APPENDIX 2

EIAR DESCRIPTION CHAPTER

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.

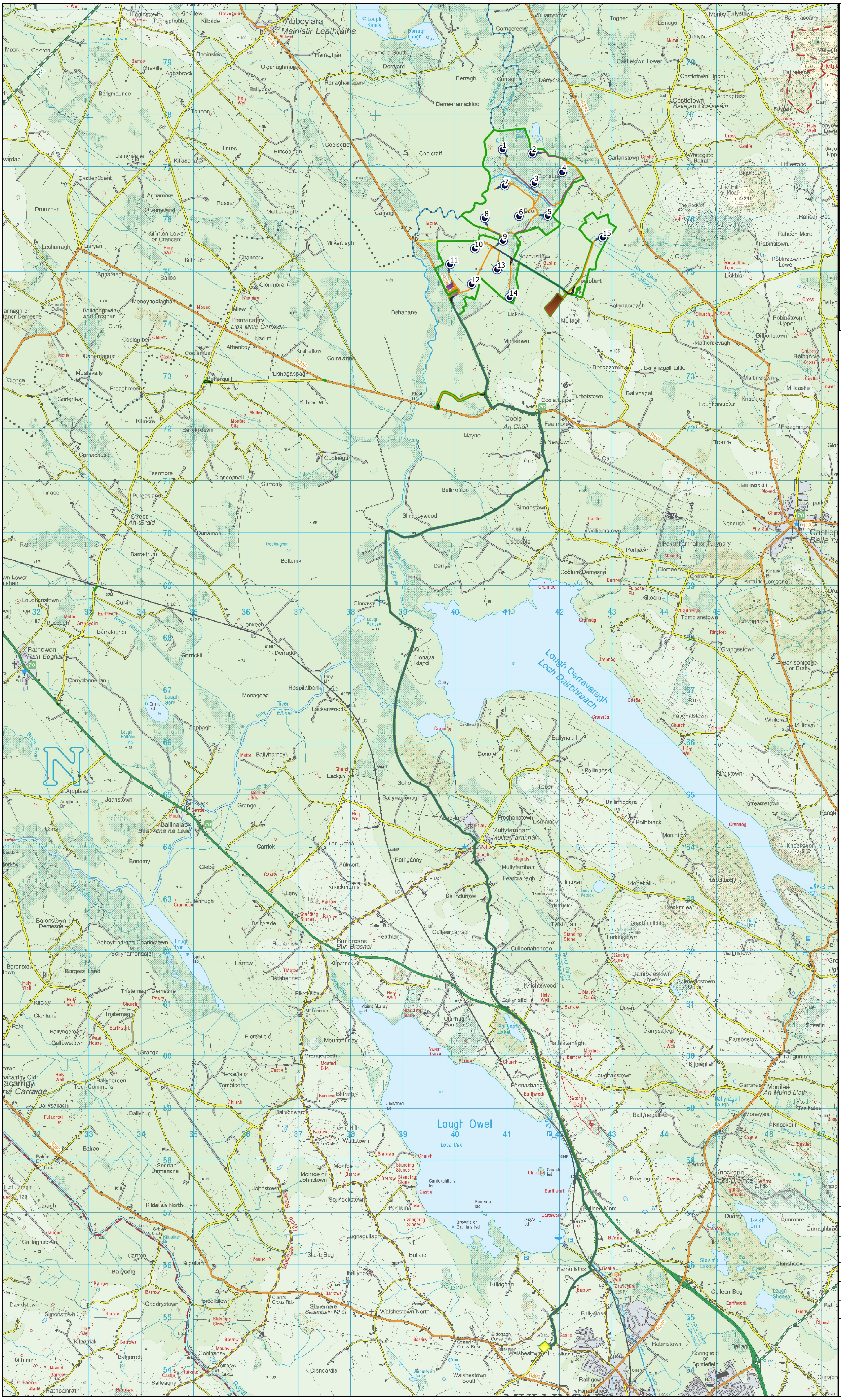
The overall layout of the Proposed Development is shown on Figure 4-1a and Figure 4-1b. These figures show the Proposed Development infrastructure as outlined above. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to this EIAR.

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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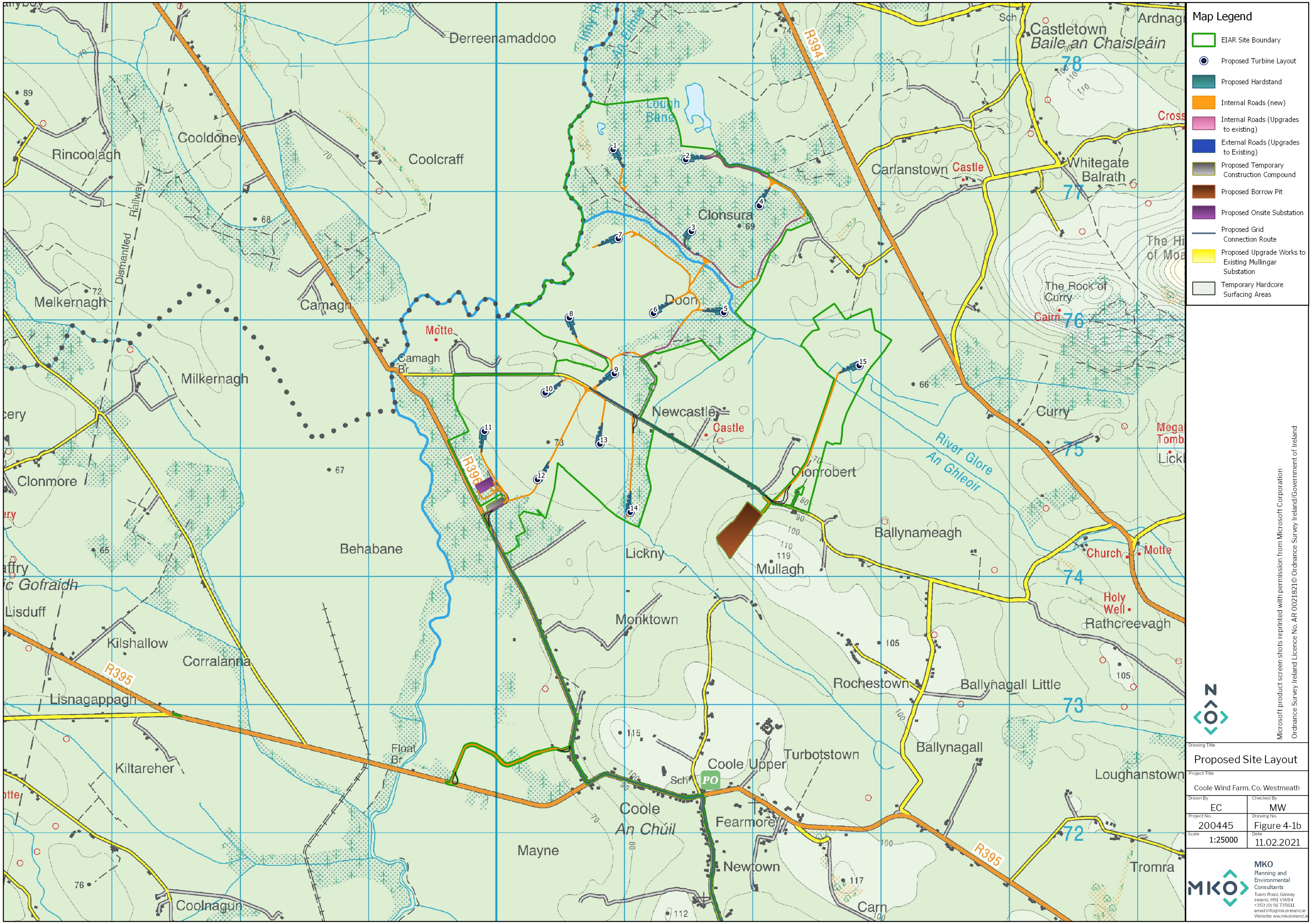

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Drawing Title

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

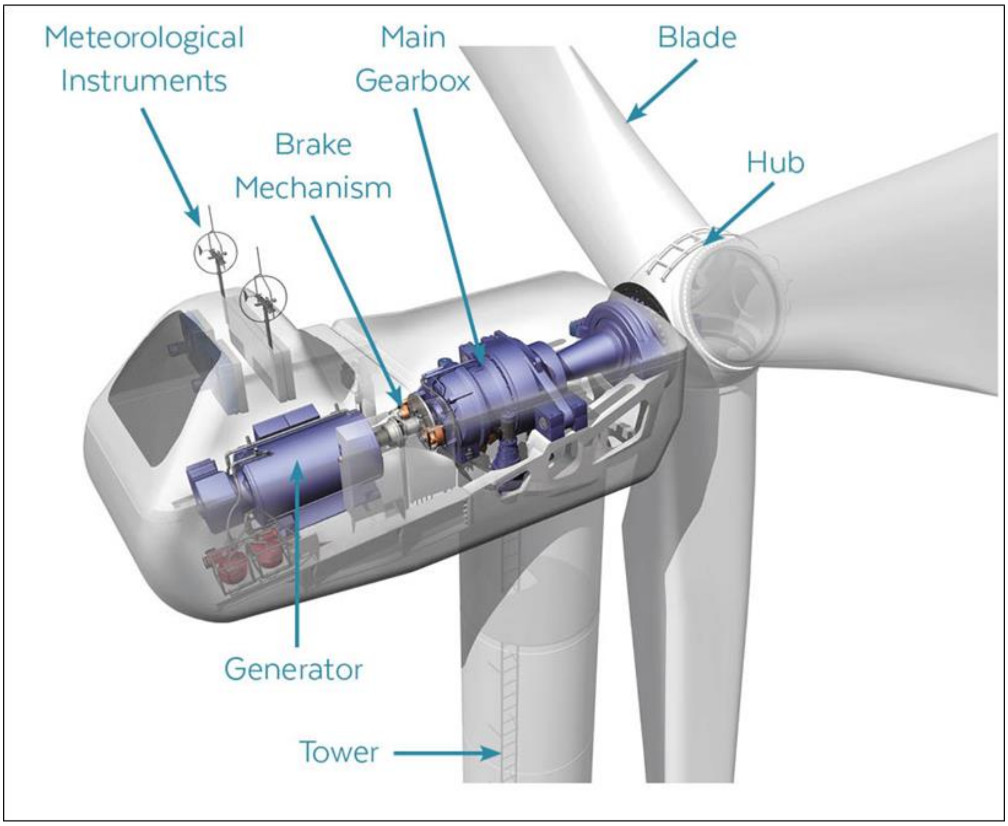
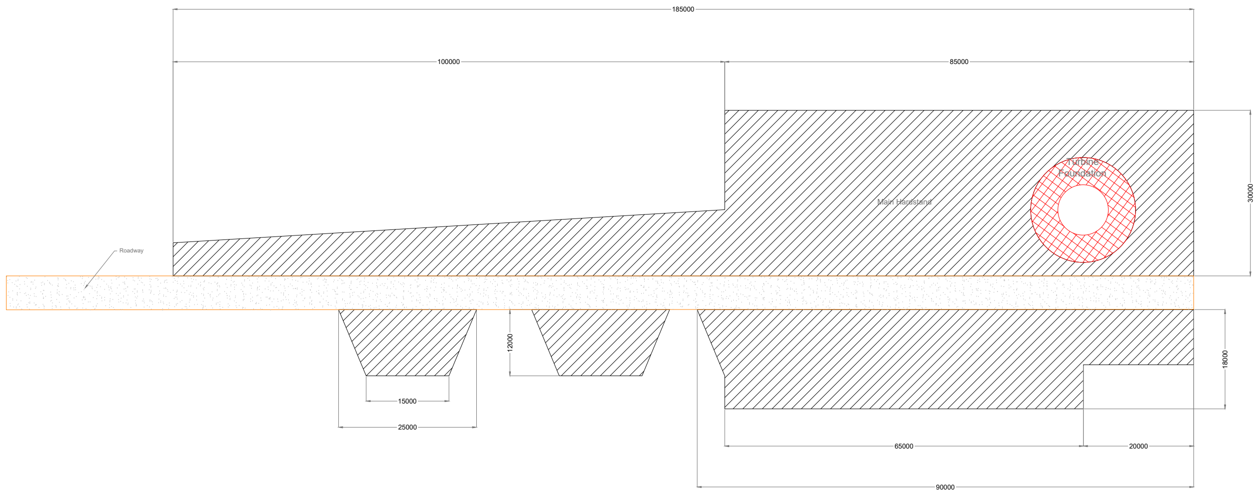
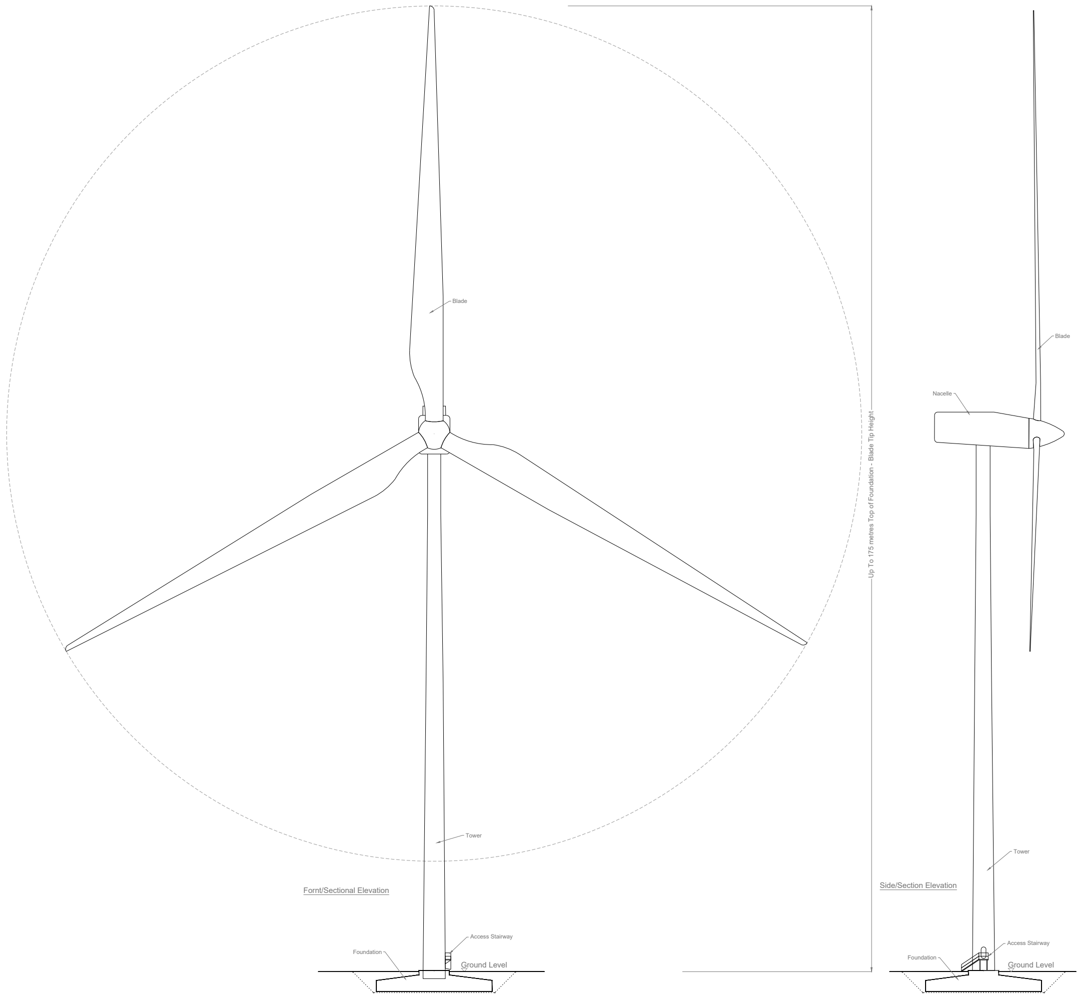
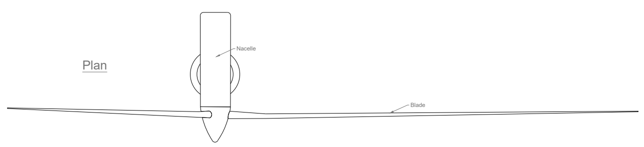
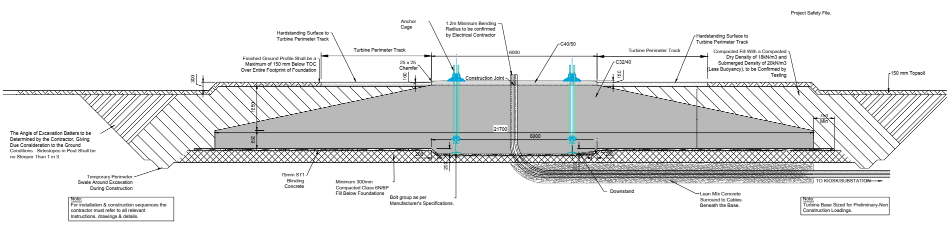


Figure 4-3 shows a typical turbine base layout, including turbine foundation, hard standing area, assembly area, access road and surrounding works area.









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.

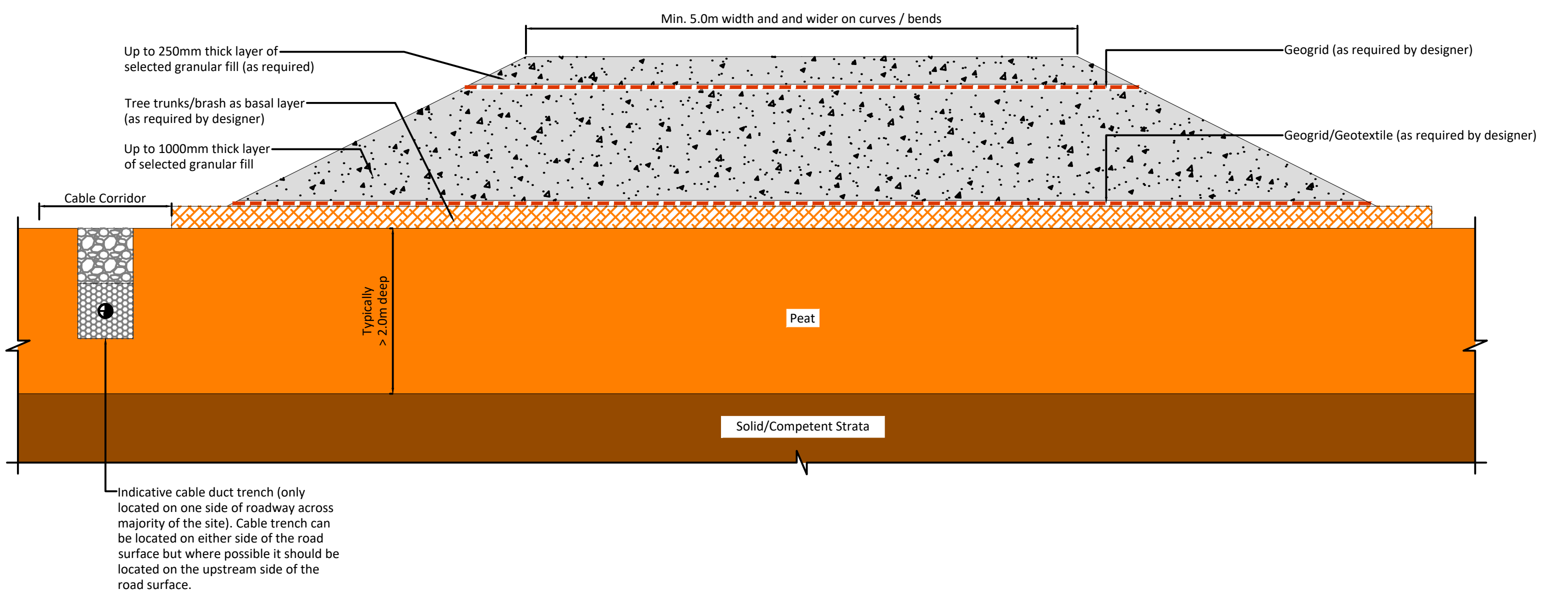

Figure 4-4	
DRAWING TITLE: Type D New Floated Access Road	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 46
SCALE: 1:50 @ A3	DATE: 26.02.2021
OS SHEET No.:	

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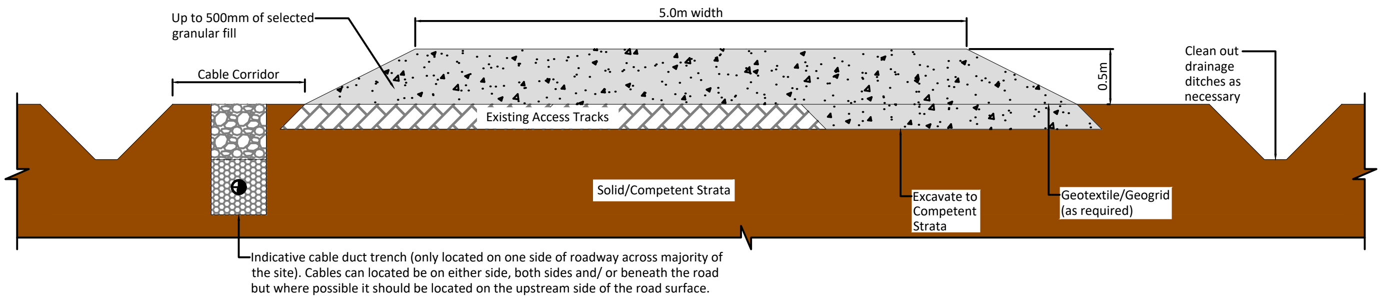
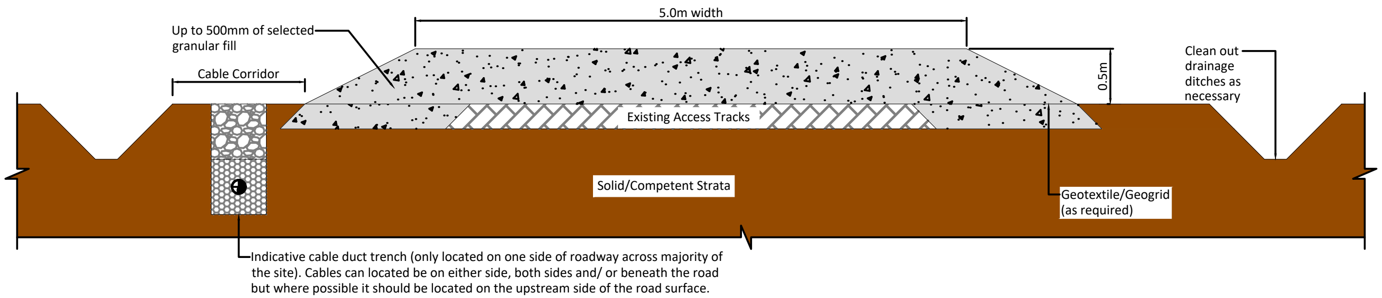
surface but where possible it should be located on the upstream side of the road surface.



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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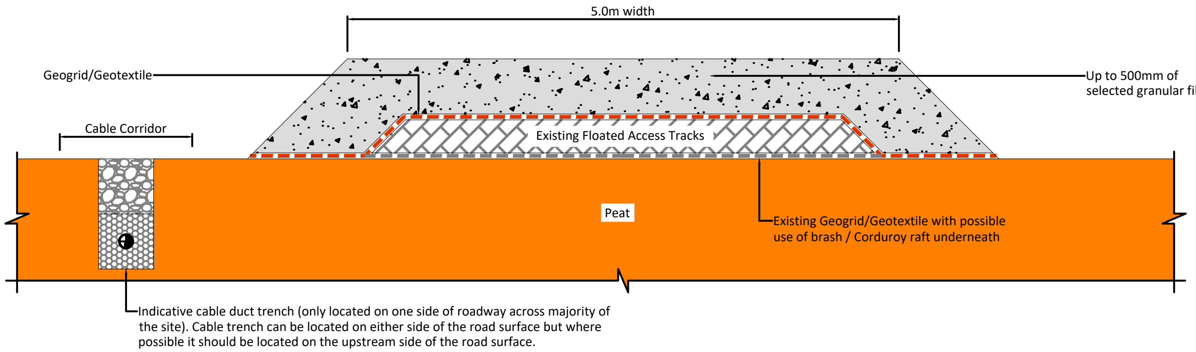
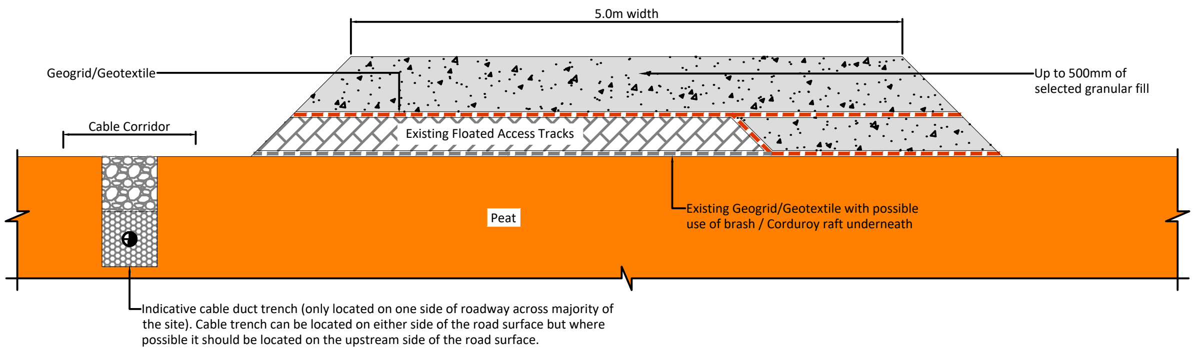
Upgrade of Existing Track on Flat Ground



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).

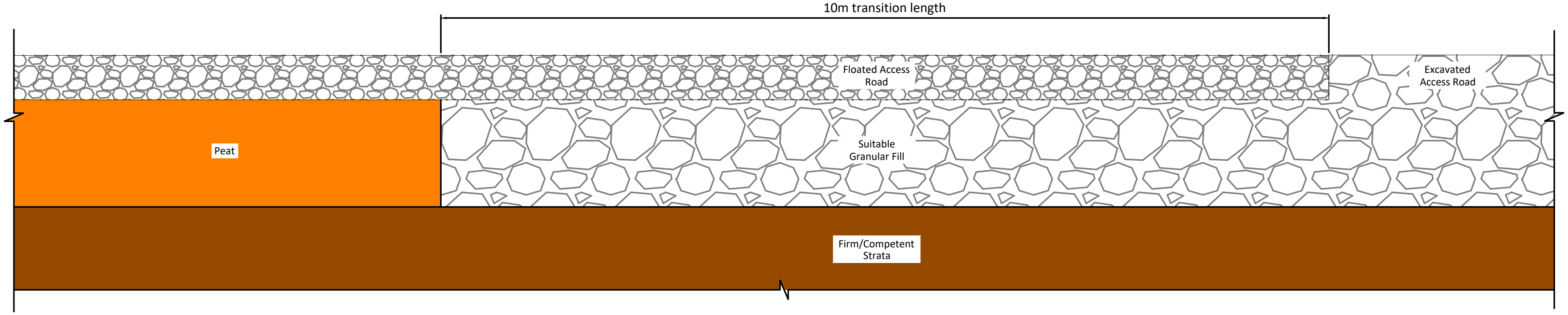

Figure 4-7

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
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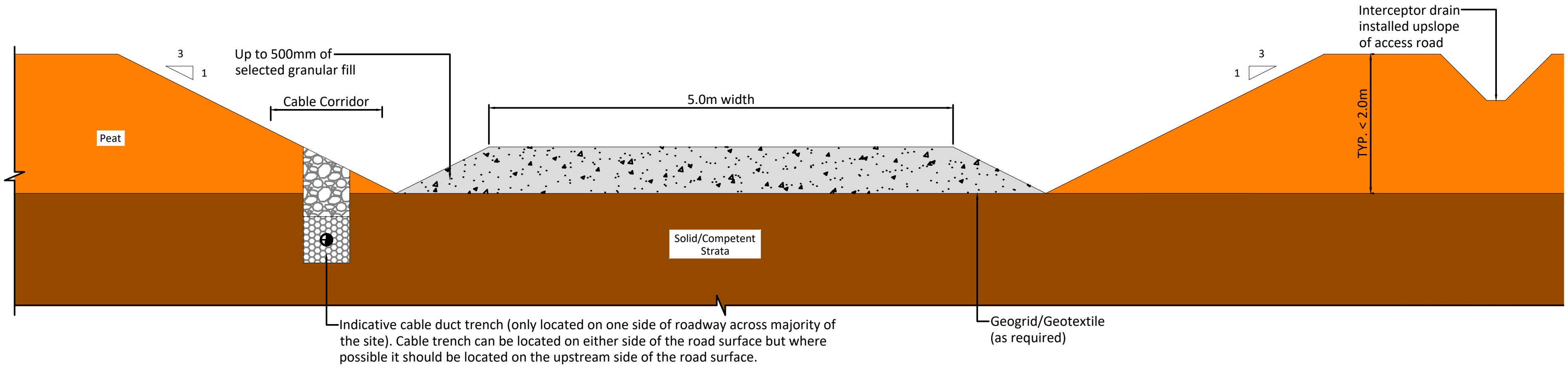

Figure 4-8	
DRAWING TITLE: Type C New Excavate and Replace Access Road	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 45
SCALE: 1:50 @ A3	DATE: 26.02.2021
OS SHEET No.:	

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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.

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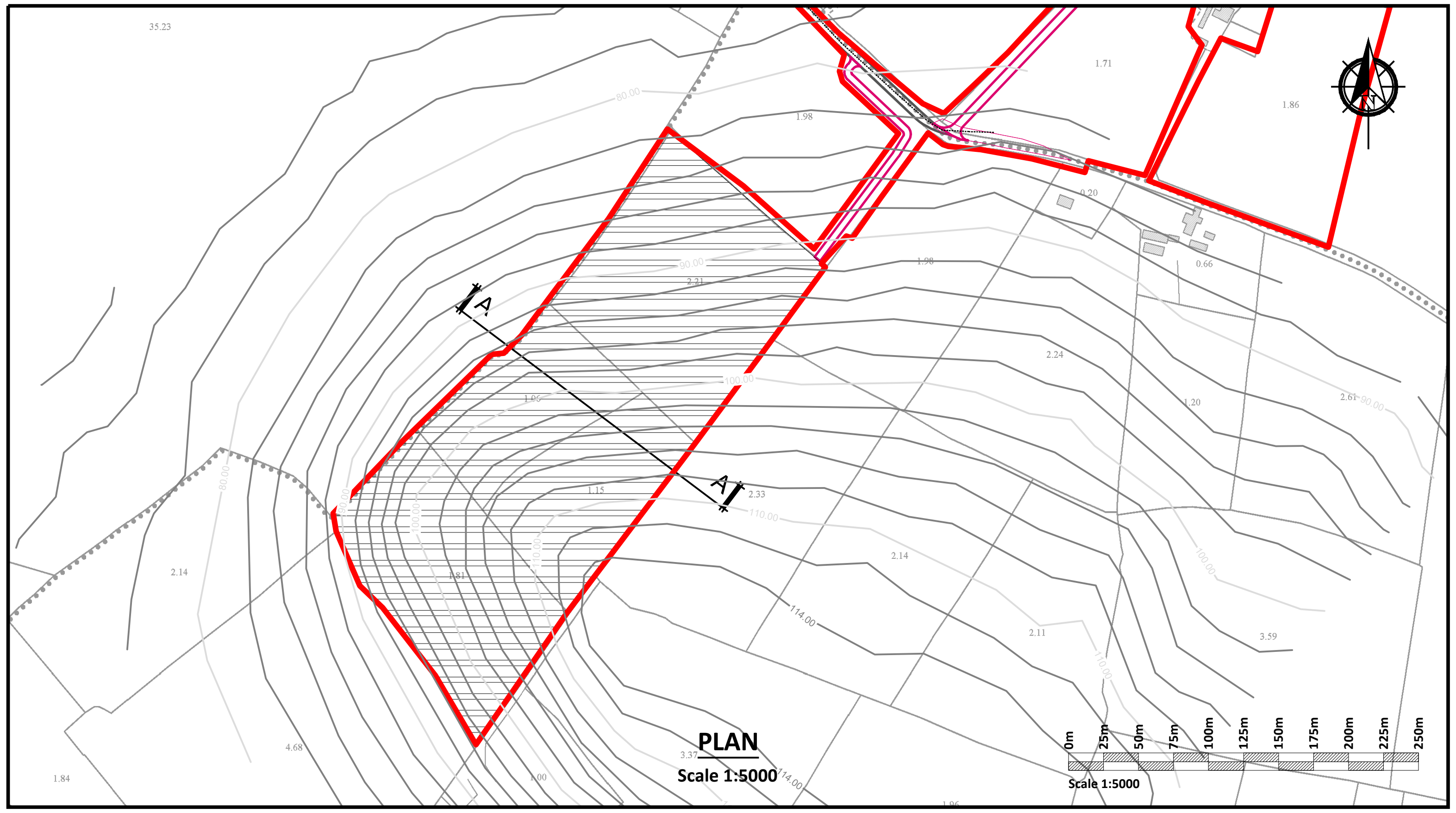


Legend:

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

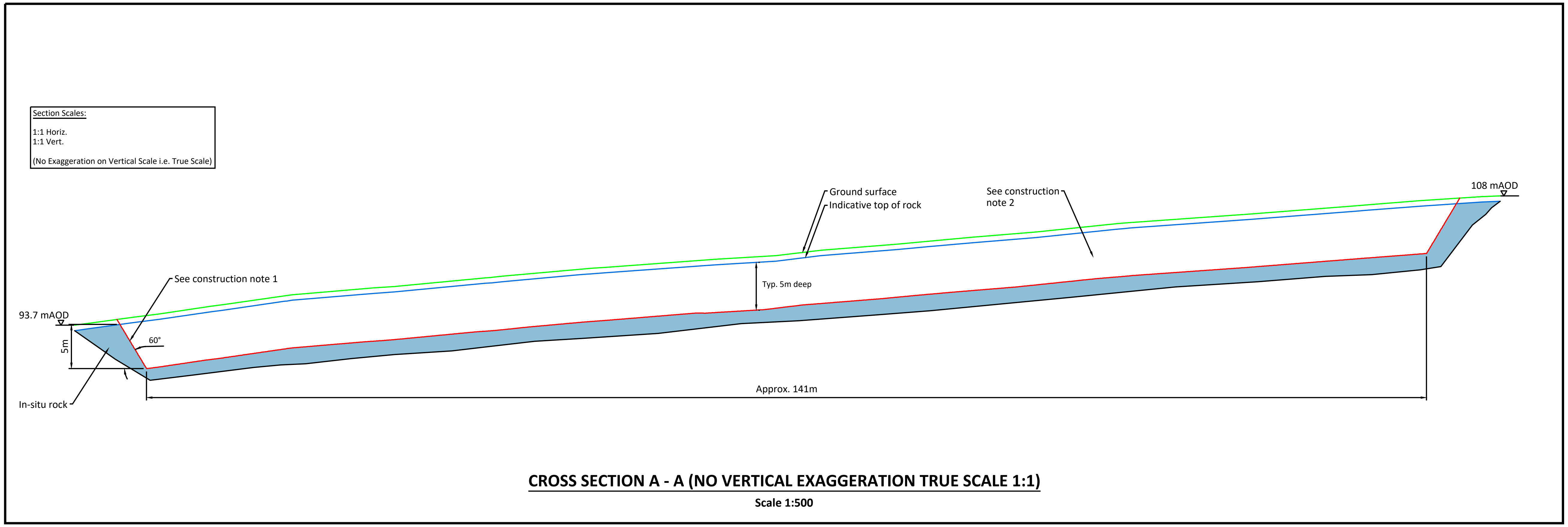
Construction Notes:

(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.



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

Scale 1:500

Scale (@ A3)
1:5000

Date - 23.02.21

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

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Checked - IH
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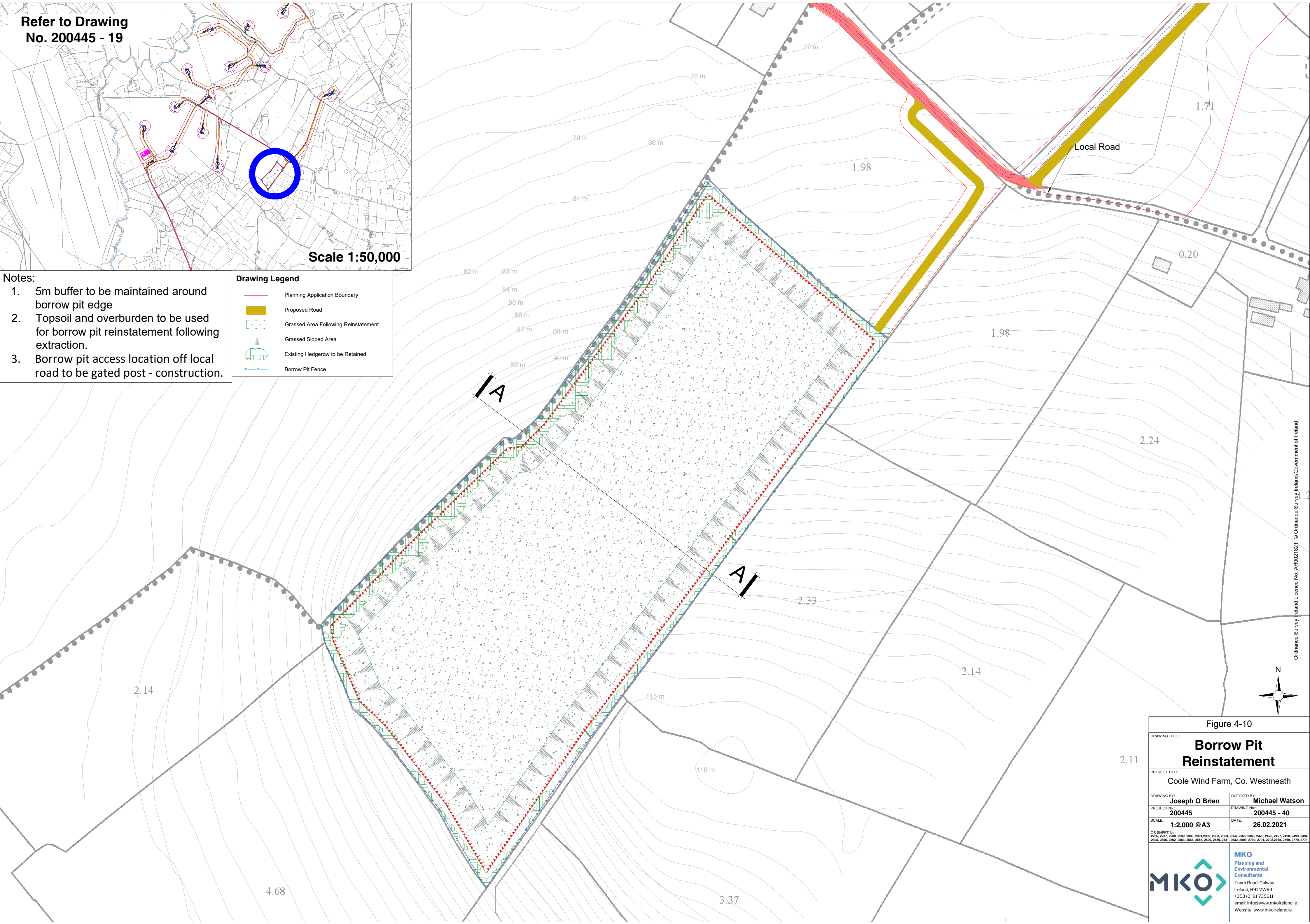
Tuesday 23 February 2021



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

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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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.

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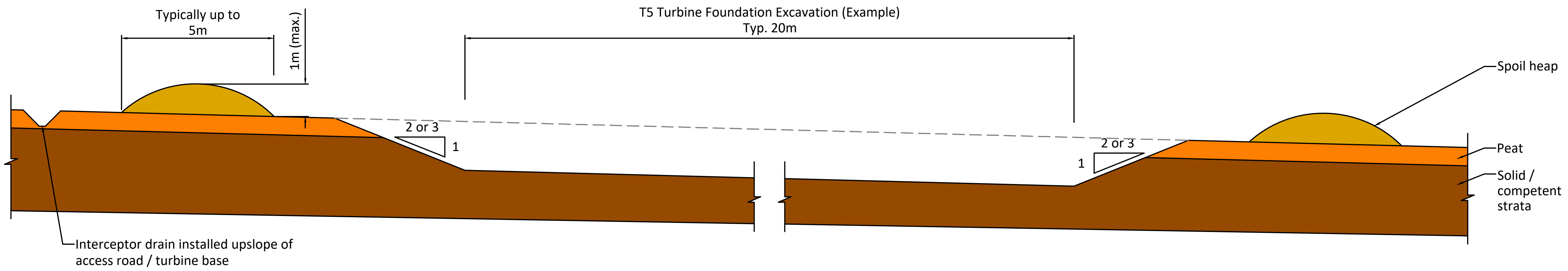

Construction Notes:

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

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Date - 23.02.21

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

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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

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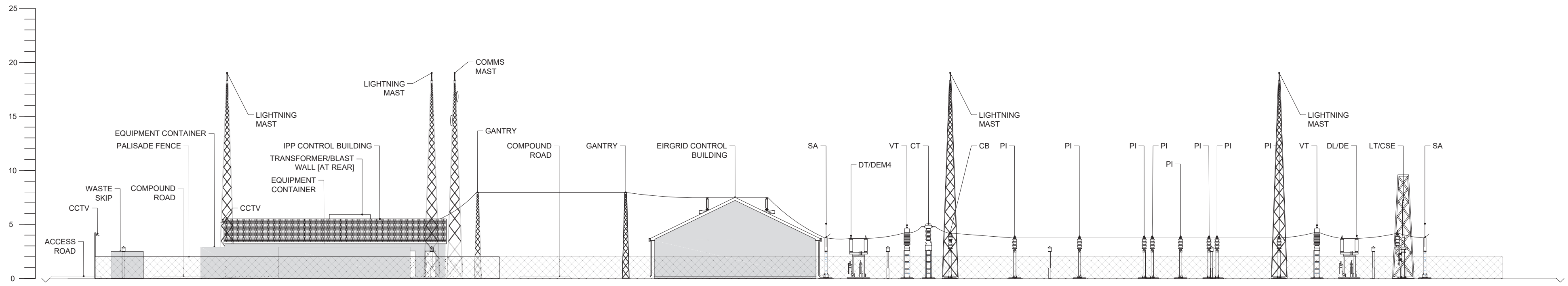
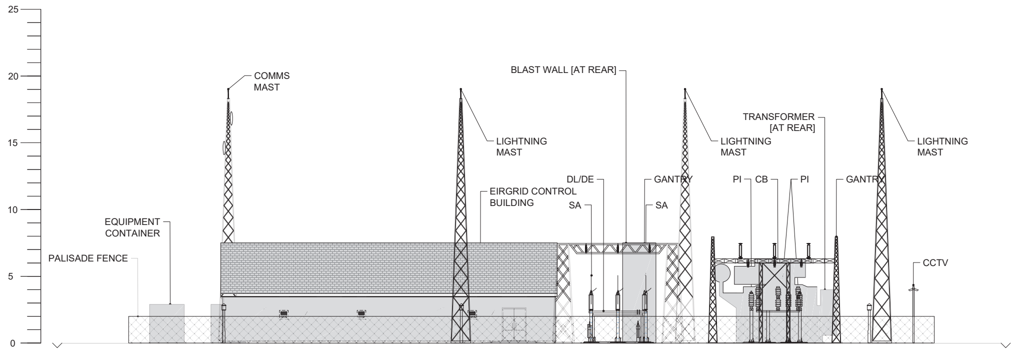


SIDE ELEVATION



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

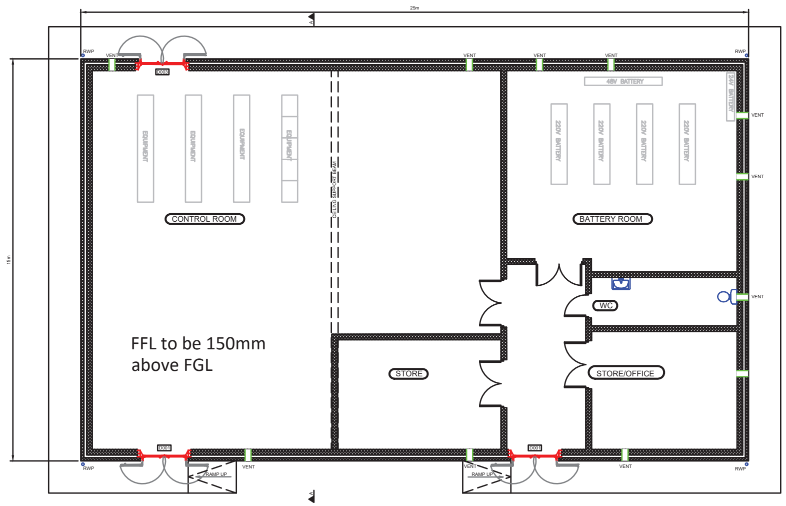
PROJECT
COOLE WIND FARM

TITLE
110kV SUBSTATION COMPOUND ILLUSTRATIVE ELEVATIONS

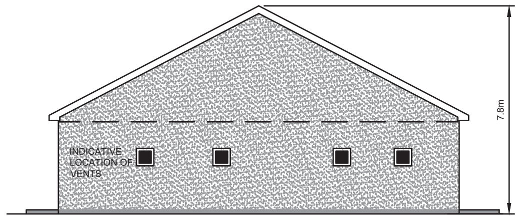
REVISION
A

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

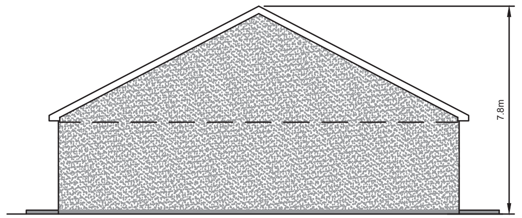
CHECKED AND APPROVED	DATE	STATUS	DRAWING NUMBER
P. KING	16/01/2020	DRAFT	COLE d007.2



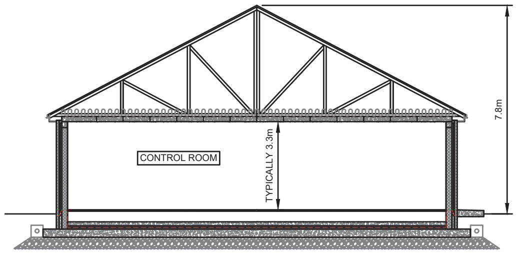
PLAN ON CONTROL BUILDING



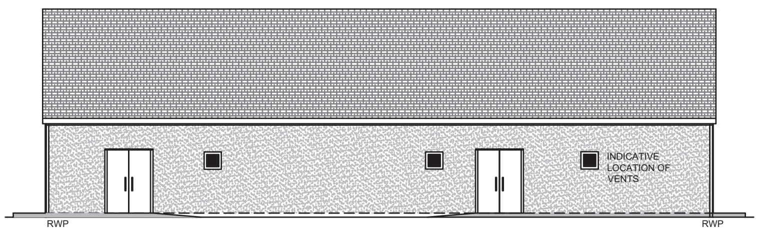
ELEVATION ON SIDE FACE



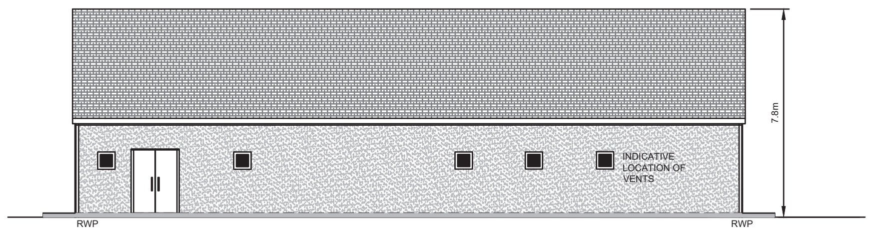
ELEVATION ON SIDE FACE



SECTION A-A



ELEVATION ON FRONT FACE



ELEVATION ON REAR FACE

Figure 4-14a

NOTES

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: CONTROL BUILDING: TYPICAL PLAN AND ELEVATIONS

REVISION: A

DRAWN BY: M STUART — DATE: 09/05/2020

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

PAPER SIZE: A3 — SCALE: 1:200

STATUS

DRAWING NUMBER: COLE d007.3

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Z:\Projects\Ireland\Coole COLE\Drawings\d007 Coole WF Substation\COLE D007.3-4 Substation Building

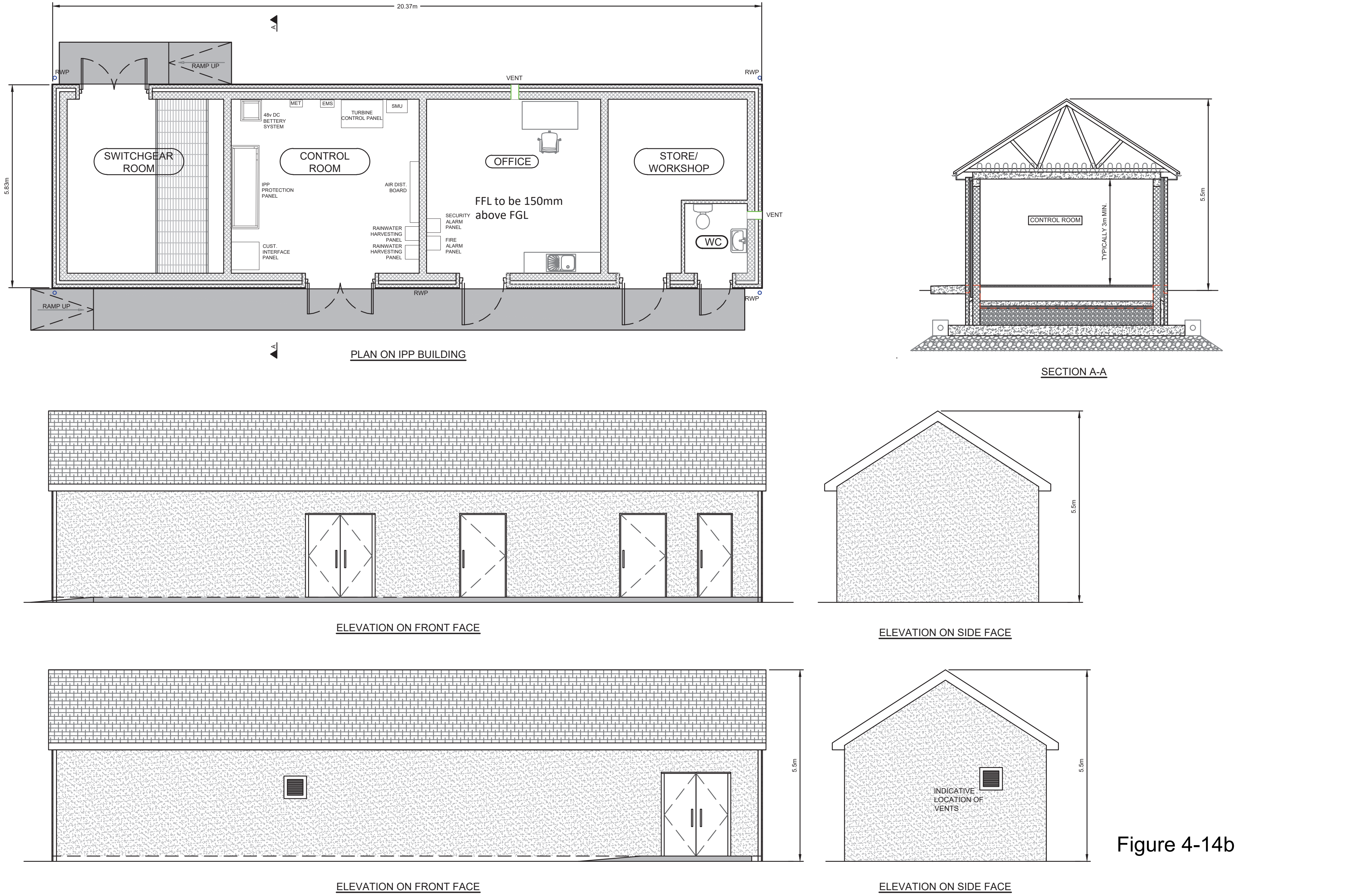

Figure 4-14b

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

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CLIENT:

PROJECT: COOLE WIND FARM

TITLE: IPP BUILDING: TYPICAL PLAN AND ELEVATIONS

REVISION: A

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

CHECKED AND APPROVED	DATE	STATUS	DRAWING NUMBER
J SHANAHAN	09/05/2020		COLE d007.4

Plotted - 11/05/2020 14:56:35
Z:\Projects\Ireland\Coole COLE\Drawings\d007 Coole WF Substation\COLE D007.3-4 Substation Building

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.

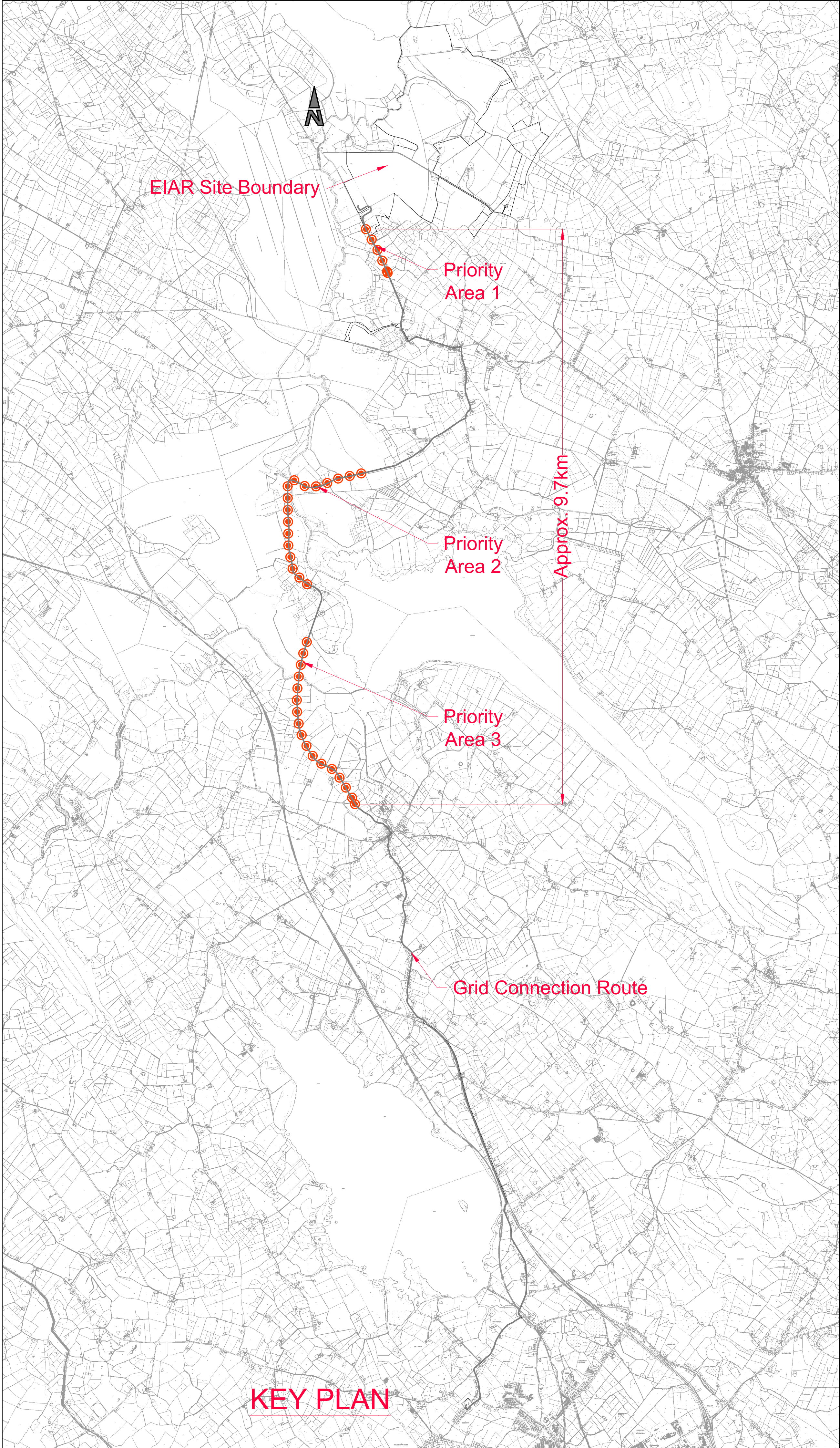
The main findings of the AGEC Cable Route Assessment Report are as follows:

- 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.*



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.

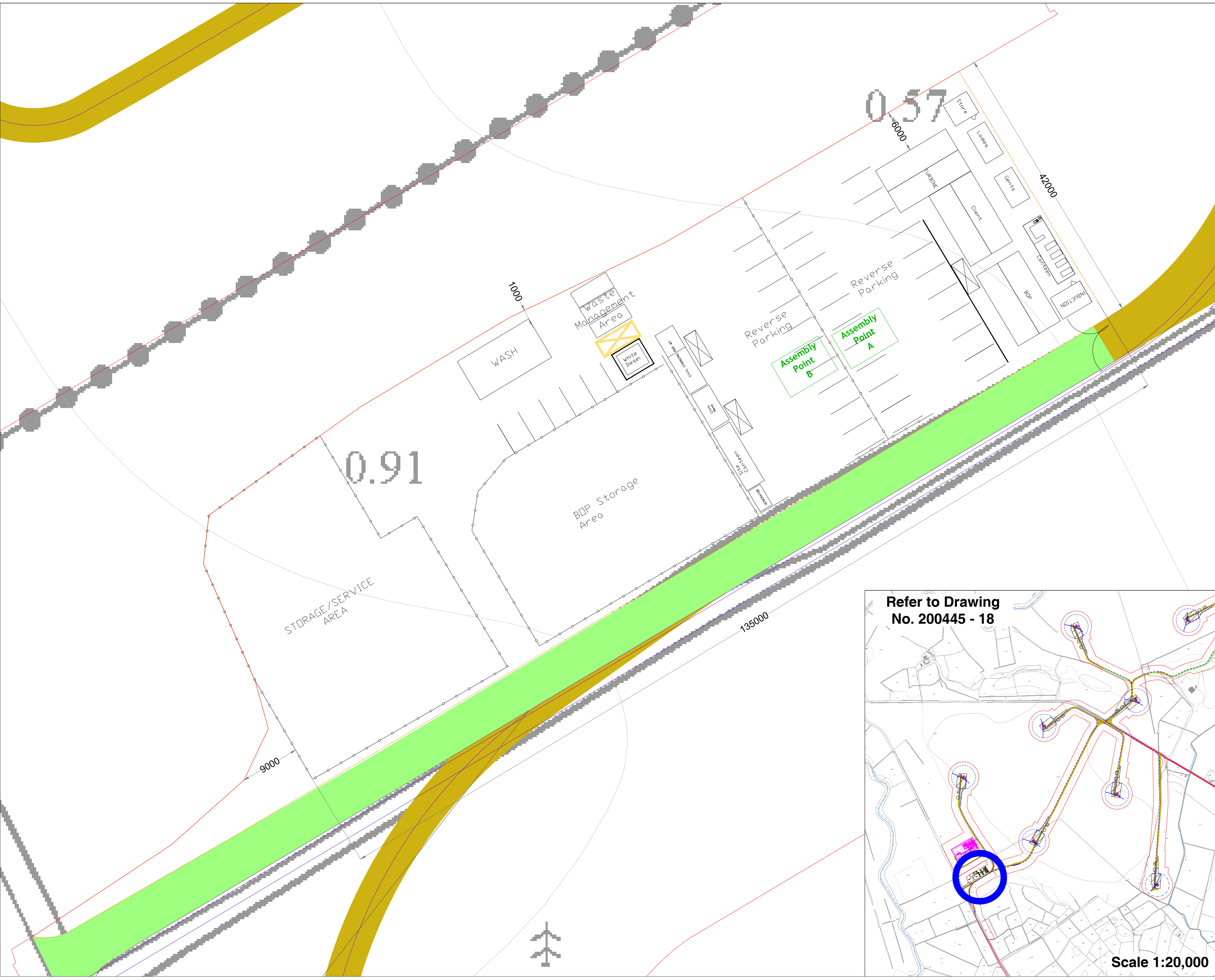
A total of 16.36 hectares of forestry is required to be felled within and around the Proposed Development footprint. Figure 4-17 shows the extent of the area to be felled as part of the Proposed Development.

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

N

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

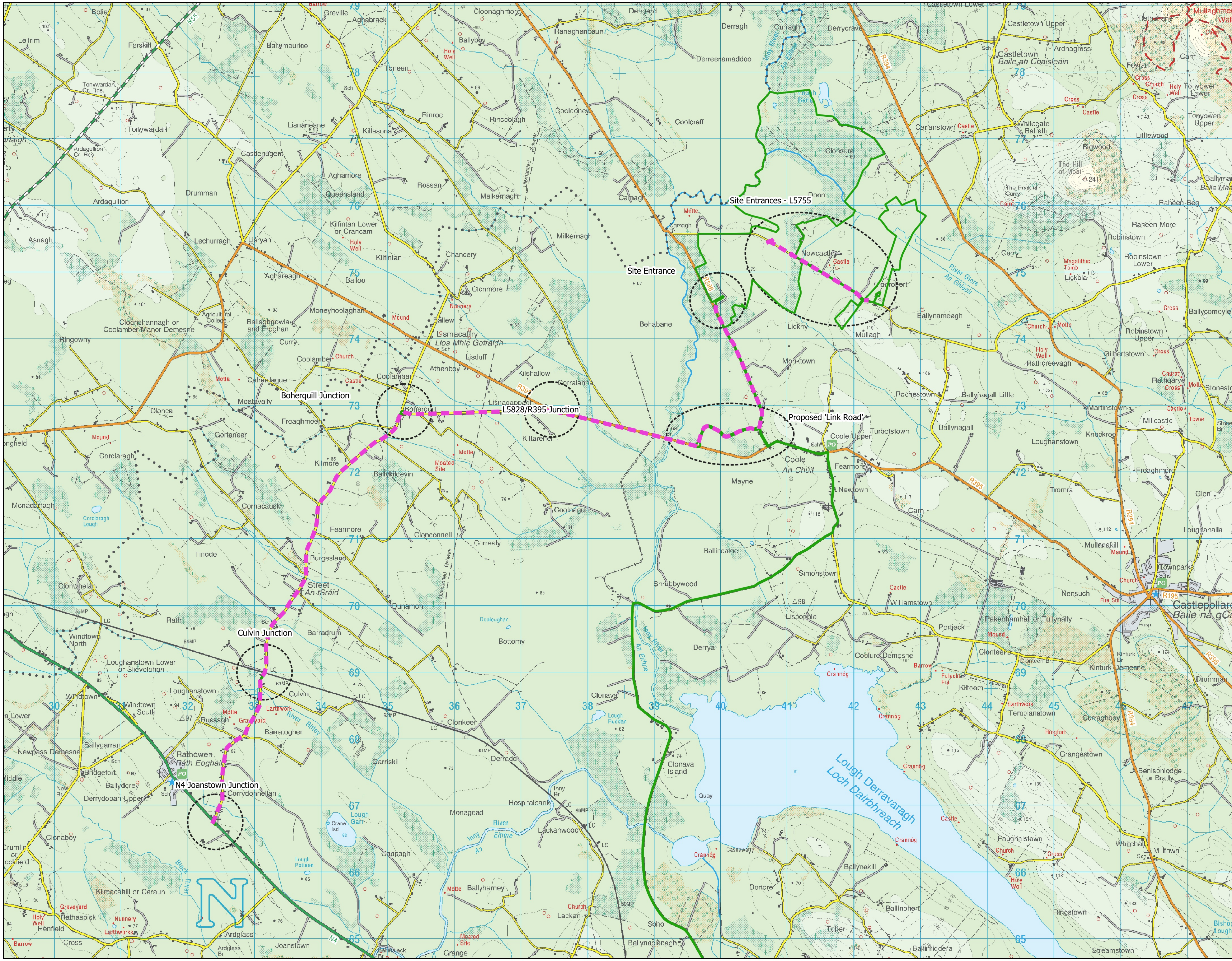
4.3.18.1 Environmental Management

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

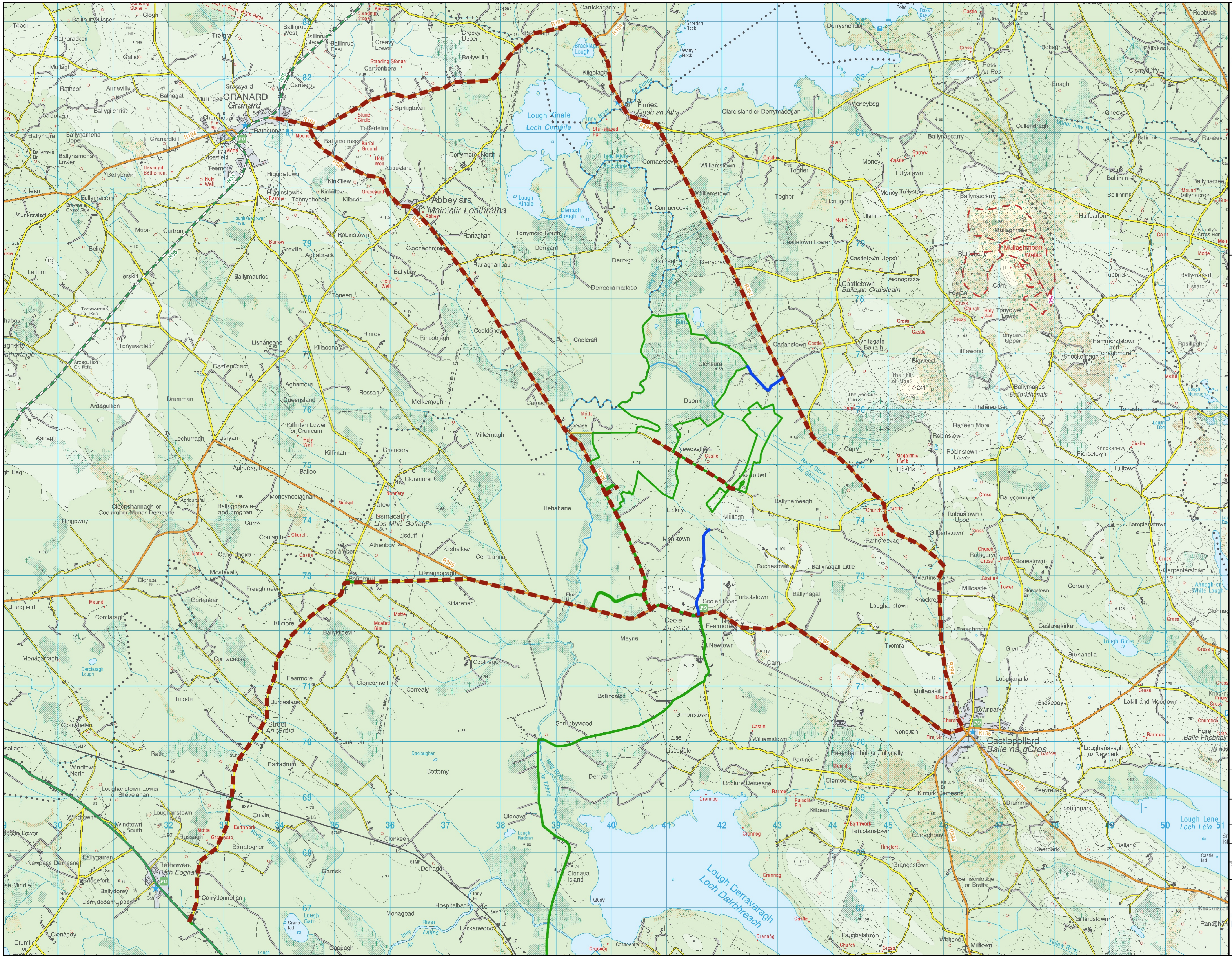
The proposed turbine delivery route is described in Section 4.3.17 above and shown in Figure 4-18. All deliveries of turbine components to the site will be by way of the proposed transport route outlined in Figure 4-18.

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).

