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') which is the subject of a proposed application for planning permission to An Bord Pleanála. The Proposed Development comprises the provision of the following:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;
viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;
xi. Site Drainage;
xii. Forestry Felling;
xiii. Signage, and;
xiv. All associated site development works.

This application is seeking a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm. Refer to Section 1.4 in Chapter 1 of this EIAR for further information.

All elements of the proposed project as described in this chapter, including the Proposed Development as described above, replanting and any works required on public roads to accommodate turbine delivery, 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 wind farm, while at the same time maximising the energy yield of the wind resource passing over the site. A constraints study, as described in Section 3.6.1, in Chapter 3 of this EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site.

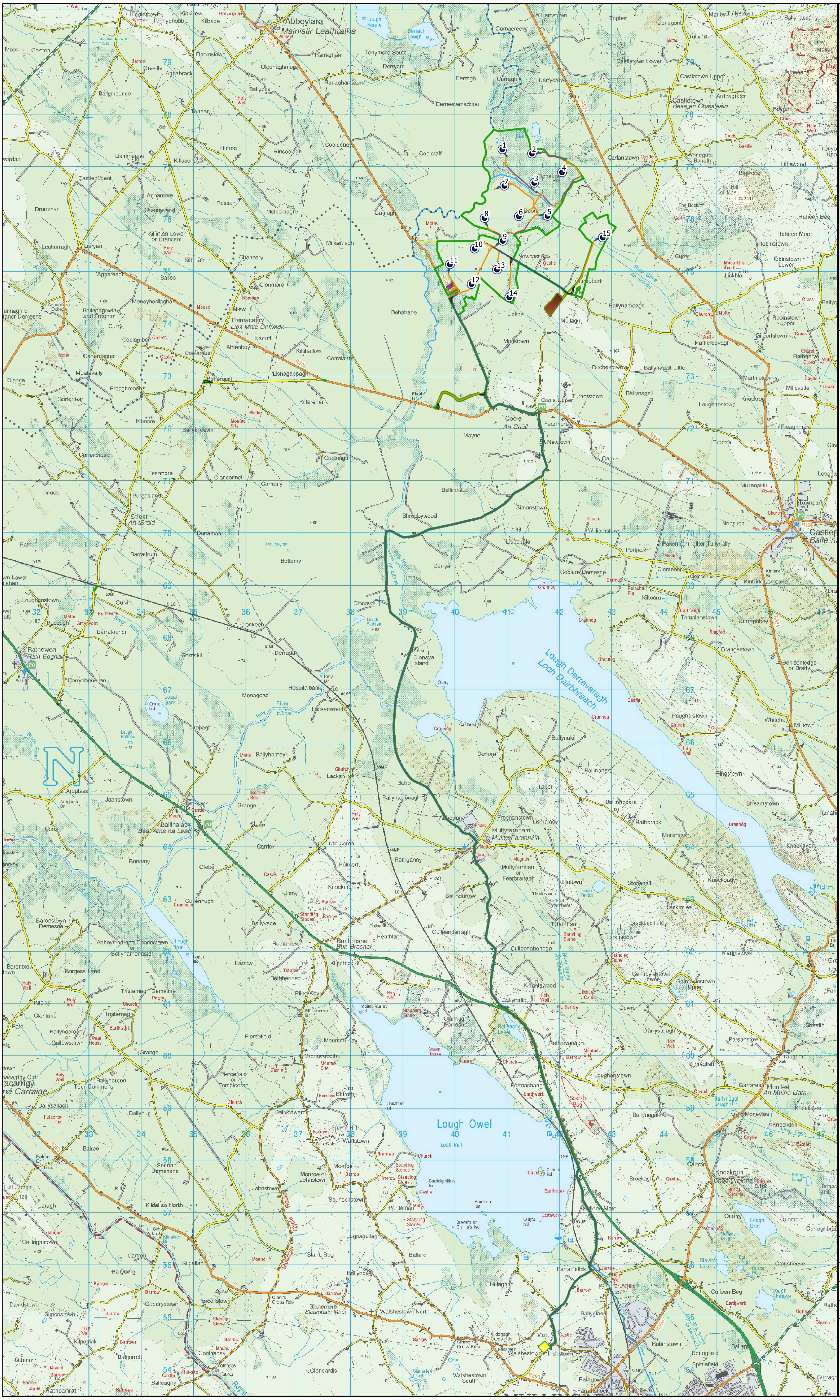
The overall layout of the Proposed Development is shown on Figure 4-1a and Figure 4-1b. These figures show the Proposed Development infrastructure as outlined above. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to this EIAR.

4.3 Development Components

The proposed wind turbine layout has been optimised using wind farm design software (a combination of WAsP, ResGen, WindPro and WindFarmer) 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	640852	777346	64
2	641419	777267	64
3	641463	776708	66
4	641994	776908	65
5	641716	776074	63
6	641168	776069	65
7	640893	776651	65
8	640511	776034	62
9	640862	775599	66
10	640322	775448	68
11	639849	775149	67
12	640263	774772	69
13	640750	775050	68
14	640986	774517	67
15	642772	775661	62



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- External Roads (Upgrades to Existing)
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Temporary Hardcore Surfacing Areas

Drawing Title: Proposed Site Layout	
Project Title: Coole Wind Farm, Co. Westmeath	
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 4-1a
Scale: 1:65000	Date: 11.02.2021

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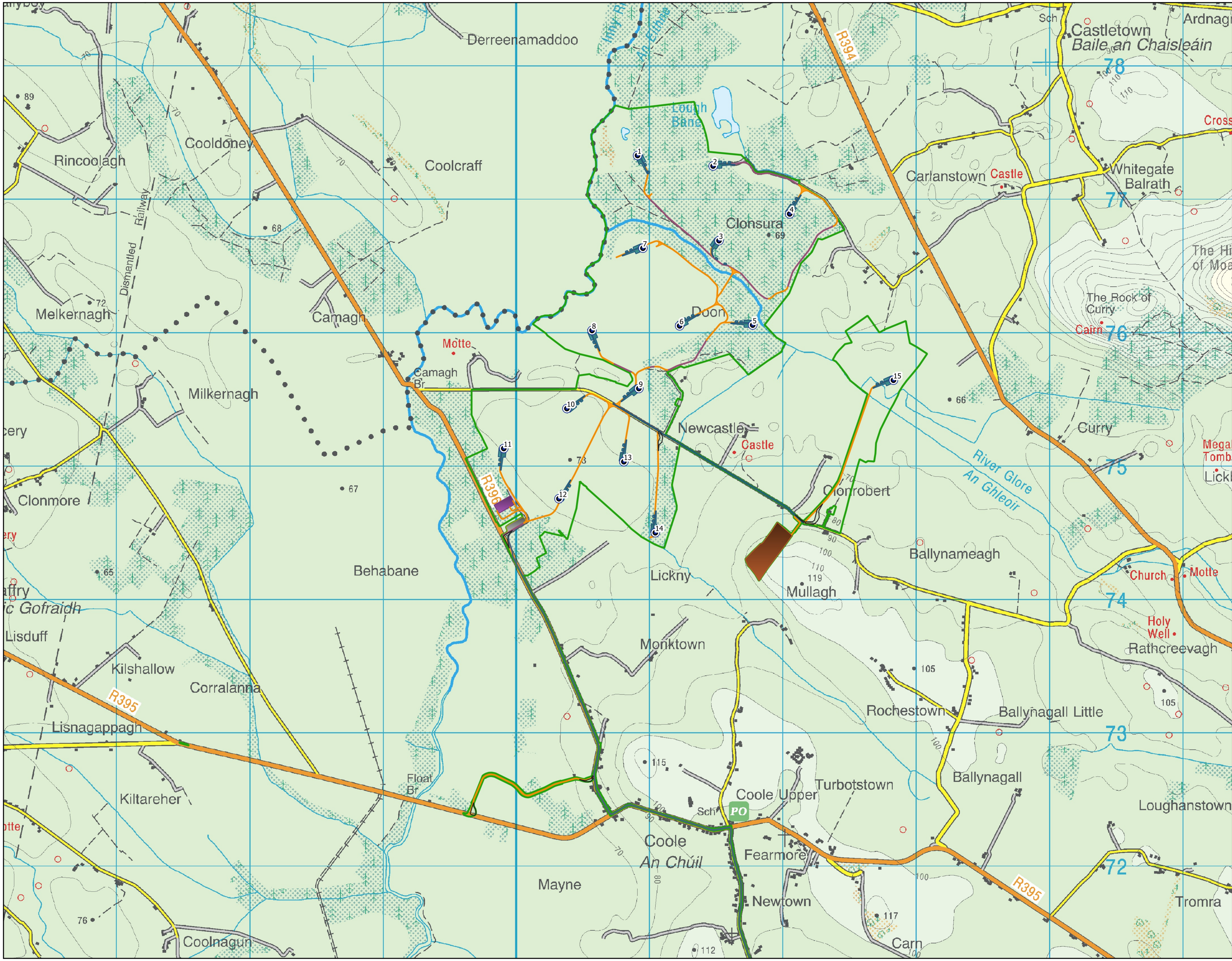

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- External Roads (Upgrades to Existing)
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Temporary Hardcore Surfacing Areas

Drawing Title
Proposed Site Layout

Project Title
Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No. 200445	Drawing No. Figure 4-1b
Scale 1:25000	Date 11.02.2021

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4.3.1 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 proposed wind turbines will have a tip height of up to 175 metres. Within this size envelope, various configurations of hub height, rotor diameter and ground to blade tip height may be used. The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed a tip height of up to 175 metres. Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics, with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times.

For the purposes of this EIAR, various types and sizes of wind turbines with a tip height of up to 175-metre have been selected and considered in the relevant sections of the EIAR to assess the worst-case scenario. Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds), as addressed elsewhere in this EIAR. In each EIAR section that requires the consideration of turbine parameters as part of the impact assessment, the 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 on the market at the pre-planning and EIAR preparation stage, which would better suit the site and fit within the proposed size envelope. Should this circumstance arise, the specific parameters of the new turbines will be assessed for their 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.

The individual components of a typical geared wind turbine nacelle and hub are shown in Figure 4-2 below.

Figure 4-2 Turbine nacelle and-5 hub components

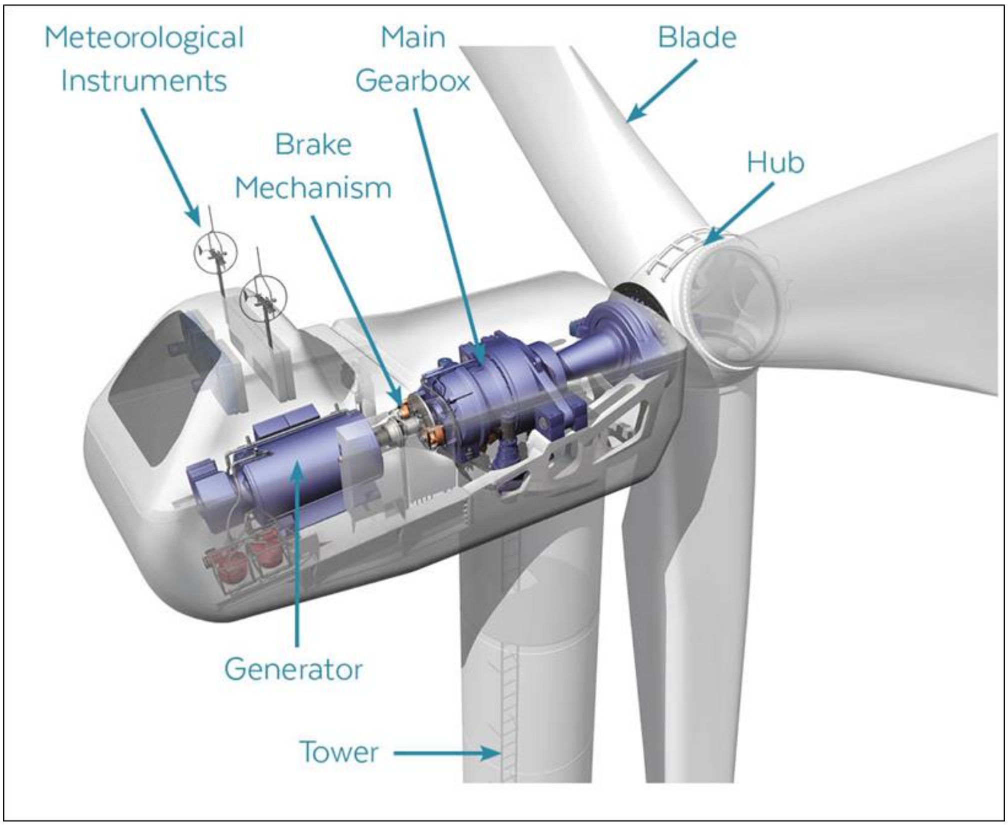
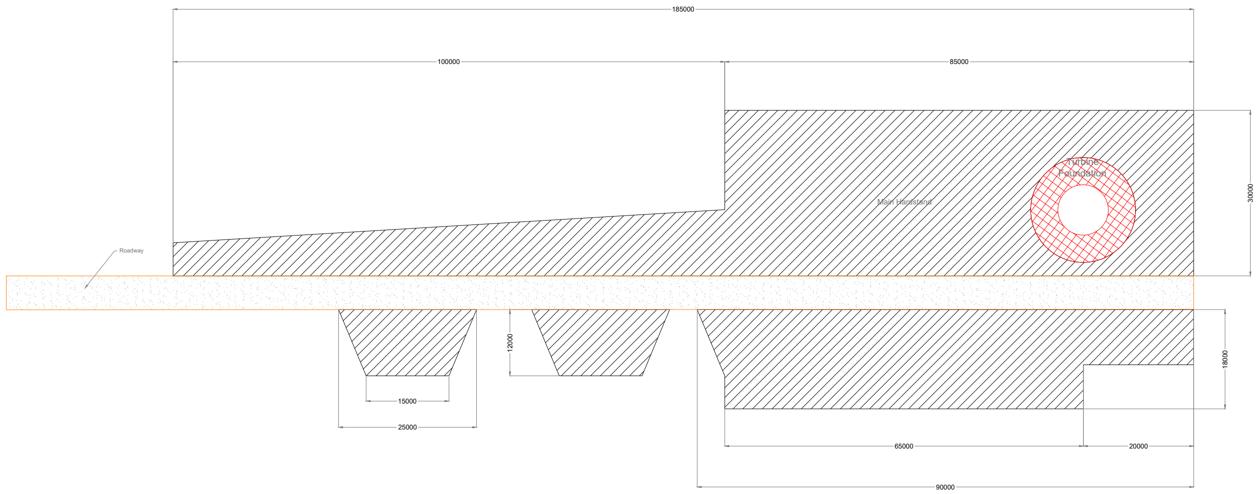
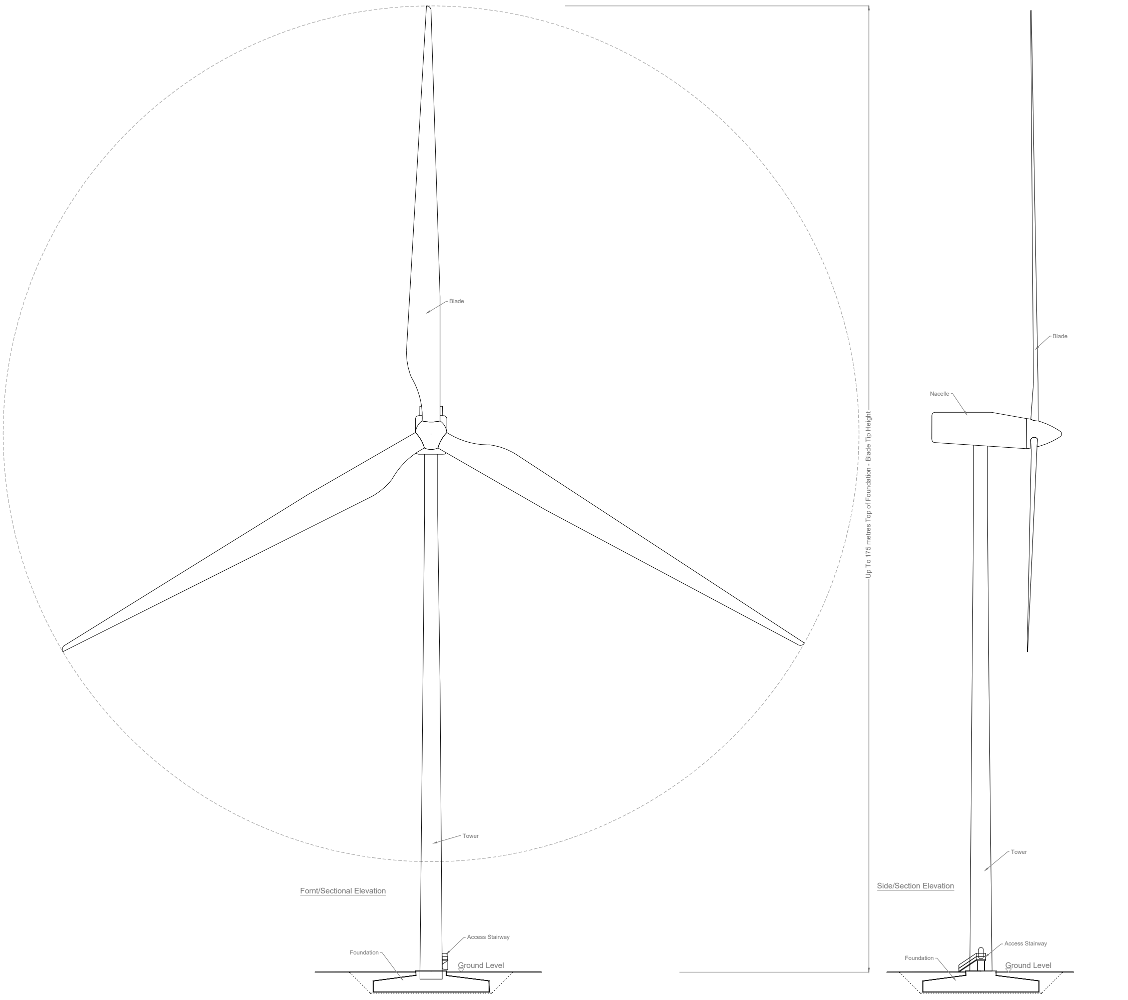
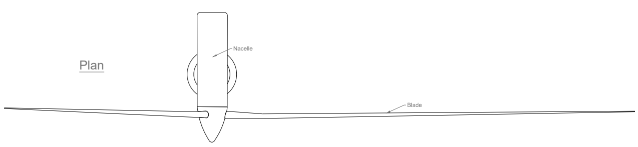
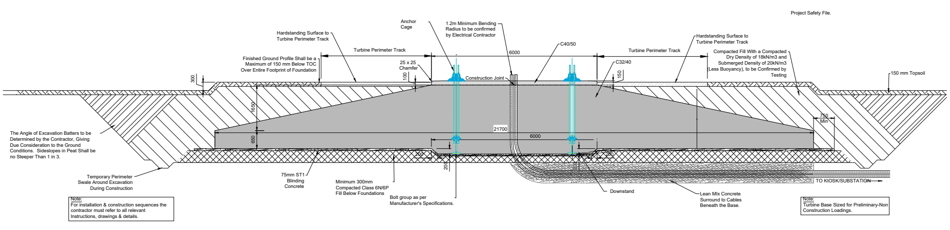


Figure 4-3 shows a typical turbine base layout, including turbine foundation, hard standing area, assembly area, access road and surrounding works area.









Typical Section
Scale 1:100

Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of up to 175m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Ground level represents the top of turbine foundation.

Figure 4-3

DRAWING TITLE:
Typical Wind Turbine Hardstanding & Elevations

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 42
SCALE: 1:500 @A1	DATE: 26.02.2021

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4.3.2 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 turbines 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 typical horizontal and vertical extent of a turbine's foundation is shown in Figure 4-3.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower or 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).

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

4.3.3 Hard Standing Areas

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

4.3.4 Assembly Area

Unbound, levelled assembly areas will be located on either side of the hard-standing area as shown on Figure 4-3. 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.

4.3.5 Power Output

The Proposed Development will have Maximum Export Capacity (MEC) in excess of 50MW. 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.

A rated output of 6 MW has been assumed throughout this document for various calculations. This results in an estimated installed capacity of 90 MW. Assuming an installed capacity of 90 MW, the Proposed Development therefore has the potential to produce up to 275,940 MWh (megawatt hours) of electricity per year, based on the following calculation:

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

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

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

C = ... Assumed rated output of the wind turbines: 90 MW

The 275,940 MWh of electricity produced by the Proposed Development would be sufficient to supply approximately 65,700 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity[1] (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 31,813 occupied households in Co. Westmeath. Per annum, based on a capacity factor of 35%, the Proposed Development would therefore produce sufficient electricity for the equivalent of all households in Co. Westmeath, plus an additional 33,881 households. EirGrid in their All Island Generation Capacity Statement (2019-2028) estimates a capacity factor of approximately 30% for onshore wind. The 35% capacity factor applied for the Proposed Development is greater than the EirGrid estimation as a result of the turbine type proposed for the site i.e. tall turbines (tip height of up 175m) with greater rotor diameters. This turbine type allows for the use of fewer, taller turbines with an increased efficiency and in return greater economic benefit to the consumer.

4.3.6 Site Roads

Current access to the Proposed Development site is via Regional and local roads. From the western side, the Proposed Development site is accessed via an existing site entrance and forestry track off the R396 Regional Road in the townland of Monktown. The northern area of the site is accessed from the L57671 local road in the townland of Clonsura, which adjoins the R394 Regional Road. Note however the L57971 will not be used as an access route for the Proposed Development. The Proposed Development site is also traversed by the L5755 local road, which travels in an east-west direction across the site, linking the R396 to the R394. Proposed turbine locations T1 to T9, and T15 are located north of the L5755 road, while turbines T10 to T14 are located south of the local road.

It is proposed to upgrade the existing forestry track entrance off the R396 Regional Road for use as the site entrance during the construction and operational phases. The Proposed Development will also require the construction of new access roads on the wind farm site, and upgrade to some sections of existing onsite roads. The Proposed Development layout is shown in Figure 4-1.

Fehily Timoney (FT) were appointed to assess the extent and condition of the existing site ground conditions, and specify the type of upgrade work or new road required to access all turbine and

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

infrastructure locations on site. Further details on the specification of road types are provided below and presented in the FT Peat and Spoil Management Plan in Appendix 4-2 of this EIAR.

In total, it is proposed to construct approximately 11.14 kilometres of new access road (including the link road and borrow pit access road), and to upgrade approximately 3.13 kilometres of existing access track. The majority of new access roads will be constructed using a floating road technique with excavation of new roads where ground conditions permit. Straight sections of proposed roadways (new and existing for upgrade) will require a running width of approximately five metres to accommodate the transportation of large turbine components. Corners and junctions will be wider to allow the trucks to manoeuvre around bends. Additional details are presented below under Section 4.3.7 on Road Construction Types. All site access roads that it is proposed to use as part of the Proposed Development, both existing and proposed, will comply with the turbine supplier's requirements. The material required for upgrade and construction of roads within the site will be obtained primarily from the proposed borrow pit, with the remainder where required coming from local commercial quarries where possible, as described in Section 4.3.8 below.

Additional road requirements associated with the Proposed Development include the construction of a link road measuring approximately 1.2 kilometres in length, between the R395 and R396 Regional Roads. The construction of this road will allow turbine delivery and other construction vehicles to avoid using the existing turn in Coole village; further details are presented in Section 4.5 on Access and Transportation. The proposed borrow pit will be accessed from the L5755 local road via a proposed new section of road measuring approximately 0.20 kilometres in length; further details are provided in Section 4.3.7 below.

4.3.7 Road Construction Types

4.3.7.1 New Floating Roads

New roadways will be required onsite for access to turbine locations, with the majority of these access roads floated unless ground conditions permit the use of excavated roads. New roadways will have a running width of approximately five metres, with wider section at corners and on the approaches to turbine locations, as described above. The proposed road layout also incorporates 2 No. passing bays to allow two trucks pass each other while travelling around the site.

All new roadways will be constructed with a camber to aid drainage and surface water runoff. The gradient and slope of the camber will depend on the site characteristics where the road is actually being constructed.

The road construction preliminary design has taken into account the following key factors, as stated in the FT Peat and Spoil Management Plan in Appendix 4-2:

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.

Construction of floating access roads across the peat is the proposed technique for the majority of the site access roads. Given the flat topography and deep nature of peat on site, floating access roads are deemed an appropriate construction technique.

The general construction methodology for floating access roads, as presented in FT's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR and shown in Figure 4-4, is summarised as follows:

1. Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 4m.
2. Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
3. Construction of road to be in accordance with appropriate design from the designer.
4. The typical make-up of the new floated access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (Figure 4-4).
5. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
6. Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.
7. The finished road width will be approximately 5m, with wider sections on bends and corners.
8. Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.
9. To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.
10. Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.
11. Following end-tipping a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
12. A final surface layer shall be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

A typical section of a new floated road is shown in Figure 4-4.

4.3.7.2 Upgrade of Existing Access Roads or Tracks

Upgrading of existing tracks through peat is proposed for limited sections of access track across the site, as shown in Figure 4-5 and Figure 4-6. Given the flat topography and deep nature of peat on site, upgrading of existing excavated access roads is deemed appropriate only where specified.

The general construction methodology for upgrading of existing sections of onsite roads or tracks, as presented in FT's Peat and Spoil Management Plan in Appendix 4-2, is summarised below.

1. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations. Access road construction shall be to the line and level requirements as per design/planning conditions.
2. For upgrading of existing excavated access roads (Type A - Figure 4-5) the following guidelines apply:
    a) Excavation of the widened section of access road should take place to a competent stratum beneath the peat 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.

