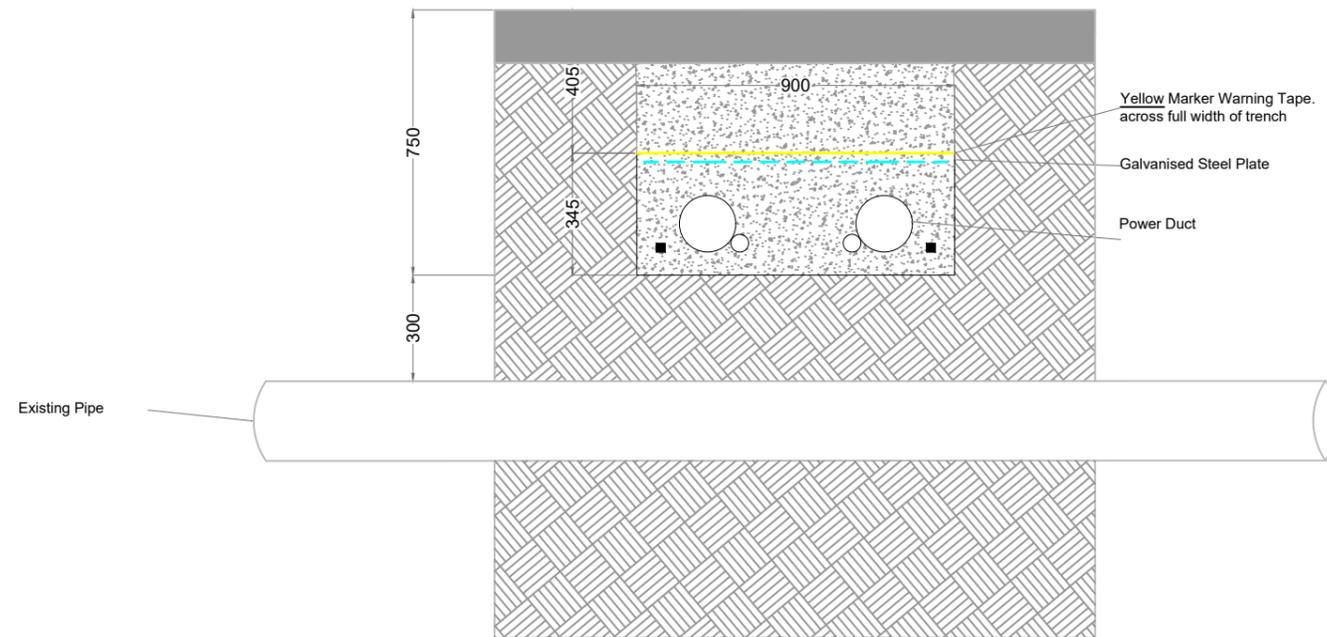
Figure 4-23	
DRAWING TITLE: Deep Formation Crossing Under Culvert - Option 2	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O'Brien	CHECKED BY: Michael Watson
PROJECT No.: 170224c	DRAWING No.: 170224c - 43
SCALE: 1:20 @ A3	DATE: 26.10.2021



MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
email: info@www.mkofireland.ie
Website: www.mkofireland.ie



**33kV IPP Trench Elevation - 2 Circuits
Culvert Crossing Option 3**



**33kV IPP Trench Elevation - 2 Circuits
Culvert Crossing Option 3**

Figure 4-24	
DRAWING TITLE: Shallow Formation Crossing Over Culvert - Option 3	
PROJECT TITLE: Slieveacurry Renewable Energy Development, Co. Clare	
DRAWING BY: Joseph O'Brien	CHECKED BY: Michael Watson
PROJECT No.: 170224c	DRAWING No.: 170224c - 44
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MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 VV84
+353 (0) 91 735611
email: info@www.mkofireland.ie
Website: www.mkofireland.ie

Table 4-3 Underground Cable Route – Watercourse Crossings Methodology

Watercourse Crossing Reference No.	Watercourse Type	Cover from Road Level to Top of Culvert (m)	Crossing Option Description	Watercourse Crossing Option	Extent of In-Stream Works
1	600 mm diameter corrugated pipe	1.3	Where cable ducts are to be installed over an existing culvert and sufficient cover cannot be achieved, the ducts will be laid in a much shallower trench, the depth of which will be determined by the cover available at the culvert crossing location. Where sufficient deck cover is not available to fully accommodate the required ducts, it may be necessary to locally raise the pavement level.	Option 3	None. No in-stream works required.
2	Steel arch overbridge	2.0	Where adequate cover exists above a culvert, the standard trench 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.	Option 1	None. No in-stream works required.
3	Steel arch overbridge	2.0	Where adequate cover exists above a culvert, the standard trench 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.	Option 1	None. No in-stream works required.
4	900mm diameter corrugated pipe	5.0	Where adequate cover exists above a culvert, the standard trench 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.	Option 1	None. No in-stream works required.