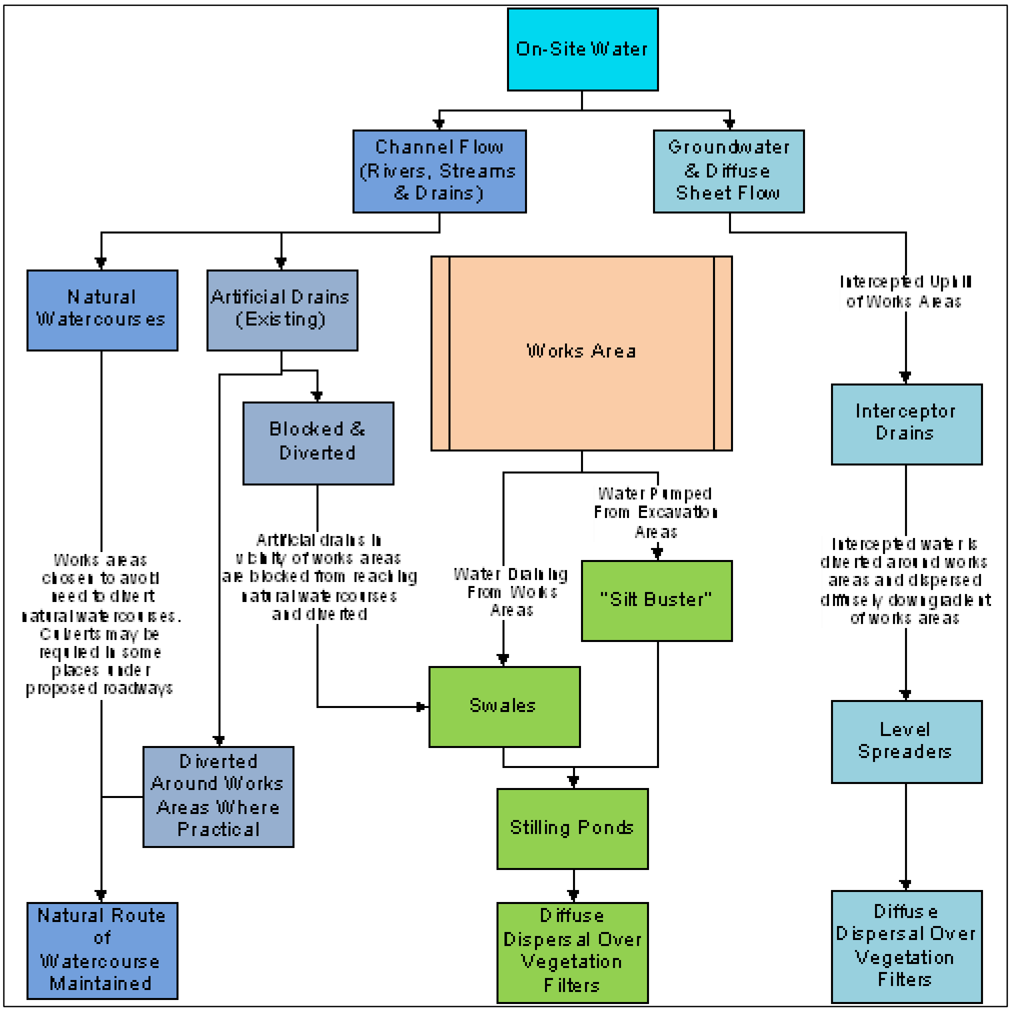
4.6.3 Drainage Design Principles

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

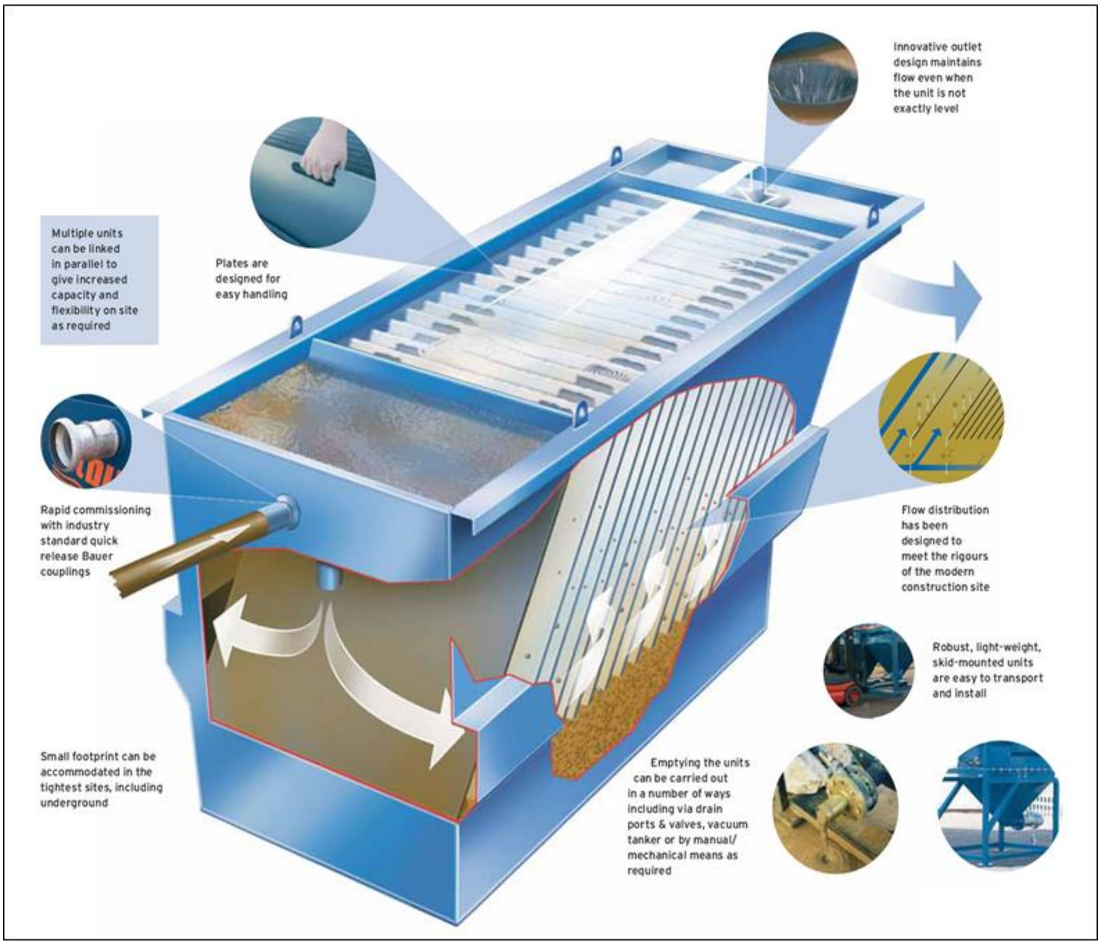
A "siltbuster" or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

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

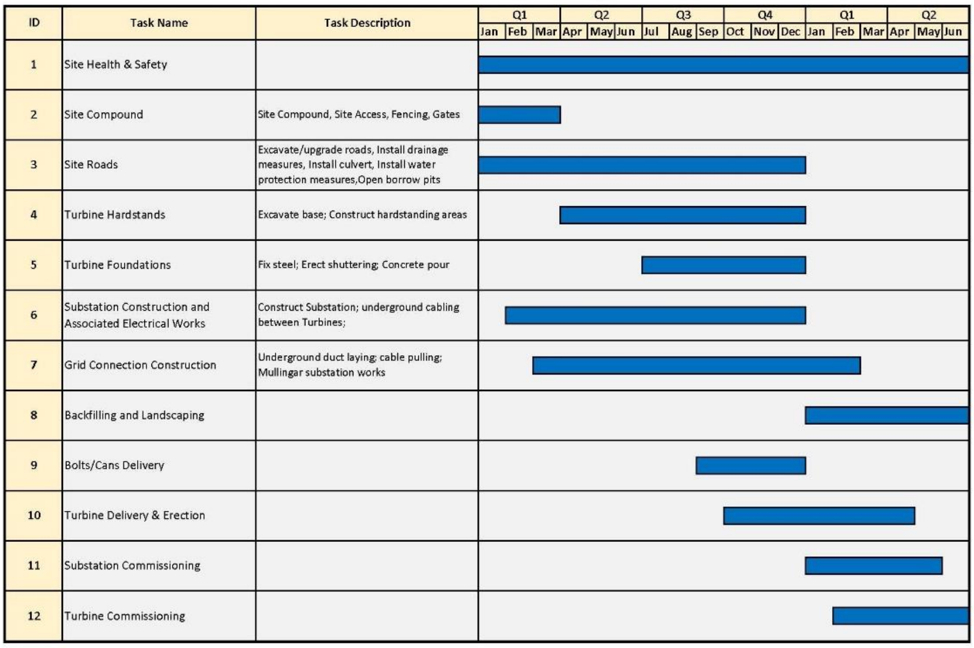
- Excavate trenches for site cables, lay cables and backfill. Provide joint bays at road crossings.
- Erect external electrical equipment at substation
- Erect transformers at compound.
- Pull cables between onsite substation and Mullingar substation where upgrade works are proposed
- Erect external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

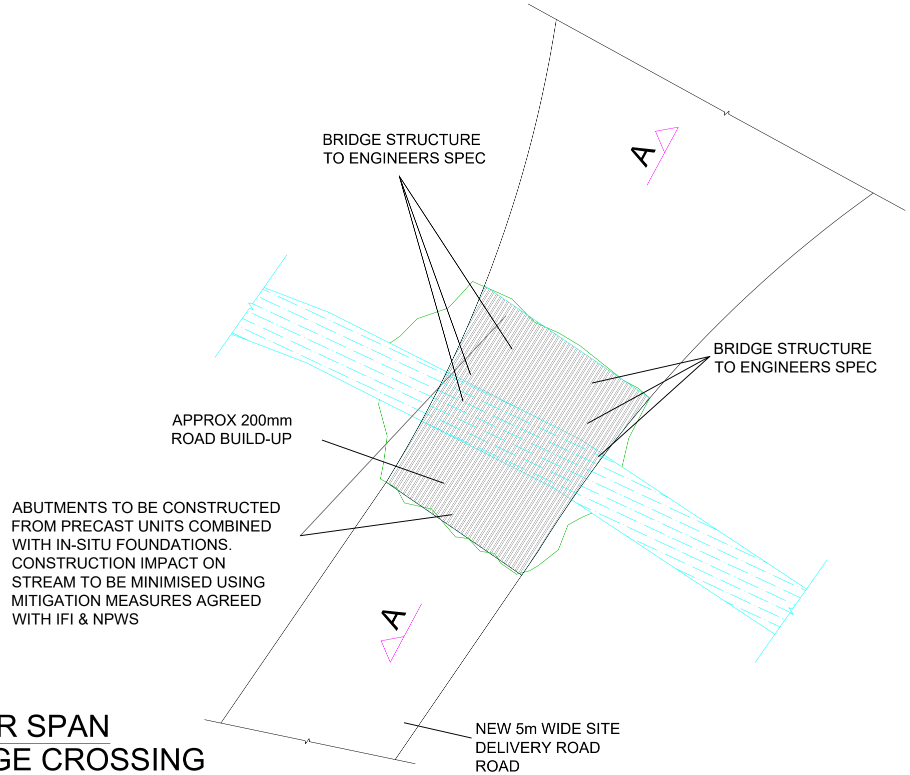
4.8.4 On-site Electricity Substation and Control Building

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

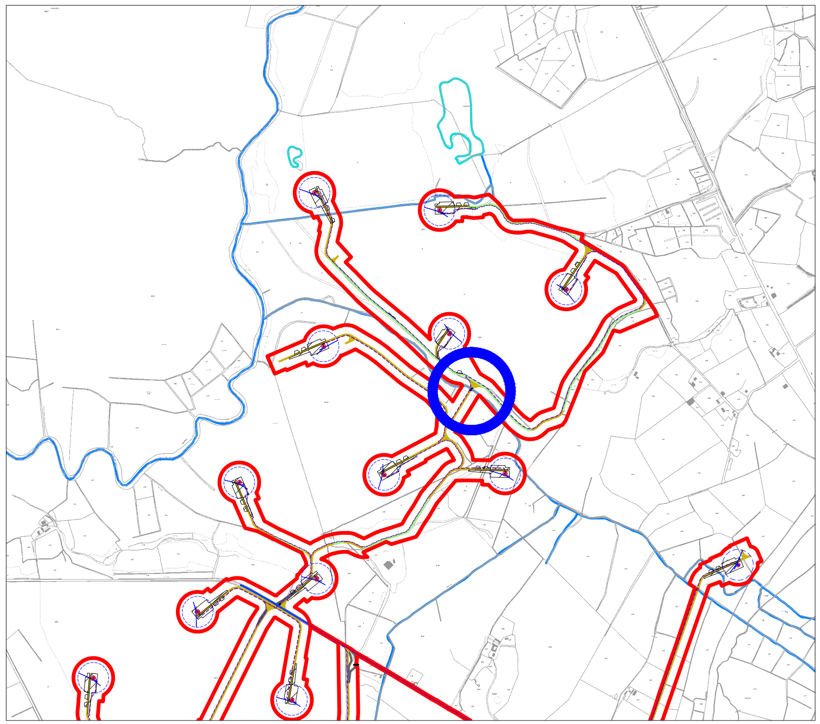
- Following felling, the area of the substation will be marked out using ranging rods or wooden posts and the soil stripped and removed to the nearby storage area for later use in landscaping. No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling 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

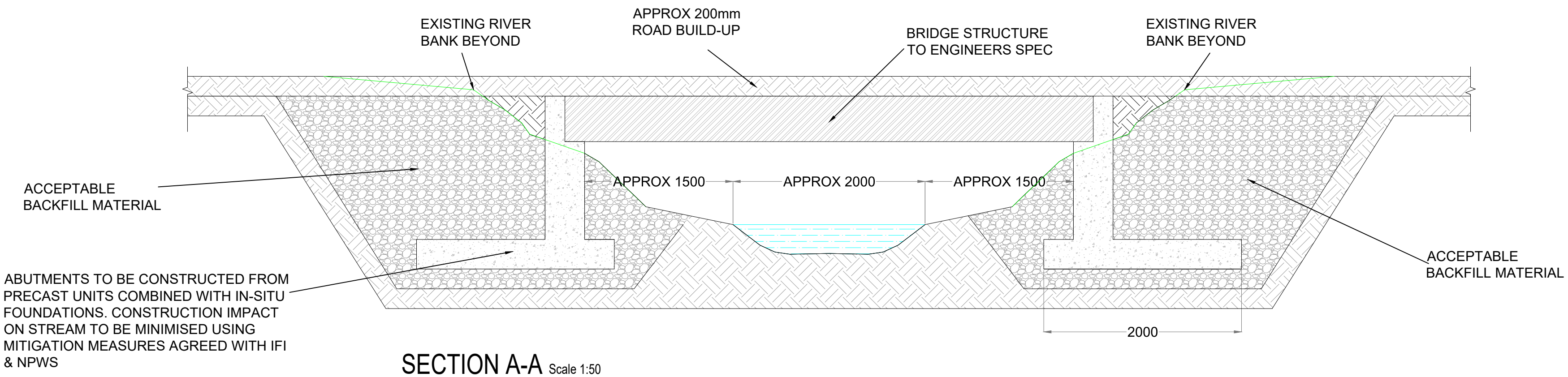
IONIC Consulting Engineers were commissioned to complete the typical design of the grid connection cable trenches and proposed cable connection to the existing Mullingar substation. The typical design drawings are included as Appendix 4-3 to this EIAR. The upgrade works proposed at the existing Mullingar 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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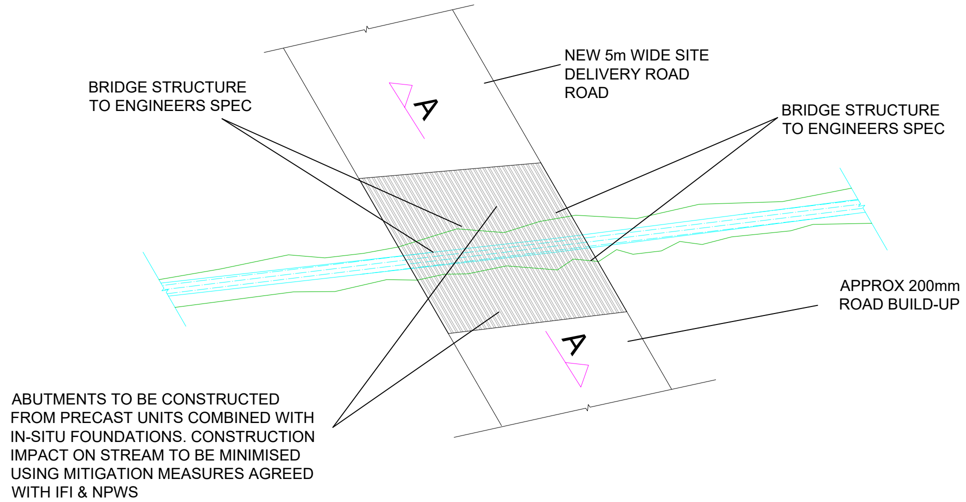
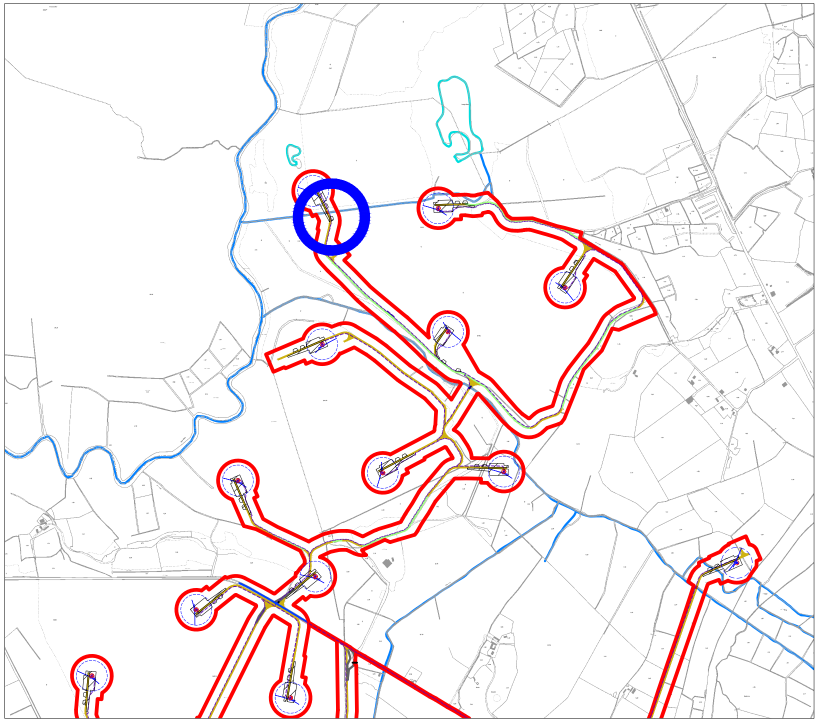
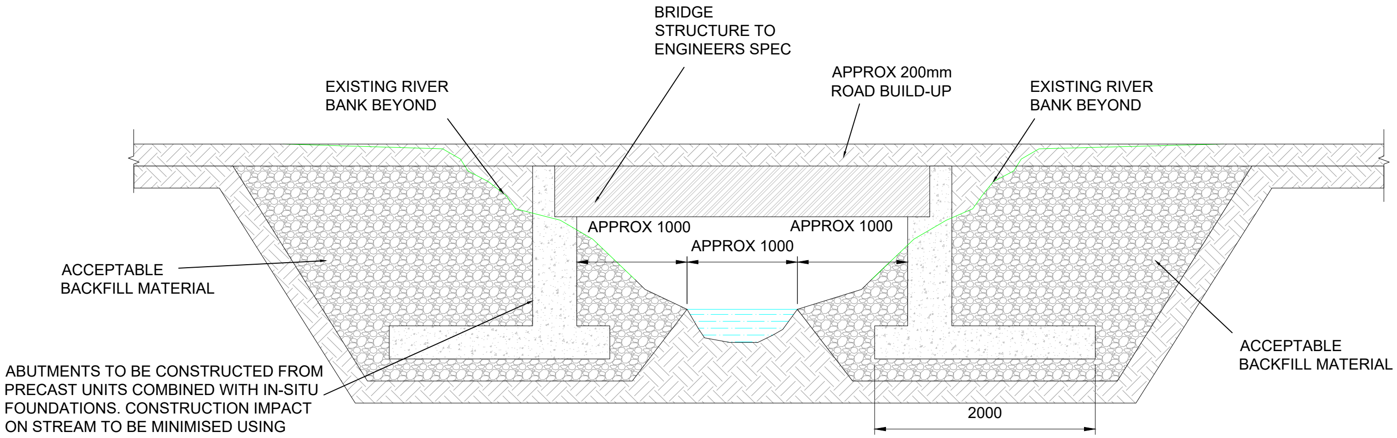


CLEAR SPAN
BRIDGE CROSSING
PLAN
Scale 1:200



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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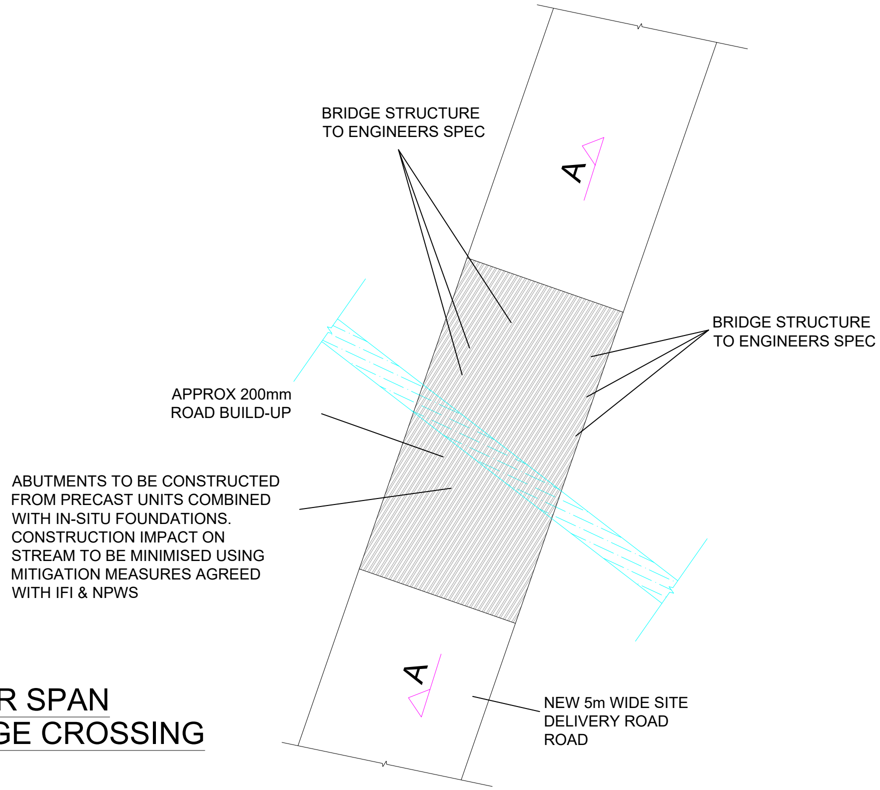
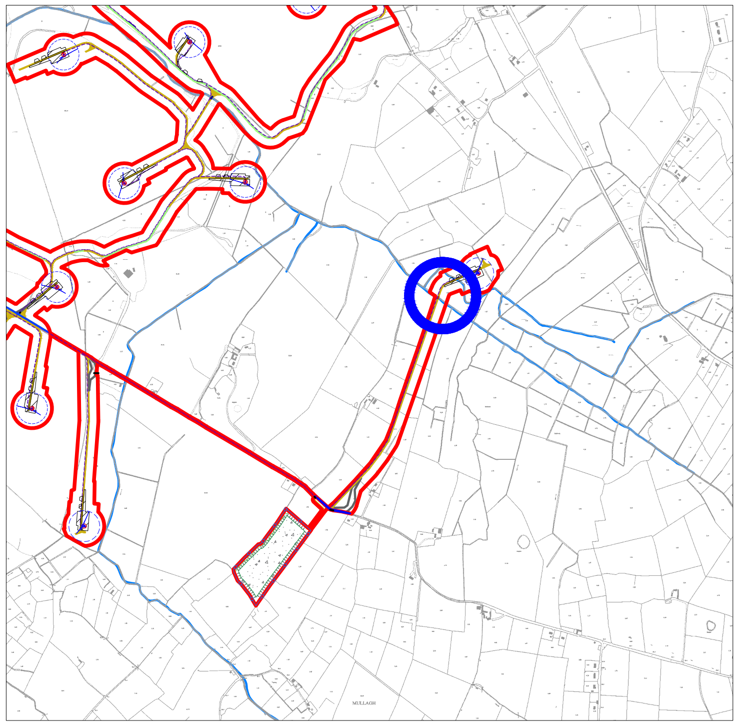
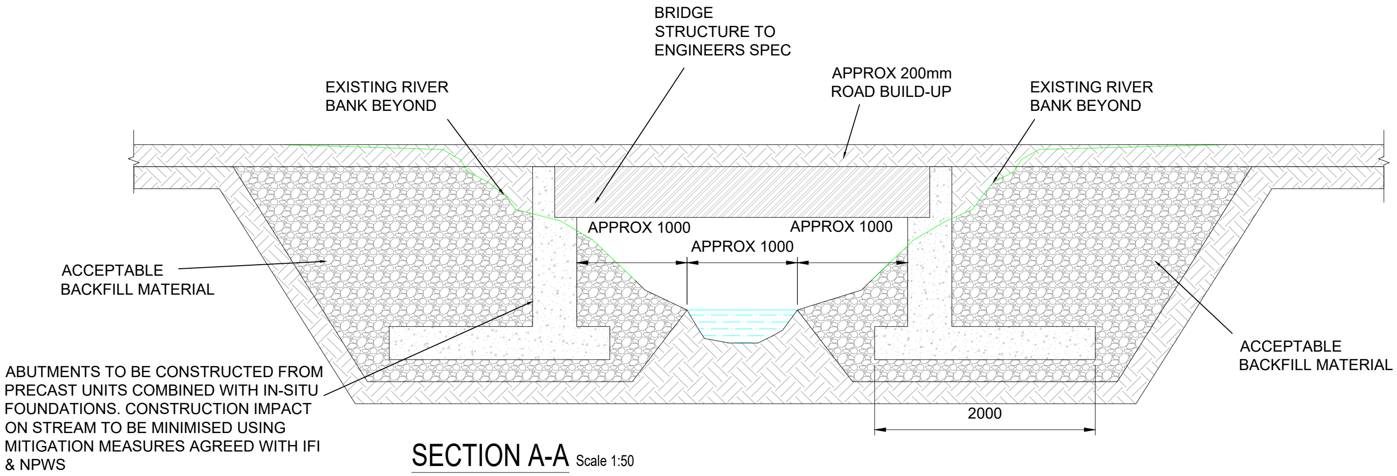


CLEAR SPAN BRIDGE CROSSING PLAN
Scale 1:200



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.:
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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

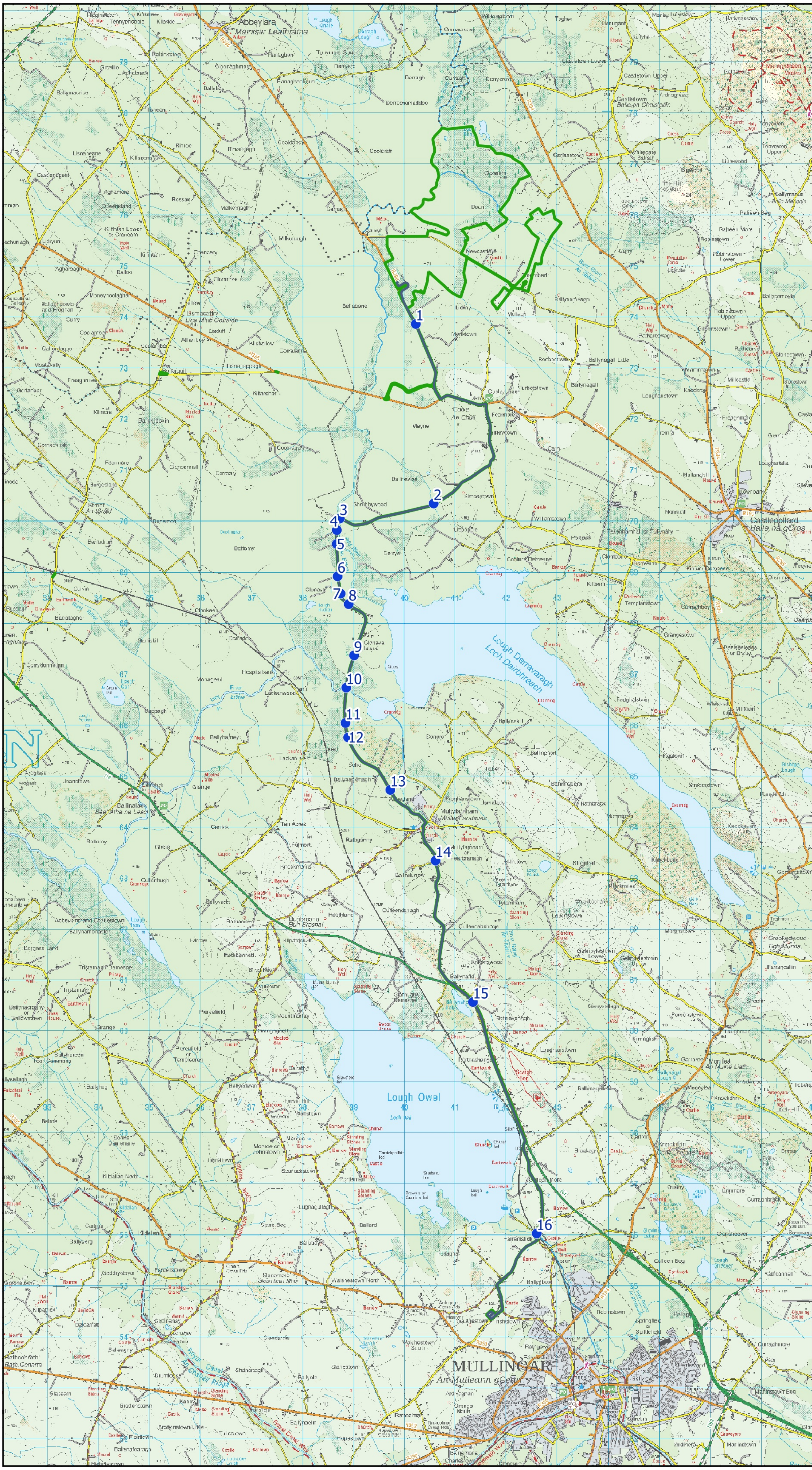
In the event that none of the above methods are appropriate, directional drilling will be utilised. The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional

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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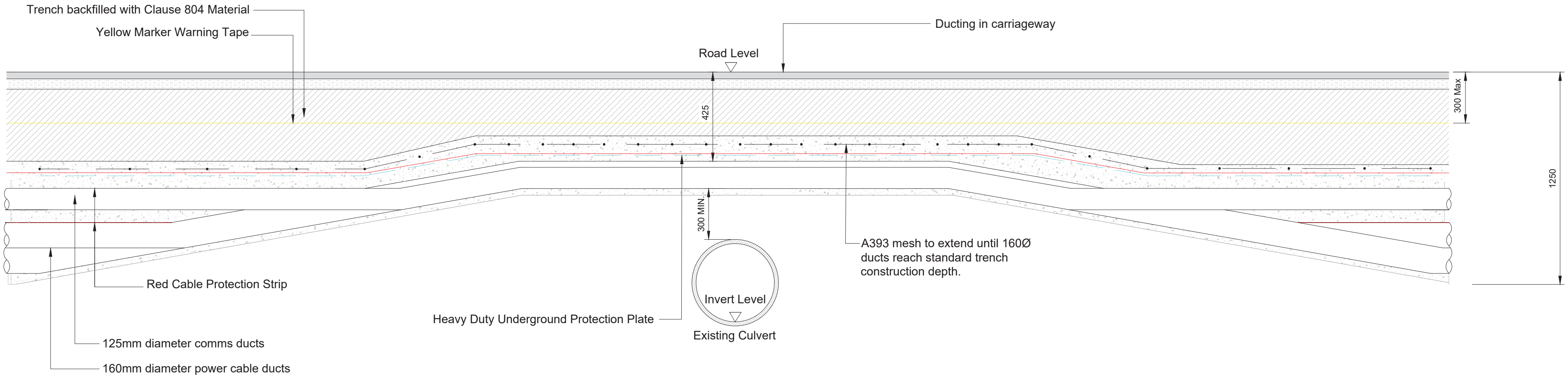

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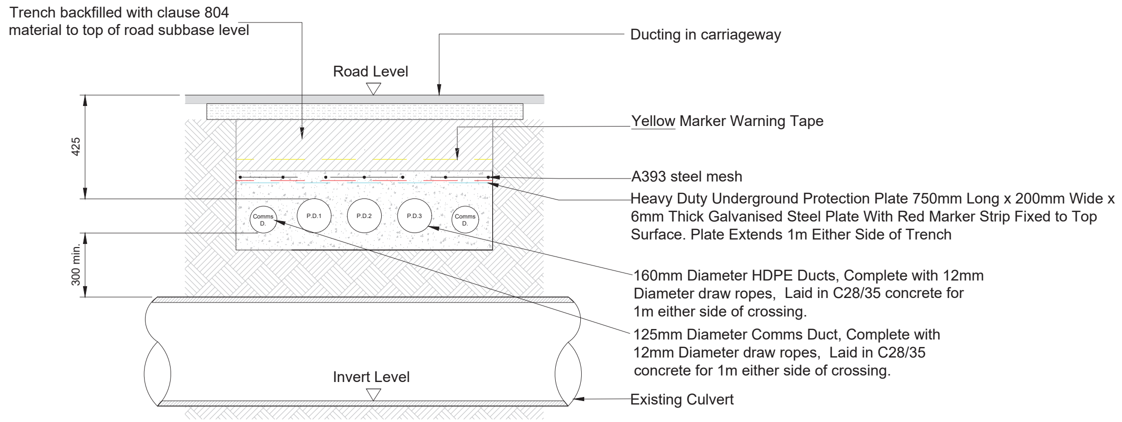

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Figure 4-27

Option 1 - Crossing over Culvert

NOTES

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: WATER CROSSINGS TYPICAL DETAIL - OVER

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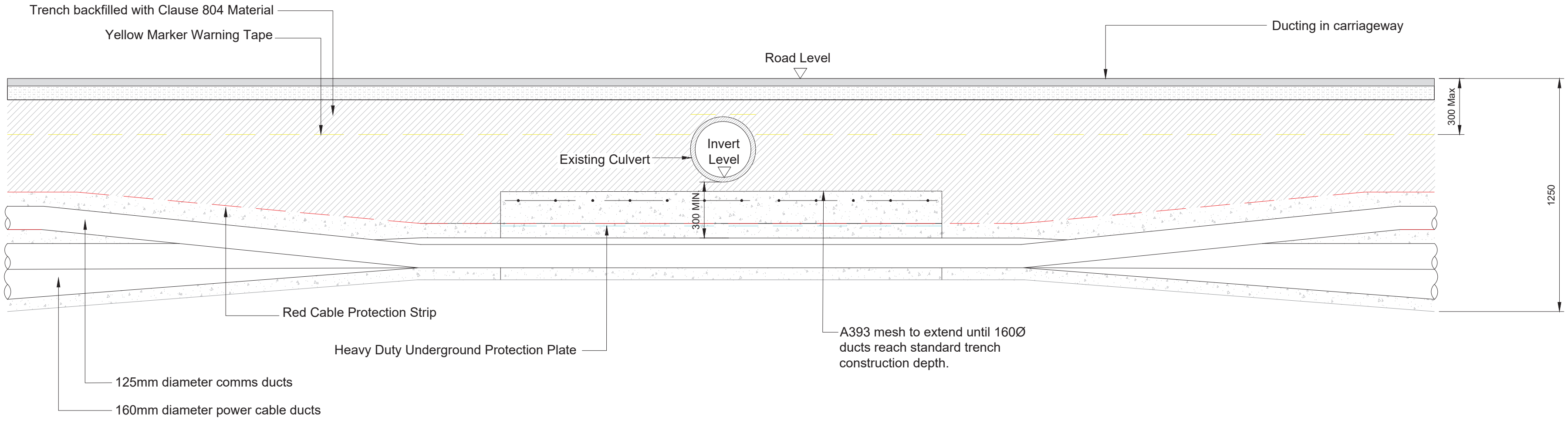

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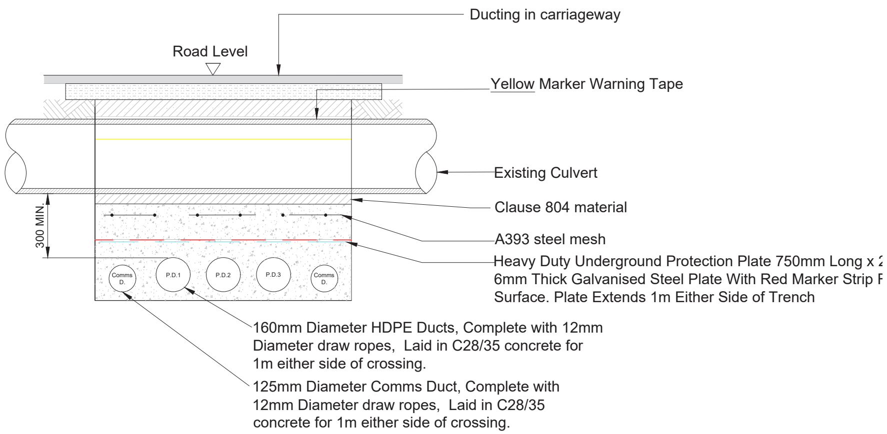

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Figure 4-28

Option 2 - Crossing under Piped Culvert

NOTES

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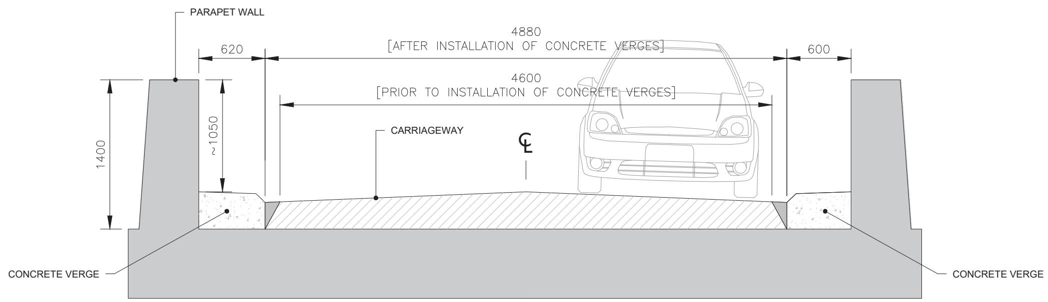

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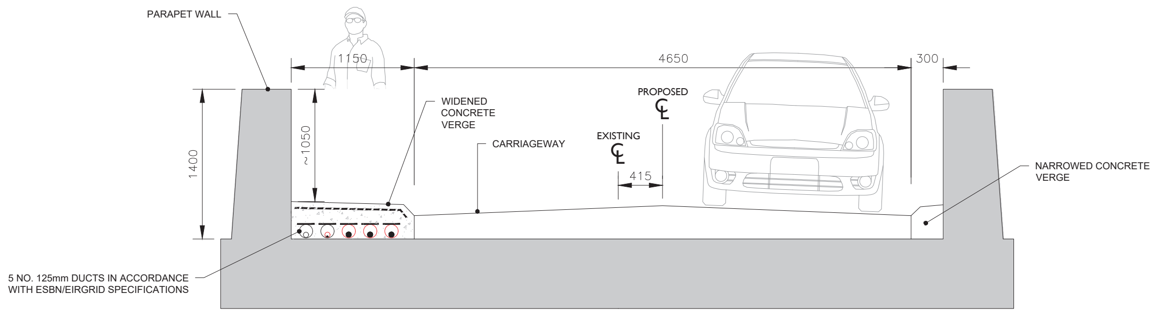

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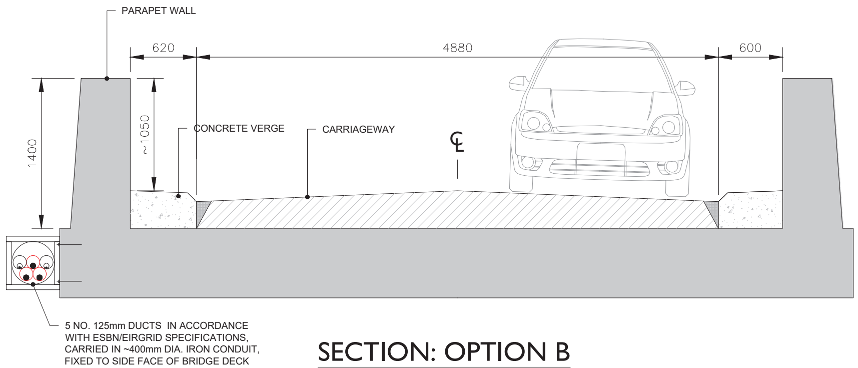

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Figure 4-29

Option 3 - Flatbed Formation over Culverts

NOTES

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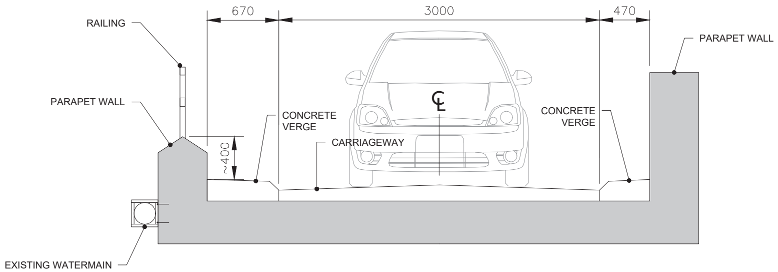

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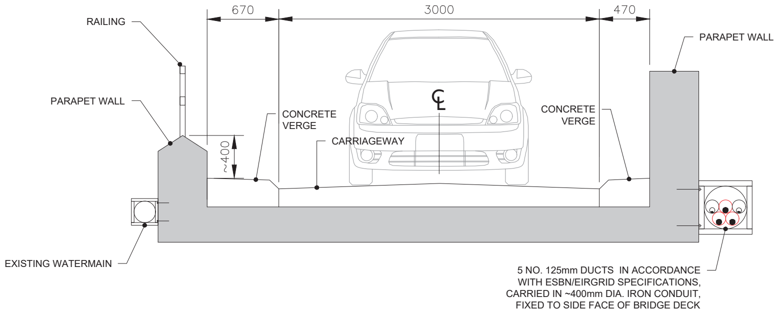

SECTION: OPTION A

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Figure 4-30

Option 4 - Outside of Bridge Decking

NOTES

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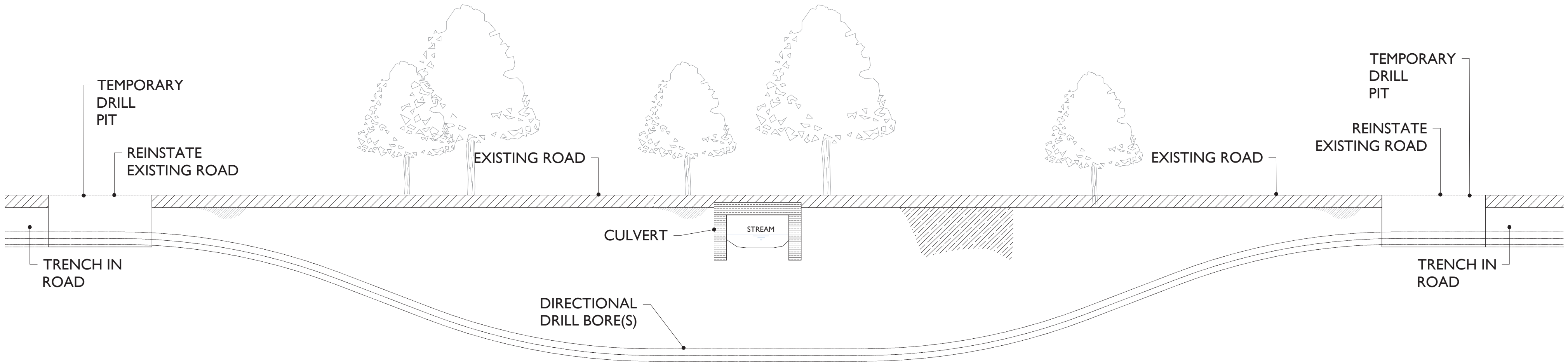

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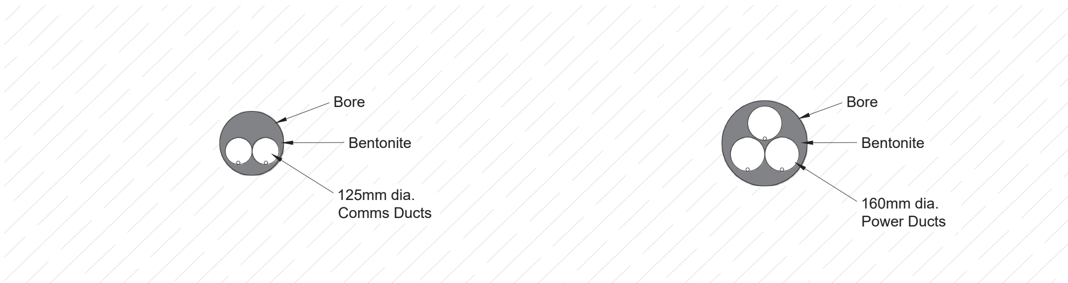

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NOTE: No. and diameter of bores to be confirmed at detailed design.

Figure 4-31

Option 5 - Directional Drilling

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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".

APPENDIX 4-1

SITE LAYOUT PLANNING DRAWINGS

Planning and Environmental Consultants

Proposed Wind Farm Development

Coole Wind Farm, Co. Westmeath

Planning Permission Application Drawings

Schedule of Drawings

Drawing No.	Drawing Title	Scale	Page Size
200445 – 01	Location Context Map	1: 60,000	A3
200445 – 02	Site Location Map	1: 60,000	A3
200445 – 03	Site Location Key Plan	1: 30,000	A1
200445 – 04	Site Location Plan 1 of 9	1: 5,000	A1
200445 – 05	Site Location Plan 2 of 9	1: 5,000	A1
200445 – 06	Site Location Plan 3 of 9	1: 5,000	A1
200445 – 07	Site Location Plan 4 of 9	1: 5,000	A1
200445 – 08	Site Location Plan 5 of 9	1: 5,000	A1
200445 – 09	Site Location Plan 6 of 9	1: 5,000	A1
200445 – 10	Site Location Plan 7 of 9	1: 5,000	A1
200445 – 11	Site Location Plan 8 of 9	1: 5,000	A1
200445 – 12	Site Location Plan 9 of 9	1: 5,000	A1
200445 – 13	Site Layout Key Plan	1: 30,000	A1
200445 – 14	Site Layout Sheet 1 of 24	1: 2,500	A1
200445 – 15	Site Layout Sheet 2 of 24	1: 2,500	A1
200445 – 16	Site Layout Sheet 3 of 24	1: 2,500	A1
200445 – 17	Site Layout Sheet 4 of 24	1: 2,500	A1
200445 – 18	Site Layout Sheet 5 of 24	1: 2,500	A1
200445 – 19	Site Layout Sheet 6 of 24	1: 2,500	A1
200445 – 20	Site Layout Sheet 7 of 24	1: 2,500	A1
200445 – 21	Site Layout Sheet 8 of 24	1: 2,500	A1
200445 – 22	Site Layout Sheet 9 of 24	1: 2,500	A1
200445 – 23	Site Layout Sheet 10 of 24	1: 2,500	A1
200445 – 24	Site Layout Sheet 11 of 24	1: 2,500	A1
200445 – 25	Site Layout Sheet 12 of 24	1: 2,500	A1
200445 – 26	Site Layout Sheet 13 of 24	1: 2,500	A1
200445 – 27	Site Layout Sheet 14 of 24	1: 2,500	A1
200445 – 28	Site Layout Sheet 15 of 24	1: 2,500	A1
200445 – 29	Site Layout Sheet 16 of 24	1: 2,500	A1
200445 – 30	Site Layout Sheet 17 of 24	1: 2,500	A1
200445 – 31	Site Layout Sheet 18 of 24	1: 2,500	A1
200445 – 32	Site Layout Sheet 19 of 24	1: 2,500	A1
200445 – 33	Site Layout Sheet 20 of 24	1: 2,500	A1
200445 – 34	Site Layout Sheet 21 of 24	1: 2,500	A1
200445 – 35	Site Layout Sheet 22 of 24	1: 2,500	A1
200445 – 36	Site Layout Sheet 23 of 24	1: 2,500	A1
200445 – 37	Site Layout Sheet 24 of 24	1: 2,500	A1
200445 - 38	Temporary Construction Compound	1: 500	A3
200445 – 39	Substation Layout	1: 500	A3
200445 – 40	Borrow Pit	1: 2,000	A3
200445 – 41	Borrow Pit Sections	As Shown	A3
200445 – 42	Typical Wind Turbine Hardstanding & Elevations	1: 500	A1
200445 – 43	Indicative Turbine Foundation Standard Detail	As Shown	A3
200445 – 44	Type A Upgrade of Existing Excavated Access Tracks	1: 50	A3
200445 – 45	Type B Upgrade of Existing Floated Access Tracks	1: 50	A3
200445 – 46	Type C New Excavate and Replace Access Road	1: 50	A3
200445 – 47	Type D New Floated Access Road	1: 50	A3
200445 – 48	Transition Detail for Floated and Excavated Access Road	1: 50	A3
200445 – 49	Wastewater Holding Tank Typical Details	1: 20	A3
200445 – 50	Proposed Site Access A	1: 1,000	A3
200445 – 51	Proposed Site Access B	1: 1,000	A3
200445 – 52	Proposed Site Access C	1: 1,000	A3
200445 – 53	Proposed Site Access D	1: 1,000	A3
200445 – 54	Proposed Site Access E	1: 1,000	A3
200445 – 55	Proposed Site Access F & G	1: 1,000	A3
200445 – 56	Typical Clear Span Bridge (Crossing 1)	As Shown	A3
200445 – 57	Typical Clear Span Bridge (Crossing 2)	As Shown	A3
200445 – 58	Typical Clear Span Bridge (Crossing 3)	As Shown	A3
COLE d005.2.1	TYPICAL DETAILS ROAD SECTION TYPE A	1: 50	A3
COLE d005.2.2	TYPICAL DETAILS ROAD SECTION TYPE B	1: 50	A3
COLE d005.2.3	TYPICAL DETAILS ROAD SECTION TYPE C	1: 50	A3
COLE d005.2.4	TYPICAL DETAILS ROAD SECTION TYPE D	1: 50	A3
COLE d005.2.5	TYPICAL DETAILS ROAD SECTION TYPE E1	1: 50	A3
COLE d005.2.4	TYPICAL DETAILS ROAD SECTION TYPE E2	1: 50	A3
COLE d005.4.2	GRID ROUTE TRENCH TYPICAL DETAILS	1: 50	A3
COLE d007.2	SUBSTATION COMPOUND TYPICAL ELEVATIONS	1: 200	A1
COLE d007.3	CONTROL BUILDING: TYPICAL PLAN AND ELEVATIONS	1: 200	A3
COLE d007.4	IPP BUILDING: TYPICAL PLAN AND ELEVATIONS	1: 100	A1
COLE d005.3.1	BRIDGE CROSSINGS WH-L1825-001.00	1: 50	A3
COLE d005.3.2	BRIDGE CROSSINGS WH-L1825-002.00	1: 50	A3

Continued →

COLE d005.4.3	WATER CROSSINGS TYPICAL DETAIL - OVER	1: 50	A3
COLE d005.4.4	WATER CROSSINGS TYPICAL DETAIL - UNDER CULVERT	1: 50	A3
COLE d005.4.5	WATER CROSSINGS TYPICAL DETAIL - DIRECTIONAL DRILL	1: 50	A3
COLE d005.5.1	RAILWAY CROSSING ILLUSTRATIVE OPTIONS	1: 100	A1
COLE d005.5.2	RAILWAY CROSSING ILLUSTRATIVE OPTIONS	1: 100	A1
COLE d005.4.1	JOINT BAY TYPICAL DETAILS	1: 50	A3
COLE d006.1.1	MULLINGAR SUBSTATION ILLUSTRATIVE PLAN	1: 100	A1
COLE d006.1.2	MULLINGAR SUBSTATION EXTENSION EQUIPMENT DETAILS	1: 100	A1
P1320-2-0221-A1-D101-00A	Drainage Layout Sheet 1 of 7	1: 2,000	A1
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P1320-2-0221-A1-D103-00A	Drainage Layout Sheet 3 of 7	1: 2,000	A1
P1320-2-0221-A1-D104-00A	Drainage Layout Sheet 4 of 7	1: 2,000	A1
P1320-2-0221-A1-D105-00A	Drainage Layout Sheet 5 of 7	1: 2,000	A1
P1320-2-0221-A1-D106-00A	Drainage Layout Sheet 6 of 7	1: 2,000	A1
P1320-2-0221-A1-D107-00A	Drainage Layout Sheet 7 of 7	1: 2,000	A1
P1320–2-0221-A1-501-00A	Drainage Details 1	As Shown	A1
P1320–2-0221-A1-502-00A	Drainage Details 2	As Shown	A1

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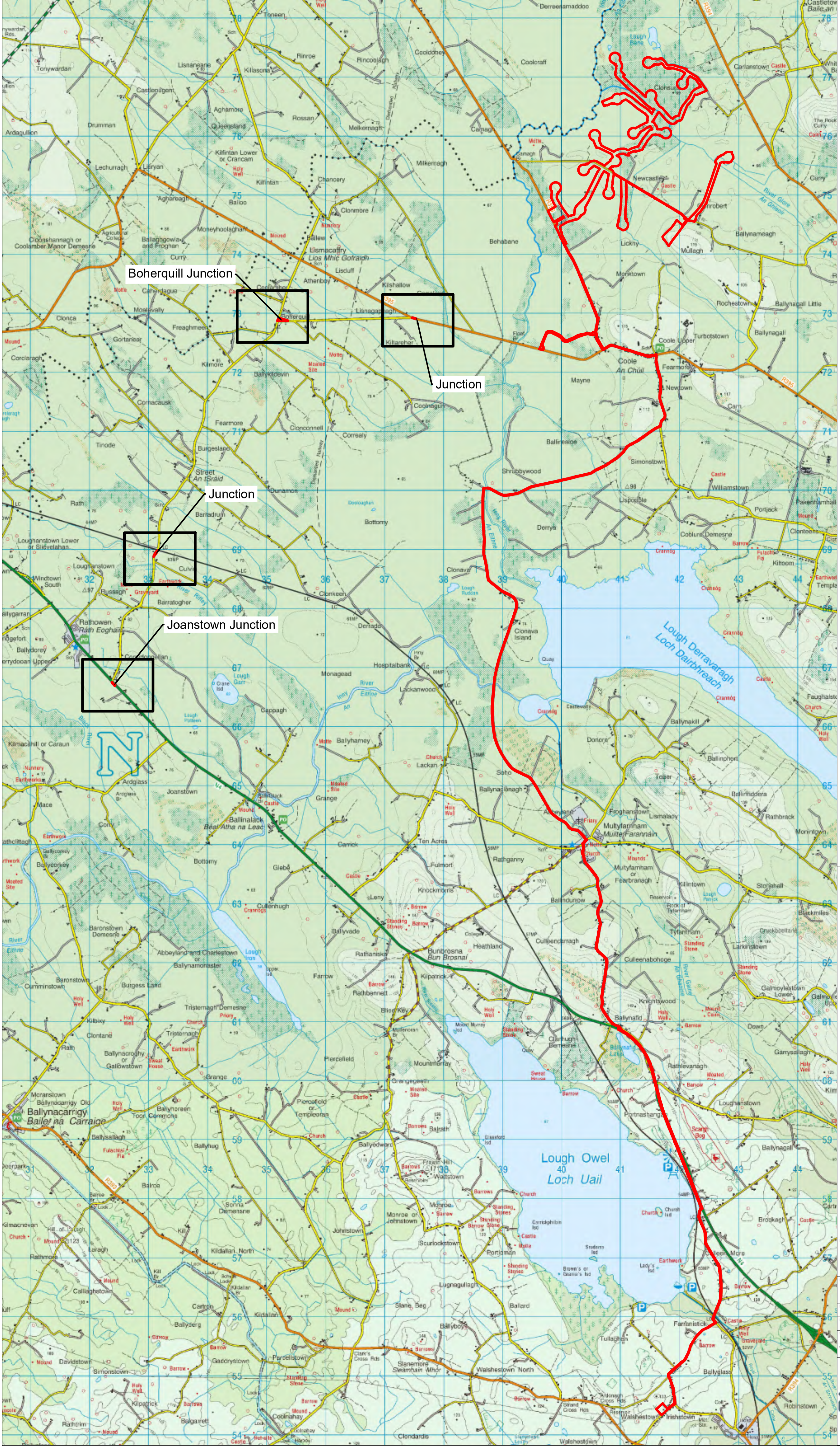

Drawing Legend

Planning Application Boundary

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DRAWING TITLE:

Location Context Map

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 01
SCALE: 1:60,000 @A3	DATE: 18.03.2021
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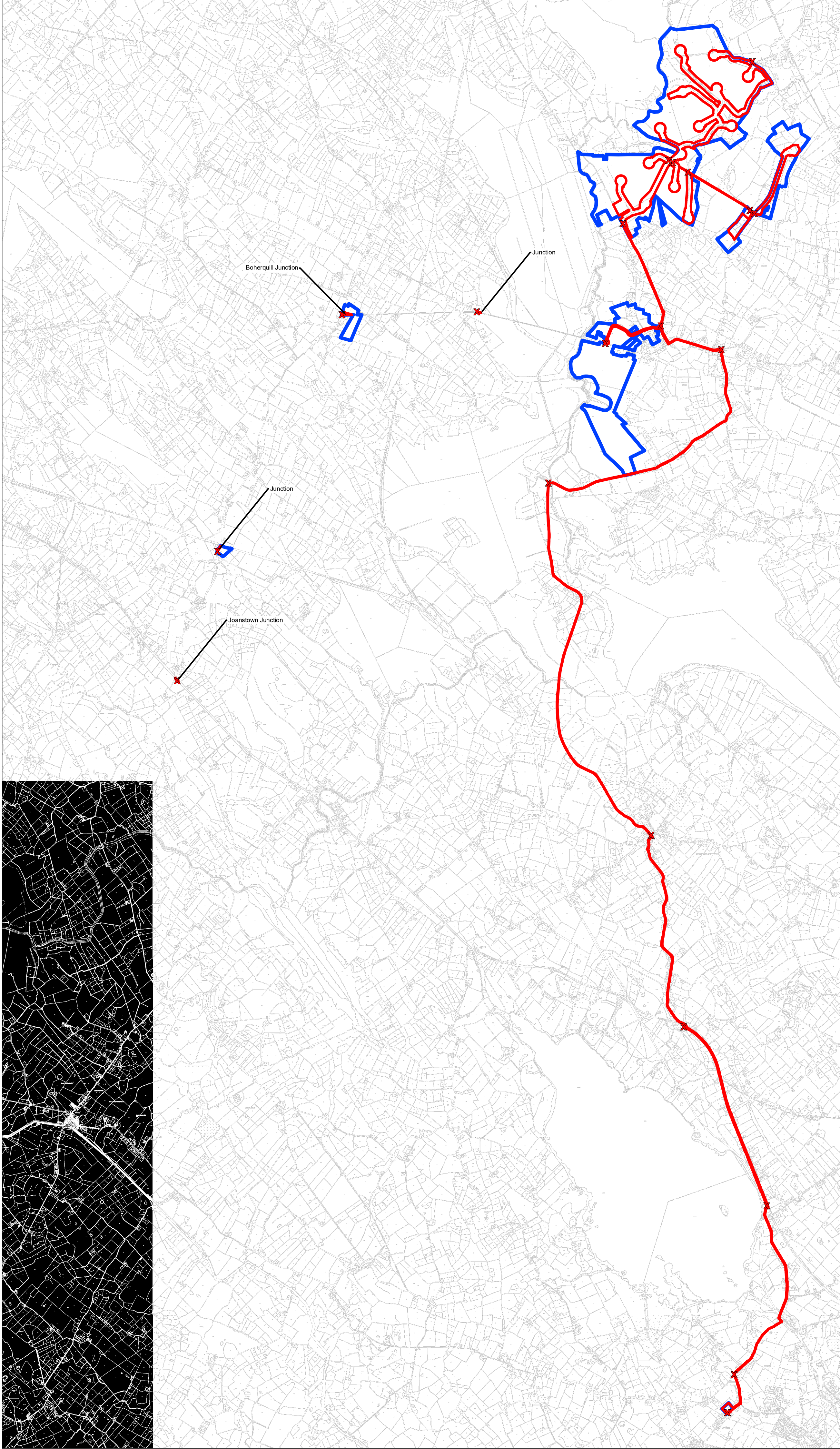

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Landowners Boundary
- Site Notice

DRAWING TITLE:

Site Location Map

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

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PROJECT No.: **200445**	DRAWING No.: **200445 - 02**
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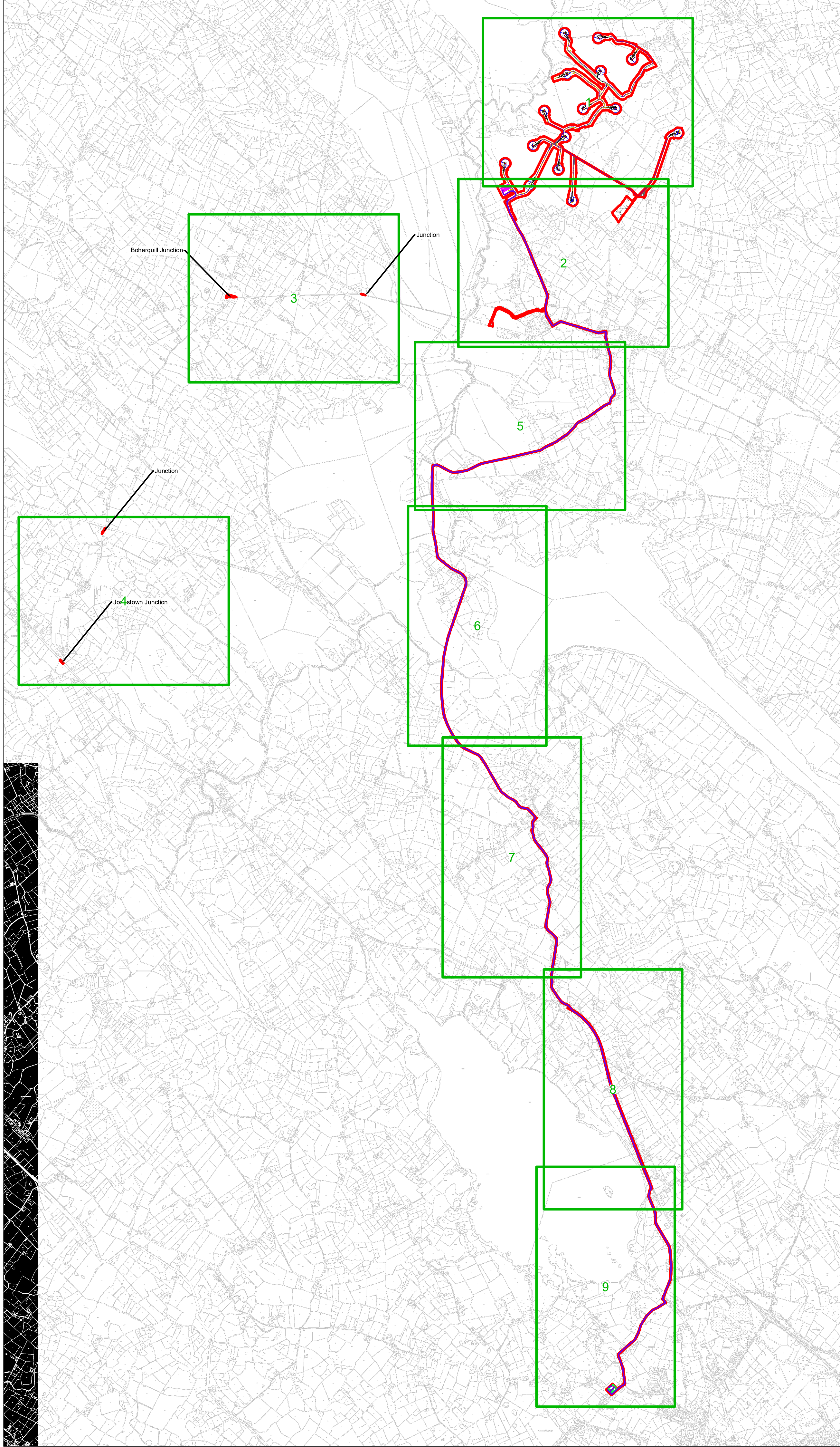

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Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Temporary Construction Compound
- Indicative Internal Electrical Cabling
- Indicative Grid Connection Route
- Wind Farm Substation
- Existing Mullingar Substation

N

DRAWING TITLE:

Site Location Key Plan

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 03**
SCALE: **1:30,000 @ A1**	DATE: **18.03.2021**

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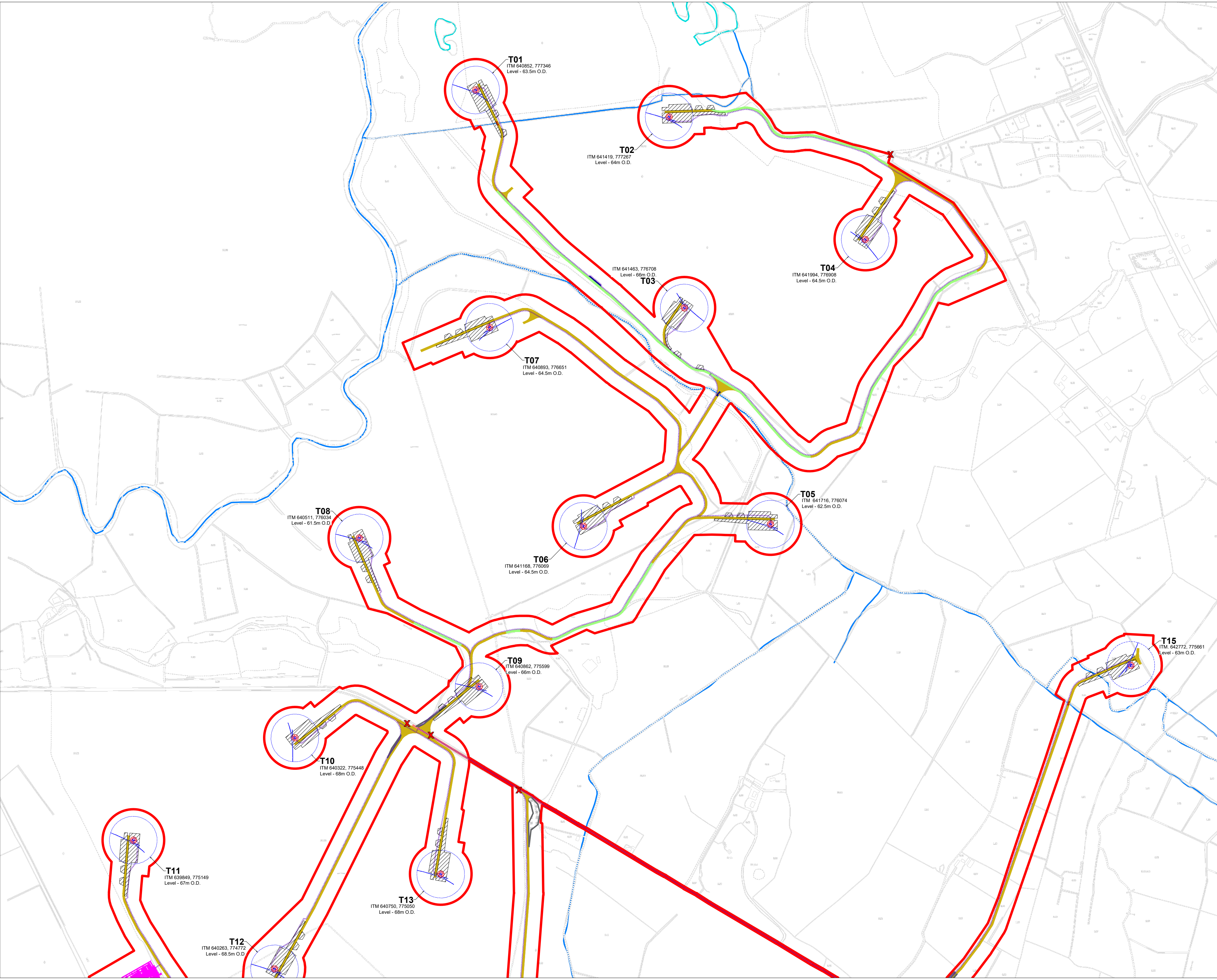

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Existing Crossing for Upgrade
- Passing Bays
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Temporary Construction Compound
- Indicative Internal Electrical Cabling
- Wind Farm Substation
- River/Stream
- Lakes

N

DRAWING TITLE:

Site Location Plan Sheet 1 of 9

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 04
SCALE: 1:5,000 @ A1	DATE: 18.03.2021

OS SHEET No.:
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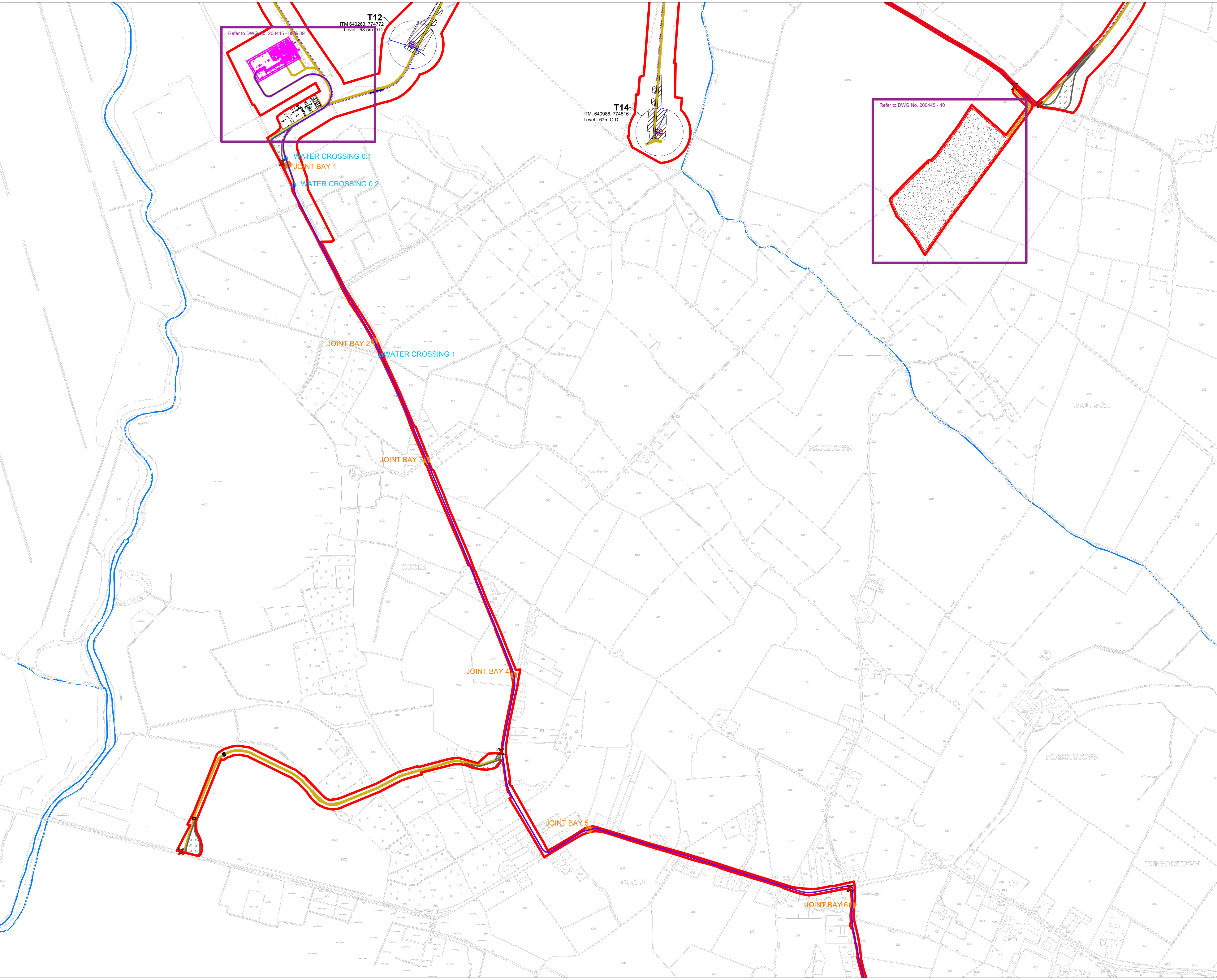

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Site Notice
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Passing Bays
- Unbound Hardcore Surface
- Crossing Point for Landowners
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Indicative Internal Electrical Cabling
- Indicative Grid Connection Route
- Wind Farm Substation
- Indicative Joint Bay
- Watercrossing
- River/Stream

N

DRAWING TITLE:

Site Location Plan
Sheet 2 of 9

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 05**
SCALE: **1:5,000 @ A1**	DATE: **18.03.2021**

OS SHEET No.:
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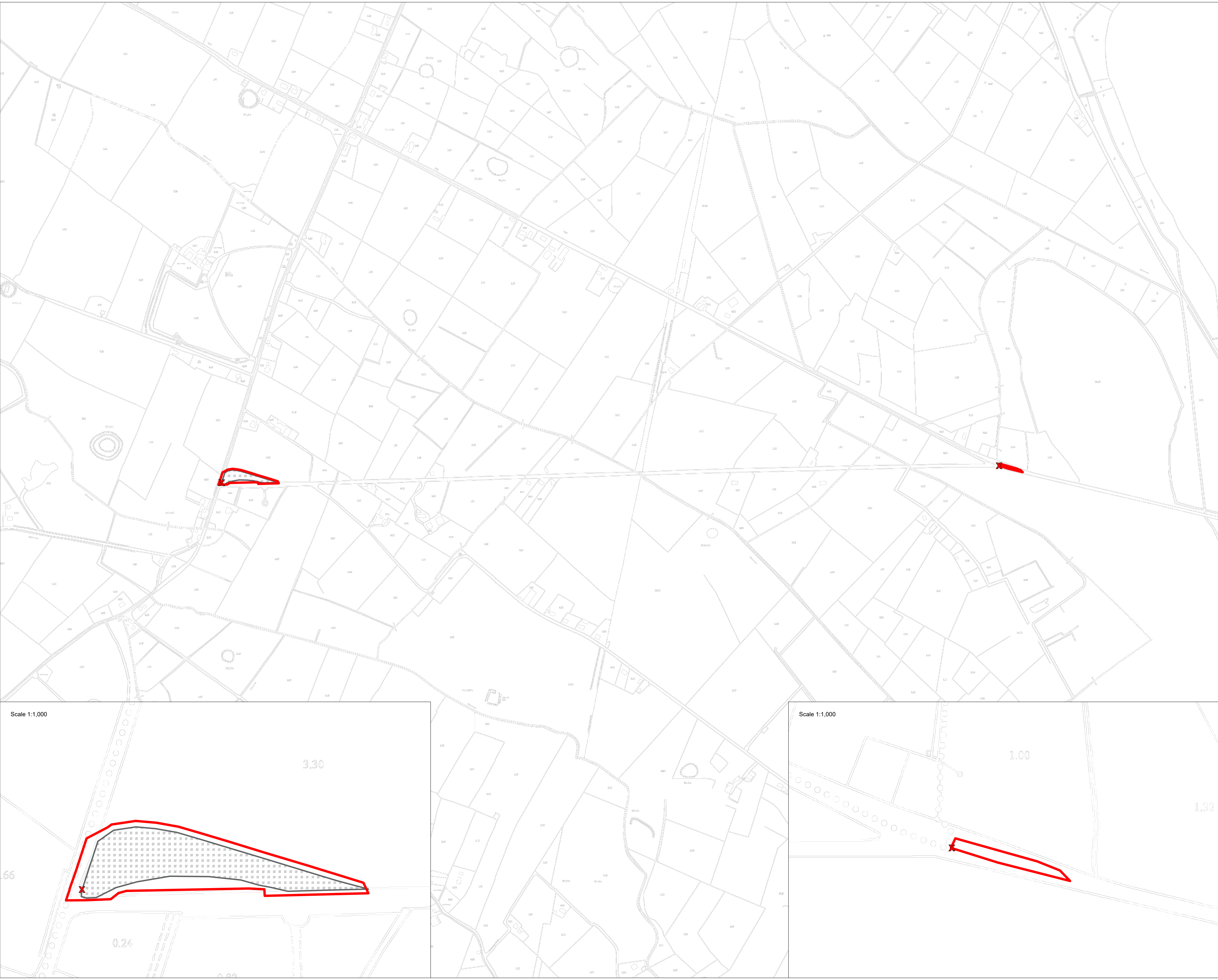

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Unbound Hardcore Surface
- Site Notice

N

DRAWING TITLE:
Site Location Plan
Sheet 3 of 9

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 06**
SCALE: **1:5,000 @ A1**	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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Ireland, H91 VW84
+353 (0) 91 735611
email: info@www.mkoireland.ie
Website: www.mkoireland.ie

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Unbound Hardcore Surface
- Site Notice

N

DRAWING TITLE:
Site Location Plan Sheet 4 of 9

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 07
SCALE: 1:5,000 @ A1	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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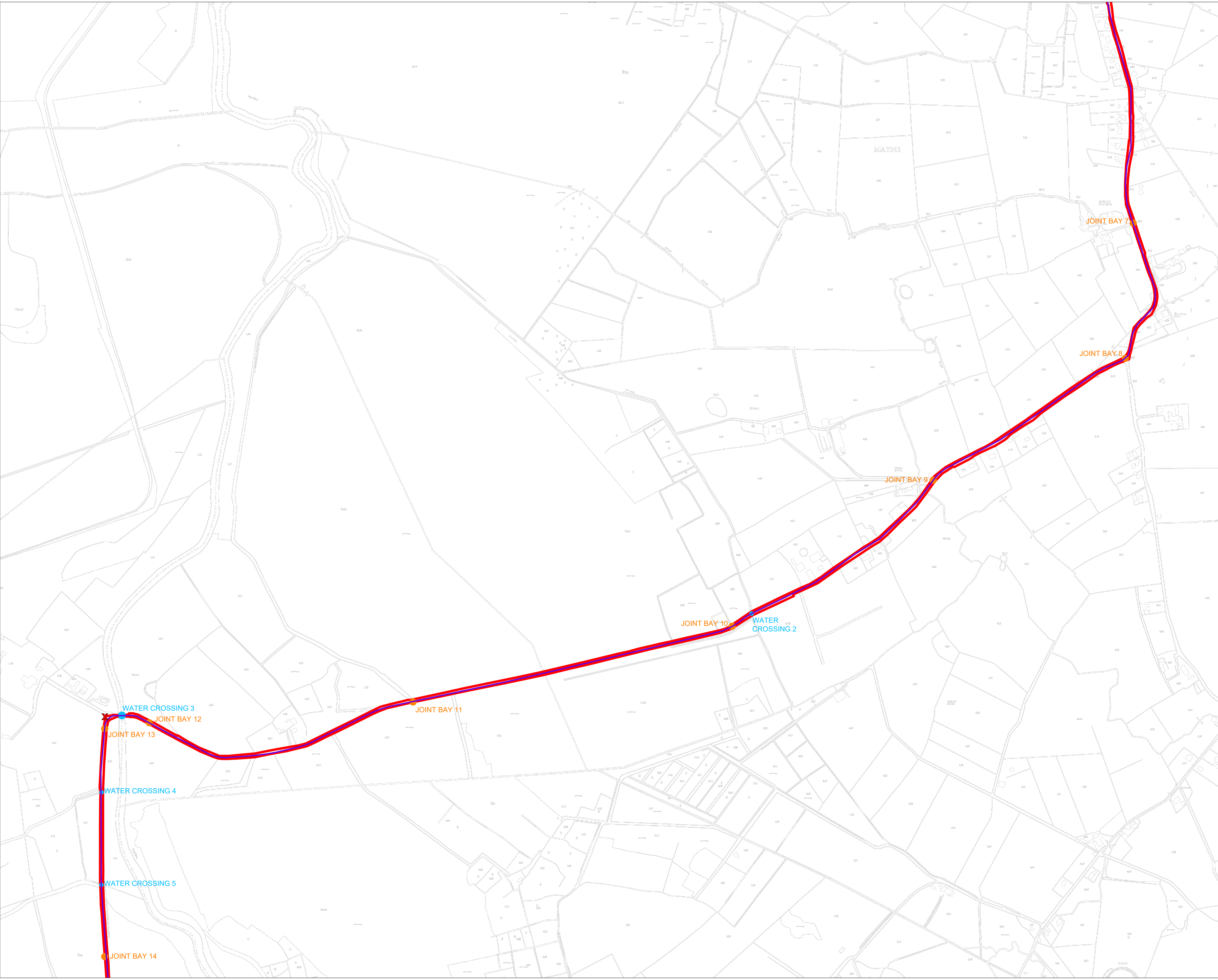

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Site Notice
- Indicative Grid Connection Route
- Indicative Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Location Plan Sheet 5 of 9

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 08**
SCALE: **1:5,000 @ A1**	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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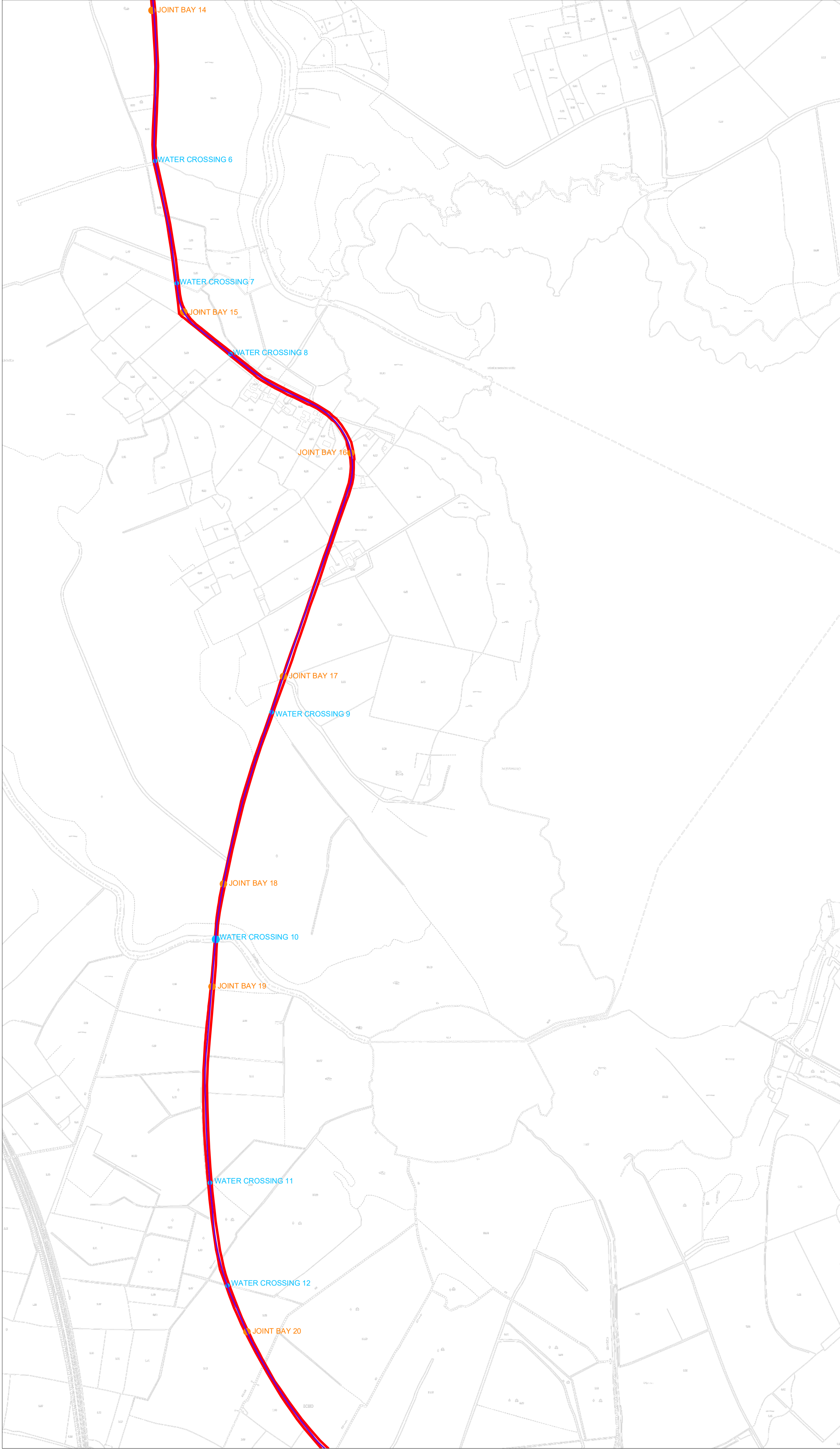

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- Indicative Joint Bay
- Watercrossing

DRAWING TITLE:
Site Location Plan Sheet 6 of 9

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 09
SCALE: 1:5,000 @ A1	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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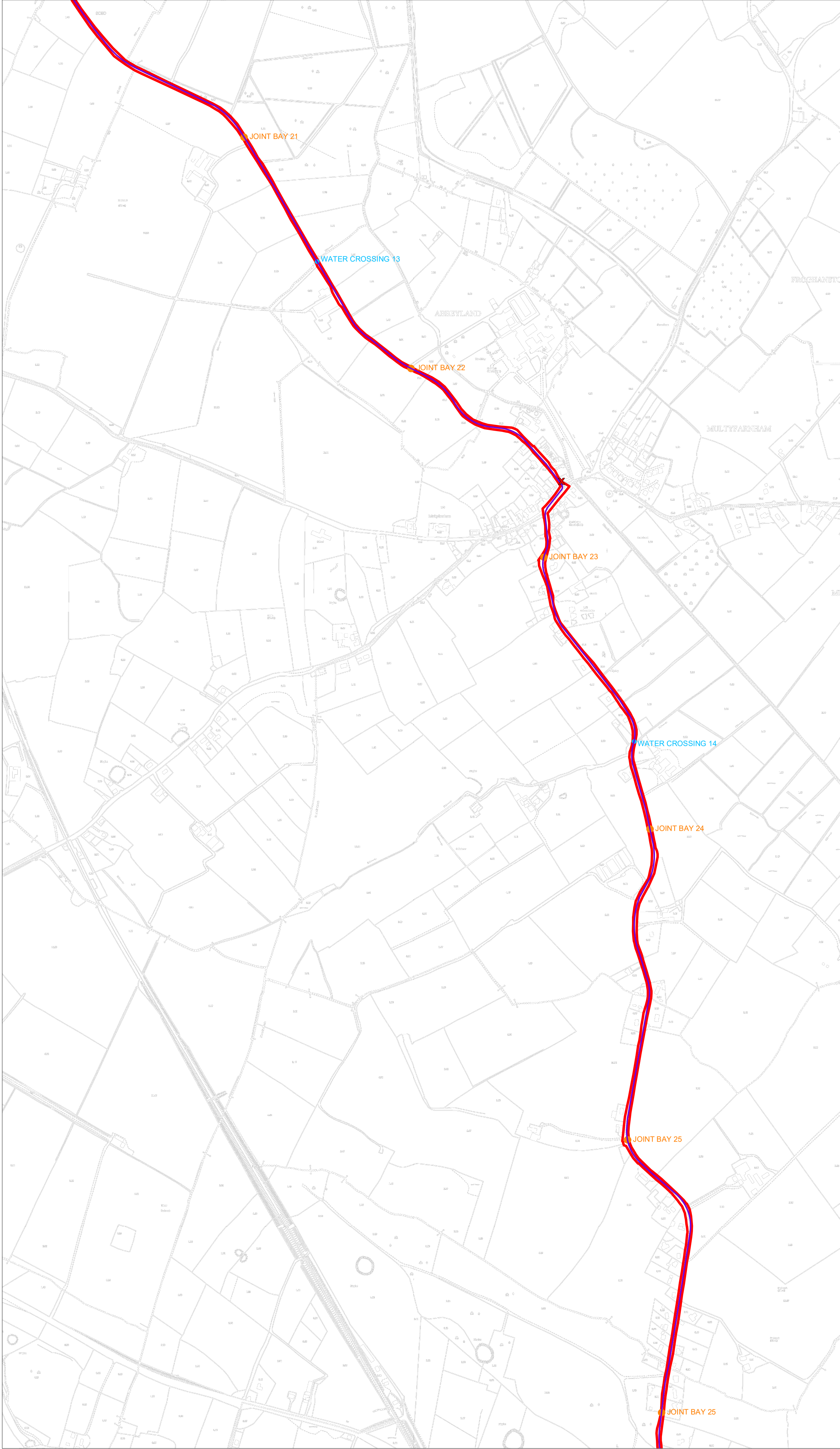
Website: www.mkoireland.ie