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
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. For upgrading of existing floated access tracks (Type B – Figure 4-6) the following guidelines apply:
    a) The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are localised variations in the make-up of the existing floated access tracks on site, frequently no tree brash/trunks were used in the make-up and the presence of a geogrid was also noted in localised sections of the existing track.
    b) The surface of the existing access track should be levelled prior to the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
    c) Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access track.
    d) Where fine granular/cohesive type material has been used in the existing floated access road make-up (as is the case on some of the existing access roads in the southeast of the site), a layer of geotextile is likely to be required as a separator layer with a layer of geogrid.
    e) The geogrid will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers.
4. The finished road width will have a running width of 5m, with wider sections on bends and corners.
5. On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
6. At transitions between new floating and existing excavated roads a length of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded to accommodate wind turbine construction and delivery traffic.

A typical section of existing road for upgrade is shown in Figure 4-5 and Figure 4-6. A section through the transition detail between floating and existing excavated roads is shown in Figure 4-7. Where possible, internal cabling may be placed within the internal road corridor, subject to ESB/Eirgrid specifications.

4.3.7.3 Excavated Road Construction Methodology

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site and details are shown in Figure 4-8.

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.

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

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 swill be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.
4. 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.
5. 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.
6. 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.
7. The excavated access road will be constructed with up to 1000mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
8. Access roads to be finished with a layer of capping across the full width of the road.
9. A layer of geogrid/geotextile may be required at the surface of the competent stratum.
10. At transitions between floating and excavated roads a length of road of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road (Figure 4-7).
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.

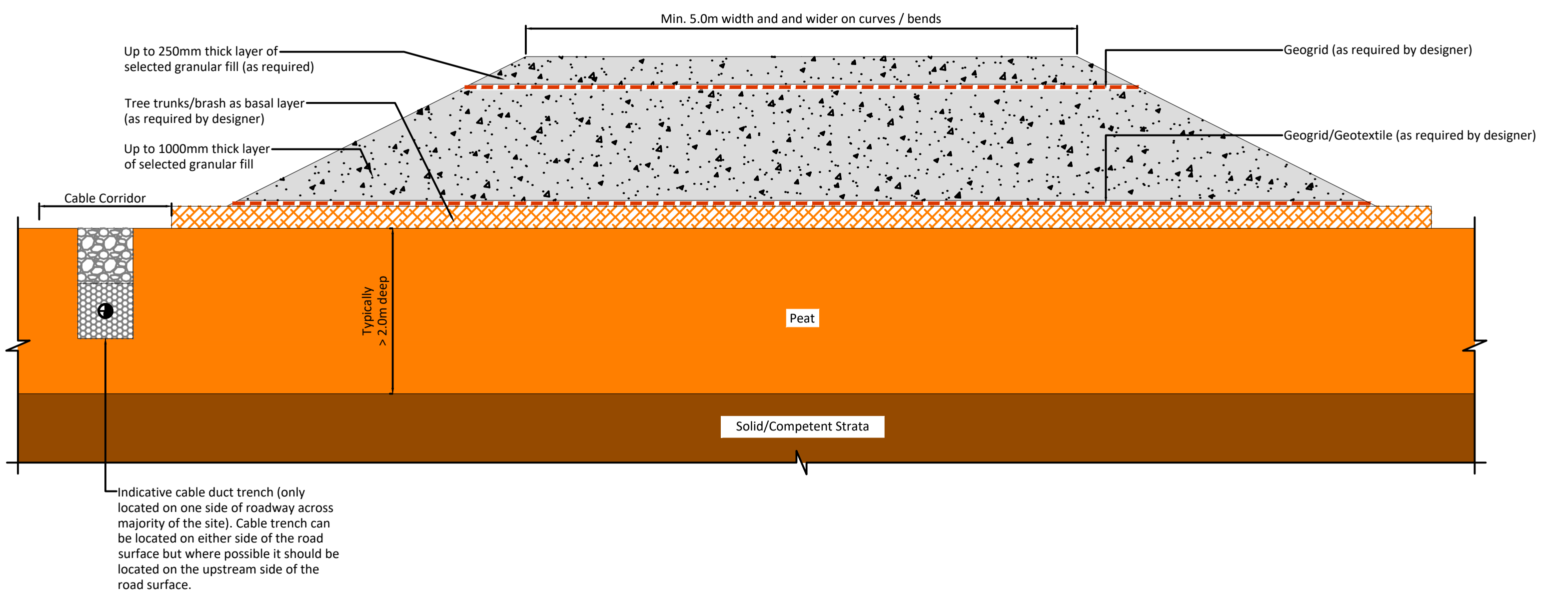

Figure 4-4

DRAWING TITLE:
Type D New Floated Access Road

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 46
SCALE: 1:50 @ A3	DATE: 26.02.2021
OS SHEET No.:	

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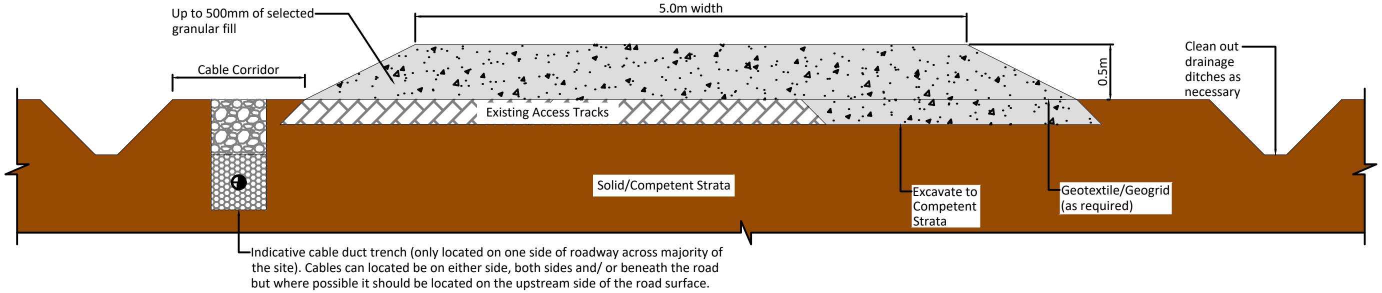
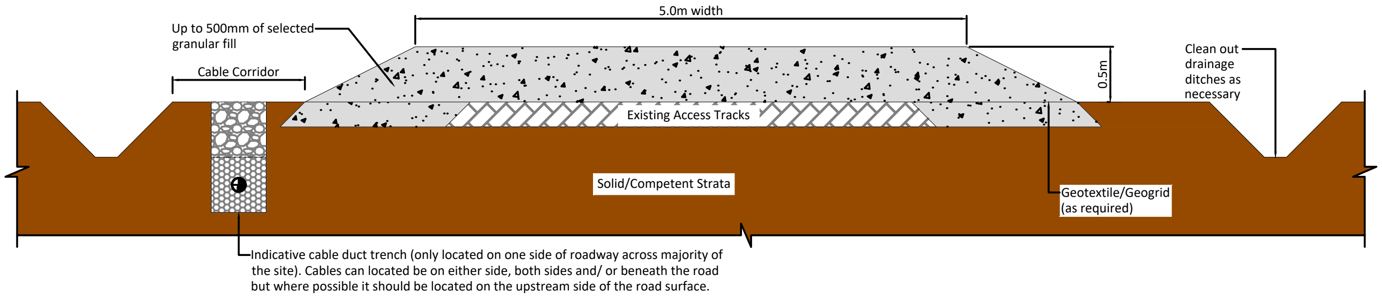
surface but where possible it should be located on the upstream side of the road surface.



Upgrade of Existing Track on Sidelong Ground



Upgrade of Existing Track on Flat Ground

Figure 4-5

DRAWING TITLE: Type A Upgrade of Existing Excavated Access Tracks

PROJECT TITLE: Coole Wind Farm, Co. Westmeath

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 43
SCALE: 1:50 @ A3	DATE: 26.02.2021

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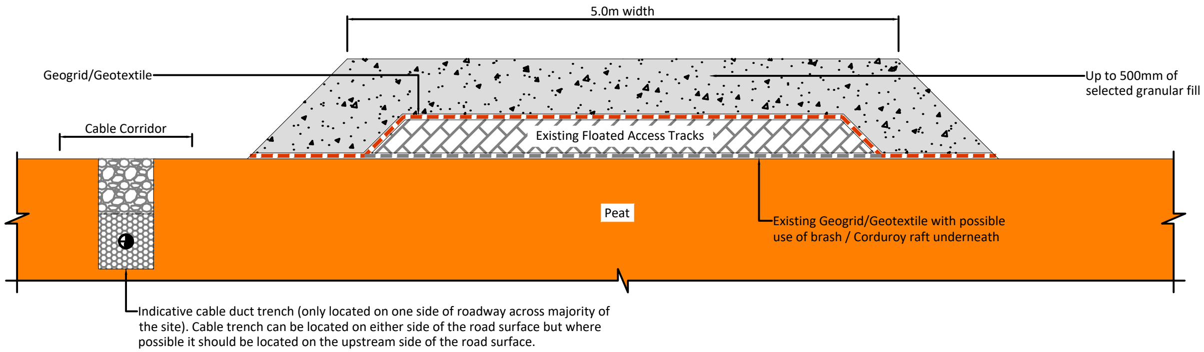
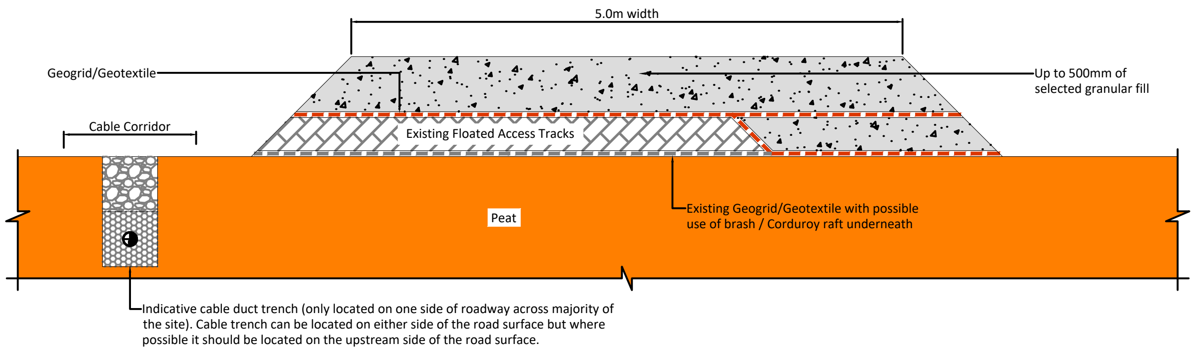
Upgrade of Existing Track on Flat Ground



Upgrade of Existing Track on Flat Ground



Upgrade of Existing Track on Sidelong Ground

Figure 4-6

DRAWING TITLE: Type B Upgrade of Existing Floated Access Tracks

PROJECT TITLE: Coole Wind Farm, Co. Westmeath

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 44
SCALE: 1:50 @ A3	DATE: 26.02.2021

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Notes:

1) Floated access road detail may comprise 500 to 750mm stone fill, layer of geotextile & 1 to 2 layers of geogrid.
2) Excavated access road detail may comprise up to 500mm stone & layer of geotextile (depending on ground conditions encountered).

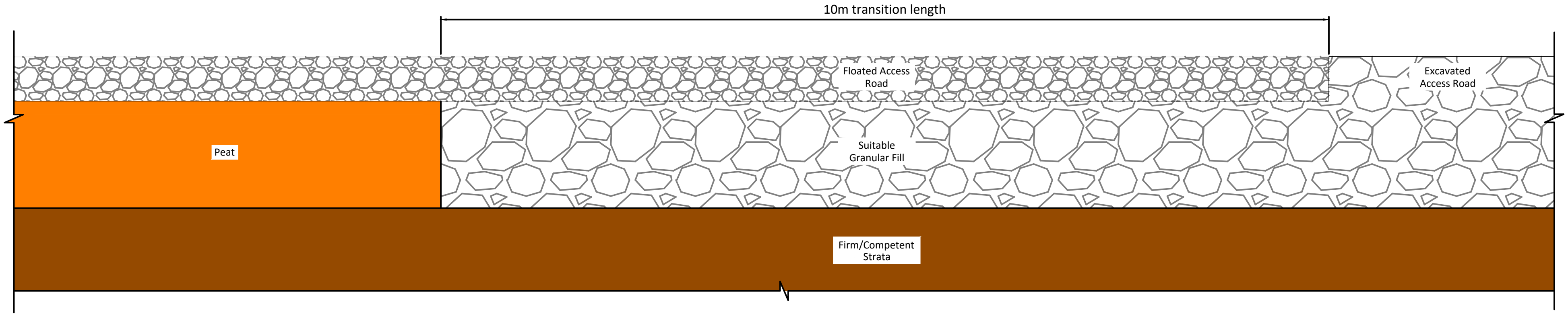

Figure 4-7

DRAWING TITLE:
Transition Detail for Floated and Excavated Access Road

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 47
SCALE: 1:50 @ A3	DATE: 26.02.2021
OS SHEET No.:	

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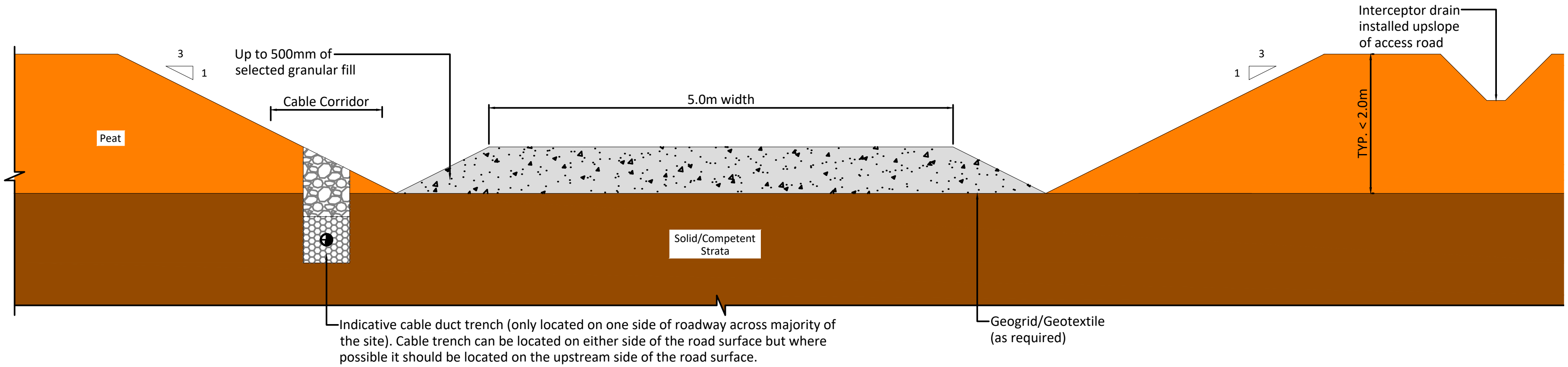

Figure 4-8

DRAWING TITLE: Type C New Excavate and Replace Access Road

PROJECT TITLE: Coole Wind Farm, Co. Westmeath

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 45
SCALE: 1:50 @ A3	DATE: 26.02.2021
OS SHEET No.:	

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4.3.8 Borrow Pit

4.3.8.1 Description

It is proposed to develop 1 No. borrow pit as part of the Proposed Development, the location of which is shown on Figure 4-1 and in the design drawings in Appendix 4-1. The site of the proposed borrow pit is located on agricultural grassland, approximately 700 metres southeast of the nearest proposed turbine location (T14). The proposed borrow pit will be accessed from the L5755 local road, which will connect the borrow pit to the proposed wind farm site. The borrow pit access road is located less than 0.1 kilometre west of the access road to T15.

A new access road will be constructed on agricultural grassland, to connect the proposed borrow pit site to the L5755 local road. The proposed access road measures approximately 200 metres in length, and the entrance location has been sited so as to achieve adequate sightlines to the west and east along the L5755, as shown in Figure 4-9.

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 pit. Usable rock may also be won from other infrastructure construction including the substation and the turbine base excavations.

Figure 4-9 below shows the detailed plan and sections through the proposed borrow pit. Table 4-2, below, outlines the location and surface area of the borrow pit.

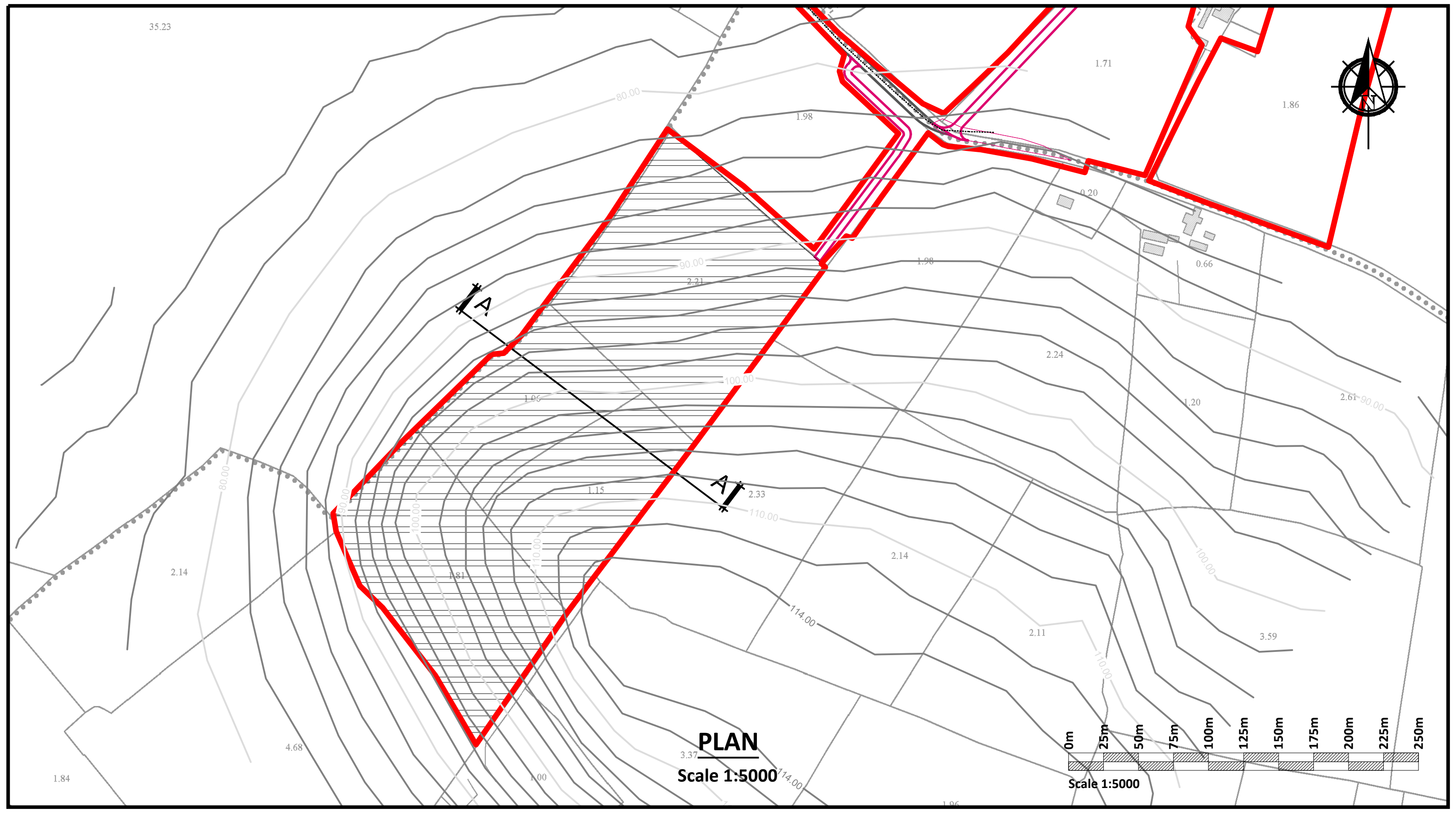
Table 4-2 Borrow Pit Location and Area

Borrow Pit No.	Location (Centrepoint, ITM Coordinates)		Area (Ha)
	Easting	Northing	
1	641830	774380	6.21

The Geotechnical and Peat Stability Assessment carried out by FT (see Appendix 8-1) refers to the results of the ground investigations carried out by Hydro-Environmental Services (HES), including trial pits at the site of the proposed borrow pit. Further details on the HES ground investigations are also presented in Chapter 8 of this EIAR on Land, Soils & Geology. The ground conditions at the proposed borrow pit site can be summarised as a sandy gravelly clay topsoil, underlain by glacial till (0.3 to 1.1 metre thickness) consisting of orange to brown slightly gravelly clay. The bedrock comprises strong intact limestone at typically 1.5 metres below ground level (mbgl). No peat was recorded at the site of the proposed borrow pit.

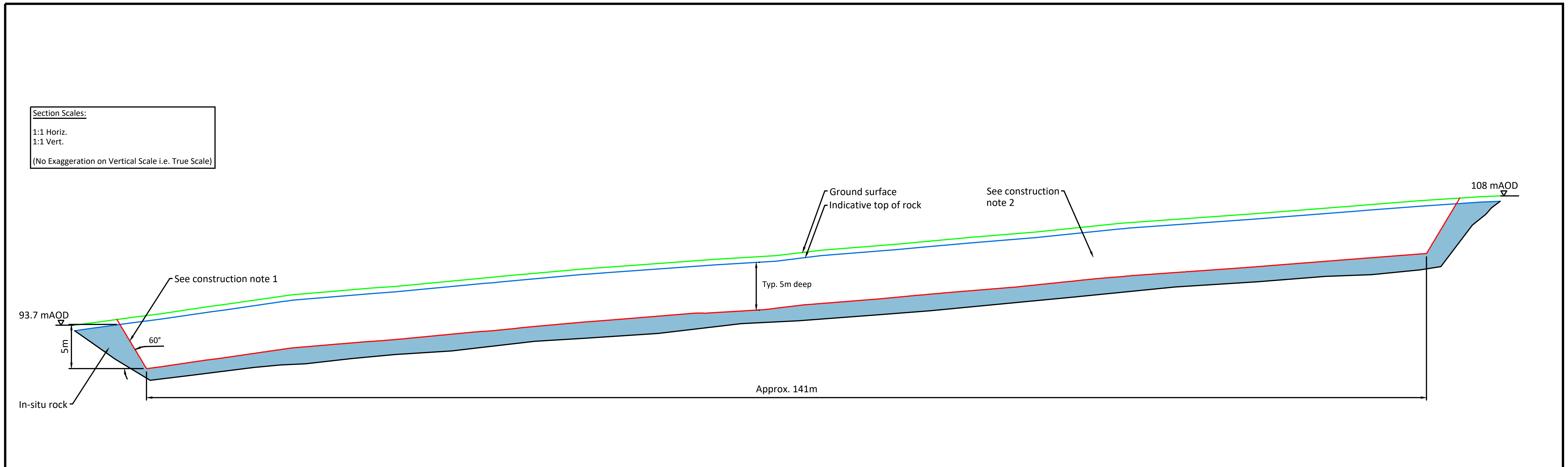
There is an estimated 74,400 m^3 of topsoil and subsoils present at the proposed borrow pit location which will be stripped back and stockpiled within the borrow pit footprint and which will be available for the reinstatement process post-construction. During construction, the borrow pit area will be secured and a stock-proof fence or berms will be erected around the area to prevent access. Appropriate health and safety signage will also be erected on this fencing and at locations around the fenced area.

The borrow pit will, on removal of all necessary and useful rock, be reinstated and made safe from a health and safety perspective and the slopes will be graded using the subsoils and topsoil currently at this location. Figure 4-10 shows the proposed borrow pit following reinstatement. A gate will be in place at the borrow pit entrance location, set back from the local road.



Legend:

- Turbine and Hardstand
- Construction Compound
- Borrow Pit
- Onsite Substation
- Existing Internal Roads to Upgrade
- New Internal Roads
- Turbine Delivery Route
- Site Boundary



CROSS SECTION A - A (NO VERTICAL EXAGGERATION TRUE SCALE 1:1)

Scale 1:500

Construction Notes:

(1) In-situ rock slope formed at stable inclinations to suit local rock conditions.

(2) Localised deepening of quarry floor to suit extraction operations, as required.

(3) The thickness of overburden was based on the trial pits carried out within the footprint of the borrow pit.

(4) Further guidelines on the construction of the borrow areas is included within the Peat Management Plan.