As presented in Table 4-3 above, 4 no. stream crossings will be traversed by the proposed cable all of which are off the public road and on private access tracks or existing wind farm roads. Crossing no's 2 to 4 all have adequate cover for the cable to pass over the existing crossing and maintaining 1m cover from top of cable duct to road/access track finished surface which is referred to as *Option 1*. Figure 4-22 for *Option 1* shows cover of 975mm however this is an indicative detail and may not be approximate relative to the watercourse crossing in question. However, considering the access tracks comprise unbound granular material, they can be raised after the laying of the cable slightly during reinstatement to ensure 1m cover is achieved.

For Crossing no. 1, which will be traversed using what is referred to as *Option 3*, the indicative detail in Figure 4-24 shows cover of less than the desired 1m. However, again, this is a detail to demonstrate the methodology proposed. Table 4-3 shows a depth of 1.3m at this location from track surface to the top of the existing watercourse crossing pipe. Maintaining the required 0.3m lateral separation between cable ducts and the watercourse crossing pipe and taking a 0.11m cable duct height leaves cover of 0.89m. As suggested above, considering this is unbound granular material access track, the surface can be raised to achieve the necessary 1m cover. Furthermore, the option to pass under the existing piped stream crossing has been presented as Option 2 and is outlined in Figure 4-23 can also ensure a 1m cover if it is considered appropriate to adopt.

For the remaining 10 no. culvert crossings as outlined in Appendix 4-7, the flexibility in the options presented can be tailored to specific locations to ensure the 1m cover over the cable ducting will be achieved and also more importantly ensure instream works are avoided. The 10 no. culverts are located off the public road.

No cable works are proposed near public road bridges.

4.8 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 Proposed Development. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding by means of meteorological equipment and control systems to changes in wind speed and direction.

The wind turbines will be connected together and data relayed from the wind turbines 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.

4.8.1 Maintenance

Each turbine would be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition there is often 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 substations components and site tracks will also require periodic maintenance.

Although the level of activity required for the maintenance of the Proposed Development is not significant, the impacts associated with traffic volumes for this period are assessed in Chapter 14.

4.8.2 Monitoring

Section 7 of the CEMP sets out a programme of monitoring required for the operational phase of the project. The CEMP should be consulted for detailed information on the monitoring requirements during the operational phase, however a brief summary of the key information is provided below:

- Monthly sampling and laboratory analysis will be undertaken for six months during the operational phase.
- The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.
- Post-construction bird monitoring which includes breeding bird surveys, winter roost surveys and corpse searching on the site determine the level of fatalities for the site as a result of collisions with the installed turbines. These surveys will be completed in accordance with guidelines issued by the Scottish Natural Heritage (SNH, 2009)
- Post-construction bat monitoring will be undertaken for at least three years' post construction of the renewable energy development. The monitoring will also include corpse searching in the areas surrounding the turbines to gather data on any actual collisions.
- Post-construction habitat condition monitoring will be undertaken 1 year post construction to ensure that there are no negative effects on marsh fritillary habitat.
- Monitoring for shadow flicker at properties where any exceedance of the shadow flicker limit has been predicted as outlined in Chapter 5.
- Post turbine commissioning noise monitoring.

4.9 Decommissioning

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the equipment may be replaced with a new technology, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully.

Upon decommissioning of the Proposed Development, the wind turbines will be disassembled in reverse order to how they were erected. The turbines will be disassembled with the same model of cranes that were used for their erection. The turbine will be removed from site using the same transport methodology adopted for delivery to site initially. The turbine materials will be transferred to a suitable recycling or recovery facility.

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 environment emissions such as noise, dust and/or vibration.

Site roadways could be in use for purposes other than the operation of the development by the time the decommissioning of the Proposed Development is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. It is envisaged that the roads will provide a useful means of extracting the commercial forestry crop which exists on the site. 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.

The electrical cabling connecting the Proposed Development to the existing 110kV substation in the townland of Knockalassa will be removed from the underground cable ducting at the end of the useful life of the renewable energy development. The cable ducting will be left in-situ as it is considered the

most environmentally prudent option, avoiding unnecessary excavation and soil disturbance for an underground element that is not visible.

A Decommissioning Plan has been prepared (Appendix 4-8) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will be agreed with the competent authority at that time. 4. The potential for effects during the decommissioning phase of the proposed renewable energy development has been fully assessed in the EIAR.

As noted in the Scottish Natural Heritage report (SNH) *Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms* (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

“best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm”.