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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Site Notice
- Indicative Grid Connection Route
- Indicative Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Location Plan Sheet 7 of 9

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 10
SCALE: 1:5,000 @ A1	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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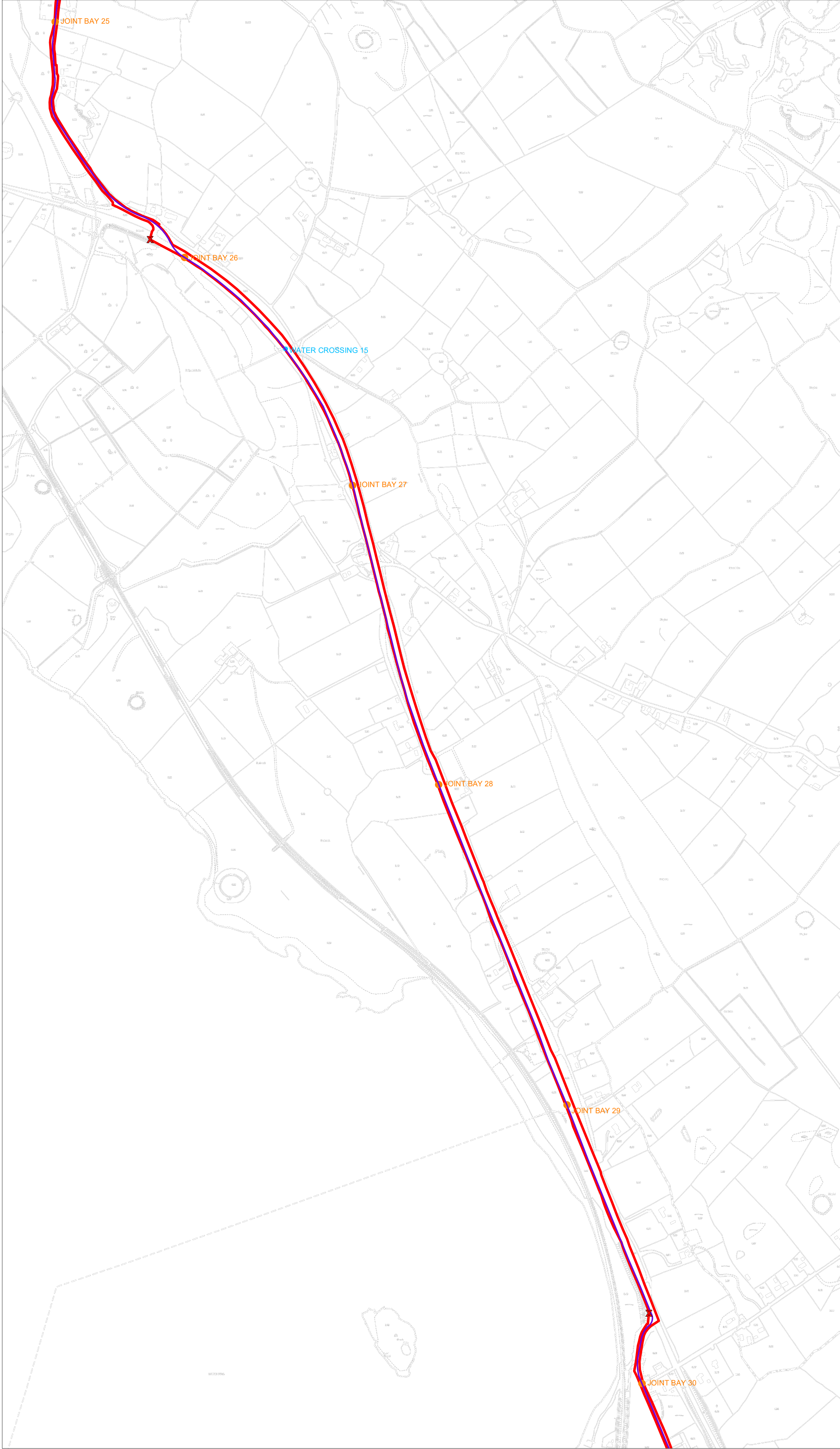

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Site Notice
- Indicative Grid Connection Route
- Indicative Joint Bay
- Watercrossing

DRAWING TITLE:
Site Location Plan
Sheet 8 of 9

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 11
SCALE: 1:5,000 @ A1	DATE: 18.03.2021

OS SHEET No.: 2234, 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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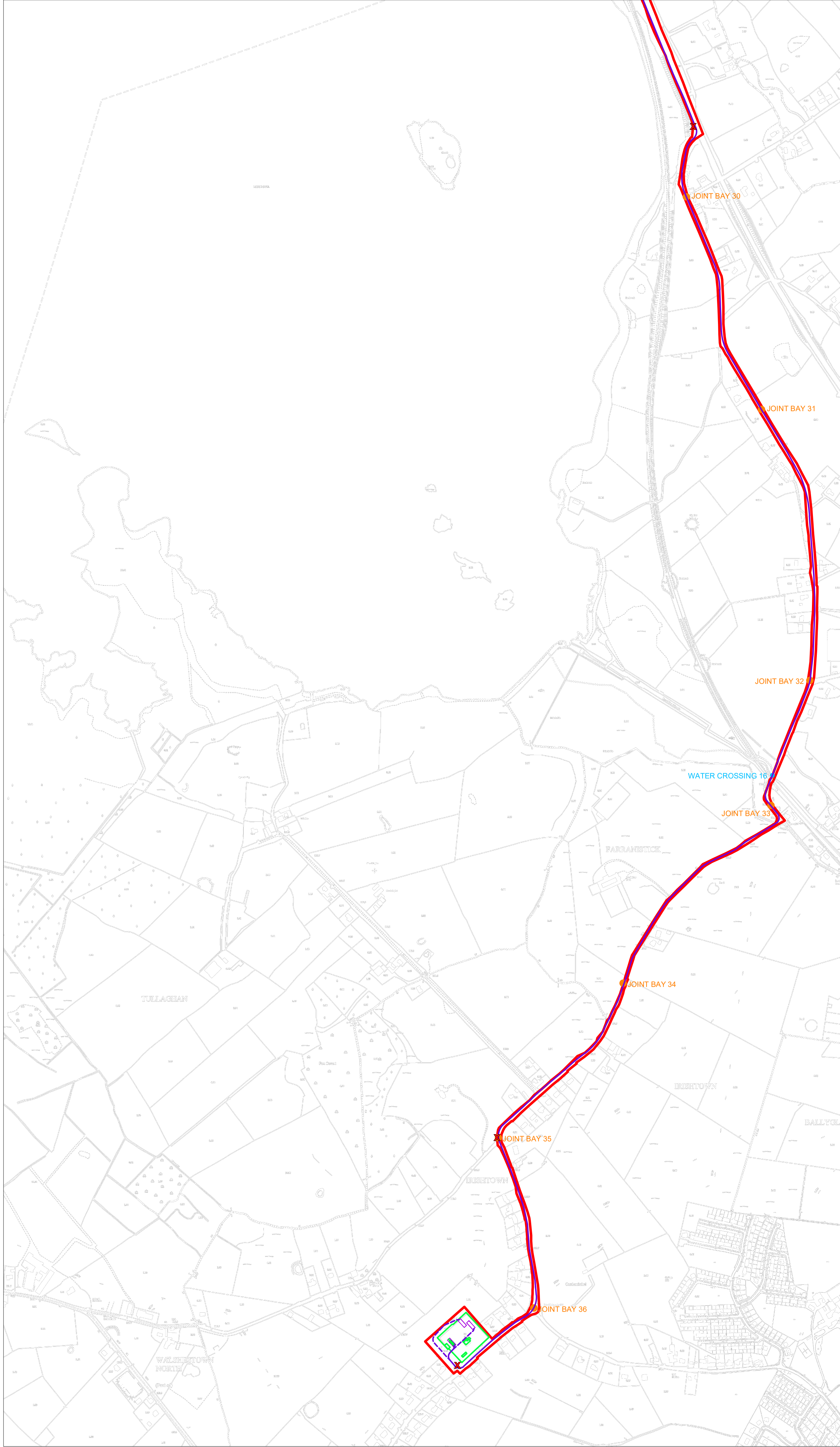

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Site Notice
- Indicative Grid Connection Route
- Indicative Joint Bay
- Watercrossing
- Existing Mullingar Substation

N

DRAWING TITLE:

Site Location Plan Sheet 9 of 9

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 12
SCALE: 1:5,000 @ A1	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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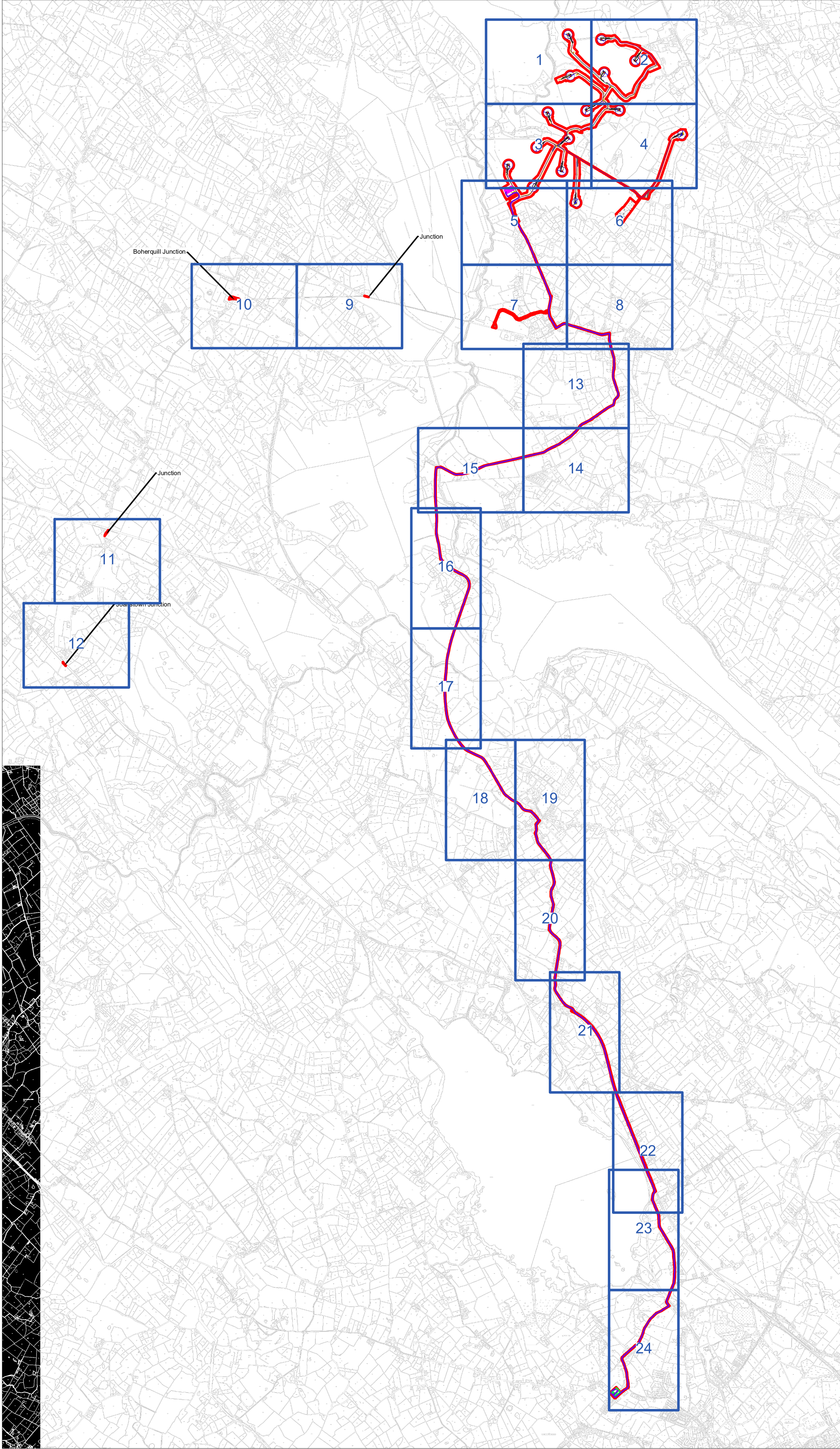

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Temporary Construction Compound
- Indicative Internal Electrical Cabling
- Indicative Grid Connection Route
- Wind Farm Substation
- Existing Mullingar Substation

N

DRAWING TITLE:

Site Layout Key Plan B

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 13
SCALE: 1:30,000 @ A1	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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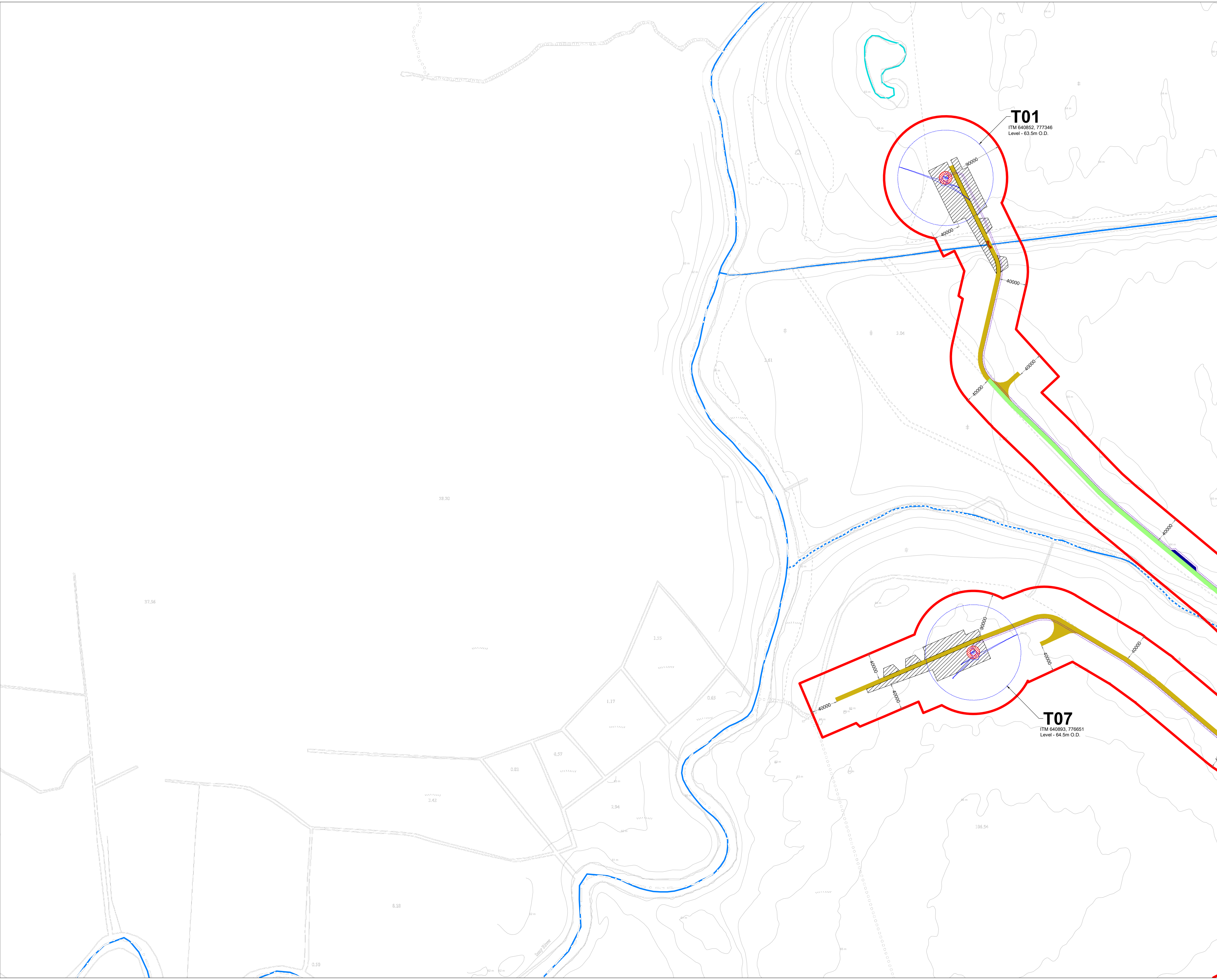

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Passing Bays
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Indicative Internal Electrical Cabling
- River/Stream

DRAWING TITLE:
Site Layout Plan Sheet 1 of 24

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 14
SCALE: 1:2,500 @ A1	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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email: info@www.mkoireland.ie
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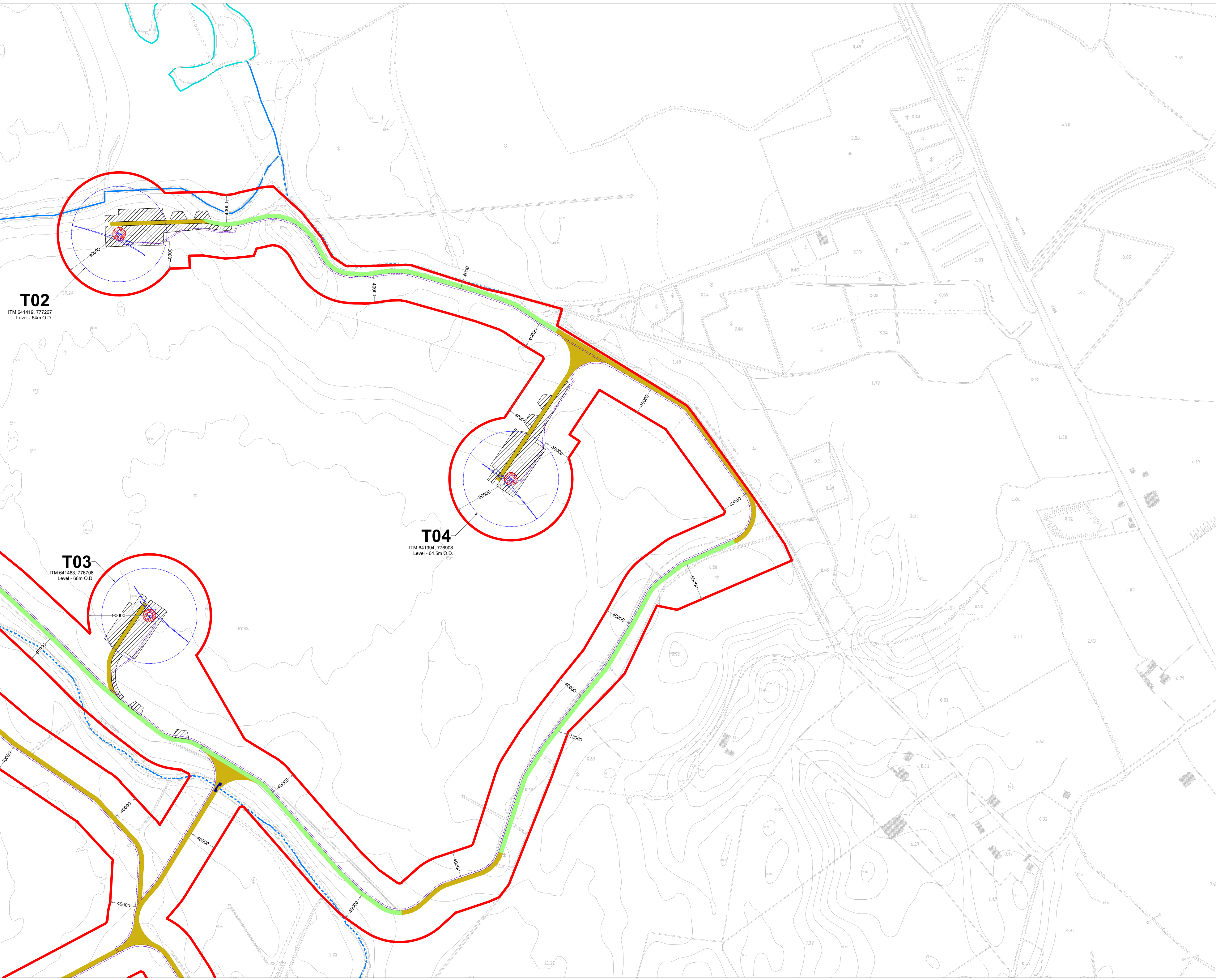

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Proposed Road
- Existing Crossing for Upgrade
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Indicative Internal Electrical Cabling
- River/Stream
- Lakes

N

DRAWING TITLE:
Site Layout Plan Sheet 2 of 24

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 15
SCALE: 1:2,500 @ A1	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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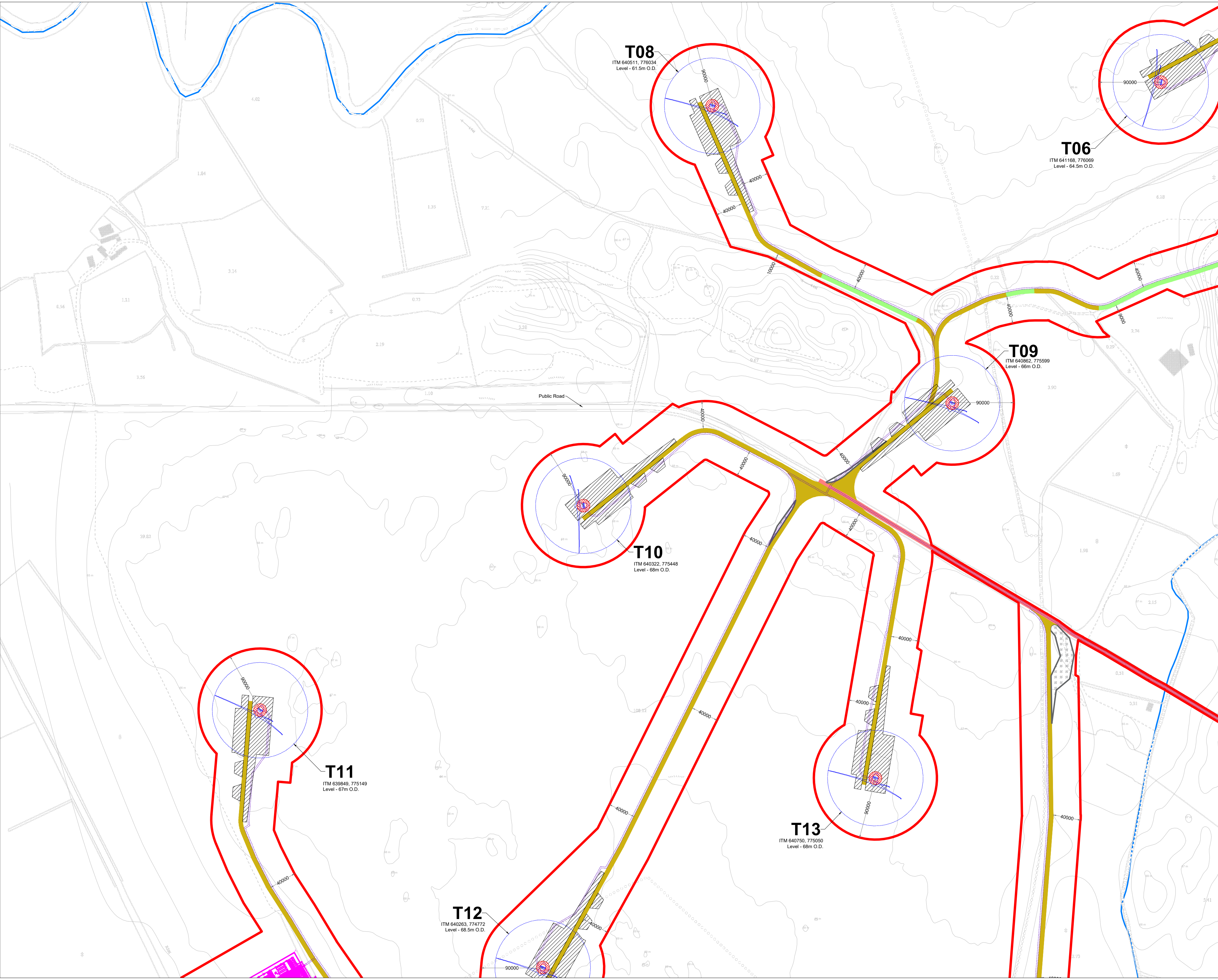

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8. Final levels may vary depending on local ground conditions.
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Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Existing Crossing for Upgrade
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Indicative Internal Electrical Cabling
- Wind Farm Substation
- River/Stream

N

DRAWING TITLE:

Site Layout Plan Sheet 3 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY:	CHECKED BY:
Joseph O Brien	Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 16
SCALE: 1:2,500 @ A1	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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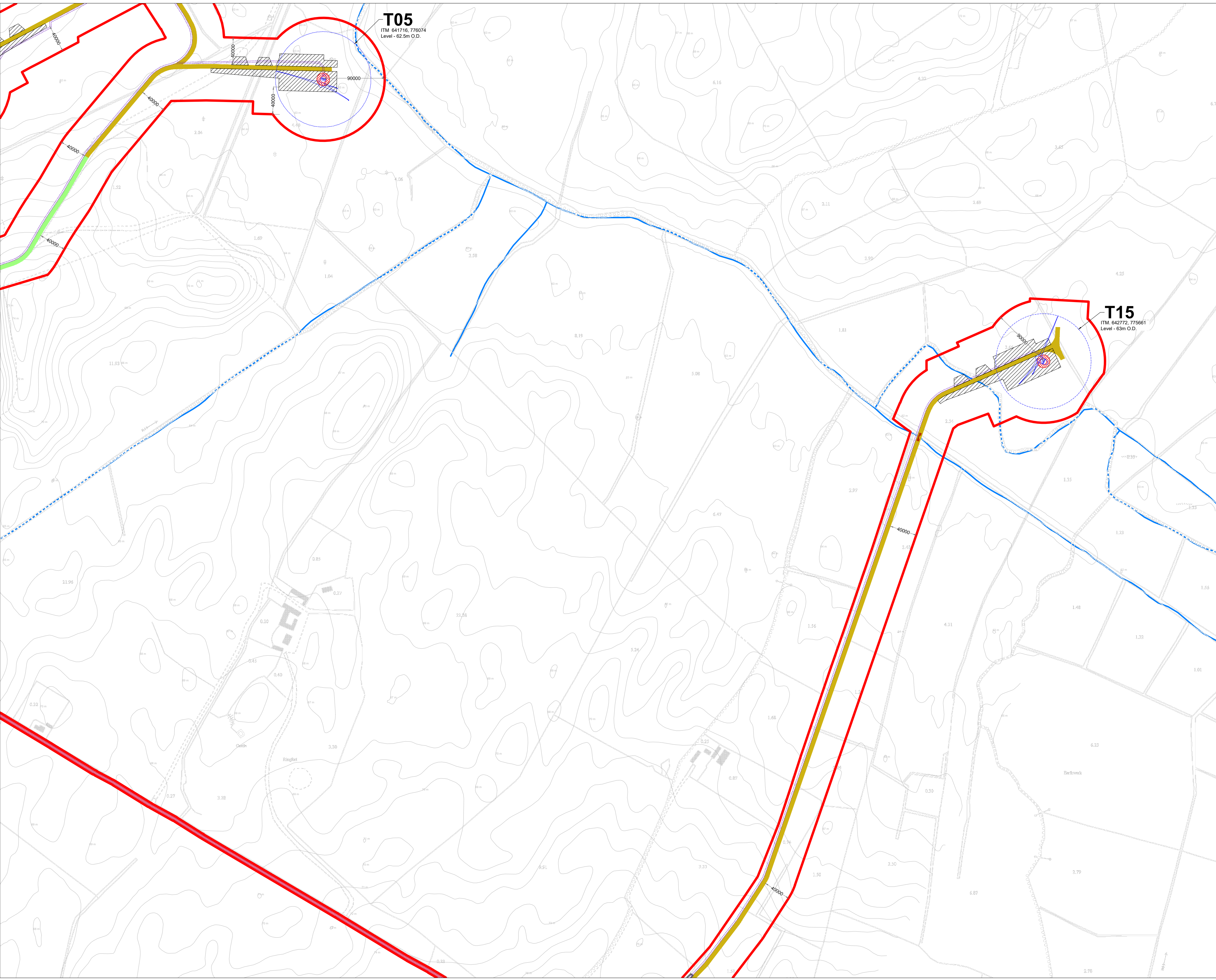

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Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Proposed New Crossing
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Indicative Internal Electrical Cabling
- Wind Farm Substation
- River/Stream

N

DRAWING TITLE:

Site Layout Plan Sheet 4 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 17
SCALE: 1:2,500 @ A1	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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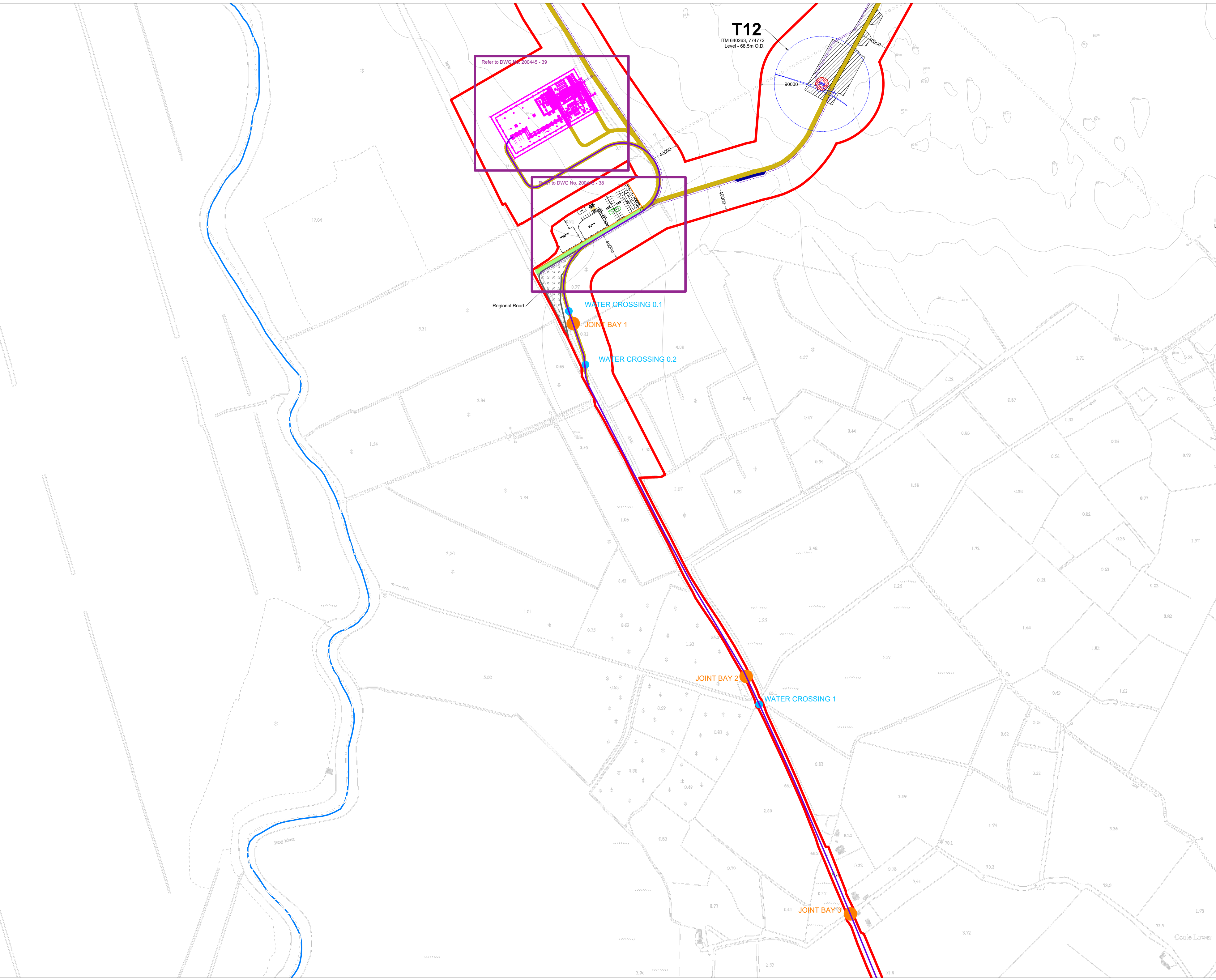

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9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing Internal Road to be Upgraded
- Existing External Road to be Upgraded
- Proposed Road
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Temporary Construction Compound
- Indicative Internal Electrical Cabling
- Indicative Grid Connection Route
- Wind Farm Substation
- X Spot Height
- Indicative Joint Bay
- Watercrossing
- River/Stream

N

DRAWING TITLE:
Site Layout Plan
Sheet 5 of 24

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 18
SCALE: 1:2,500 @ A1	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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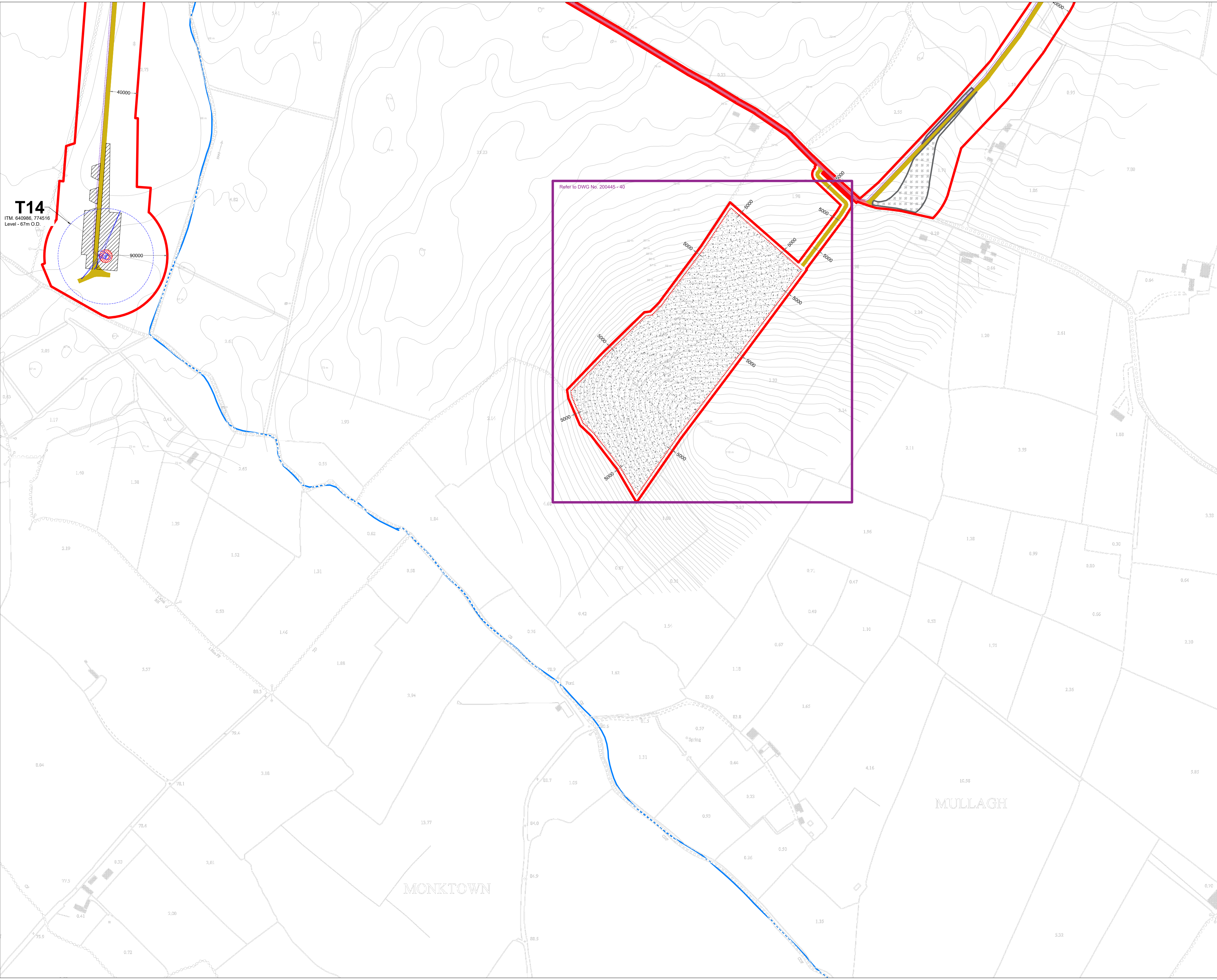
email: info@www.mkoireland.ie
Website: www.mkoireland.ie



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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Existing External Road to be Upgraded
- Proposed Road
- Unbound Hardcore Surface
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit
- Indicative Internal Electrical Cabling
- River/Stream

N

DRAWING TITLE:

Site Layout Plan Sheet 6 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 19
SCALE: 1:2,500 @ A1	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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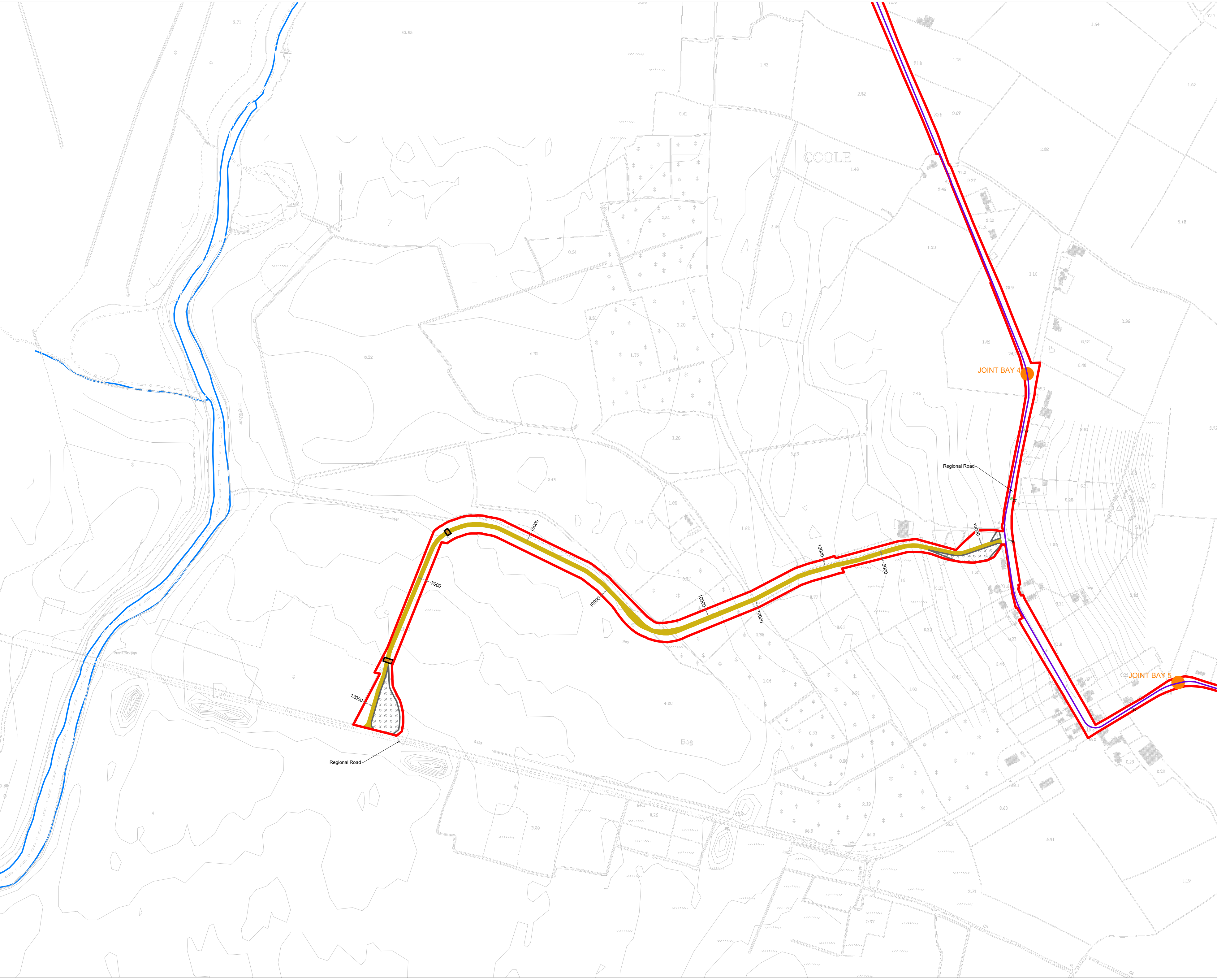

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Unbound Hardcore Surface
- Crossing Point for Landowners
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay
- River/Stream

N

DRAWING TITLE:

Site Layout Plan Sheet 7 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 20
SCALE: 1:2,500 @ A1	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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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay

N

DRAWING TITLE:

Site Layout Plan Sheet 8 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 21**
SCALE: **1:2,500 @ A1**	DATE: **18.03.2021**

OS SHEET No.:
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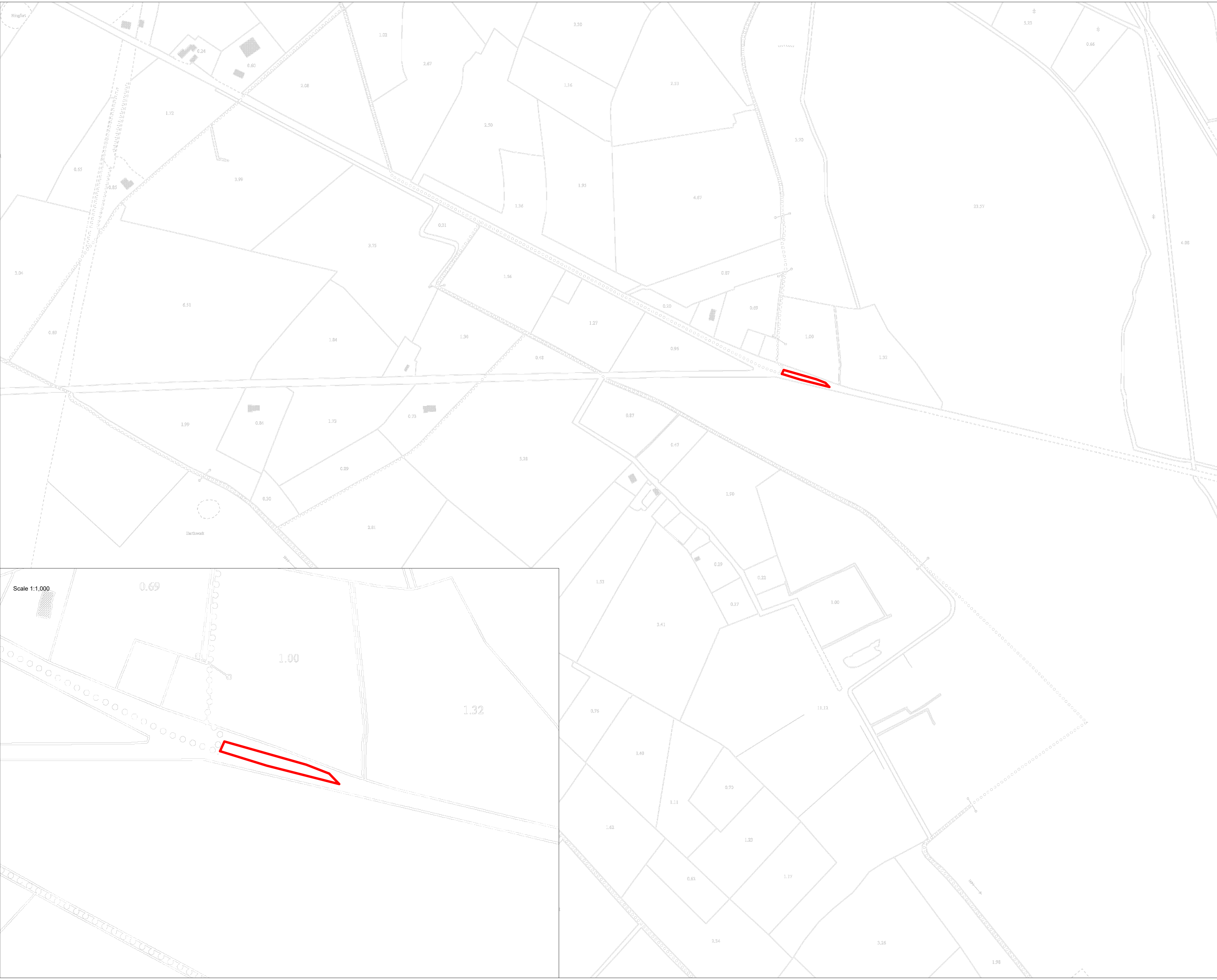

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

Planning Application Boundary

N

DRAWING TITLE:

Site Layout Plan Sheet 9 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 22
SCALE: 1:2,500 @ A1	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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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Unbound Hardcore Surface

N

DRAWING TITLE:

Site Layout Plan Sheet 10 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 23**
SCALE: **1:2,500 @ A1**	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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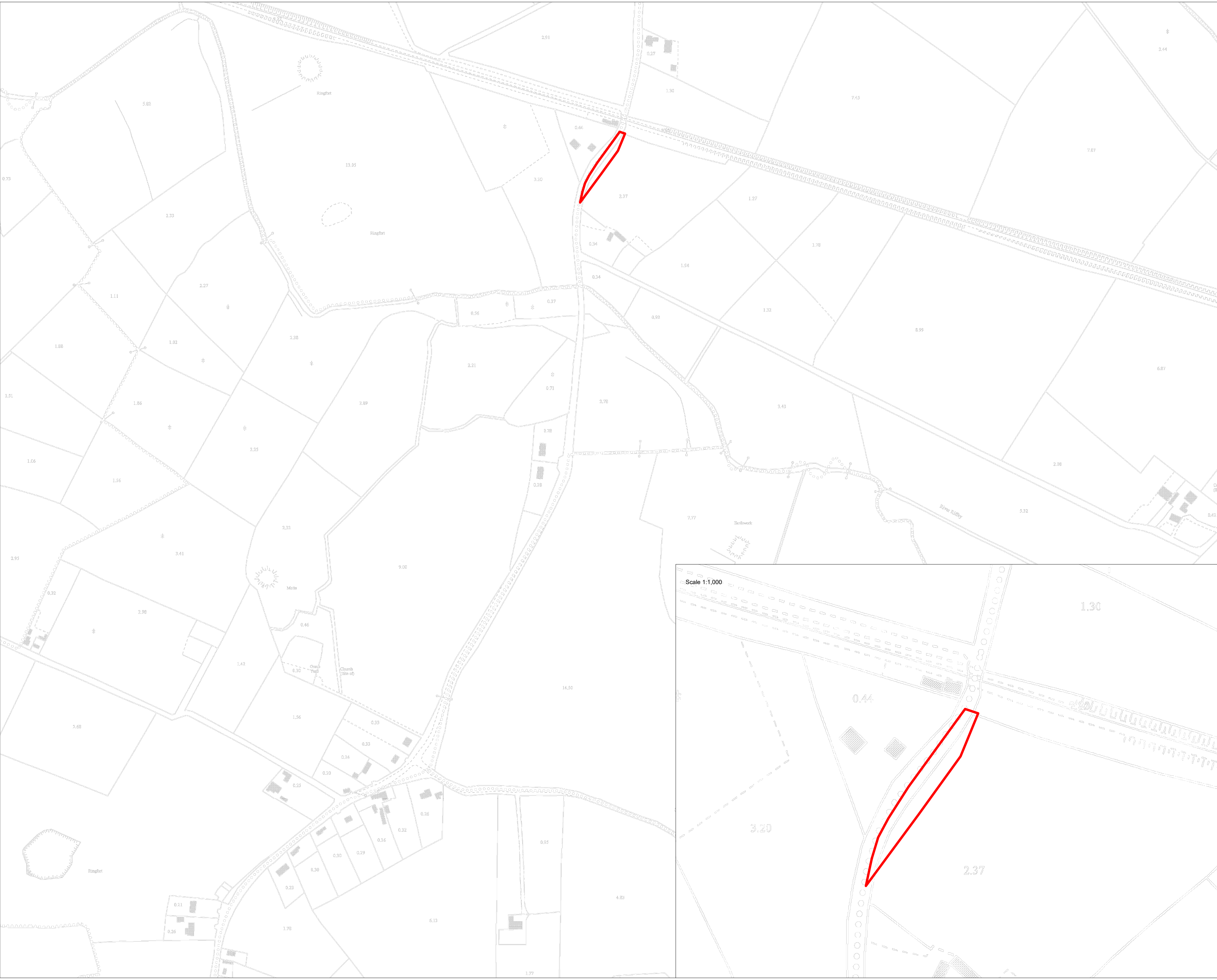

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

Planning Application Boundary

N

DRAWING TITLE:

Site Layout Plan Sheet 11 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 24**
SCALE: **1:2,500 @ A1**	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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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Unbound Hardcore Surface

N

DRAWING TITLE:

Site Layout Plan Sheet 12 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 25
SCALE: 1:2,500 @ A1	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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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay

N

DRAWING TITLE: **Site Layout Plan Sheet 13 of 24**	
PROJECT TITLE: **Coole Wind Farm, Co. Westmeath**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 26**
SCALE: **1:2,500 @ A1**	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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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay
- Watercrossing

DRAWING TITLE:

Site Layout Plan Sheet 14 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 27
SCALE: 1:2,500 @ A1	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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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan Sheet 15 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 28
SCALE: 1:2,500 @ A1	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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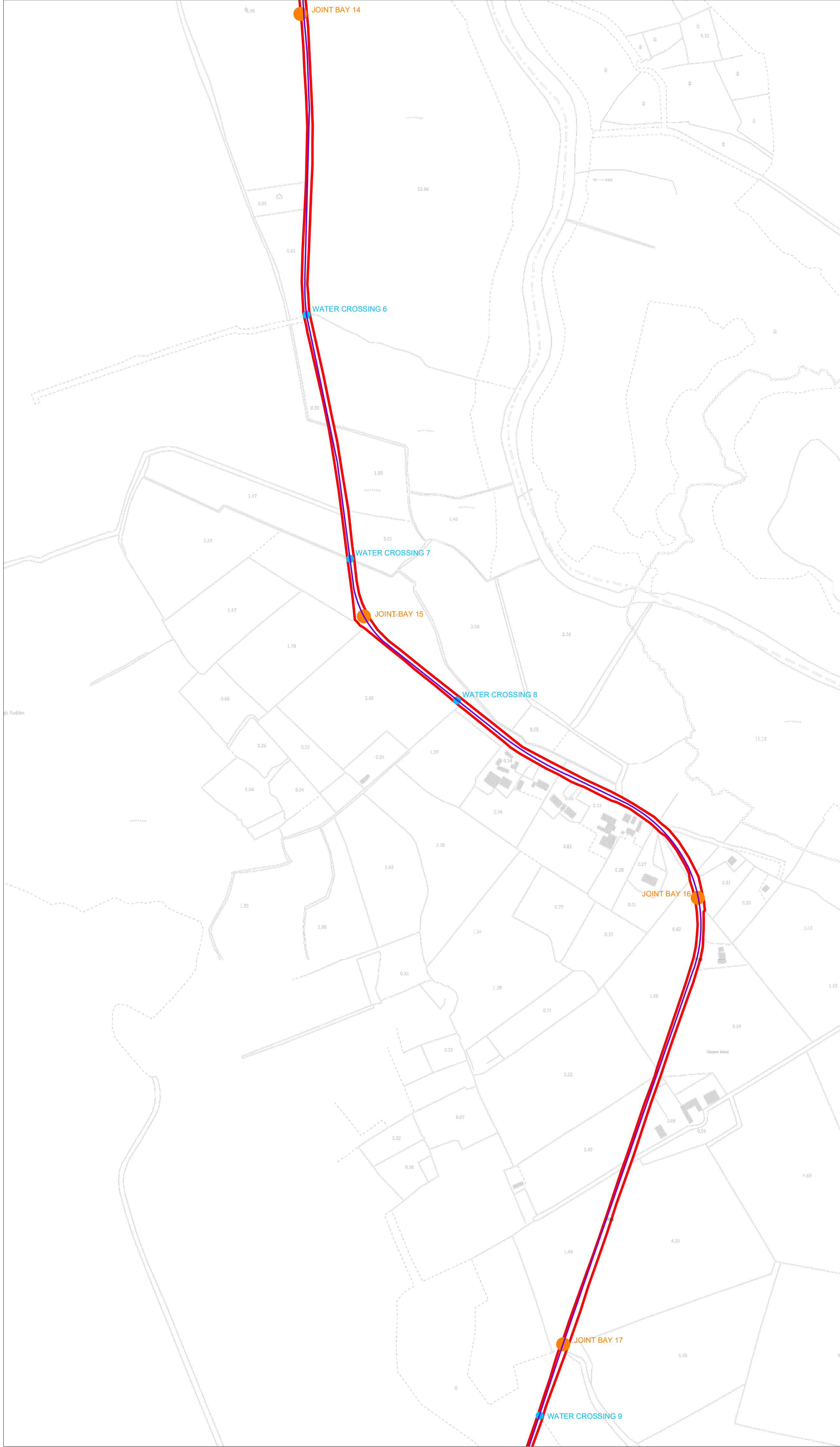

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8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay
- Watercrossing

N

DRAWING TITLE:
Site Layout Plan Sheet 16 of 24

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 29
SCALE: 1:2,500 @ A1	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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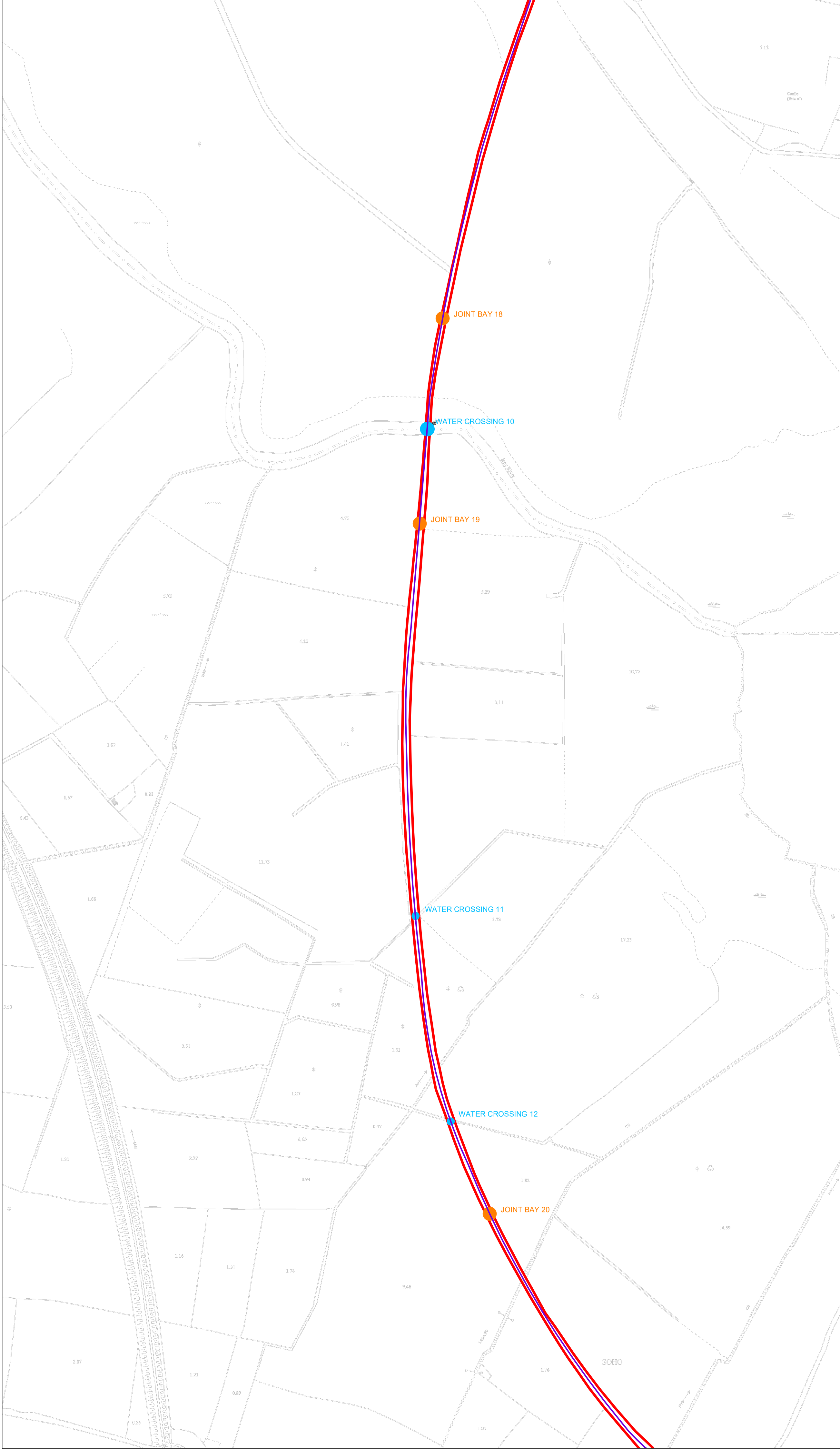

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- Indicative Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan Sheet 17 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 30
SCALE: 1:2,500 @ A1	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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Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- Indicative Joint Bay
- Watercrossing

DRAWING TITLE:

Site Layout Plan Sheet 18 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 31
SCALE: 1:2,500 @ A1	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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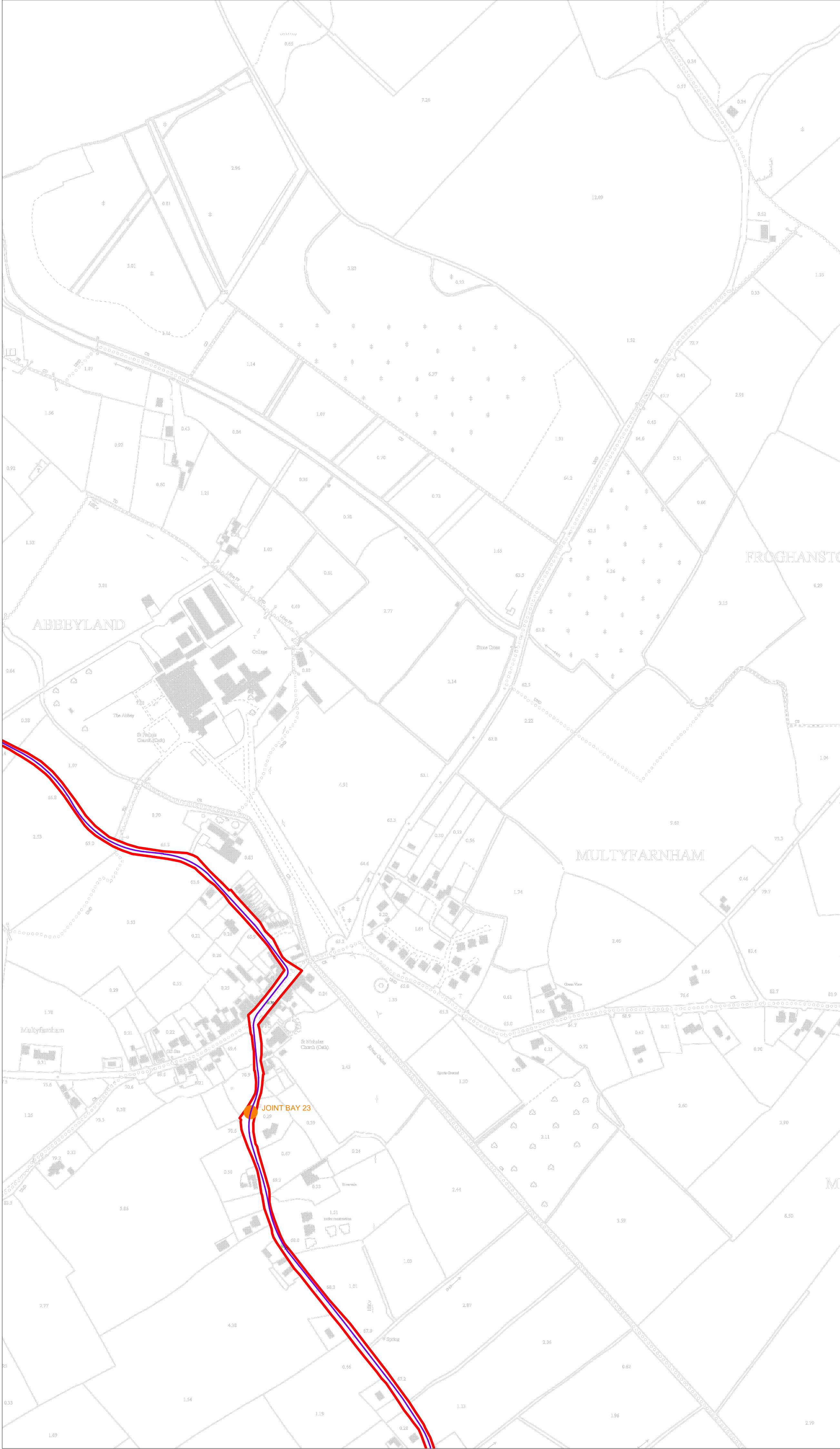
email: info@www.mkoireland.ie
Website: www.mkoireland.ie



Project Design Drawing Notes

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay

N

DRAWING TITLE:

Site Layout Plan Sheet 19 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 32
SCALE: 1:2,500 @ A1	DATE: 18.03.2021

OS SHEET No.:

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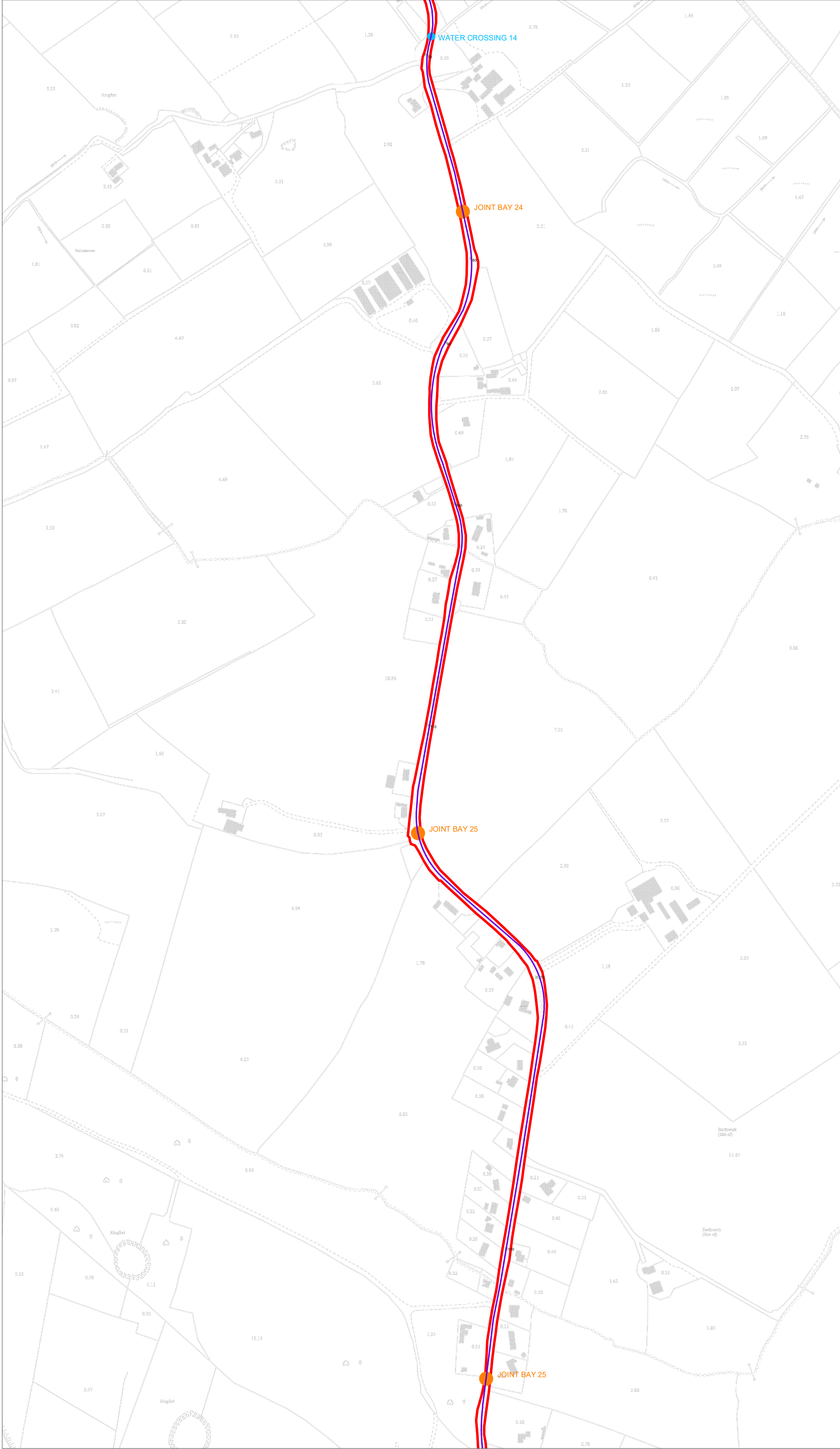

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay
- Watercrossing

N

DRAWING TITLE:

Site Layout Plan Sheet 20 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 33
SCALE: 1:2,500 @ A1	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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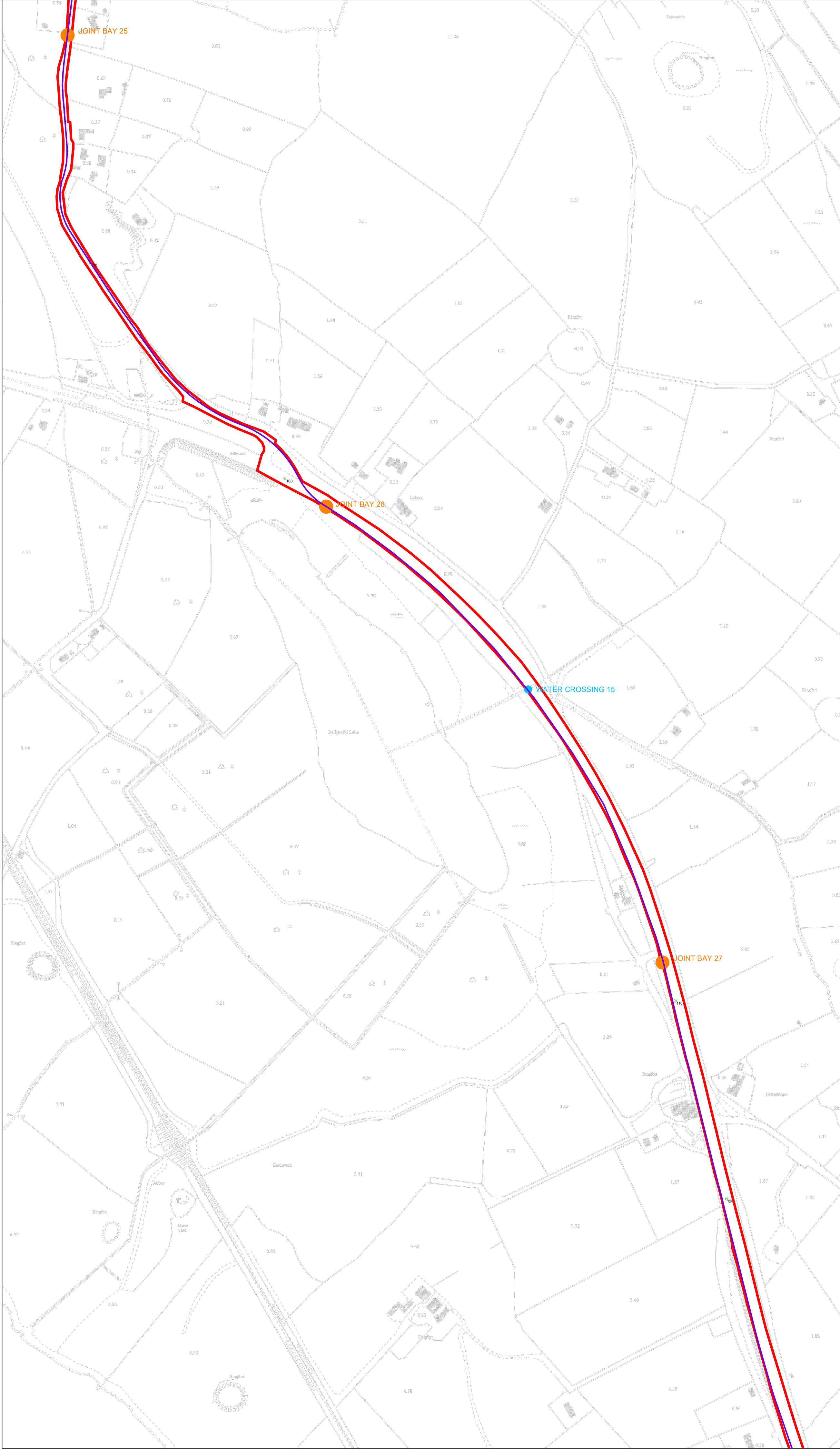

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay
- Watercrossing

DRAWING TITLE:

Site Layout Plan
Sheet 21 of 24

PROJECT TITLE:

Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 34
SCALE: 1:2,500 @ A1	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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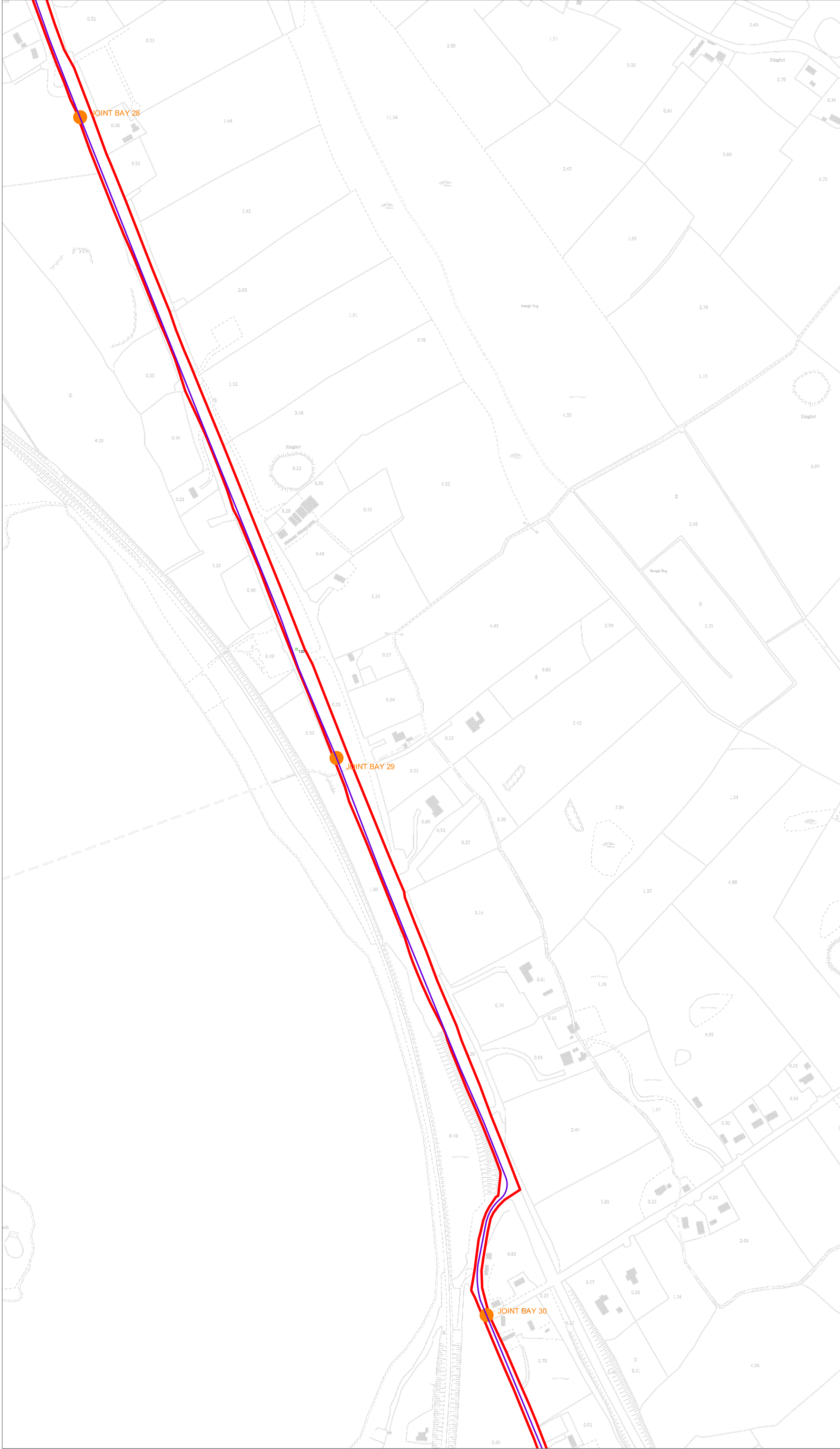

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay

DRAWING TITLE:

Site Layout Plan Sheet 22 of 24

PROJECT TITLE: Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 35
SCALE: 1:2,500 @ A1	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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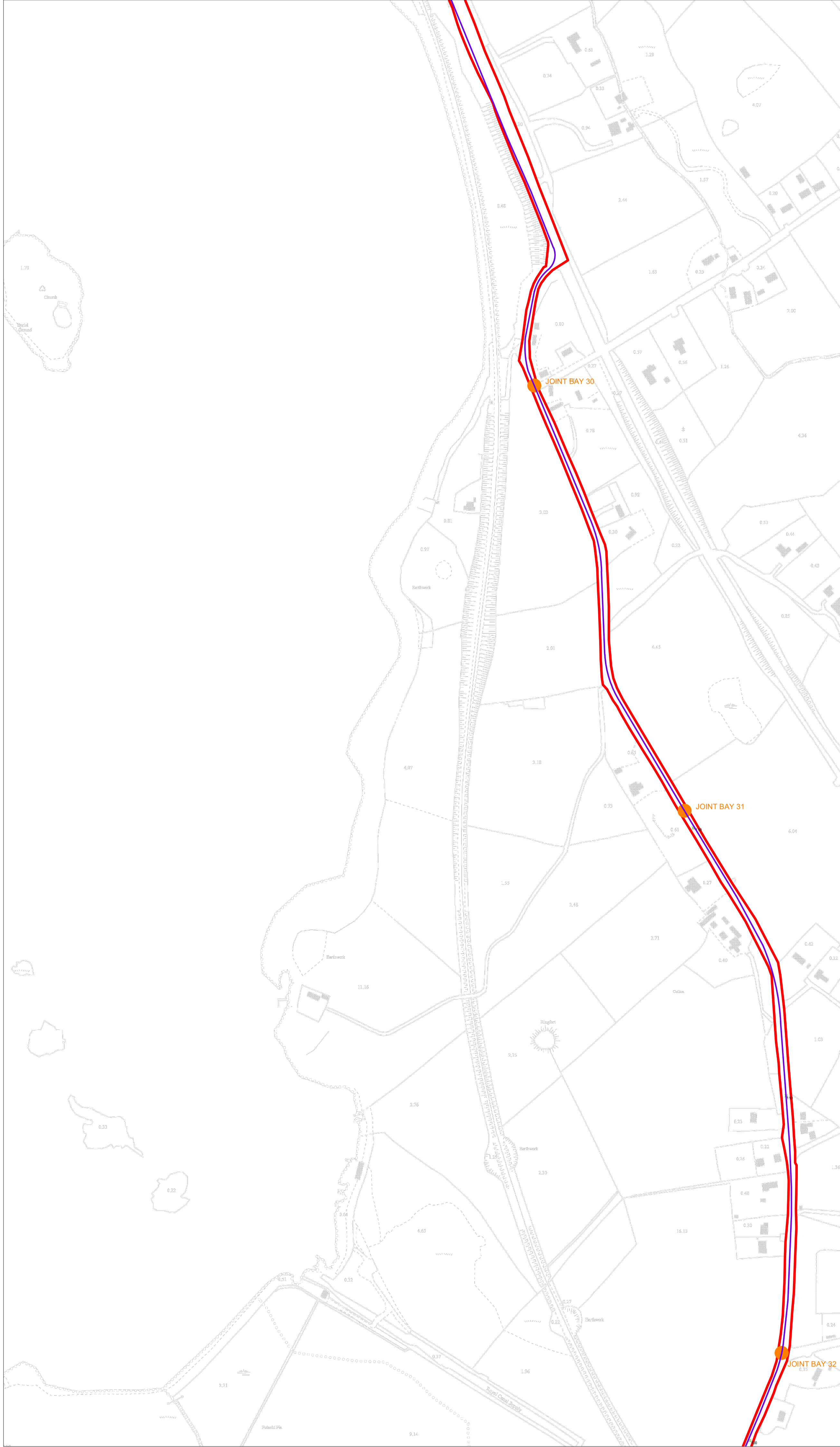

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7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- X Spot Height
- Indicative Joint Bay

N

DRAWING TITLE:
Site Layout Plan
Sheet 23 of 24

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 36
SCALE: 1:2,500 @ A1	DATE: 18.03.2021

OS SHEET No.:

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6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of cable/joint bay in the road corridor to be subject to ESB specifications and agreement with Westmeath County Council

Drawing Legend

- Planning Application Boundary
- Indicative Grid Connection Route
- Existing Mullingar Substation
- X Spot Height
- Indicative Joint Bay
- Watercrossing

N

DRAWING TITLE:
Site Layout Plan
Sheet 24 of 24

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 37
SCALE: 1:2,500 @ A1	DATE: 18.03.2021

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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

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: 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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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

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: 18.03.2021

OS SHEET No.:

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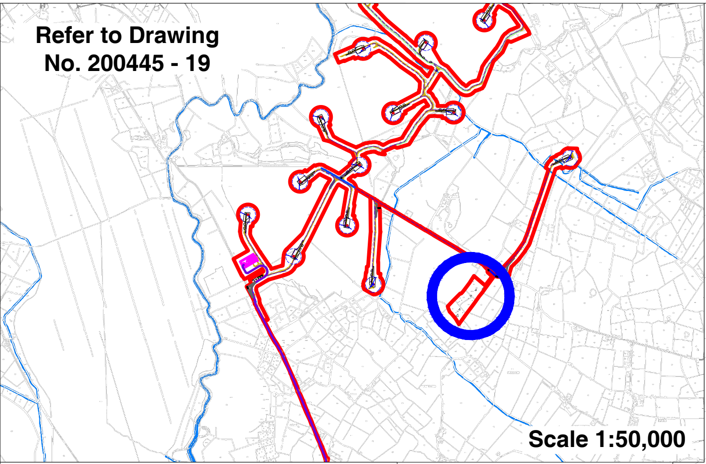
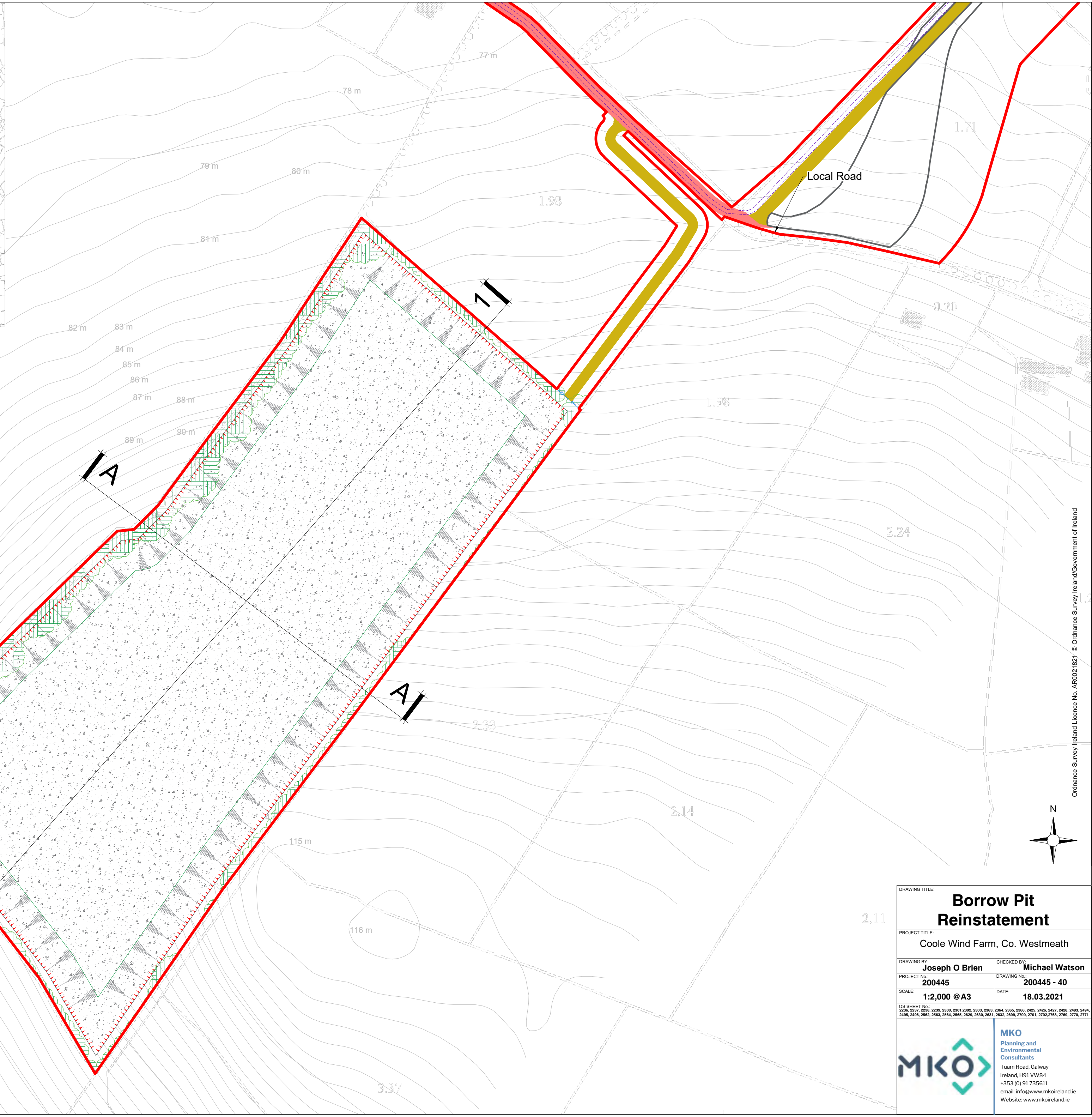


Notes:

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



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: 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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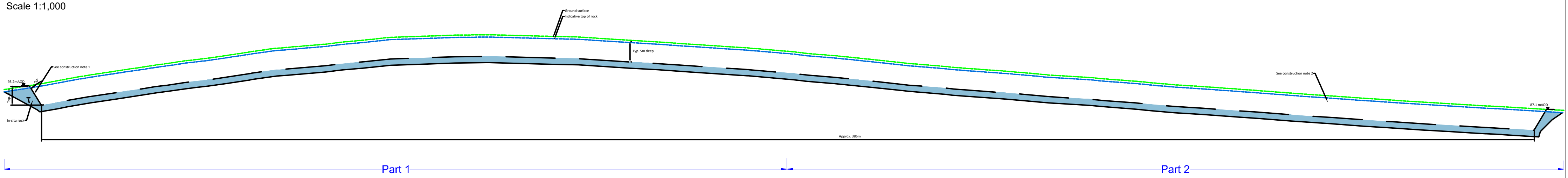
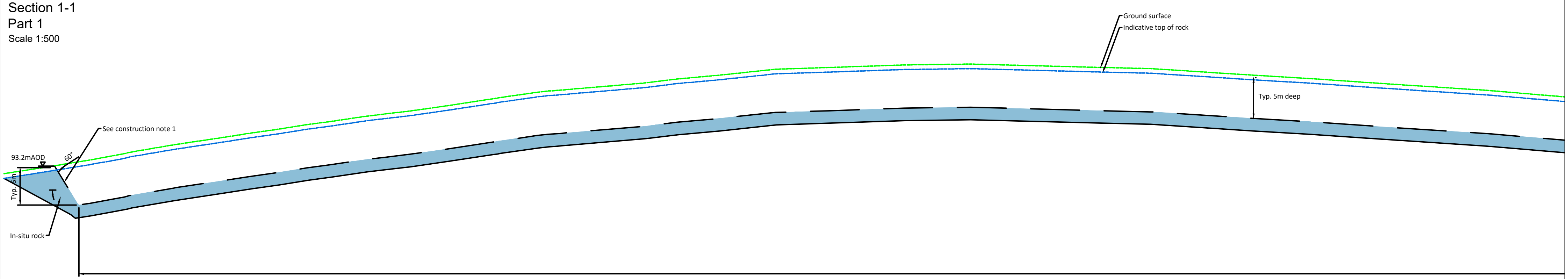
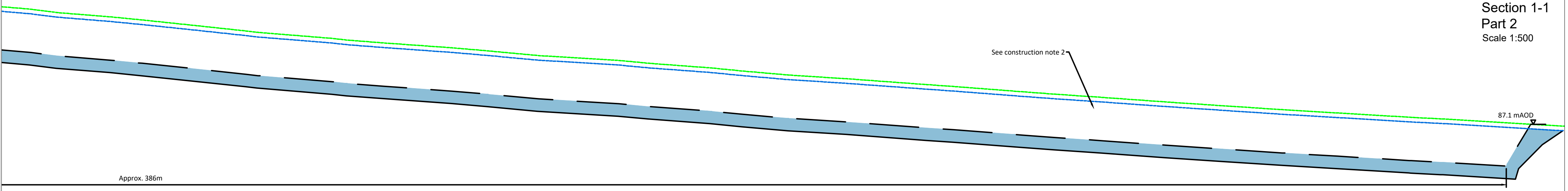
Section 1-1
Scale 1:1,000



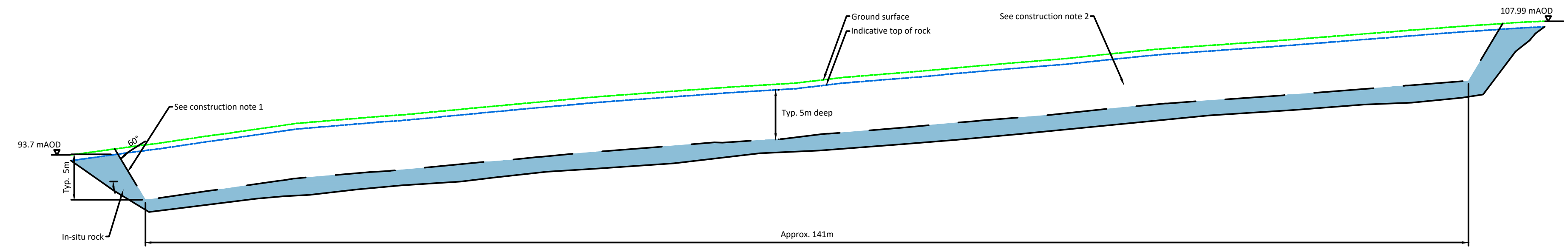
Section 1-1
Part 1
Scale 1:500



Section 1-1
Part 2
Scale 1:500



Section A-A
Part 1
Scale 1:500



DRAWING TITLE: **Borrow Pit Sections**	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 41
SCALE: As Shown @ A3	DATE: 18.03.2021
OS SHEET No.:	

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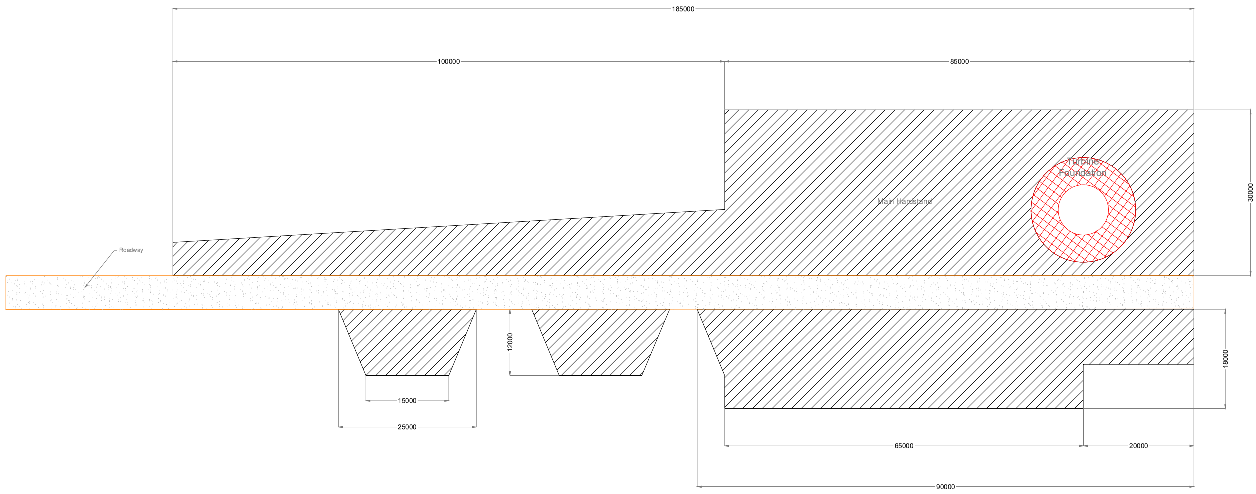

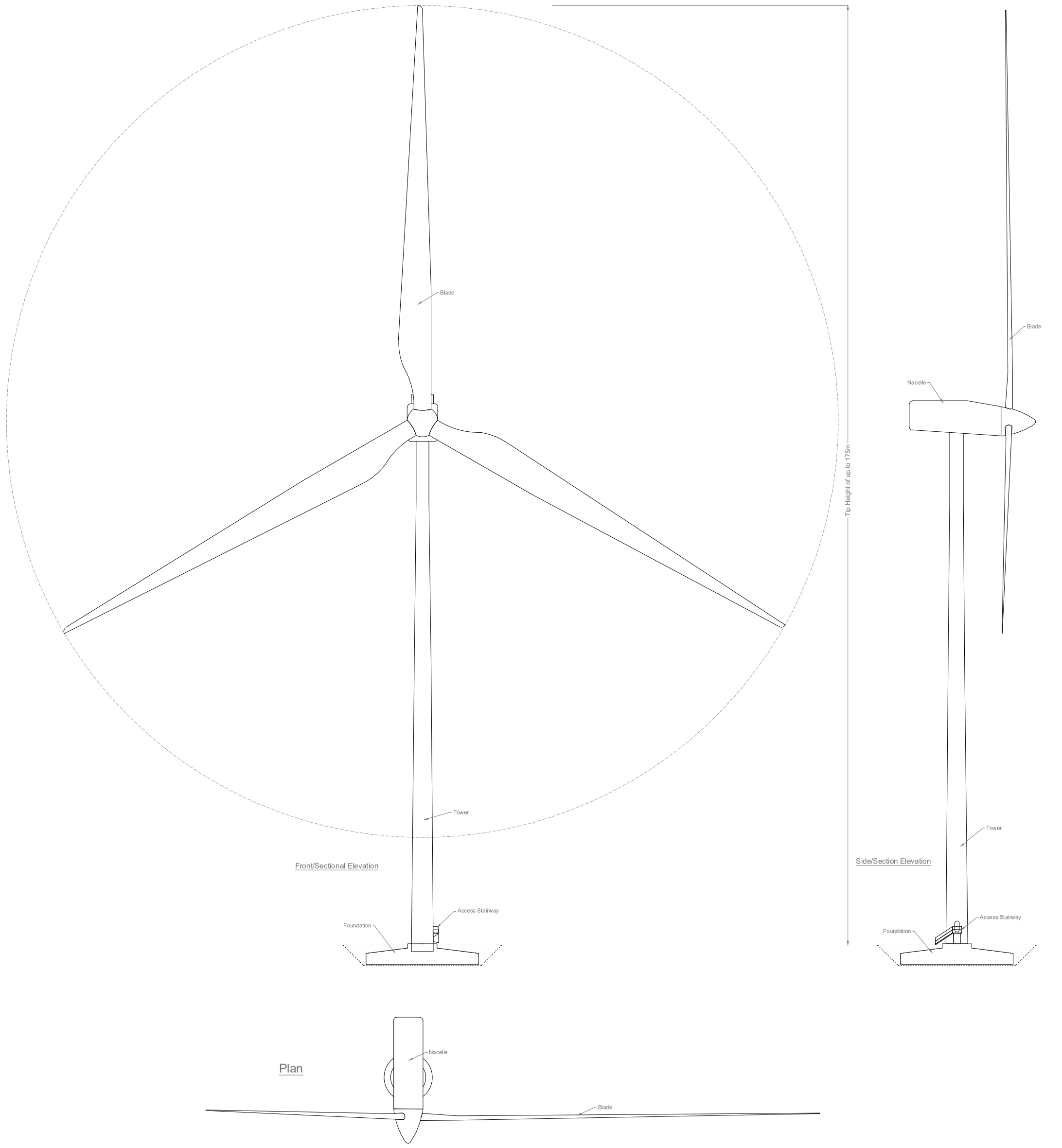

Drawing Notes

1. Proposed wind turbines to have a 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.

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: **18.03.2021**

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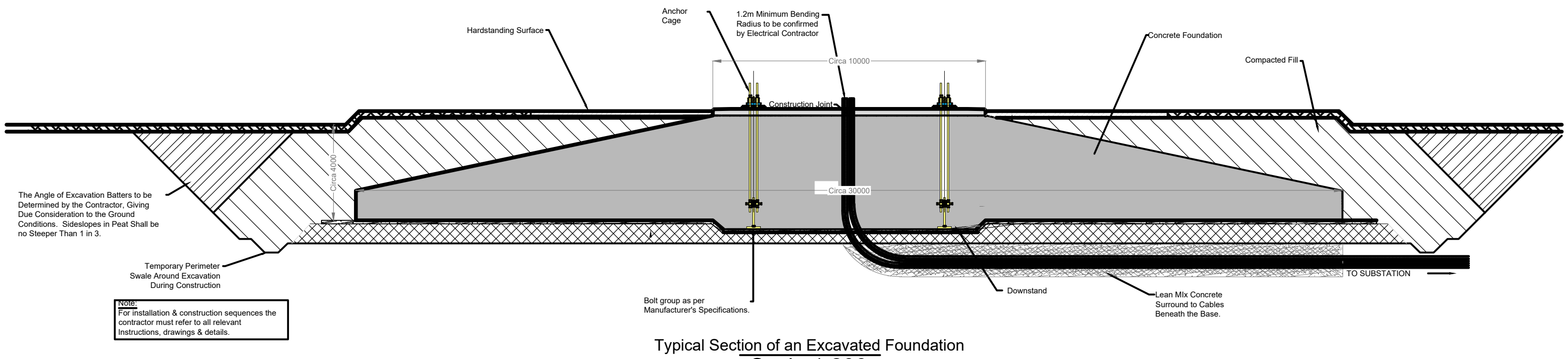
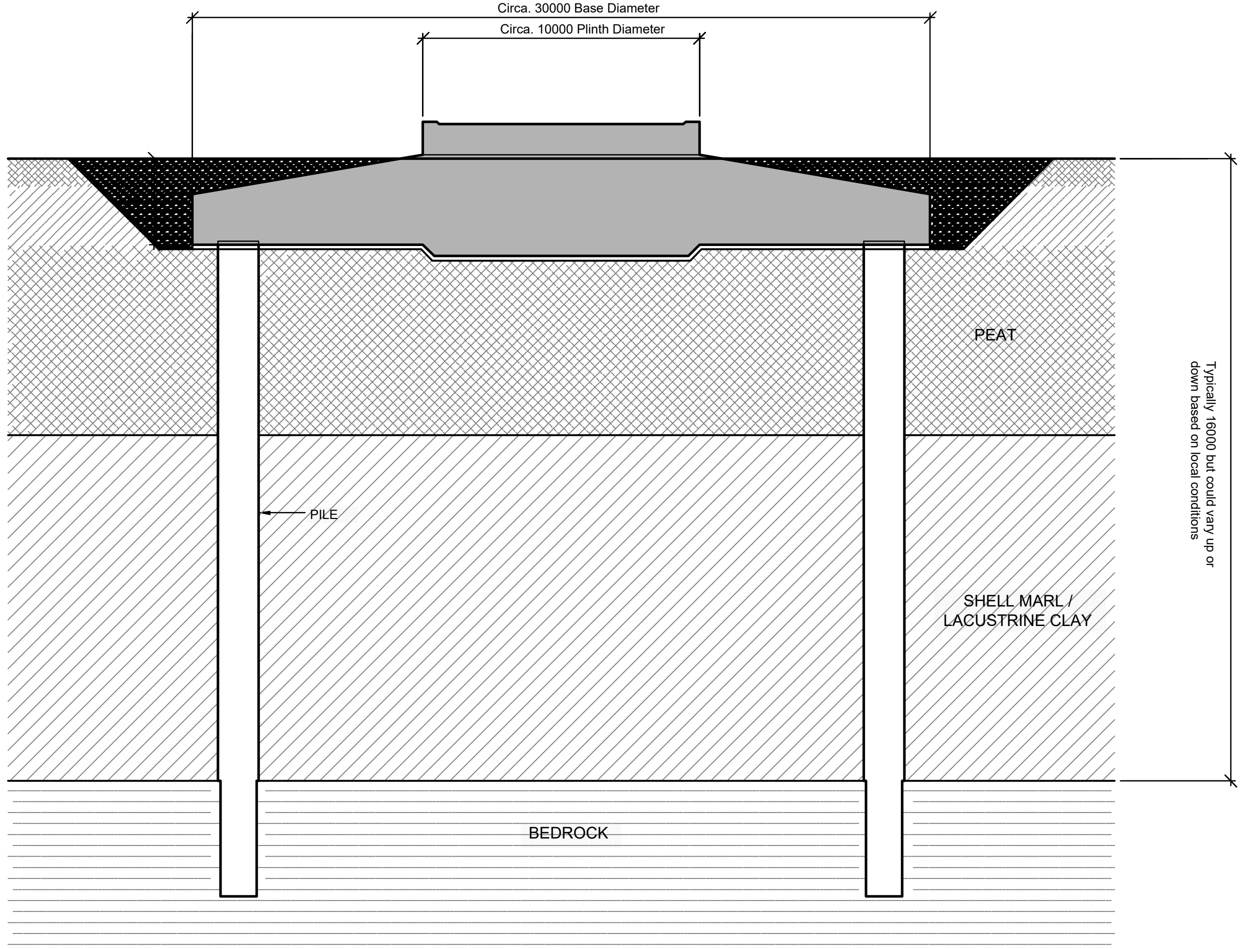


Typical Section of an Excavated Foundation
Scale 1:200



Typical Section of a Piled a Foundation
Scale 1:200

Note
Details/dimensions are provided for indicative purposes and will be subject to detailed design by the appointed contractor

DRAWING TITLE: Indicative Turbine Foundation Standard Detail	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 43
SCALE: 1:200@A3	DATE: 18.03.2021

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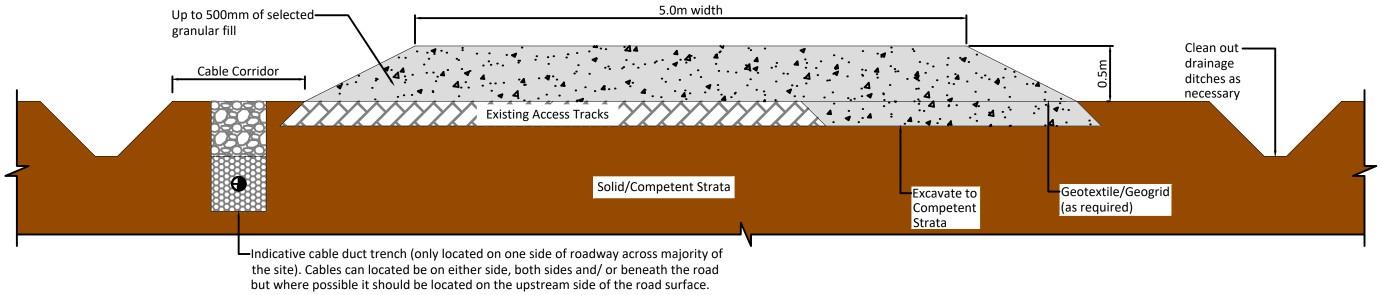
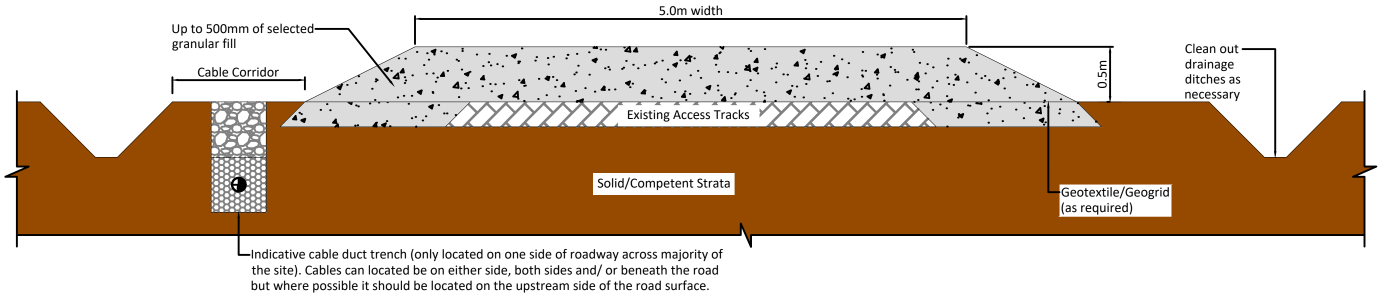
surface but where possible it should be located on the upstream side of the road surface.



Upgrade of Existing Track on Sidelong Ground



Upgrade of Existing Track on Flat Ground

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 - 44
SCALE: 1:50 @ A3	DATE: 18.03.2021

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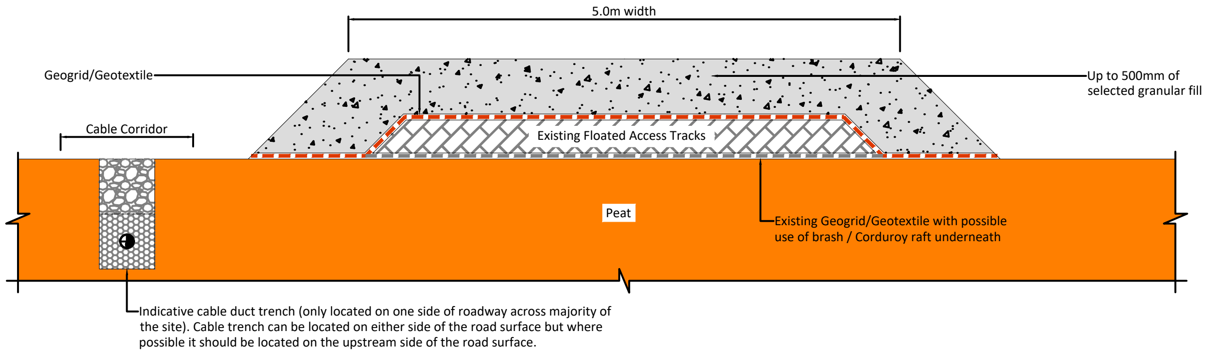
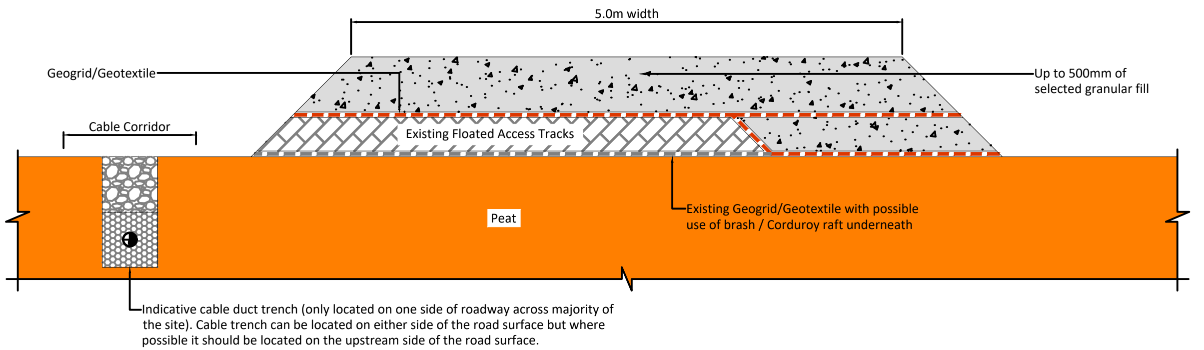
Upgrade of Existing Track on Flat Ground



Upgrade of Existing Track on Flat Ground



Upgrade of Existing Track on Sidelong Ground

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 - 45
SCALE: 1:50 @ A3	DATE: 18.03.2021

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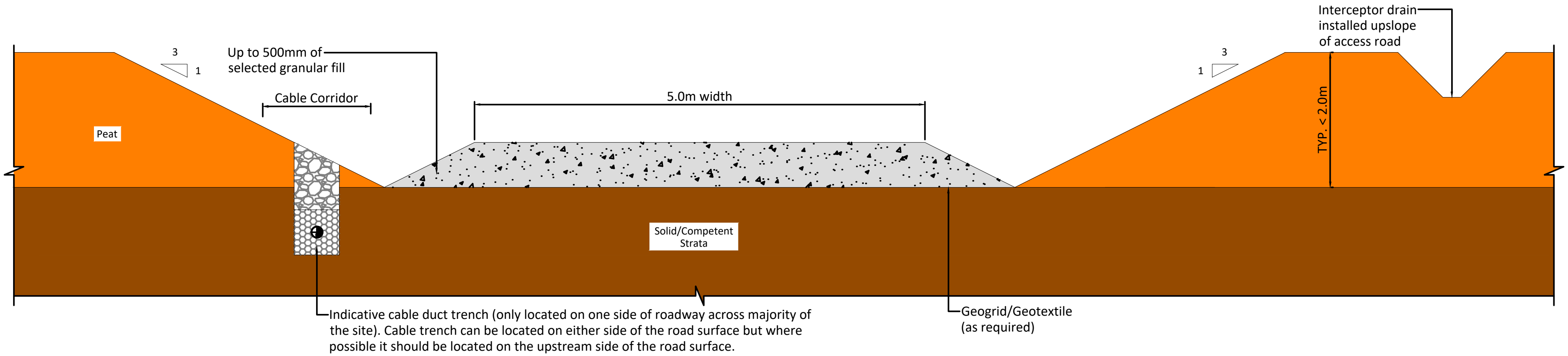

DRAWING TITLE: Type C New Excavate and Replace Access Road	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 46
SCALE: 1:50 @ A3	DATE: 18.03.2021
OS SHEET No.:	

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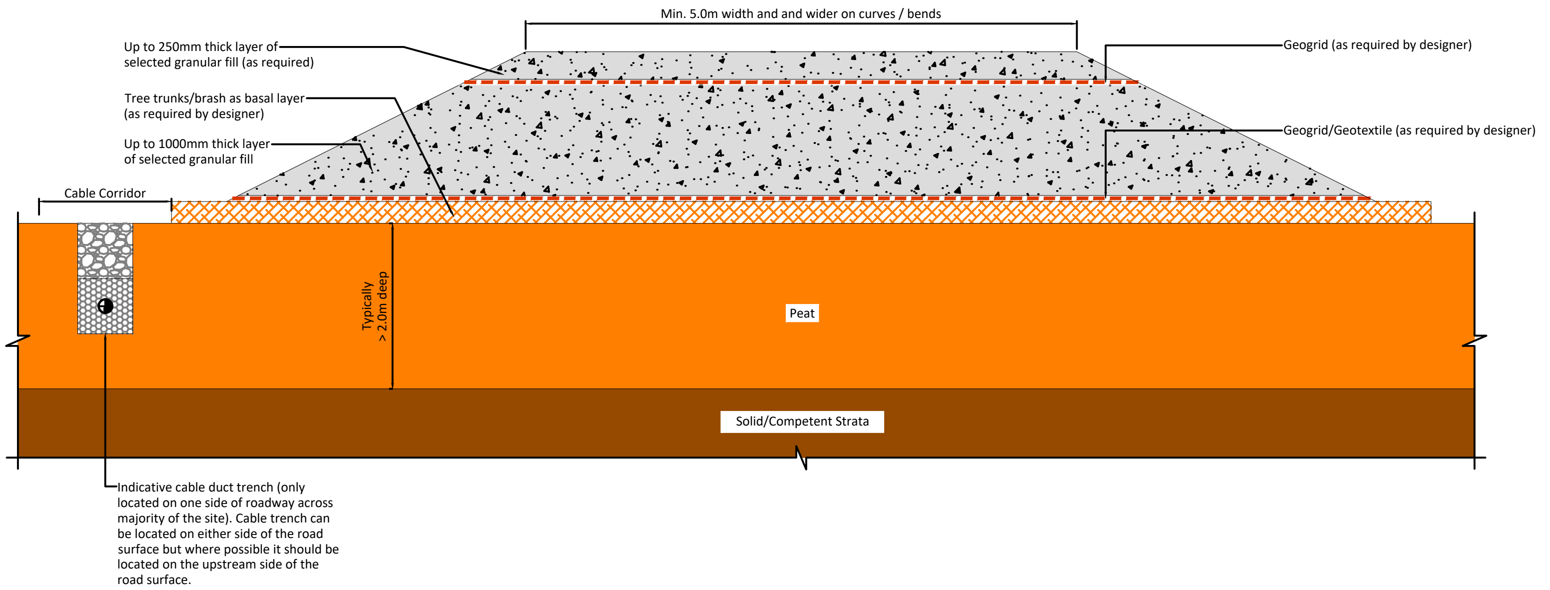

DRAWING TITLE: Type D New Floated Access Road	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 200445	DRAWING No.: 200445 - 47
SCALE: 1:50 @ A3	DATE: 18.03.2021
OS SHEET No.:	

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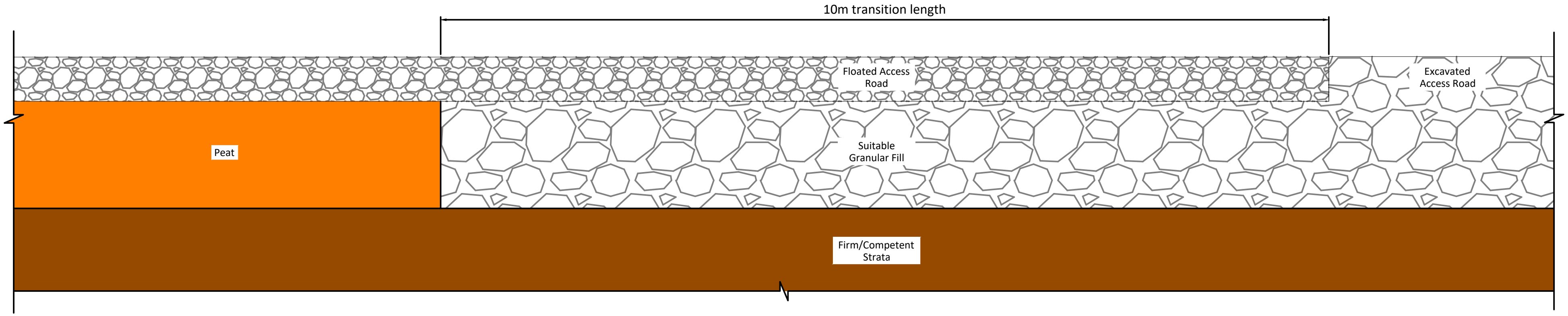
Notes:

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).



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 - 48
SCALE: 1:50 @ A3	DATE: 18.03.2021
OS SHEET No.:	

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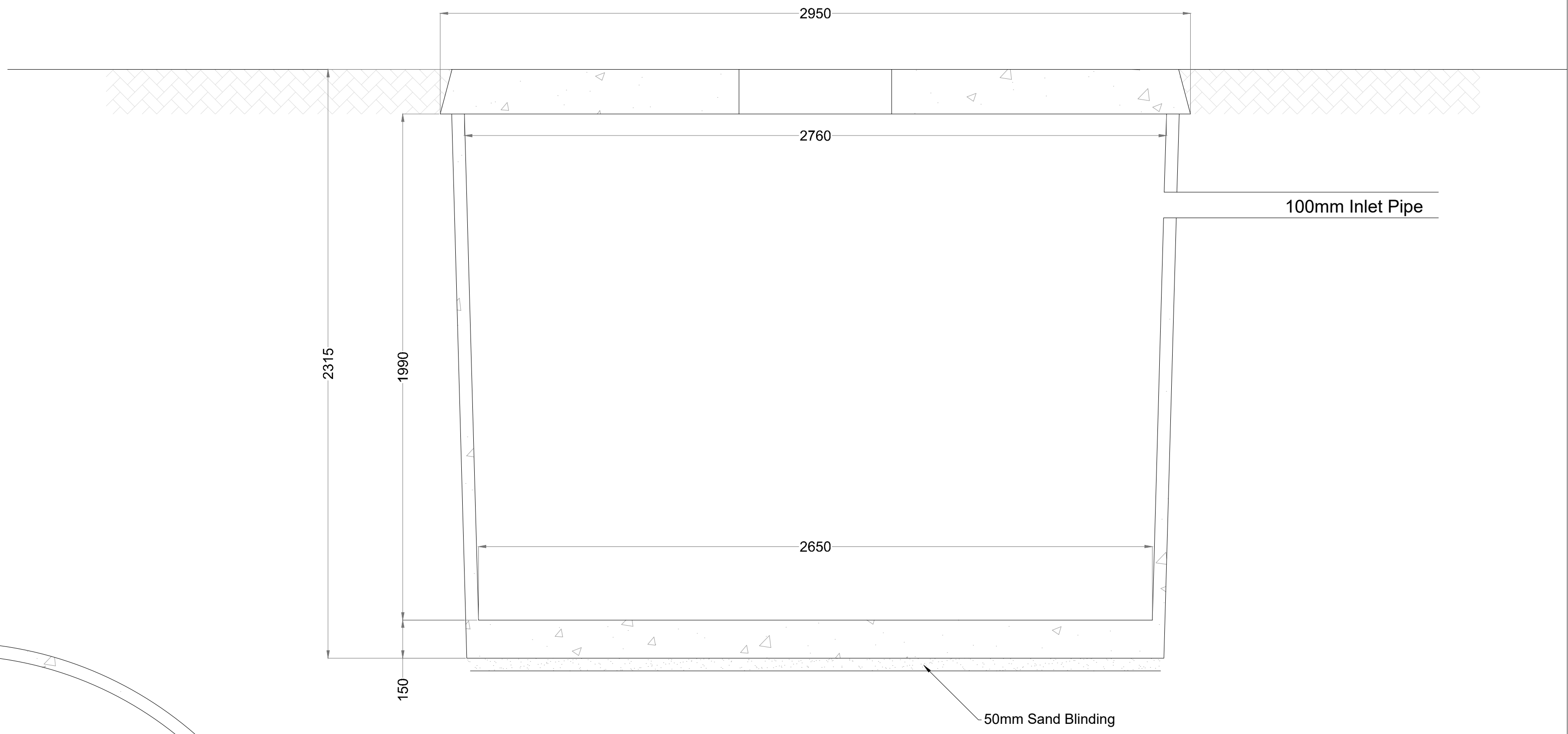

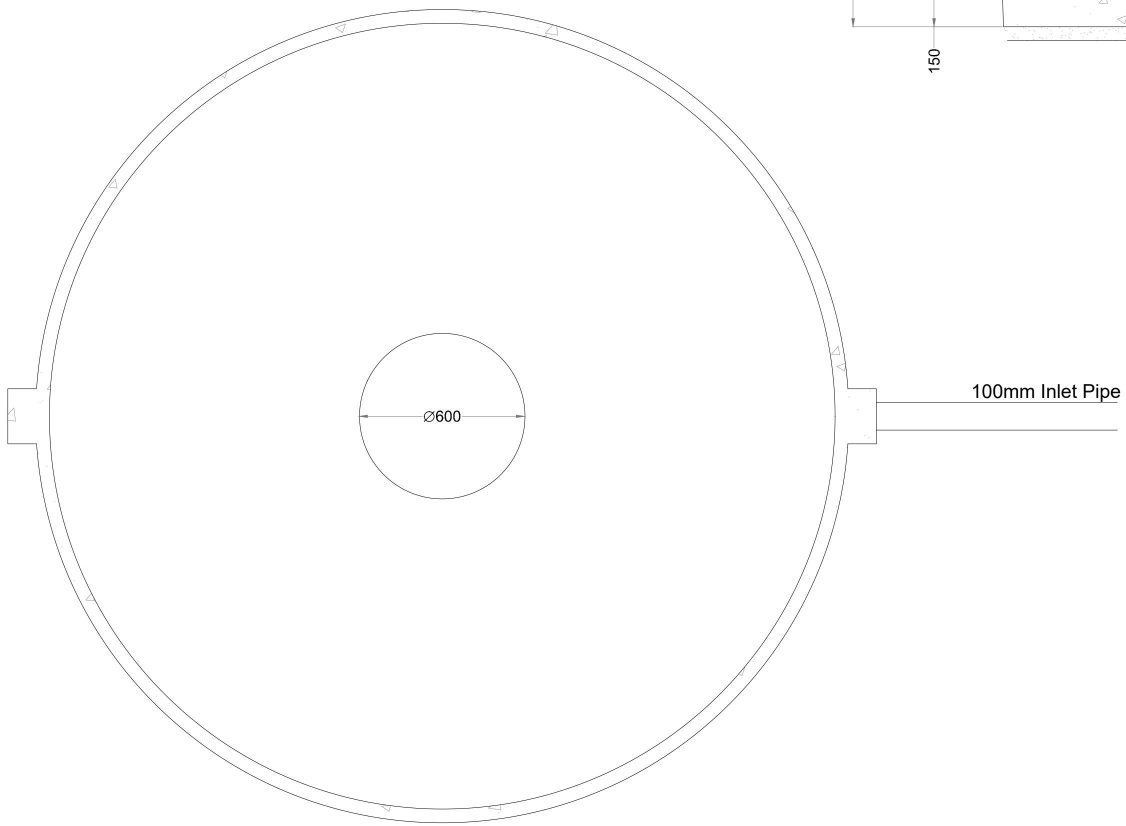

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PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No: **200445**	DRAWING No: **200445 - 49**
SCALE: **1:20 @A3**	DATE: **18.03.2021**

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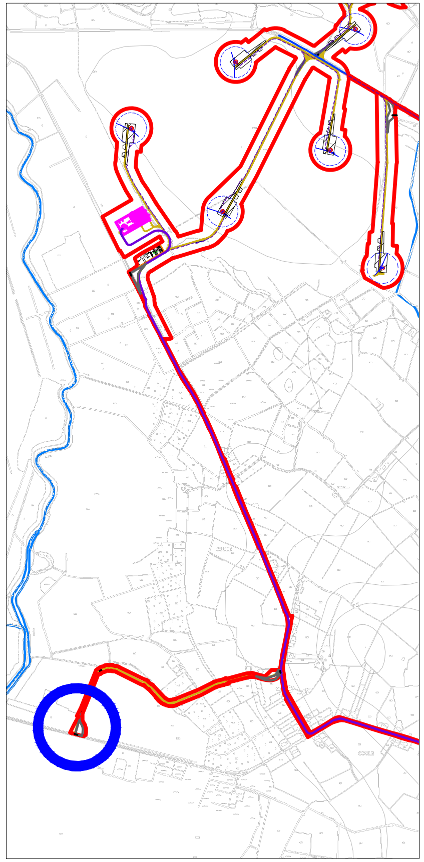
Drawing Legend

- Proposed Road
- Unbound Hardcore Surface
- Crossing Point for Landowners
- Sight Line

1:25,000 Location on Context Map



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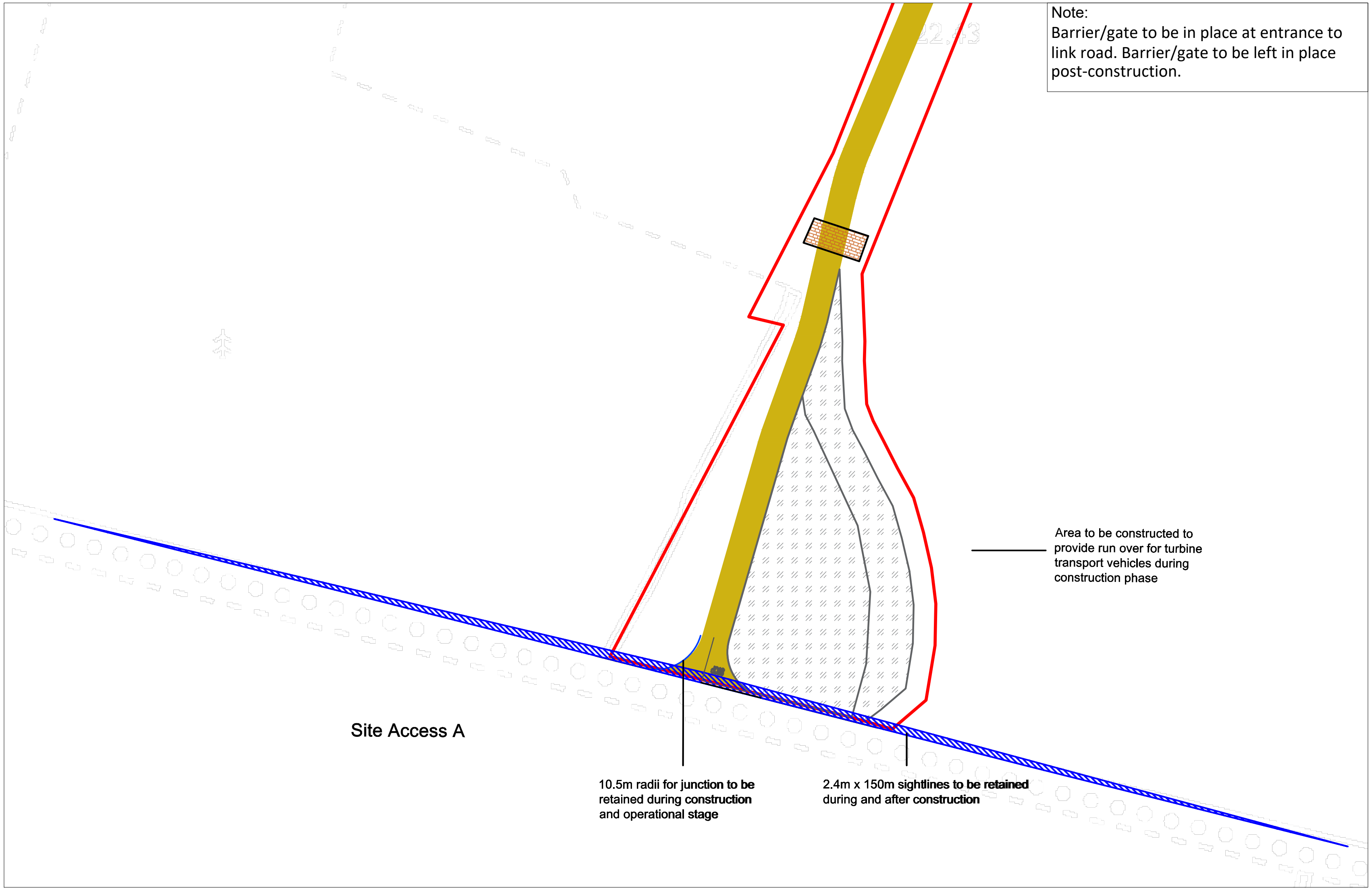

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PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 50
SCALE: 1:1,000 @A3	DATE: 18.03.2021
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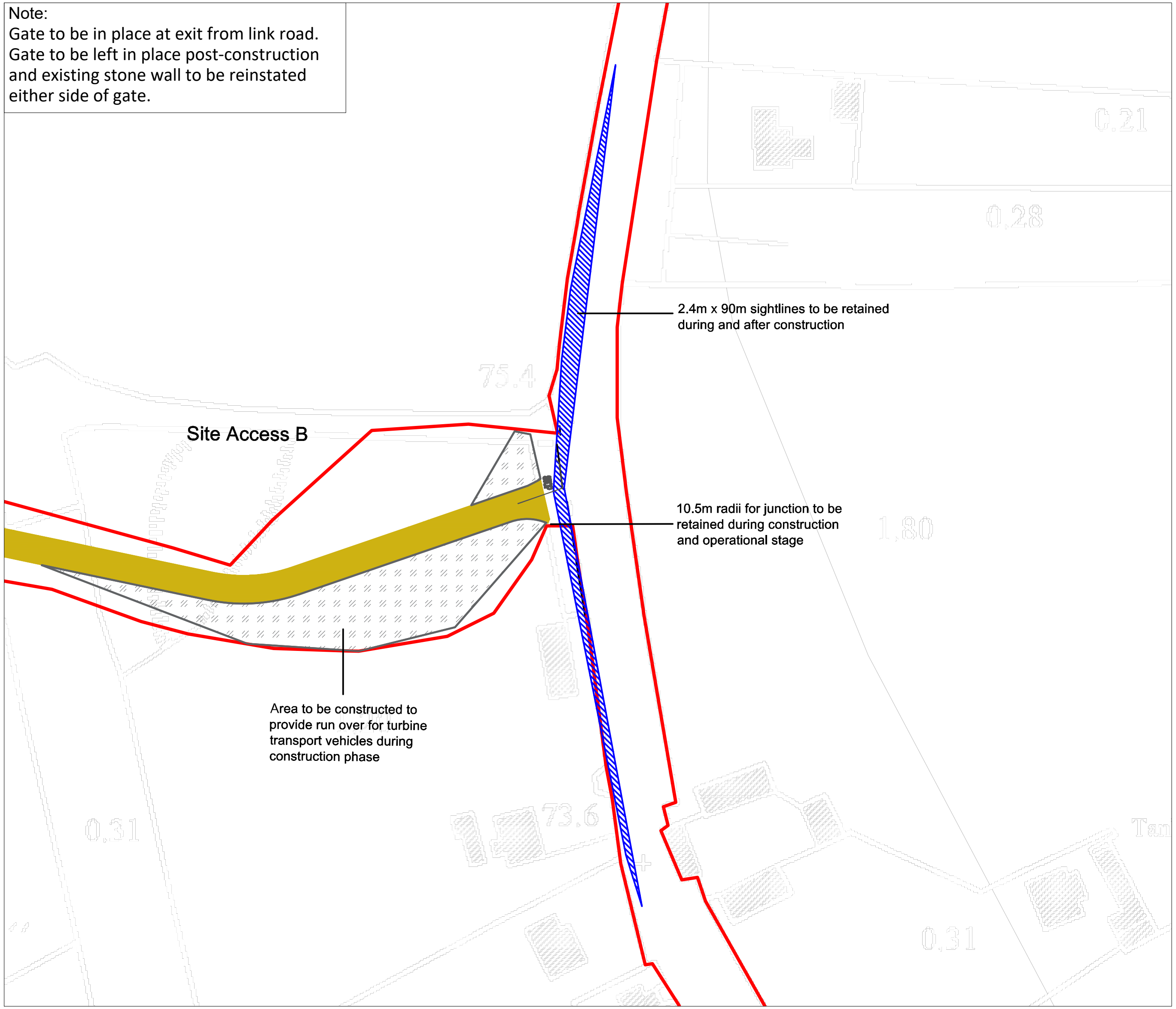
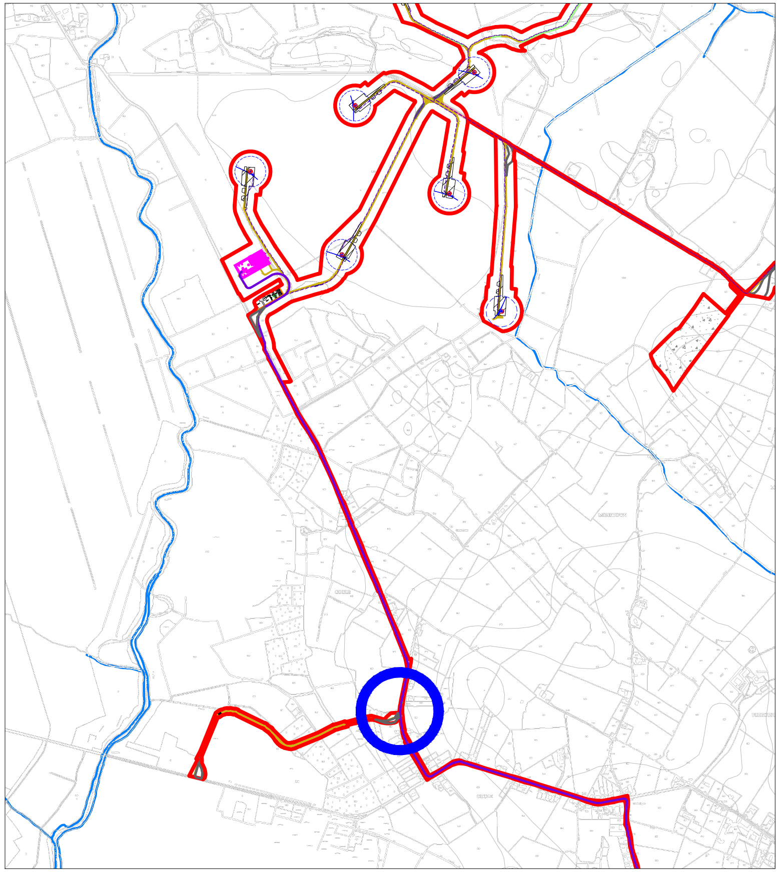
Drawing Legend

Proposed Road

Unbound Hardcore Surface

Sight Line





1:25,000 Location on Context Map

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N

DRAWING TITLE: **Proposed Site Access B**	
PROJECT TITLE: Coole Wind Farm, Co. Westmeath	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 51**
SCALE: **1:1,000 @A3**	DATE: **18.03.2021**
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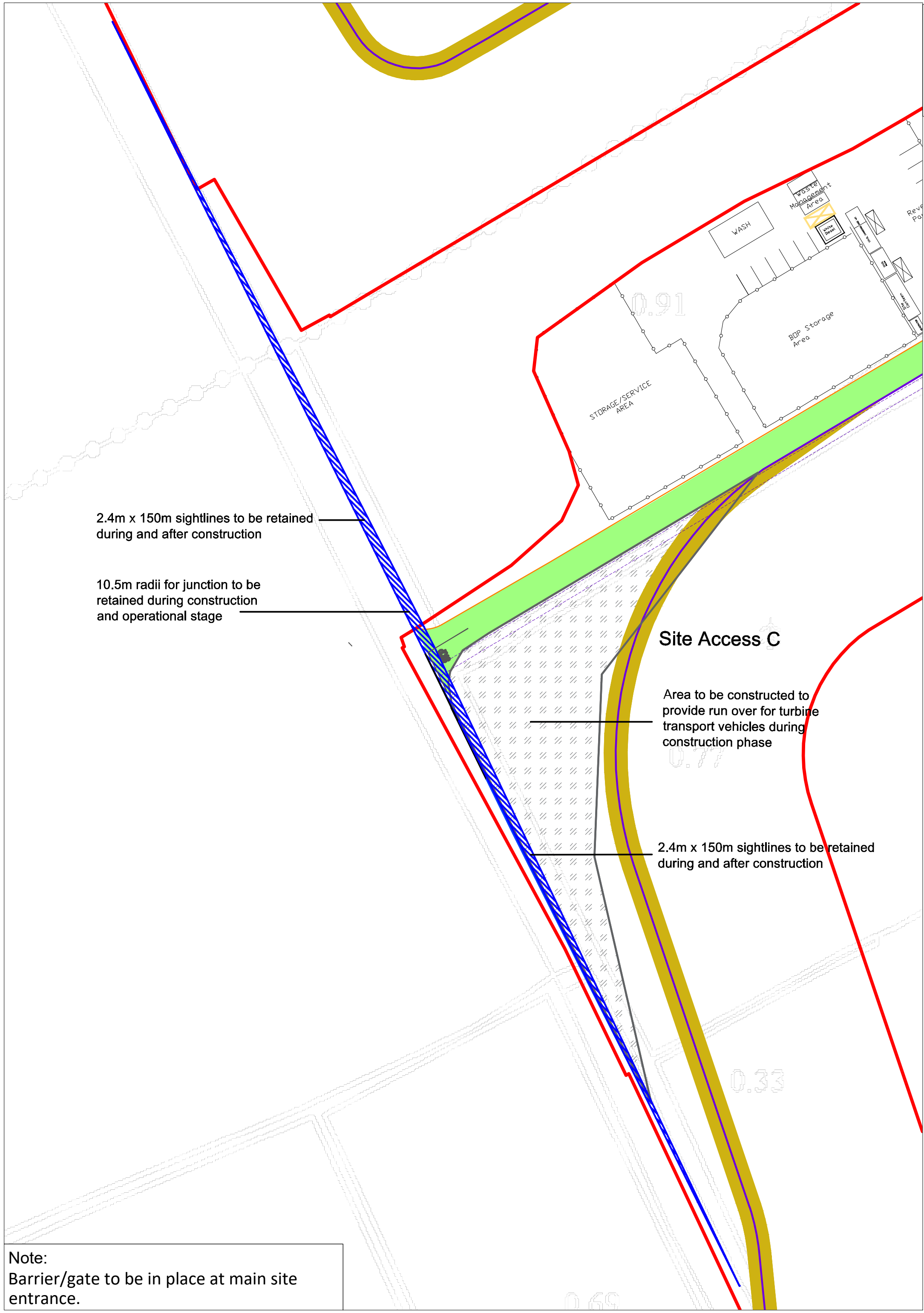
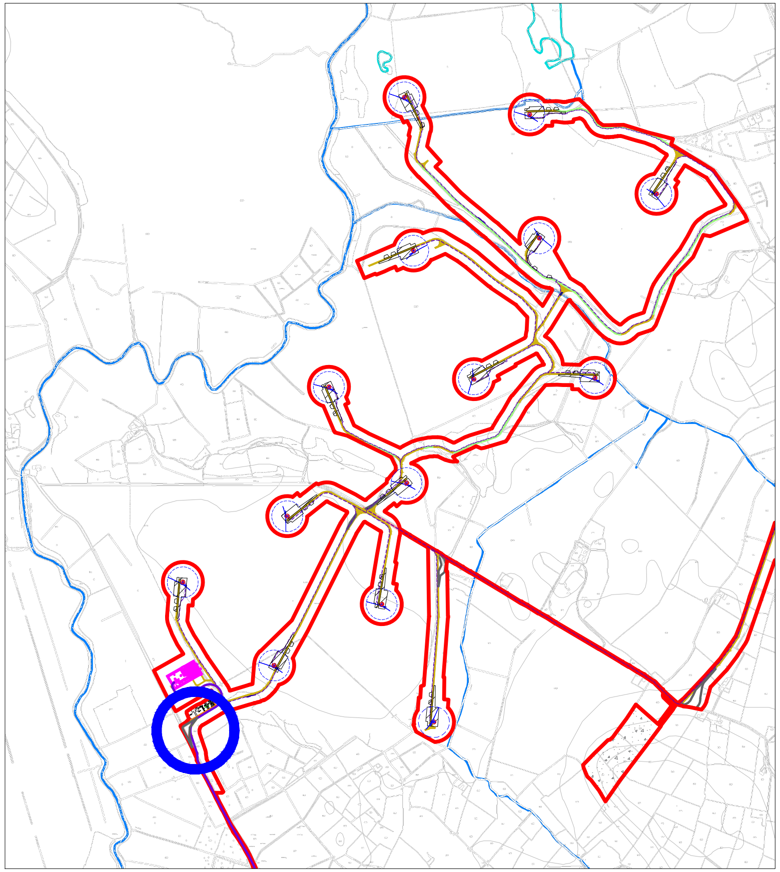


Note:
Barrier/gate to be in place at main site entrance.

Drawing Legend

- Existing Internal Road to be Upgraded
- Proposed Road
- Unbound Hardcore Surface
- Sight Line



1:25,000 Location on Context Map

N

DRAWING TITLE:
Proposed Site Access C

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 52
SCALE: 1:1,000 @A3	DATE: 18.03.2021

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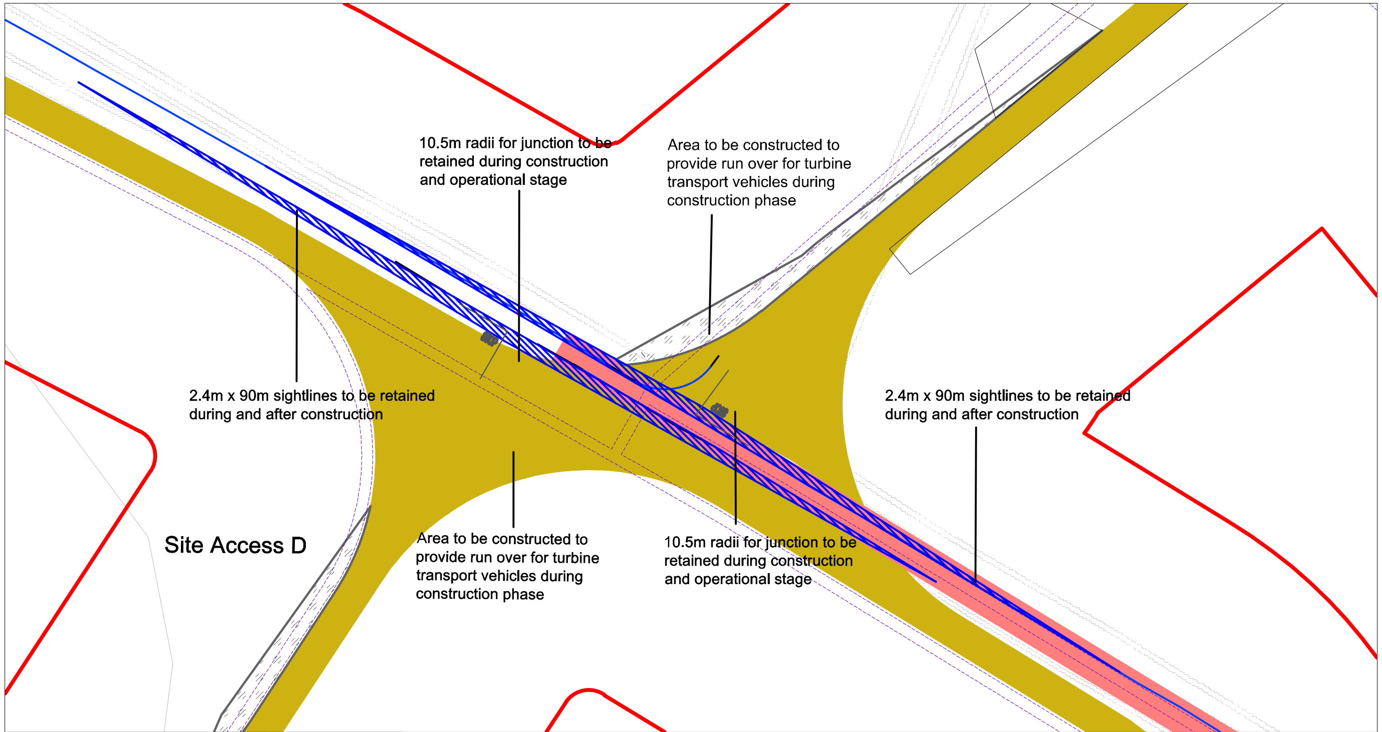
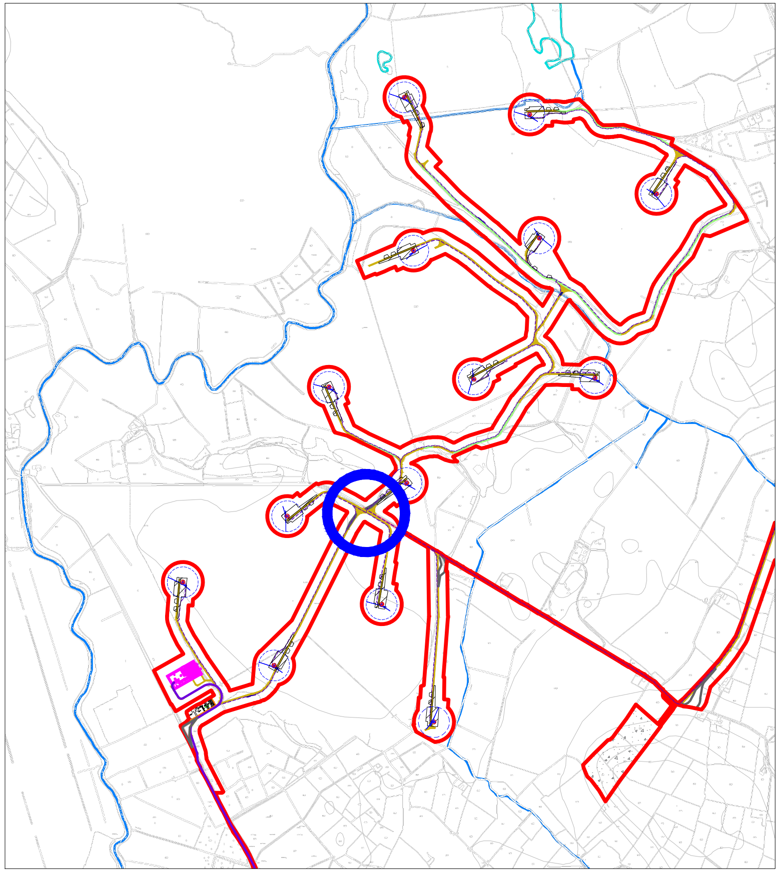
Drawing Legend

- Proposed Road
- Existing External Road to be Upgraded
- Unbound Hardcore Surface
- Sight Line



Note:
Barrier/gate to be in place at site access/egress points off local road.



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DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **200445**	DRAWING No.: **200445 - 53**
SCALE: **1:1,000 @A3**	DATE: **18.03.2021**
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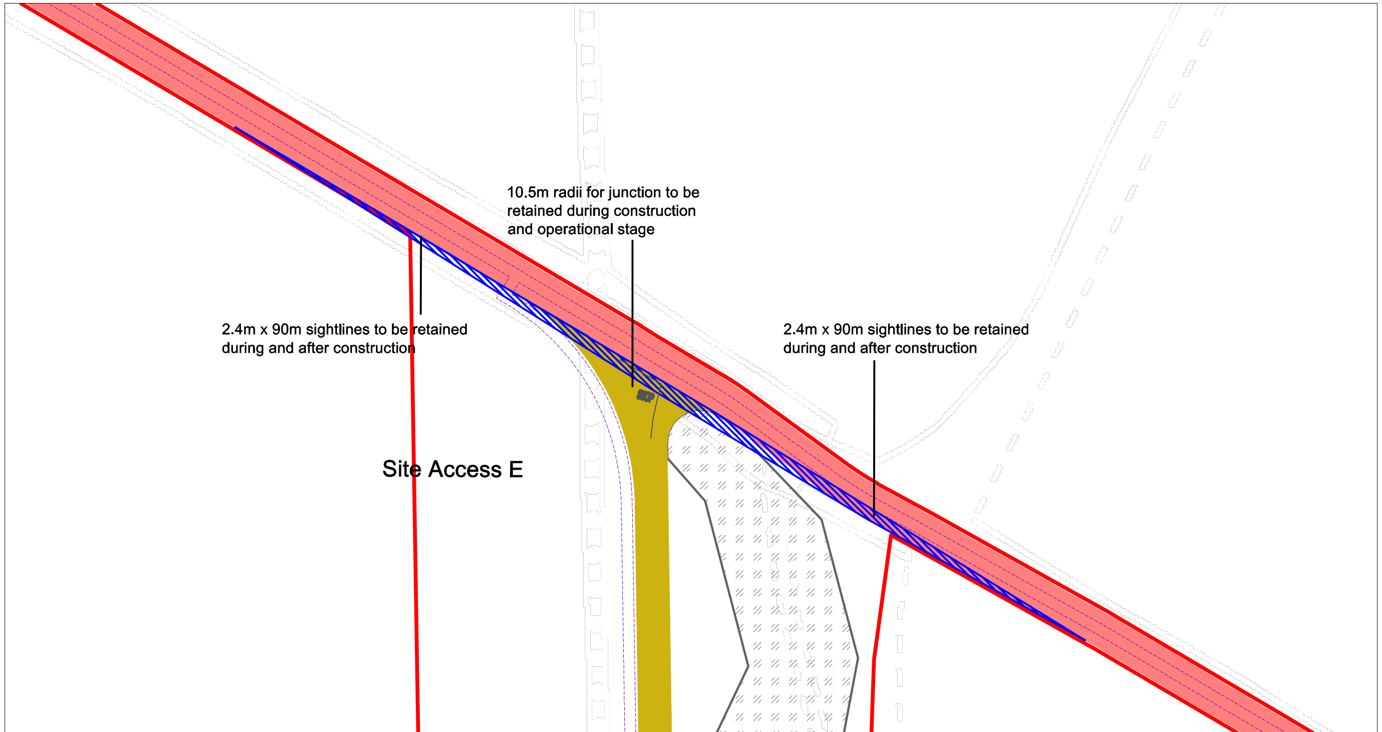
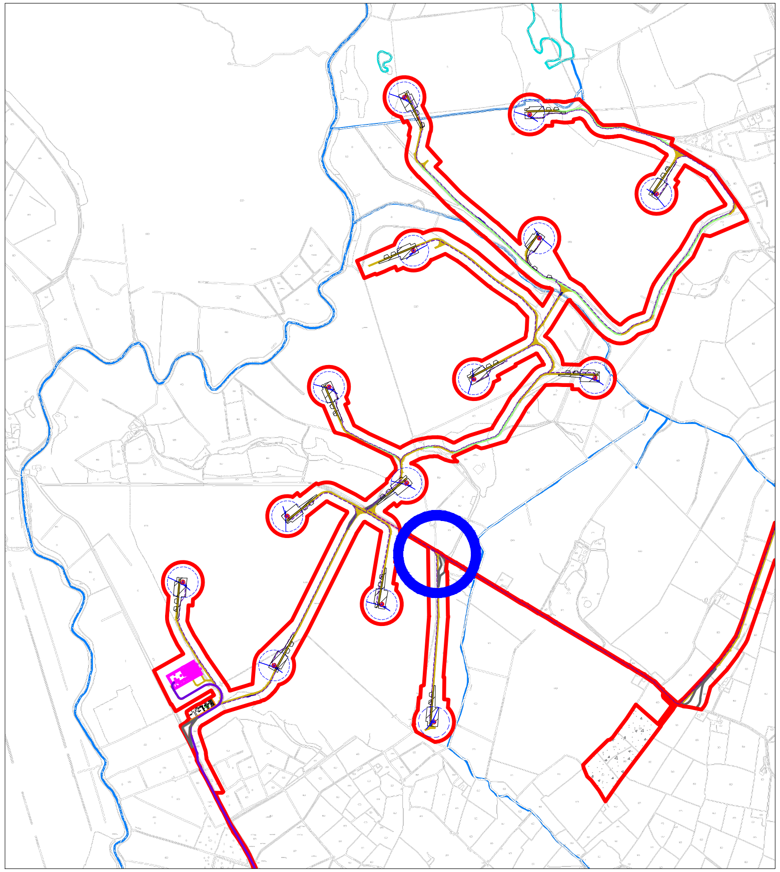
Website: www.mkoireland.ie

Drawing Legend

- Proposed Road
- Existing External Road to be Upgraded
- Unbound Hardcore Surface
- Sight Line





1:25,000 Location on Context Map

Note:
Barrier/gate to be in place at site access/egress points off local road.