Scale (@ A3)
1:5000

Date - 23.02.21

FIGURE 4-9 - BORROW PIT NO 1 - PLAN AND CROSS SECTION DETAILS

Drawn - POR

Checked - IH

Rev - D

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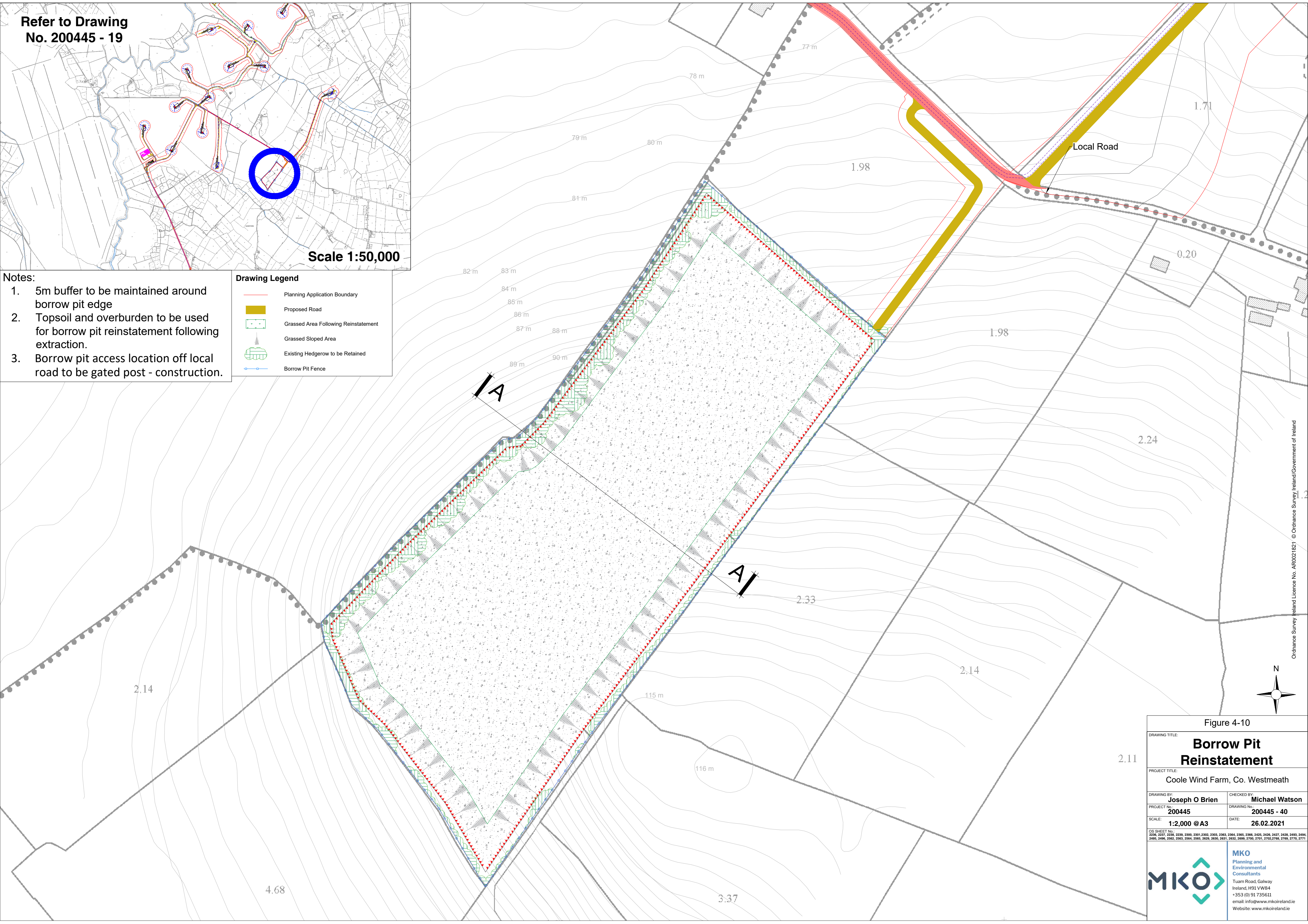
Tuesday 23 February 2021



Refer to Drawing No. 200445 - 19
Scale 1:50,000
Notes:
1. 5m buffer to be maintained around borrow pit edge
2. Topsoil and overburden to be used for borrow pit reinstatement following extraction.
3. Borrow pit access location off local road to be gated post - construction.
Drawing Legend
Planning Application Boundary
Proposed Road
Grassed Area Following Reinstatement
Grassed Sloped Area
Existing Hedgerow to be Retained
Borrow Pit Fence
Local Road
A
A
N
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Figure 4-10
DRAWING TITLE:
Borrow Pit Reinstatement
PROJECT TITLE:
Coole Wind Farm, Co. Westmeath
DRAWING BY: Joseph O Brien
CHECKED BY: Michael Watson
PROJECT No.: 200445
DRAWING No.: 200445 - 40
SCALE: 1:2,000 @A3
DATE: 26.02.2021
OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771
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Website: www.mkoireland.ie

4.3.8.2 Rock Extraction Methods

The extraction of rock from the borrow pit is a workstage of the Proposed Development which will be a temporary operation run over a short period of time relative to the duration of the entire Proposed Development. As described above, there is a layer of overburden present at the borrow pit location, which will be stripped back and stockpiled using standard track mounted excavators.

Although blasting was originally considered as a method for rock extraction at the Proposed Development site, following ongoing consultation with individuals and the local community it was found that blasting would not be viewed as an appropriate extraction method in the area with locals expressing concerns around the use of blasting. For this reason, blasting has been omitted as a proposed method of rock extraction. Given that the rock present at the borrow pit is limestone and that the borrow pit itself is relatively shallow, rock breaking is considered sufficient as the extraction method at the Proposed Development site.

4.3.8.2.1 *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. The potential impacts associated with noise are assessed in Chapter 11 Noise and Vibration.

4.3.9 Sand and Stone Requirements

The volumes of granular fill (sand and stone) required for the construction of the Proposed Development, outlined in Table 4-3 below, have been estimated based on the Proposed Development footprint and the proposed final levels for the various infrastructure. Construction grade granular fill and higher quality, final surfacing fill (including sand) will both be required for the construction of the Proposed Development. Granular fill volumes have been estimated using the following methodology:

- The hard-standing areas, access roads, substation platform and compound will be constructed up to approximately 1.2 metre above the existing ground level, using construction grade granular fill. A capping layer measuring 250mm and comprising higher quality, final surfacing materials; generally washed gravels, will be applied at the turbine hardstands, on roads, and at the onsite substation location.
- The stone batter around all infrastructure will extend out by approximately 750mm.
- The subsoils beneath the borrow pit access road will be excavated and replaced with construction grade granular fill. The first 750mm will comprise construction grade granular fill

and the final 250mm surface layer will comprise higher quality, final surfacing materials generally washed gravels.

- The internal site underground cable trenches will be approximately 1200mm in depth. The cable trench will be backfilled up to 600mm with sand, within which the ducting will be placed. Suitable materials from the excavations of the trenches will be reinstated if possible to form the final layer of the trench.

Table 4-3 Approximate Granular Fill Volumes Required

Development Component	Area (m^2) (approximate)	Construction Grade Fill (m^3)	Higher Quality Final Surface Layer Fill (m^3)
Turbine 1	4,500	5,400	900
Turbine 2	4,500	5,400	900
Turbine 3	4,500	5,400	900
Turbine 4	4,500	5,400	900
Turbine 5	4,500	5,400	900
Turbine 6	4,500	5,400	900
Turbine 7	4,500	5,400	900
Turbine 8	4,500	5,400	900
Turbine 9	4,500	5,400	900
Turbine 10	4,500	5,400	900
Turbine 11	4,500	5,400	900
Turbine 12	4,500	5,400	900
Turbine 13	4,500	5,400	900
Turbine 14	4,500	5,400	900
Turbine 15	4,500	5,400	900
All Access Roads including proposed link road	82,775	97,530	20,695
Construction Compound	6,800	8,160	1,700
Onsite Substation	10,000	12,000	2,500
Junction works	8,904	4,452	-
Onsite Cable Trench	13,135	-	2,872
Total		**203,142**	**41,276**

The construction grade granular fill will be sourced from the proposed borrow pit. Allowing for a 25% contingency (worst case requirement), the proposed borrow pit will be designed to provide up to

251,915 m^3 of construction grade fill. The higher quality, surfacing granular fill and sand where required will be sourced from local commercial quarries where possible.

4.3.10 Peat and Spoil Management Plan

4.3.10.1 Quantities

Minimal peat excavation is likely to be required on site due to the proposed construction techniques for the site. With the exception of Turbine T5 and T15, all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. In addition, piled foundations may be required for the substation building. It is anticipated that the substation platform and construction compound platform will likely be constructed using floating techniques. The proposed construction method for all the new proposed access roads is a floated technique. The quantity of peat requiring management on the site has been estimated, as presented in Table 4-4 below. These quantities were calculated by FT as part of the Peat and Spoil Management Plan presented in Appendix 4-2 of this EIAR.

Table 4-4 Peat and Spoil Volumes Requiring Management

Development Component	Area (m^2) (approx.)	Peat Volume (m^3) (approx.)	Spoil (non-peat) Volume (m^3)
2 no. Turbines	Assumed 22m diameter turbine foundation dig out for turbine T5 and T15 only	1,055	1,690
2 no. Crane hardstand	4,500m^2	11,880	3,240
1 no. Construction Compound Platform*	6,800m^2	0	0*
1 no. Substation Platform & Building**	10,000m^2	0	0**
Upgraded Access Roads (onsite and link road)	Approximate plan area of upgraded access road is 16,850m^2	3,575	2,140
Borrow Pit	Plan area of borrow pit is approximately 62,100m^2	0	74,400***
Total		**16,510m^3**	**81,470m^3**
Total Peat and Spoil to be managed		**97,980 m^3**	
Total Peat and Spoil to be managed excluding borrow pit spoil to be reinstated		23,580 m^3	

** Note 1 - Due to the depth of peat & soft soils at the proposed construction compound location, the platform will be constructed using a floated technique i.e. there will be no excavation of peat/spoil at this location. This will be confirmed at detailed design stage.*

***Note 2 - Due to the depth of peat & soft soils at the proposed substation location, the platform will be constructed using a floated technique i.e. there will be no excavation of peat/spoil at this location. In addition, it is envisaged that the substation building will likely require a piled foundation. This will be confirmed at detailed design stage.*

****Note 3 – As detailed in Section 4.3.8.1 above, Borrow Pit topsoil and subsoils (74,400m^3) present at the proposed borrow pit location which will be stripped back and stockpiled within the borrow pit footprint and which will be available for the reinstatement process post-construction.*

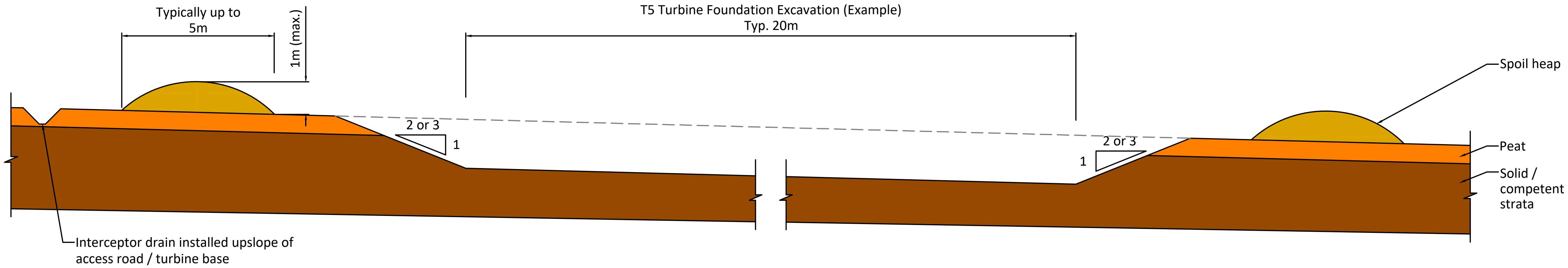
4.3.10.2 Peat and Spoil Management

The management of excavated peat and spoil, and the methods of storage are described in FT's Peat and Spoil Management Plan in Appendix 4-2 and summarised below.

The peatland areas of the Proposed Development site have been extensively harvested using mechanical harvesting equipment, resulting in a well-drained and extensively trafficked peat. Experience has shown that the most environmentally sensitive and stable way of handling and moving peat is its placement across the site and at locations as close as possible to the excavation areas. The 23,580m^3 of peat and overburden that is excavated as part of the construction works will be placed/spread locally alongside the excavations for the infrastructure elements. As an example, Figure 4-11 shows a typical cross section with locally placed/spread spoil either side of an excavation.

The proposed methodology for the placement and storage of peat, as described in the FT's Peat and Spoil Management Plan, is summarised below.

1. The peat and overburden that is excavated as part of the construction works will be locally placed/spread alongside the excavations for the infrastructure elements. As an example, Figure 4-11 shows a typical cross section with placed/spread spoil either side of an excavation. Given the flat topography/nature of the site, this approach for the placement of excavated spoil is deemed appropriate.
2. During the construction process, the spoil will be relayed locally to the side of the excavation by an excavator and spread on the bog on one or both sides of the excavations.
3. The spoil will be spread to a depth not exceeding 1.0m in height over a typical width of 5m. The placed peat shall be tracked in to ensure it is adequately compacted and stable and graded to complement the topography and drainage system on the site.
4. Where practical, it will be ensured that the surface of the placed material is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spread material shall be carried out as placement of material progresses. This will reduce the likelihood of debris run-off and ensure stability of the spread material.
5. The placement of excavated material will be avoided without first establishing the adequacy of the ground to support the load. This may involve a visual inspection by competent personnel. The placement of material may require the use of long reach excavators and low ground pressure machinery in localised areas.
6. Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface.
7. Finished/shaped side slopes in the placed material is likely to be in the region of 1 (v): to 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker material are encountered then slacker slopes may be required.
8. All placed/spread material will be allowed to revegetate naturally from the extensive seed source of the plants that have already colonised in the area. Alternatively, and possibly in addition, seeding of the placed material could be carried out which would aid in stabilising the placed material in the long term.



Construction Notes:

1) Typical side excavation slope 1v:3h in peat, slope inclination to be reviewed during construction. Where areas of weaker peat are found to be present, slacker slope will be required.
Typical side excavation slope 1v:2h in overburden, slacker slopes may be required.
2) Interceptor drain to be placed on the upslope side of excavation (as shown for the excavation above) to divert surface water away from excavation.
3) Spoil heap may consist of peat and overburden from local excavations.
4) Stored material should be shaped to allow suface water to run-off.
5) Placed / spread spoil should be allowed to re-vegetate naturally from plant species in the area.
6) Supervision by suitably qualified is required during the works.

Scale 1:150

Scale (@ A3)
1:150

Date - 23.02.21

FIGURE 4-11 - PLACED / STORED MATERIAL - TYPICAL CROSS SECTION

Drawn - POR
Checked - IH
Rev - B

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Tuesday 23 February 2021

9. Movement monitoring instrumentation may be required in deeper in-situ peat areas. The locations where monitoring is required will be identified prior to construction works commencing on site.
10. Supervision by a geotechnical engineer or appropriately competent person will be undertaken during the works.
11. An interceptor drain will be installed upslope of the placed material areas to divert any surface water away from these areas. This will help ensure stability of the placed material and reduce the likelihood of debris run-off. Further details on Site Drainage are presented in Section 4.6 below.

4.3.11 Onsite Electricity Substation

It is proposed to construct one on site electricity substation within the Proposed Development site, as shown in Figure 4-1. The proposed substation site is located within an area of forestry, which will screen it from view from the R396 Regional Road, located approximately 40 metres west of the substation at its nearest point.

The footprint of the proposed electricity substation compound measures approximately 140 metres by 70 metres, and will include a wind farm control building and an IPP building, and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid. Further details regarding the connection of the onsite substation to the national electricity grid are provided in Section 4.3.13 below.

The layout and elevations of the proposed onsite substation is shown on Figure 4-12 and Figure 4-13. The substation compound will be surrounded by a 2.65-metre high steel palisade fence (or as otherwise required by ESB/Eirgrid), and internal fences will also segregate different areas within the main substation. The construction and exact layout of electrical equipment in the electricity substation will be to ESB/Eirgrid networks specifications.

4.3.11.1 Wind Farm Control Building

A wind farm control building will be located within the substation compound. The building will measure approximately 25 metres by 15 metres, and approximately 7.8 metres in height. The layout and elevation of the proposed wind farm control building are shown on Figure 4-14a. The wind farm control building will include a small office space and staff welfare facilities for the staff that will work on the operational phase of the proposed project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin.

An IPP (independent power producer) building and ESB control rooms will also be located within the substation compound. The building will measure approximately 20.37 metres by 5.83 metres, and approximately 5.5 metres in height. The layout and elevation of the proposed IPP control building are shown on Figure 14-14b. The IPP building will include a small office space and staff welfare facilities for the staff that will work on the operational phase of the Proposed Development.

Due to the specific nature of the operational phase of the Proposed Development (approximately 2 staff members on site at any one time), there will be a very small water requirement for occasional toilet flushing and hand-washing and therefore the water requirement is small. It is proposed to install a rainwater harvesting tank adjacent to the control building. During the operational phase, potable drinking water will be supplied by a water cooler at the control building. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required on a regular basis.

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.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Indicative Internal Electrical Cabling
- Indicative Grid Connection Route

N

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Figure 4-12

DRAWING TITLE:

Substation Layout

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 39**
SCALE: **1:500 @A3**	DATE: **26.02.2021**

OS SHEET No.:
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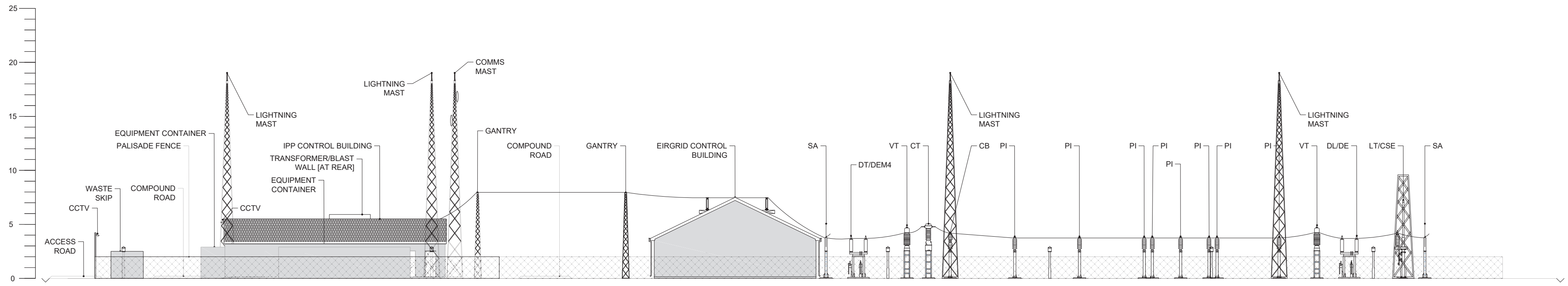
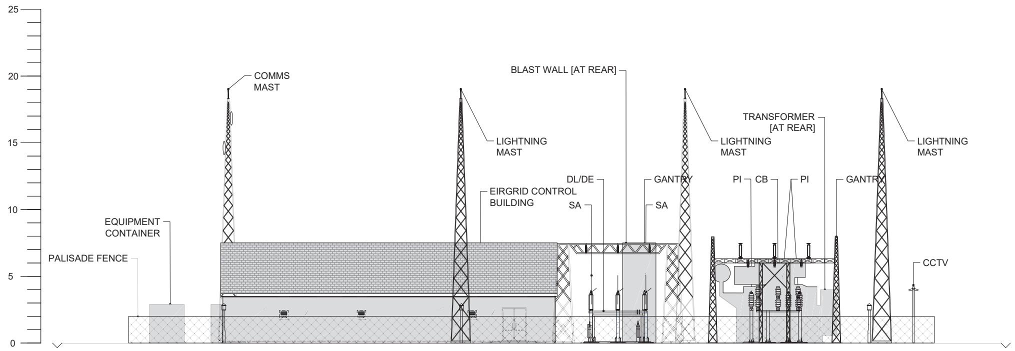


SIDE ELEVATION



END ELEVATION

Figure 4-13

NOTES

1. LAYOUT AND ARRANGEMENT OF SUBSTATION CONTROL BUILDING AND ELECTRICAL EQUIPMENT WITHIN COMPOUND IS SHOWN INDICATIVELY AND FOR ILLUSTRATION PURPOSES ONLY. DETAILS ARE BASED ON CURRENTLY ANTICIPATED EIRGRID/ESBN SPECIFICATIONS. FINAL LAYOUT AND ELECTRICAL EQUIPMENT DETAILS WILL BE CONFIRMED DURING DETAILED DESIGN WHEN EIRGRID/ESBN FINAL SPECIFICATIONS ARE CONFIRMED.
2. FINAL SPECIFICATIONS OF BUILDINGS AND ELECTRICAL EQUIPMENT WILL BE AS PER EIRGRID AND ESB SPECIFICATIONS.
3. POSITION AND NUMBER OF LIGHTNING MASTS TO BE CONFIRMED IN FINAL DESIGN.
4. INTERNAL SUBSTATION DUCTING OMITTED FOR CLARITY.

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
A	16/01/2020	JS	PK	FIRST ISSUE

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Formerly known as WIND PROSPECT IRELAND

CLIENT

PROJECT: COOLE WIND FARM

TITLE: 110kV SUBSTATION COMPOUND ILLUSTRATIVE ELEVATIONS

REVISION: A

DRAWN BY	DATE	PAPER SIZE	SCALE
J. SHANAHAN	16/01/2020	A1	1:200

CHECKED AND APPROVED	DATE	STATUS
P. KING	16/01/2020	DRAFT

DRAWING NUMBER: COLE d007.2

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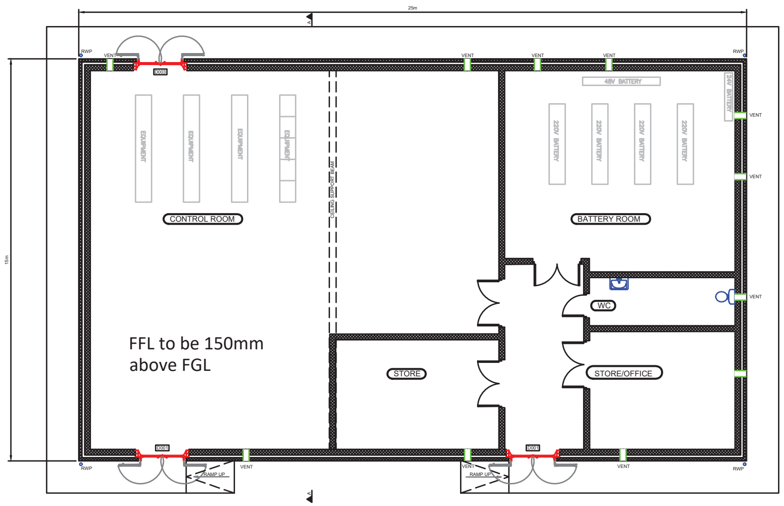
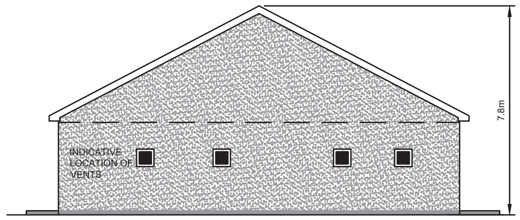
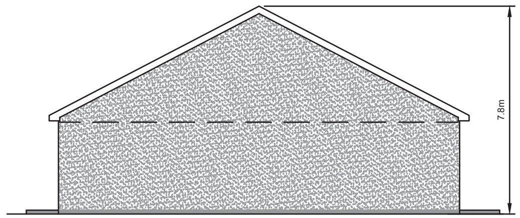


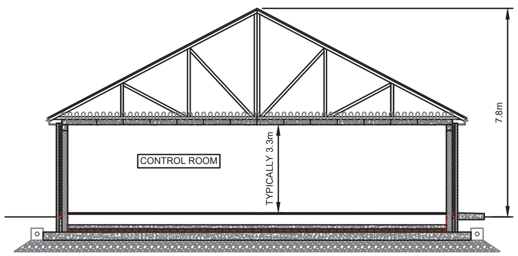
PLAN ON CONTROL BUILDING



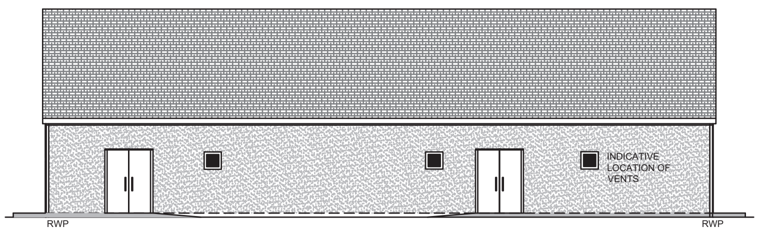
ELEVATION ON SIDE FACE



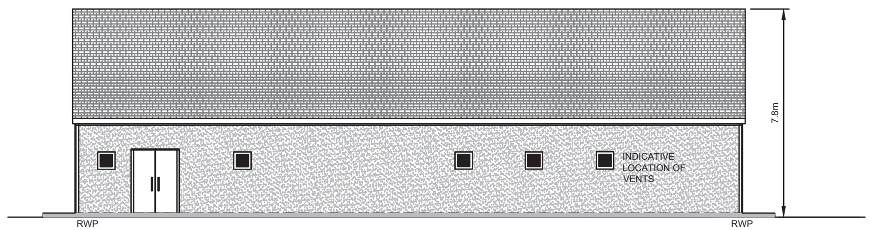
ELEVATION ON SIDE FACE



SECTION A-A



ELEVATION ON FRONT FACE



ELEVATION ON REAR FACE

Figure 4-14a

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
A	11/05/2020	MJS	JS	FIRST ISSUE

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Formerly known as WIND PROSPECT IRELAND

CLIENT

PROJECT: COOLE WIND FARM

TITLE: CONTROL BUILDING: TYPICAL PLAN AND ELEVATIONS

DRAWN BY: M STUART	DATE: 09/05/2020	PAPER SIZE: A3	SCALE: 1:200
CHECKED AND APPROVED: J SHANAHAN	DATE: 09/05/2020	STATUS:	

DRAWING NUMBER: COLE d007.3

REVISION: A

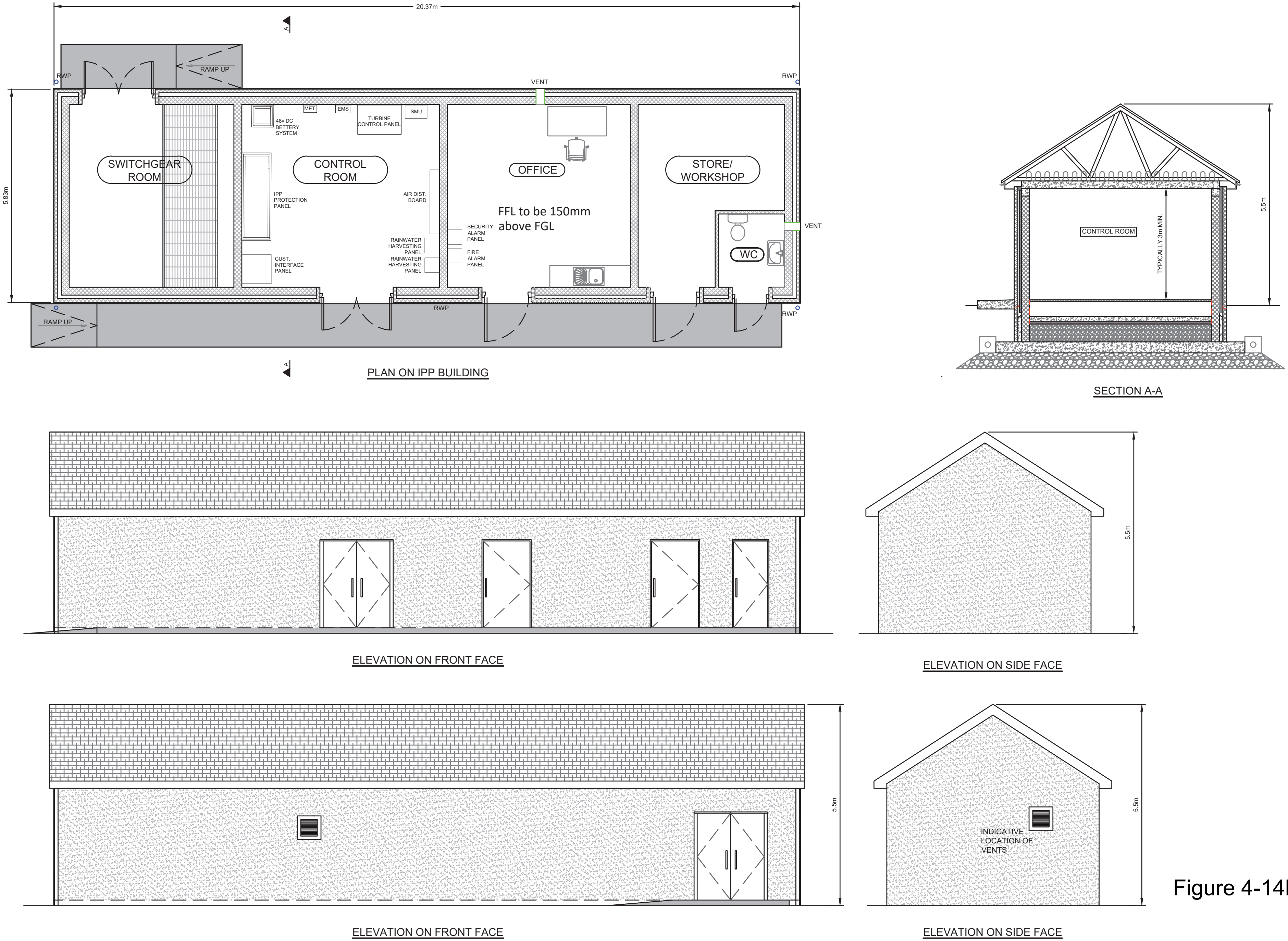

Figure 4-14b

NOTES				
A	11/05/2020	MJS	JS	FIRST ISSUE
REV	DATE	DRAWN BY	CHECKED BY	DETAILS

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CLIENT

PROJECT: COOLE WIND FARM

TITLE: IPP BUILDING: TYPICAL PLAN AND ELEVATIONS

REVISION: A

DRAWN BY: M STUART — DATE: 09/05/2020 — PAPER SIZE: A3 — SCALE: 1:100

CHECKED AND APPROVED: J SHANAHAN — DATE: 09/05/2020 — STATUS

DRAWING NUMBER: COLE d007.4

It is proposed to manage wastewater from the staff welfare facilities in the control building by means of a sealed storage tank located adjacent to the building, with all wastewater being tankered off site by a permitted waste collector to a wastewater treatment plant.

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. The capacity of the sealed storage tank will measure approximately 9 m^3, and it will be emptied as required on a regular basis, estimated at a frequency of once per month or less times per month. Such a proposal for managing the wastewater arising on site has become standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment would be challenging, and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal. The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week.

Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007, will be employed to transport wastewater away from the site. When the final destination of the materials is known following the appointment of a permitted contractor, this information can be submitted to the Planning Authority if necessary.

4.3.12 Site Underground Cabling

Each turbine will be connected to the onsite electricity substation via an underground electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in cable ducts approximately 1.2 metres below the ground surface, along the sides of roadways. Refer to Appendix 4-1 of this EIAR.

4.3.13 Grid Connection

The Proposed Development will connect to the national electricity grid via Mullingar 110 kV substation. Mullingar Substation is located in the townland of Irishtown approximately 2 kilometres northwest of Mullingar town. The proposed grid connection route measures approximately 26km in length from the proposed wind farm site to the existing substation near Mullingar, and is shown in Figure 4-1. The grid connection route would comprise underground cabling located primarily within the public road corridor, with a short section of underground cabling (approximately 700m) across private lands at the northernmost end.

IONIC Consulting Engineers were commissioned to complete the design of the grid connection cable trenches which are detailed In Section 4.8.7 below and presented in Appendix 4-3. The proposed grid connection construction methodology, including proposals for water crossings on the underground grid connection route, is also described in Section 4.8.7 below. The planning drawings presented in Appendix 4-1 of this EIAR also show the proposed grid connection route in further detail.

4.3.13.1 Ground Investigations

4.3.13.1.1 *AGEC Report*

Following consultation and correspondence with Westmeath County Council in relation to the proposed underground grid connection route, a peat stability assessment of sections of public roads underlain by peat of the grid connection route was carried out by Applied Ground Engineering

Consultants (AGEC)[2],in April 2017. The purpose of this assessment was to establish the ground conditions in three priority sections of road (as identified by Westmeath County Council at the time) with respect to construction of the underground cables and the potential effects on the structural integrity of the roads. While additional more detailed investigations have since been carried out into peat depths along the route, resulting in a more refined and robust construction methodology, the report findings in terms of ground conditions is still very useful, and are presented as Appendix 4-4 of this EIAR. The sections of road assessed by AGEC measure approximately 8 kilometres in total and are shown in Figure 4-15.

The geotechnical assessment report includes the results of a walkover survey of the ground conditions along the three (3) priority areas for the proposed cable route as well as the results of an indicative stability analysis in accordance with Eurocode 7 (Design Approach 1, Condition 2) on a typical section of the road embankment with a trench located at the edge of the road embankment (for example) and construction plant located on the road.

Although the report also includes typical trench details for sections of the underground cable route and possible construction options for areas of deeper peat, additional more detailed investigations and engineering designs have since been carried out for the full length of the cable route.

The AGEC report includes the following:

- Probing data from the verges on both sides of the road at approximately 200 m intervals along the three (3) priority areas to determine the ground conditions including the thickness of peat and / or soft ground;
- Shear vane test results in peat at various locations along the three (3) priority areas;
- Salient observations on ground conditions and drainage;
- The results of peat stability analysis carried out on a typical road section to determine if a cable trench along with construction equipment on the road would cause instability of the road.

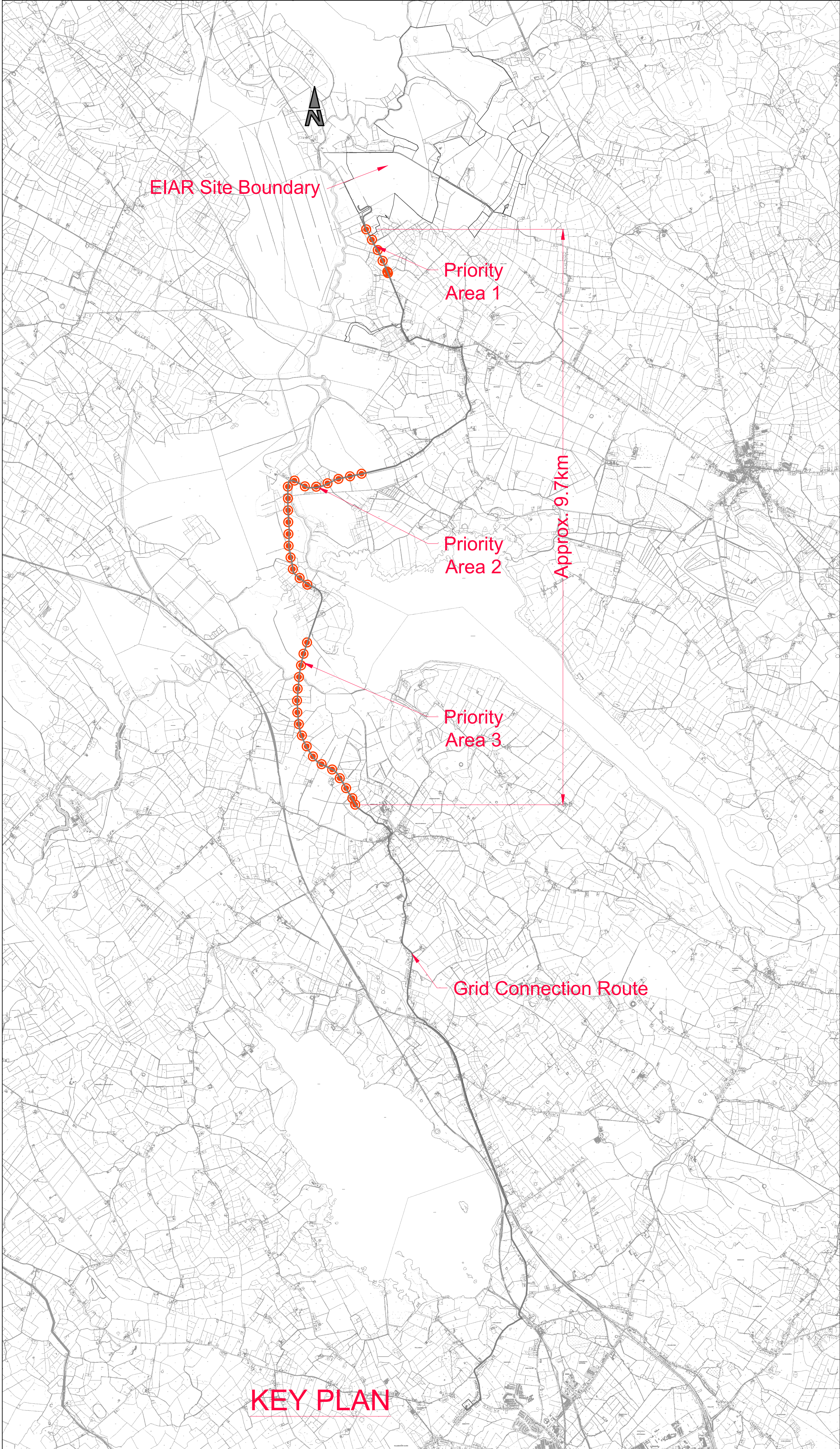
The main findings of the AGEC Cable Route Assessment Report are as follows:

- Based on the information obtained during the site walkover, installation of the cable trench within the road or road verges is feasible, provided proper construction techniques are followed to maintain the integrity of the roads on bog ramparts. Once the cable is laid in the roads, the trench will be backfilled to appropriate standards and the road surface reinstated as directed by Westmeath County Council;
- A stability analysis shows that the inclusion of the cable trench would not reduce the stability of the existing road embankments.

Stability Analysis

The route assessment report in Appendix 4-4 also describes the stability analysis undertaken by AGEC. An indicative stability analysis in accordance with Eurocode 7 (Design Approach 1, Condition 2) was .

[2] *AGEC Ltd were rebranded and became Fehily Timoney (FT) in 2019.*



N

DRAWING TITLE: Cable Route Assessment Sections	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **Figure 4-15**
SCALE: **1:60,000 @A3**	DATE: **18.03.2021**
OS SHEET No.: **2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771**	

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carried out on a typical section of the road embankment with a trench located at the edge of the road embankment (for example) and construction plant located on the road. The analysis examined the drained condition using typical soil parameters

A calculated minimum factor of safety of 1.24 was achieved. The required minimum factor of safety is 1. The results indicate that the stability of the road will not be an issue with the trench in place.

Based on the information obtained during the site walkover, installation of the cable trench within the road or road verges is feasible, provided proper construction techniques are followed to maintain the integrity of the roads on bog ramparts. Once the cable is laid in the roads, the trench will be backfilled to appropriate standards and the road surface reinstated as directed by Westmeath County Council.

A stability analysis shows that the inclusion of the cable trench would not reduce the stability of the road embankment.

IONIC Consulting Engineers design of the cable and substation works required have incorporated any available historical data and reports described above, in addition to carrying out their own site investigations and are presented in Appendix 4-3.

4.3.13.1.2 *APEX Geophysical Investigation Report*

To further investigate the grid connection route, a geophysical investigation was conducted by APEX Geophysics Ltd. in October 2019 to determine the presence/thickness of peat along the grid connection route. This has been provided as Appendix 4-5 of this EIAR, and a brief summary is provided below.

The geophysical investigation comprising of Ground Penetrating Radar (GPR) profiling was carried out along the regional road extending for c. 15km from the town of Multyfarnham in the south, through the village of Coole to the Proposed Development site entrance. The survey was carried out on the 17th and 18th September and the 3rd and 4th October 2019. Several GPR antenna frequencies were employed to maximize the resolution\depth of the GPR signal. Soft ground probing was carried out along the route to identify/confirm areas of soft ground\peat. Thirteen Russian Cores were targeted in areas of peat to determine its thickness and to identify underlying materials. The coring information was correlated with the GPR data to assist in the interpretation of the GPR profiles. The peat thickness recorded in the Russian cores ranges from 0.82m to 5.62m. The material underlying the peat was predominantly soft white Shell Marl with two occurrences of soft grey Clay. Four sections of peat were resolved in the GPR data ranging from 0.285m to 5.34m depth below the road surface with a maximum thickness of 4.34m. The results of the investigation are detailed in Appendix 4-5 of this EIAR. It is noted that findings of the geophysical investigation should be reviewed after any further intrusive ground investigations to ensure it is up to date.

As detailed in Section 2.6.3 in Chapter 2 of this EIAR, the intended approach, i.e. confirming that the grid connection could be laid without affecting the integrity of the road, was set out in correspondence issued to the Planning Authority in September 2017 as detailed in Section 2.6.3. Following that, further details relating to construction methodology and design were discussed at the two pre-planning meetings that took place on the 15th of August 2019, and the 4th of February 2020. The approaches discussed in these meetings were considered satisfactory by the Planning Authority at that time.

4.3.14 Proposed Upgrade works at Existing Electricity Substation

It is proposed to upgrade the existing Mullingar 110kV substation to accommodate the connection of the proposed wind farm development. The upgrade works at the substation will consist of the construction of an additional dedicated bay. Three potential connection points have been identified for this connection in consultation with ESB and EirGrid with the exact location to be identified at detail design stage, as indicated on the planning drawings in Appendix 4-1.

4.3.15 Temporary Construction Compound

A temporary construction compound is proposed, located inside the wind farm site entrance from the R396 Regional Road, as shown in Figure 4-1. The proposed compound area measures approximately 6,610m^2. The layout of the proposed compound area is shown in Figure 4-16, and incorporates temporary site offices, staff facilities and car-parking areas.

A dedicated waste management area will be located within the compound, with waste to be sorted and collected from site by permitted collectors. Potable drinking water will be supplied via water coolers located within the staff facilities, which will be restocked on a regular basis as required during the

construction phase. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required for the duration of the construction period.

Temporary port-a-loo toilets located within portacabins 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. Power will be supplied by a diesel generator, located within the compound. The construction compound will be used for temporary storage of some construction materials, prior to their delivery to the required area of the site.

4.3.16 Tree Felling and Replanting

4.3.16.1 Tree Felling

The majority of the proposed wind farm site is occupied by commercial cutover peat, with some areas occupied by commercial forestry. As part of the Proposed Development, some tree felling is required within and around the development footprint to allow the construction of turbine bases, access roads and other ancillary infrastructure. There are two turbines within the Proposed Development that are located within an area of forestry; T5 and T14. It should be noted that all forestry on the site of the proposed wind farm was originally planted as a commercial crop, and will be felled in the coming years should the proposed wind farm proceed or not.

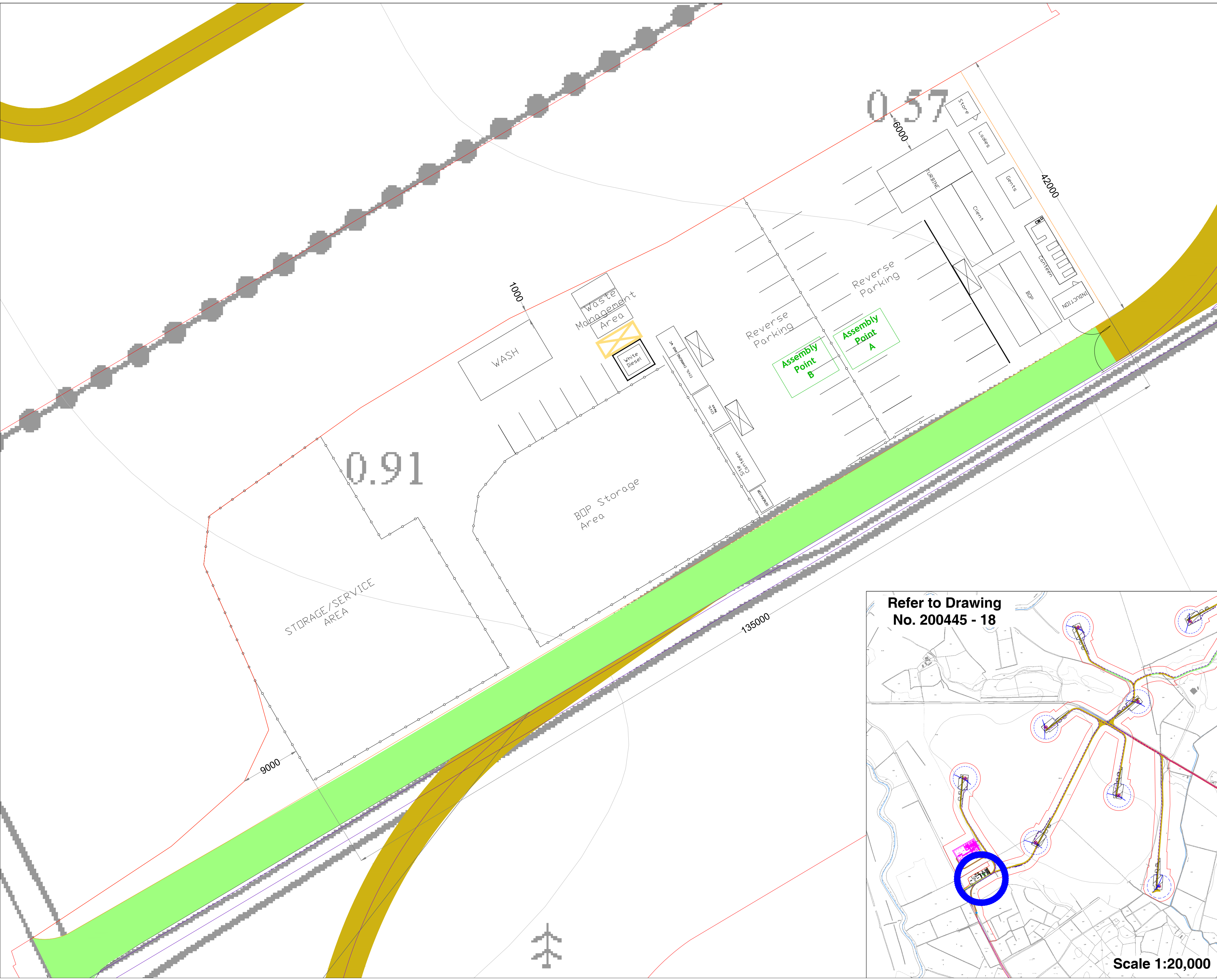
A total of 16.36 hectares of forestry is required to be felled within and around the Proposed Development footprint. Figure 4-17 shows the extent of the area to be felled as part of the Proposed Development.

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

4.3.16.2 Replanting

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

A total of 16.36 hectares of new forestry will be replanted as a condition of any felling licence 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.



Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Proposed Road
- Indicative Internal Electrical Cabling
- Temporary Construction Compound
- Indicative Grid Connection Route

N

Figure 4-16

DRAWING TITLE:

Temporary Construction Compound

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 38**
SCALE: **1:500 @A3**	DATE: **26.02.2021**

OS SHEET No.:
2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- External Roads (Upgrades to Existing)
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Temporary Hardcore Surfacing Areas
- Forestry Felling Areas

Drawing Title	
Forestry Felling Areas	
Project Title	
Coole Wind Farm, Co. Westmeath	
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 4-17
Scale: 1:25000	Date: 11.02.2021

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The replacement replanting of forestry can occur anywhere in the State subject to licence. A potential replanting area has been identified in the townland of Maheraboy, approximately 1.4 kilometres east of Ballaghdereen, Co. Roscommon. An area at this site measuring 16.53 hectares has been granted Forest Service Technical Approval for afforestation. If these replant lands become unavailable, other similarly approved lands will be acquired for replanting should the proposed wind farm 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 presented in Appendix 4-6 of this EIAR.

4.3.17 Link Road, Junction Accommodation and Public Road Works

The proposed turbine delivery route is presented in Figure 4-18. A Delivery Route Selection and Assessment was carried out by Exceptional Load Services (ELS) to identify the optimum delivery route to site, and is presented as Appendix 4-7 of this EIAR. It is proposed to deliver turbines to the site from the port of delivery (i.e. Dublin, Cork or Waterford) via the M4 motorway and then the N4 National Primary Road single-lane carriageway between Mullingar and Edgeworthstown.

From the N4, the turbine delivery route turns northwards on the L1927 local road, then turns right onto the L5828 at Boherquill, and from here onto the R395 Regional Road at Lisnagappagh. From the R395, the turbine delivery route will then connect to the R396 via a proposed new section of access road ("link road") in the townland of Coole, thereby avoiding the existing left-hand-turn in Coole village.

The proposed link road measures approximately 1.2 kilometres in length, and will traverse land currently occupied by commercial cutover peat and agricultural grassland. The road will have a running width of five metres, and wider on the corners, as per the wind farm site roads as described in Section 4.3.6 above. The junctions between the proposed link road and the R395 and R396 Regional Roads have been designed so as to achieve the required turning areas and sightlines. Further details are presented below in Section 4.5.2 and in Chapter 14: Material Assets of this EIAR. Improvements and modifications to existing public road infrastructure on the turbine delivery route to facilitate delivery of abnormal loads are required at eleven locations and are further detailed in Section 14.1 in Chapter 14 of this EIAR and in the detailed site layout drawings in Appendix 4-1.

At locations where hardsurfacing works are required, the existing road verge and field vegetation at the junction will be cleared back, and material will be excavated to allow the placing of stone/hard surfacing within the proposed area. A series of removable bollards will be placed along the existing road edge in order to preserve the structure of the junction outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the area and boundaries will be reinstated restoring the junction to its existing configuration.

Location 1 – N4/L1927 junction at Joanstown

The analyses indicates that a temporary hardcore surfacing area and visibility splays will be required at this junction in order to accommodate the wind turbine vehicles. It is proposed to widen the area along the south-west of the N4 at its junction with the L1927 road. The proposed area for temporary hardcore surfacing measures approximately 0.03 hectares. The hard surfacing is temporary and the verge will be reinstated to its original condition post construction.

Location 2 – Railway Line Level Crossing on the L1927

The swept path analysis undertaken for this location shows that the abnormally sized turbine vehicles will be able to negotiate this crossing with minor impacts on sections of hedge (over-sail) and grass verges. It is noted that a land agreement has been secured adjacent to the public road immediately south of the railway line which will be hard surfaced to ensure the turbine can pass through the level crossing. The boundary and area will be reinstated to its existing configuration post construction.

Location 3 – L1927/L5828 right turn at Boherquill

The analyses indicates that a temporary hardcore surfacing area and visibility splays will be required at this junction in order to accommodate the wind turbine vehicles. It is proposed to widen the north eastern corner of the existing junction to facilitate the delivery of turbines. These works will require clearing back part of the existing road verge and field vegetation at the junction, and excavation of material to allow the placing of stone/hard surfacing within the proposed area. A series of removable bollards will be placed along the existing road edge where the hedgerow has been removed in order to preserve the structure of the junction outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the area and boundaries will be reinstated restoring the junction to its existing configuration with the exception of a gated access at the eastern end where the hard surfacing meets the public road.

Location 4 – Gentle right turn from L5828 onto R395

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 and grass verges. The verge will be hardsurfaced to accommodate the delivery of the turbines. The hard surfacing is temporary and the verge will be reinstated to its original condition.

Location 5 and 6 - Site access junctions A and B that provide access/egress onto proposed link road (linking R395 and R396)

The swept path analysis undertaken for this location shows that the abnormally sized turbine vehicles will be accommodated at this location with temporary hardcore surfacing and visibility splays at the turning areas providing access and egress to the proposed link road. Barrier/gate to be in place at the entrance to link road and left in place post-construction. Gate to be in place at the exit from the link road. Gate to be left in place post construction and existing stone wall to be reinstated either side of the gate.

Location 7 - Site access junction C that provides access to the site from the R396

The analyses indicates that a temporary hardcore surfacing area and visibility splays will be required at this junction in order to accommodate the wind turbine vehicles. It is proposed to widen the turn into the proposed wind farm site to the east of the R396 to facilitate the delivery of turbines. Barrier / gate to be in place at site access point off the public road and left in place post-construction.

Location 8 - Site access junction D which crosses the L5755

The swept path analysis undertaken for this location shows that the abnormally sized turbine vehicles will be able to negotiate this crossing with minor impacts on sections of hedge and grass verges. Barrier / gate to be in place at site access / egress points off the public road and left in place post-construction.