N

DRAWING TITLE:
Proposed Site Access E

PROJECT TITLE:
Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 54
SCALE: 1:1,000 @A3	DATE: 18.03.2021

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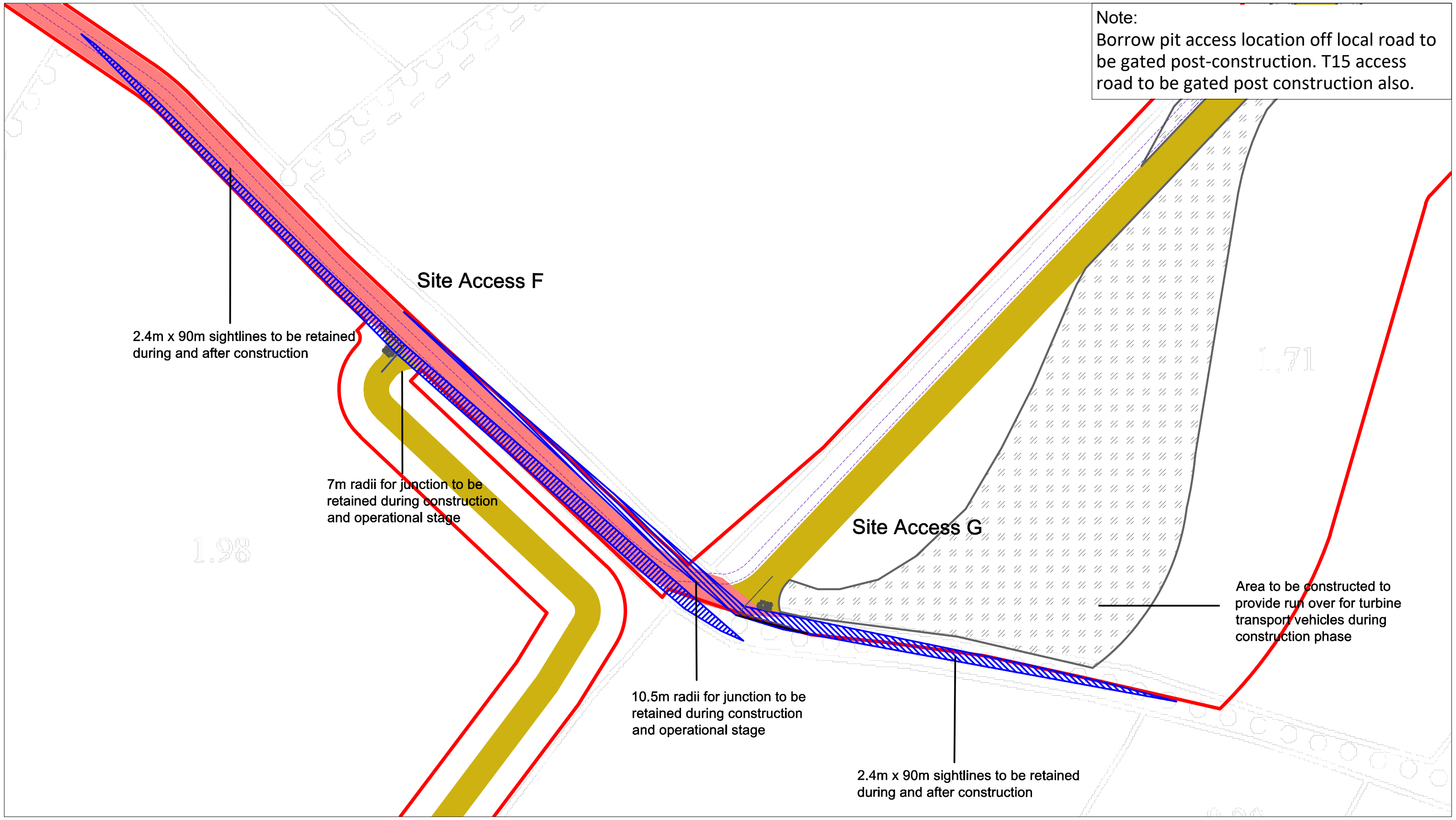
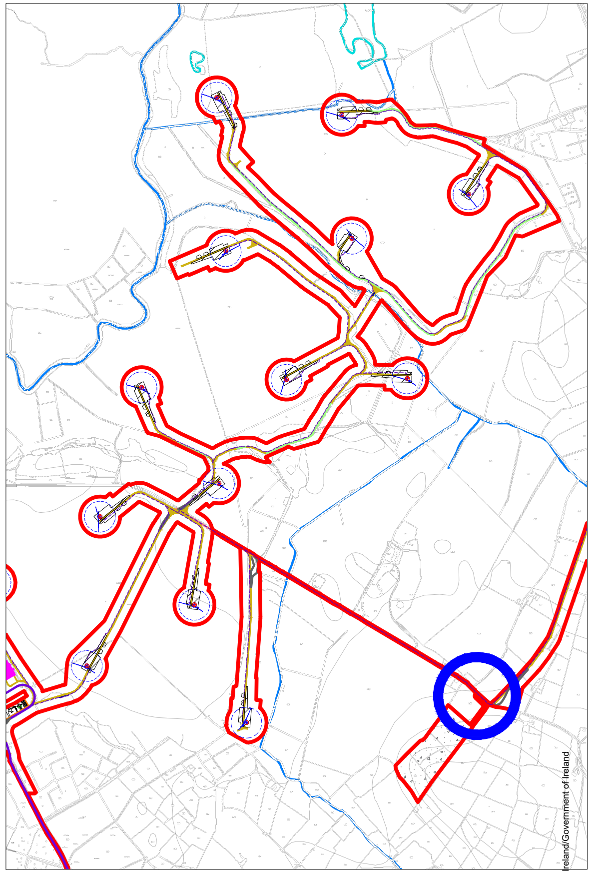
Website: www.mkoireland.ie

Drawing Legend

- Proposed Road
- Existing External Road to be Upgraded
- Unbound Hardcore Surface
- Sight Line





1:25,000 Location on Context Map

DRAWING TITLE:
Proposed Site Access F & G

PROJECT TITLE: Coole Wind Farm, Co. Westmeath

DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 200445	DRAWING No.: 200445 - 55
SCALE: 1:1,000 @A3	DATE: 18.03.2021

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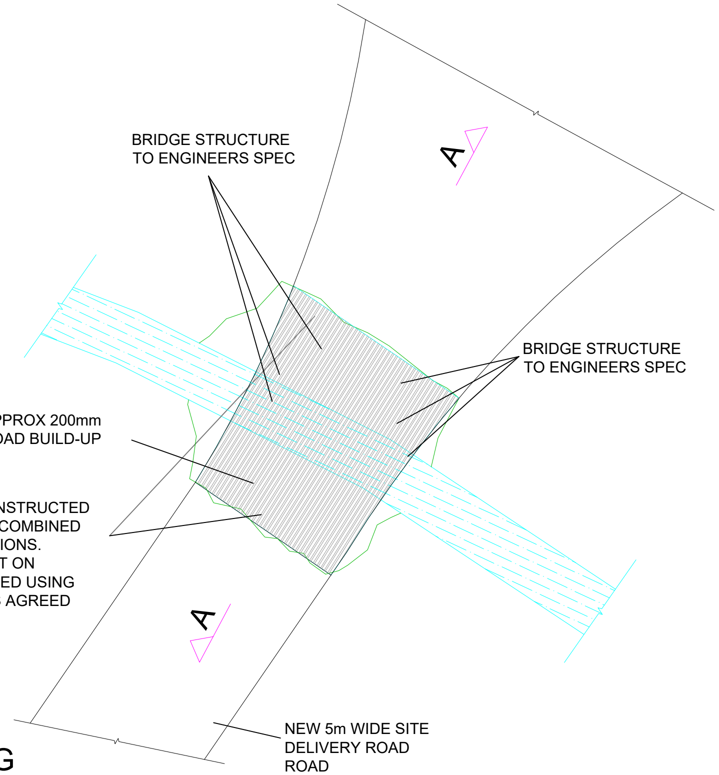
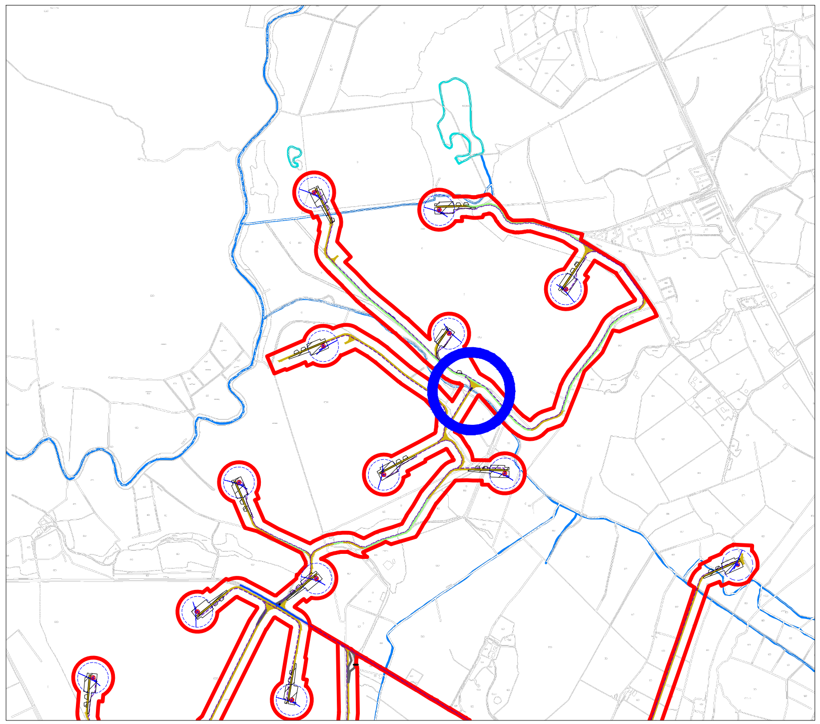


CLEAR SPAN
BRIDGE CROSSING
PLAN

Scale 1:200



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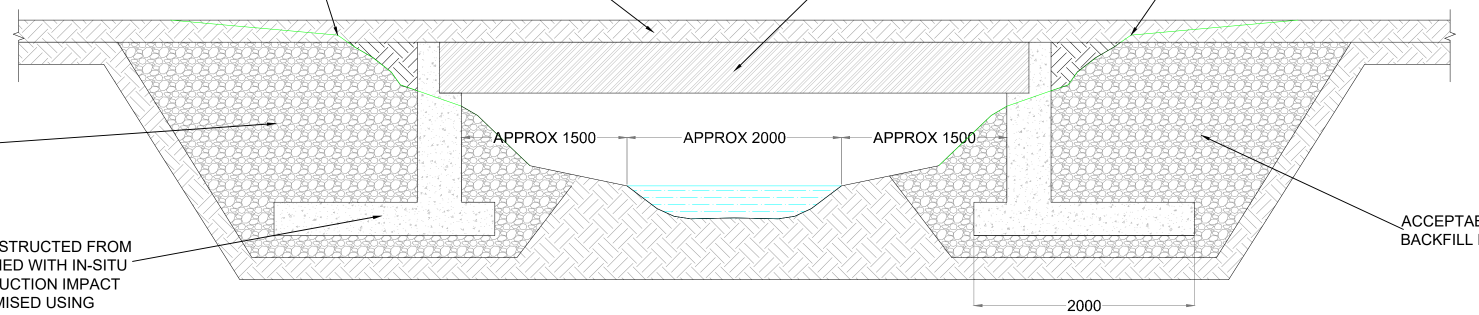

SECTION A-A Scale 1:50

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 - 56
SCALE: As Shown @A3	DATE: 18.03.2021

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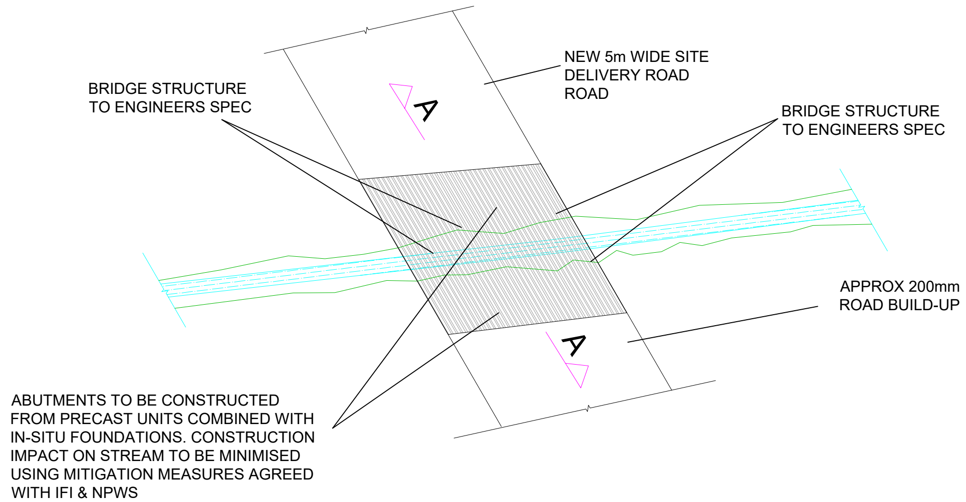
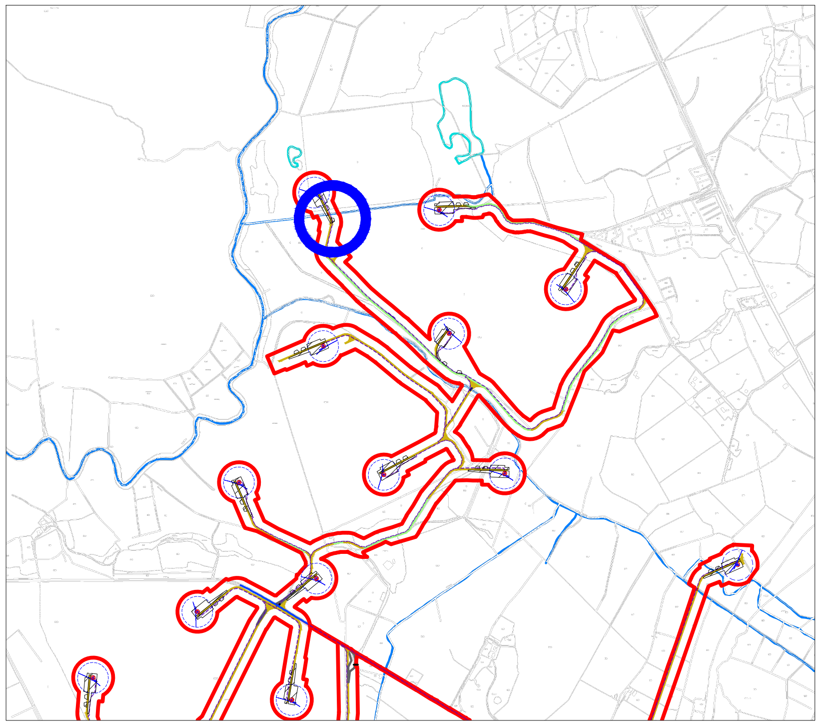
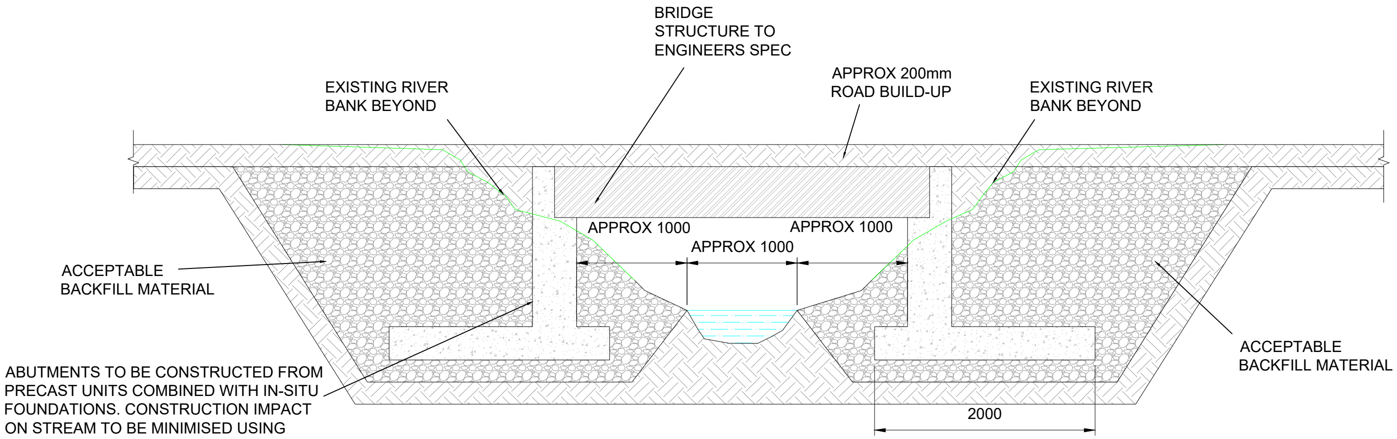


CLEAR SPAN BRIDGE CROSSING PLAN

Scale 1:200



1:25,000 Location on Context Map



SECTION A-A

Scale 1:50

N

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 - 57
SCALE: As Shown @A3	DATE: 18.03.2021

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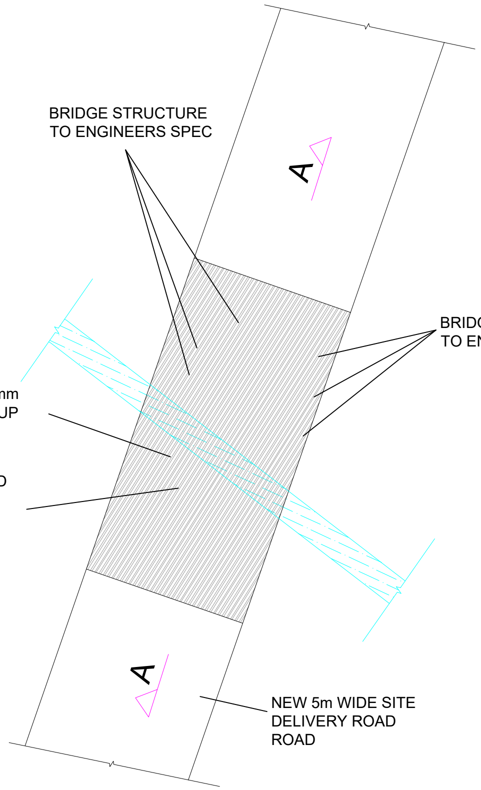

CLEAR SPAN
BRIDGE CROSSING
PLAN
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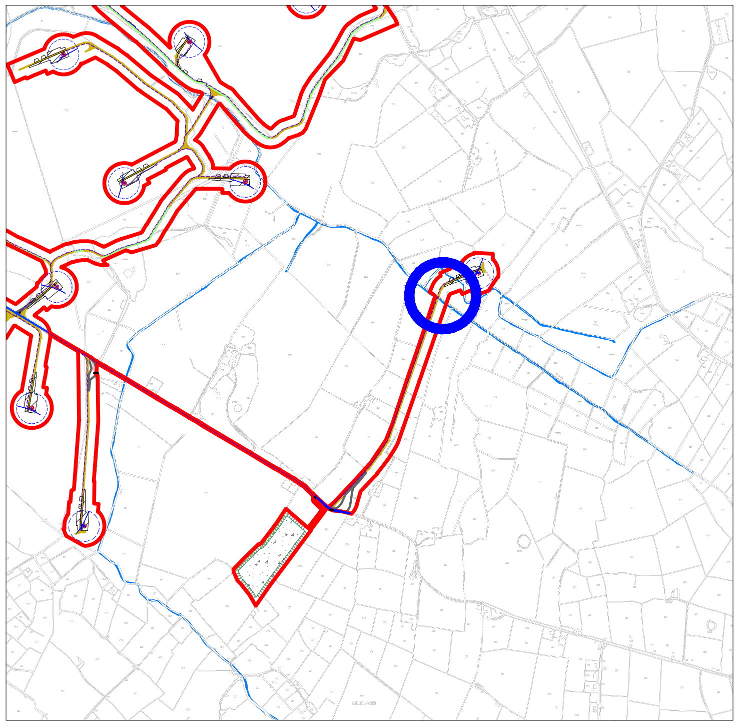

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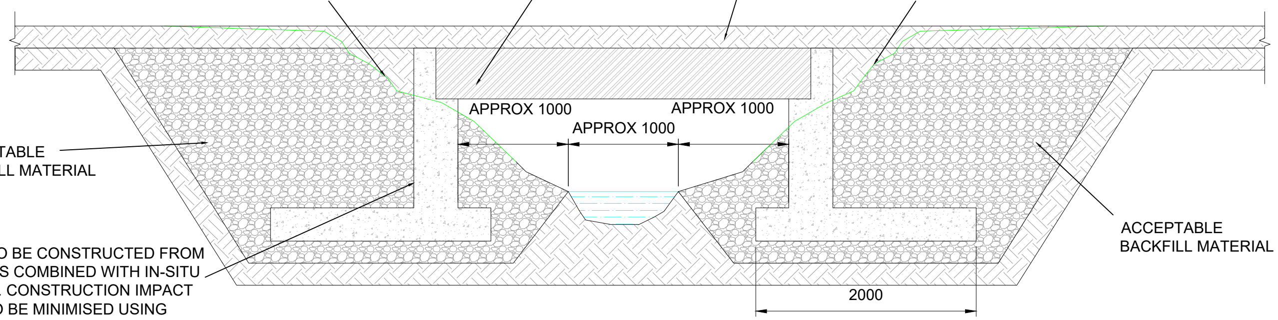

SECTION A-A Scale 1:50

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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 - 58**
SCALE: **As Shown @A3**	DATE: **18.03.2021**

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APPENDIX 4-2

PEAT AND SPOIL MANAGEMENT PLAN

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

PEAT & SPOIL MANAGEMENT PLAN

COOLE WIND FARM

Prepared for: **MKO**

Date: February 2021

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PEAT & SPOIL MANAGEMENT PLAN
COOLE WIND FARM

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT
User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Draft for Comment	IH	PJ	BdeH	29.10.20
1	Update following layout alterations	IH	PJ	BdeH	17.12.20
2	Revisions to Peat & Spoil volumes	IH	PJ	BdeH	13.01.21
3	Updates following Client comments	IH	PJ	BdeH	16.02.21
4	Updates following Client comments	IH	PJ	BdeH	25.02.21

Client: MKO

Keywords: Peat, Management, Excavation

Abstract: Fehily Timoney and Company (FT) were engaged by MKO to compile a Peat Management Plan (PMP) for Coole wind farm. The purpose of this report is to provide a Peat Management Plan for the construction phase of the wind farm. The report describes how peat which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated onsite. The report also provides construction details for the types of roads which will be put in place at the site and proposed peat placement/reinstatement areas which will be developed at the site.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.70 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

1.2 Project Description

Fehily Timoney and Company (FT) was engaged in August 2020 by McCarthy Keville O'Sullivan (MKO) on behalf of Coole Wind Farm Ltd. to compile a Peat Management Plan for the Coole wind farm site.

The proposed Coole wind farm is at a site located approximately 9km west of Castlepollard in Co. Westmeath.

The site, which is generally flat, consists predominantly of bare locally re-vegetated cut-away peat and intact shallow to deep peat with an extensive drainage network. The site has been extensively harvested using mechanical harvesting equipment resulting in a well-drained and extensively trafficked peat.

The development comprises of the following:

(1) up to 15 no. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas,

(2) 1 no. onsite electrical substation including control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank,

(3) 1 no. temporary construction compound,

(4) provision of new site access roads, upgrading of existing access roads and hardstanding areas,

(5) excavation of 1 no. borrow pit,

(6) all associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation,

(7) construction of 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,

(8) upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable,

(9) construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery,

(10) 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,

(11) drainage

(12) forestry felling

(13) signage, and

(14) all associated site development works.

1.3 Purpose

The purpose of this report is to provide a peat management plan with particular reference to peat stability for the construction phase of the project.

This peat management plan also includes a monitoring programme which will be implemented during the construction phase of the wind farm and a contingency plan should peat instability/failure occur at the site.

As work is carried out on site the contents of the peat management plan and peat stability monitoring programme will be updated, as appropriate.

This peat management plan contains some drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for site is outlined in detail in the relevant chapter of Environmental Impact Assessment Report (EIAR).

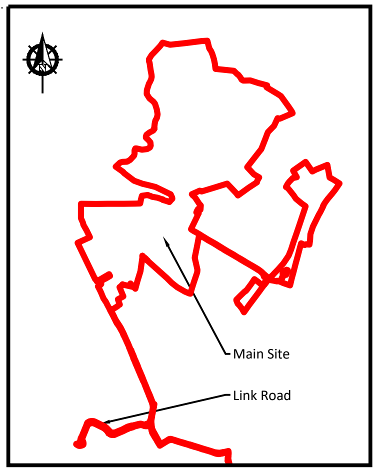
1.4 Proposed Construction Techniques for Site

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. The substation platform and construction compound platform will likely be constructed using floating techniques. New proposed roads will be both floated and excavated techniques. Any existing access tracks will be upgraded as per Section 3 of this report.

1.5 Peat Instability Definition

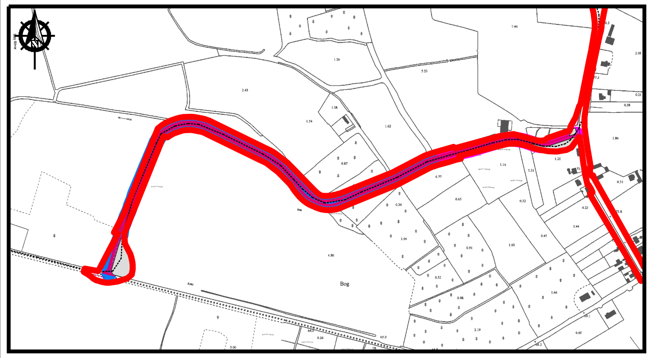
Peat instability in this report is defined as a mass movement of a body of peat that would have a significant adverse impact on the surrounding environment. Peat instability excludes localised movement of peat that would occur below a floating access road, creep movement or localised erosion type events.

Adherence to the peat management plan should reasonably minimise the potential for all such peat movements. However, it is noted that due to the soft ground nature of the peat terrain it is not possible to completely avoid localised peat movement.



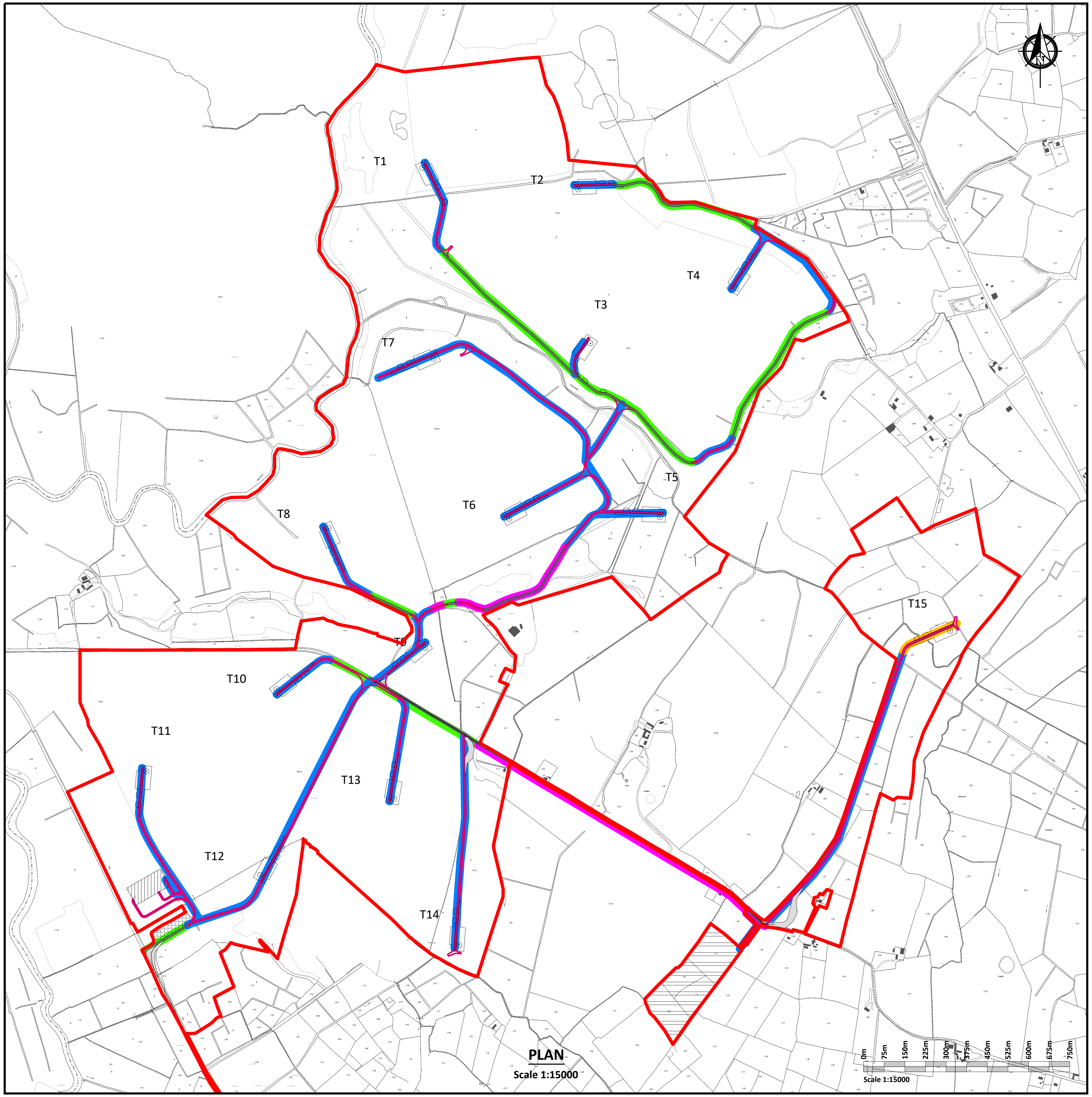
KEYPLAN

Scale 1:100000



PLAN

Scale 1:15000



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Road Type Legend:

- Type A - Upgrade of Existing Excavated Access Tracks
- Type B - Upgrade of Existing Floated Access Tracks
- Type C - New Excavated Access Road
- Type D - New Floated Access Road

Legend:

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

Scale (@ A3)
1:15000

Date - 12.01.21

FIGURE 1.1 - PLAN DRAWING OF WIND FARM WITH ROAD CONSTRUCTION TYPE

Drawn - POR

Checked - IH

Rev - C

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Tuesday 12 January 2021

2. CONSTRUCTION ACTIVITIES COVERED BY PEAT MANAGEMENT PLAN

For the construction phase of the Coole wind farm the activities that are considered to have issues in relation to peat stability are as follows:

(1) Upgrade of existing access tracks (floating tracks)

(2) Construction of new excavated roads through peat

(3) Construction of floating roads over peat (no peat will be excavated but the methodology for construction is included for completeness)

(4) Excavation and placement of arisings (given the ground conditions on site and the proposed construction techniques, the excavation and placement of arising's envisaged for the site is minimal)

(5) Excavations in peat for turbine bases, hardstands and other infrastructure foundations. Given the depth of peat and soft lacustrine deposits encountered on site, excavation works will be limited. It is proposed that some excavation works will be carried out at turbine T5 and T15 and the associated hardstands along with certain areas of existing access track upgrading.

(6) Excavations in peat for underground cables

Peat management of the above construction activities are covered individually in this report.

2.1 Road Construction Types

To provide access within the site and to connect the wind turbines and associated infrastructure existing tracks will need to be upgraded and new access roads will need to be constructed. The road construction preliminary design has taken into account the following key factors:

(1) Buildability considerations

(2) Maximising use of existing infrastructure

(3) Minimising excavation arisings

(4) Serviceability requirements for construction and wind turbine delivery and maintenance vehicles

(5) Requirement to minimise disruption to peat hydrology

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

The general road construction techniques to be considered are given in Table 2-1.

It should be noted that this report does not include a detailed design for the access roads on the Coole wind farm site. This report includes the most suitable type of road construction envisaged for each section of access road based on the ground/site conditions recorded during the site walkovers. Where floating roads are proposed in this report, a typical methodology is presented however a detailed design will be carried out prior to construction on site.

Table 2.1: General Road Construction Techniques

Construction Method	Typical Site Conditions			Comment
	Construction Type	Typical Peat Depth (m)	Typical Slope Inclination (degs)	
Upgrade of existing access roads	Type A	Up to 5.5m (variable peat depths)	Typically, less than 2 degrees, locally up to 7 degrees (in shallower peat areas)	A number of localised existing access tracks sections are required to be upgraded – Figure 1-1
	Type B			
Construction of new excavated roads through peat	Type C	-	-	New excavated roads through peat is the proposed access road construction technique, where possible, for the site access tracks – Figure 1-1
Construction of new floating roads over peat	Type D	Typically, less than 4.5m, locally up to 6.5m	Typically, less than 3 degrees, locally up 5 degrees	Floating access roads across the peat is the new proposed access road construction technique for the majority of the site access tracks – Figure 1-1

It should be noted that Table 2.1 summarises the general road construction techniques only. Prior to the construction of any floating access roads on site a detailed design will need to be carried out.

Further details on access road construction types A to D are given in Sections 3, 4 and 5 of the report.

3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A AND B

Upgrading of existing tracks is proposed for limited sections of access track, particularly in the north of the site and for a section of the turbine delivery route to the south of the wind farm site (Figure 1-1).

Upgrading works will include the upgrading of both floated and founded access tracks

3.1 Upgrading Existing Access Tracks Construction Methodology

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) 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 3-1) the following guidelines apply:

- (a) Excavation of the widened section of access road should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.
- (b) Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.
- (c) The surface of the existing access road should be overlaid with up to 500mm of selected granular fill.
- (d) Access roads to be finished with a layer of capping across the full width of the track
- (e) A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road (to be confirmed by the designer).
- (f) For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

(3) For upgrading of existing floated access tracks (Type B – Figure 3-2) the following guidelines apply:

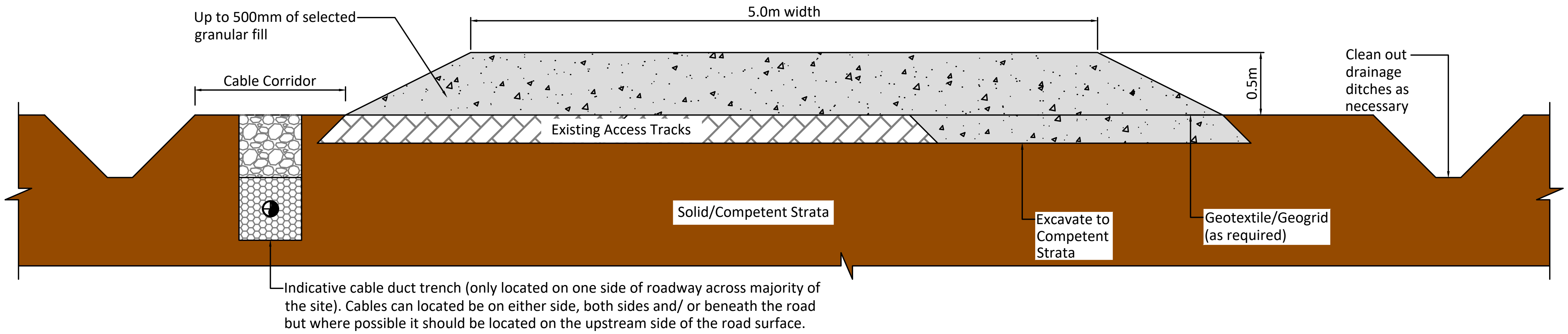
- (a) The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are localised 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 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.

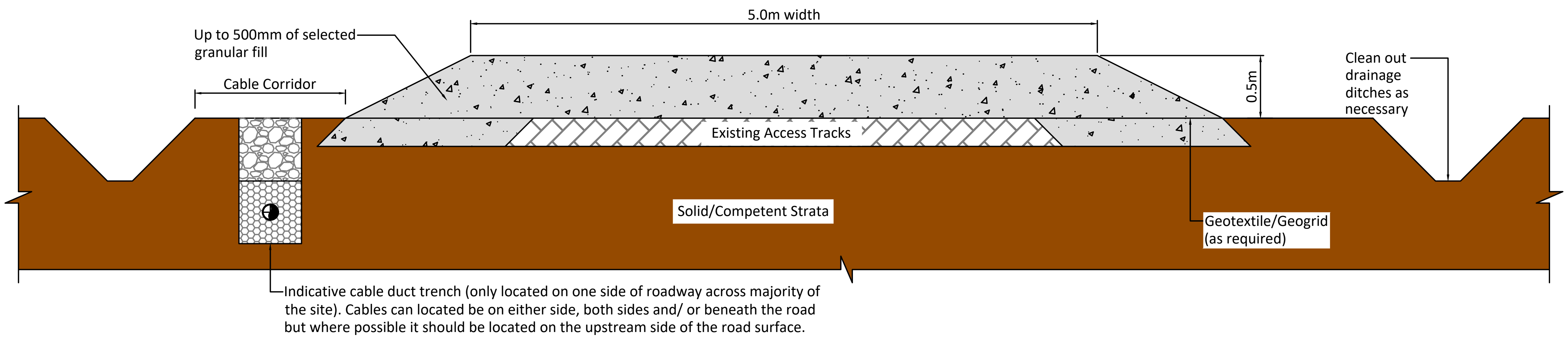
(e) The geogrid will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers.

(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.





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Date - 23.02.21

FIGURE 3.1 - TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACK

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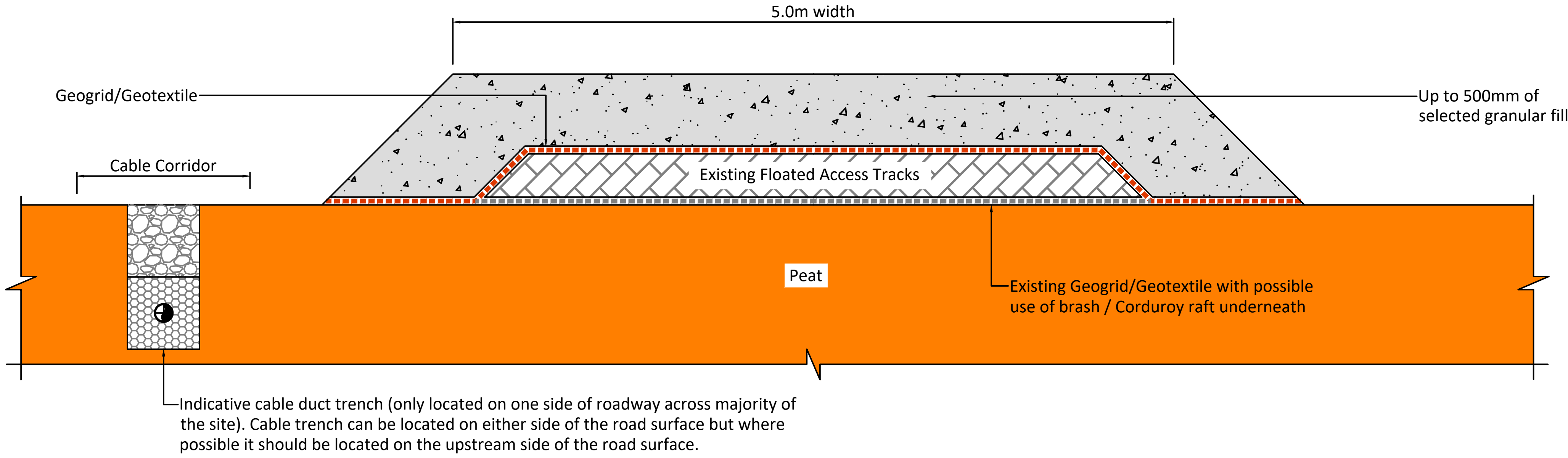
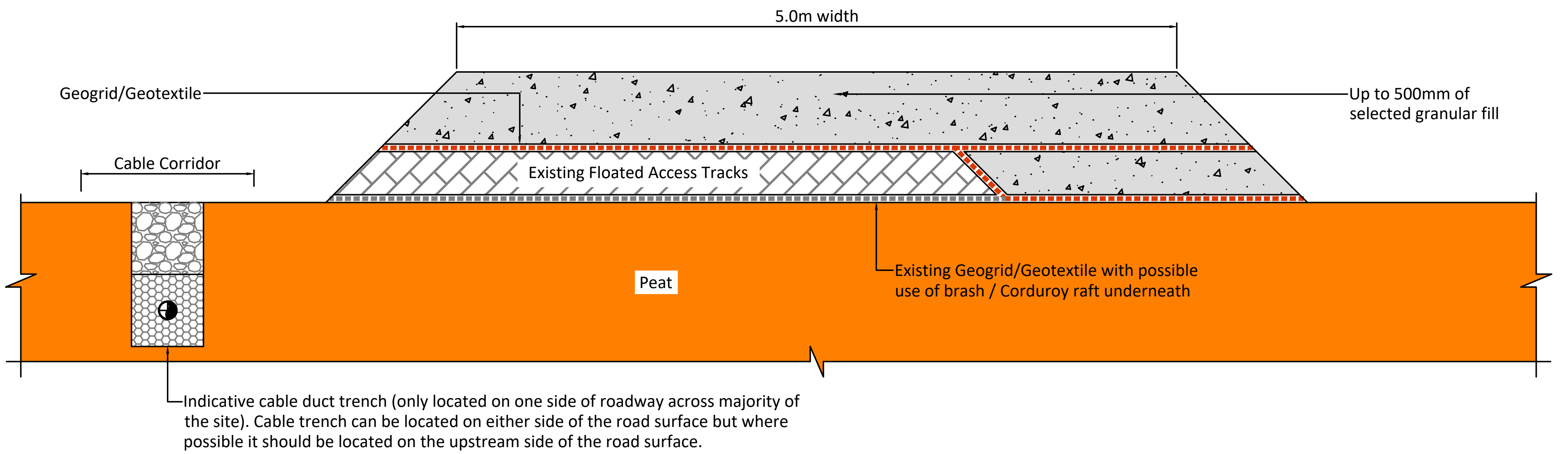


Upgrade of Existing Track on Flat Ground



Upgrade of Existing Track on Sidelong Ground

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FIGURE 3.2 - TYPE B - UPGRADE OF EXISTING FLOATED ACCESS TRACKS

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4. CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE C

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. The proposed locations for new excavated access roads on site are shown in Figure 1-1 and details are shown in Figure 4-1.

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.

4.1 Excavated Road Construction Methodology

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 (as agreed with site designer).

(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.

(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 1200mm 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 5-2).

(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.

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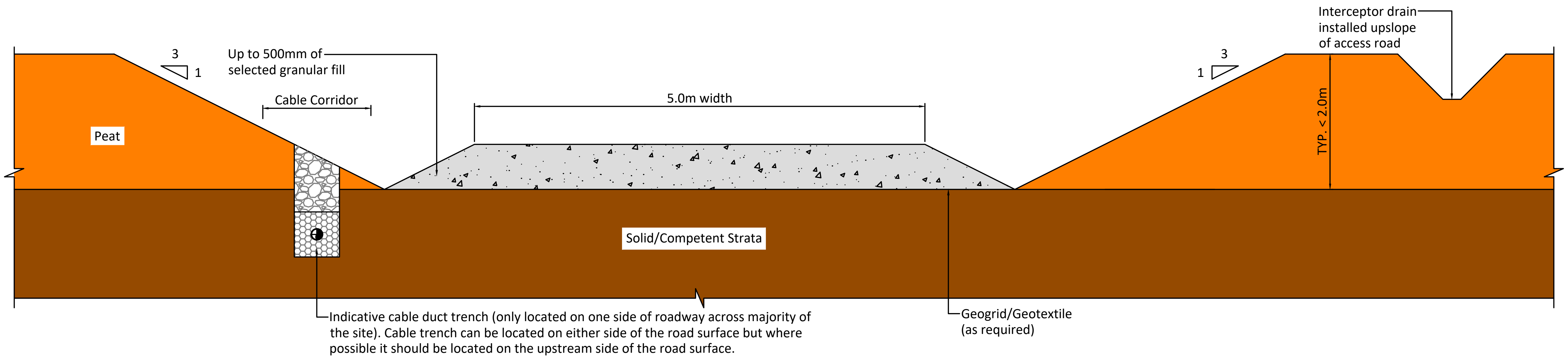

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FIGURE 4.1 - TYPE C - NEW EXCAVATED ACCESS ROAD

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5. CONSTRUCTION OF NEW FLOATED ROADS OVER PEAT – TYPE D

Floating roads across peat will be used for the construction of the majority of access roads. The use of new floated access tracks will be limited on site to areas of flatter terrain. The proposed locations for the new floating access roads on site are shown in Figure 1-1 and details are shown in Figure 5-1. It should be noted that these locations should be confirmed by the designer.

A confirmatory stability analysis should be carried out by the designer where it is proposed to install floating access roads over the peat prior to any construction work commencing on site.

Floating roads minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavate and replace type access road may be more suitable (see Section 6), although this is not anticipated at the location of the floated roads.

5.1 Floating Road Construction Methodology

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, which are considered in the relevant chapter of the EIAR.

Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

(1) Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.

(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 5-1).

(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.

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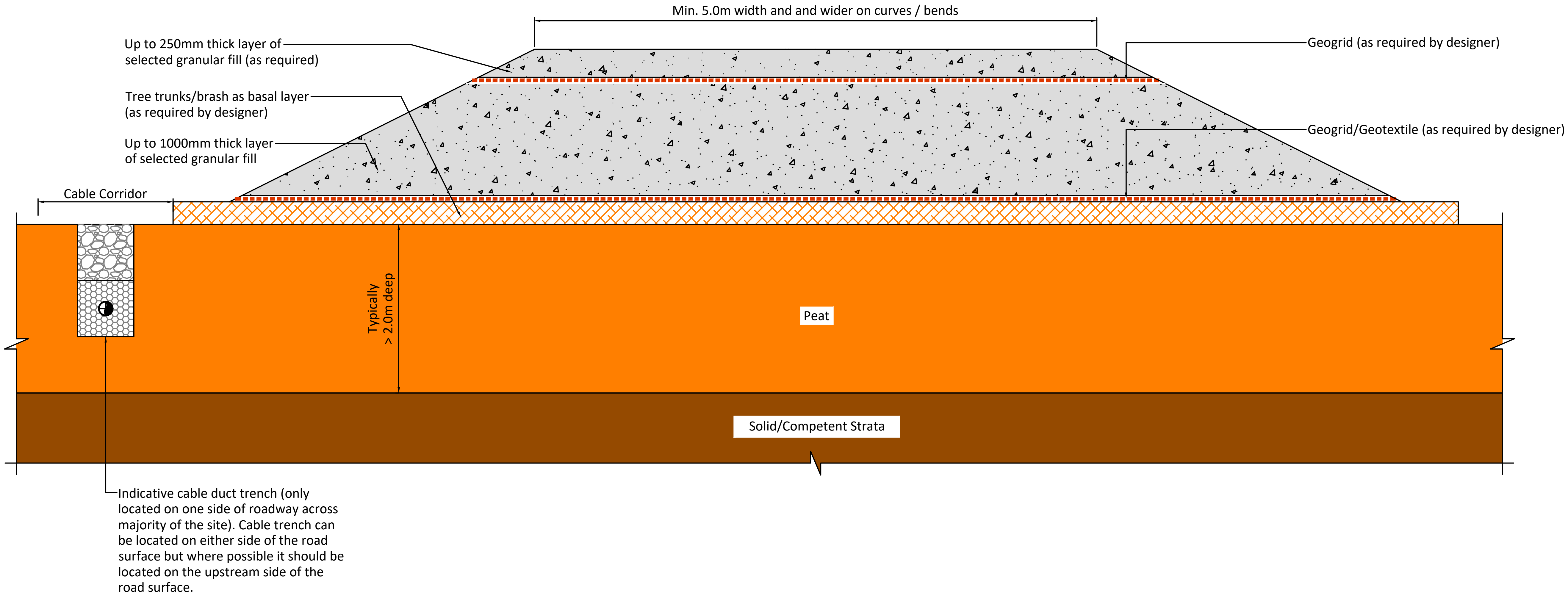

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FIGURE 5.1 - TYPE D - NEW FLOATED ACCESS ROAD

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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).

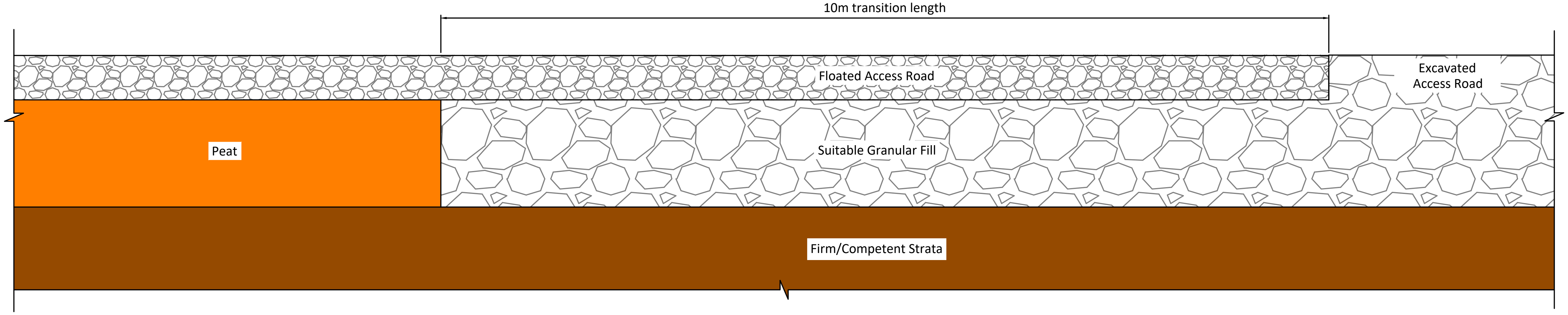

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FIGURE 5.2 - TRANSITION DETAIL FOR FLOATED & EXCAVATED ACCESS ROAD

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6. GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

The following general construction guidelines are given for the access roads on site.

(1) Where an open ditch is present alongside an existing/proposed floating access track, the ditch may need to be filled prior to upgrading/constructing the access track. The ditch shall be filled with suitable drainage stone. As applicable, a perforated pipe shall be laid into a ditch prior to filling so as to maintain water flow within the ditch.

(2) Where existing drainage crosses the road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded access road. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.

(3) No excavations (e.g. drainage, peat cuttings) shall be carried out within 5m distance of a completed floated access road edge, or at a distance determined following site inspection. The presence of excavations can destabilise the road. Temporary excavations should be excavated in short lengths and backfilled as soon as practicable.

(4) No stockpiling of materials shall take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.

(5) End-tipping of stone onto the road during the construction/upgrading of the access road should be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.

(6) Due to the nature of floating road construction it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2m). These survey points shall be surveyed on a weekly basis, possibly more frequently when construction activities are ongoing in the area.

(7) It is recommended that the construction and upgrading of access roads in areas of deep peat (greater than 2m) is inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(8) In the event of excessive vertical displacement of the road during/following construction then mitigation measures may be required to ensure the stability of the road. This may include:

    (a) Introduction of pressure berms either side of the road (that are 2 to 5m wide by 0.5m deep stone layer).

    (b) Where peat is relatively shallow then excavate peat and replace with suitable fill.

    (c) Slowing the rate of construction.

(9) Settlement of a floated access road is expected and will likely be in the order of several 100mm in the deeper peat areas; as such it may be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works it is recommended that measures are taken to re-level the road, as necessary.

7. EXCAVATION AND STORAGE OF ARISINGS

7.1 Excavation and Storage of Arisings Methodology

This methodology includes procedures that are to be included in the construction phase 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.

Minimal excavation is likely to be required on site due the proposed construction techniques for site as a result of the deep nature of peat and underlying soft soil deposits encountered.

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, it is likely that a piled foundation will be required for the substation building. The substation platform and construction compound platform will likely be constructed using floating techniques. The majority of new access roads will use a floated technique.

The 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 7-1 shows a typical cross section with locally placed/spread spoil either side of an excavation. Further details are given in Section 7.5 of this report.

The proposed borrow pit is located on an existing pasture/grazing land area, approximately 700m to the south east of T14. A plan and cross section drawing of the borrow pit is included as Figure 7-2 to this report. In relation to the borrow pit, it is proposed to remove the overburden material and stockpile local to the borrow pit excavation. The rock will then be removed from the borrow pit and used in the construction of the access tracks, hardstandings, working platforms, etc, on the wind farm site. Upon removal of all required rock from the borrow pit it is proposed to reinstate the borrow pit with the locally stored overburden material from the borrow pit footprint.

A small volume of excavated non-peat spoil will be generated as a result of the upgrade works to a section of the turbine delivery route to the south of the site. The minimal amount of non-peat spoil generated would be landscaped into the existing terrain adjacent to the access tracks. See Figure 1-1 for the extent of the upgrade works required to this section of the turbine delivery route.

7.2 Summary of Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the Coole wind farm site are given in Table 7-1.

Table 7.1: Summary of Excvated Peat and Spoil Volumes on Site

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3)	Comment
2 no. Turbines	Assumed 22m diameter turbine foundation dig out for turbine T5 and T15 only	1,055	1,690	For calculation purposes, it is estimated that 13 of the 15 turbine bases will be piled hence no excavation of peat has being allowed for at these locations. This will be confirmed at detailed design stage. Excavated peat and spoil to be stored locally as per Section 7.5.
2 no. Crane Hardstands	Plan area of rectangular hardstand for T5 and T15 is 4,500m^2	11,880	3,240	For calculation purposes, it is assumed that 2 no. hardstands are constructed using a founded construction technique, the remaining are assumed to be piled. This will be confirmed at detailed design stage. Excavated peat and spoil to be stored locally as per Section 7.5.
1 no. Construction Compound Platform	Plan area of construction compound is 6,600m^2	-	-	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.
1 no. Substation Platform & Building	Plan area of substation platform is 10,000m^2	0		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 limited 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.
Upgraded access roads (on-site and link road)	Approximate plan area of upgraded access roads is 6,000m^2	3,575	2,140	It is envisaged that there will be some peat excavated as a result of the upgrading works carried out to the existing excavated assess tracks and excavation of new tracks on site. Excavated peat and spoil to be stored locally as per Section 7.5.
Borrow Pit	Plan area of borrow pit is 62,100m^2	-	74,400	Based on the trial pitting carried out, no peat is noted at the borrow pit location. Spoil generated from the stripping of overburden will be backfilled into the borrow pit.
	Total =	**16,510m^3**	**81,470m^3**	**Total = 97,980m^3 (peat and spoil volume)**

Note (1) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

7.3 Summary of Stone Volumes Required on Site

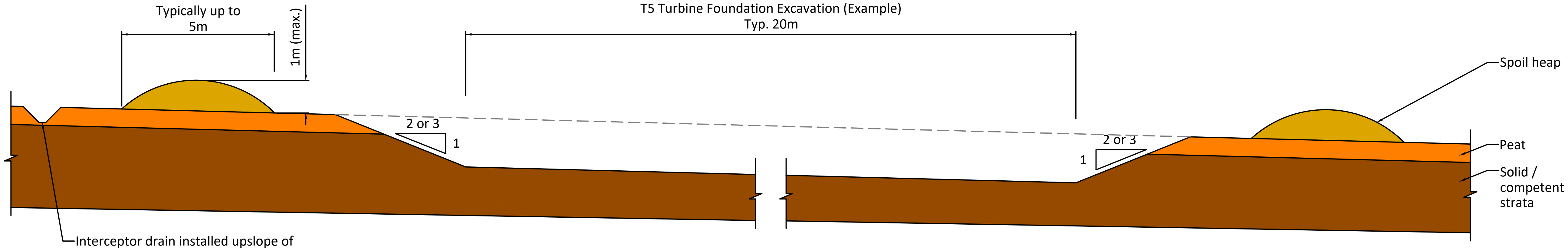
A summary of the estimated stone volumes required for the Coole wind farm site is given in Table 7-2.

Table 7.2: Summary of Stone Volumes Required

Infrastructure Element (1)	Typical Dimensions	Stone Volume (m^3) (2)	Comment
Turbine Fill and Crane Hardstands	15 turbines and hardstands	104,815	Stone thickness of 1.2m assumed for hardstand thickness.
Access Roads	Up to 5m in width, approximately 16km in length	121,900	Stone thickness of 1.2m along access roads assumed for calculation purposes
Substation Compound	Approximately 10,000m^2	15,000	Stone thickness of 1.2m assumed for calculation purposes
1 no. Construction Compound Platform	Approximately 6,800m^2	10,200	Stone thickness of 1.2m assumed for calculation purposes
	Total =	**251,915m^3**	

Note (1) A factor of 25% (bulking factor of 20% and contingency factor of 5%) has been applied to the estimated stone volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

(2) These volumes do not include requirements for surfacing of hardstands/access roads with higher quality surface layer



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.

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FIGURE 7.1 - PLACED / STORED MATERIAL - TYPICAL CROSS SECTION

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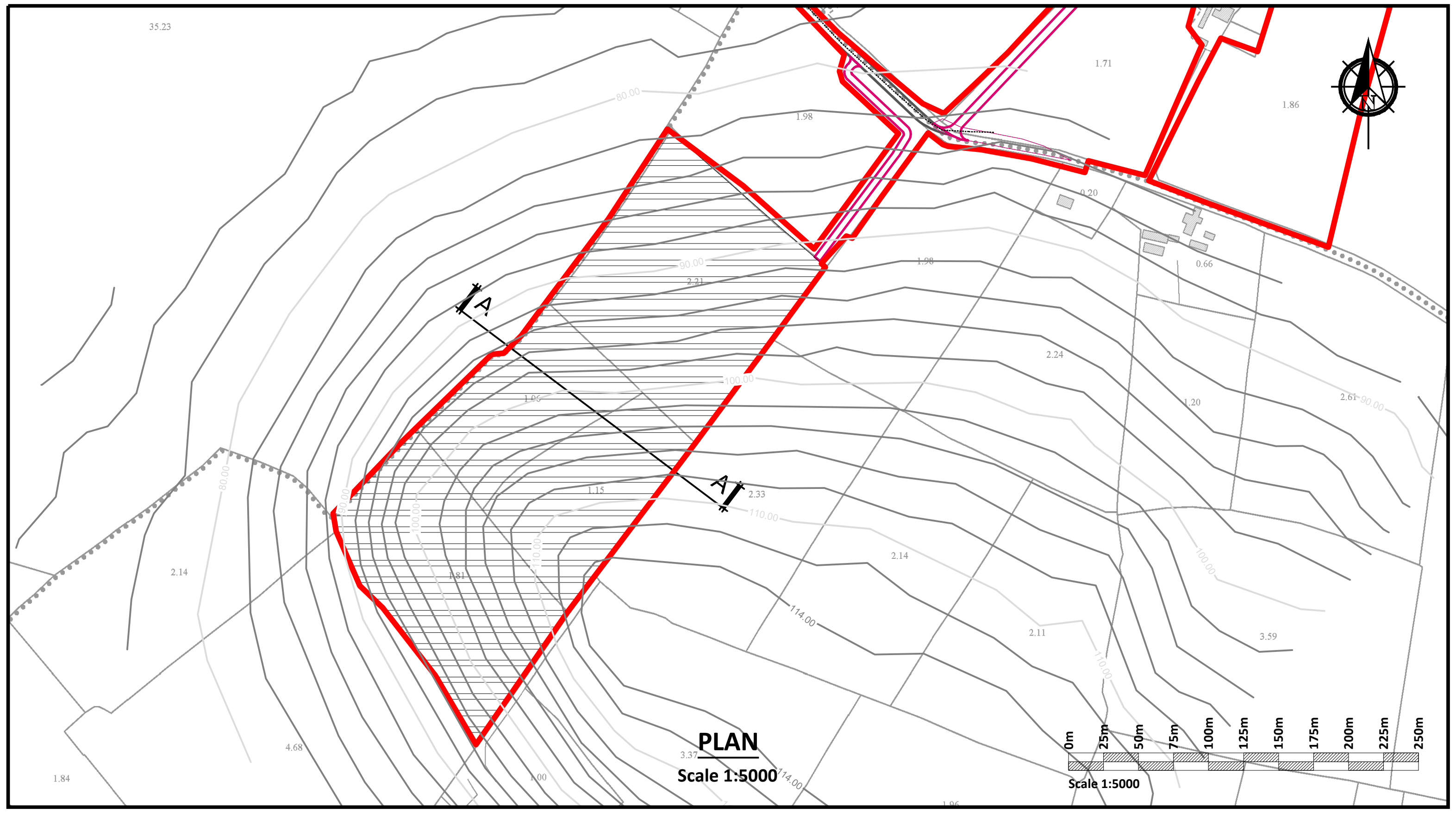

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Legend:

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

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.

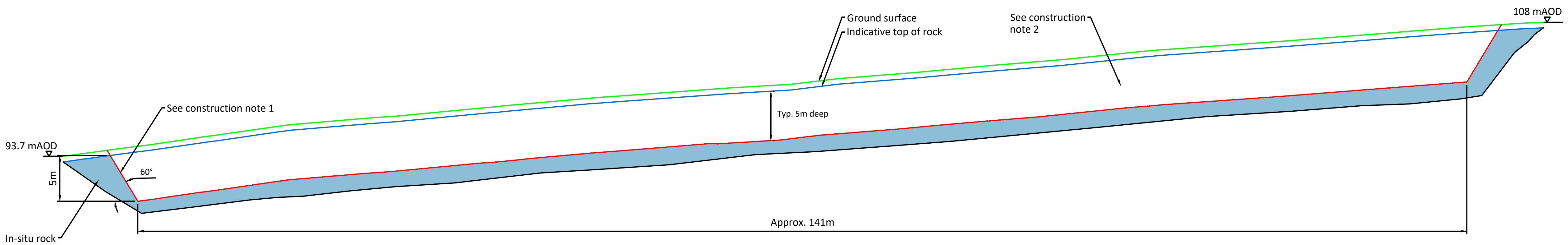
(3) The thickness of overburden was based on the trial pits carried out within the footprint of the borrow pit.

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

Section Scales:

1:1 Horiz.
1:1 Vert.

(No Exaggeration on Vertical Scale i.e. True Scale)



CROSS SECTION A - A (NO VERTICAL EXAGGERATION TRUE SCALE 1:1)
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Scale (@ A3) 1:5000	**FIGURE 7.2 - BORROW PIT NO 1 - PLAN AND CROSS SECTION DETAILS**	Drawn - POR
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7.4 Guidelines for the Construction and Reinstatement of Borrow Pits

One location has been identified as a potential borrow pit and is shown on Figure 7-2. The overburden depth within the development footprint of the borrow pit is less than 1m.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using excavated spoil comprising overburden material stripped during the excavation of the borrow pit. The excavated rock from the borrow pit will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated spoil to be placed safely. It is proposed to construct cells within the borrow pit for the placement of the excavated spoil. This is to allow for the safe placement and grading of the spoil using dumper trucks and excavators. It also eliminates the need to construct above ground retaining structures which may have an unnecessary visual impact and increase the development footprint of the proposed wind farm. The text below provides design and construction guidelines for the borrow pit.

Figure 7-2 shows typical construction details for the borrow pit.

The borrow pit shall be constructed as follows:

(1) The rock within the borrow pit footprint will be removed by breaking, following a confirmatory ground investigation carried out at the proposed borrow pit. The ground investigation shall comprise rotary core drilling with associated engineering logging including rock quality designation and strength testing, as required.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes should be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.

(3) The stability of the rock faces within the borrow pit should be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock.

(4) Infilling of the spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated spoil to be reinstated safely.

(5) The use of temporary access ramps and long reach excavators during the placement of the excavated spoil is likely to be required.

(6) Where possible, the surface of the placed spoil should be shaped to allow efficient run-off of surface water from the placed arisings.

(7) An interceptor drain should also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.

(8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.

(9) A silting pond may be required at the lower side/outfall location of the borrow pit.

(10) Where possible, the topsoil shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the spoil within the borrow pits.

(11) Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.

(12) All the above mentioned general guidelines and requirements should be confirmed by the designer prior to construction. A detailed construction methodology for the borrow pits should be compiled prior to construction.

7.5 Guidelines for the Placement/Spreading of Spoil alongside Excavations

The volume of materials to be placed adjacent to the excavation areas is considered minimal. The following recommendations and best practice guidelines for the placement/spreading of spoil alongside excavations should be considered and taken into account during construction.

(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 7-1 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 1m 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 should 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 should 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 is to 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): 2 to 3 (h). This slope inclination should 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.

(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 is recommended for the works.

(11) An interceptor drain should 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.

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

8. EXCAVATIONS IN PEAT FOR TURBINE BASES, HARDSTANDINGS AND INFRASTRUCTURE FOUNDATIONS

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, it is likely that a piled foundation will be required for the substation building. The substation platform and construction compound platform will likely be constructed using floating techniques. The majority of new access roads will use a floated technique.

Hence excavated spoil from the proposed construction works will be minimal. The following outlines the methodology to be used during construction/excavation in peat. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

8.1 Methodology

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) With respect to placement of arisings from excavations the guidelines given in Section 7 are to be followed.

(2) All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 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.

(3) Excavations shall be kept reasonably free from water at all times. Water should be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.

(4) Where water is channelled or pumped from an excavation then this water is to be fed into an established watercourse or drainage ditch following suitable treatment.

9. EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Coole Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Coole Wind Farm will connect to the national grid via an existing substation located in Mullingar to the south of the proposed wind farm development. The proposed grid connection is approximately 26.4km in length and will follow existing and proposed tracks and the public road corridor.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in the EIAR.

It is proposed to excavate the trenches for the underground cable at a uniform level in peat or other overburden material. The trenches will be 900mm wide and 1200mm deep.

The cable trench route is envisaged to encounter peat and till derived from Limestone and Cherts.

9.1 Methodology

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) With respect to placement of arisings from excavations the guidelines given in Section 7 are to be followed.

(2) It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or other overburden material.

(3) All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 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.

(4) Similarly, all excavations within non-peat overburden for the cable trench are to be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h). This slope inclination will be reviewed during construction, as appropriate.

(5) Excavations shall be kept reasonably free from water at all times.

(6) Any material excavated from the cable trench which is deemed suitable for reinstatement of the trench will be used for this purpose i.e. stockpiled locally to the works and reused for backfilling.

(7) Any material not deemed suitable for the reinstatement of the cable trench will be landscaped locally to the trench, where possible.

10. GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTICE

To minimise the risk of construction activity causing potential peat instability it is recommended that the Construction Method Statements (CMS) for the project will also take into account, but not be limited, to the general recommendations below together with the specific recommendations above.

(1) Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge. All water discharged form excavations during work shall be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.

(2) Avoidance of unstable excavations. All excavations shall be suitably supported to prevent collapse and development of tension cracks.

(3) Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.

(4) Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits (see Section 11).

(5) Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.

(6) Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.

(7) Routine inspection of wind farm site by Contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).

11. INSTRUMENTATION

11.1 Movement Monitoring Posts

To monitor possible peat movements, it is proposed to install sighting posts upslope and downslope of the access road at staggered intervals at locations where the peat depth is greater than 4.0m. Additional monitoring locations may be required at infrastructure locations with deeper peat deposits. Details of sighting posts are given below.

(1) A line of sighting posts shall comprise:

(a) A line of wooden stakes (typically 1 to 1.5m long) placed vertically into the peat to form a straight line.

(b) The sighting line shall comprise 6 no. posts at 5m centres that is a line some 25m long.

(c) A string line shall be attached to the first and last posts and all intervening posts shall be adjusted so they are just touching the string line.

(2) Lines of sighting posts shall be placed across the existing slope about 5m away from the area to be worked. It is recommended that the posts are located along the road at 10m intervals in areas of deep peat (say greater than 2.0m). Where there are relatively steeper slopes or softer ground a sighting line shall be placed down the slope, or at any location where monitoring would be deemed useful.

(3) Each line of sighting posts shall be uniquely referenced with each post in the line given a reference. The post reference shall be marked on each post (e.g. reference 1-1, 1-2, 1-3, 1-4, 1-5, 1-6 for posts in line 1).

(4) The sighting lines shall be monitored at the beginning of each working day, and during the day where considered appropriate (e.g. when working activity is concentrated at a specific location).

(5) Monitoring of the posts shall comprise sighting along the line and recording any relative movement of posts from the string line.

(6) Where increased movements are recorded the frequency of monitoring shall be increased.

(7) A monitoring record shall be kept of the date, time and relative movement of each post, if any. This record shall be updated and stored as a spreadsheet.

12. CONTINGENCY MEASURES

12.1 Excessive Movement

Where there is excessive movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) All activities (if any) shall cease within the affected area.

(2) Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.

(3) Re-commencement of activities shall only start following a cessation of movement and agreement with all parties.

12.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) On alert of a peat slide incident, all activities (if any) in the area should cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.

(3) All relevant authorities should be notified if a peat slide event occurs on site.

(4) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrages

Whilst it is not anticipated from the analysis undertaken that a peat slide will occur on site, as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill should comprise well-graded coarse rock pieces from about 300mm up to typically 1000mm.

The rock fill for the check barrage could be sourced from locally won granular fill material on site, i.e. the borrow pit to the southeast of the wind farm development.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

Typically, the check barrage should fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of typically 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

(1) Access to the check barrage location shall be along the existing access roads on the wind farm site and/or along public roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.

(2) Operatives employed to carry out the construction of the check barrage would need to be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.

(3) The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding is agreed with all parties.

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APPENDIX 4-3

IONIC TYPICAL DETAIL DRAWINGS

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PHOTO B

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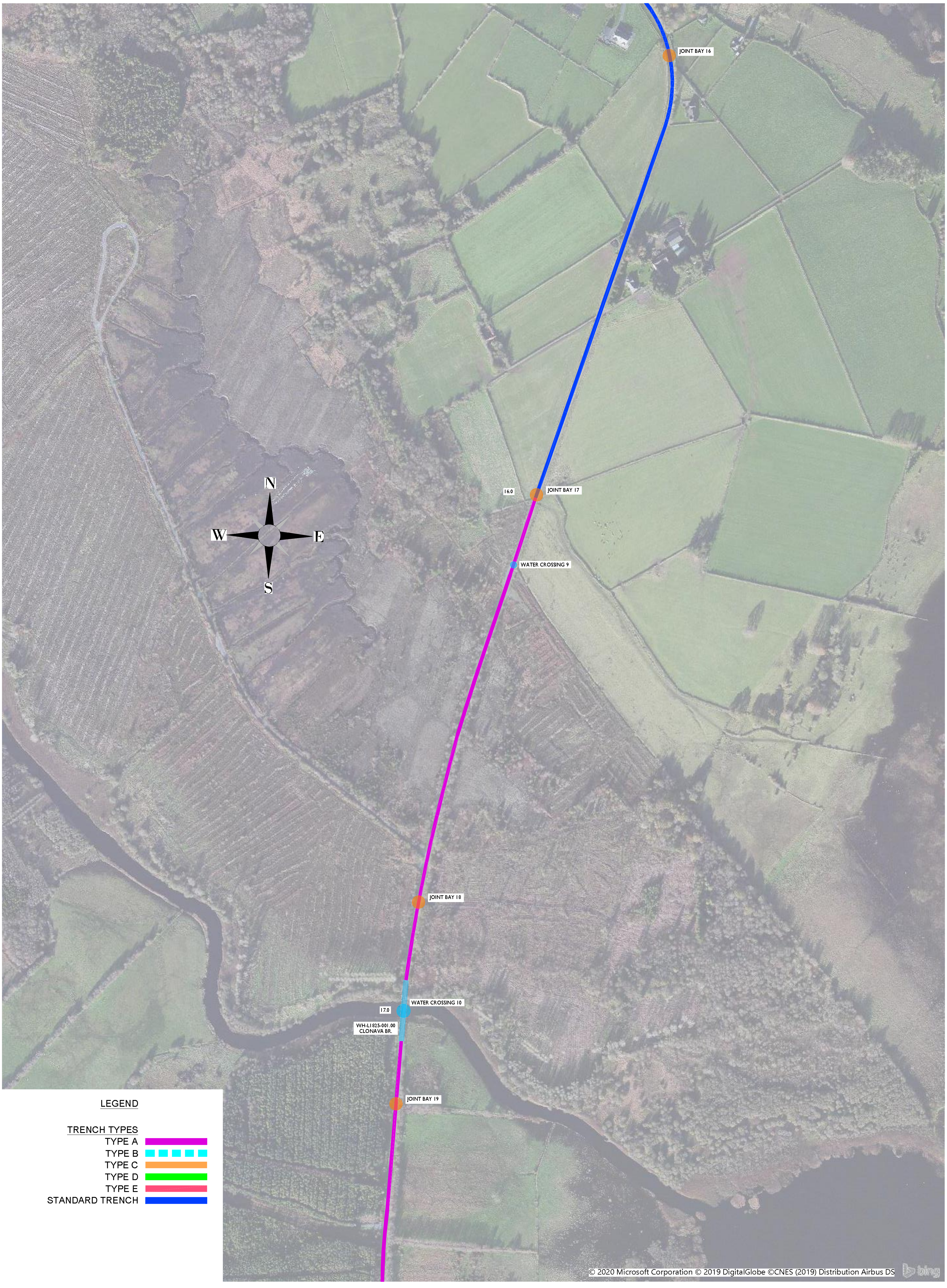

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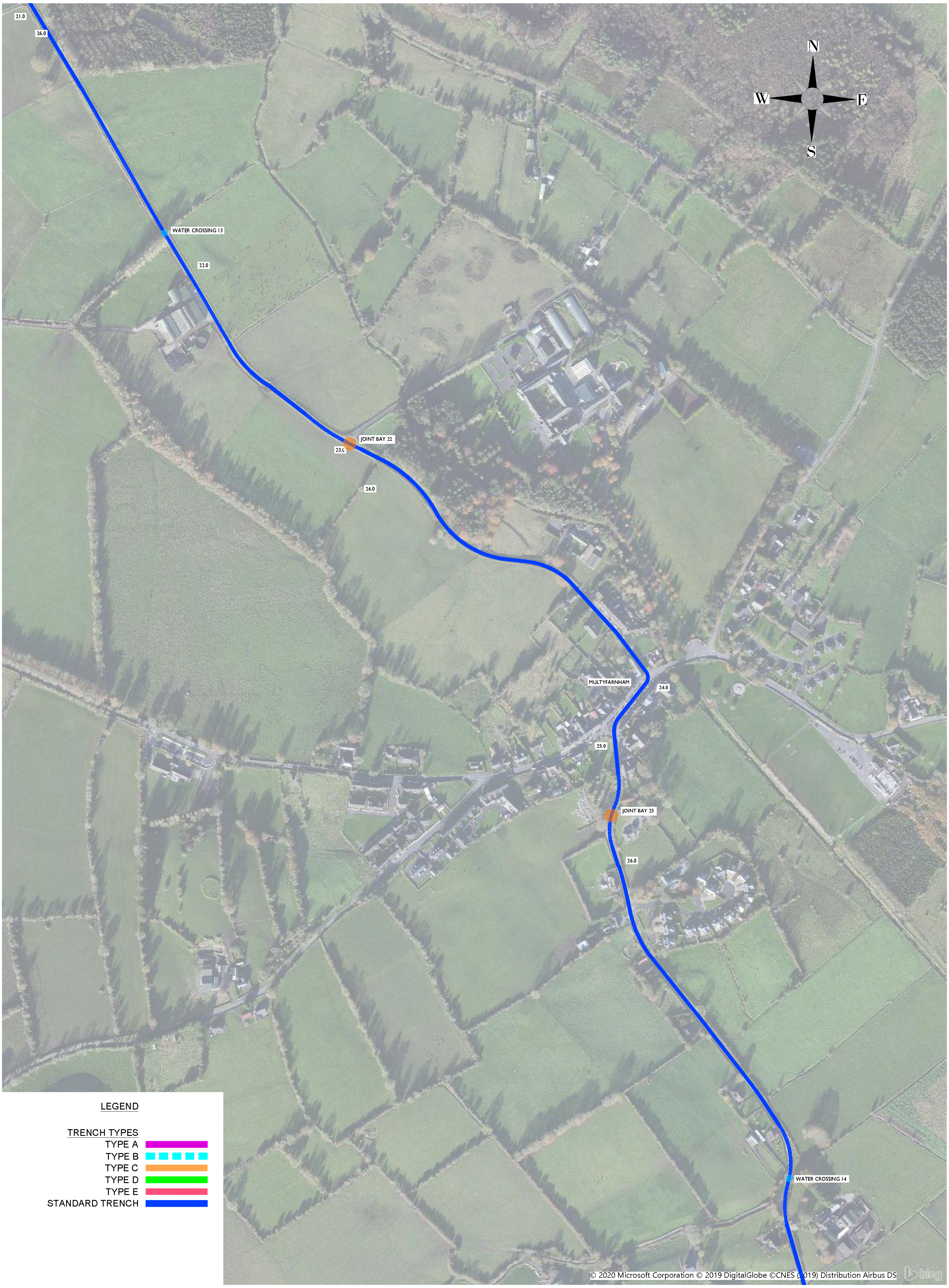

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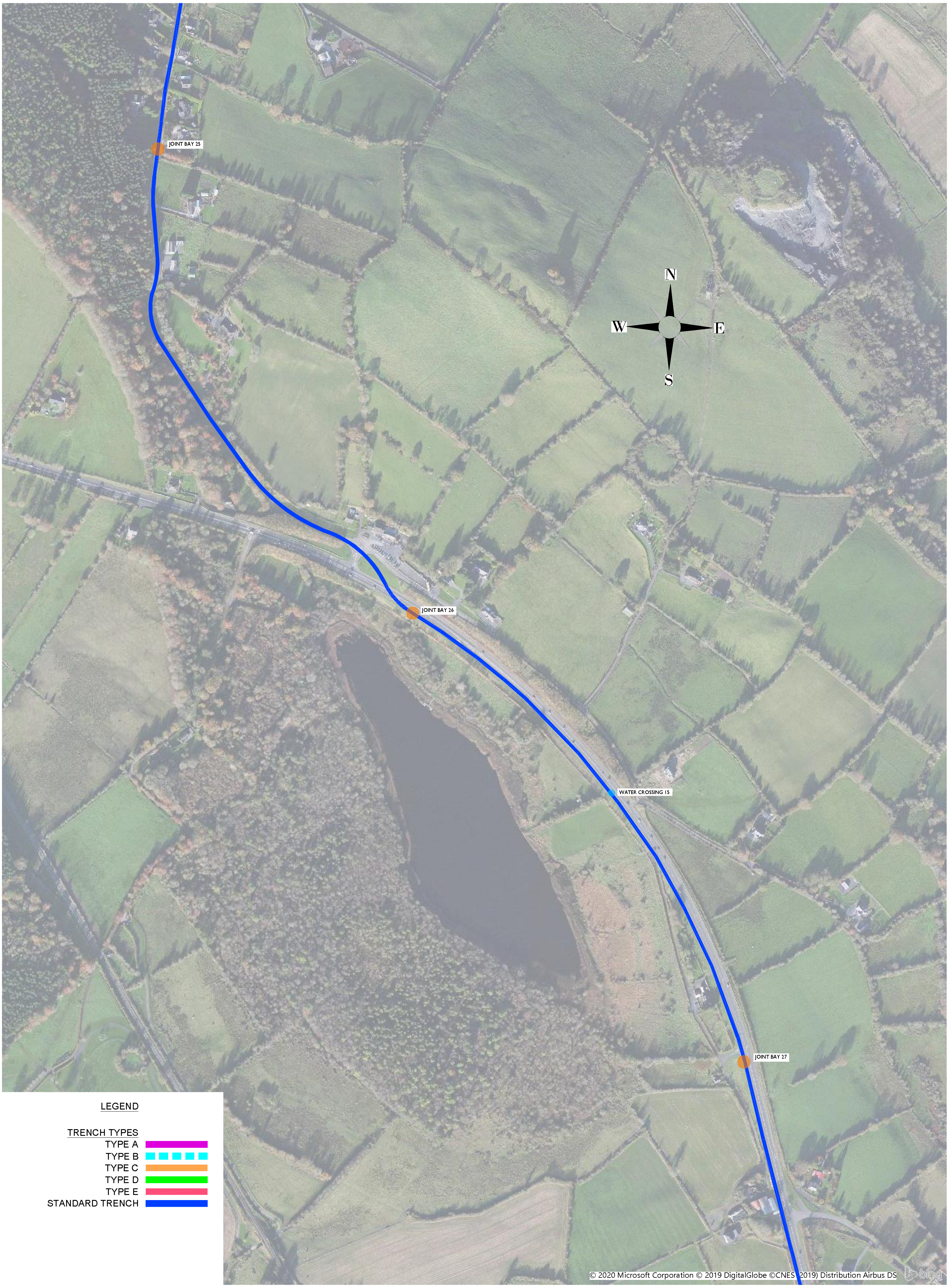

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: ILLUSTRATIVE TRENCH TYPE DETAILS SHEET 12 OF 16

REVISION: C

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	19/03/2020	A3	1:10000

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J. SHANAHAN	19/03/2020		COLE d005.1.12

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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
ILLUSTRATIVE TRENCH TYPE DETAILS
SHEET 13 OF 16

REVISION
C

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: ILLUSTRATIVE TRENCH TYPE DETAILS SHEET 14 OF 16

DRAWN BY	DATE	PAPER SIZE	SCALE
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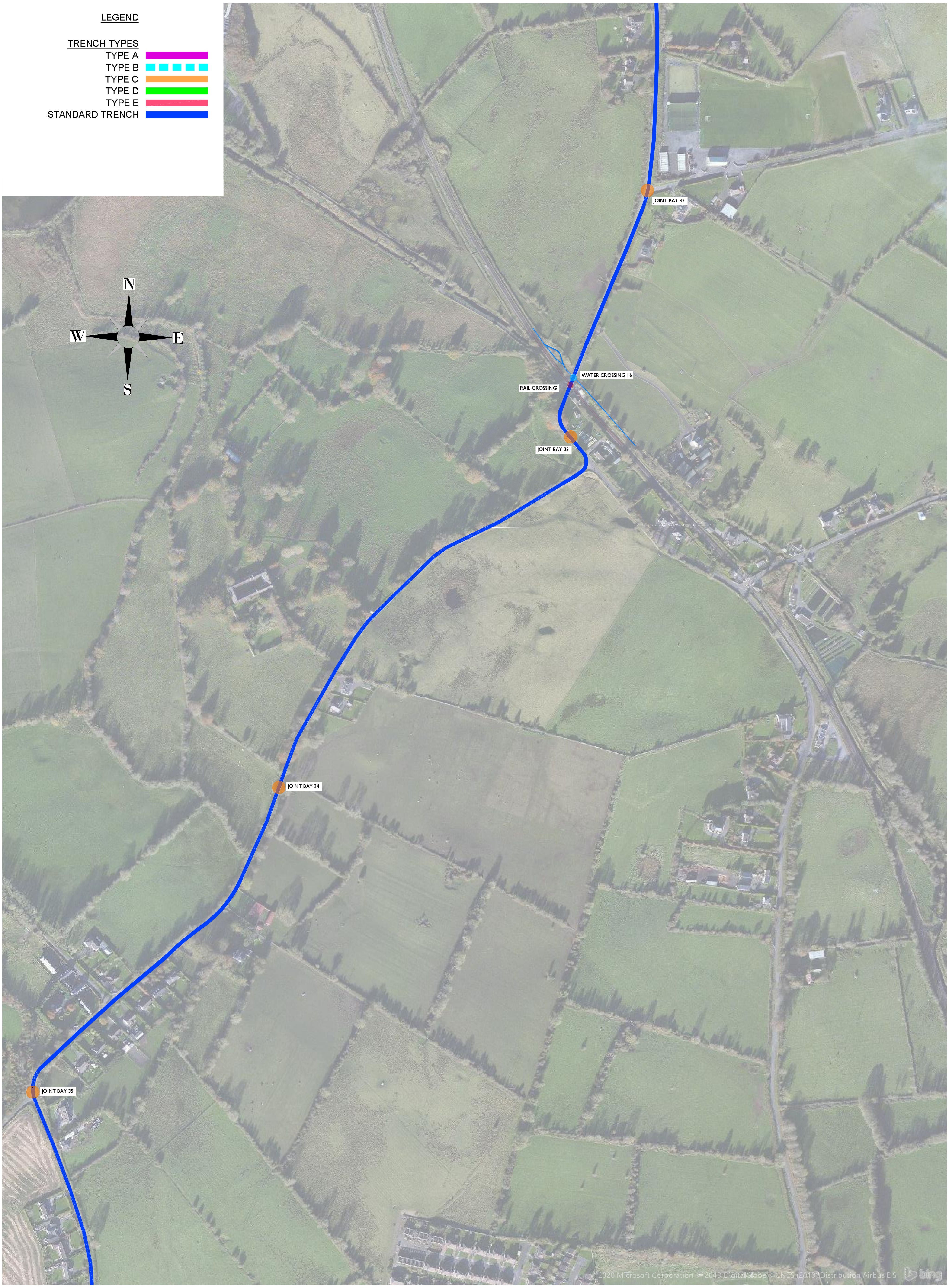

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TITLE: ILLUSTRATIVE TRENCH TYPE DETAILS SHEET 15 OF 16

REVISION: C

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	19/03/2020	A3	1:10000

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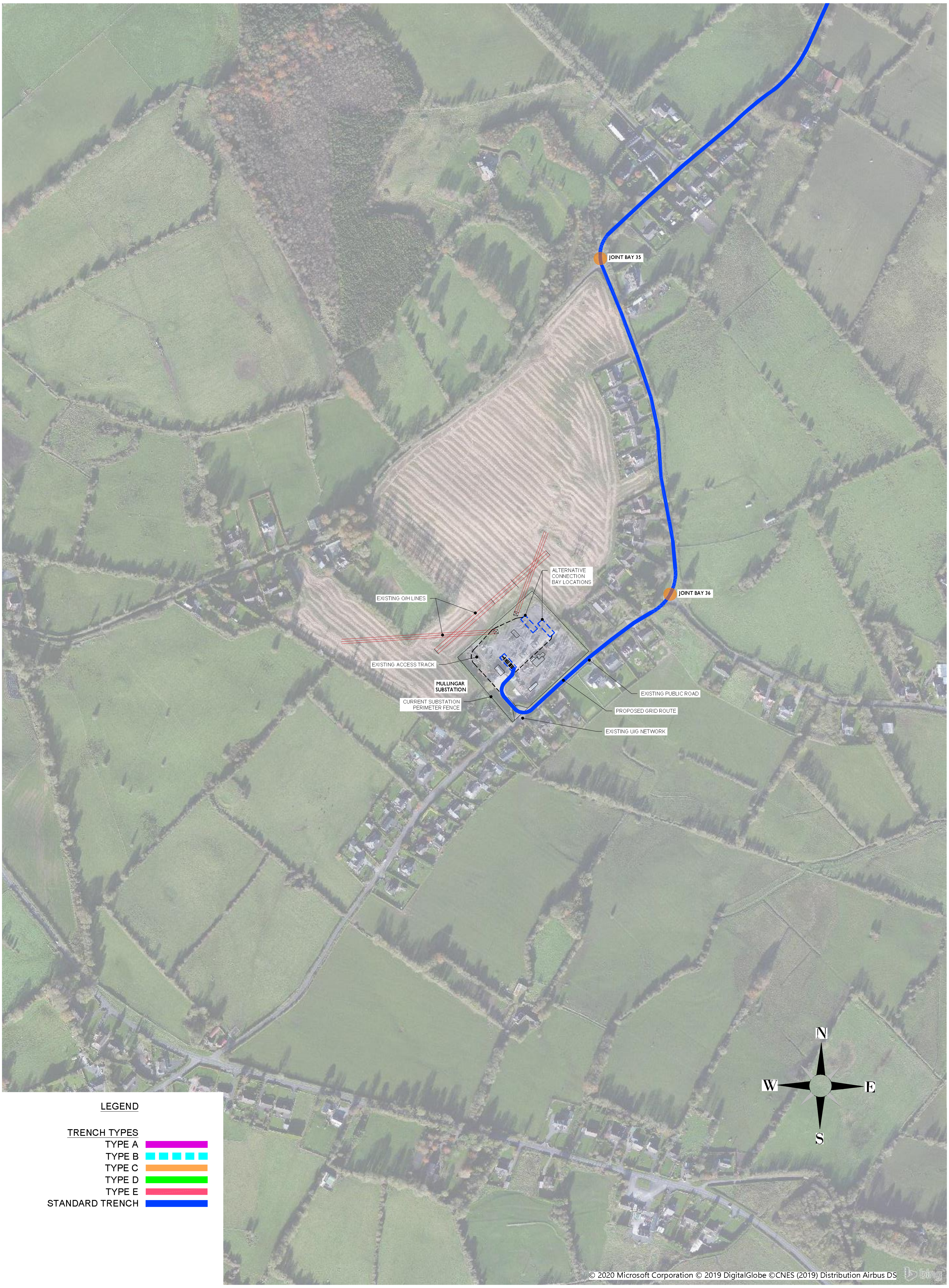