Location 9 – Site access junction E which provides access to Turbine T14 located south of L5755

The analyses indicates that a temporary hardcore surfacing area and visibility splays will be required at this junction in order to accommodate the abnormally sized turbine vehicles. It is proposed to widen the turn into the proposed turbine T14 to the south of the L5755 to facilitate the delivery of the turbine. T14 access location off the public road to be gated and remain gated post construction.

Location 10 – Site access junction F, which is the access junction off the L5755 to / from the proposed borrow pit, and

The analyses indicates that temporary visibility splays will be required at this junction in order to accommodate the construction vehicles. The borrow pit access location off the public road is to be gated post construction.

Location 11 - Site access junction G which provides access to turbine number 15 situated to the north of the L5755.

The analyses indicates that a temporary hardcore surfacing area and visibility splays will be required at this junction in order to accommodate the abnormally sized turbine vehicles. It is proposed to widen the turn into the proposed turbine T15 to the north of the L5755 to facilitate the delivery of the turbine. T15 access location off the public road to be gated and remain gated post construction.

Additional details on the transport of other construction materials to the proposed wind farm site are provided in Section 4.5.2 below.

4.3.18 Site Activities

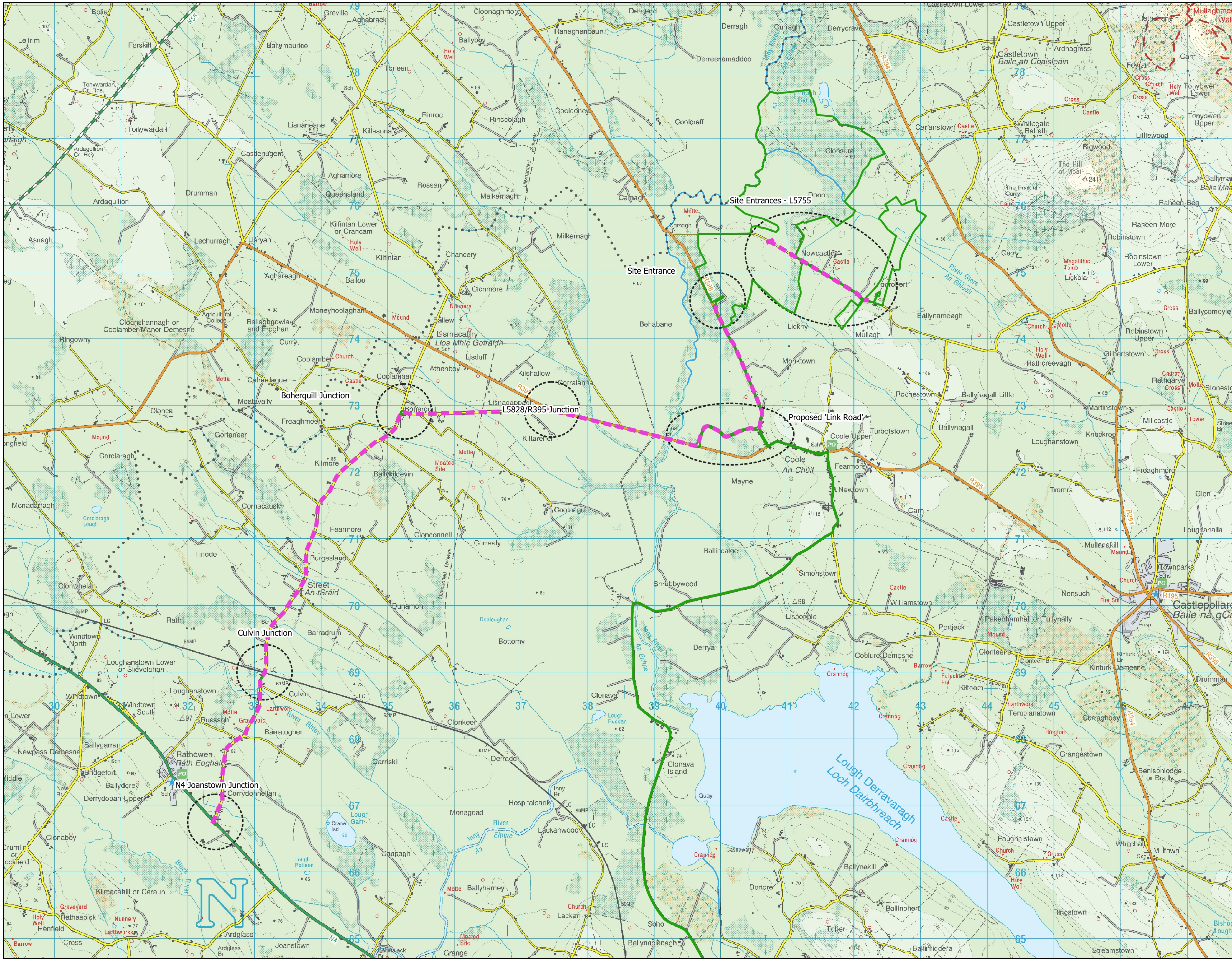
4.3.18.1 Environmental Management

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 4-8 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.

4.3.18.2 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 100m from watercourses using a mobile double skinned fuel bowser. The fuel bowser, a double-axle custom-built refuelling trailer or similar will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use.



Map Legend

- EIAR Site Boundary
- Turbine Delivery Route (from N4 National Primary Road)

Drawing Title	Proposed Turbine Delivery Route
Project Title	Coole Wind Farm, Co. Westmeath
Drawn By	EC
Checked By	MW
Project No.	200445
Drawing No.	Figure 4-18
Scale	1:50000
Date	11.02.2021

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

4.3.18.3 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 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. 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. 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 4-3 and Plate 4-4 below.

Plate 4-3 Concrete washout area

Plate 4-4 Concrete washout area

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

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

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

- Concrete trucks will not be washed out on the site, 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.

4.3.18.4 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.

4.3.18.5 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.

4.3.18.6 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.

4.3.18.7 Waste Management

The CEMP, Appendix 4-8 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 Community Gain Proposal

An important part of wind farm development is the Community Benefit Scheme. The concept of directing benefits from wind farms to the local community is promoted by the DCCAE through the new Renewable Electricity Support Scheme (RESS), the National Economic and Social Council (NESC) and the Wind Energy Ireland (WEI) among others. The new RESS in particular promotes the concept of directing benefits from locally generated electricity, back to the local area and local community. It also seeks to maximise local community involvement in decision making regarding how community benefit funds could deliver real and tangible benefits of the local area. This is a concept that Coole Wind Farm has incorporated in its community engagement since the development of the CLS in 2016.

While it may be simpler and easier to put a total fund aside for a wider community area, Coole Wind Farm is endeavouring to develop new ways to direct increased gain towards the local community with particular focus on those living closest to the wind farm. Given that local people understand the needs and requirements of the local community best, consultation with those in the local community on the form that the community benefit package should take has formed an integral part of developing this proposal. 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.

As part of the permitted 13 turbine project, commitments were made in relation to Community Benefit Proposals. These proposals will continue to be honored as part of the project now proposed. The level of community funding associated with this proposal has significantly increased (from an initial €1.25M to c.€7.5M) as a result of the proposed design changes and requirements of the new RESS scheme. Based on the permitted 13 turbine project, a Community Benefit Fund in the region of up to €1.25 million was proposed over the lifetime of the project with the value of the fund directly proportional to the level of installed MW's on the wind farm. Based on the current 15 turbine layout and design, should the Coole Wind Farm be developed under RESS, it would attract an increased community contribution above this of in the region of approx. €500,000/year for the local community for the lifetime this support. Further information is provided in the RESS Community Benefit Fund section below.

Community Benefit Proposals are directed by feedback from ongoing consultation with the local community and through feedback/comment forms completed from the public consultation event held in February 2017. Those spoken to in the local area felt that the project should bring with it real and tangible benefits for the local community and that these should be developed at an early stage from operation of the wind farm.

Aspirations expressed by the community in the local area to date include:

- Financial assistance for local community buildings such as the local Church.
- The development of facilities for the elderly in the area and specifically the continuation of previous plans for nursing home facilities in the local area.
- Improvements to the local broadband services in the area.
- Supports for existing local groups such as the Mother and Toddler Group and the Tidy Towns.
- Development of new services such as local adult computer classes, women's fitness classes and a 'Men's Shed'.
- Assistance for the community in providing a local amenity and recreation area.
- The development of all-weather sports facilities in the area.
- An energy efficiency scheme for homes in the local area.
- A community educational scheme.
- A community enterprise scheme.

The input and suggestions of the local community will continue to be sought. In order to assist the community in achieving the aspirations for the area, Coole Wind Farm Ltd. will work to provide flexibility in the annual payments structure allowing for larger payments towards the earlier stages of operation where appropriate projects of scale are identified.

RESS Community Benefit Fund

Details were announced on the 24th July 2018 of the new RESS with the detailed terms and conditions of this scheme being confirmed in February 2020. Renewable energy projects which are developed under this scheme will have a significantly increased community benefit fund associated with them and for wind energy, this contribution is currently set at €2/MWhr.

A fundamental basic of the community aspect of RESS is the ambition to develop the concept of the Energy Citizen. This concept is being promoted by ensuring significant return to local communities/areas and seeking to maximise the level of local involvement in terms of the decision-making processes. This input will influence how community benefit funds are spent and where benefit is delivered.

As mentioned above, based on the current layout and design, should the Coole Wind Farm be developed under RESS, it would attract a community contribution in the region of approx. €500,000/year for the local community for the lifetime this support. The value of this fund would be directly proportional to the electricity generated by the wind farm. This would offer a significant opportunity in terms of bringing economic, environmental and social benefits to the local area. The terms and conditions of RESS 1, set out how the community benefit aspect of this scheme will be structured at a high level. It is widely accepted that RESS 1 will from the blueprint for the terms and conditions of future RESS auctions however it is expected that this will evolve in the years to come. One such aspect of this scheme that is expected to evolve, is a mechanism that will allow local communities invest and get a return from renewable energy projects. The Dept. have indicated that they are committed to developing this feature of RESS and should this be included in future RESS auctions, it will be applicable to the Coole Wind Farm project if the proposal is successful in gaining RESS support.

Under current t&c's of RESS, the following would be required for Coole Wind Farm:

- **Direct payments** – to those living closest to the wind farm. A minimum €1,000 payment per annum for houses within 1km of the development;
- **Energy Efficiency** – Approximately €200,000 per year would be available for the development of energy initiatives to benefit people living in the local area. This is to be provided to not for profit community enterprises.
- **Support for local groups** –In excess of €200,000 per year would be available for local groups, clubs and not for profit organisations that provide services in the local area. This would include services for the elderly, local community buildings, groups such as the parent and toddler group and the development of sporting facilities such as all weather playing pitches etc. Community broadband initiatives could also be considered.
- **Administration costs** - a maximum of 10% of this fund to be made available for the administration and governance costs of the fund.

It is important to note that this funding would be directed toward the local area in the first instance and community input will be sought to influence how this funding should be distributed in the local area.

Direct Return

As outlined above, the RESS terms and conditions mandate that a minimum of €1,000 per annum be made available to all households located within 1km of the wind farm. For the Coole Wind Farm, this would mean that all 18 houses which are located within 1km of the proposed turbines would receive this direct return, distributing €18,000 per annum to local households. It should also be noted that RESS allows for larger direct payments and a wider area (out to 2km) to be considered where appropriate. Coole Wind Farm will work with the local community, and within any guidelines to be published by the Department, to establish how the direct return aspect of this proposal might be delivered most appropriately.

Feedback during consultation with the local community indicated that it was felt that those closest to the proposed project should benefit directly from the wind farm. Previous commitments made on the Local Household Dividend Scheme for the permitted 13 turbine layout will be maintained under the RESS. This dividend from the wind farm is aimed to allow people in the local area to directly benefit from the wind farm and thus improve the economic sustainability of not only individual households but the local community overall. It is hoped that households receiving a financial return from the wind farm will help to get people actively involved in renewable energy and help people to recognize the opportunities associated with our country's transition towards becoming a low carbon economy.

Local Community Enterprise Involvement in RESS

RESS1 terms and conditions set out that a not for profit community enterprise should receive 40% of the community benefit fund. This community enterprise's primary focus or aim will be the promotion of initiatives towards the UN sustainable development goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives.

This aspect of the community benefit fund can support the development of Greener Living Initiatives within the local area and is in line with feedback that we have received on local aspirations for the use of the community benefit fund. This aspect can also support, and expand, the development of the Greener Homes Scheme committed to for the permitted 13 turbine project within the local area. Approximately €200,000 per annum would be available for these initiatives.

Examples of initiatives that could potentially be supported would include:

- Converting to low carbon home heating solutions such as heat pumps
- Increasing the BER rating of local homes
- Carrying out energy efficiency works to homes
- Installation of wiring for Electric vehicle charging
- Support for those who would like to buy an Electric Vehicle
- Supporting remote working

The majority of those spoken to during the consultation with the local community see the long-term financial benefits transitioning towards low carbon solutions and reducing their overall energy usage while others expressed interest in receiving a payment which would go directly towards their electricity bills. In Ireland's move towards transitioning to a low carbon economy Coole Wind Farm Ltd. would like to assist the local community in becoming more energy savvy and see locals reaping long term gains from this scheme. Coole Wind Farm Ltd. will also consider requests from those who feel that contributions towards electricity bills in the short term might be more appropriate for them.

Local Community groups in RESS

The balance of funding which would be expected to be in excess of €200,000 per annum (after stipulated allocations and administration costs) will be distributed within the area to local groups and households in line with the RESS terms and conditions. The allocation of this funding will be influenced by local community feedback, inputs and requirements.

Expected future RESS Community Investment opportunities

In addition to the significantly increased community benefit fund that will be associated with RESS projects, it is envisaged that future RESS auction terms and conditions will require that projects developed under the new scheme will also have a requirement to offer a community investment opportunity to people living in the local area. During the consultation with the local community much interest was expressed in terms of the role that the Proposed Development can play in combatting climate change and reducing dependencies on fossil fuels while opening up opportunities for those in the local area and bringing benefit locally. In order to provide those in the wider community with an opportunity to get involved in green projects and have an interest in this project specifically, Coole Wind Farm Ltd. will work to develop this facility where available under RESS.

Whilst this initiative was proposed in the draft terms and conditions for RESS1, it was removed as the full workings of this aspect of the scheme had not been finalised. The department have however indicated their intention to further develop this proposal and to include it in future RESS auctions.

Local Business Support Strategy

During Coole Wind Farm Ltd.'s engagement with the local community, the opinion was expressed that local businesses should benefit from the development of the proposed wind farm. In response to this and as a part of Coole Wind Farm Ltd.'s commitment to seek to increase the economic sustainability of areas surrounding wind farm developments, the applicant continues to develop a Local Business

Support Strategy. This strategy is aimed at maximising the economic return for the local area by ensuring that local suppliers, contractors and business are considered for all appropriate opportunities.

The Local Business Support Strategy includes the following:

- The development and maintenance of an up to date Local Business Database;
- The communication of all potential contract/supply opportunities to businesses and individuals on this database;
- The provision of contact details for a dedicated Project Liaison Officer who will facilitate and assist local business in endeavours to apply for contracts or supply agreements;
- The inclusion of the Local Business Database in invitations to tender being sent to potential main contractors interested in securing contracts during the construction and operation of the Proposed Development;
- Tenderers will be required to provide a statement of Local Economic Gain in their tender documents with consideration of local business involvement a material consideration in the tendering process; and
- During construction and operation, contractors will be required to report on performance in terms of both the number of local businesses supplying services or goods to the project and the local economic benefit accruing therefrom.

A Local Business Database is being developed and businesses are being encouraged to provide details on the services or goods that they feel that they could deliver relevant to the construction and operation of the wind farm. This information will be passed on to all contractors tendering for works on the Proposed Development. During consultation with the local business community, the Local Business Support Strategy and the formation of the Local Business Database has been very well received.

In addition to local economic benefit that can be derived directly from the construction and operation of the wind farm, the Community Benefit Package proposed also offers significant local economic opportunity in its own right. The Local Community Enterprise Scheme would further provide opportunities for local businesses and tradesmen to retrofit existing houses to make them greener and more energy efficient. Whilst the responsibility of administering this fund may not ultimately lie solely with the wind farm operator, it would be intended that the principles of the Local Business Support Strategy would also apply i.e. communication of Local Business Database.

4.5 Access and Transportation

4.5.1 Site Entrance

It is proposed to upgrade the existing forestry track entrance off the R396 Regional Road for use as the wind farm site entrance for the construction and operational phases. 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 the Traffic and Transport Assessment in Section 14.1 of this EIAR. 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 R396 Regional Road, which will also form the wind farm site entrance during the operational phase. The site entrance location is shown in Figure 4-1, and included in the detailed layout drawings in Appendix 4-1.

The delivery of all turbine and construction materials to the site will be via the site entrance off the R396. From here, the vehicles will use the internal site roads to access the proposed infrastructure locations within the site. The centre of the site is traversed by the L5755 local road, as shown in Figure 4-1; it is proposed that one crossing point will be used on the L5755 to connect the southern section of the site (Turbines T10 to T12) to the northern section (Turbines T1 to T9). This crossing point will be controlled appropriately to allow the safe passage of construction vehicles across the road, as described in the outline Traffic Management Plan in the CEMP in Appendix 4-8. Priority at the crossing point will be maintained for public traffic.

The delivery of turbine and construction materials to Turbines T14 & T15 will be via the L5755 from the aforementioned crossing point on the L5755. There will be an entrance south to T14 approximately 0.3 kilometres east of the crossing point on the L5755 and an entrance north to T15 approximately 1.6 kilometres east of the crossing point on the L5755. Appropriate sightlines will be established to the east and west of these access junctions for the safe egress of traffic. The proposed works will result in permanent upgrade of the L5755 local road which will also form part of the wind farm site entrances to T14 and T15 during the operational phase. The section of L5755 and entrances to T14, T15 and the proposed borrow pit will be controlled appropriately to allow the safe passage of construction vehicles along the road, as described in the outline Traffic Management Plan in the CEMP in Appendix 4-8. Priority along the section of road and at the site entrances will be maintained for public traffic.

4.5.2 Turbine and Construction Materials Transport Route

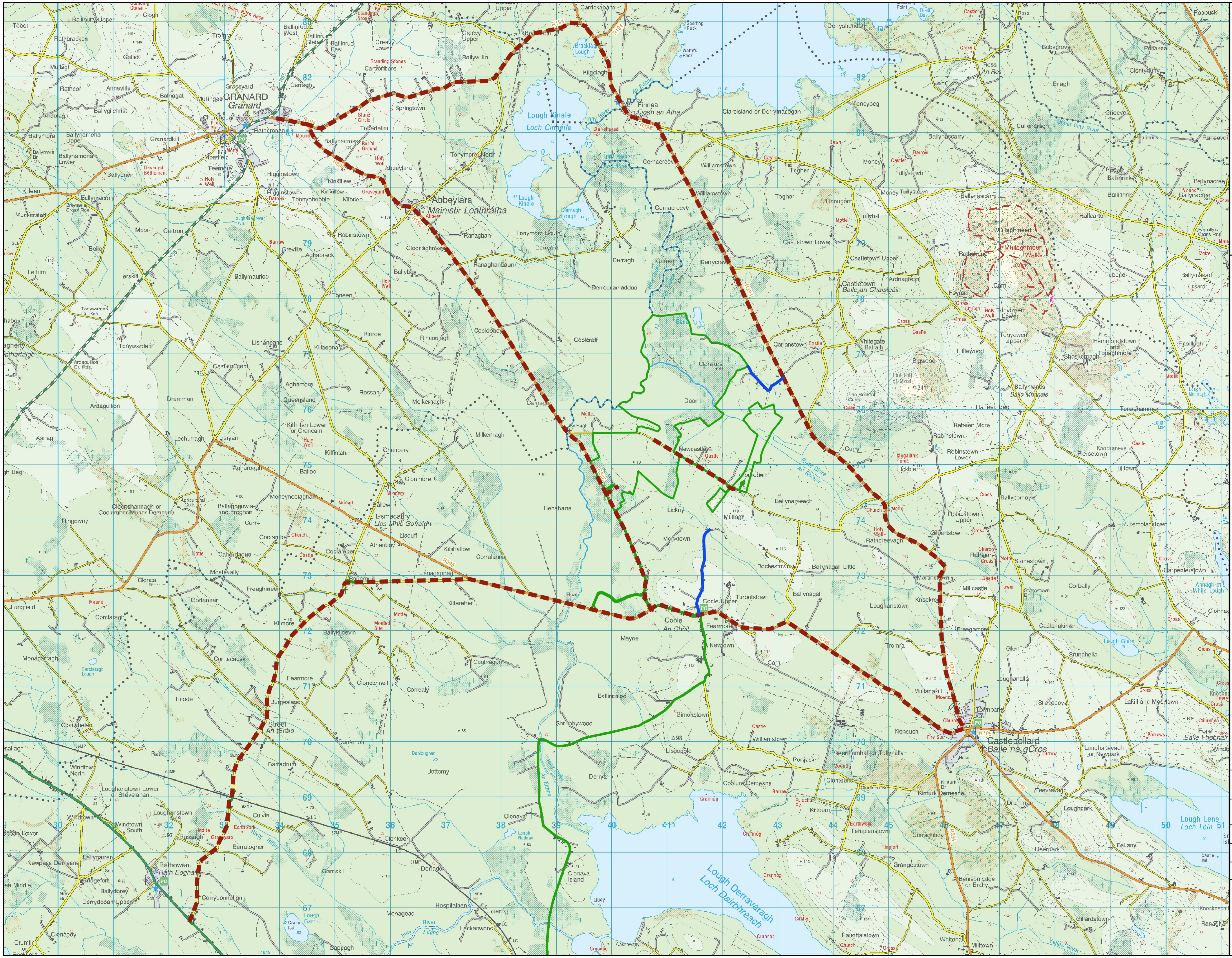
The proposed turbine delivery route is described in Section 4.3.17 above and shown in Figure 4-18. All deliveries of turbine components to the site will be by way of the proposed transport route outlined in Figure 4-18.

Other construction materials will be delivered to the site via the proposed haul routes shown on Figure 4-19. This general construction traffic will use the Regional roads in the area surrounding the site. The number of construction vehicles that will be generated during the construction phase of the proposed development are described as part of the Traffic and Transport Assessment in Section 14.1 of this EIAR. As detailed in Section 2.6.4 and Section 3.8 of this EIAR, an option was also considered to provide a construction site entrance at an existing site entrance from the L57671 local road, which adjoins the R394 Regional Road (local road leading to Clonsura bog from the Finea road). However, following consultation with the local community a commitment was made not to use this access. From feedback and responses received on the project, it is also proposed that all traffic associated with the Proposed Development will avoid the use of the local road in front of Coole National School (L18266) as shown on Figure 4-1.

4.5.2.1 Traffic Management

A turbine with a blade length of up to 77.5 metres has been used in assessing the traffic impact of the Proposed Development. The blade transporter for such a turbine blade would have a total vehicle length of 83.5 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 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 gets unusual 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 https://windenergyireland.com/), transport challenges are something the wind energy industry and specialist transport sector has become particularly adept in finding solutions to.



Map Legend

- EIAR Site Boundary
- Potential Construction Routes (non-Abnormal Loads)
- No Construction Access

Drawing Title: Construction Materials Haul Routes	
Project Title: Coole Wind Farm, Co. Westmeath	
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 4-19
Scale: 1:60000	Date: 11.02.2021

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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

In relation to the structural loadings on the designated delivery routes it must first be noted that all construction and delivery vehicles for the proposed development will be subject to the standard axle weight requirements set out under Road Traffic Regulations and therefore the loadings from construction traffic will not exceed the relevant standards. Notwithstanding the need to use some specialist vehicles to facilitate turbine delivery, it should be noted that the number of load-bearing axles for any specialist vehicles carrying large loads are designed to ensure that the load on any one axle does not exceed acceptable load bearing statutory limits.

A Traffic Management Plan has been prepared as set out in the CEMP in Appendix 4-8 of the EIAR. In the event planning permission is granted for the Proposed Development, the final Traffic Management Plan will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.

The plan will include:

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

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

It is not anticipated that any section of the local 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 to avoid disruption to work and school-related traffic.

Prior to the Traffic Management Plan being finalised, a full dry run of the transport operation along the proposed route will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the traffic management plan for agreement with Westmeath County Council. All turbine deliveries will be provided for in a transport management plan which will have to be prepared in advance of the construction stage, 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 Planning Authority for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

4.6 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. There is an existing drainage system and surface water discharges from the site. The Proposed Development's drainage design has been proposed specifically with the intention of having no negative impact on the water quality of the site and discharges from 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 in so far as possible. One existing water crossing within the proposed wind farm site will be upgraded as part of the Proposed Development, with the construction of two clear span bridges over the River Glore in the northern sections of the site – see Section 4.8.3 below for further details.

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 via settlement ponds, and over vegetation filters at a significant distance from natural watercourses.

Section 1.4.1 in Chapter 1 of this EIAR provides detail on the coordinated management of site activities, including drainage, between peat harvesting operations on the site should they continue and the construction and operation of the Proposed Development.

4.6.2 Existing Drainage Features

On a regional scale, the proposed wind farm site is located in the Inny River surface water sub-catchment, which is in the Upper Shannon catchment within Hydrometric Area 26 of the Shannon International River Basin District (SIRBD). On a more local scale, the proposed wind farm site is located in the Inny River sub-catchment and two sub-basins of the Inny River. The majority of the site is within the Inny_050 sub basin with a small section in the south of the site near the R396 Regional Road within the Inny_060 sub basin. The Inny River flows in a southerly direction along the western boundary of the site and discharges into Lough Derraverragh approximately 7.5km downstream of the site.