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
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B	23.01.2020	MB	JS	JOINT BAYS ADDED
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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: ILLUSTRATIVE TRENCH TYPE DETAILS SHEET 16 OF 16

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M. BROWNE	20/03/2020	A3	1:10000

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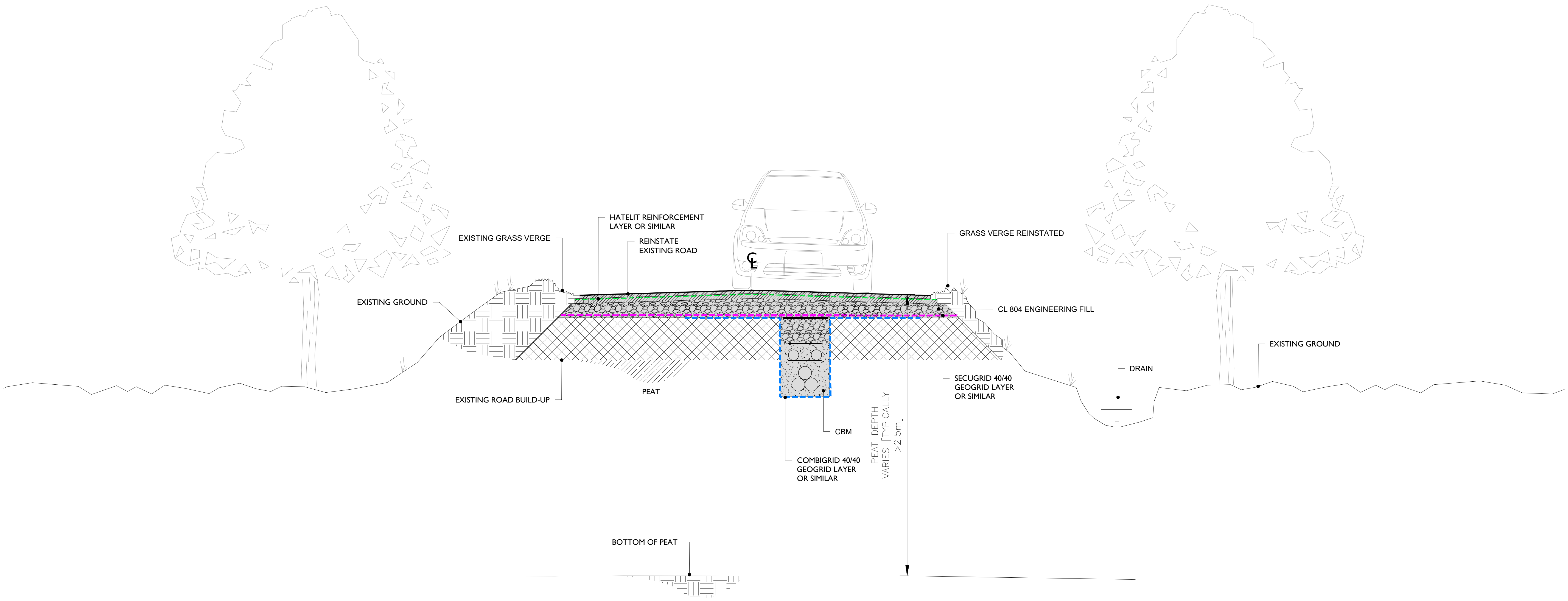

ILLUSTRATIVE SECTION THROUGH FLOATING ROAD
[>2.5M TO BASE OF PEAT]

SCALE 1:50

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
ILLUSTRATIVE DETAILS
ROAD SECTION TYPE A

REVISION
A

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	09/12/2019	A3	1:50

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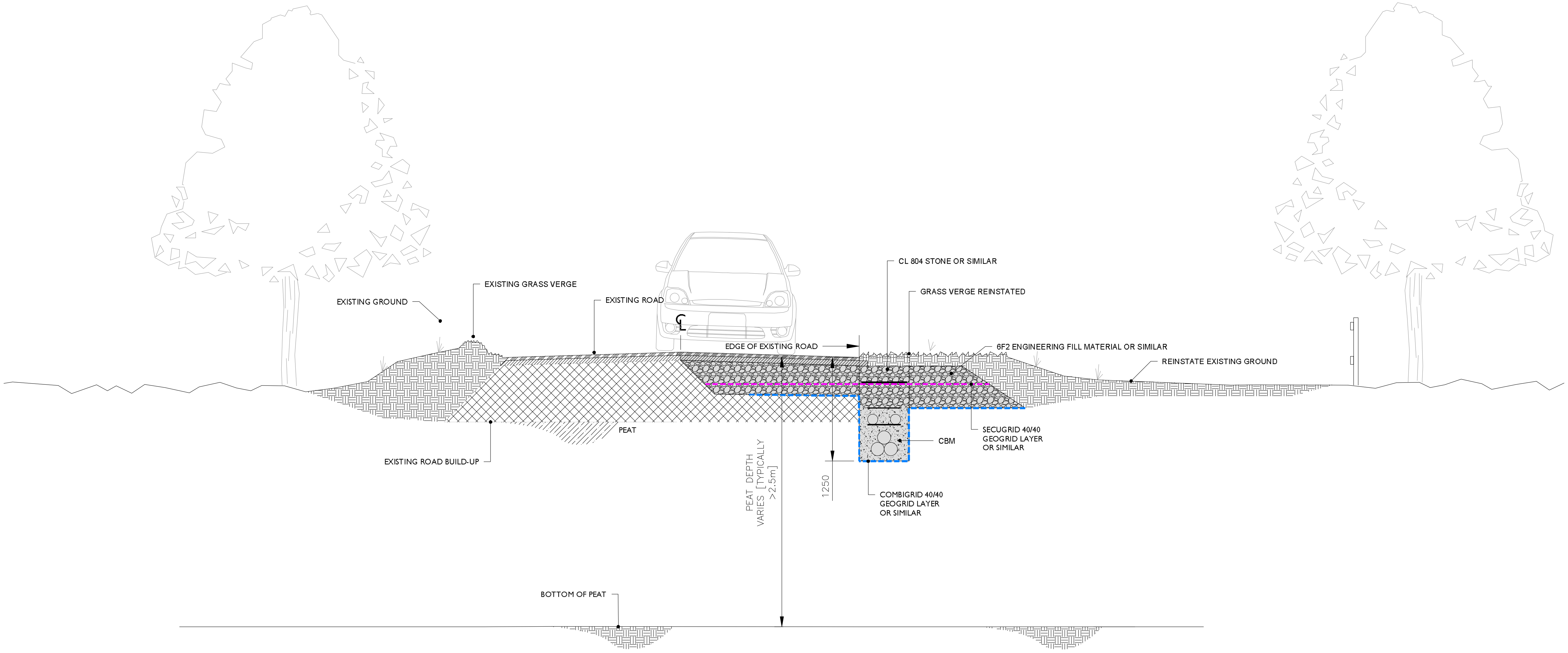
J. SHANAHAN	09/12/2019	

DRAWING NUMBER
COLE d005.2.1



TYPICAL SECTION THROUGH FLOATING ROAD
TRENCH IN VERGE [TYPICALLY >2.5M TO BASE OF PEAT]

SCALE 1:50

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: TYPICAL DETAILS ROAD SECTION TYPE B

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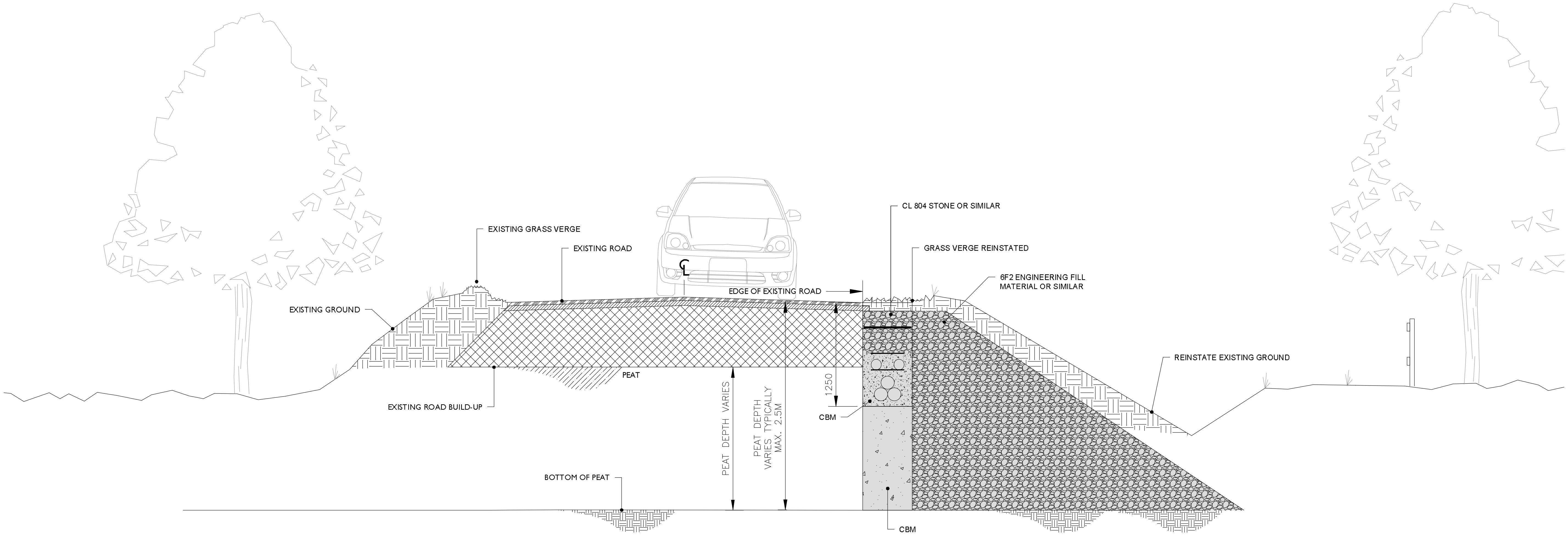

TYPICAL SECTION THROUGH FLOATING ROAD
TRENCH IN VERGE [<2.5M TO BASE OF PEAT]

SCALE 1:50

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
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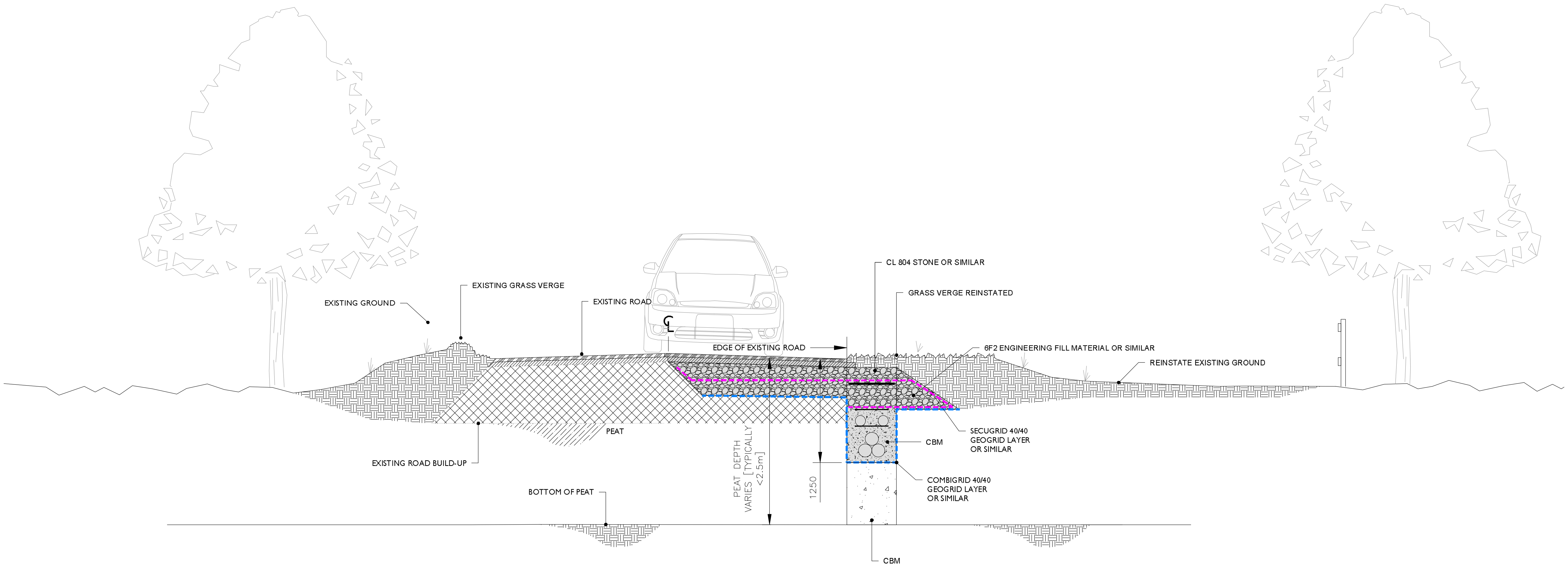
PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
TYPICAL DETAILS
ROAD SECTION TYPE C

REVISION
B

DRAWING NUMBER
COLE d005.2.3



TYPICAL SECTION THROUGH FLOATING ROAD TRENCH IN VERGE [<2.5M TO BASE OF PEAT]

SCALE 1:50

NOTES

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: TYPICAL DETAILS ROAD SECTION TYPE D

REVISION: B

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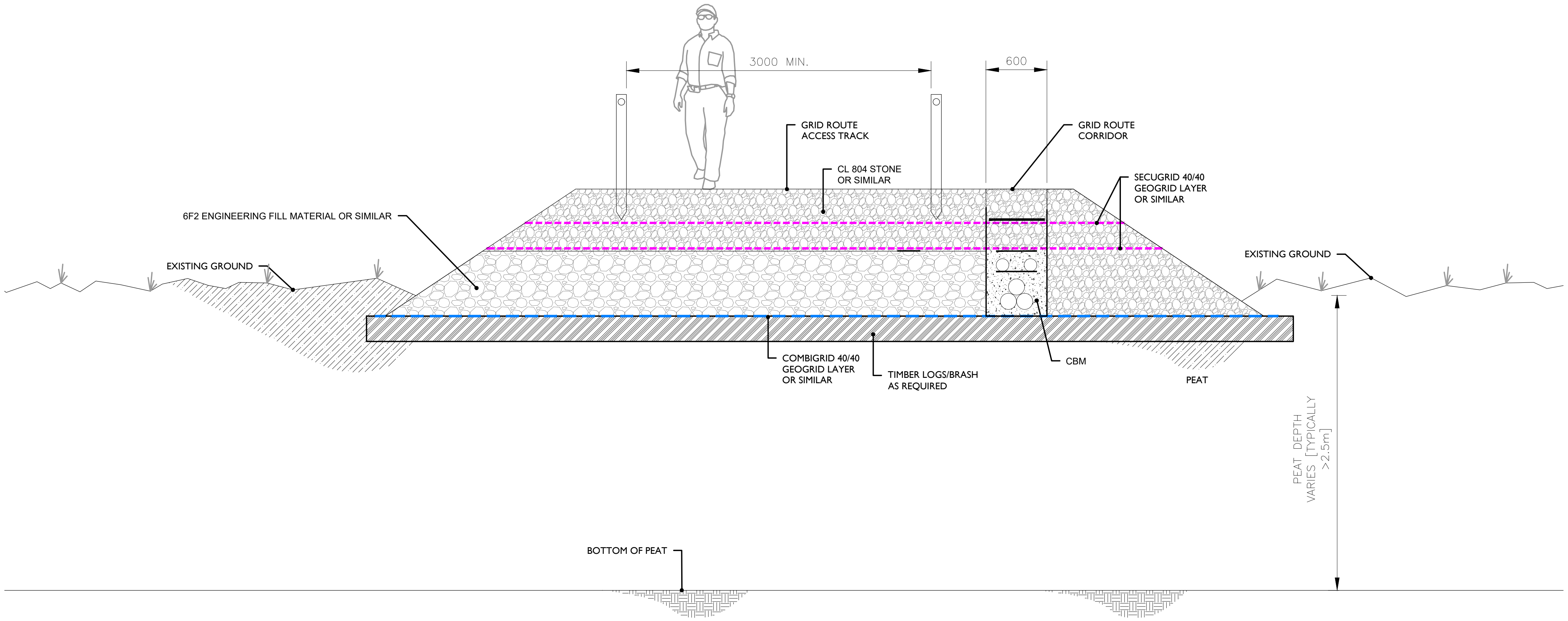

TYPICAL SECTION THROUGH FLOATING GRID ROUTE TRACK

Scale 1:50

NOTES

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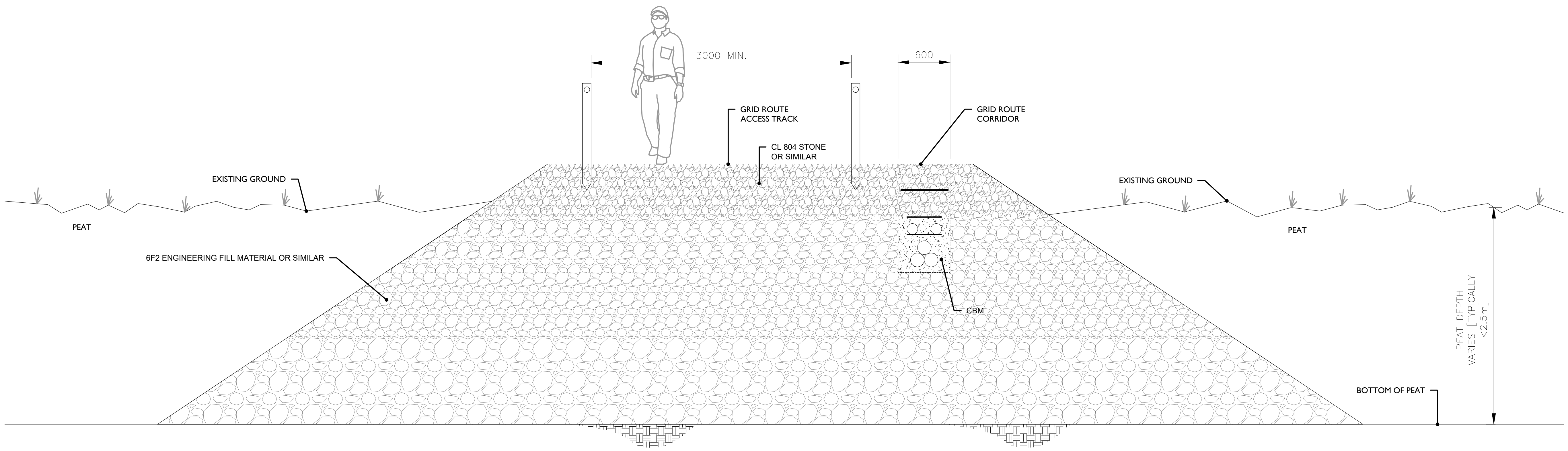
PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: TYPICAL DETAILS ROAD SECTION TYPE E1

REVISION: B

DRAWING NUMBER: COLE d005.2.5



TYPICAL SECTION THROUGH SOLID GRID ROUTE TRACK

Scale 1:50

NOTES

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: TYPICAL DETAILS ROAD SECTION TYPE E2

REVISION: B

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J. SHANAHAN	19/01/2020	

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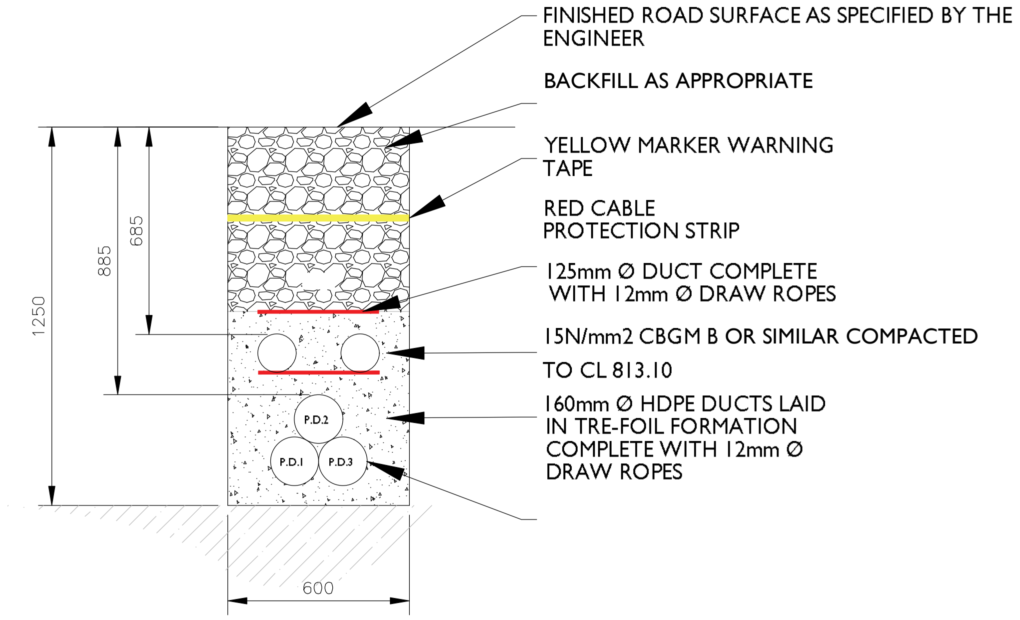
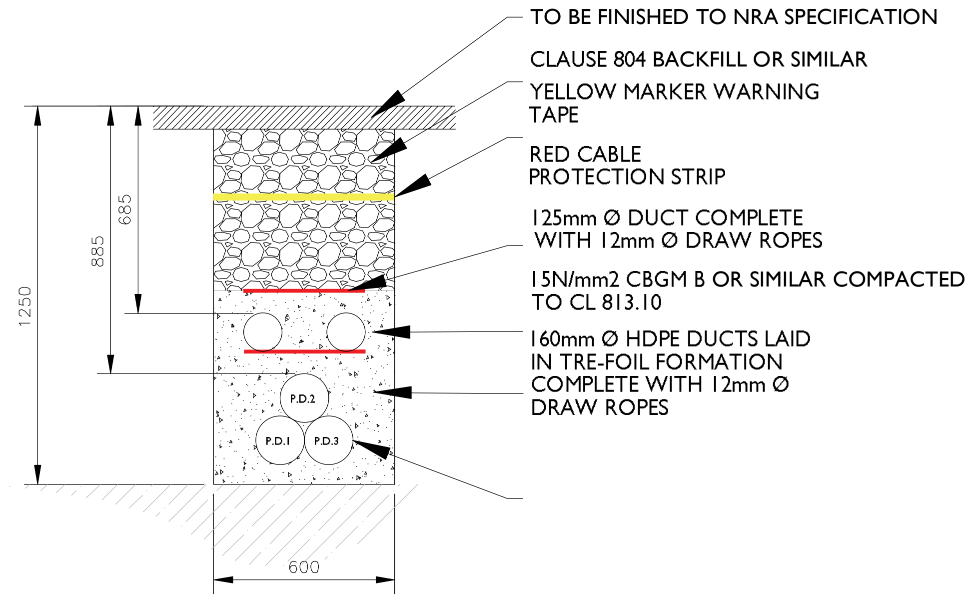


TYPICAL TRENCH DETAIL - PRIVATE ROAD



TYPICAL TRENCH DETAIL - PUBLIC ROAD

NOTES

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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
GRID ROUTE TRENCH
TYPICAL DETAILS

REVISION
A

DRAWN BY	DATE	PAPER SIZE	SCALE
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J. SHANAHAN	19/01/2020	

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COLE d005.4.2

Plotted - 21/01/2020 17:51:01
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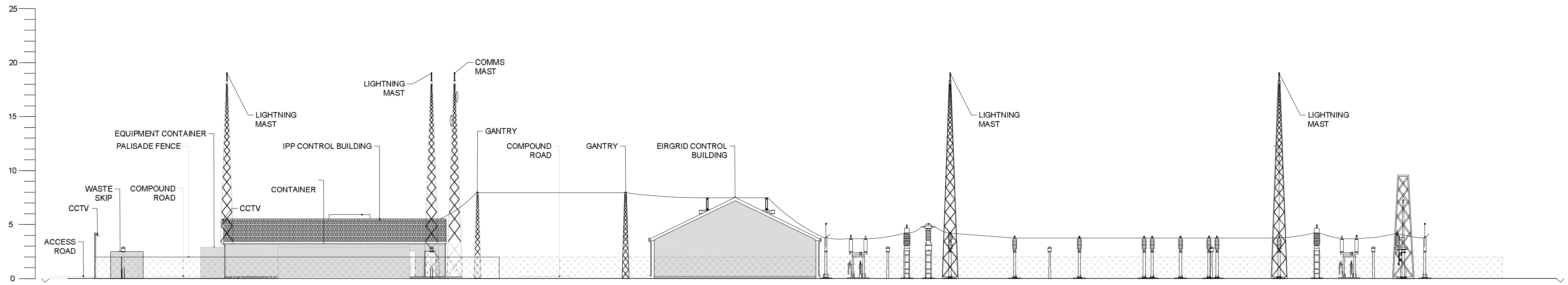
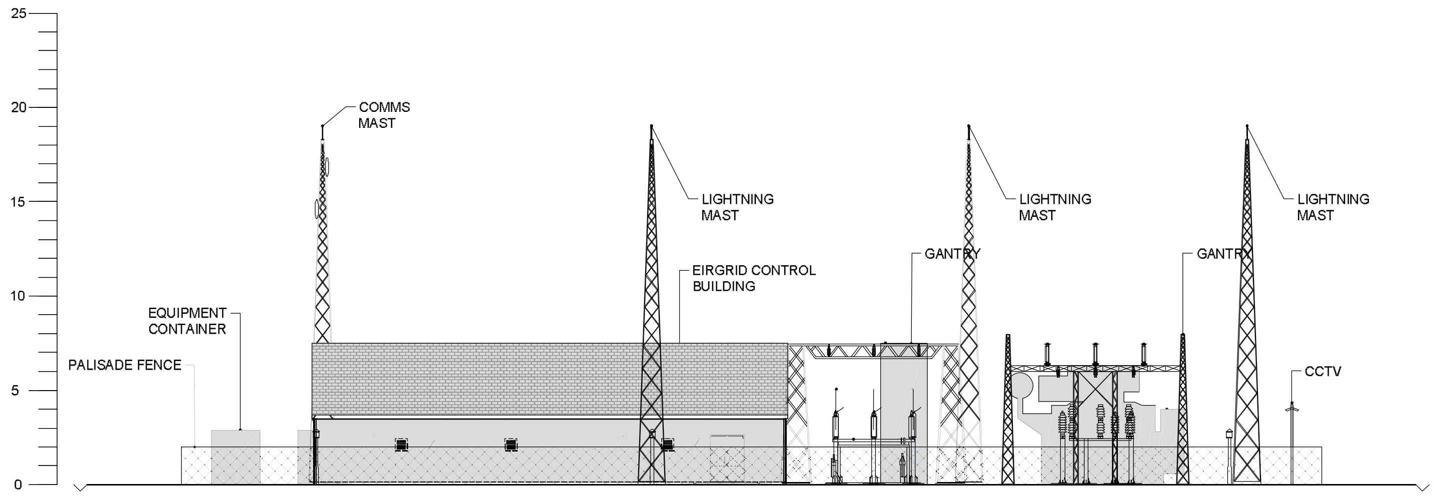


SIDE ELEVATION



END ELEVATION

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
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PROJECT: COOLE WIND FARM

TITLE: SUBSTATION COMPOUND ILLUSTRATIVE ELEVATIONS

REVISION: A

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J. SHANAHAN	16/01/2020	A3	1:800

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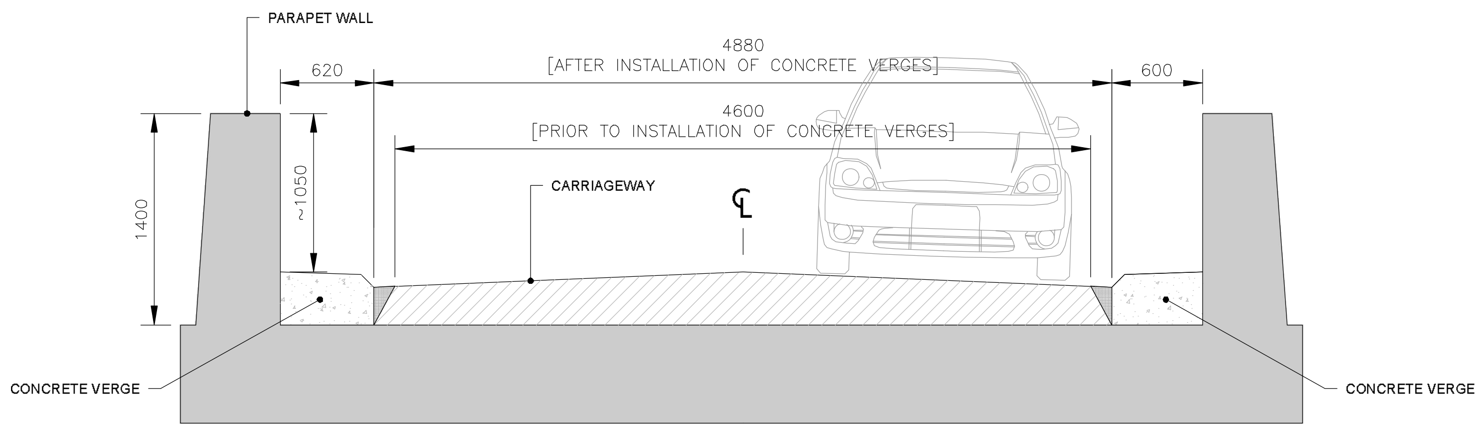

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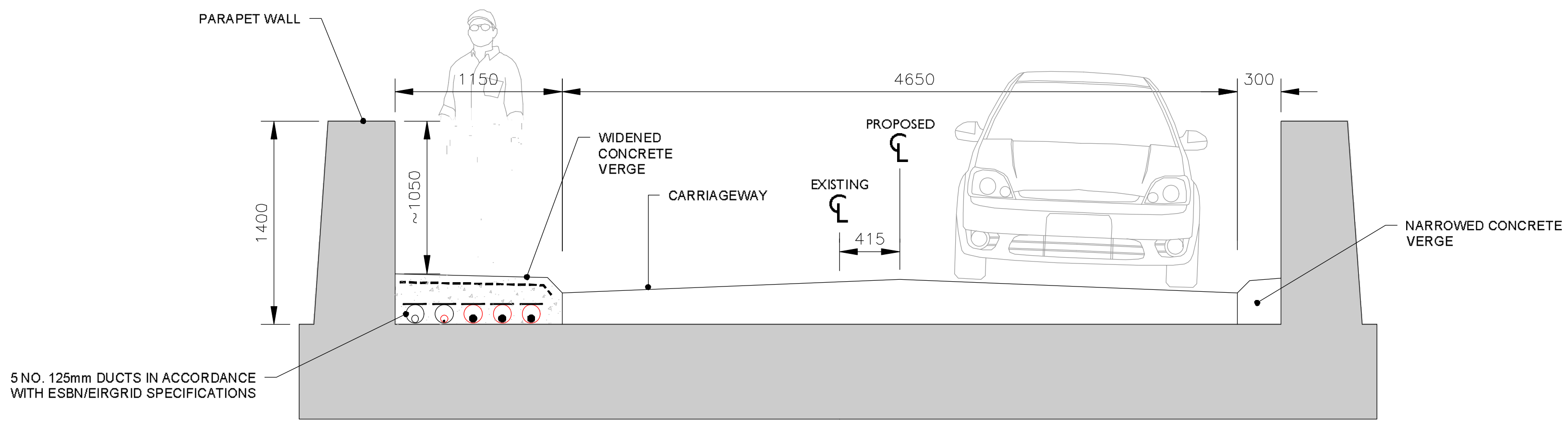
SCALE 1:50



SECTION: OPTION A
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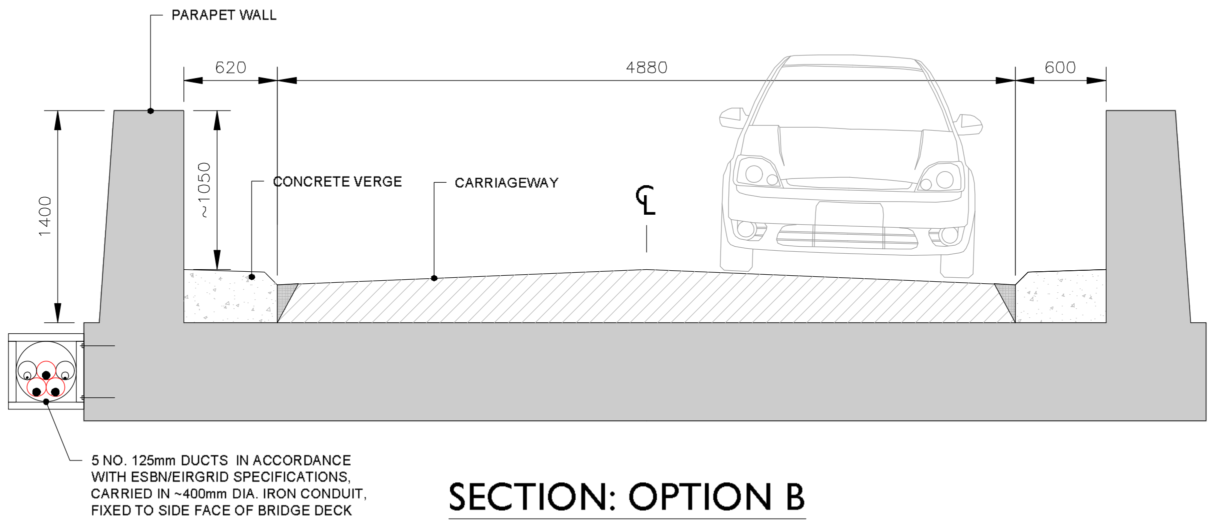

SECTION: OPTION B
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NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
TYPICAL DETAIL - BRIDGE CROSSING WH-L1825-001.00

REVISION
B

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	09/12/2019	A3	1:50

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J. SHANAHAN	09/12/2019	

DRAWING NUMBER
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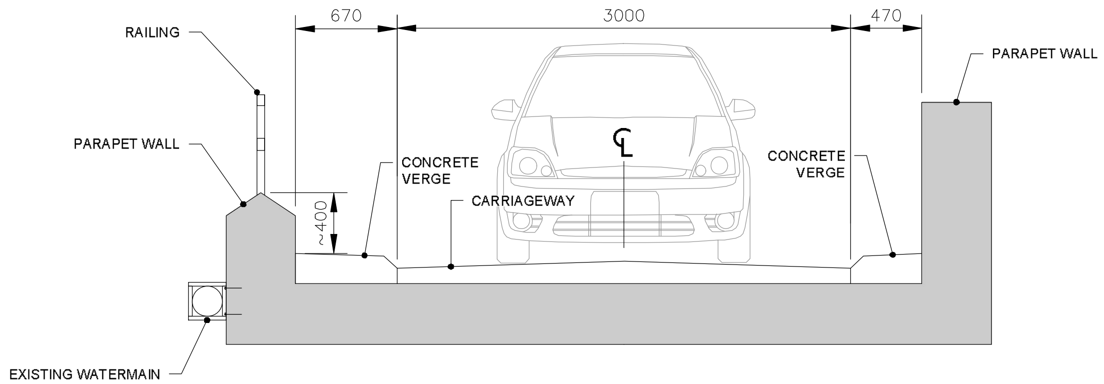

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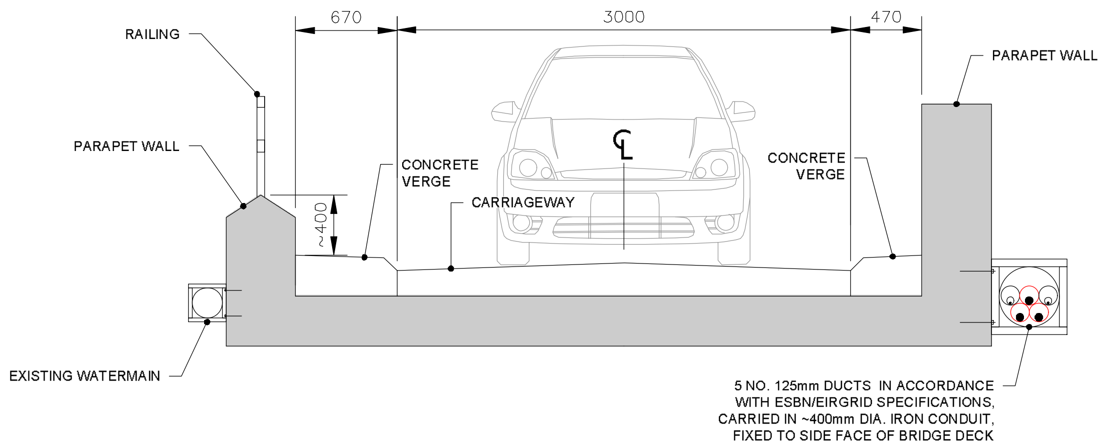

SECTION: OPTION A

SCALE 1:50

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
B	24.01.2020	M.B.	J.S.	DUCT NOTE & PLAN UPDATED
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J. SHANAHAN	09/12/2019	

PROJECT

COOLE WIND FARM
GRID ROUTE

TITLE

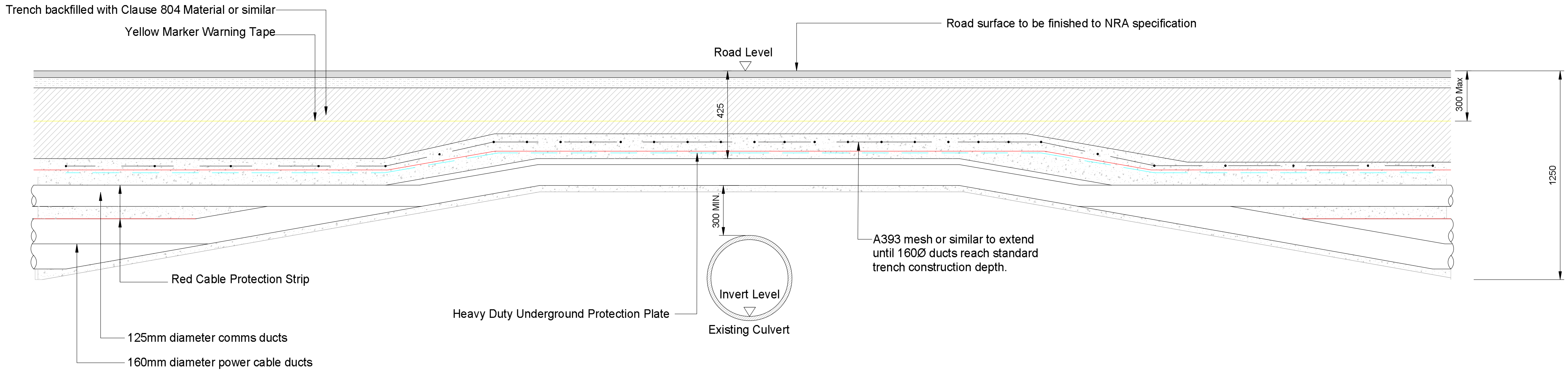
TYPICAL DETAIL - BRIDGE CROSSING WH-L1825-002.00

REVISION

B

DRAWING NUMBER

COLE d005.3.2



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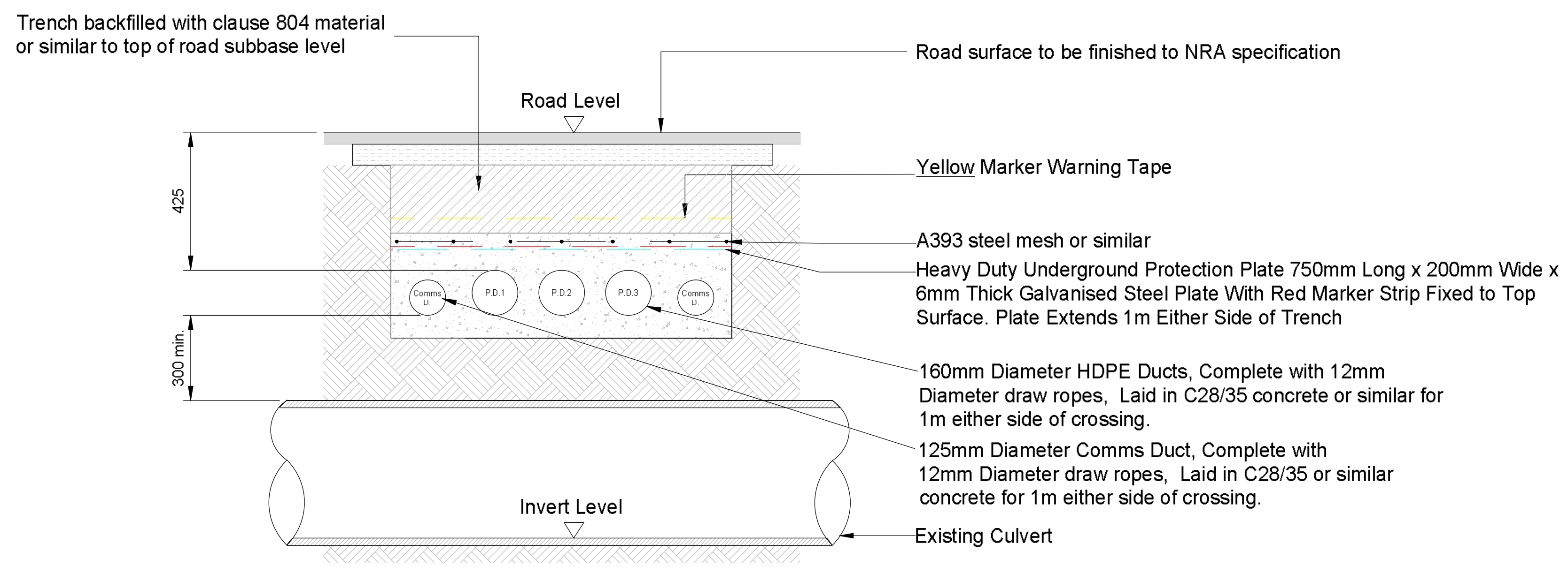

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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
WATER CROSSINGS
TYPICAL DETAIL - OVER

REVISION
A

DRAWN BY	DATE	PAPER SIZE	SCALE
M. BROWNE	19/01/2020	A3	1:50

CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	19/01/2020	

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COLE d005.4.3

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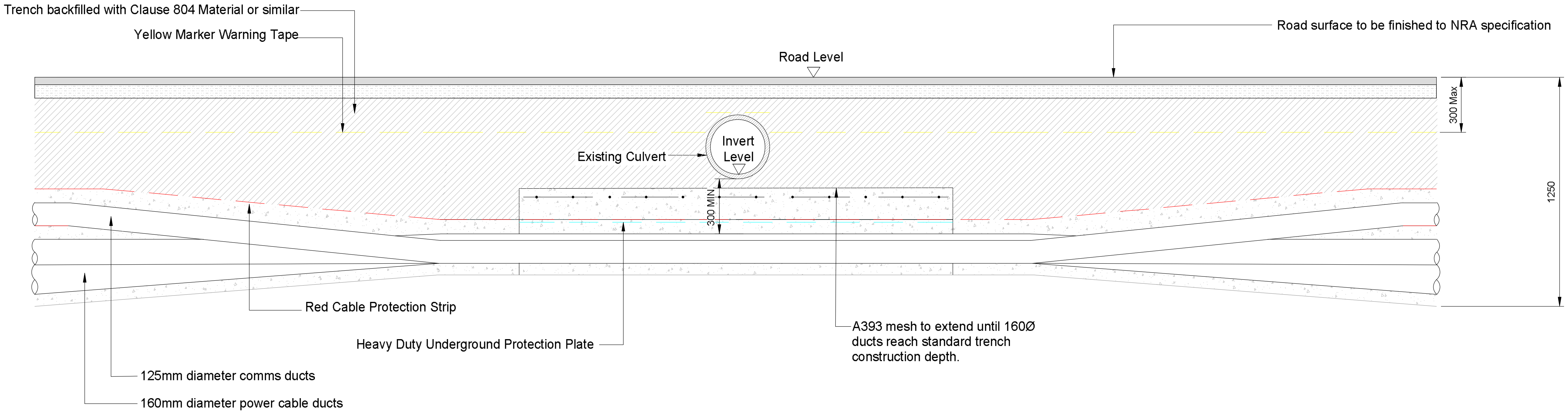

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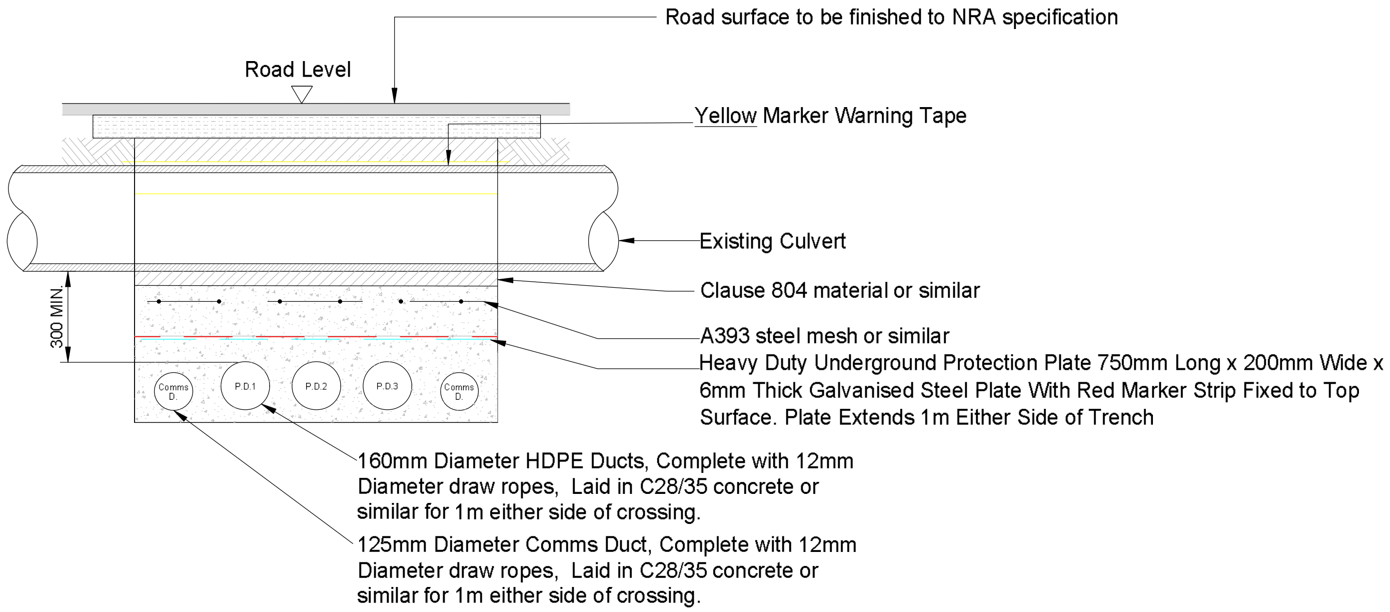

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PROJECT
COOLE WIND FARM
GRID ROUTE

TITLE
WATER CROSSINGS
TYPICAL DETAIL - UNDER CULVERT

REVISION
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DRAWN BY	DATE	PAPER SIZE	SCALE
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DRAWING NUMBER
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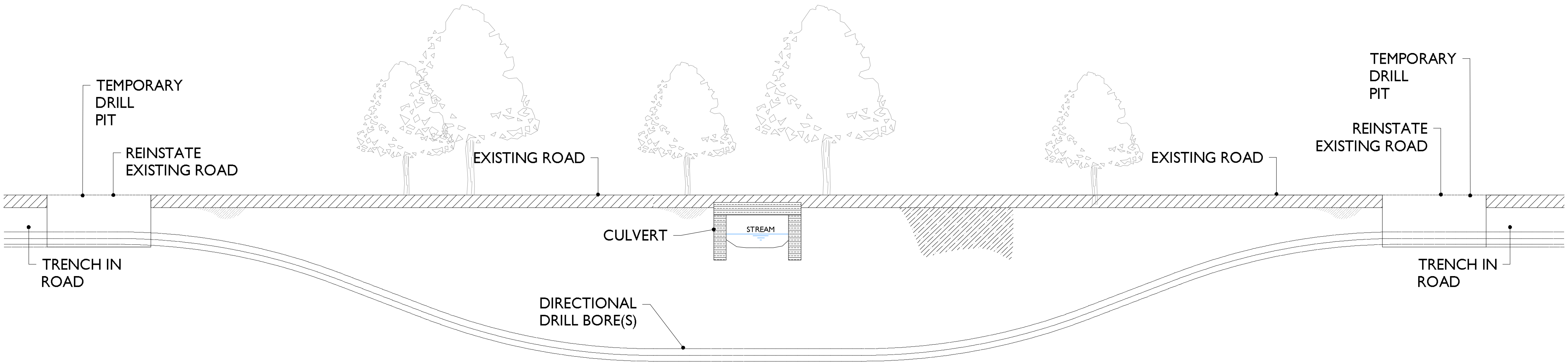

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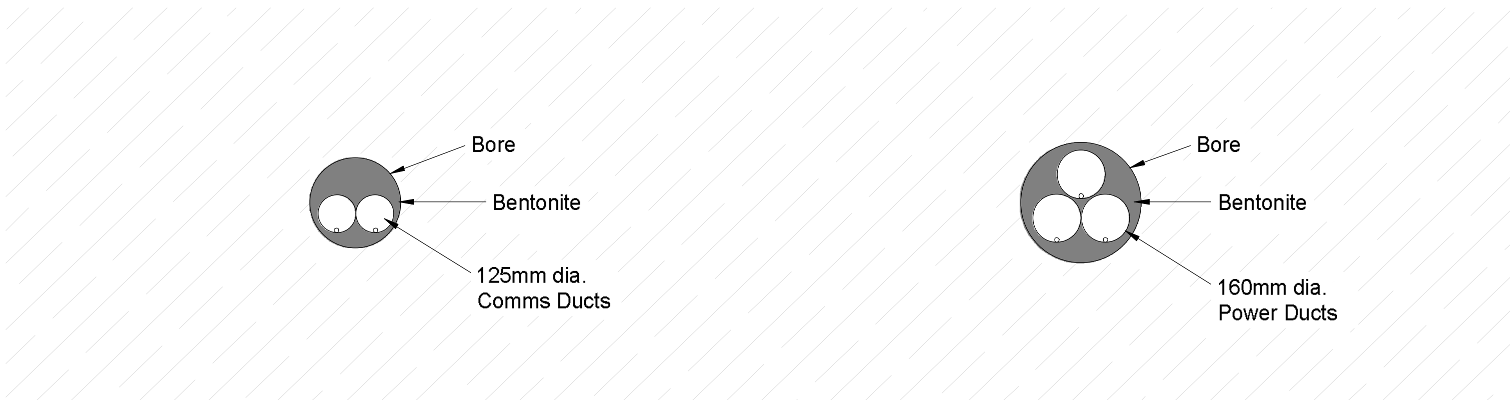

SECTION
SCALE 1:25

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

NOTES

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: WATER CROSSINGS TYPICAL DETAIL - DIRECTIONAL DRILL

REVISION: A

DRAWN BY	DATE	PAPER SIZE	SCALE
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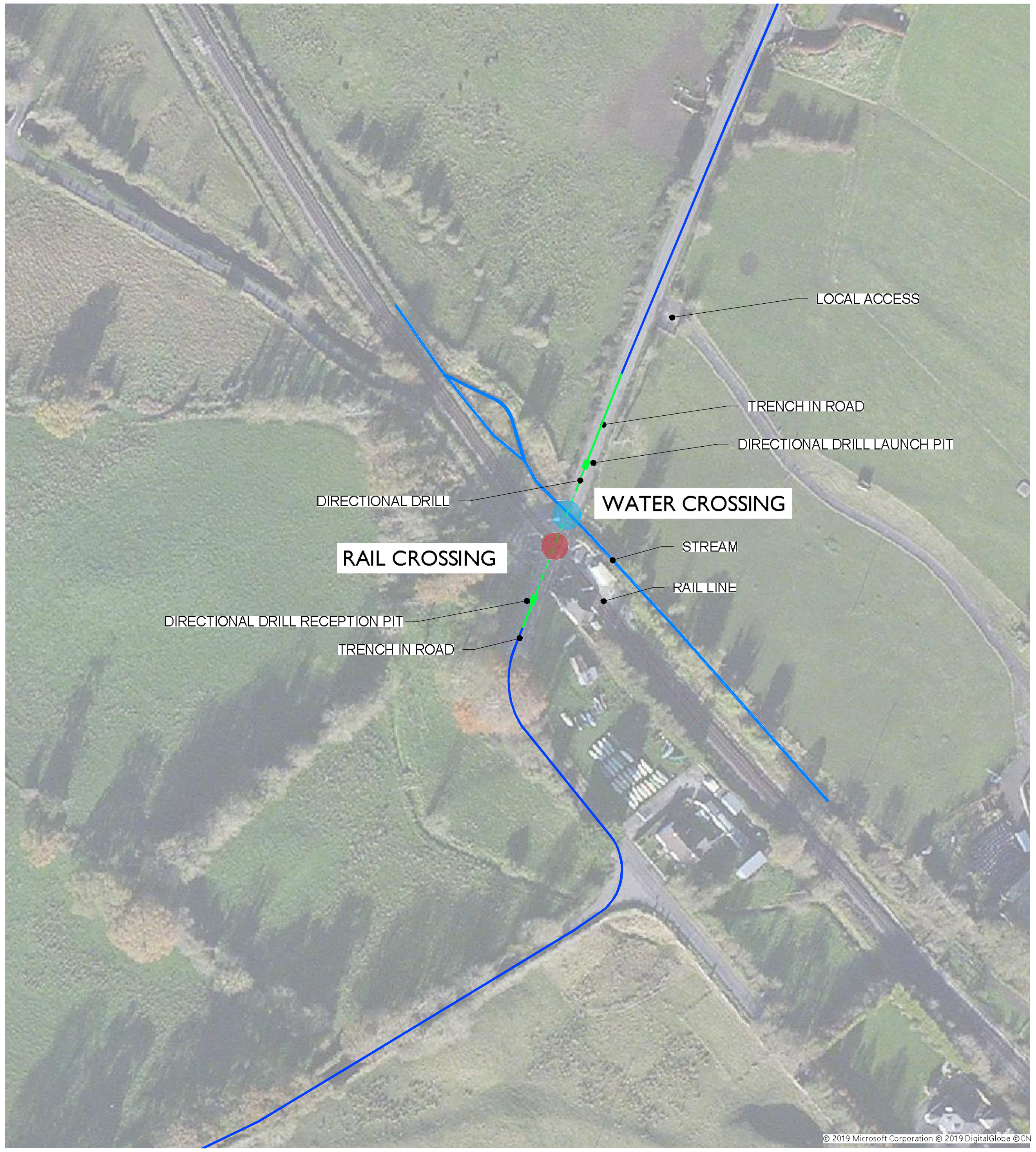

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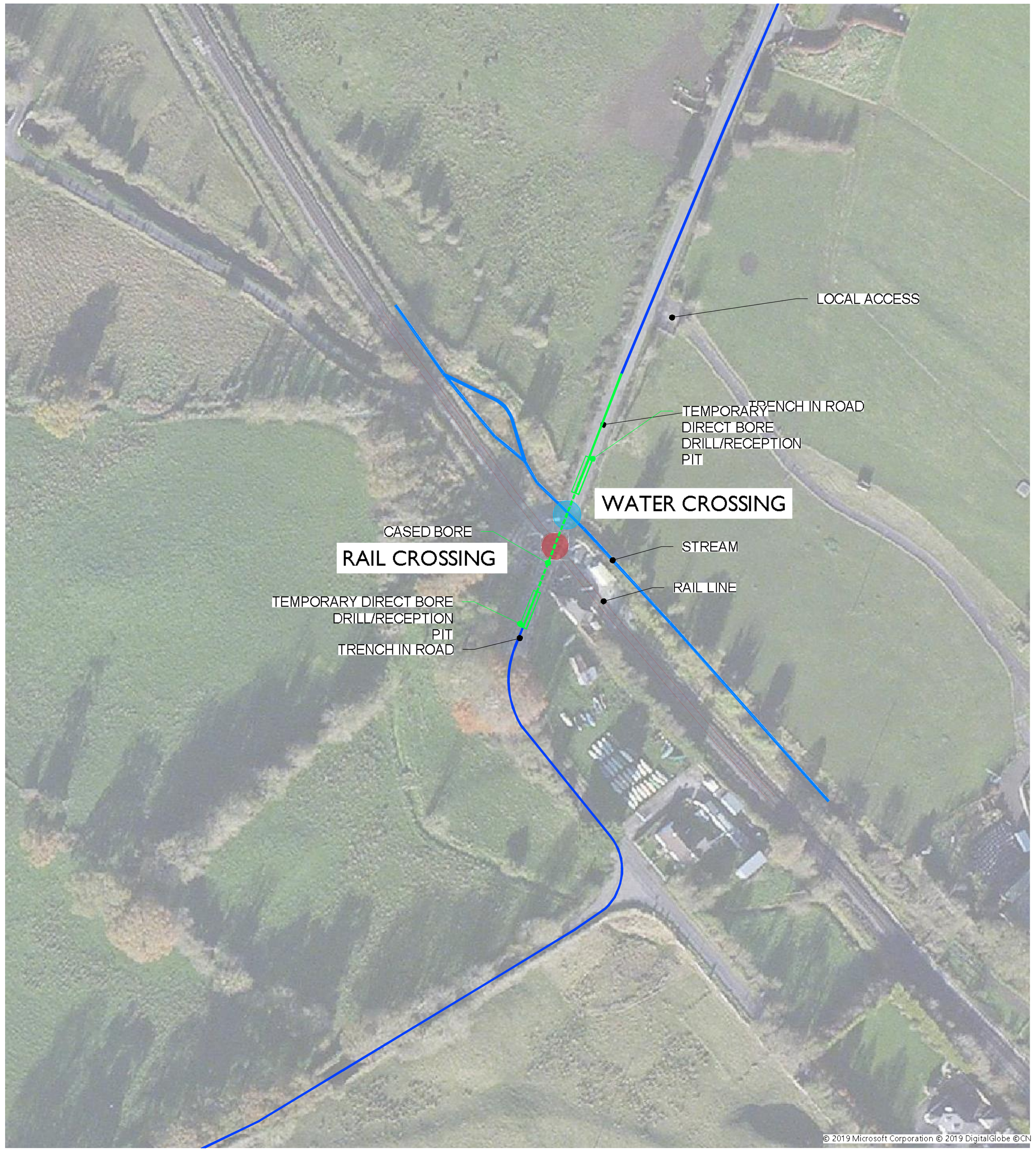
Scale 1:50



OPTION 2 CASED BORE - ILLUSTRATIVE PLAN AT RAIL CROSSING
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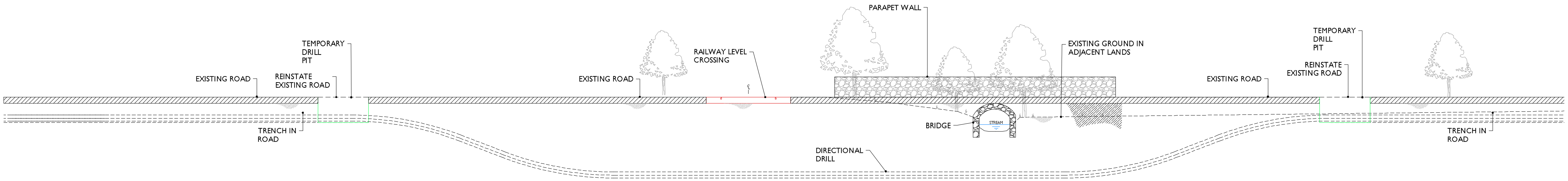

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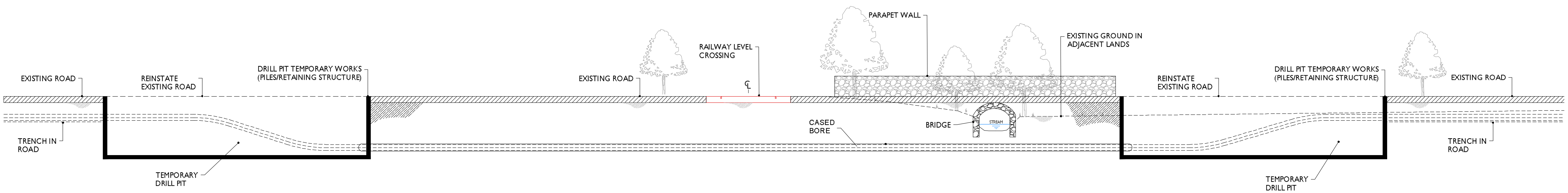

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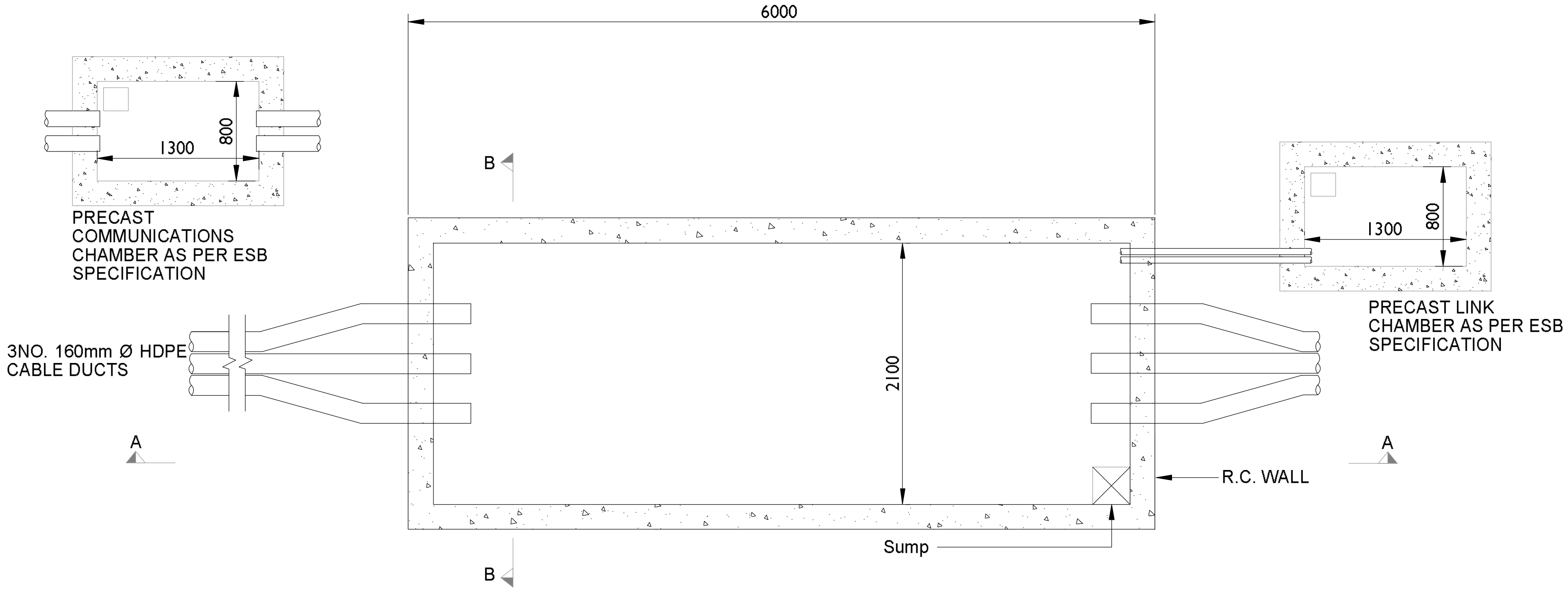
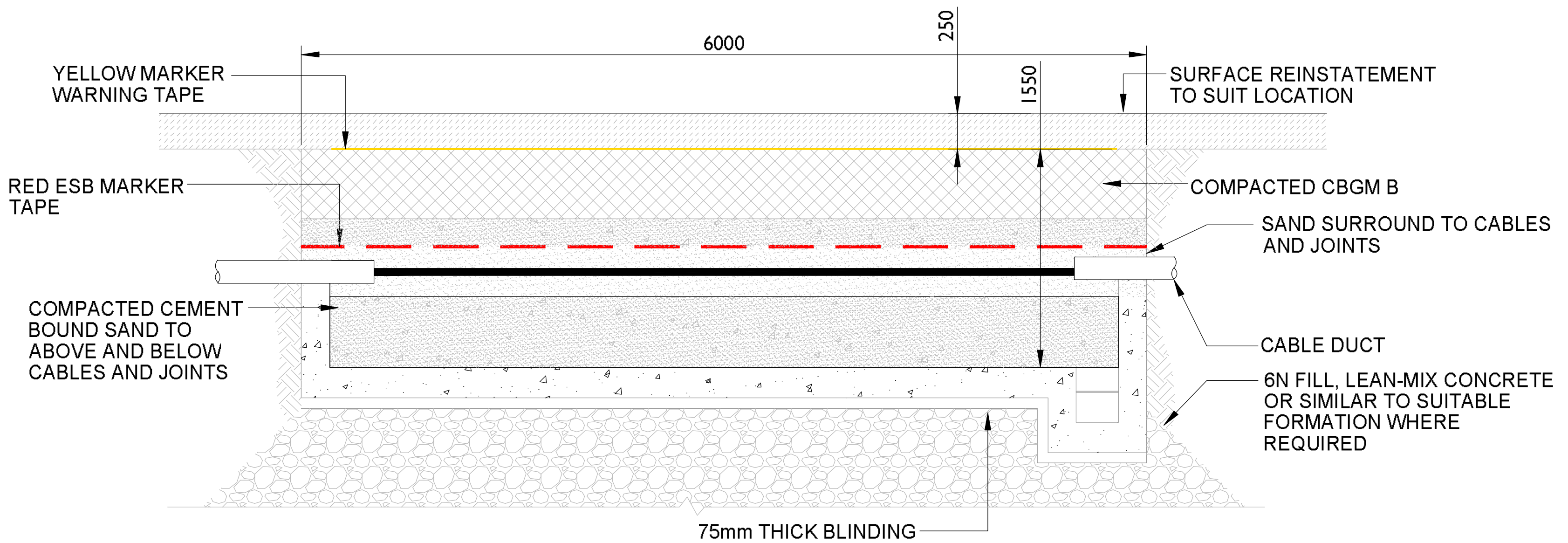


PLAN OF TYPICAL JOINT BAY WITH LINK & COMMUNICATIONS CHAMBERS

SCALE 1:50



TYPICAL SECTION A-A: PERMANENT REINSTATEMENT WORKS

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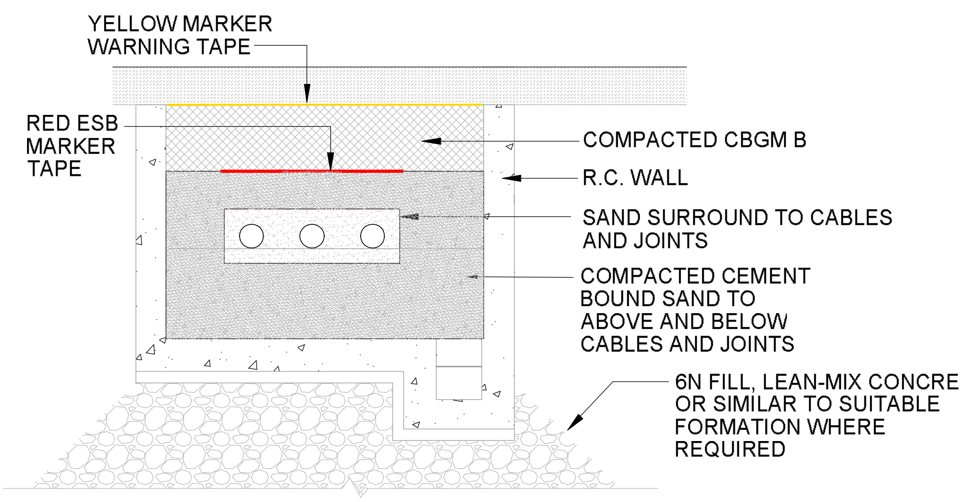

TYPICAL SECTION B-B: PERMANENT REINSTATEMENT WORKS

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: JOINT BAY TYPICAL DETAILS

REVISION: A

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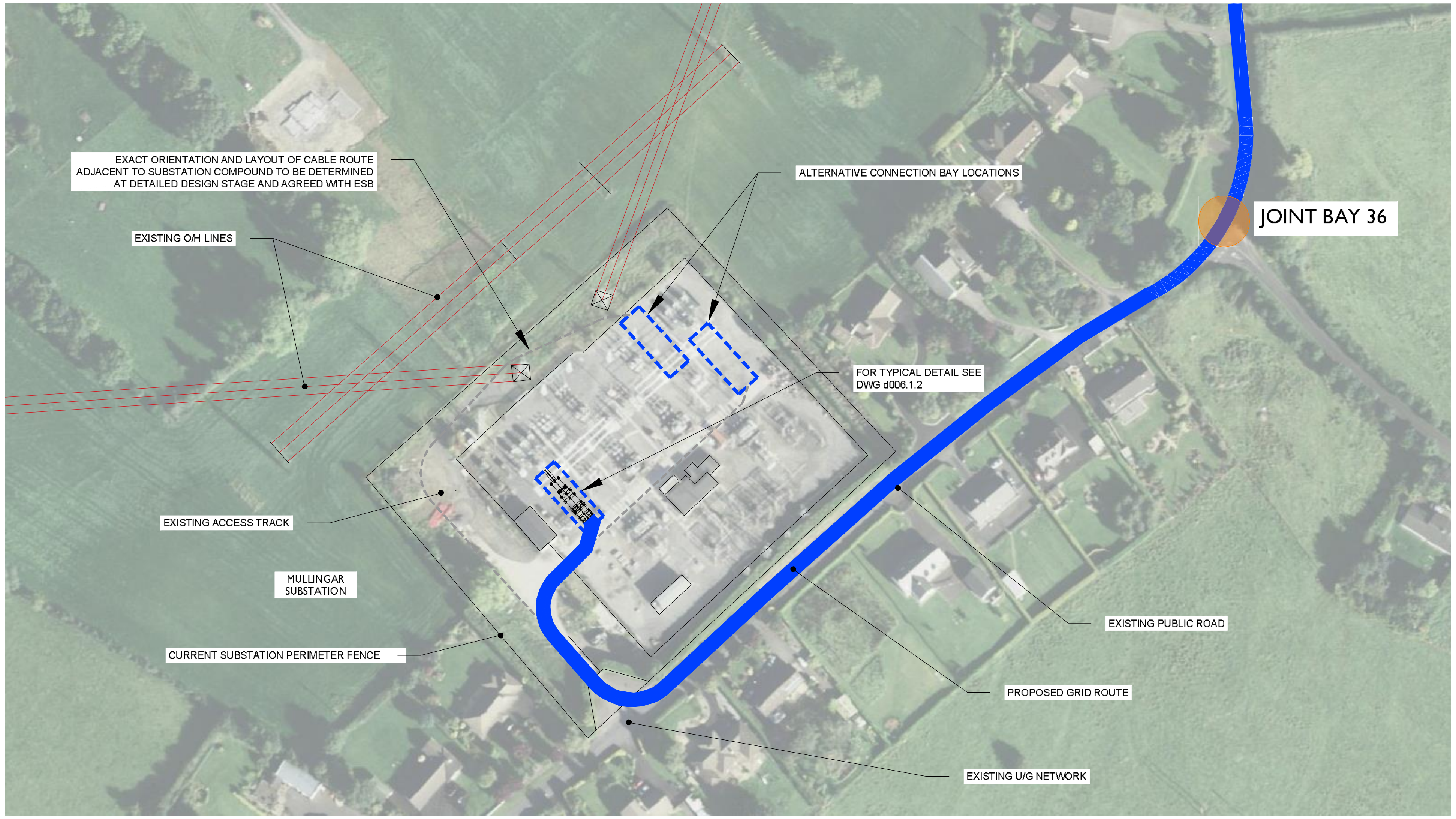

MULLINGAR SUBSTATION - ILLUSTRATIVE PLAN

Scale 1:400

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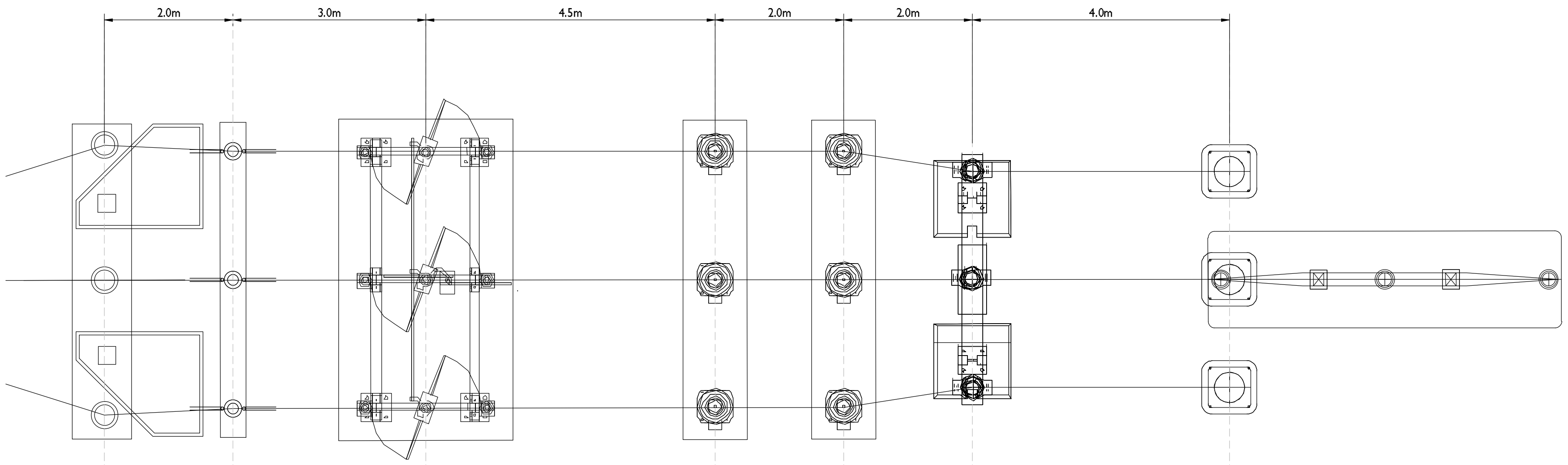
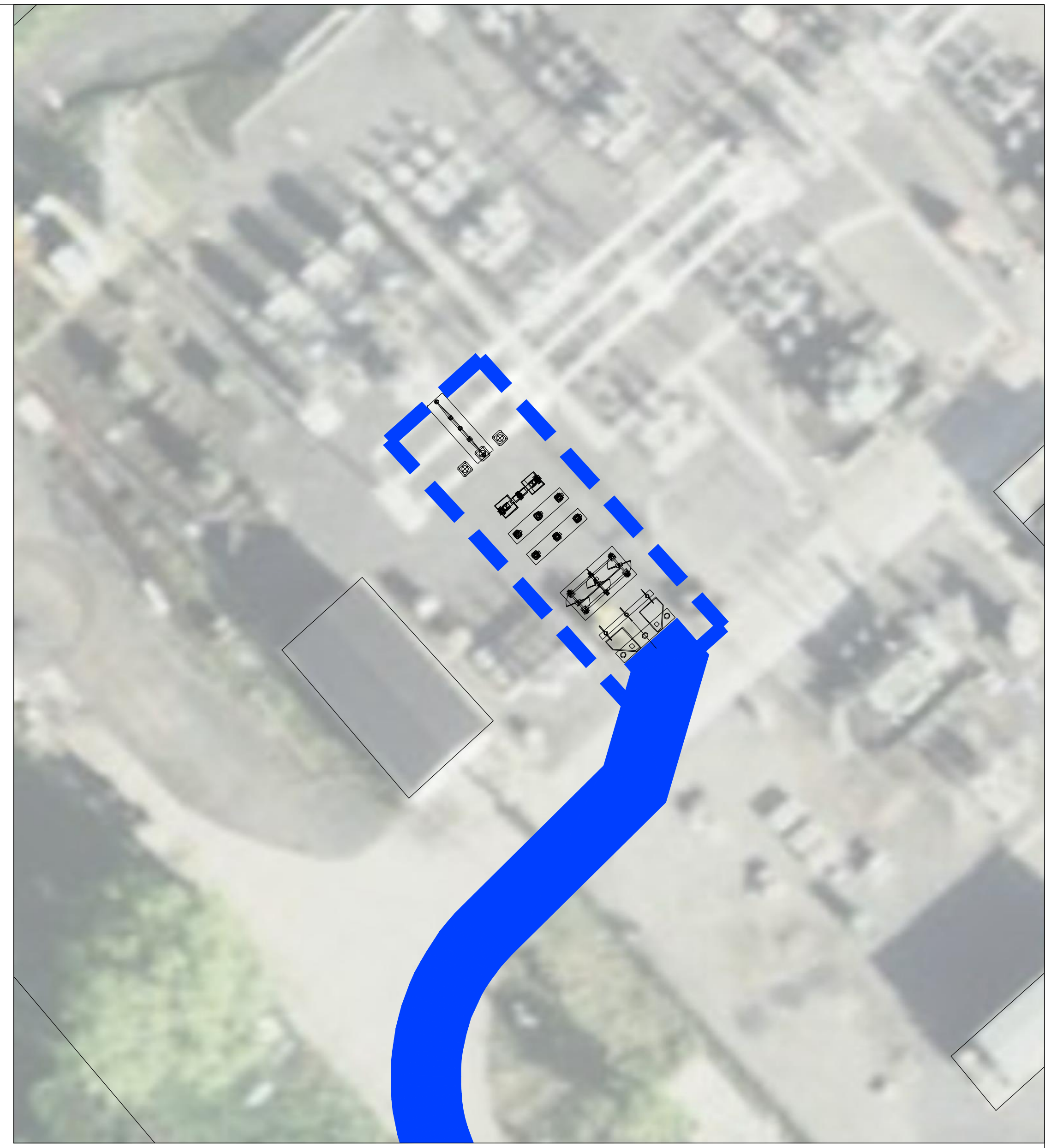


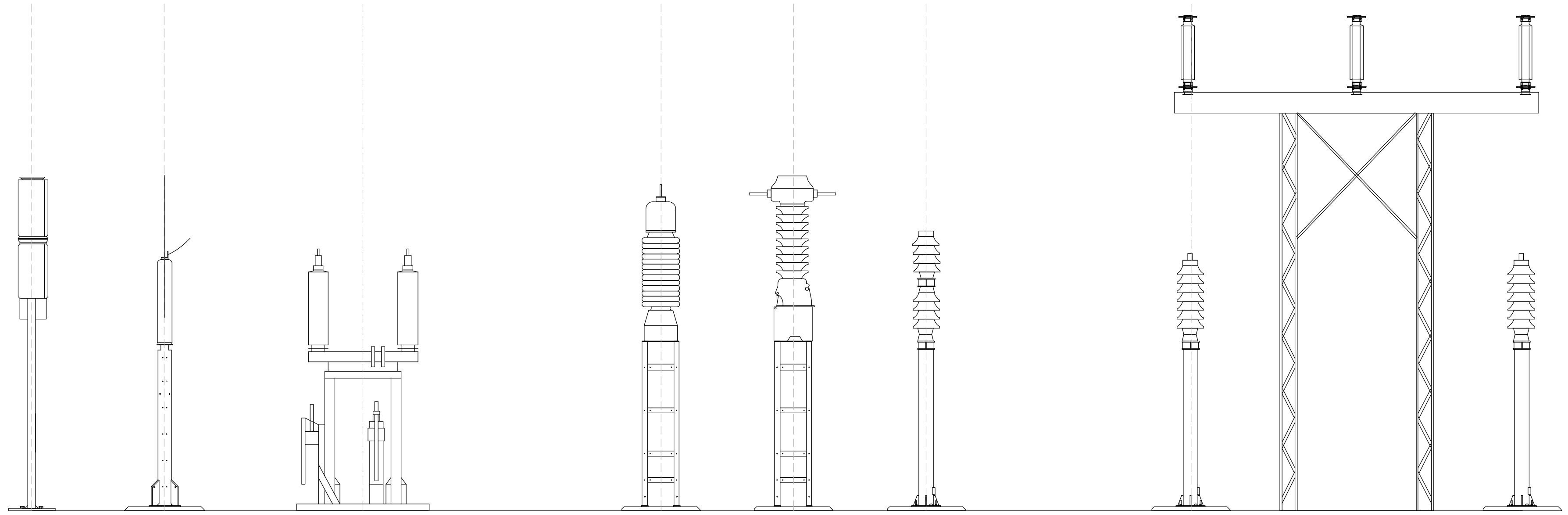
MULLINGAR SUBSTATION - EXTENSION EQUIPMENT PLAN

SCALE 1:200



MULLINGAR SUBSTATION - EXTENSION EQUIPMENT LOCATION

SCALE 1:1000



MULLINGAR SUBSTATION - EXTENSION EQUIPMENT ELEVATIONS

SCALE 1:2000

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TITLE: ILLUSTRATIVE EXTENSION EQUIPMENT DETAILS

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APPENDIX 4-4

AGEC COOLE WIND FARM CABLE ROUTE PRIORITY AREA SURVEY

COOLE WIND FARM CABLE ROUTE PRIORITY AREA SURVEY

Prepared for:

McCarthy Keville O'Sullivan Ltd

April 2017

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Task	**Nominated authority**	**Approved (signature)**
Prepared by	Author: Billy Murphy	Billy Murphy
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Quality check	Quality Manager: Marion English	Marion English

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 General

Applied Ground Engineering Consultants Ltd (AGEC) were requested by McCarthy Keville O'Sullivan (McCarthy KOS) to carry out a walkover survey and carry out a peat stability assessment of roads located on bog ramparts along three (3) sections of the proposed underground cable route for the Coole Wind Farm project. The total length of the proposed route is 25.8 kilometres (km) with approximately 8 km comprising road over bogs of varying depth (3 priority areas). These areas were identified by Westmeath County Council roads engineer.