The elevation of the proposed wind farm site ranges between approximately 60m OD and 66m OD. The vast majority of the site is situated on commercial peatland The site comprises three separate peat basins, the northern, central and southern basins, each with its own separate drainage system. Further details on outfall drainage directions in each area of the site are provided in Section 9.3.5 of this EIAR: Chapter 9 Hydrology and Hydrogeology. Turbines T1 to T4, and T6 to T13 are all located within the peat basins, while T5 and T14 are located in areas of coniferous forestry along the eastern margin of the basins and T15 is located within an area of agricultural (rough grazing) land to the southeast of the peat basins, on the eastern side of the Glore River.

A drain, which divides the northern basin in two sections, discharges directly to the Inny River northwest of the site. Lough Bane proposed Natural Heritage Area(pNHA) is located adjacent to the northern boundary of the Proposed Development site; however, no part of the Proposed Development footprint is located within the pNHA. Lough Bane itself is located approximately 180 metres north of the internal access road between Turbines T2 and T4. An unnamed small dystrophic lake is located on the north western corner of the site. The presence of perimeter boundary drains and intermediate high banks (uncut sections of high bog) means that there is no runoff from the peat harvesting area into Lough Bane or the dystrophic lake.

The western section of the proposed wind farm site drains directly to the Inny River via a number of settlement ponds and outfall channels. The River Glore flows from across the northern section of the site from east to west and merges with the Inny River on the western boundary of the site.

The proposed wind farm site has parallel-running peat drains that are spaced approximately every 12-15 metres on the bog surface for surface water runoff removal. Surface water runoff collected in these drains is conveyed to a headland silt trap, from where it flows into a larger boundary drain and then onto a sedimentation basin for retention and controlled discharge. The parallel running bog surface drains are only approximately 1.5m deep and therefore do not intercept the mineral subsoil underlying the peat. These internal field drains are deepened as harvesting progresses. The larger boundary drains are generally deeper and regularly intercept the mineral subsoils.

The proposed underground grid connection route is located within the Shannon International River Basin District. With respect to regional hydrology, the grid route is located in 2 no. regional surface water catchments (the River Inny and the River Brosna) and 3 no. regional surface water sub-catchments. The southern section of the proposed grid route, along the eastern edge of Lough Owel and on to Mullingar (~8km long) is located within the Brosna sub-catchment (Brosna_SC_010) within the regional Lower Shannon catchment (25A). The area north of Lough Owel to the northern edge of Lough Derravargh is located within the Inny sub-catchment (Inny[Shannon]_SC_030). North of Lough Derravargh, towards Coole, falls within the boundary of the Inny sub-catchment (Inny[Shannon]_SC_020). Both of these subcatchments are located within the regional Upper Shannon Catchment (26F).

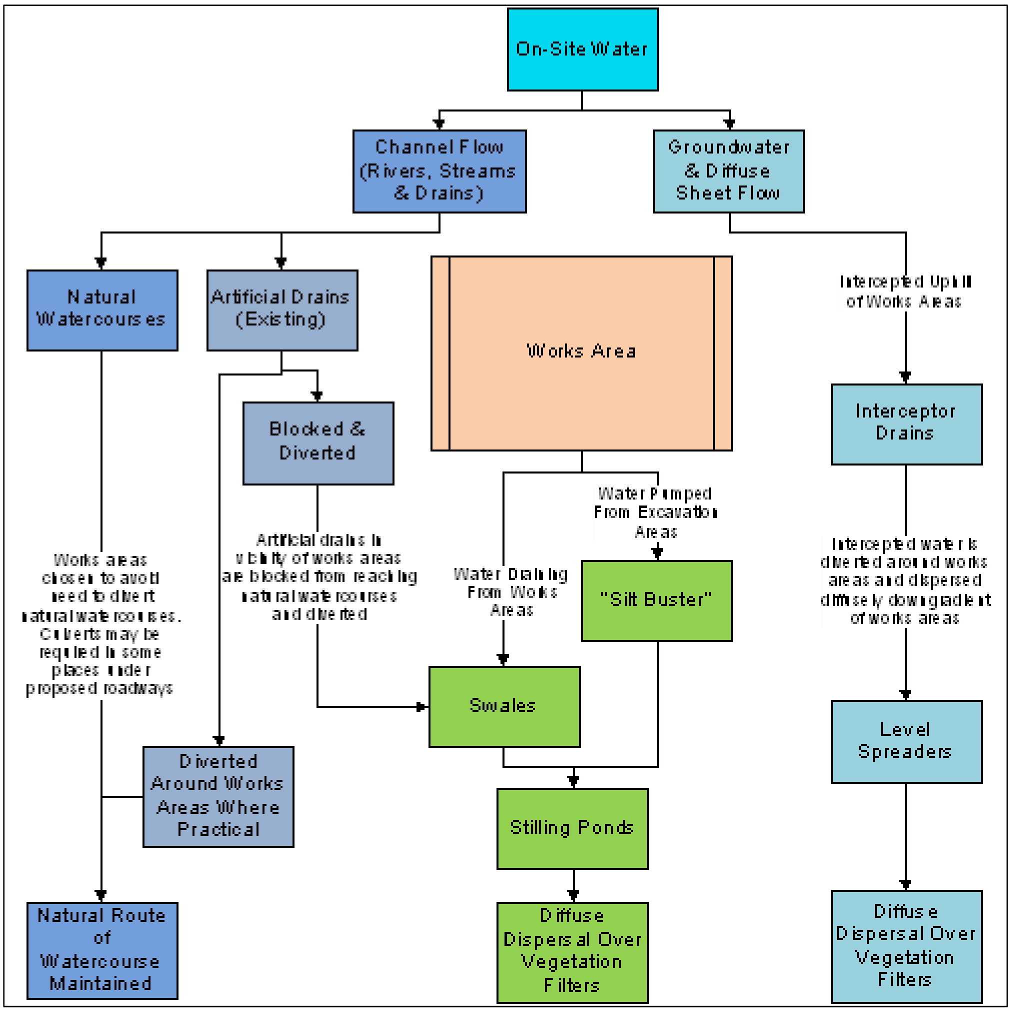
4.6.3 Drainage Design Principles

Drainage water from any works areas of the wind farm site 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 4-20 below.

Figure 4-20 Proposed Development Drainage Process Flow



4.6.4 Drainage Design

A preliminary drainage design for the Proposed Development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in the drainage design drawings in Appendix 4-9 to this EIAR. The drainage design employs the various measures further described and is cognisant of the following guidance documents:

- Environmental Requirements for Afforestation (Forest Service, 2016a);
- 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 will be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting as conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.6.4.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 4.6.4.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.6.4.2 Collector Drains/Swales

Collector drains or 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.

Collector drains 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.

Collector drains 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 collector drains, 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 also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

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 4/40mm non-friable crushed stone. 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 where required at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

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

4.6.4.4 Level 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 levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site, or areas where they are not likely to give rise to peat stability issues.

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

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 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 approximately 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 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 (settlement) ponds prior to diffuse discharge to the vegetation filters via a level spreader.

4.6.4.6 Stilling Ponds/Settlement Ponds

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to attenuate runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

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

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

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area. 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 with sediment cleaned out of the still pond as necessary and on a regular basis.

4.6.4.7 Siltbuster

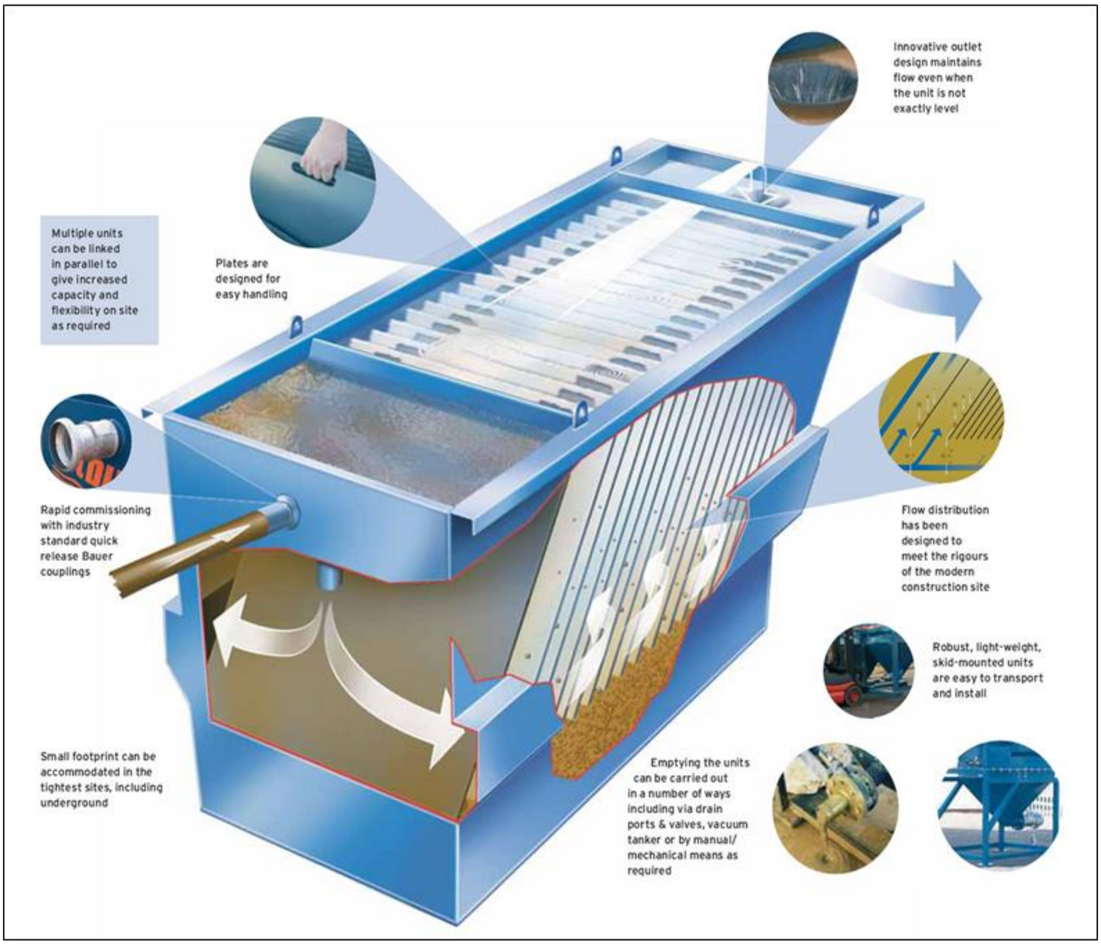
A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

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 4-21 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 4-21 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)



4.6.4.8 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

4.6.4.9 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where watercourse crossings take place.

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

Silt fences will be emplaced along drains and parallel to access roads edges as required, down-gradient of all new roads and turbine locations. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral subsoils of glacial and glacio-fluvial origin, and entrained in surface water runoff.

Inspection and maintenance of these structures during the construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Site fence material will be Terra Stop Premium as per the specifications provided at https://www.hy-tex.co.uk/products/geotextiles/terrastop-premium-silt-fence or equivalent manufacturer certified CE mark for erosion control of EN13253 or similar.

The most suitable type, number or combination of silt fences will be determined on a location-specific basis for the various parts of the site. Although they may be indicated in the drainage designs shown in Appendix 4-1 to be just a single line, silt fences may be installed in series on the ground.

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

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 doesn't occur above or below the culvert and water can continue to flow as necessary.

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

4.6.5 Forestry Felling Drainage Measures

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Felling will take place prior to groundworks commencing.

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:

- 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 ensures the discharging water gently fans out over the buffer zone before entering the aquatic zone.
- Machine combinations, such as mechanical harvesters or chainsaw felling will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance;
- Mechanised operations will be suspended during and immediately after heavy rainfall.
- Where brash is required to form brash mats, it is to be laid out at harvesting stage to prevent soil disturbance by machine movement.
- Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations.
- Felling of trees will be pointed directionally away from watercourses.
- Felling will be planned to minimise the number of machine passes in any one area.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone. Straw bales and check dams to be emplaced on the down gradient side of timber storage sites.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but removing of natural debris deflectors will be avoided.

4.6.6 Borrow Pit Drainage

The proposed borrow pit will extract bedrock below the local groundwater table and therefore there is some moderate potential to impact on local groundwater levels. The proposed borrow pit is located on an elevated area of ground and drainage by gravity will ensue after reinstatement. The pit will be relatively shallow (5m), and therefore the potential for groundwater level impacts to extend significant distances from the pit is negligible. As detailed in Section 9.4.13 in Chapter 9 of this EIAR, a potential zone of influence of between 56 and 177 metres has been calculated from the proposed borrow pit. No known active wells were identified within a 177-metre radius of the proposed borrow pit, therefore potential for impact is limited. Relevant environmental management guidelines from the EPA quarry 2006 guidance document – "Environmental Management in the Extractive Industry" in relation to groundwater issues will be implemented during the construction phase.

4.6.7 Floating Road Drainage

Where sections of floating road are to be installed instead of excavated roads, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths. Large surface water drainage pipes will be placed at these locations below the level of the proposed road sub-base. These drainage pipes will be extended each side of the proposed road and cable trench construction corridor, along the paths of the existing drains.

With the exception of the installation of cross drains under the floating road corridor, minimal additional drainage will be installed to run parallel to the roads, in order to maintain the natural hydrology of the peatland areas over which the roads will be floated.

4.6.8 Cable Trench Drainage

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

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the up-gradient side of the trench and is temporarily sealed/smoothed over using the back of the excavator bucket. Should any rainfall cause runoff from the excavated material, the material will be collected and contained in the downgradient cable trench. Excess subsoil will be removed from the cable trench works area immediately upon excavation, and in the case of the Proposed Development will be used for landscaping and reinstatements of other areas elsewhere on site or reused as fill material for the trench if appropriate.

4.6.9 Site and Drainage Management

4.6.9.1 Preparative Site Drainage Management

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

An adequate amount of clean stone, silt fencing, 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.

4.6.9.2 Pre-emptive Site Drainage Management

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

4.6.9.3 Reactive Site Drainage Management

The final drainage design prepared for the Proposed Development prior to commencement of construction will have to 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 Proposed Development 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.

4.6.10 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. 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 Proposed Development 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 with sediment cleaned out of the silt trap as necessary and on a regular basis.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the Proposed Development. Weekly inspections during the construction phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

4.7 Construction Management

4.7.1 Construction Timing

It is estimated that the construction phase including civil, electrical, grid works and turbine assembly will take approximately 12 to 18 months.

Pre-commencement surveys will be undertaken by a qualified ornithologist prior to the initiation of works at the proposed wind farm site. The survey will include a thorough walkover survey to a 500m radius of the development footprint and/or all works areas, where access allows. If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located, and earmarked for monitoring at the beginning of the first winter or breeding season of the construction phase. If it is found to be active during the construction phase no works shall be undertaken within a disturbance buffer in line with industry best practice as outlined below:

- In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 350m radius of the lapwing breeding territories.
- In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 500m radius of the barn owl breeding site.
- No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied.

The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Any required removal of vegetation will be undertaken following inspection by a suitable qualify ornithologist to ensure no nesting birds are affected. This is further detailed in Section 7.10.1 in Chapter 7 of this EIAR.

4.7.2 Construction Sequencing

The construction phase can be broken down into three main phases, 1) civil engineering works, 2) electrical works and 3) turbine erection and commissioning. The main task items under each phase are outlined below.

Civil Engineering Works

- Clear and hardcore area for temporary construction compound. Install same.
- Construct new site roads and hard-standings and crane pads.
- Construct drainage ditches, culverts etc. integral to road construction.
- Construct substation building and groundworks for the substation compound.
- Excavate for turbine bases where required. Store soil/peat locally for backfilling and re-use. 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.
- Excavate trenches for the grid connection lay ducts and backfill.
- Construct bases/plinths for transformer.
- Erect fencing at transformer compound.

Electrical Works

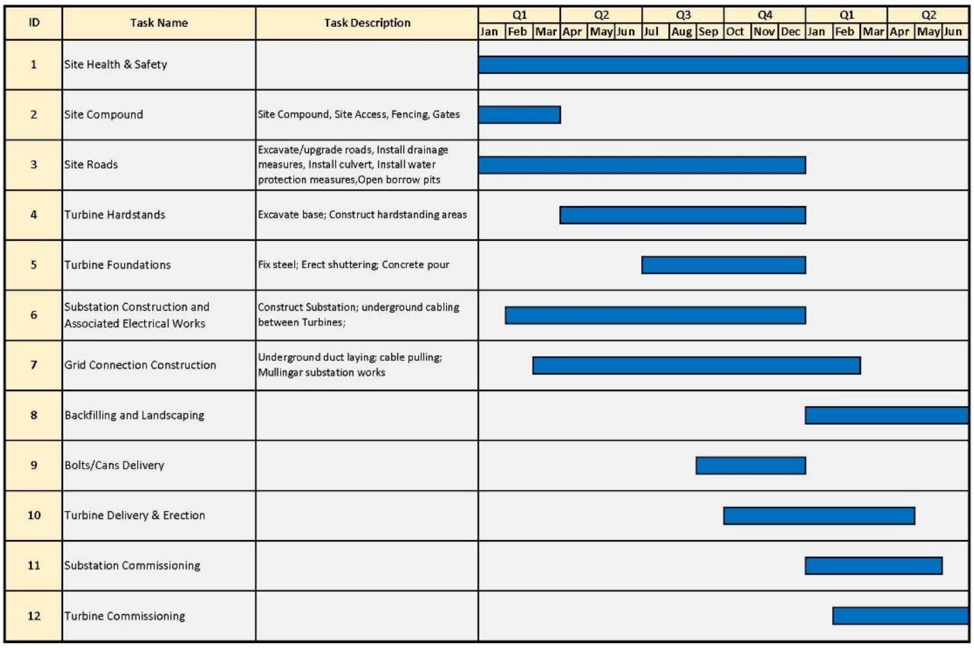
- Excavate trenches for site cables, lay cables and backfill. Provide joint bays at road crossings.
- Erect external electrical equipment at substation
- Erect transformers at compound.
- Pull cables between onsite substation and Mullingar substation where upgrade works are proposed
- Erect external electrical equipment at onsite substation and Mullingar substation where upgrade works are proposed
- Install control equipment in the proposed onsite substation building

Turbine Erection and Commissioning

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

The phasing and scheduling of the main construction task items are outlined in Figure 4-22 below, where 1st January has been selected as an arbitrary start date for construction activities.

Figure 4-22 Indicative Construction Schedule



4.7.3 Construction Phase Monitoring and Oversight

The requirement for a CEMP to be prepared in advance of any construction works commencing on any wind farm site and submitted for agreement to the Planning Authority is now well-established. The proposed procedures for the implementation of the mitigation measures outlined in such a CEMP and their effectiveness and completion is typically audited by way of a Construction and Environmental Management Plan Audit Report. The CEMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation, all conditions attached to the grant of planning permission and any further mitigation measures proposed during the detailed design stage, 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 4-8 of this EIAR. The CEMP includes details of drainage, peat and overburden management, waste management etc, and gives examples of how the above-mentioned Audit Report will function and be presented. It is intended that the CEMP would be updated prior to the commencement of the Proposed Development, to include all mitigations measures, conditions and or alterations to the EIAR and application documents that may emerge during the course of the planning process, and would be submitted to the Planning Authority for written approval.

The on-site construction staff will be responsible for implementing the mitigation measures specified in the EIAR and compiled in the Audit Report. Their implementation will be overseen by the ECoW or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. The system of auditing referred to above ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary.

4.8 Construction Methodologies

4.8.1 Turbine Foundations

Foundations for wind turbines may be of the gravity, rock anchored and piled type. Trial pitting and/or windrow sampling has been carried out at each of the turbine base locations. Based on the geotechnical investigations to date, 13 of the 15 No. proposed turbine foundation at the site will likely require a piled foundation. Piling depths will depend on site conditions. These will be established by detailed post-consent geotechnical investigations. The exact dimensions and types of foundations will be determined by pre-construction structural design calculations incorporating appropriate factors of safety.

Each of the turbines to be erected on site will have a reinforced concrete base. Where piling is not required, overburden will be stripped off the foundation area to a suitable formation using a 360° excavator, and will be placed across the site as close to the excavation as practical. A five-metre-wide working area will be required around each turbine base, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be 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. In the case of gravity foundations, 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 hardcore material and or lean mix concrete, compacted in 250 millimetres (mm) layers, with sufficient compacted effort (i.e. compacted with seven passes using 12 tonne roller). Drainage measures will be installed to protect the formation by forming an interceptor drain around the perimeter of the base which will outfall out at the lowest point level spreader or settlement pond.

In the case of piled foundations the piling of typically 30-50 concrete piles to the required depth will be carried out. The piles will most likely be constructed by coring and inserting a steel sleeve which will be filled with reinforced concrete prior to sleeve removal.

An embankment approximately 600 mm high will be constructed around the perimeter of each turbine base where required and a fence or berm will be erected to prevent construction traffic from driving into the demarcated working area. All necessary health and safety signage will be erected to warn of works etc.

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

A 360º excavator with suitable approved lifting equipment will be used to unload reinforcing steel to required areas. The bottom matt of steel will be fixed prior to the tower cans, if used, being lifted into position. Steel cans, if used, will be lifted into position using a crane and approved lifting appliances and reinforcing steel will be positioned around cans in accordance with the turbine suppliers' requirements. The can will be levelled using the jacks at the base of the can. The top flange of the can will be checked to ensure it is level using a dumpy level. The remaining reinforcing steel will then be fixed and earthing material attached. The level of can 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. After a period of time when the concrete has set sufficiently the top surface of the concrete surface is to be finished with a power float.

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

4.8.2 Site Roads and Hardstands Areas

Site roads will be constructed to each turbine base and at each base a crane hard standing will be constructed to the turbine manufacturer's specifications.

Construction methodologies for the construction of new floating road, and upgrading of existing excavated tracks are described in Section 4.3.7 above.

Where roads and hardstands are to be excavated, tracked excavators will carry out excavation for roads with appropriate equipment attached. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. Any surplus excavated material will be spread as close to the excavation areas as practical as set out in the Peat and Spoil Management Plan, Appendix 4-2. 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.

When the formation layer has been reached, stone from the 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 Proposed Development.

4.8.3 Proposed Water Crossing

It is proposed to replace the existing timber bridge over the River Glore within the proposed wind farm site with a 5-metre clear span bridge. The existing bridge crossing is shown in Plate 4-8 below. The proposed bridge crossing will form part of the internal site road network, connecting Turbines T5-T12 to Turbines T1-T4. The crossing location is at Grid Reference E 641,560 N 776,452, as shown in Figure 4-23 and the design avoids the need for in-stream works.

Plate 4-8 Existing timber bridge crossing on River Glore, proposed to be replaced

A second crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge as shown on Figure 4-24 which shows the typical clear span bridge design.

A third crossing will be required to provide access to Turbine T15 over the River Glore. This will require a 5-metre clear span bridge as shown in Figure 4-25 which shows the typical clear span bridge design. The clear span bridge's will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

The typical construction methodology for the installation of clear span bridges is presented below:

- The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ

using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the north or opposite side of the river for excavation and foundation installation will require the installation of pre-cast concrete slab across the river to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams will be installed using a crane which will be set up on the southern side of the stream and will be lifted into place from the stream back with no contact with the watercourse.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.

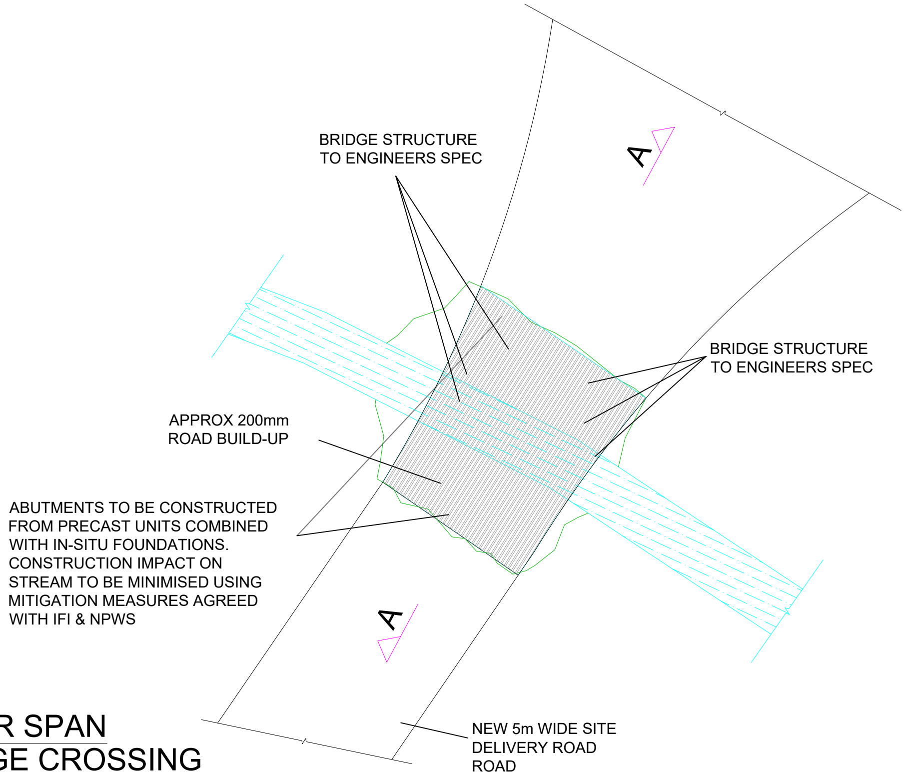
4.8.4 On-site Electricity Substation and Control Building

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

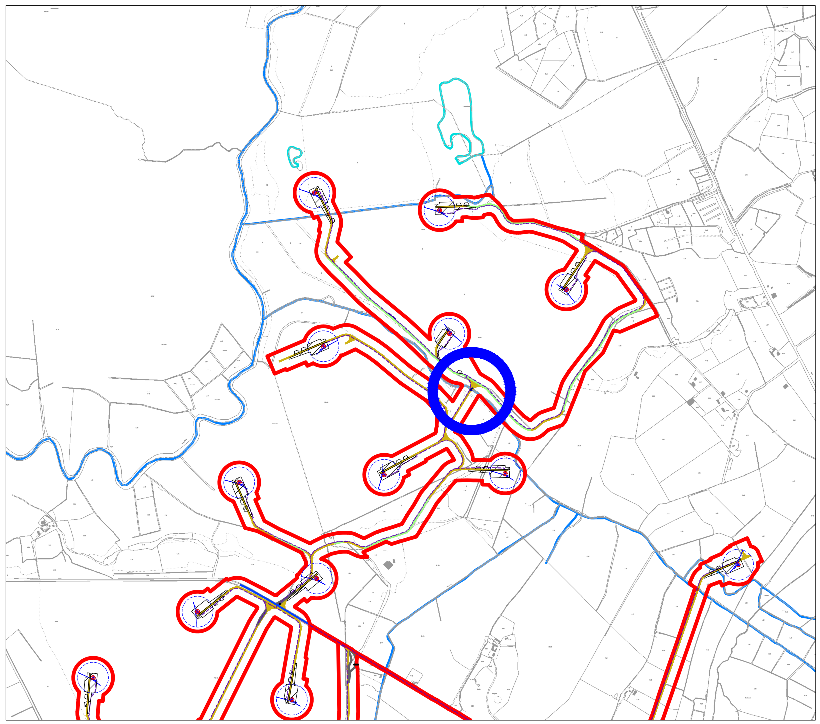
- Following felling, the area of the substation will be marked out using ranging rods or wooden posts and the soil stripped and removed to the nearby storage area for later use in landscaping. No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises;
- The dimensions of the substation area will be set to meet the requirements of the ESB/EirGrid and the necessary equipment to safely and efficiently operate the wind farm;
- The wind farm control building and IPP building will also be built within the substation compound;
- It is anticipated that the foundations will be piled. The piles will most likely be constructed by coring and inserting a steel sleeve which will be filled with reinforced concrete prior to sleeve removal;
- The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather;
- The electrical equipment will be installed and commissioned;
- Perimeter fencing will be erected; and
- The construction and components of the substation have been designed to ESB/Eirgrid specifications.