The surrounding landscape is predominately flat with land-use comprising forestry, agricultural land and both intact and cutaway peatland. The Geological Survey of Ireland (GSI, 2006 & 2016) geological plans indicate that the soils and subsoils along the gridline route generally consist of Till, Sands and Gravels and Peat overlying cherty limestone, minor shale of the Derravaragh Cherts formation as well as dark limestone and shale of the Lucan formation.

1.2 Scope and Objective

The 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 (see Figure 7). It also includes typical trench details for sections of the underground cable route and possible construction options for areas of deeper peat.

The report includes the following:

(1) 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.

(2) Shear vane test results in peat at various locations along the three (3) priority areas ;

(3) Salient observations on ground conditions and drainage.

(4) 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.

(5) Typical construction methods for the cable trench and possible options for the cable trench construction in areas of deeper peat.

2 SURVEY RESULTS

2.1 General

The survey was carried out on April 4th and 5th 2017. The survey comprised a walkover of the proposed cable route in three (3) priority areas by a geotechnical engineer experienced in peat assessment.

The proposed cable route comprises buried high voltage cables placed within the road or the adjacent verge.

The purpose of the survey was to establish the ground conditions along the route in the three (3) areas of concern with respect to construction of the buried cables and the potential effects on the road.

2.2 Survey Details

The survey was carried out from south to north with probes completed at about 200 m intervals with in-situ vanes completed at various locations. All locations were co-ordinated by hand-held GPS and on site measurements.

3 FINDINGS OF SURVEY

3.1 General

The walkover survey was completed along the three (3) priority areas of the proposed cable route. The topography in the area is generally flat with the land use comprising a mix of farm land, bog and forestry. Where the deeper areas of peat were encountered, the road construction is likely floating. The roads were generally in fair condition with the road surface undulating in places with little surface cracking / potholes. During the inspection, road traffic comprised mixed vehicles types including heavy lorries.

The survey results are presented in Table 1. At most survey point locations, a reading was taken in each verge, this is designated as E and W or N and S in Table 1.

3.2 Peat Depth

Peat probing was carried out along both sides of the road within the verge to determine peat depths. The results of the peat depth survey are shown on peat depth contour plans (Figures 1 to 3).

Peat depths range from no penetration up to about 6.3 m with an average depth of about 1.8 m, which excludes no penetration reading.

The probes give an indication of the depth of peat expected to be present, however, it was noted that due to the well-drained nature of the peat that it became hard to advance the probes at depth and the depth values encountered may possibly be deeper than recorded.

At about forty-seven (47) of the eighty (80) points no penetration was recorded from the probing. Even though no penetration generally indicates a lack of peat, it should be noted that the road verge may contain made ground consisting of gravel / stone or other obstructions that prevented the probes from penetrating the ground.

3.3 Shear Vane Strength of Peat

Shear vane measurements were taken at various locations along the proposed route within the verges using a Geonor H-10 shear vane. The purpose of the testing was to determine the indicative strength of the peat. The indicative strength results are shown in Table 1.

The indicative strength results range from 20 to 80 kPa with an average of about 45 kPa. In comparison to shear vane results from other peat sites the results for the proposed cable route are relatively high. The relatively high peat strength is likely in part due to the roadside drainage which has allowed the peat to drain and consolidate over a period of time.

The indicative peat strength with depth is shown in Figure 4.

4 SUMMARY

A summary of the survey results for the three (3) priority sections of the proposed cable route are given below.

4.1 Peat Less Than 1.25 m

- About 75 % of the priority areas (see Figures 1 to 3) measured typical peat depths of less than 1.25 m.
- A typical cable trench detail is shown on Figure 5 which could be considered suitable for this condition. The trench could be located beside (road verge) or within the road.
- Trench support will be required during construction to maintain the integrity of the trench / road.

4.2 Peat Between 1.25 m and 4.25 m

- About 20 % of the priority areas (see Figures 1 to 3) measured typical peat depths of between 1.25 m and 4.25 m.
- A typical cable trench detail is shown on Figure 6 which could be considered suitable for this condition. The trench could be located beside (road verge) or within the road.
- This typical trench section will require an excavate and replace technique of up to 3 m below the base of the trench.
- Trench support will be required during construction to maintain the integrity of the trench / road.

4.3 Peat Greater Than 4.25 m

- About 5 % of the priority areas (see Figures 1 to 3) measured typical peat depths greater than 4.25 m with the maximum recorded peat depth of about 6.3 m.
- Various options to lay the cable in this area may include:
  - Light weight backfill to provide neutral buoyancy (floating trench);
  - Deep dig to competent stratum;
  - Mini-piles;
  - Peat stabilisation (e.g. Allu soil mixer); and
  - Vary trench route to avoid deeper peat (i.e. peat depth can vary across the road width).

4.4 Stability Analysis

An indicative stability analysis in accordance with Eurocode 7 (Design Approach 1, Condition 2) was 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 (see Figure 7). 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. For detailed design, a number of different scenarios will be examined including stability during trench construction, various trench locations (beside (road verge) / in road) and also at different road sections.

5 CONCLUSIONS

(1) 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.

(2) Based on the information obtained during the site walkover, most of the priority sections of the proposed cable route can be constructed using typical trench details as shown in Figure 5 and 6.

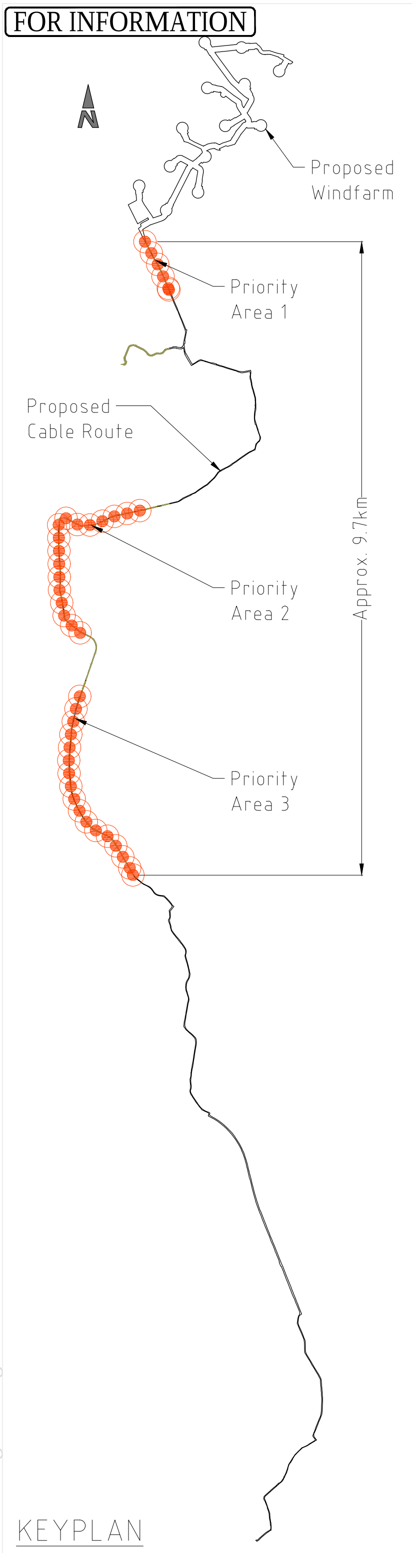
(3) There are sections of the proposed route where deeper peat was encountered that will need additional consideration regarding construction detail and measures before finalising construction plans, see options in Section 4.3.

(4) It is recommended that the sections of deeper peat are reviewed on a section-by-section basis with the various options considered for these sections of the cable installation at the detailed design stage.

(5) A stability analysis shows that the inclusion of the cable trench would not reduce the stability of the road embankment. For detailed design, further stability analysis will be carried out to verify the stability of the road embankment for a number of cable trench scenarios in order to choose the most appropriate construction solution.

FIGURES

FOR INFORMATION



Peat Depth Legend (mbgl):

- ≥ 0 < 0.25
- ≥ 0.25 < 0.5
- ≥ 0.5 < 0.75
- ≥ 0.75 < 1
- ≥ 1 < 1.25
- ≥ 1.25 < 1.5
- ≥ 1.5 < 1.75
- ≥ 1.75 < 2
- ≥ 2 < 2.25
- ≥ 2.25 < 2.5
- ≥ 2.5 < 2.75
- ≥ 2.75 < 3
- ≥ 3 < 3.25
- ≥ 3.25 < 3.5
- ≥ 3.5 < 3.75
- ≥ 3.75 < 4
- ≥ 4 < 4.25
- ≥ 4.25 < 4.5
- ≥ 4.5 < 4.75
- ≥ 4.75 < 5
- > 5

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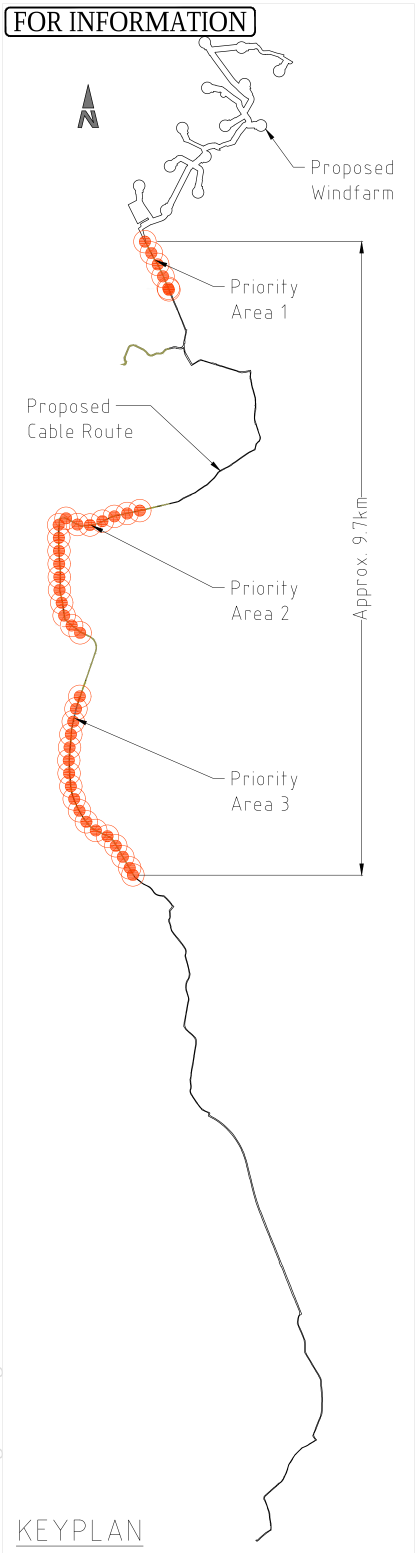
NOTE:
1 The peat depth contour plan shown on the figure is based on peat depth probes carried out by AGEC.

Figure 1 - Peat Depth Contour Plan - Priority Area 1

FOR INFORMATION



Peat Depth Legend (mbgl):

- ≥ 0 < 0.25
- ≥ 0.25 < 0.5
- ≥ 0.5 < 0.75
- ≥ 0.75 < 1
- ≥ 1 < 1.25
- ≥ 1.25 < 1.5
- ≥ 1.5 < 1.75
- ≥ 1.75 < 2
- ≥ 2 < 2.25
- ≥ 2.25 < 2.5
- ≥ 2.5 < 2.75
- ≥ 2.75 < 3
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- ≥ 3.25 < 3.5
- ≥ 3.5 < 3.75
- ≥ 3.75 < 4
- ≥ 4 < 4.25
- ≥ 4.25 < 4.5
- ≥ 4.5 < 4.75
- ≥ 4.75 < 5
- > 5

NOTE:
1 The peat depth contour plan shown on the figure is based on peat depth probes carried out by AGEC.

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Figure 2 - Peat Depth Contour Plan - Priority Area 2

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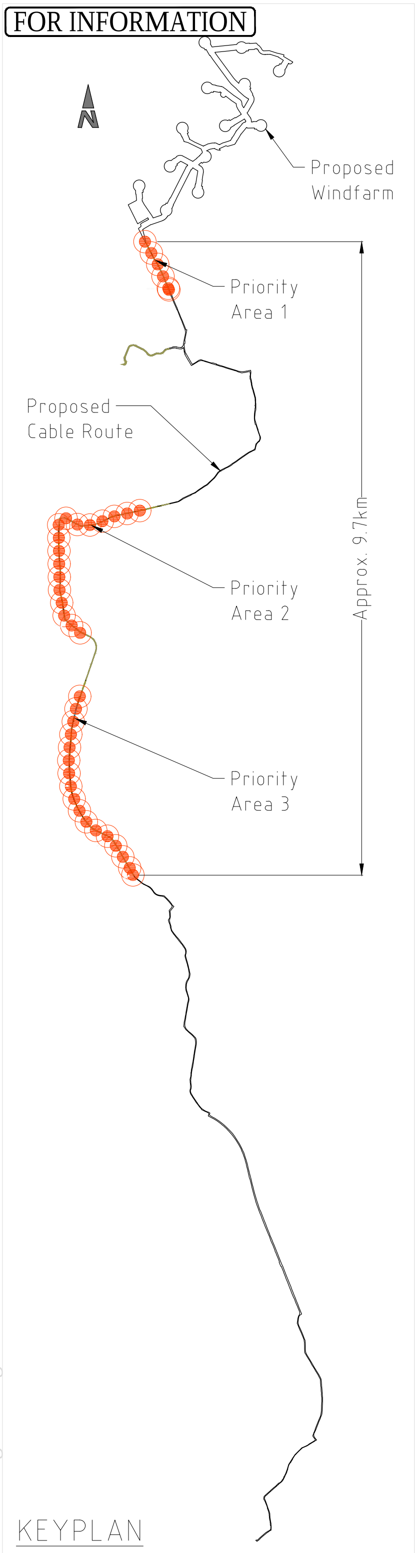

Peat Depth Legend (mbgl):

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	≥ 0.25 < 0.5
	≥ 0.5 < 0.75
	≥ 0.75 < 1
	≥ 1 < 1.25
	≥ 1.25 < 1.5
	≥ 1.5 < 1.75
	≥ 1.75 < 2
	≥ 2 < 2.25
	≥ 2.25 < 2.5
	≥ 2.5 < 2.75
	≥ 2.75 < 3
	≥ 3 < 3.25
	≥ 3.25 < 3.5
	≥ 3.5 < 3.75
	≥ 3.75 < 4
	≥ 4 < 4.25
	≥ 4.25 < 4.5
	≥ 4.5 < 4.75
	≥ 4.75 < 5
	> 5

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NOTE:
1 The peat depth contour plan shown on the figure is based on peat depth probes carried out by AGEC.

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Figure 3 - Peat Depth Contour Plan - Priority Area 3

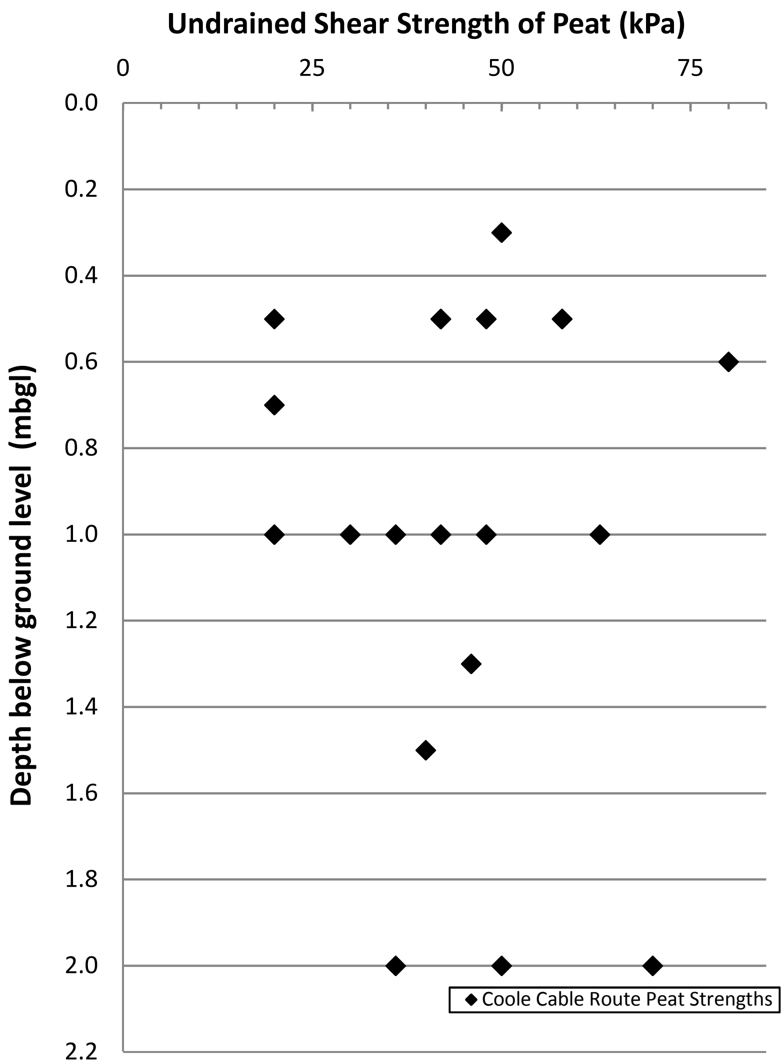
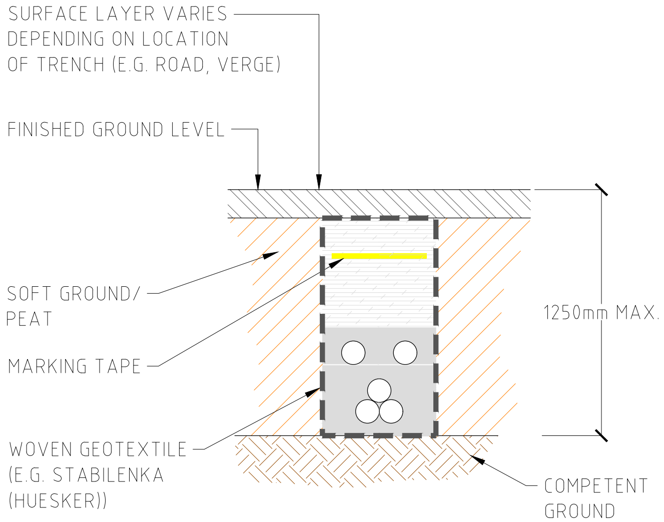


Figure 4 Undrained Shear Strength (C_u) Profile for Peat with Depth

FOR INFORMATION

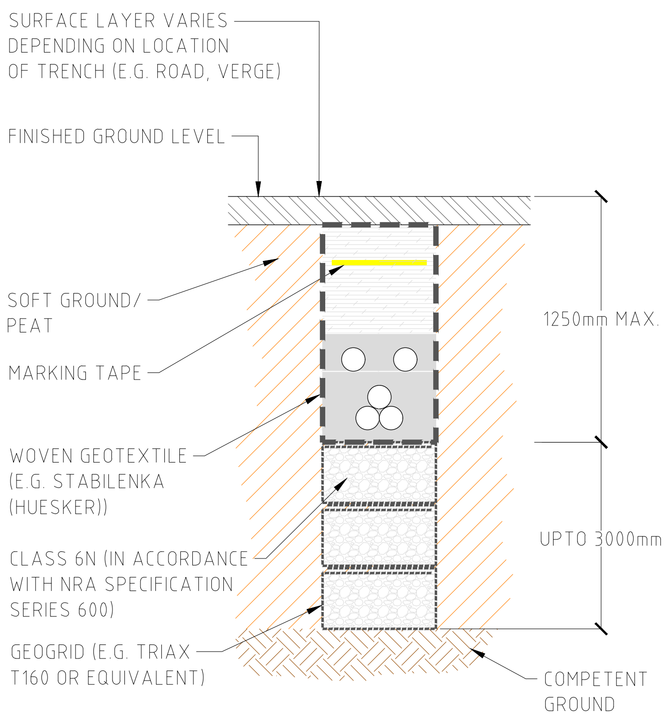


SOFT GROUND (<1250mm)

- PAVEMENT MATERIALS AND TRENCH REINSTATEMENT MATERIALS AS PER CABLE DESIGNERS REQUIREMENTS.
- TRENCH SUPPORT WILL BE REQUIRED DURING CONSTRUCTION TO MAINTAIN INTEGRITY OF THE TRENCH/ROAD.

Figure 5 - Typical Trench Section for Peat / Soft Ground (<1250mm)

FOR INFORMATION



SOFT GROUND (>1250mm to <4250mm)

- PAVEMENT MATERIALS AND TRENCH REINSTATEMENT MATERIALS AS PER CABLE DESIGNERS REQUIREMENTS.
- TRENCH SUPPORT WILL BE REQUIRED DURING CONSTRUCTION TO MAINTAIN INTEGRITY OF THE TRENCH/ROAD.

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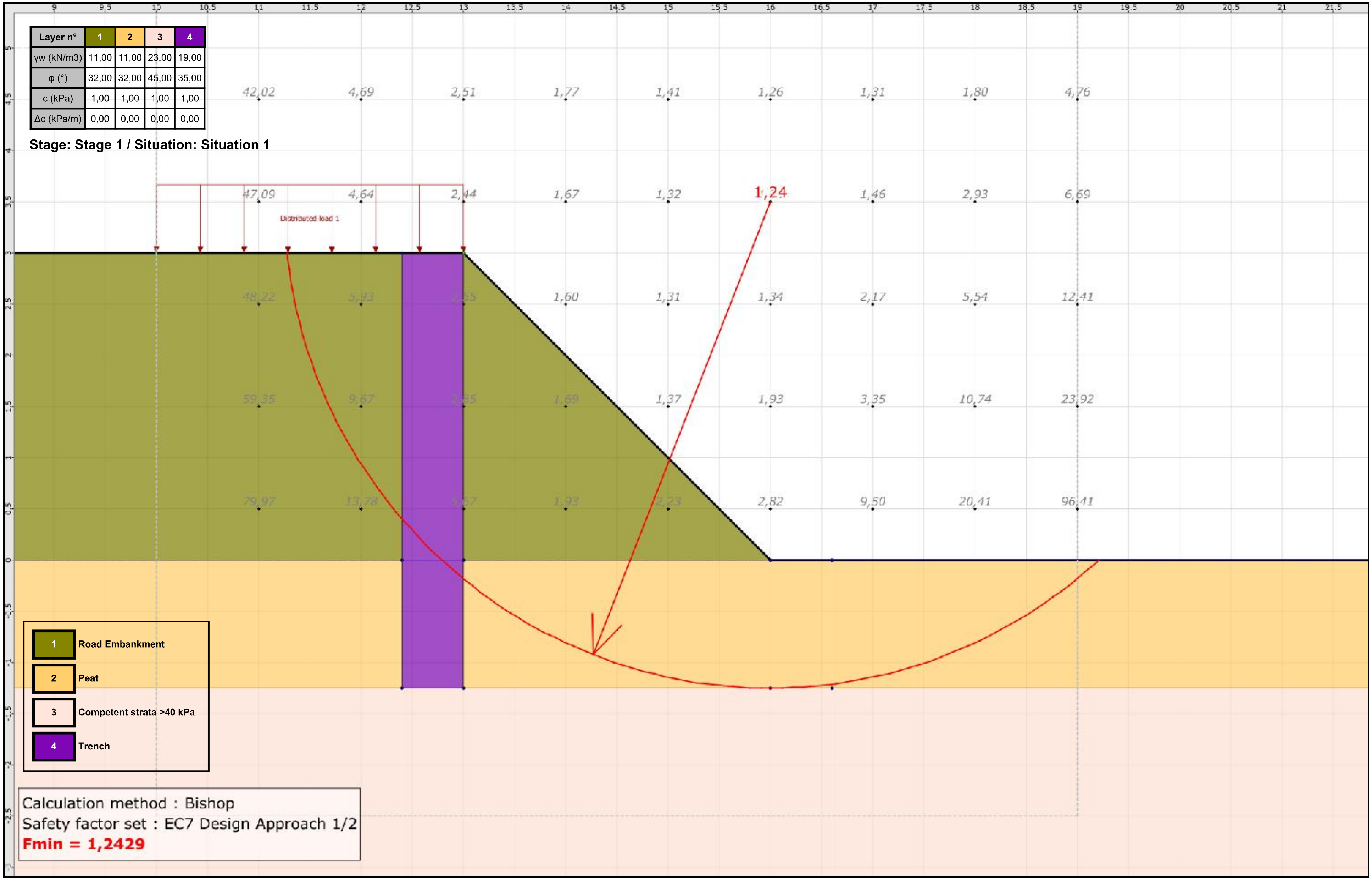
Figure 6 - Typical Trench Section for Peat / Soft Ground (>1250mm to <4250mm)

Scale 1:50

Layer n°	1	2	3	4
γw (kN/m3)	11,00	11,00	23,00	19,00
φ (°)	32,00	32,00	45,00	35,00
c (kPa)	1,00	1,00	1,00	1,00
Δc (kPa/m)	0,00	0,00	0,00	0,00

Stage: Stage 1 / Situation: Situation 1



Calculation method : Bishop
Safety factor set : EC7 Design Approach 1/2
Fmin = 1,2429

Talren v5 v5.1.5	Figure 7: Stability Check on Road with Trench and Construction Plant	Project : Road Stability

TABLES

Table 1 Survey Results

Point	Easting[1]	Northing[1]	Depth of Peat (m bgl)	Depth of test (m bgl)	Peat Strength (kPa)	Comment
1 E	639942	774293	0.9	0.5	48	Measured from bottom of embankment ~2 m from road. Embankment ~2.5 m high.
1 W	639932	774293	0.3	-	-	Measured from bottom of embankment ~2 m from road. Embankment ~2.5 m high.
2 E	640039	774118	1.8	1.0	36	Measured from bottom of embankment ~3 m from road. Embankment is ~2.5 m high.
2 W	640029	774118	0.2	-	-	Measured from bottom of embankment ~2.5 m from road. Embankment is ~2.5 m high.
3 E	640137	773944	- [2]	-	-	No penetration as far as ditch ~5 m from edge of road.
3 W	640127	773944	0.9	-	-	Measured from base of embankment ~3 m from road. Embankment is ~2 m high. Too many roots to do a vane.
4 E	640218	773761	- [2]	-	-	No penetration at bottom of embankment ~1.5 m from road. Embankment is ~1 m high.
4 W	640208	773761	- [2]	-	-	No penetration between road and ditch ~0.5 m from road.
5 E	640298	773578	- [2]	-	-	No penetration between road and fence ~2.5 m from road.
5 W	640288	773578	- [2]	-	-	No penetration between road and ditch ~1 m from road.
6 E	640309	773555	- [2]	-	-	No penetration between road and ditch ~1.5 m from road.
6 W	640299	773555	- [2]	-	-	No penetration between road and ditch ~1.5 m from road.
7 N	639859	770172	- [2]	-	-	No penetration under ditch on verge of road. Bog on other side of ditch.
7 S	639859	770162	0.9	-	-	No penetration between road and 4 m from road. Open bog area. Couldn't turn vane.
8 N	639663	770128	- [2]	-	-	No penetration under ditch on verge of road. Bog on other side of ditch.
8 S	639663	770118	- [2]	-	-	Concrete yard for stockpiling peat.
9 N	639468	770085	- [2]	-	-	No penetration between road and ditch ~2 m from road.

Point	Easting[1]	Northing[1]	Depth of Peat (m bgl)	Depth of test (m bgl)	Peat Strength (kPa)	Comment
9 S	639468	770075	0.9	0.5	20	Measured ~3 m from road.
10 N	639283	770011	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
10 S	639283	770000	- [2]	-	-	No penetration between road and ditch ~ 1 m from road. Farm field other side of ditch.
11 N	639093	769953	- [2]	-	-	No penetration between road and ditch ~0.5 m from road. Farm field other side of ditch.
11 S	639093	769943	- [2]	-	-	No penetration between road and ditch ~0.5 m from road. Farm field other side of ditch.
12 N	638901	769959	- [2]	-	-	No penetration between road and ditch ~0.5 m from road. Farm field other side of ditch.
12 S	638901	769949	- [2]	-	-	No penetration between road and ditch ~0.5 m from road. Farm field other side of ditch.
13	638726	770051	-	-	-	On narrow bend near bridge (over river).
14	638613	769950	-	-	-	On narrow bend near bridge (over river).
15 E	638621	769750	2.0	-	-	Measured ~1.5 m from road.
15 W	638611	769750	3.1	1.0	30	Measured ~2 m from road.
16 E	638623	769550	1.8	1.0	63	Measured ~3 m from road.
16 W	638613	769550	1.8	-	-	Measured ~2 m from road. Stream crossing at 16.
17 E	638626	769350	0.9	-	-	Measured ~3 m from road.
17 W	638616	769350	- [2]	-	-	No penetration up to ~4 m from road.
18 E	638628	769150	- [2]	-	-	No penetration up to ~6 m from edge of road. Bog other side of ditch line.
18 W	638618	769150	1.8	1.0	48	Measured ~3 m from road. Bog other side of ditch line.
19 E	638631	768950	1.5	0.3	50	Measured ~3 m from road. Bog other side of ditch line.

Point	Easting[1]	Northing[1]	Depth of Peat (m bgl)	Depth of test (m bgl)	Peat Strength (kPa)	Comment
19 W	638621	768950	1.5	0.5	58	Measured ~3 m from road. Bog other side of ditch line.
20 E	638664	768753	2.9	1.0	20	Measured ~3 m from road. Bog other side of ditch line.
20 W	638654	768753	0.9	0.5	58	Measured ~3 m from road. Bog other side of ditch line.
21 E	638703	768557	- [2]	-	-	No penetration between road and ditch ~ 1 m from road. Farm field other side of ditch.
21 W	638693	768557	- [2]	-	-	No penetration between road and ditch ~ 1 m from road. Farm field other side of ditch.
22 E	638818	768407	- [2]	-	-	No penetration between road and ditch ~ 1 m from road. Farm field other side of ditch.
22 W	638808	768407	- [2]	-	-	No penetration between road and ditch ~ 1 m from road. Farm field other side of ditch.
23 E	638948	768294	- [2]	-	-	No penetration between road and ditch ~ 1 m from road. Farm field other side of ditch.
23 W	638938	768294	- [2]	-	-	No penetration between road and ditch ~ 1 m from road. Farm field other side of ditch.
24 E	638943	767318	0.5	-	-	Measured ~2.5 m from road. Bog on other side of ditch.
24 W	638933	767318	0.5	-	-	Measured ~2.5 m from road. Bog on other side of ditch.
25 E	638884	767127	4.0	1.5	40	Measured ~2 m off road.
25 W	638874	767127	6.3	2.0	70	Measured ~3 m off road.
26 E	638842	766932	2.5	0.5	42	Measured ~3 m off road.
26 W	638832	766932	- [2]	-	-	No penetration between road and ditch ~2 m off road.
27 E	638806	766735	2.9	0.5	42	Measured ~ 3 m off road. River crossing at 27.
27 W	638796	766735	0.5	-	-	Measured ~ 3 m off road. River crossing at 27.
28 E	638785	766536	- [2]	-	-	No penetration between road and ditch ~3 m from road.

Point	Easting[1]	Northing[1]	Depth of Peat (m bgl)	Depth of test (m bgl)	Peat Strength (kPa)	Comment
28 W	638775	766536	4.5	2.0	50	Measured ~2.5 m from road.
29 E	638774	766337	0.9	-	-	Measured ~3 m off road.
29 W	638764	766337	1.5	1.3	46	Measured at bottom of ditch ~2.5 m from road. Ditch is ~2 m high.
30 E	638779	766137	1.5	-	-	Measured ~1 m off road.
30 W	638769	766137	- [2]	-	-	No penetration between road and ditch ~3 m from road.
31 E	638805	765939	2.3	0.6	80	Measured ~1 m off road.
31 W	638795	765939	- [2]	-	-	No penetration between road and ditch ~3 m from road.
32 E	638856	765746	1.5	1.0	42	Measured ~1 m off road.
32 W	638846	765746	4.3	2.0	36	Measured ~2 m off road.
33 E	638938	765565	0.2	-	-	Measured ~2 m off road.
33 W	638928	765565	2.0	0.7	20	Measured at bottom of ditch ~2 m off road. Ditch is ~1 m high.
34 E	639042	765394	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
34 W	639032	765394	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
35 E	639188	765263	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
35 W	639178	765263	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
36 E	639367	765173	- [2]	-	-	Small forested area. No penetration.
36 W	639357	765173	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
37 E	639495	765026	- [2]	-	-	Small forested area. No penetration.

Point	Easting[1]	Northing[1]	Depth of Peat (m bgl)	Depth of test (m bgl)	Peat Strength (kPa)	Comment
37 W	639485	765026	- [2]	-	-	Farm yard.
38 E	639603	764858	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
38 W	639593	764858	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
39 E	639707	764688	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
39 W	639697	764688	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
40 E	639756	764580	- [2]	-	-	No penetration between road and ditch ~1 m from road. Farm field other side of ditch.
40 W	639746	764580	- [2]	-	-	Farm yard.

Notes:

(1) Coordinates approximate based on hand held GPS and on site measurements;

(2) Unable to penetrate with probe.

APPENDIX 4-5

APEX CABLE ROUTE GEOPHYSICAL INVESTIGATION REPORT

AGP19176_01

Report
on the
Geophysical Investigation
At
The Coole Grid Route,
Co. Westmeath
for
Statkraft Ireland Limited

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October 2019

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP19176		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
IAN SHARKEY (DIP MIN ENG)	EURGEOL DR. YVONNE O'CONNELL P.GEO., PH.D. (GEOPHYSICS)	V.01	09TH OCTOBER 2019

CONTENTS

1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Statkraft Ireland Limited to carry out a geophysical investigation for the proposed Coole Grid cable route, Co. Westmeath to map the presence and thickness of the peat along the proposed grid route.

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 Longford/Westmeath border in the North.

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 at chainage 3027m.

The results of the investigation are presented in a series of figures and tables shown in Appendices B and Appendix C.

The findings of the geophysical investigation should be reviewed following any further intrusive investigations.

2. INTRODUCTION

APEX Geophysics Limited was requested by Statkraft Ireland Limited to carry out a geophysical investigation for the proposed Coole Grid cable route, Co. Westmeath to investigate the presence and thickness of the peat along the proposed cable route.

2.1 Survey Objectives

The objectives of the investigation are to:

- Determine the presence of peat under the road,
- Provide information on the thickness of the peat.

2.2 Site Background

The investigation 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 Longford/Westmeath border in the North (Fig. 2.1). The elevation of the regional road ranges from 59 mOD – 99 mOD.

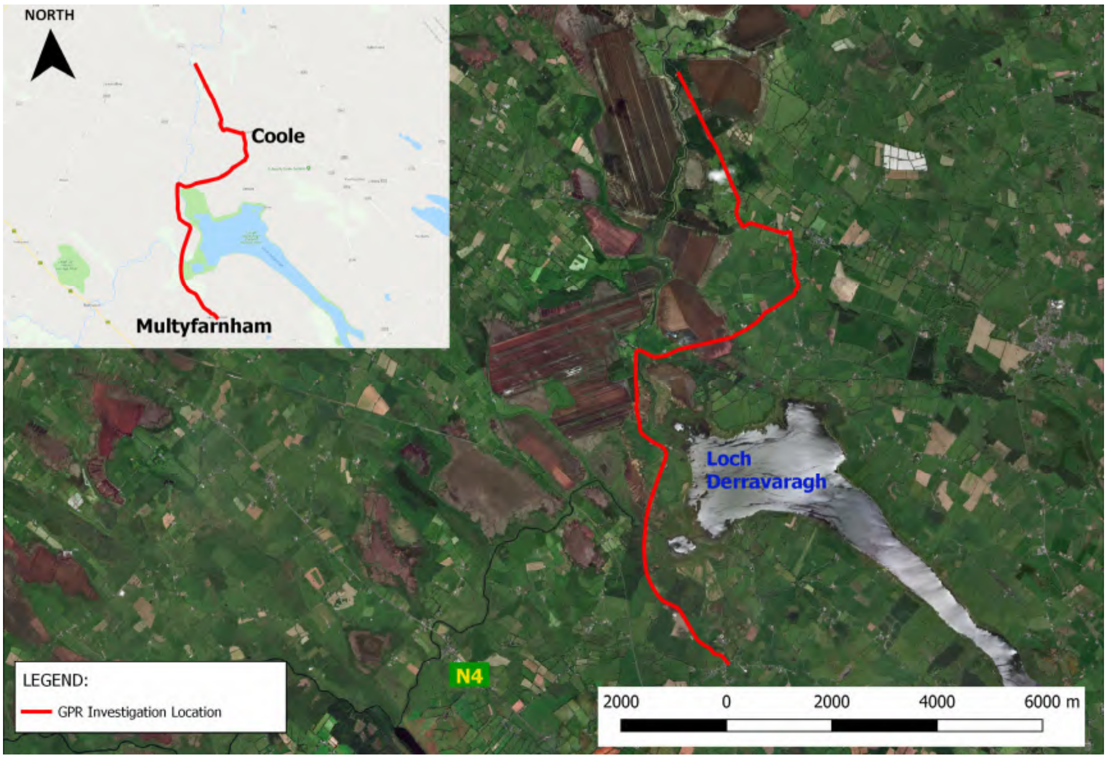

Fig 2.1: Investigation location.

2.2.1 Soils

The Geological Survey of Ireland (GSI) Quaternary sediments map for the area (Fig. 2.2) indicates that the survey route is predominantly underlain by cutover raised peat. Limestone till is mapped in the south, centre and north of the survey route and sandstone and shale till is mapped in the north of the survey route. Limestone gravels are shown in the north and south of the site.

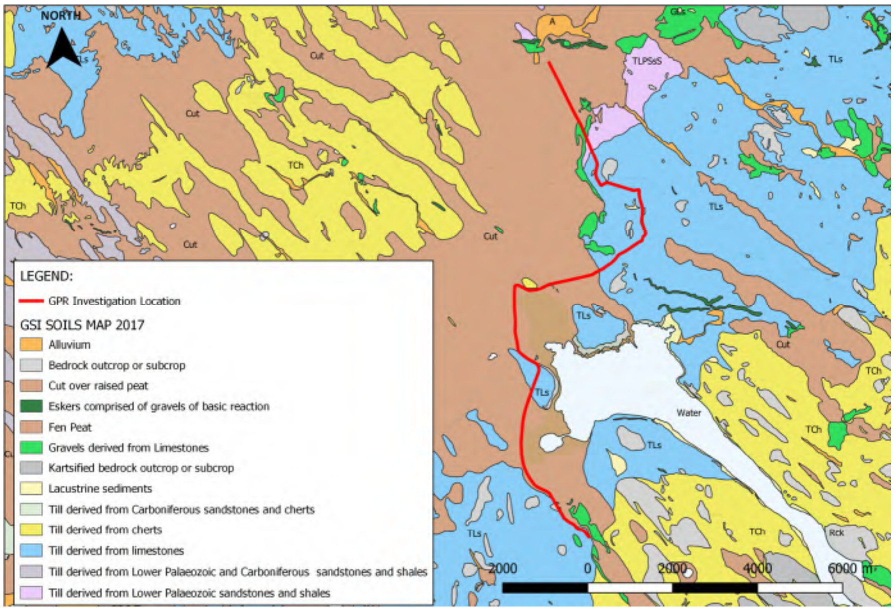

Fig 2.2: GSI Soils Map.

2.2.2 Geology

The GSI 1:100k Bedrock Geology map for the area (Figure 2.3) indicates that the survey route is predominantly underlain by dark limestone & shale (`Calp') of Lucan Formation with Mudbank limestone in the centre of the route. and cherty limestone and minor shale of the Derravaragh Cherts in the south of the survey route. Two SW-NE faults are mapped west and east of the road.

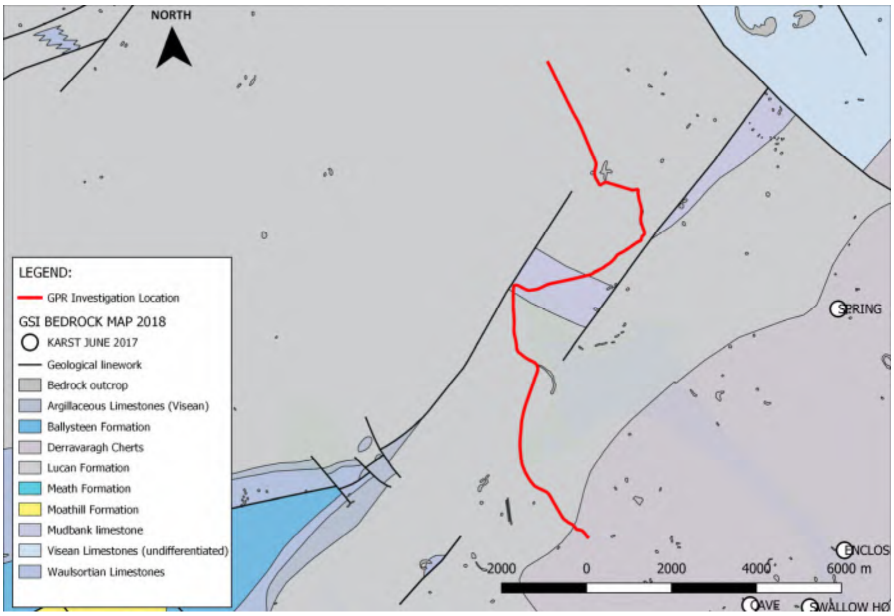

Fig 2.3: GSI Bedrock geology Map.

2.2.3 Vulnerability

The groundwater vulnerability rating for the site (Fig. 2.4) is classified as predominantly low to moderate to high, with some areas of an extreme vulnerability and rock at or near surface in the south, centre and north of the survey area.

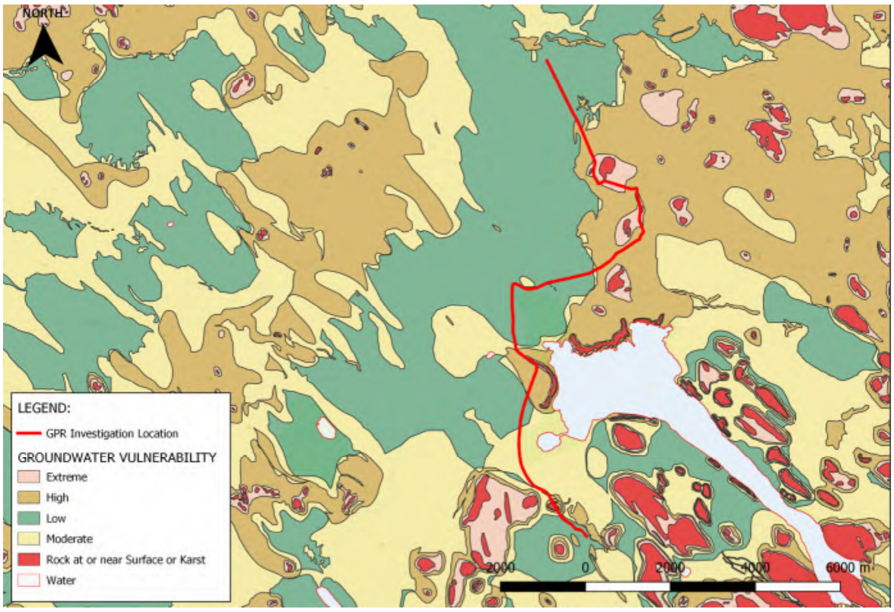

Fig 2.4: Groundwater vulnerability.

2.2.4 Historical Data

The historical 6 inch sheet for the area indicates bog deposits in the north, centre and south of the road, marked in orange (Fig. 2.5). Outcrops of dark Limestone are shown in blue on the map.

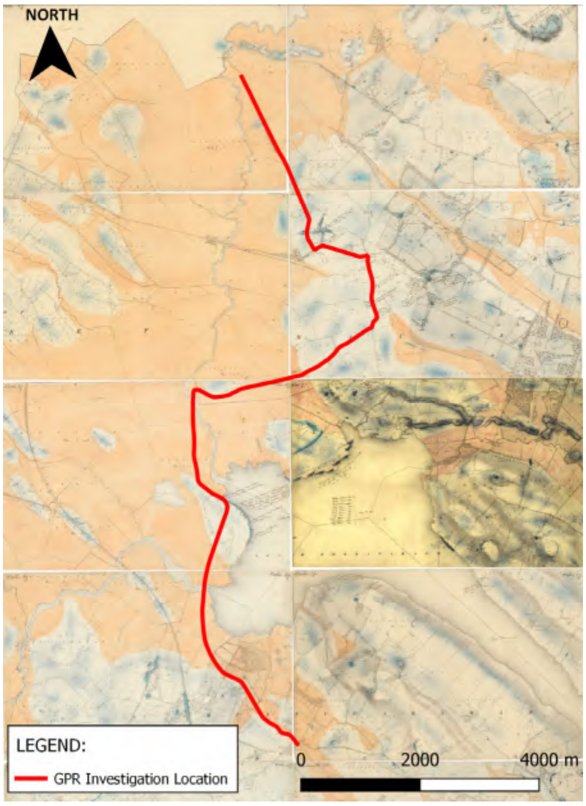

Fig 2.5: The historical 6inch map.

2.2.5 Direct Investigation Data

Thirteen Russian Cores (RS1-RS13) were targeted in areas of peat to determine the thickness of peat, the nature of the material underlying the peat and to correlate the readings to the GPR profiles (e.g. Figure 2.6).

The peat thickness recorded in the Russian cores ranges from 0.82m to 5.62m. Underlying material was predominantly soft white SHELL MARL with two occurrences of soft grey CLAY. The findings from the Russian cores are listed in Table 2.1.

Fig 2.6: Russian core showing soft white shell marl overlain by peat.

	Chainage (m)	Peat Thickness (m)	Underlying Material
RS1	2420	2.66	Soft White Shell Marl
RS2	2682	2.00	Soft White Shell Marl
RS3	3031	4.70	Unknown, Bog Oak at Base of Peat
RS4	3257	2.45	Soft White Shell Marl
RS5	3443	3.60	Soft White Shell Marl
RS6	3739	5.65	Soft White Shell Marl
RS7	3975	0.82	Soft White Shell Marl
RS8	6262	1.10	Soft White Shell Marl
RS9	8268	3.43	Soft Grey Clay
RS10	8889	2.40	Soft White Shell Marl
RS11	9050	1.60	Soft White Shell Marl
RS12	14274	0.90	Soft Grey Clay
RS13	15098	1.10	Soft Grey Clay

Table 2.1: Russian core data.

No other intrusive investigation was available at the time of producing this report. Where additional intrusive data becomes available the findings from the geophysical investigation should be reviewed accordingly.

2.3 Survey Rationale

Ground Penetrating Radar (GPR) works by sending radio waves into the ground and measuring the time of the reflected wave. Reflections occur where different material properties exist.

GPR has been used extensively in the determination of pavement construction. Pavement construction materials are generally well controlled and prove an effective target for the GPR technique providing continuous layer information which can be correlated to more intrusive core data.

GPR has been used extensively in the determination of peat thickness in both raised bog as well as upland blanket bog and has proved to be extremely accurate. The base of the peat is normally underlain by materials with significantly different properties to the peat itself. This in turn produces a strong signal from the base of the peat enabling accurate thickness measurements to be made. Where peat has a high inorganic content (organic soil rather than pure peat) the penetration is reduced and the peat base may not be fully resolved.

Where high conductivity materials such as ash or clinker are recycled into road construction the GPR signal will be attenuated and may not penetrate sufficiently to resolve the base of peat.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. Further information on the detailed methodology employed in this investigation is given in **APPENDIX A**.

3. RESULTS

The investigation was carried out on the 17th and 18th September and the 3rd and 4th October, 2019. Seven GPR profiles were recorded at the chainages outlined in table 3.1. The higher GPR frequencies (providing higher resolution at shallower depths of penetration) were recorded along the entire route to image road construction material and lower GPR frequencies (providing a greater depth of penetration at a lower resolution) were recorded across areas of peat. The geophysical survey locations are plotted on Drawing AGP19176_0, Appendix C.

GPR Center Frequency	Chainage (m)	
	From:	To:
400MHz	0	15662
250MHz	0	15662
100MHz	1624	9031
	13196	15662
40MHz	2074	4067
	5482	6460
	7533	9049

Table3.1: GPR Investigation Locations.

The pavement construction and underlying peat deposits interpreted from the GPR data are presented on Drawing's AGP19176_02 to AGP19176_07, Appendix C. The longitudinal sections are vertically exaggerated x 100 for presentation purposes.

A pavement construction summary is presented in tabular format in Appendix B.

4. DISCUSSION & RECOMMENDATIONS

The GPR data was generally of good quality and the data have been interpreted as follows:

- The 250MHz and 400 MHz GPR frequencies contained sufficient detail to image the road construction materials.

- The reflections from the base of the peat were attenuated across much of the 100MHz data. This is possibly due to the presence of a highly conductive material such as ash or clinker which may form part of the pavement construction. As a result, the reflections from the base of the peat were further investigated with a 40MHz GPR frequency.

- Peat was resolved beneath four sections of the road construction with a maximum thickness of 4.34m at chainage 3027m. These areas were further investigated with Russian cores to correlate the peat depth with the GPR data.

- Where the peat thickness is minimal below the base of the subbase it is likely that there has been mixing between the overlying material and the base of the peat.

- Possible shallow bedrock has been interpreted along six sections of the survey route. The shallow bedrock presents as planar reflections from the bedding planes within the rock.

The findings of the geophysical investigation should be reviewed following any further intrusive investigations.

5. GPR Data Examples

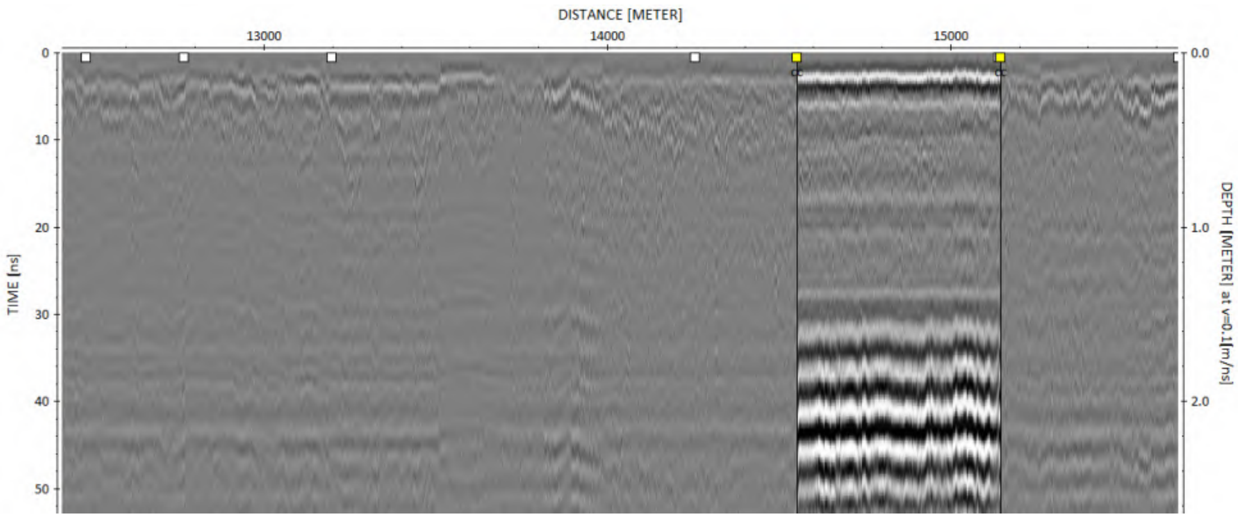

Figure 5.1: 400MHz Frequency – A high amplitude response occurring at a depth of c.0.12mbelow ground level (bgl) between chainage 14550 and 15150 indicates the presence of rebar in the pavement construction.

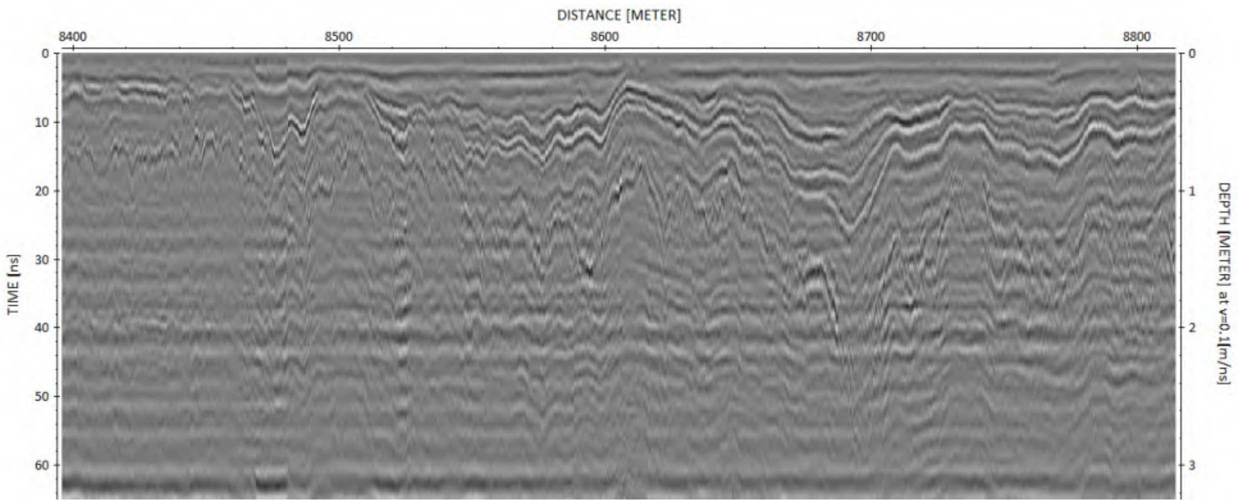

Figure 5.2: 400MHz Frequency – A series of planar reflections occurring between 0.5m to 1.5m bgl delineate layering within the pavement construction.

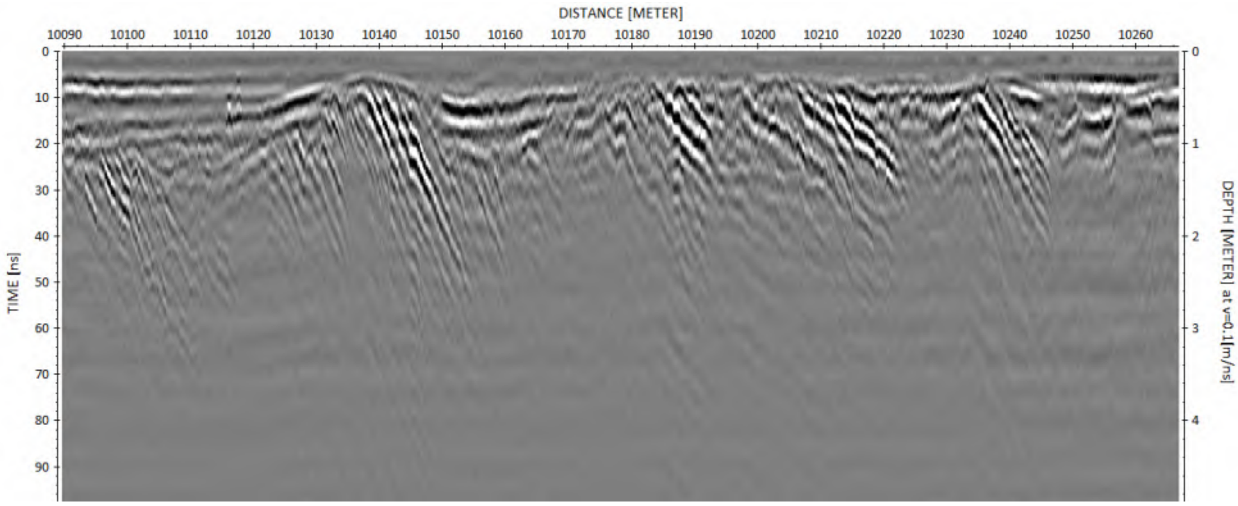

Figure 5.3: 250MHz Frequency – A series of oblique planar reflections occurring between 0.5m to 3m bgl are interpreted as been due to bedding in the underlying bedrock.

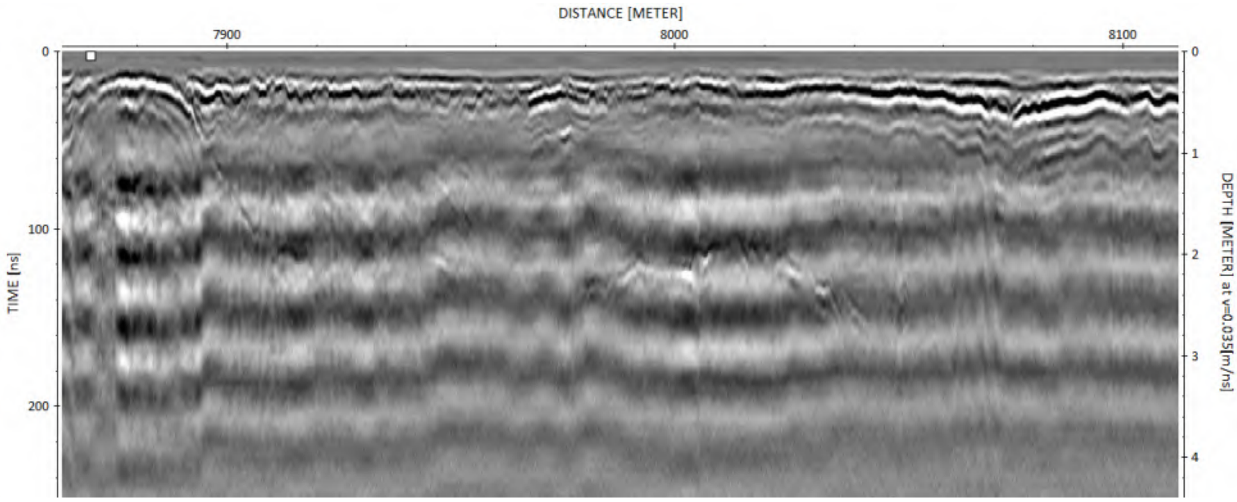

Figure 5.4: 100MHz Frequency – A planar reflection occurring between 30-150ns defines the base of peat. The signal is attenuated from chainage 8040m to 8100m beneath a section of thicker road construction. The attenuation may be due to conductive ash\clinker recycled into the roadbase.

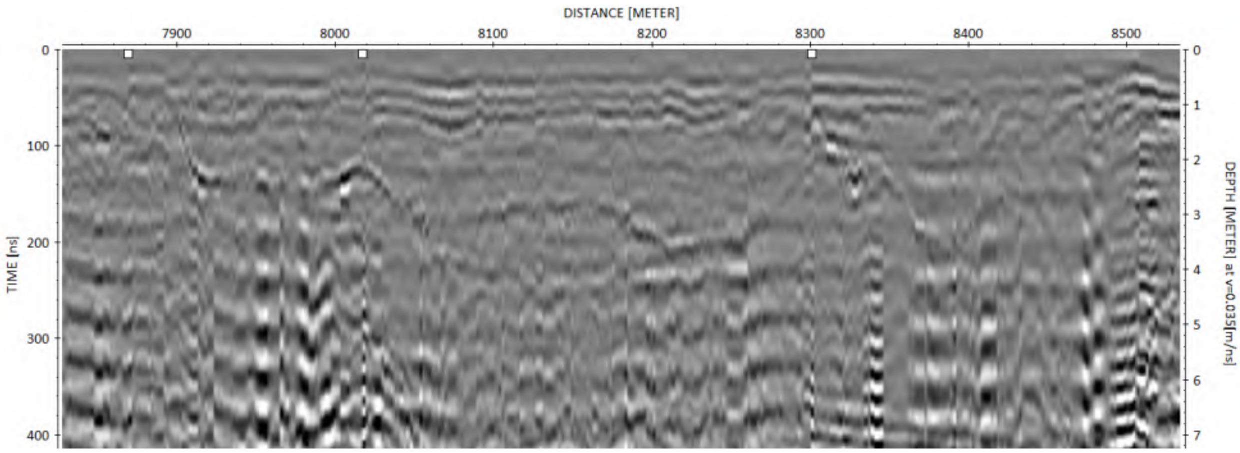

Figure 5.1: 40MHz Frequency – A planar reflection occurring between 30-200ns defines the base of peat.

APPENDIX A: DETAILED METHODOLOGY

An investigation using Ground Penetrating Radar (GPR) was commissioned to investigate the site.

Ground Penetrating Radar (GPR)

Ground penetrating radar is effective at determining the presence of layer detail within pavement construction by assessing the amplitude and phase of reflected signals from internal boundaries. The amount of reflected energy varies when there is a discontinuity caused by separation or the presence of a different material type. Changes in material type and/or the presence of discontinuities significantly alters the reflected energy.

GPR Pavement investigation is effective at resolving material boundaries (manmade or geological) but is limited in the determination of the exact nature of the boundaries. When combined with a targeted coring program any ambiguities on layer type can be resolved and an accurate longitudinal cross section can be generated.

Principles

Ground Penetrating Radar (GPR) is a reflective electro-magnetic technique that involves the transmission of high frequency radio waves (typically 100 to 1000MHz) into the ground and recording the subsequent reflections.

These pulses are transmitted with a high repetition rate as the antenna is moved along the ground and the reflected pulses build up a cross section (time series) of the sub-surface. Partial reflections of the electromagnetic pulse occur at the boundaries of materials with different dielectric properties.

By understanding the material types under investigation, specifically the electromagnetic pulse velocity, it is possible to convert the reflected time series to an accurate depth section, using:

Depth [m] = Velocity [m/ns] * Reflected Time * 0.5

The velocity and depth of penetration of the GPR signal depends on the electrical properties of the material with highly conductive materials showing a low penetration due to high absorption rates. Clay-rich and water saturated materials have a lower penetration than gravelly and dry soils. Signal penetration and resolution limits are also governed by the centre frequency of the transmitted electromagnetic pulse. High frequencies give good resolution and shallow penetration. Lower frequencies give lower resolution and deeper penetration.

Reinforced concrete will often act as a barrier to GPR signals (independent of frequency) and in such cases the resolution of deeper layers of subbase / subgrade may not be possible.

Data collection

40MHz, 100MHz, 250MHz & 40MHz GPR data were collected across the specified pavement section. The use of these frequencies enable accurate resolution of the shallow, bound material layers, as well as providing good penetration into the deeper subbase and subgrade materials.

Data collection was controlled by an Electronic Distance Measuring (EDM) system linked to the hub of the survey vehicle. This enables a highly accurate, independent measuring system to be used to ensure data are collected at the specified intervals. Data were collected at 0.25m centres along the NSWP in the Southbound Lane.

Digital marks are placed on the data at predefined locations to determine the extents of the sections to be investigated.

Data processing

GPR data was collected as continuous longitudinal profiles as described above. The processing and location of subsurface features was achieved by using a proprietary processing software (ReflexWin V.8.2.2)

The following processing was applied to the data:

- Spatial relocation (data merge with surveyed positions)
- Temporal relocation (depth correction)
- Frequency band pass filtering
- Amplitude recovery gain (time dependent gain)
- Noise removal (background removal)
- Running average

Calibration

The calculation of accurate thickness measurements relies on the correlation of GPR radio wave velocity to measured material thickness. The velocity of the underlying peat material was calibrated to a series of probes taken at either side of the road to determine the depth of the peat base below the existing road surface.

Known velocities of the different materials making up the pavement construction were been used in the calculation of thickness detail.

- 0.1 m/ns Road Construction materials
- 0.035m/ns Peat

Thirty soft ground probes were taken adjacent to the road across the area investigation. Thirteen Russian samples were targeted in areas where peat were identified. The Russian samples identify the thickness of peat and the type of material underlying the peat.

Spatial Relocation

All the geophysical investigation locations were acquired using a Trimble Geo 7X high-accuracy GNSS handheld system using the settings listed below. This system allows collection of GPS data with c.20mm accuracy.

Projection:	Irish Transverse Mercator
Datum:	Ordnance
Coordinate units:	Meters
Altitude units:	Meters
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland

APPENDIX B: PAVEMENT CONSTRUCTION SUMMARY TABLE

CHAINAGE		COORDINATES		ROAD CONSTRUCTION MATERIAL			PEAT MATERIAL			
start (m)	end (m)	easting ING	northing ING	min. depth (m)	max. depth (m)	avg. depth (m)	min. depth (m)	max. depth (m)	avg. depth (m)	Comments
	0	640364.083	764104.575							
0	1602	639283.526	765212.979	0.276	1.014	0.515				Section 1
1602	3278	638801.803	766700.748	0.400	2.387	0.765	0.833	5.340	2.645	Section 2 - Peat underlain by Shell Marl
3278	3355	638807.094	766777.567	0.657	1.685	0.941				Section 3 - Concrete Bridge Deck
3355	4055	638987.860	767452.176	0.437	2.231	0.779	0.664	5.140	3.676	Section 4 - Peat underlain by Shell Marl
4055	4486	639129.018	767859.410	0.268	0.491	0.341				Section 5
4486	4843	639144.495	768193.841	0.275	0.474	0.363				Section 6 - Possible Shallow Bedrock
4843	5342	638734.357	768473.072	0.331	0.836	0.504				Section 7
5342	6458	638617.150	769572.915	0.444	2.200	0.798	0.855	3.862	2.050	Section 8 - Peat underlain by Shell Marl
6458	7550	639217.202	769971.463	0.198	1.744	0.757				Section 9
7550	9119	640701.605	770443.741	0.208	3.043	0.882	0.426	4.883	2.709	Section 10 - Peat underlain by Shell Marl & Grey Clay
9119	9755	641194.058	770833.946	0.151	1.198	0.474				Section 11
9755	9851	641275.626	770884.384	0.148	0.402	0.270				Section 12 - Possible Shallow Bedrock
9851	10034	641426.158	770988.442	0.198	0.854	0.486				Section 13
10034	10240	641601.764	771095.191	0.250	0.951	0.525				Section 14 - Possible Shallow Bedrock
10240	10661	641645.686	771471.071	0.220	0.767	0.408				Section 15
10661	11017	641631.136	771822.066	0.219	0.731	0.444				Section 16 - Possible Shallow Bedrock
11017	11435	641553.443	772230.346	0.179	0.500	0.334				Section 17- Possible Shallow Bedrock
11435	11528	641541.828	772308.951	0.218	0.594	0.340				Section 18
11528	12257	640840.766	772466.270	0.211	0.489	0.319				Section 19
12257	12804	640526.050	772717.243	0.214	0.767	0.361				Section 20- Possible Shallow Bedrock
12804	13814	640256.122	773663.372	0.146	0.994	0.424				Section 21
13814	14542	639484.408	775208.405	0.103	0.608	0.338	0.285	0.792	0.547	Section 22- Peat underlain by Grey Clay
14542	15145	639661.915	774853.315	0.308	1.255	0.537	0.611	1.275	0.816	Section 23- Peat underlain by Grey Clay, Possible reinforced concrete within road construction
15145	15662	639430.310	775314.396	0.153	0.313	0.213	0.392	0.775	0.572	Section 24- Peat underlain by Grey Clay

FIGURE 1: GEOPHYSICAL LOCATIONS

SCALE 1:40,000

N

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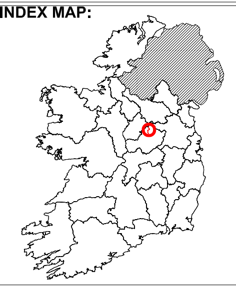
INDEX MAP:



LEGEND:

GPR Profile

GPR RECORDING LOCATIONS		
Frequency	Chainage (m)	
	From:	To:
400MHz	0	15662
250MHz	0	15662
100MHz	1621	9031
	13196	15662
40MHz	2074	4067
	5482	6480
	7533	9049

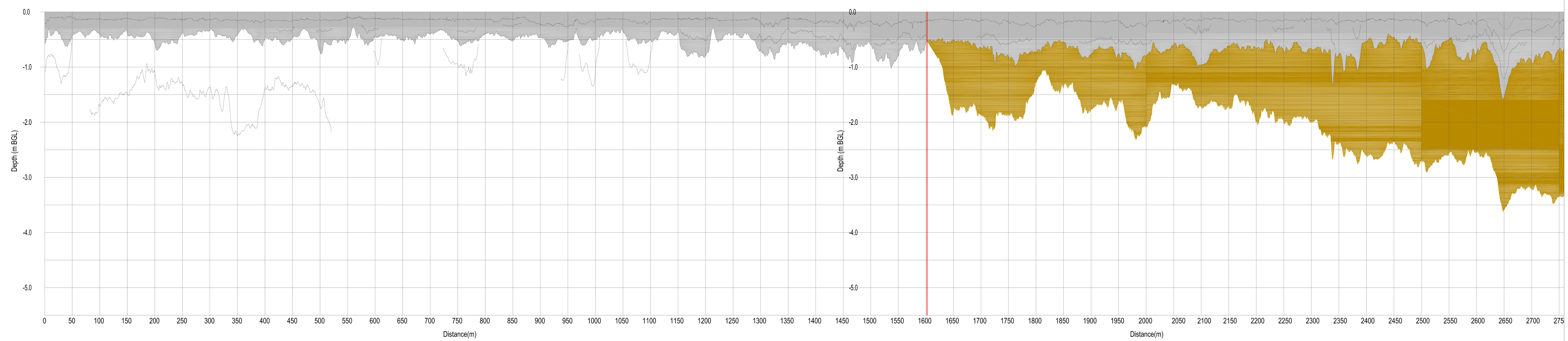
The information displayed here is to be used in conjunction with Report AGP19176_01, Report on the Geophysical Investigation at Coole Grid Route for Statkraft Ireland Limited.; Apex Geophysics Limited. 9th October 2019

PROJECT:	COOLE GRID ROUTE GEOPHYSICAL INVESTIGATION
CLIENT.:	STATKRAFT IRELAND LIMITED
DRAWING NO:	AGP19176_01
SCALE:	AS INDICATED @ A3
DATE:	09TH-AUGUST-2019

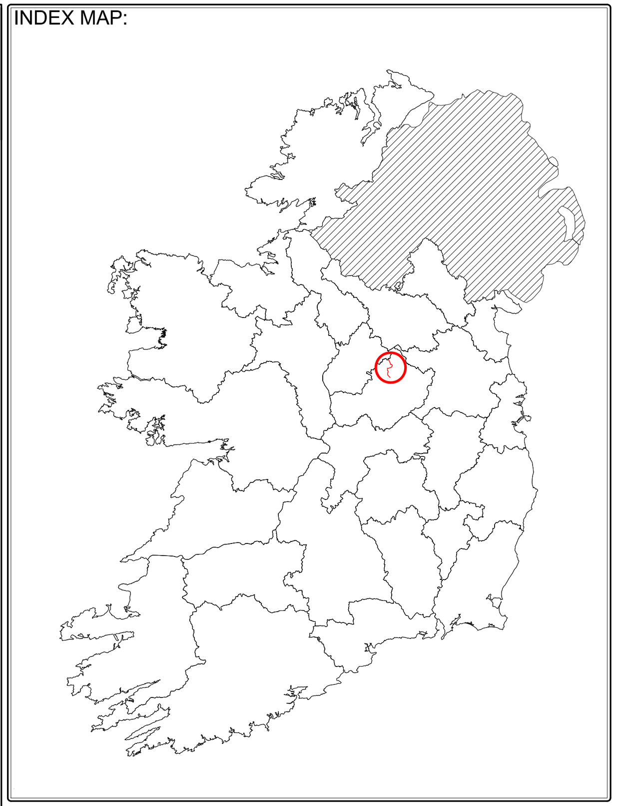
Version:	Date:	Drawn By:	Checked:
01	09-10-2019	IS	YOC

FIGURE 1: Geophysical Locations
Scale 1:4000

FIGURE 2: Interpreted Geophysical Section
Scale Vt - 1:40, Hz - 1:4000



INDEX MAP:



LEGEND:

Figure 1 key
- GPR Profile

Figure 2 key
- Road Construction
- Internal Layering in Road Construction
- Peat
- Base of Peat
- Unknown Layer
- Construction change

The information displayed here is to be used in conjunction with Report AGP19176_01, Report on the Geophysical Investigation at Coole Grid Route for Statkraft Ireland Limited.; Apex Geophysics Limited. 9th October 2019

PROJECT: COOLE GRID ROUTE GEOPHYSICAL INVESTIGATION

CLIENT: STATKRAFT IRELAND LIMITED

DRAWING NUMBER: AGP19176_02

SCALE: AS SHOWN @ A1

DATE: 09TH AUGUST 2019

DRAWN: IS | CHECKED: YOC

REVISION:	DATE:	DRAWN:	CHECKED:
001	09-10-2019	IS	YOC

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APPENDIX 4-6

ASSESSMENT OF FORESTRY REPLACEMENT LANDS

Assessment of Forestry Replacement Lands

Coole Wind Farm Development, Co. Westmeath

DOCUMENT DETAILS

Client: **Coole Wind Farm Ltd**

Project Title: **Coole Wind Farm Development, Co. Westmeath**

Project Number: **200445**

Document Title: **Assessment of Forestry Replacement Lands**

Document File Name: **Replanting Assessment F - 2021.03.08 - 200445**

Prepared By: **MKO**
Tuam Road
Galway
Ireland
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MKO Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	08.03.2021	EOS/LK	MW

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1. INTRODUCTION

1.1 Introduction

This report has been prepared by McCarthy Keville O'Sullivan Ltd. (MKO) on behalf of Coole Wind Farm Ltd., who intends to apply to An Bord Pleanála for planning permission to construct a wind energy development and all associated infrastructure in the townland of Coole and adjacent townlands, in Co. Westmeath.

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

A total of 16.36 hectares of new forestry will therefore be replaced as a condition of any felling licence that might issue in respect of the proposed wind energy development. Replanting is a requirement of the Forest Service and is primarily a matter for the statutory licensing processes under the Forestry Act 2014 that are under the control of the Minister for Agriculture, Food and the Marine and the Forest Service. Please refer to Section 4.3.16 in Chapter 4 of this EIAR for further detail on felling requirements.

The replacement of forestry can occur anywhere in the State subject to licence. Bare replacement lands are therefore required to be obtained by the applicant and ringfenced for the replacement of forestry felled as part of the construction of wind energy developments. These lands are subject to an application for Technical Approval by the Forest Service. Should technical approval be granted, the lands can be left bare until a felling licence for the wind farm to which they are linked has been acquired. Bare replacement lands can also be planted ahead of a felling licence being acquired for the wind farm as long as they are held specifically for the purpose of replacing forestry felled as part of the wind farm development.