4.8.5 Proposed Upgrade Works at Existing Substation

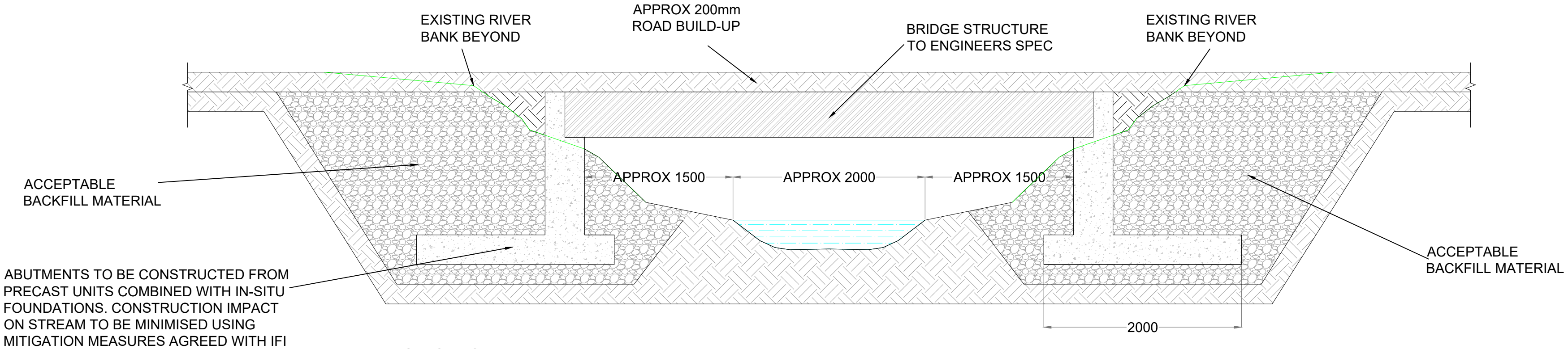
IONIC Consulting Engineers were commissioned to complete the typical design of the grid connection cable trenches and proposed cable connection to the existing Mullingar substation. The typical design drawings are included as Appendix 4-3 to this EIAR. The upgrade works proposed at the existing Mullingar substation will consist of the construction of an additional dedicated bay to facilitate the connection of the cable which will comprise of extension equipment shown in drawing d006.1.2 in Appendix 4-3. This infrastructure will comprise of concrete plinths and modular prefabricated equipment which will be assembled and installed onsite. Three potential connection points were identified for this connection in consultation with ESB and EirGrid and are shown in the detailed site layout drawings in Appendix 4-1 and in Appendix 4-3, with the exact location to be identified at detail design stage.



CLEAR SPAN
BRIDGE CROSSING
PLAN
Scale 1:200



1:25,000 Location on Context Map



SECTION A-A Scale 1:50

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Figure 4-23

DRAWING TITLE:
Typical Clear Span Bridge (Crossing 1)

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 55**
SCALE: **As Shown @A3**	DATE: **26.02.2021**

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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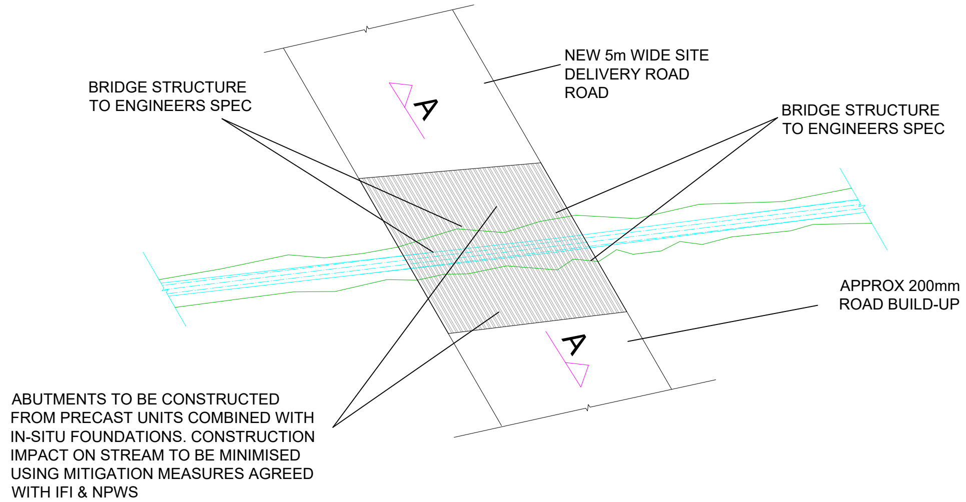
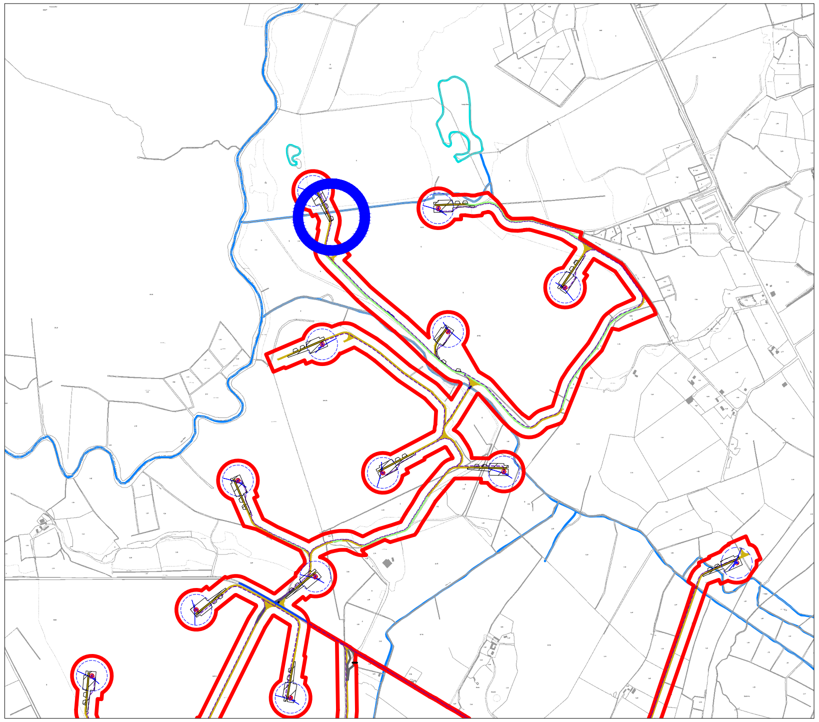
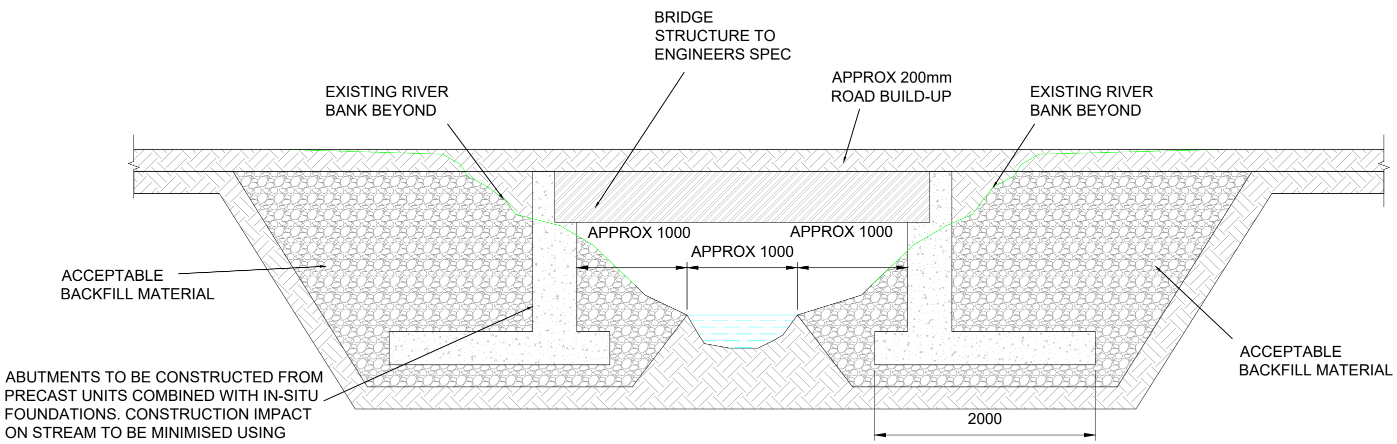


CLEAR SPAN BRIDGE CROSSING PLAN

Scale 1:200



1:25,000 Location on Context Map



SECTION A-A

Scale 1:50

N

Figure 4-24

DRAWING TITLE:

Typical Clear Span Bridge (Crossing 2)

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 56
SCALE: As Shown @A3	DATE: 26.02.2021

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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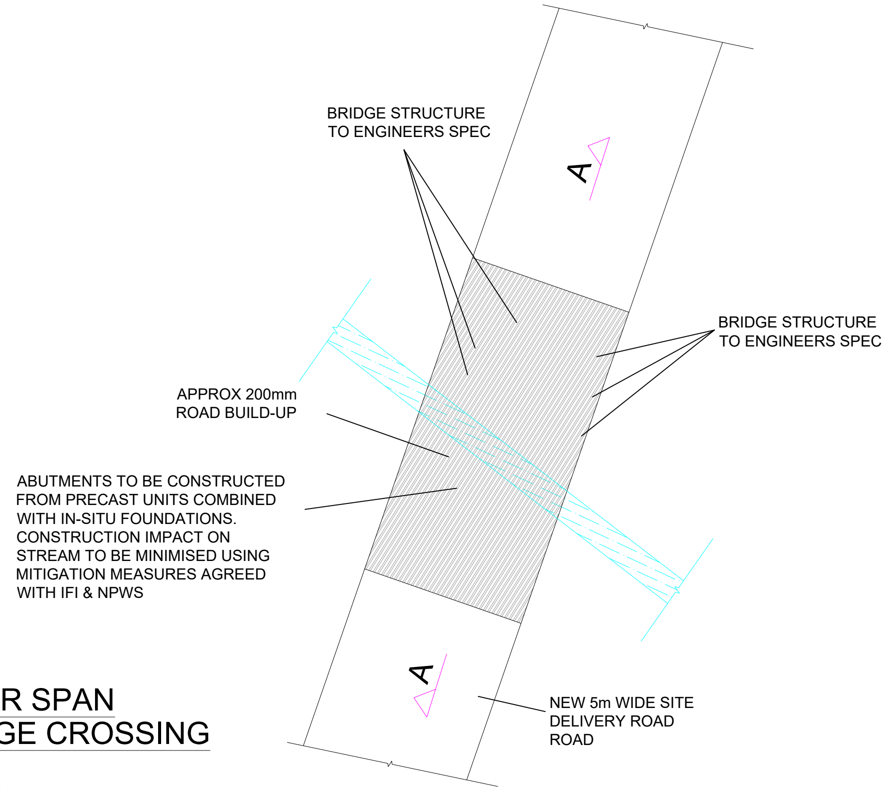
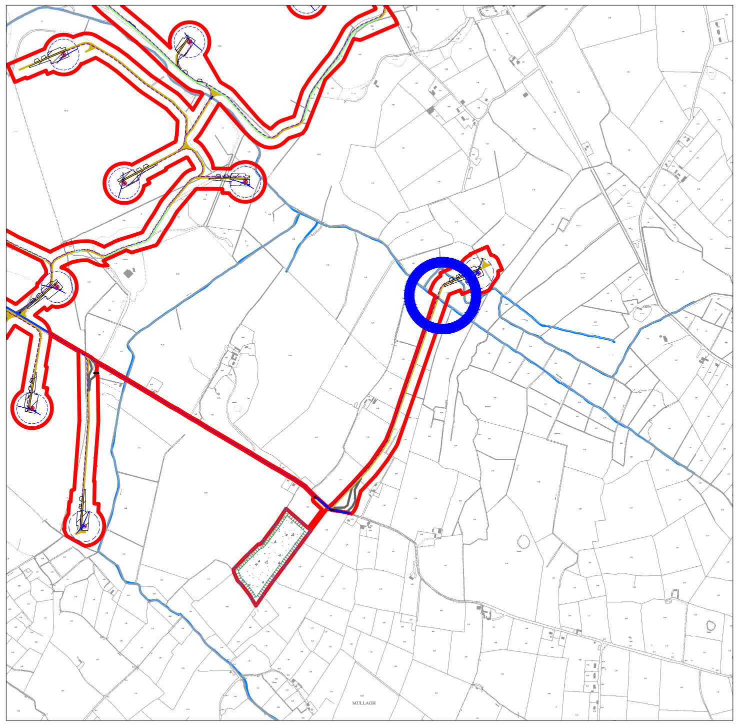
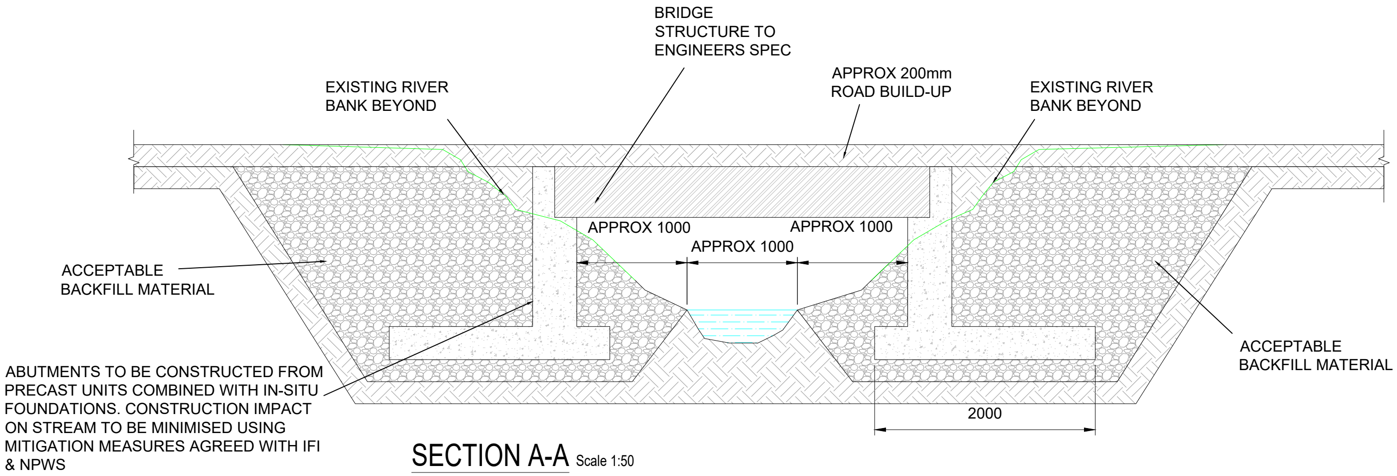


CLEAR SPAN BRIDGE CROSSING PLAN
Scale 1:200



1:25,000 Location on Context Map



SECTION A-A Scale 1:50

N

Figure 4-25

DRAWING TITLE:
Typical Clear Span Bridge (Crossing 3)

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 57**
SCALE: **As Shown @A3**	DATE: **26.02.2021**

OS SHEET No.: 2236, 2237, 2238, 2239, 2300, 2301,2302, 2303, 2363, 2364, 2365, 2366, 2425, 2426, 2427, 2428, 2493, 2494, 2495, 2496, 2562, 2563, 2564, 2565, 2629, 2630, 2631, 2632, 2699, 2700, 2701, 2702,2768, 2769, 2770, 2771

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4.8.6 Temporary Construction Compound

The temporary construction compound 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; and,
- Upon completion of the project the temporary construction compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required.

4.8.7 Grid Connection Cable Trench

Underground electrical cables will connect the proposed wind turbines to the proposed onsite substation. From here, the proposed wind farm will connect to the national grid via an underground cable connection between the site and the existing Mullingar 110 kV substation. The grid connection route follows the public road network, as described in Section 4.3.13 above. The exact location of the cable within the road curtilage will be subject to ESB/Eirgrid specifications and agreement with Westmeath County Council.

IONIC Consulting Engineers were commissioned to complete the design of the grid connection cable trenches which are detailed below and presented in Appendix 4-3.

The specifications for cables and cable installation will be in accordance with Eirgrid/ESB requirements. Appendix 4-10 presents the Eirgrid Standard Specification for Ducting/Cabling.

What is provided below are the grid connection methodologies for:

- Cable Trench Installation in non-peatland environments
- Cable Trench Installation through peatland
    - Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)
    - Trench Type B (Through Floating Road Trench in Verge with >2.5m to base of peat)
    - Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)
    - Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)
    - Trench Type E1 (Through Floating Grid Route Track with >2.5m to base of peat)
    - Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)

4.8.7.1 Typical Cable Trench Installation in Non-Peatland Environments

The underground cable required to facilitate grid connection will be laid beneath the surface of the site and/or public road using the following typical methodology:

- The area where excavations are planned will be surveyed, prior to the commencement of works, to identify all existing underground services.

- Two teams consisting of tracked excavators, dumpers and a tractor and stone cart with side-shoot or similar will dig the trench and lay approximately 300m of the underground cable ducting per day.
- One team will start at one end of the grid route with the other team starting approximately half way along the grid connection route. Both teams will be constructing in the same direction maintaining a distance between the teams of approx. 13km. .
- The excavators will open a trench at the edge of the road surface, the trench will be a maximum of approximately 600mm wide and 1,250mm deep.
- The excavated material will be loaded into the dumpers to be transported to a designated temporary stockpiling area to be reused as backfilling material where appropriate.
- Clay plugs will be installed at 50m intervals to prevent the trench becoming a conduit for surface water runoff.
- Once the trench has been excavated, a level 65mm blinding layer with semi-dry lean-mix concrete will be placed at the base of the trench;
- The cable trefoil 160mm HDPE power ducts will be placed in the trench and tied at 3m intervals to keep the trefoil formation;
- Lean-mix concrete (CBM4 or similar) will be compacted around the ducts and to 75mm above the top trefoil duct where a red cable marker strip will be placed;
- Two 125mm HPDE comms cable ducts will be laid, spaced a clear 200mm apart using appropriate spacers;
- Lean-mix concrete (CBM4 or similar) will be compacted around the ducts and to 75mm above the comms duct where a red cable marker strip will be placed
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- The trench will be surfaced as per the road surface specifications of the national, regional or local public road.
- Cable joint pits will be located at approximately 500m intervals or as otherwise required by ESB/Eirgrid requirements along the proposed cable route, each joint pit will be approximately 2.5m x 6m in size and contain a communications chamber, an earth link box and a cable joint bay, all of which will be located in the road edge and accessible for cable pulling and future maintenance.

4.8.7.2 Cable Trench Installation through peatland

The following are a list of typical general requirements for the ducting work in peat:

- The ducting shall be placed in the trench as per the specific cable design drawings to ESB / Eirgrid specifications, generally following the sequence outlined below.
- Appropriate traffic management would be implemented on site. This will involve road closures.
- Suitable drainage and environmental mitigation measures would be established along the section of road.
- Detailed method statement regarding the ducting works will be provided by the contractor.
- An assessment of all areas of natural drainage from the area of works will be carried out, and measures put in place to prevent any material draining from the trenching works into adjacent drainage ditches or streams.
- Spill kits shall be available during trenching. A spill mat will be used by the fuel tanker while refuelling.
- Following the trench excavation, ducts will generally be installed and surrounded with concrete. The placement of the concrete will be controlled in such a manner as to prevent any concrete entering adjacent drainage ditches or streams.
- Upon completion of trenching works the site shall be cleaned and any waste will be disposed of at a licenced facility.

- Note that monitoring of floating road settlement may be required before, during and after construction to ensure the stability of the trench and the floating road.
- Where the road surface is to be sealed, a suitable road surfacing build-up/reinforcement will be agreed with the road authorities.
- Where the depth of the peat is greater than 2.5m, generally roads and grid route infrastructure would be constructed at the surface of the existing road or verge, in order to limit excavation of the underlying peat for the trench.

4.8.7.2.1 Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.1 in Appendix 4-3

- Existing road build-up will be planed off/excavated as required.
- The trench will be excavated within the road build-up.
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

4.8.7.2.2 Trench Type B (Through Floating Road Trench in Verge with >2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.2 in Appendix 4-3:

- Existing road build-up and verge will be planed off/excavated as required.
- The trench will be excavated within the verge.
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.

- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install a two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

4.8.7.2.3 Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.3 in Appendix 4-3:

- Existing verge will be excavated to the trench width.
- The lower section of the excavation, beneath the trench, will be filled with CBM or similar to support the trench. Note, provision will be made within this lower section to ensure continuity of groundwater flow underneath the trench (e.g. intermittent sections with permeable stone surrounded with a geotextile and/or sections of pipe).
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Layer the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

4.8.7.2.4 Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.4 in Appendix 4-3:

- Existing road build-up and verge will be planed off/excavated as required.
- The trench will be excavated within the verge.
- The lower section of the excavation, beneath the trench, will be filled with CBM or similar to support the trench. Note, provision will be made within this lower section to ensure continuity of groundwater flow underneath the trench (e.g. intermittent sections with permeable stone surrounded with a geotextile and/or sections of pipe).
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation. A layer of brash or timber logs may be required on the verge side beneath the geogrid layer.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities.
- Reinstate the road verges and any grassed areas or berms.

4.8.7.2.5 Trench Type E1 (Through Floating Grid Route Track with >2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.5 in Appendix 4-3:

- Fell trees within the construction corridor.
- Where required, turn the tree stumps over to create a starting platform for the access track and/or lay a layer of brash or timber logs.
- Lay the combigrid and construct the lower section of the road to act as a construction access track. Install drainage crossings along the route as it progresses (usually corrugated pipes slung down beneath the road into the existing drains or incorporated into the road itself).
- The trench will be excavated within the track build-up.

- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable ducts, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface. An additional geogrid layer may be required in the upper section of the road.
- A layer of Cl 804 material or similar will form part of the final access track running surface.
- Install any reflective posts or fencing and cable identification marker posts.

4.8.7.2.6 Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.6 in Appendix 4-3:

- Fell trees within the construction corridor.
- Peat would be excavated to subgrade, with stone placed to build up the lower sections of the road.
- Install drainage crossings along the route as it progresses (usually corrugated pipes incorporated into the road build up).
- Lay a layer of combigrid and construct the lower section of the road to act as a construction access track.
- The trench would be excavated within the track build-up.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Layer the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface. An additional geogrid layer may be required in the upper section of the road.
- A layer of Cl 804 material or similar will form part of the final access track running surface.
- Install any reflective posts or fencing and cable identification marker posts.

4.8.7.3 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.

4.8.7.4 Joint Bays

Joint bays are pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They will be located at various points along the ducting route at approximately 500-metre intervals or as otherwise specified by ESB requirements.

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

Joint bays will not be installed on peat where possible and their proposed locations have been shown indicatively in Appendix 4-1 and in Appendix 4-8.

A detailed site investigation will determine the specific ground conditions at a joint bay locations prior to detailed design stage. Where a relatively shallow depth of peat will remain beneath the underside of the joint bay, this peat would be excavated and replaced with stone upfill (e.g. 6N or similar) to construct a suitable formation for the joint bay boxes. At some joint bay locations, it may be preferable to place concrete or CBM instead of engineering fill, e.g. if there are space constraints and the construction footprint is to be minimised.

While not envisaged at any locations at this stage, if there are areas of deep peat at a joint bay location it may be necessary to install a piled platform in order to support the joint bay and the ancillary boxes. The piles would most likely be precast driven or in-situ bored concrete piles, with an in-situ reinforcement concrete pile cap to support the joint bay structures.

4.8.7.5 Grid Connection Watercourse/Culvert Crossings and Irish Rail Level Crossing

There is a total of 16 no. watercourse crossings along the public road section of the proposed grid connection, the locations of which are shown in Figure 4-26. There are 7 no. river/stream crossings (Locations No. 2, 3, 4, 10, 14, 15 & 16), with the remaining crossings being classified as culverts.

The proposed grid connection route will traverse one Irish Rail level crossing in the townlands of Farranistick and Culleen More adjacent to water course crossing No 16, see drawing 200445 – 37 in Appendix 4-1. The proposed methodologies for the provision of the grid connection at this railway crossing is shown in drawing COLE d005.51 in Appendix 4-3. Any such works traversing a rail line requires a license agreement to be put in place between the developer and Córas Iompair Éireann

(CIE) prior to construction. The Developer will put this licence in place in consultation with Córas Iompair Éireann prior to construction.

The proposed methodologies for the provision of the grid connection at these locations is set out in Table 4-5 below, which provides a summary of the watercourse crossing/culvert survey and description of works for all crossings. Should an alternative methodology option be required for individual crossings during the construction process this will be agreed with the relevant authorities including Westmeath County Council prior to works commencing. A description of each crossing option is provided below. Instream works are not required at any watercourse crossing along the proposed grid connection.

There are an additional 2 watercourse crossings (denoted as 0.1 and 0.2), classified as drains, that are located within the wind farm site, see Drawing 200445 – 18 in Appendix 4-1. They will be crossed using Option 1 of the watercourse crossing methodologies outlined below, along with any other drains in the wider area. The below methodologies are shown on the detailed layout drawings included in Appendix 4-1

4.8.7.5.1 Crossings over Culverts– Option 1

The watercourse at any of the crossings will not be disturbed because no instream works or bridge/culvert alterations are proposed. Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where adequate cover exists above a culvert, the ESB/Eirgrid specified flat formation ducting arrangement will be used where the cable ducts pass over a culvert maintaining 300mm minimum clearance to the top of the culvert . A heavy duty steel plate will be placed over the ducts as distance between the road surface and the ducts will have been reduced. See Figure 4-27.

4.8.7.5.2 Crossing under Piped Culverts– Option 2

Where adequate cover does not exist between the top of the culvert and the finished surface of the road the cable ducts will be passed under the culvert as outlined in Figure 4-28. A 300mm minimum separation distance will be maintained between the top of the ducts and the bottom of the piped culvert. A heavy duty steel plate will be placed above the ducting extending for 1m at either side of the culvert.

4.8.7.5.3 Flatbed Formation over Culverts – Option 3

Where cable ducts are to be installed over an existing culvert where sufficient cover cannot be achieved to install the ducts as per option 1, the ducts will be laid in a shallow trench the depth of which will be determined by the location of the top of the culvert. The ducts will be laid in this trench in a flatbed formation over the existing culvert and will be incased in 6mm thick steel galvanized plate with a 30N concrete surround as per ESB/Eirgrid specification. This method of duct installation is further detailed in Figure 4-29.

4.8.7.5.4 Outside of Bridge Decking – Option 4

Where sufficient cover and road width isn't available to place the ducting in the bridge decking, the cable can be placed in a stainless steel conduit with a minimum wall thickness of 4mm secured to the outside of the bridge deck supported by cleats at 1m intervals as per ESB/Eirgrid specifications. This method of crossing a bridge structure is detailed in Figure 4-30

4.8.7.5.5 Directional Drilling – Option 5

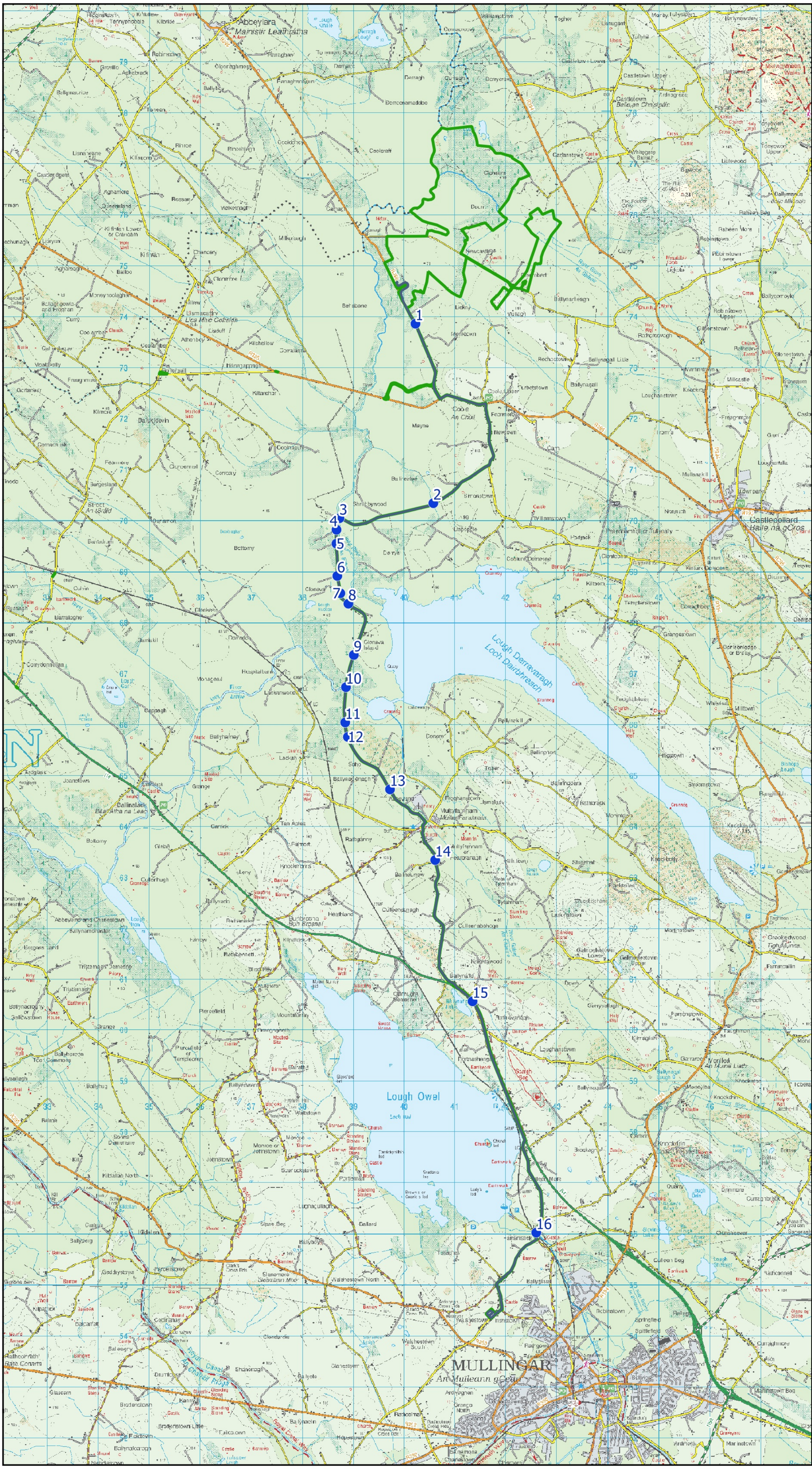
In the event that none of the above methods are appropriate, directional drilling will be utilised. The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional

Drill (approximately 22 tonnes) or similar. The launch and reception pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any potential adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved disposal site.

Backfilling of launch and reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 4-31.



Map Legend

- EIAR Site Boundary
- Grid Connection Route Watercourse Crossing Locations
- Proposed Grid Connection Route

Drawing Title	
Grid Connection Route Watercourse Crossing Locations	
Project Title	
Coole Wind Farm, Co. Westmeath	
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 4-26
Scale: 1:100000	Date: 11/02/2021

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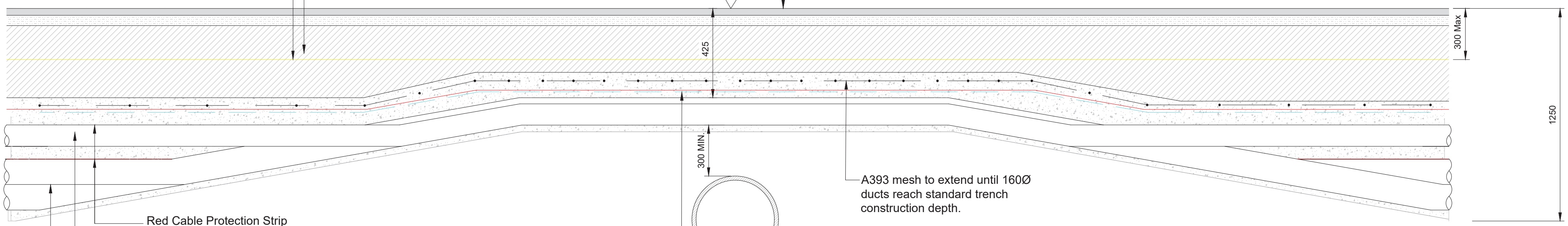

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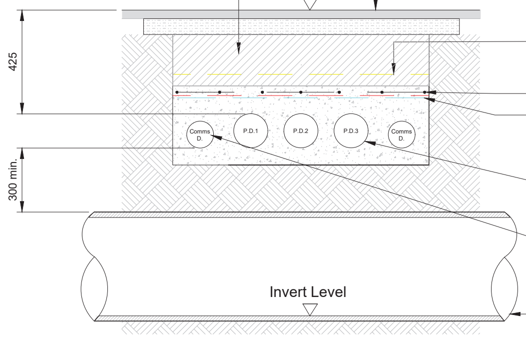

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Figure 4-27

Option 1 - Crossing over Culvert

NOTES

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CLIENT

PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: WATER CROSSINGS TYPICAL DETAIL - OVER

REVISION: A

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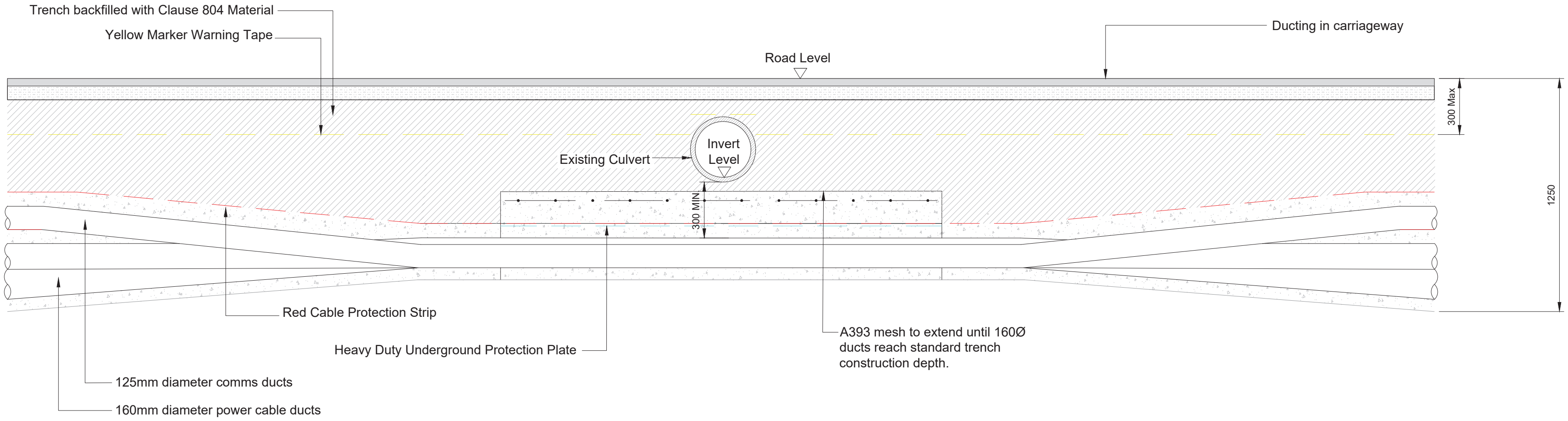

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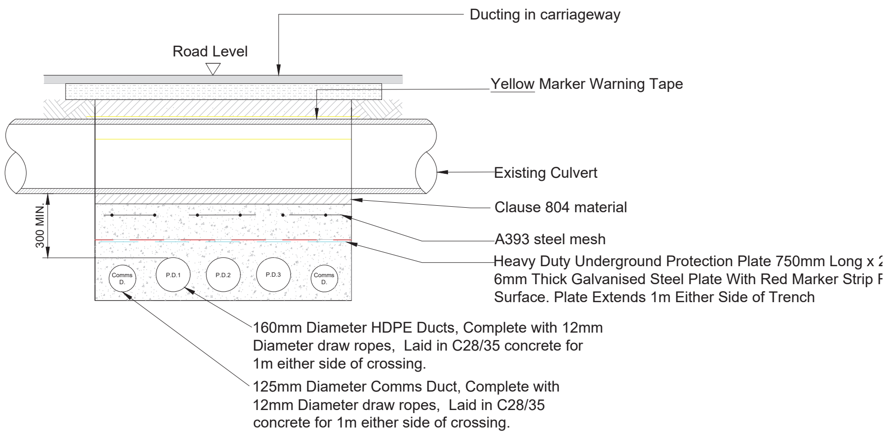

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Figure 4-28

Option 2 - Crossing under Piped Culvert

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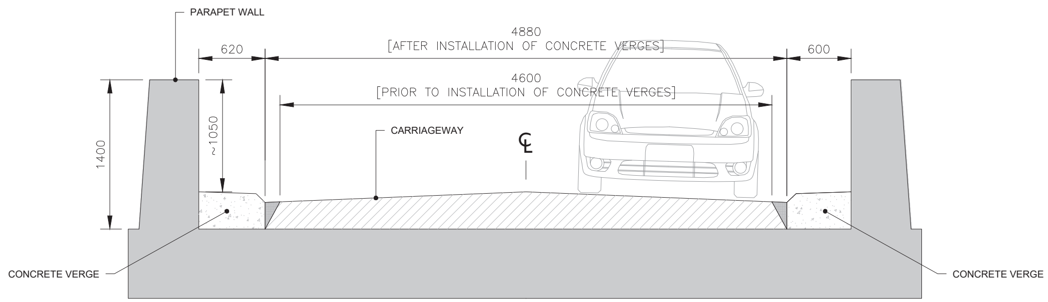

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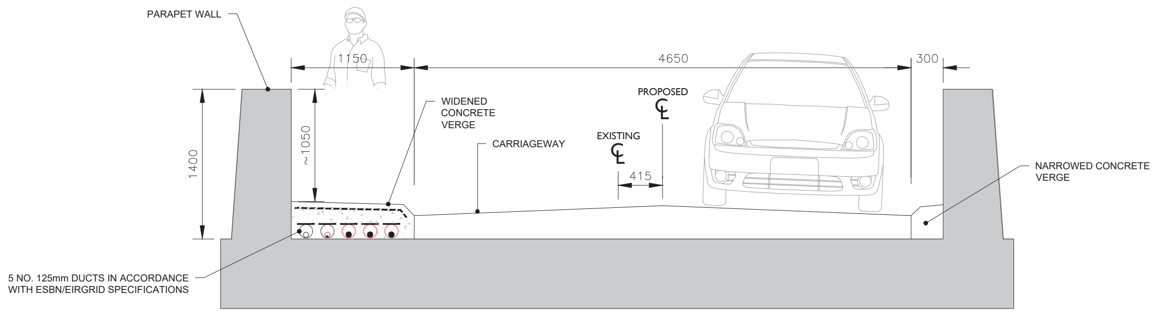

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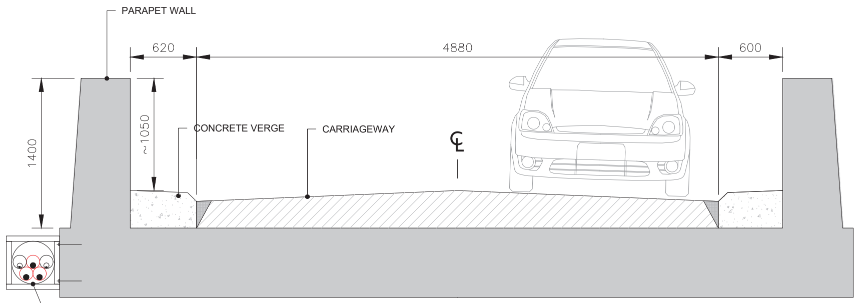

SECTION: OPTION B

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Figure 4-29

Option 3 - Flatbed Formation over Culverts

NOTES

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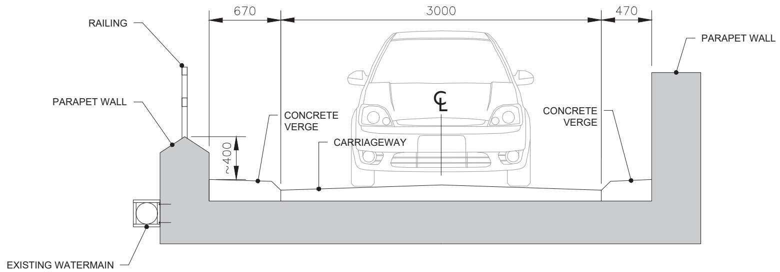

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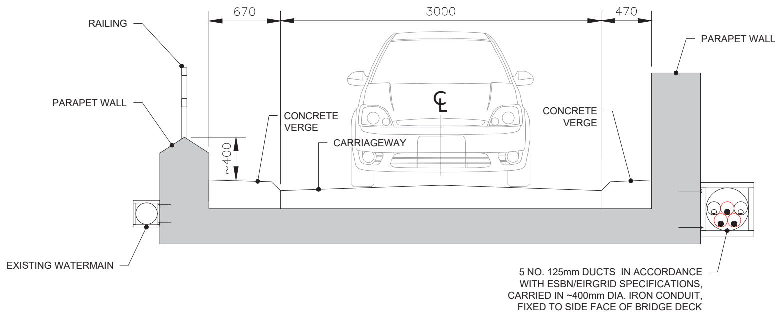

SECTION: OPTION A

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Figure 4-30

Option 4 - Outside of Bridge Decking

NOTES

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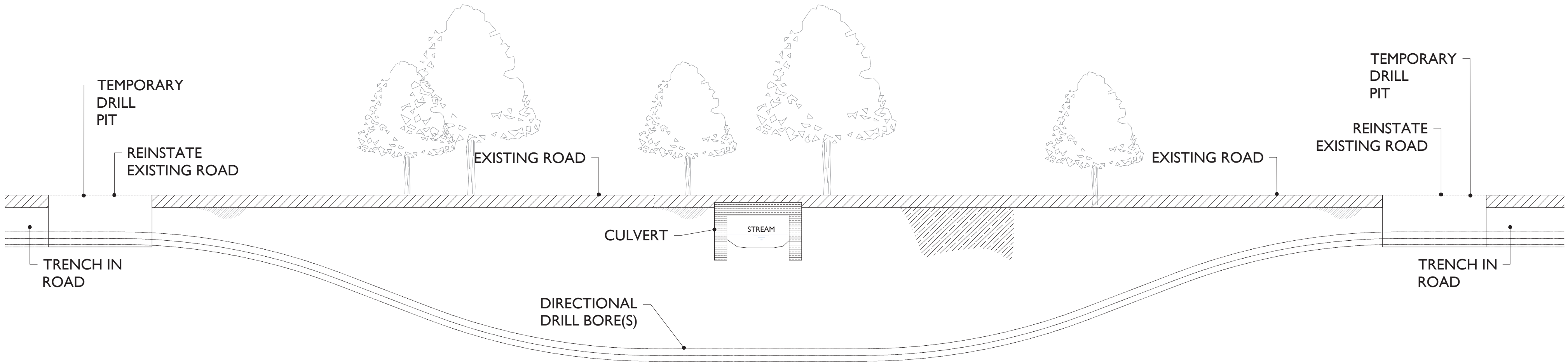

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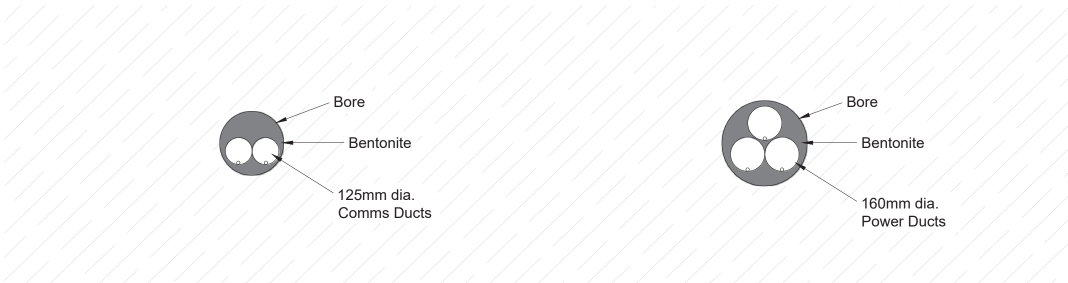

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NOTE: No. and diameter of bores to be confirmed at detailed design.

Figure 4-31

Option 5 - Directional Drilling

NOTES

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Table 4-5 Grid Connection Watercourse Crossings

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
1	1500 x 3000mm high stone bridge	600mm	n/a (5100mm where directional drilling required)	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to lay the cable ducts in a flatbed formation in a shallow trench in the deck of the bridge. Alternatively if the structure of the bridge deck cannot accommodate a trench of any depth, the cable ducts will be installed under the watercourse by means of directional drilling. Either option will ensure that no contact will be made with the watercourse during the works.	Option 3 or 5	None. No in-stream works required.
2	900mm Ø concrete pipe.	1100mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
3	18m long X 6m high concrete bridge	900mm	n/a (8500mm where directional drilling required)	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to place the cables in a stainless steel ducts secured to the outside deck of the bridge. Alternatively, the cable ducts will be installed under the watercourse by means of directional drilling. Either option will ensure that no contact will be made with the watercourse during the works.	Option 4 or 5	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
4	Pipe outlet not visible	1200mm. est.	n/a	No in-stream works required at this culvert crossing. It is assumed the culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid.. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
5	900mm Ø concrete pipe.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
6	600mm Ø concrete pipe.	1800mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
7	600mm Ø concrete pipe.	1300mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
8	2 no. 300mm Ø concrete pipes.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
9	600mm Ø concrete pipe.	800mm.	1900mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
10	80m long x 5m high concrete bridge	900mm	n/a (7500mm where directional drilling required)	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to lay the cable ducts in a flatbed formation in a shallow trench in the deck of the bridge or else place the cables in a stainless steel duct secured to the outside deck of the bridge. Alternatively, if the structure of the bridge deck cannot accommodate either option above, the cable ducts will be installed under the watercourse by means of directional drilling. All options will ensure that no contact will be made with the watercourse during the works.	Option 3, 4 or 5	None. No in-stream works required.
11	600mm Ø concrete pipe.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
12	500mm Ø concrete pipe.	1000mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
13	1000mm Ø concrete pipe.	600mm	2100mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
14	3500 x 1200mm high concrete bridge	500mm	n/a	No in-stream works required at this culvert crossing. It is proposed to construct the ducts in a flatbed formation over the culvert. Therefore, no contact will be made with the stream during the works.	Option 3	None. No in-stream works required.
15	1000mm Ø concrete pipe.	300-500mm est.	2000mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
16	3000 x 1500mm high stone bridge	300mm	3300mm	Due to the lack of cover over the existing stone bridge and its proximity to the railway level crossing, the cable will be installed under this culvert by means of directional drilling which will ensure that no contact will be made with the stream during the works.	Option 5	None. No in-stream works required.

4.8.8 Link Road, Junction Accommodation and Public Road Works

As described in Section 4.3.17 above, improvements and modifications to the existing public road network to facilitate turbine delivery will be required as part of the Proposed Development works. This will include construction of a link road between the R395 and R396 Regional Roads and junction improvement works, including providing hardsurfacing at eleven locations; along the public road corridor at: the N4 junction with the L1927 in the townland of Joanstown, clearing of existing verge and vegetation before the railway line level crossing on the L1927, hardsurfacing and widening of the L1927 and L5828 junction in the townland of Boherquill, clearing of existing verge and vegetation at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points contained within the proposed wind farm site at junctions along the L5755.

The proposed link road between the R395 and R396 measures approximately 1.2 kilometres in length with a running width of approximately 5m. The road will traverse areas of cutover peat and improved agricultural grassland. The construction methodology for the link road is summarised as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The accommodation works when not in use during the construction phase will be cordoned off from the public road, using bollards/fencing as required.
- Upon completion of the turbine delivery phase of the proposed wind farm the granular fill and final surface running layer will be left in situ, within the works areas.
- A barrier/ gate will be put in place at the entrance to the link road and a gate will be installed at the exit. An existing stone wall at the exit will be reinstated either side of the gate.
- Gates/barriers will be left in situ post construction to prevent access.

Leaving the granular fill and final surface running layer in place within the link road will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase).

The minor junction improvement works proposed and detailed in Section 4.3.1.7 will involve similar methodologies and sequencing of works as detailed in Section 3.1.1.15 of the CEMP in Appendix 4-8. The works will require clearing back the existing road verge and field vegetation at the junctions, and excavation of material to allow the placing of stone/hard surfacing within the proposed areas. A series of removable bollards and/or temporary fencing will be placed along the existing road edge in order to preserve the structure of the junctions outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the areas and boundaries will be reinstated restoring the junctions to their original configurations.

Further details on the construction methodologies are presented in the CEMP provided as Appendix 4-8 to this EIAR. A Method Statement for the junction improvement works along the turbine delivery route is included in Appendix 4-8 CEMP. All accommodation and link road works will be the subject of a method statement and traffic management plan prepared by the appointed contractor with the approval of Westmeath County Council, prior to the commencement of construction works.

4.9 Operation

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

The wind turbines will be connected 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.

4.10 Maintenance

Each turbine will be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically, maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substation 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.

4.10.1 Monitoring

Section 9 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 of water quality 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.

4.11 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 wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully. The substation will remain in place as it will be under the ownership of ESB/EirGrid.

Upon decommissioning of the Proposed Development, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration.

Site roadways could be in use for purposes other than the operation of the wind farm 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. 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 underground 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 4-11) 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 agreed with the competent authority at that time. 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".