A potential replanting site for the proposed Coole wind farm felling requirement has been identified in County Roscommon. These lands have been granted Forest Service Technical Approval for afforestation (see Appendix 1 for technical approval document) and these or similarly approved lands will be used for replanting should the proposed wind farm receive planning permission.

1.2 Report Structure

The main sections of this report are presented as follows:

- Section 2: Project Background and Description
- Section 3: Planning Policy and Planning History
- Section 4: Impact Assessment Methodology
- Section 5: Biodiversity
- Section 6: Land, Soils and Geology
- Section 7: Hydrology and Hydrogeology
- Section 8: Landscape
- Section 9: Cultural Heritage
- Section 10: Air, Climate and Noise
- Section 11: Population & Human Health
- Section 12: Material Assets

In this report, the replacement lands are assessed in combination with any existing, permitted or proposed developments located in the immediate vicinity of the replacement lands. The replacement land is assessed in combination with the proposed Coole Wind Energy Development in Chapters 5 to 14 of the EIAR.

2. PROJECT BACKGROUND AND DESCRIPTION

2.1 Background

2.1.1 Replanting Approval

Replanting or off-site afforestation is a requirement of the Forestry Act 2014 and its consent is regulated under the Forestry Regulations 2017 (SI 191/2017 which set out the provisions for licensing for afforestation.

Approval for afforestation is not granted by the Forest Service on lands where there is the potential for significant environmental impacts.

The lands addressed in this document have been granted Technical Approval by the Forest Service for afforestation.

To afforest any land where the area involved is greater than 0.1 ha requires the approval of the Minister for Agriculture, Food and the Marine, under the 2017 Regulations. The application for approval is known as Pre-Planting Approval – Form 1 and is subject to the following procedures:

- The application is referred to the relevant Forest Service Inspector for assessment and recommendations;
- If there are any environmental considerations identified, the application is referred to the relevant external body, e.g. National Parks and Wildlife Services, National Monuments Service, Regional Fisheries Boards, Local Authorities, etc., for consideration;
- If the proposed development is greater than 25 hectares the application is referred to the relevant Local Authority;
- If the site is greater than 2.5 hectares the application is advertised on the Department's website; and
- If the site is greater than 50 hectares an Environmental Impact Assessment and planning permission are required (Part 3, Article 5 (2)(c) of S.I. 191/2017).

The Pre-Planting Approval – Form 1 requires a wide range of details in relation to the proposed area to be forested. Notwithstanding the size of the proposed application, the environmental considerations which must be answered/considered for the approval are listed in Table 2-1 below. The Pre-Planting Approval – Form 1 notes that, if present, all items listed may require the Department of Agriculture, Food and the Marine (DAFM) to consult with prescribed bodies, while those in bold type may require the DAFM to undertake public consultation.

Table 2-1 Environmental Considerations in Afforestation Applications for Approval - Form 1

	Environmental Considerations
1	Water Quality
1.1	Is the area designated potentially acid sensitive by this Department (DAFM)?
1.2	Is the area >5 ha and sensitive for fisheries?
1.3	Is the area non-sensitive for fisheries and >40 ha?
1.4	Is the area >10 ha and within a catchment area of a Local Authority designated water scheme?
2	Designated Habitats
2.1	Is the area within a NHA, pNHA, SAC, SPA or National Park?

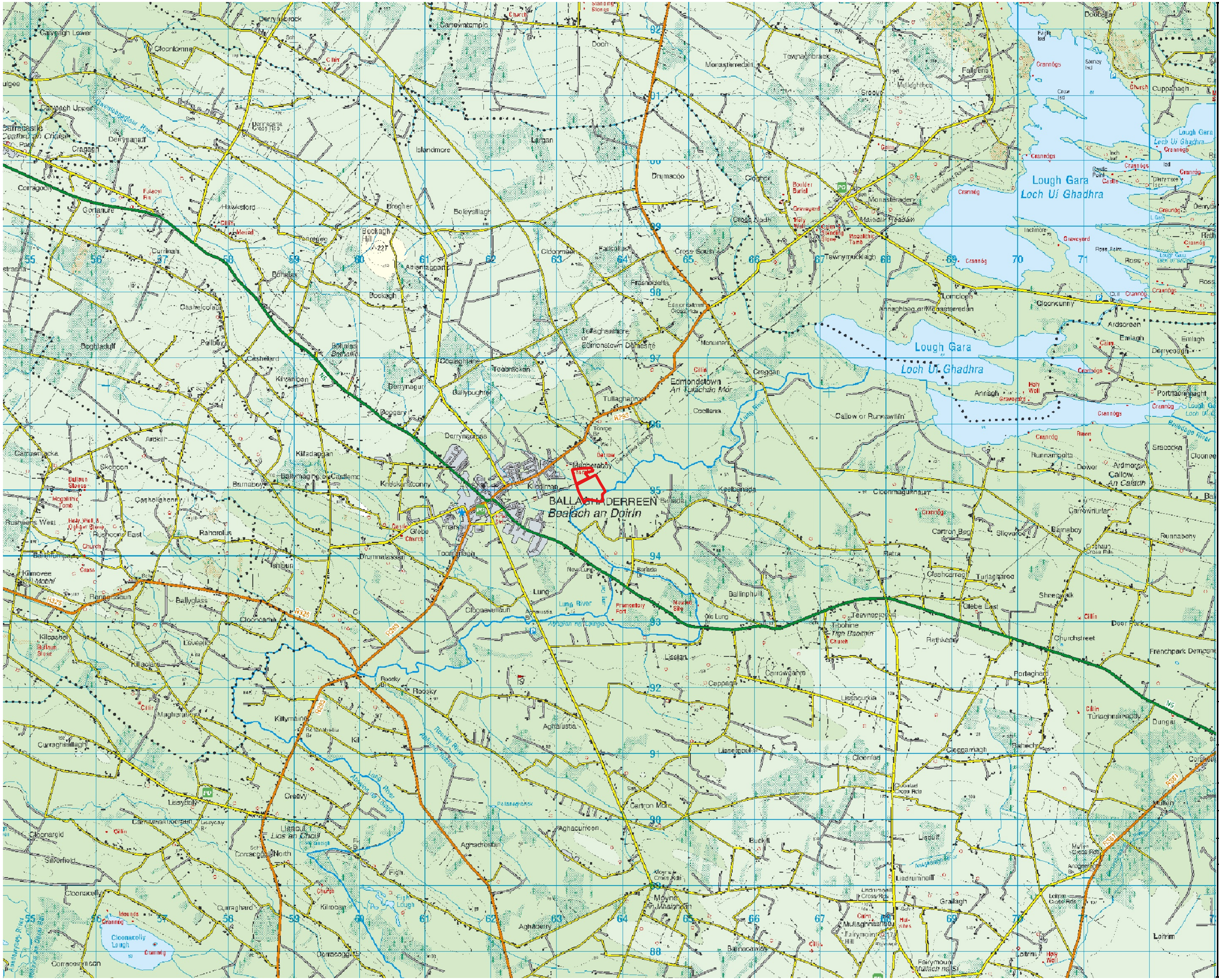
	Environmental Considerations
2.2	If the area is within a NHA, is a completed notifiable Action Form/ Action Requiring Consent Form (consent from National Parks and Wildlife Service) included?
2.3	If the area within a Hen Harrier SPA, will operations occur between the 1st of April and the 15th August inclusive?
2.4	Is the area within a NPWS referral zone for NHA, pNHA, SAC or SPA?
2.5	Is the area within 3 km upstream of a NHA, pNHA, SAC, SPA or National Park?
2.6	Is the area within a Fresh Water Pearl Mussel 6 km zone? If yes, the Forestry and Fresh Water Pearl Mussel Requirements Forms A and B should be included with the Application
2.7	Is the area within a Freshwater Pearl Mussel Catchment?
2.8	Does the area contain a current REPS plan habitat?
3	Archaeology
3.1	Does the area contain an archaeological site or feature with intensive public usage?
3.2	Does the area contain or adjoin a listed archaeological site or monument?
4	Landscape
4.1	Is the area within a prime scenic area in the County Development Plan?
4.2	Are there any other High Amenity Landscape considerations?
5	Size for Notification to Local Authority
5.1	Is the area greater than 25 ha?
6	Other Environmental Considerations
6.1	Specify

2.2 Proposed Replanting Lands

A potential replanting site has been identified, and any replanting associated with the proposed development will take place at this or similarly Technically Approved lands. The potential site has been assessed as part of the Afforestation Approval – Form 1 process described above, and has obtained Technical Approval for Afforestation from the Forest Service.

The replanting site is located in the townland of Magheraboy, Co. Roscommon, approximately 1.4km to the east of Ballaghaderreen town centre. The site is accessed via the R293 Regional Road to the north of the site. The site location is presented in Figure 2-1.

The total approved area for afforestation, as per the Technical Approval document, is approximately 16.53 hectares ('Proposed Site'), which is currently dominated by grazed wet grassland. The Lung River flows in a easterly direction along the southern site boundary. An unnamed stream flows in a southerly direction along the western site boundary discharging into the Lung River at the southwest of the site.



Map Legend

Site Boundary

Drawing Title
Site Location - Replanting Lands

Project Title
Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No. 200445	Drawing No. Figure 2-1
Scale 1:75000	Date 08.02.2021

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2.3 Proposed Afforestation Techniques

2.3.1 Forest Service Best Practice

Afforestation and subsequent harvesting will conform to current best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte and DAFM produced guidance documents, including the specific guidelines listed below, to ensure that newly planted trees remain viable and afforestation provide minimal potential impacts to the receiving environment.

- Standards for Felling and Reforestation (DAFM, 2019)
- Environmental Requirements for Afforestation (Forest Service, 2016a)
- Land Types for Afforestation (Forest Service, 2016b)
- Forest Protection Guidelines (Forest Service, 2002)
- Forest Operations and Water Protection Guidelines (Coillte, 2013)
- Forestry and Water Quality Guidelines (Forest Service, 2000b)
- Forestry and the Landscape Guidelines (Forest Service, 2000c)
- Forestry and Archaeology Guidelines (Forest Service, 2000d)
- Forest Biodiversity Guidelines (Forest Service, 2000e)
- Forestry Standards Manual (DAFM, 2015)
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018)

Planting will be carried out in accordance with the *Forestry Schemes Manual* (Forest Service, 2011), which provides guidance in relation to ground cultivation, stocking and spacing, plant handling, planting dates, fertiliser application, fencing, fire, and weed control. Certain specific silvicultural and environmental conditions are also set out in the Forest Service Technical Approvals for each site, which will be adhered to.

2.3.2 Planting

Planting will be by hand. The main forms of planting, as described in the Forestry Schemes Manual, are set out as follows.

Slit Planting

A spade is used to make a vertical slit in the ground. The trees roots are carefully positioned in the slit to ensure that roots are equally spaced in the vertical slit created. The slit is closed and firmed up ensuring the tree is vertical and upright. It is important to ensure that roots are not bent over which can lead to poor development, e.g. J root. This form of planting can be suitable for ribbons, mounds and ripped ground.

Angle Notch

A spade is used to cut a T or L-shaped slit in the ground. The spade is used to lift the slit and the trees roots placed underneath to ensure good root distribution without causing damage. The slit is closed and firmed up to ensure that stem is left vertical and upright.

Pit Planting

A spade is used to dig a hole and the trees roots placed in the centre. Soil is placed around the tree and firmed in, ensuring that it is upright and straight. This form of planting can be used in sensitive sites where no ground preparation has taken place. It may also be appropriate for steep slopes where other types of preparation may lead to sediment run off.

The Technical Approvals for the proposed replanting lands include the species approved for afforestation.

2.3.3 Drainage

Drainage and sediment control at each site will be designed in accordance with the measures outlined in the Forestry Standards Manual[1] and Environmental Requirements for Afforestation[2]. Appropriate drainage designs will include collector drains, interceptor drains and cut-off drains. A description of each drain type, as per the Forestry Schemes Manual, is set out below. Figure 2-2 presents a schematic diagram of each drain type.

Collector Drains

Collector drains collect water from mound drains, plough furrows, mole drains, etc., and discharge via sediment traps and/or an interceptor drain. Collector drains are excavated to a depth not greater than 10-15 cm below the depth of mound drains. Where collector drains have to be extended into erodible material, 'mini' silt traps are placed appropriately by deepening the drains in places.

Interceptor Drains

Interceptor drains are constructed along the edges of aquatic buffer zones, i.e. areas where forest operations are curtailed and which are managed for environmental protection and enhancement. Interceptor drains collect the discharge from the drainage sub-catchment and allow it to overflow into the buffer zone. In most cases, slope will allow for drainage channels to taper out or be connected to an interceptor drain rather than enter a buffer zone. However, on flat sites, or those with low slopes, it will be necessary to connect drains into the aquatic zone. This may be done only where it will not result in sediment or any pollutants entering the aquatic zone.

Cut off Drains

Cut off drains are constructed immediately up slope of a site and are designed to direct water away from the site.

[1] *Forestry Standards Manual (DAFM, 2015)*
[2] *Environmental Requirements for Afforestation (Forest Service, 2016a)*

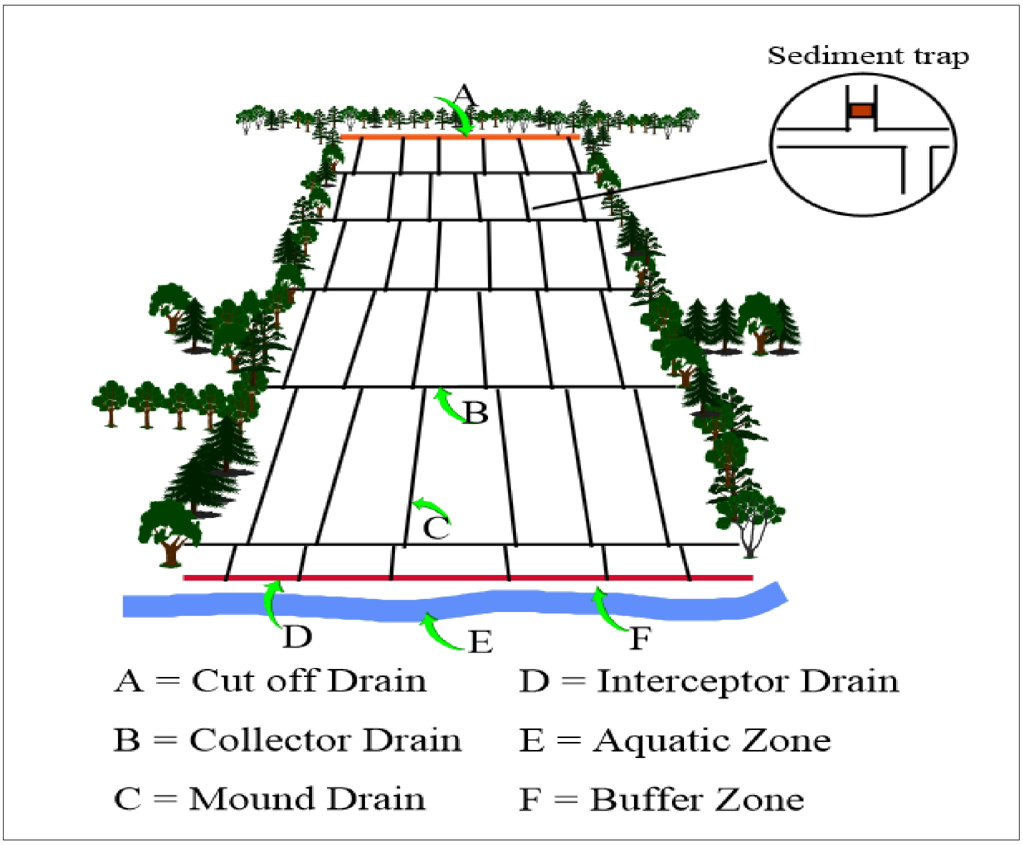


Figure 2-2 Standard Forestry Drainage (Forest Service, 2011

Designs similar to the one above may be suitable for steeper erodible sites.

3. PLANNING POLICY AND PLANNING HISTORY

This section contains relevant national and local policies regarding forestry. This includes reference to several national forestry policy documents, the *Climate Action Plan 2019* (Department of Communications, Climate Action & Environment, 2019) as well as the County Development Plan for Roscommon.

This section of the report also addresses the planning history within, and in the vicinity of, the proposed replanting lands.

3.1 Planning Policy

3.1.1 National Policy

National policy includes Forest Service policy as well as policy on climate change. Forestry policy in Ireland is overseen by the Forest Policy Section of the DAFM. At a European and international level, the Forest Policy Section is responsible for the transposition of EU directives and regulations into Irish law, as well as representing the Forest Service at a European level. On a national level, the Forest Policy Section deals with issues relating to climate change, carbon sequestration, wood energy, forestry and the environment, legislative framework and liaison with stakeholders which includes other government agencies.

National policy is aimed towards increasing Ireland's forest cover in a sustainable manner. The document *Forests, products and people: Ireland's forest policy – a renewed vision* (DAFM, 2014) sets out an updated national forest policy strategy that takes account of the substantial changes that have occurred in Irish forestry since the publication of its forerunner, *Growing for the Future (DAFM, 1996).* As part of the Department's policy to ensure compatibility between forestry development and the protection of the environment, the Forest Service is implementing Sustainable Forest Management (SFM) with a view to ensuring that all timber produced in Ireland is derived from sustainably managed forests. This work is in accordance with Ireland's commitment to the six pan-European criteria for SFM adopted at the Third Ministerial Conference on the Protection of Forests in Europe, Lisbon, 1998. The implementation of SFM within Ireland is supported by the Irish National Forest Standard, the *Code of Best Forest Practice* and a suite of environmental guidelines (relating to water quality, landscape, archaeology, biodiversity and harvesting) as well as the work of the Forestry Inspectorate and the ongoing review of Irish forest legislation.

The *Environmental Requirements for Afforestation* (Forest Service, 2016a), released in December 2016, incorporate more recent developments in relation to environmental regulation, research and changes in forest practices, and consolidate into one single coherent document those measures and safeguards relating to afforestation which were previously contained within the following Forest Service Environmental 'Guidelines': *Forestry and Water Quality Guidelines*, *Forestry and Archaeology Guidelines*, *Forestry and the Landscape Guidelines*, and *Forest Biodiversity Guidelines*. The use of the word 'requirements' in the title was selected over 'guidelines', in order to underline the mandatory nature of the measures therein.

These environmental guidelines are referred to in Section 3.1.3 below.

3.1.1.1 Forests, products and people: Ireland's forest policy – a renewed vision

This document, published in 2014 by DAFM, contains strategic goals and recommendations of the Forest Policy Review Group. The strategic goal is defined as:

> *"Develop an internationally competitive and sustainable forest sector that provides a full range of economic, environmental and social benefits to society and which accords with the Forest Europe definition of sustainable development."*

The report notes the increasing economic, environmental and social role of forestry in Ireland, stating that forestry accounts for 10.8% of the land area of the country, which is low in comparison with other European countries. The strong forest growth rates found in Ireland when compared to other European countries is also noted. The role of forestry in rural development and diversification as well as rural employment is also recognised.

The document notes also the contribution of forests to mitigation of climate change through carbon sequestration and notes that Irish forests will sequester approximately 4.8 million tonnes of CO_2 in 2020. This document's afforestation policy therefore supports Ireland's efforts to reach the greenhouse gas emission reduction targets as well as reducing dependence on fossil fuels.

The role of the forest resource in contributing to the renewable energy policy goals, such as achieving a percentage of power generation by co-firing with biomass, as well as biomass in power generation, is also noted. The report notes that the contribution of forestry to achieving renewable energy targets is dependent on the scale and accessibility of the resource, and that a continuation of afforestation in order to maintain a sustainable level of supply of small roundwood would result in confidence for investment in Combined Heat and Power (CHP) and other wood energy technologies.

Some recommended relevant policies and actions include:

- **Expansion of the Forest Resource**: To increase the forest area, in accordance with SFM principles, in order to support a long term sustainable roundwood supply of 7 to 8 million cubic metres per annum. This policy aims to increase afforestation to 15.000 hectares annually.
- **Management of the Resource**: To ensure that the sustainable management of the forest resource in accordance with best practice thereby ensuring its capacity to provide the full range of timber and other benefits.
- **Environment and Public Goods**: To ensure that afforestation, management of existing forests and development of the forest sector are undertaken in a manner that enhances their contribution to the environment and the capacity to provide public goods and services.

3.1.1.2 Forestry Programme 2014-2020

This document was submitted in accordance with EU Guidelines on State Aid for Agriculture and Forestry in Rural Areas 2014-2020 and represents Ireland's proposals for 100% State aid funding for a new forestry programme 2014-2020. These measures are consistent with the document *Forests, products and people; Ireland's forest policy – a renewed vision* as referred to in Section 3.1.1.1 above. The European Commission has prolonged the validity of state aid rules applicable in the agricultural and forestry sectors, for a further two years until December 31, 2022.

This document contains a number of responses to the actions and policies identified in the above document, and these include an Afforestation scheme - this is the main response to the policy entitled *'Expansion of the forest resource'*.

An identification of needs was carried out by DAFM in relation to forestry, and these needs are as follows:

- Increase, on a permanent basis, Ireland's forest cover to capture carbon, produce wood and help mitigation;
- Increase and sustain the production of forest-based biomass to meet renewable energy targets;
- Support forest holders to actively manage their plantations; and
- Optimise the environmental and social benefits of new and existing forests.

A number of measures are proposed to meet these needs, and the most relevant of these refers to the first measure, which is aimed at increasing Ireland's forest cover (currently at approximately 10.8%) which is well below the EU average of 38%. The aim is to increase forest cover to 18% by the mid-century. The second need, that to increase forest-based biomass in order to meet the stated targets for renewable energy by 2020.

3.1.1.3 Climate Action Plan 2019

The *Climate Action Plan* (DCCAE, 2019) which features 183 action plans sets out how Ireland will meet its EU targets to reduce its carbon emissions by 30% between 2021 and 2030 and lay the foundations for achieving net zero carbon emissions by 2050. One of the key targets in relation to forestry is the delivery of '*..an average of 8,000 ha per annum of newly planted forest, and sustainable forest management of existing forests (21 MtCO2eq. cumulative abatement)'.* Ongoing and proposed measures to deliver the target include:

- The investment of nearly €3 billion in forestry, since the late 1980s, which through ongoing sustainable forest management will contribute to delivering abatement of 21 MtCO2eq over the period 2021 to 2030.
- Review of the current afforestation programme to enhance participation rates, and inform land use policy to increase the benefits for climate, the environment, and rural communities.
- Commitment by Coillte to replant or restock a total of 34,770 hectares between 2016 and 2020.
- Bord na Móna's estate extends to a little under 80,000 ha. To date a little over 18,000 ha of the cut-away and cut-over peatland has been rehabilitated and the target for 2019 is to complete a further 3,000 ha. By way of additional context, as much as 50,000ha of the overall estate is currently under consideration for a wide variety of commercial future uses of which renewable energy projects constitute the greatest proportion by far.
- Hedgerows are estimated to cover 3.9% of the Irish landscape or 660,000 km length. The total area of hedgerow and non-forest woodland patches across the landscape could possibly represent a significant carbon sink and could potentially be used as a mitigation option.

3.1.1.4 Project Ireland 2040- National Planning Framework

Agricultural diversification and alternative landuses are necessary in order to maintain and create jobs in rural Ireland where low quality land presents challenges for sustainable development and economic growth. Afforestation is recognised as an alternative landuse which creates rural employment and drives the national economy. The direct and indirect contribution of the forestry sector to the economy has been calculated at €2.3 billion annually. Afforestation play an important role reaching national CO_2 target emissions "*through carbon sequestration in forests and the provision of renewable fuels and raw materials. Irish forestry is a major carbon sink and afforestation is the most significant mitigation option that is available to Ireland's land use sector".* In order to facilitate this further, the annual target for afforestation by 2020 is 8,290 hectares, an increase in over 2,000 hectares over the past three years.

Table 3-1 Project Ireland 2040 NPF Objectives which relate to forestry

National Policy Objective 23	Facilitate the development of the rural economy through supporting a sustainable and economically efficient agricultural and food sector, together with forestry, fishing and aquaculture, energy and extractive industries, the bio-economy and diversification into alternative on-farm and off-farm activities, while at the same time noting the importance of maintaining and protecting the natural landscape and built heritage which are vital to rural tourism.

3.1.2 Local Policy

3.1.2.1 Roscommon County Development Plan 2014-2020

The current adopted Roscommon County Development Plan (CDP) states that the council acts as a consultee rather than an assessor in relation to forestry development and adhere to the *'Code of Best Forestry Practice – Ireland (2000)'*. The council recognise the benefits of forestry as a method of: boosting the rural economy, encouraging population growth and agricultural diversity, and assisting in Irelands goal of reaching CO_2 target emissions. It is also recognised as a recreational use and therefore the council encourages forestry development. However, any such afforestation proposals must be appropriate in scale and nature with the surrounding environment to the location, comply with the following:

- *"landscapes of scenic value are not unduly eroded.*
- *areas with environmental and archaeological protections are safeguarded.*
- *access from forestry development onto public roads for the purposes of thinning and felling do not compromise traffic safety"*

Roscommon County Council (RCC) requests a mixture of broadleaf and conifer species to be planted where possible in order to support flora and fauna species and to encourage rich biodiversity in the forestry landscape. A planting free zone of 30m along public roads should be observed. Reference should be made to the document *Code of Best Forestry Practice – Ireland* (2000), published by the Forest Service, Department of the Marine and Natural Resources.

Policies and objectives in the Roscommon CDP which relate to forestry can be found in Table 3-2 below.

Table 3-2 Policies and objectives in Roscommon CDP which relate to forestry

Policy 188	RCC shall facilitate forestation in suitable locations in co-operation with the Forest Service and Coillte Teoranta and in accordance with sustainable Forest Management guidelines including; › Forestry and Landscape Guidelines in order to enhance the overall landscape, involving shape, scale, diversity, visual force and unity. › Forestry and Water Quality Guidelines including recommendations in relation to sensitive water catchments, cultivation, drainage, fertilizing and storage, the use of chemicals, herbicides and fuels, road making, bridges and culverts and harvesting Forestry and Archaeology Guidelines designed to ensure that Ireland's rich heritage of archaeological sites and artefacts are not damaged by forest operations. › Forest Biodiversity Guidelines to recognize the importance of the maintenance and enhancement of forest biodiversity and implement the objectives in a forestry context of the National Biodiversity Plan such as structural diversity, retained habitats and open spaces, the retention of

	deadwood, the control of troublesome species and the use of conservation of native species. - Forest Harvesting and Environmental Guidelines to ensure that all forest harvesting operations, including felling, extraction, road and site restoration, are environmentally sustainable.
Policy 189	Facilitate forestation in appropriate locations, in co-operation with Coillte Teoranta and the Forest Service and in line with National policy and the Roscommon LCA (S 3.6 of the LCA Report 2007), while ensuring the no pollution or injury is caused to natural waters, wildlife habitats or conservation areas.
Policy 190	Discourage forestry development in proposed/candidate/adopted SAC's, NHA'S and SPA's, in designated Sensitive Rural Landscapes and in water quality sensitive areas.
Policy 191	Promote appropriate forestry related industries and rural tourism.
Policy 192	Prevent excessive forestation that would negatively impact on rural communities i.e. forestry development should be appropriate to the surrounding area in terms of nature and scale and should not allow that residential development becomes isolated when plantations mature.
Policy 193	Promote mixed species forestry and selective rather than clear felling.
Policy 194	The Council will co-operate with Coillte Teoranta, the Forest Service and private landowners in promoting greater public access and recreational use of Forests in the County.
Policy 195	Have regard to the Bio-energy Action Plan for Ireland 2007, to the Department of Agriculture and Food Best Practice Manuals and to the LCA when considering significant planting of bio energy crops.
Policy 196	RCC shall support the development of the bio-energy industry over the Plan period.

The Roscommon County Development Plan 2021-2027 is currently out for public consultation.

3.1.3 Forest Service Guidelines

3.1.3.1 Environmental Requirements for Afforestation

The *Environmental Requirements for Afforestation* (Forest Service, 2016a), released in December 2016, incorporate more recent developments in relation to environmental regulation, research and changes in forest practices, and consolidate into one single coherent document those measures and safeguards relating to afforestation which were previously contained within the following Forest Service Environmental Guidelines: *Forestry and Water Quality Guidelines*, *Forestry and Archaeology Guidelines*, *Forestry and the Landscape Guidelines*, and *Forest Biodiversity Guidelines*. The use of the word 'requirements' in this document's title was selected over 'guidelines', in order to underline the mandatory nature of the measures therein.

The overall aim of the *Environmental Requirements for Afforestation* is to ensure that the establishment of forests is carried out in a way that is compatible with the protection and enhancement of the environment, in regard to water quality, biodiversity, archaeology, landscape and other environmental receptors. In relation to water, the focus is on reducing and eliminating sources of pollution and preventing the creation of pathways to receiving waters. The Requirements provide an enhanced baseline level of protection regarding afforestation and water, with the water setback representing an important feature. They will also support the *Plan for Forestry and Freshwater Pearl Mussel in Ireland* (DAFM, 2016), by providing an enhanced baseline level of protection regarding afforestation and water.

The *Environmental Requirements for Afforestation* are set out in three stages that reflect the project development process, i.e. pre-application design, site works, and ongoing site management. While some overlap exists, these three stages reflect the typical sequence of activities undertaken by an Applicant and her / his Registered Forester, and the corresponding sequence of mandatory environmental measures that apply, throughout afforestation up until the end of the premium period (or 15 years, for non-grant aided forests).

Afforestation at the proposed replanting land will be carried out in accordance with the *Environmental Requirements for Afforestation* document, as stated in the conditions attached to each Technical Approval.

3.2 Planning History

A planning history search was carried out for the proposed replanting lands and the lands in their immediate vicinity. This entailed reference to the Planning Application search facility and maps on the website of the Planning Authority, i.e. Roscommon County Council. The planning history searches found that planning applications in the vicinity of the proposed replanting lands relate to housing. No projects or plans were identified that would be incompatible with the proposed replanting or give rise to significant cumulative impacts.

4. IMPACT ASSESSMENT METHODOLOGY

The impacts of afforestation at the potential replanting lands described in Section 2.2 of this report have been assessed under the following key environmental headings:

- Biodiversity
- Land, Soils and Geology
- Hydrology and Hydrogeology
- Landscape
- Cultural Heritage
- Air, Climate and Noise
- Human Beings
- Material Assets

Each site is addressed separately under the key environmental headings, and described in terms of Baseline Environment, Impact Assessment, Proposed Mitigation Measures and Residual Impacts and Significance of Effects. The findings of the assessment are presented in Sections 5 to 12 of this report.

Impacts are described in terms of quality, significance, duration and type, where possible. The classification of impacts in this report uses the standard best-practice terms provided in the Environmental Protection Agency (EPA) document, *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2017). Table 1-2 (pp. 1-16 to 1-19) of the Environmental Impact Assessment Report (EIAR) submitted as part of the Coole Wind Energy Development planning application presents a copy of the impact classification terminology.

Appropriate mitigation measures are presented where relevant to reduce, remedy or eliminate potential impacts. Residual impacts are also presented following any impact for which mitigation measures are prescribed.

5. BIODIVERSITY

This section of the report includes accurate descriptions of the baseline ecological environment of the forestry replacement lands, which is based on an appropriate level of survey work that was carried out in accordance with the most appropriate guidelines and methodologies. The assessment then completes a thorough assessment of the impacts of the proposed afforestation on biodiversity. Where likely ecologically significant effects are identified, measures are prescribed to avoid or minimise or compensate for such effects associated with afforestation, at the following locations:

- Magheraboy, Co. Roscommon

This section of the report includes accurate descriptions of the baseline ecological environment of the forestry replacement lands, which is based on an appropriate level of survey work that was carried out in accordance with the most appropriate guidelines and methodologies. The assessment then completes a thorough assessment of the impacts of the proposed afforestation on biodiversity. Where likely ecologically significant effects are identified, measures are prescribed to avoid or minimise or compensate for such effects associated with afforestation at the locations identified above.

5.1 Establishing the Zone of Influence

As described in the CIEEM, 2018 *Guidelines for Ecological Impact Assessment in The UK and Ireland*, *'the 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities'.* The zone of influence will vary with different ecological features, depending on their sensitivities to an environmental change. This may extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries.

The assessment of the site began with a desk study of available published data on sites designated for nature conservation, other ecologically sensitive sites, habitats and species of interest near the proposed development. A review of OSI mapping, online environmental web-mappers and ortho-photography was also undertaken. The baseline information obtained from the desk study was the first stage in defining a zone of influence of the proposed development.

The zone of likely influence for the proposed development varied depending on the ecological receptors identified on site. In the assessment, effects on habitats and species within the site were considered and also the potential for the proposed development to affect habitats and species outside the site.

5.2 Methodology

5.2.1 Field Surveys

An ecological site visit was undertaken at the subject site in November 2020. Habitats were identified in accordance with the Heritage Council's *'Guide to Habitats in Ireland'* (Fossitt, 2000). Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follow '*Mosses and Liverworts of Britain and Ireland - a field guide'* (British Bryological Society, 2010).

The multi-disciplinary walkover surveys were designed to detect the presence, or likely presence, of a range of protected habitats and species. Incidental sighting/observations of birds and additional fauna were noted during the site visits. Surveys were undertaken in accordance best practice guidance (TII, 2008: *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*). During the multi-disciplinary ecological walkover surveys the potential for the study area to support protected mammals listed in the Wildlife Acts, 1976–2019, such as pine marten, red squirrel, Irish hare, pygmy shrew, Irish stoat etc. was assessed.

During the multi-disciplinary walkover surveys, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

Features within the sites were visually assessed for potential as bat roosting habitat using a protocol set out in the Bat Conservation Trust (BCT) Bat Surveys for Professional Ecologists: good practice Guidelines (3rd edn.) (Collins, J (ed.), 2016). Table 4.1 of the BCT Guidelines identifies a grading protocol for assessing structures, trees and commuting/foraging habitat for bats. The protocol is divided into four Suitability Categories: High, Moderate, Low and Negligible.

Seasonal factors that affect distribution patterns and habits of species were considered when conducting the surveys. The potential of the sites to support certain populations (in particular those of conservation importance that may not have been recorded during the field survey due to their seasonal absence or nocturnal/cryptic habits) was assessed. All habitats were readily identifiable, and it is considered that a comprehensive and accurate assessment of the habitats was achieved.

5.2.2 Desk Study

The following sections detail the results of the searches of published material that were consulted as part of the desk study. These included the Site Synopses of relevant designated sites as compiled by the National Parks and Wildlife Service (NPWS) of the Department of Culture Heritage, and the Gaeltacht (CHG) bird and plant distribution atlases and other research publications.

5.2.2.1 Designated Sites

5.2.2.1.1 *European Sites*

The Habitats Directive (together with the Birds Directive) forms the cornerstone of Europe's nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection. In total, the Habitats Directive protects over 1,000 animal and plant species and over 200 'habitat types' (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.

With the introduction of the EU Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) which were transposed into Irish law as S.I. No. 94/1997 *European Communities (Birds and Natural Habitats) Regulations* 1997, the European Union formally recognised the significance of protecting rare and endangered species of flora and fauna, and also, more importantly, their habitats. The 1997 Regulations and their amendments were subsequently revised and consolidated in S.I. No. 477/2011- *European Communities (Birds and Natural Habitats) Regulations* 2011. This legislation requires the establishment and conservation of a network of sites of particular conservation value that are to be termed 'European Sites'. This includes Special Areas of Conservation and Special Protection Areas, as described below.

Special Areas of Conservation

Articles 3 – 9 of the EU Habitats Directive (92/43/EEC) provide the EU legislative framework of protecting rare and endangered species of flora and fauna, and habitats. Annex I of the Directive lists habitat types whose conservation requires the designation of Special Areas of Conservation (SAC). Priority habitats, such as Turloughs, which are in danger of disappearing within the EU territory are also listed in Annex I. Annex II of the Directive lists animal and plant species (e.g. Marsh Fritillary, Atlantic Salmon, and Killarney Fern) whose conservation also requires the designation of SAC. Annex IV lists animal and plant species in need of strict protection such as Lesser Horseshoe Bat and Otter, and Annex V lists animal and plant species whose taking in the wild and exploitation may be subject to management measures. In Ireland, species listed under Annex V include Irish Hare, Common Frog and Pine Marten.

Species can be listed in more than one Annex, as is the case with Otter and Lesser Horseshoe Bat which are listed on both Annex II and Annex IV.

Special Protection Areas

Council Directive 79/409/EEC of 2 April 1976 on the conservation of wild birds (Birds Directive) has been substantially amended several times. In the interests of clarity and rationality the said Directive was codified in 2009 and is now cited as Directive 2009/147/EC. The Directive instructs Member States to take measures to maintain populations of all bird species naturally occurring in the wild state in the EU (Article 2). Such measures may include the maintenance and/or re-establishment of habitats in order to sustain these bird populations (Article 3).

A subset of bird species has been identified in the Directive and are listed in Annex I as requiring special conservation measures in relation to their habitats. These species have been listed on account of inter alia: their risk of extinction; vulnerability to specific changes in their habitat; and/or due to their relatively small population size or restricted distribution. Special Protection Areas (SPAs) are to be identified and classified for these Annex I listed species and for regularly occurring migratory species, paying particular attention to the protection of wetlands (Article 4).

5.2.2.1.2 *Nationally Designated Sites*

Natural Heritage Areas (NHAs) and Proposed Natural Heritage Areas (pNHAs) are heritage sites that were designated for the protection of flora, fauna, habitats and geological sites under the Wildlife (Amendment) Act 2000. These sites do not form part of the Natura 2000 network.

5.2.3 Methodology for Assessment of Impacts and Effects

5.2.3.1 Identification of Target Receptors and Key Ecological Receptors

The methodology for assessment followed a precautionary screening approach with regard to the identification of Key Ecological Receptors (KERs). Following a comprehensive desk study, site visits were undertaken, “Target receptors” likely to occur in the zone of influence of the development were identified. The target receptors included habitats and species that were protected under the following legislation:

- Annexes of the EU Habitats Directive
- Qualifying Interests (QI) of Special Areas of Conservation (SAC) within the likely zone of impact.
- Species protected under the Wildlife Acts 1976-2019
- Species protected under the Flora Protection Order 2015

5.2.3.2 Determining Importance of Ecological Receptors

The importance of the ecological features identified within the study area was determined with reference to a defined geographical context. This was undertaken following a methodology that is set out in Chapter 3 of the ‘*Guidelines for Assessment of Ecological Impacts of National Roads Schemes*’ (NRA, 2009). These guidelines set out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular receptor is of importance on the following scales:

- International
- National
- County
- Local Importance (Higher Value)
- Local Importance (Lower Value)

The Guidelines clearly set out the criteria by which each geographic level of importance can be assigned. Locally Important (lower value) receptors contain habitats and species that are widespread and of low ecological significance and of any importance only in the local area. Internationally Important sites are either designated for conservation as part of the Natura 2000 Network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected flora and fauna. Specific criteria for assigning each of the other levels of importance are set out in the guidelines and have been followed in this assessment. Where appropriate, the geographic frame of reference set out above was adapted to suit local circumstances. In addition, and where appropriate, the conservation status of habitats and species is considered when determining the significance of ecological receptors.

Any ecological receptors that are determined to be of National or International, County or Local importance (Higher Value) following the criteria set out in NRA (2009) are considered to be Key Ecological Receptors (KERs) for the purposes of ecological impact assessment if there is a pathway for effects thereon. Any receptors that are determined to be of Local Importance (Lower Value) are not considered to be Key Ecological Receptors.

5.2.3.3 Characterisation of Impacts and Effects

The proposed development will result in a number of impacts. The ecological effects of these impacts are characterised as per the CIEEM '*Guidelines for Ecological Impact Assessment in the UK and Ireland*' (2018). These guidelines are the industry standard for the completion of Ecological Impact Assessment in the UK and Ireland. This chapter has also been prepared in accordance with the corresponding EPA guidance (EPA 2017). The headings under which the impacts are characterised follow those listed in the guidance document and are applied where relevant. A summary of the impact characteristics considered in the assessment is provided below:

- **Positive or Negative.** Assessment of whether the proposed development results in a positive or negative effect on the ecological receptor.
- **Extent.** Description of the spatial area over which the effect has the potential to occur.
- **Magnitude** Refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population.
- **Duration** is defined in relation to ecological characteristics (such as the lifecycle of a species) as well as human timeframes. For example, five years, which might seem short-term in the human context or that of other long-lived species, would span at least five generations of some invertebrate species.
- **Frequency and Timing.** This relates to the number of times that an impact occurs and its frequency. A small-scale impact can have a significant effect if it is repeated on numerous occasions over a long period.
- **Reversibility.** This is a consideration of whether an effect is reversible within a 'reasonable' timescale. What is considered to be a reasonable timescale can vary between receptors and is justified where appropriate in the impact assessment section of this report.

5.2.3.4 Determining the Significance of Effects

The ecological significance of the effects of the proposed development are determined following the precautionary principle and in accordance with the methodology set out in Section 5 of CIEEM (2018).

For the purpose of Ecological Impact Assessment (EcIA), 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local (CIEEM, 2018).

When determining significance, consideration is given to whether:

- Any processes or key characteristics of key ecological receptors will be removed or changed.
- There will be an effect on the nature, extent, structure and function of important ecological features.
- There is an effect on the average population size and viability of ecologically important species.
- There is an effect on the conservation status of important ecological habitats and species.

The EPA draft *Guidelines on information to be included in Environmental Impact Assessment Reports* (EPA, 2017) and the *Guidelines for assessment of Ecological Impacts of National Road Schemes*, (NRA, 2009) were also considered when determining significance and the assessment is in accordance with those guidelines.

The terminology used in the determination of significance follows the suggested language set out in the Draft EPA Guidelines (2017) as shown in Table 5-1.

Table 5-1 Criteria for determining significance of effect, based on (EPA, 2017) guidelines

Effect Magnitude	Definition
No change	No discernible change in the ecology of the affected feature.
Imperceptible effect	An effect capable of measurement but without noticeable consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight effect	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate effect	An effect that alters the character of the environment that is consistent with existing and emerging trends.
Significant effect	An effect which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound effect	An effect which obliterates sensitive characteristics.

As per TII (NRA, 2009) and CIEEM (2018) best practice guidelines, the following key elements should also be examined when determining the significance of effects:

- The likely effects on 'integrity' should be used as a measure to determine whether an impact on a site is likely to be significant (NRA, 2009).
- A 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives (CIEEM, 2018).

Integrity

In the context of EcIA, 'integrity' refers to the coherence of the ecological structure and function, across the entirety of a site, that enables it to sustain all of the ecological resources for which it has been valued (NRA, 2009). Impacts resulting in adverse changes to the nature, extent, structure and function of component habitats and effects on the average population size and viability of component species, would affect the integrity of a site, if it changes the condition of the ecosystem to unfavourable.

Conservation status

An impact on the conservation status of a habitat or species is considered to be significant if it will result in a change in conservation status. According to CIEEM (2018) guidelines the definition for conservation status in relation to habitats and species are as follows:

- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

As defined in the EU Habitats Directive 92/43/EEC, the conservation of a habitat is favourable when:

- Its natural range, and areas it covers within that range, are stable or increasing
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future
- The conservation status of its typical species is favourable.

The conservation of a species is favourable when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- There is and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

According to the NRA/CIEEM methodology, if it is determined that the integrity and/or conservation status of an ecological feature will be impacted on, then the level of significance of that impact is related to the geographical scale at which the impact will occur (i.e. local, county, national, international).

5.2.3.5 Incorporation of Mitigation

Section 5.3.4 of this document assesses the potential effects of the proposed development to ensure that all effects on Key Ecological Receptors (KERs) are adequately addressed. Where significant effects on Key Ecological Receptors are predicted, mitigation is incorporated into the assessment to address such impacts. The implemented mitigation measures avoid or reduce or offset potential significant residual effects, post mitigation.

5.2.3.6 Limitations

The information provided in this assessment accurately and comprehensively describes the baseline ecological environment following dedicated ecological surveys; provides an accurate prediction of the likely ecological effects of the proposed development; prescribes best practice and mitigation as necessary; and describes the residual ecological impacts.

The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines.

The habitats and species on the site were readily identifiable and comprehensive assessments were made during the field visits. No significant limitations in the scope, scale or context of the assessment have been identified.

5.3 Replacement Area: Magheraboy, Ballaghaderreen, Co Roscommon

The proposed replanting land Magheraboy, Ballaghaderren, Co. Roscommon has been assessed as part of the Afforestation Approval – Form 1 process described above and has obtained Technical Approval for Afforestation from the Forest Service.

5.3.1 Desk Study

The following sections detail the results of the searches of published material that were consulted as part of the desk study for the site.

5.3.1.1 Identification of the Designated Sites Likely Zone of Influence of the Project

Using the Geographic Information System (GIS) software QGIS Version 3.4 designated sites within a within a 15-kilometre radius of the proposed afforestation site were identified. Sites outside 15km were considered but no potential for impact was identified. The Nationally designated sites are listed below in Table 5-2 and all EU designated sites are listed in Table 5-3. Nationally and EU designated sites are displayed in Figure 5-1 and 5-2.

Table 5-2 Identification of Nationally designated sites within the Likely Zone of Impact

Designated Site	Separation Distance (km)	Likely Zone of Impact Determination
Natural Heritage Areas (NHA)		
Bella Bridge Bog NHA	10.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub catchment (Lung_SC_020) to the NHA (Breedoge_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the NHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cornaveagh Bog NHA	11km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub catchment (Lung_SC_020) to the NHA (Breedoge_SC_010/ Boyle_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the

		separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the NHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Tullaghan Bog (Roscommon) NHA	13.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub catchment (Lung_SC_020) to the NHA (Breedoge_SC_010/ Boyle_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the NHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Proposed Natural Heritage Areas (pNHA)		
Tullaghanrock Bog	0.9km	There will be no direct effects as the project footprint is located entirely outside the designated site. Due to the terrestrial nature of the pNHA and the small scale and nature of the afforestation works there is no potential for indirect effects on the NHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Lough Gara	1.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located approximately 6km hydrological distance upstream of Lough Gara. Due to the small scale and nature of the afforestation works there is no potential for indirect effects on the NHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Lough Glinn	7.7km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub catchment (Lung_SC_020) to the pNHA (Lung_SC_020) and there is no hydrological connectivity to this pNHA and no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**

Kilgarriff Bog	9.2km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the pNHA (Moy and Killala Bay/Moy_SC_030) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Tawnaghbed Bog	9.3km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the pNHA (Moy and Killala Bay/Moy_SC_030) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Derrynabrock Bog	9.4km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the pNHA (Moy and Killala Bay/Moy_SC_030) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Bellanagare Bog	9.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the pNHA (Suck_SC_010, Breedoge_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**

Gowlaun Bog	10.2km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the pNHA (Moy and Killala Bay/Moy_SC_030) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact**.
Derrinea Bog	10.4km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the pNHA (Lung_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Flughany Bog	10.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the pNHA (Sligo Bay & Drowse/Owenmore_SC_020, Owenmore_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact**.
Cloonshanville Bog	10.9km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the pNHA (Breedoge_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**

Cloonakillina Lough	11.1km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the pNHA (Sligo Bay & Drowse/Owenmore_SC_020, Owenmore_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Drumalough Bog	11.2km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon (26B)/Lung_SC_020) to the pNHA (Upper Shannon (26D)/Suck_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Ardagh Bog	12.5km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the pNHA (Breedoge_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Carrowbehy/Caher Bog	12.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment (partially) and sub-catchment (Upper Shannon(26B)/Lung_SC_020) to the pNHA (Upper Shannon(26B)/Lung_SC_010, Upper Shannon(26D) Suck_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA.

		No pathway for significant effect was identified and the site is not within the Likely Zone of Impact
Urlaur Lakes	12.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the pNHA (Lung_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Errit Lough	13.1km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the pNHA (Lung_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cloonchambers Bog	13.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon (26B)/Lung_SC_020) to the pNHA (Upper Shannon (26D)/Suck_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Doocastle Turlough	13.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the pNHA (Sligo Bay & Drowse/Owenmore_SC_020) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA.

		No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.
Lough Gower	13.9km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the pNHA (Lung_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Lough O'Flynn	14.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon (26B)/ Lung_SC_020) to the pNHA (Upper Shannon (26D)/ Suck_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**

Table 5-3 Identification of EU Designated sites within the Likely Zone of Impact

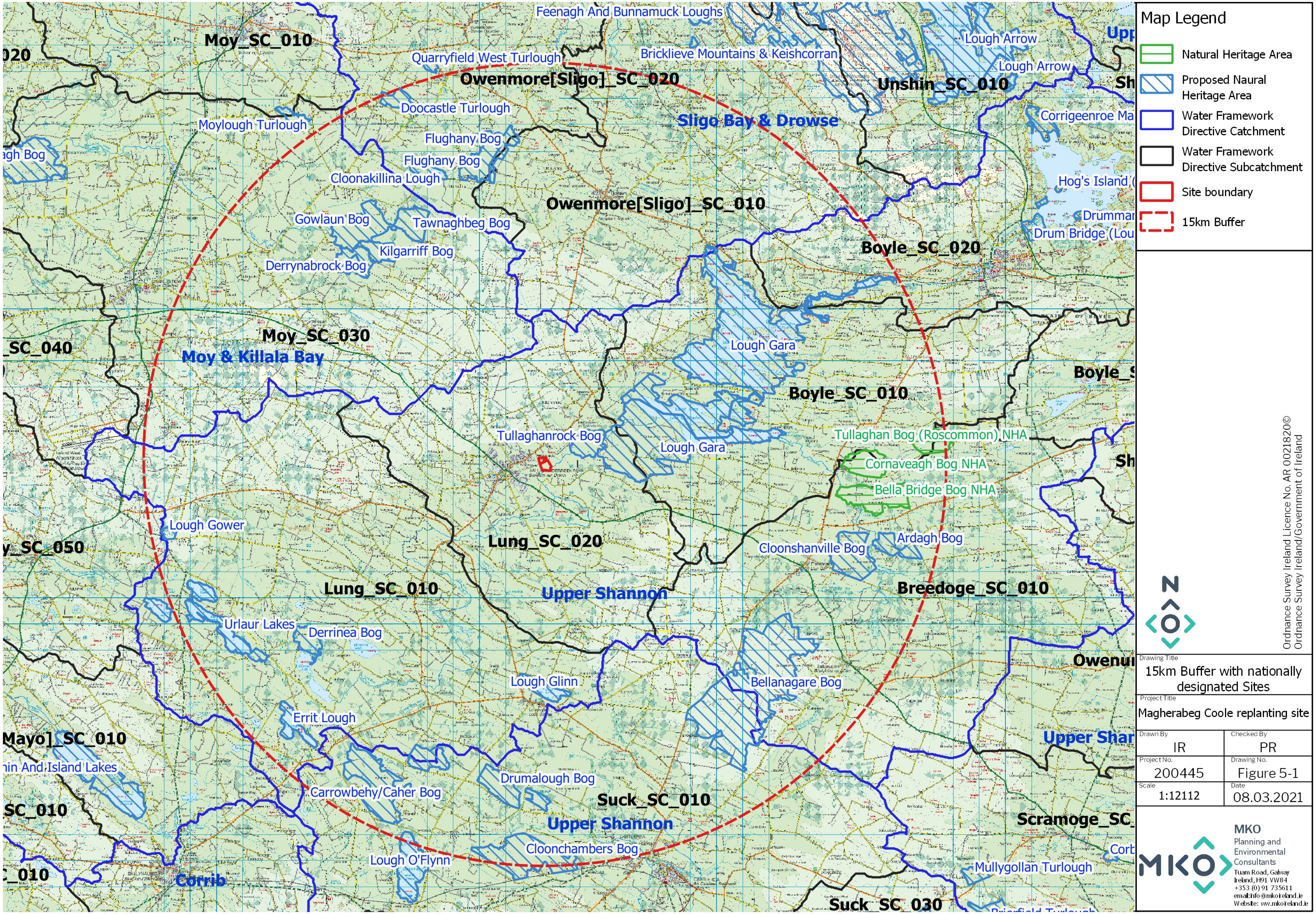
Designated Site	Separation Distance (km)	Likely Zone of Impact Determination
Special Area of Conservation (SAC)		
Tullaghnarock Bog SAC	0.9km	There will be no direct effects as the project footprint is located entirely outside the designated site. Given the terrestrial nature of the SAC and the small scale of the forestry replacement lands, as permitted in the technical approvement document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Callow Bog SAC	1.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. Given the terrestrial nature of the SAC and the small scale of the forestry replacement lands, as permitted in the technical approvement document, there is no potential for indirect effects on the SAC.

		No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.
River Moy SAC	7.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located in a separate hydrological catchment (Upper Shannon(26B)) to the SAC (Moy & Killala Bay(34)). Therefore, there is no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Bellanagare Bog SAC	9.5km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the SAC (Suck_SC_010, Breedoge_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Derrinea Bog SAC	10.4km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the SAC (Lung_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Flughany Bog SAC	10.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the SAC (Sligo Bay & Drowse/Owenmore_SC_020, Owenmore_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**

Cloonshanville Bog SAC	10.9km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the SAC (Breedoge_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cloonakillina Lough SAC	11.1km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the .1 (Sligo Bay & Drowse/Owenmore_SC_020, Owenmore_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Drumalough SAC	11.2km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon (26B)/ Lung_SC_020) to the SAC (Upper Shannon (26D)/Suck_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Carrowbehy/Caher Bog SAC	12.5km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the SAC (Lung_SC_010, Suck_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact**
Urlaur Lakes SAC	12.6km	There will be no direct effects as the project footprint is located entirely outside the designated site.

		The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the SAC (Lung_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Errit Lough SAC	13.1km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the SAC (Lung_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cloonchambers Bog SAC	13.8	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon (26B)/Lung_SC_020) to the SAC (Upper Shannon (26D)/Suck_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Doocastle Turlough SAC	13.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate catchment and sub-catchment (Upper Shannon/Lung_SC_020) to the SAC (Sligo Bay & Drowse/Owenmore_SC_020) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Special Protection Areas (SPAs)		
Lough Gara SPA	3.8km	There will be no direct effects as the project footprint is located entirely outside the designated site.

		The proposed afforestation site is located approximately 6km (hydrological distance) from the SPA. This SPA is designated for Whooper Swan and Greenland White-fronted Goose. The proposed afforestation site comprises rush dominated wet grassland and does not provide supporting habitat for any SCI species associated with the SPA. Therefore, there is no potential for impact as a result of water quality deterioration or disturbance as a result of the proposed afforestation works. There is no potential for indirect effects on the SPA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Bellanagare Bog SPA	9.7km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located within a separate sub-catchment (Lung_SC_020) to the SPA (Suck_SC_010, Breedoge_SC_010) and there is therefore no potential for impact as a result of water quality deterioration. In addition, given the separation in distance, the nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SPA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**


Map Legend
Natural Heritage Area
Proposed Naural Heritage Area
Water Framework Directive Catchment
Water Framework Directive Subcatchment
Site boundary
15km Buffer
Moy_SC_010
Feenagh And Bunnamuck Loughs
Quarryfield West Turlough
Bricklieve Mountains & Keishcorran
Lough Arrow
Owenmore[Sligo]_SC_020
Unshin_SC_010
Doocastle Turlough
Moylough Turlough
Sligo Bay & Drowse
Corrigeenroe Ma
Flughany Bog
Cloonakillina Lough
Hog's Island
Owenmore[Sligo]_SC_010
Gowlaun Bog
Tawnaghbeg Bog
Drum Bridge (Lou
Kilgarriff Bog
Boyle_SC_020
Derrynabrock Bog
Moy_SC_030
Moy & Killala Bay
Lough Gara
Boyle_SC_010
Tullaghanrock Bog
Tullaghan Bog (Roscommon) NHA
Cornaveagh Bog NHA
Bella Bridge Bog NHA
Lough Gower
Lung_SC_020
Cloonshanville Bog
Ardagh Bog
Lung_SC_010
Upper Shannon
Breedoge_SC_010
Urlaur Lakes
Derrinea Bog
Lough Glinn
Bellanagare Bog
Errit Lough
Mayo]_SC_010
Drumalough Bog
Carrowbehy/Caher Bog
Suck_SC_010
Scramoge_SC
Cloonchambers Bog
Lough O'Flynn
Corrib
Mullygollan Turlough
Suck_SC_030
N
Drawing Title
15km Buffer with nationally designated Sites
Project Title
Magherabeg Coole replanting site
Drawn By
IR
Checked By
PR
Project No.
200445
Drawing No.
Figure 5-1
Scale
1:12112
Date
08.03.2021
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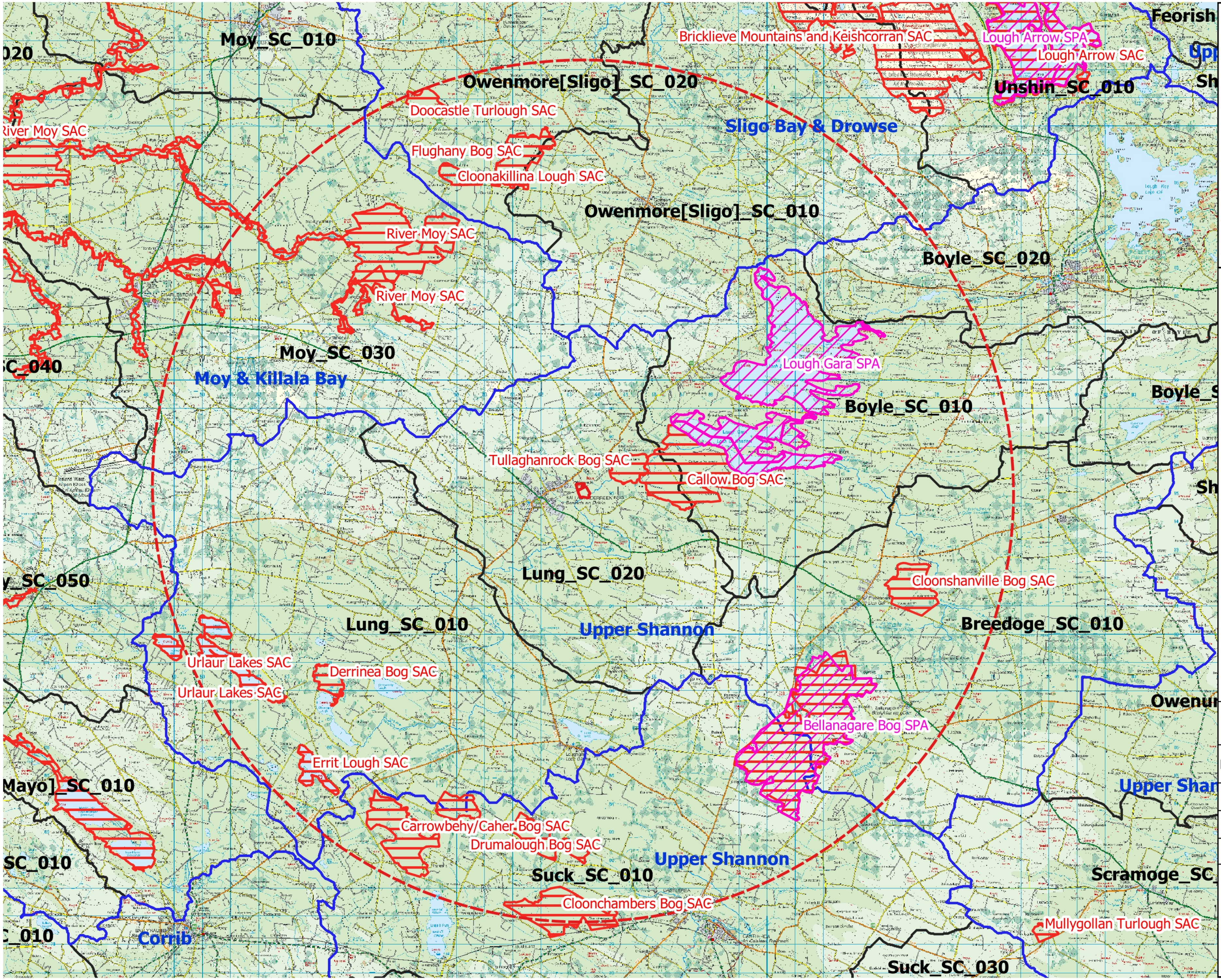

Map Legend

- Special Area of Conservation
- Special Protection Area
- Water Framework Directive Catchment
- Water Framework Directive Subcatchment
- Site boundary
- 15km Buffer

Drawing Title	
15km Buffer with EU designated Sites	
Project Title	
Magherabeg Coole replanting site	
Drawn By: IR	Checked By: PR
Project No.: 200445	Drawing No.: Figure 5-2
Scale: 1:12112	Date: 08.03.2021

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5.3.1.2 New Flora Atlas

A search was made in the New Atlas of the British & Irish Flora (Preston et al, 2002) to investigate whether any rare or unusual plant species listed under Annex II of the EU Habitats Directive, the Ireland Red List of Vascular Plants (Wyse et.al 2016) or the Flora (Protection) Order, 2015 had been recorded in the relevant 10km square in which the study site is situated (M69). The search found one record of rare or protected plant species.

Table 5-4 Species listed designated under the Flora Protection Order or the Irish Red Data Book within Hectad M69

Common Name	Scientific Name	Status
Common moonwort	Botrychium lunaria	Near threatened

5.3.1.3 Biodiversity Ireland Database

A search of the National Biodiversity Data Centre (NBDC) database was conducted with a focus on records of protected fauna recorded from hectad M69. The results of the database search (excluding birds) are provided in Table 5-5 and the results for bird species recorded within the relevant hectads (R11, R12) are provided in Table 5-6. Table 5-7 includes records of non-native invasive species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015).

Table 5-5 NBDC records for species of conservation interest within Hectad M69 [excluding birds]

Species	Designation
European otter *(Lutra lutra)*	WA, EU Habitats Directive – Annex II, IV
Freshwater white-clawed crayfish (*Austropotamobius pallipes)*	WA, EU Habitats Directive – Annex II, V
Marsh fritillary (*Euphydryas aurinia)*	EU Habitats Directive – Annex II, Vulnerable
Daubenton's bat (*Myotis daubentonii)*	WA, EU Habitats Directive -Annex IV
Lesser noctule (*Nyctalus leisleri)*	
Pipistrelle (*Pipistrellus pipistrellus sensu lato)*	
Soprano pipistrelle (*Pipistrellus pygmaeus)*	
Common frog (*Rana temporaria)*	WA, EU Habitats Directive – Annex V
Pine marten (*Martes martes)*	

WA = Wildlife Acts (1976-2019), HD Annex II, III, IV and V = EU Habitats Directive.

Table 5-6 NBDC records for bird species of conservation interest within Hectad M69

Species	Designation
European golden plover (*Pluvialis apricaria)*	WA, EU Birds Directive, - Annex I, II, II, BoCCI - Red List

Greater white-fronted goose (*Anser albifrons)*	WA, EU Birds Directive, Annex I, II, III, BoCCI - Amber List
Corn crake (*Crex crex)*	WA, EU Birds Directive -Annex I, BoCCI -Red List
Common kingfisher (*Alcedo atthis)*	WA, EU Birds Directive -Annex I, BoCCI -Amber List
Common tern (*Sterna hirundo)*	
Hen harrier (*Circus cyaneus)*	
Merlin (*Falco columbarius*)	
Whooper swan (*Cygnus cygnus)*	
Peregrine falcon (*Falco peregrinus*)	WA, EU Birds Directive – Annex I
Grey partridge (*Perdix perdix*)	WA, EU Birds Directive - Annex II, III, BoCCI - Red List
Northern pintail (*Anas acuta*)	
Northern shoveler (*Anas clypeata*)	
Red grouse (*Lagopus lagopus)*	
Eurasian curlew (*Numenius arquata)*	WA, EU Birds Directive – Annex II, BoCCI - Red List
Northern lapwing (*Vanellus vanellus)*	
Barn owl (*Tyto alba)*	WA, BoCCI - Red List
Black-headed gull *(Larus ridibundus*)	
Common redshank (*Tringa totanus)*	
Herring gull (*Larus argentatus*)	
Yellowhammer (*Emberiza citrinella)*	

WA = Wildlife Acts (1976-2019), BoCCI = Birds of Conservation Concern; EU Birds Directive Annex I.

Table 5-7 NBDC records for invasive species in Hectad M69

Common Name	Scientific Name
American mink	*Mustela vison*
Canadian waterweed	*Elodea canadensis*
Japanese knotweed	*Fallopia japonica*
Rhododendron	*Rhododendron ponticum*
Zebra mussel	*Dreissena (Dreissena) polymorpha*

5.3.1.4 Local Hydrology

The following information on the local and regional hydrological regime of the site is based on that described in Section 7 of this replanting assessment and is provided here for context. Further detail on the hydrological conditions on site are fully escribed in Section 7. The Lung River flows along the southern and south-eastern boundary of the site and there is one smaller stream bordering the western and south-western edge of the site. These watercourses provide hydrological connectivity with Lough Gara approximately 5.5km (hydrological distance) downstream. There are several manmade drains within the site and surrounds that are in place predominately to drain the surrounding lands for agricultural purposes.

The site is located within the Upper Shannon Catchment IE_26B and within the Lung_SC_020 subcatchment. The Upper Shannon Catchment comprises 12 sub catchments with 58 river water bodies, 23 lakes 15 groundwater bodies. There is one artificial water body in the Upper Shannon Catchment, namely, the Royal Canal.

5.3.1.5 Freshwater Pearl Mussel Sensitive Areas

The site is not located within a freshwater pearl mussel (*Margaritifera margaritifera*) sensitive area. The site has no connectivity to any freshwater pearl mussel sensitive areas.

5.3.1.6 Article 17 Habitat Areas

No EU Habitats Directive Article 17 habitat polygons were recorded within or immediately adjacent to the proposed replanting sites. The most proximal Article 17 habitats have been identified as Wet heath, Dry heath and Active blanket bog and are located approximately 4.2km north east of the site. There is no direct hydrological connectivity between the proposed afforestation site and the Article 17 habitats.

5.3.1.7 Conclusions of the Desktop Study

The afforestation site is not located within any site designated for nature conservation. The proposed afforestation site is located upstream of Lough Gara SPA/pNHA, Tullaghnarock Bog SAC/ pNHA and Callow Bog SAC. Tullaghnarock Bog SAC and Callow Bog SAC are designated for terrestrial habitats. Lough Gara SPA/pNHA is designated for Whooper Swan and Greenland White-fronted Goose. Given the small scale and nature of the works, the terrestrial nature of the European sites and the lack of supporting habitat for any SCI species associated with any European sites, no pathway for significant effect was identified and no sites were considered to be within the Likely Zone of Impact of the proposed works.

The mammal species recorded within the relevant hectad have widespread range and distributions in Ireland and are likely to be recorded frequently throughout Ireland (Marnell et al, 2009[3]). The site is not located within a freshwater pearl mussel 'sensitive area'. The desk study also provided useful information to inform the ecological surveys undertaken on site as well as the identification of pathways for potential impact on sensitive ecological receptors.

5.3.2 Description of Habitats within the Study Area

An MKO ecologist site visit was carried out on 19th November 2020. The site consists of ***Wet grassland (GS4)*** dominated by soft rush (*Juncus effusus*), grasses and sedges which were grazed by cattle, leaving only a few cm in height. Other species include yellow iris (*Iris pseudacoris*), creeping buttercup (*Ranunculus repens*), mint (*Mentha aquatica*) and great willowherb (*Equilobium hirsutum*) (Plate 5-1).

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[3] *Marnell, F., Kingston, N. & Looney, D. (2009) Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.*

At the time of visit, parts of the site were waterlogged and floating sweet-grass (*Glyceria fluitans*) was found growing in a few submerged linear areas traversing the site in a west-east direction (Plate 5-2). Single hawthorn trees (*Crataegus monogyna*) were found along the sides of the dismantled railway that traverses the site and bramble (*Rubus fructicosus* agg.) can be found associated with elevated ridges found throughout the site.

The site is bordered by Lung River (Plate 5-3), a ***Depositing/lowland river (FW2)*** to the south and one smaller river (unnamed) flowing into River Lung borders the west of the site and flows into the Lung River. Several ***Drainage ditches (FW4)*** traverse the site, one borders the site to the east and north-east (Plate 5-4).

Field boundaries in the form of ***Treelines (WL2)*** dominated by ash (*Fraxinus excelsior*) can be found on the north-west and north-east of the site (Plate 5-3). ***Hedgerows (WL1)*** dominated by hawthorn with an understory dominated by bramble and ivy (*Hedera helix*) can be found at the north-west and north-east of the site, and short stretches of hawthorn can be found associated with the watercourses and the dismantled railway (Plate 5-1) running from the north to the south through the site.

Plate 5-1 Juncus effusus dominated wet grassland habitat with waterlogged area at the front and view of hawthorn trees along the dismantled railway, grazing evident.


Plate 5-2 Submerged area with floating sweetgrass


Plate 5-3 River Lung as it runs along the south of the site

Plate 5-4 Small waterway to the east of the site, overgrown with watercress

Plate 5-5 Hedgerow and treeline at the north-east of the site.

5.3.2.1 Significance of Habitats

Ecological evaluation follows a methodology that is set out in Chapter 3 of the 'Guidelines for Assessment of Ecological Impacts of National Roads Schemes' (NRA, 2009). The habitats within and adjacent to the works site were evaluated in accordance with the criteria developed by the NRA (2009b), which classifies sites in terms of their ecological importance, i.e., '*international importance*', '*national importance*', '*county importance*', '*local importance (higher value)*' or 'local importance (lower value)'.

No habitats which correspond to those that are listed in Annex I of the EU Habitats Directive were identified during the site visit. The wet grassland habitat with interspersed bramble shrub that is present within the site, given its modified nature and low species diversity, is of *Local Importance (Lower Value)* as it contains areas which are of some local importance for wildlife. Hedgerow and treelines habitat were assigned a significance of *Local Importance (Higher Value)* as they have a higher level of biodiversity within the context of the local environment and provide cover and commuting corridor links between habitats of higher ecological value. The watercourses adjacent to the site are of *Local Importance* (*Higher Value*) as they provide habitat and food for local aquatic and semi-aquatic species (e.g., otter).

5.3.3 Fauna in the Existing Environment

Birds

Records of birds seen and heard on the forestry replacement site were taken. The following species were observed:

- Blackbird *Turdus merula*
- Grey heron *Ardea cinerea*
- Hooded crow *Corvus cornix*
- Magpie *Pica pica*
- Starling *Sturnus vulgaris*
- Wren *Troglodytes troglodytes*

No birds listed on Annex I of the EU Birds Directive were recorded during the field survey. The site provided habitat for a range of common and widespread species but was not of significance for rare or protected bird species. Given the lack of significant habitat for rare or protected bird species, there is no requirement for further bird surveys at the site.

Terrestrial Mammals

No evidence of badger was recorded during the site visit and no other protected mammal species, or evidence of such species, were recorded within the site boundary. A single fox scat was recorded within the centre of the site. No species listed under Annex II of the Habitats Directive were recorded during the site visit.

Otter

The Lung River runs along the southern boundary of the site and provides suitable habitat for otter. The heavily vegetated drainage ditches that occur within the site do not provide suitable habitat for otter, nor do they provide significant connectivity to other watercourses used by otter. No evidence of otter was recorded within the site though this species is anticipated to use the river for commuting and foraging.

Bats

There are no structures within the site which may provide suitable roosting habitat for bats. The site is dominated by open wet grassland with a number of linear hedgerow and treeline features that may be used by the local bat population for commuting and foraging. Overall, the site is considered to have low suitability for bat species.

5.3.3.1 Significance of Fauna

No evidence of Annex listed species, or other species of conservation concern were recorded within the site boundaries.

Bird species recorded within the site boundaries are common generally and assigned a value of Local Importance (Lower Value). The forestry replacement site provides some limited foraging, commuting and nesting habitats for these and other common bird species in general. Similar habitat is widespread in the locality.

No protected fauna associated with any nearby European Sites were recorded within the proposed afforestation site on the day of the site visit.

No QI or SCI faunal populations of ecological significance were recorded within or adjacent to the proposed replanting site boundary. Overall, given its agricultural nature, it is considered that the site of the proposed afforestation is of relatively low value to faunal species.

5.3.4 Impact Assessment

5.3.4.1 Do Nothing Impact

Were the site to remain unplanted the management on site would likely remain as it is presently i.e., grazed wet grassland with some treelines and hedgerows demarcating field boundaries. However, given that the site has received Technical Approval from the Forest Service as described above it will be afforested per the provisions of the approval at a later date.

5.3.4.2 Loss of Floral Habitat

Long-Term Neutral Impact

The proposed afforestation will result in the loss of wet grassland habitat assigned Local importance (lower value). These habitats are common in the wider landscape and the loss of these habitats is not considered to be significant.

The treelines and hedgerows along the borders of the site will be retained.

The impacted habitat is not considered to be of ecological sensitivity and their loss will constitute a neutral impact when compared with the coniferous forestry to be planted. The loss of these habitats is not considered significant at any geographic scale.

Mitigation

Despite the fact that the loss of habitats on the site of the proposed replanting site is not a significant ecological effect, all works will be carried out in accordance with the relevant Forest Service requirements, including 'Forestry Biodiversity Guidelines' (2000)'. All hedgerows and existing treelines along the borders of the site will be retained and appropriate set-back applied as per the Forest Service document 'Environmental Requirements for Afforestation (2016)'. The Technical Approval document specifies the area that should contain a suitable broadleaf and conifer species. This management would allow for the retention of the Local Value (Higher Importance) habitats.

Residual Impact

The replacement of grassland habitat with forestry is considered to be a Long Term Neutral Impact. No significant effects are anticipated.

5.3.4.3 Loss of Faunal Habitat

Long Term Neutral Impact

The proposed planting site is dominated by wet grassland and is not of high value or importance to local faunal species, with limited cover or shelter restricted to hedgerow and treeline habitats. It is likely that the proposed planting of forestry will result in some loss of foraging or breeding habitat for some faunal species. Wet grassland habitats are widespread in the local area and this loss is not considered to be significant.

The proposed afforestation site does not provide significant foraging or roosting habitat for protected bird species given the highly managed/modified nature of habitats on site, dominated by wet grassland. Given the lack of significant bird assemblages recorded within or adjacent to the site, significant impacts as a result of disturbance or displacement are not anticipated on bird species at any geographic scale.

Treelines and hedgerow provide bat commuting and foraging habitat, there will be no loss of hedgerow or trees as part of the proposal and therefore no impacts on bat commuting and foraging habitat. Some individual Hawthorn trees within the field will be removed as part of the afforestation.

Possible habitat for otter was identified to the south of the site. No instream works will take place and a minimum buffer of 10m will be retained from adjacent watercourses.

The afforestation, in particular that of broadleaf species will result in the creation of cover and nesting habitat for a range of bird species, resulting in an overall Long-Term Neutral Impact.

Mitigation / Best Practice

- All works will be carried out in accordance with the relevant Forest Service requirements, including 'Forestry Biodiversity Guidelines' (2000)'.
- All hedgerows and existing treelines around the boundary of the site will be retained and appropriate set-back applied as per the Forest Service document '*Environmental Requirements for Afforestation (2016)*'.
- Vegetation clearance will be carried out in line with the Wildlife Acts.

Residual Impact.
No significant effects on faunal habitat as a result of the proposed afforestation is anticipated.

5.3.4.4 Water Pollution & Aquatic Fauna

Short-Term Negative Impact

There is hydrological connectivity between the proposed afforestation site and Lough Gara, which is designated as an SPA/pNHA and potential for localised water pollution of the Lung River, smaller streams and drainage ditches within the site in the form of release of suspended solids, siltation and erosion.

Mitigation/Best Practice

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures; and,
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Environmental Requirements for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Land Types for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which will be applied at the replanting site. These include:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of excavation and felling, and which will minimise surrounding soils disturbance;
- Where possible, existing drains will not be disturbed during drainage works;
- Drains and sediment traps will be installed during ground preparation and felling. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;
- Drains and silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled.

Buffer Zones

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the *Environmental Requirements for Afforestation* (DAFM 2016) are shown in Table 5-7.

Table 5-8 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	20 m
Steep	(15 – 30%)	15 m	25 m
Very steep	(>30%)	20 m	25 m

Residual Impact

No adverse residual impacts on water quality are anticipated following the implementation of the measures and best practice described above.

5.3.4.5 Impact on Designated Sites

The site was subject to the Forest Service AA procedure as part of the technical approval process as per Table 5-2 above. There are no European sites within in the Likely Zone of Impact. The impact on nationally designated sites was assessed as per Table 5-3 above and there were no Natural Heritage Areas (NHA) or proposed Natural Heritage Areas (pNHAs) identified within the Likely Zone of Impact.

5.3.4.6 Cumulative Impacts

The impact assessment undertaken in this EIAR outlines that significant effects from the proposed replanting lands on hydrology and hydrogeology are unlikely. A planning history search of applications in the vicinity of the proposed replanting lands has also been carried out, as described in Section 3.2 of this report. There are no developments located in the vicinity of the site that would give rise to cumulative impacts in conjunction with the proposed replanting lands.

The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in combination with the other land uses in the area and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.

5.3.5 Conclusion

Following consideration of the residual effects (post mitigation) it is concluded that the proposed replanting site will not result in any significant effects on any of the identified KERs. No significant effects on receptors of International, National or County Importance were identified.

No potential for significant effects on the Key Ecological Receptors have been identified. No EU Habitats Directive Annex I listed habitats were identified within the site. No protected faunal species were records within the site, although the site is likely to be used by regularly occurring common and widespread species that are common in a local and National context.

Taking the above information into consideration and having regard to the precautionary principle, the proposed afforestation project will not result in any significant effect at any geographic scale and will not have any significant impacts on the ecology of the wider area.

Provided that the proposed afforestation is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, significant impacts on ecology are not anticipated at any geographic scale.

6. LAND, SOILS AND GEOLOGY

6.1 Introduction

This section of the report provides baseline information on the environmental setting of the approved afforestation lands in terms of soils and geology and discusses the potential impacts and associated effect that the activity may have on them. Where required, appropriate mitigation measures to limit any identified significant impacts to land, soils and geology are recommended.

6.1.1 Desk Study

This desk study involved collecting all relevant geological data for each site and its surrounding area. This included consultation of the following resources:

- Environmental Protection Agency database (www.epa.ie)
- Geological Survey of Ireland (GSI) - National Draft Bedrock Aquifer Map
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie)
- Bedrock Geology 1:100,000 Scale Map Series. (GSI, 2003)
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets
- General Soil Map of Ireland, 2nd edition (www.epa.ie)

6.1.2 Impact Assessment Methodology

Using information from the desk study, an estimation of the importance of the soil and geological environment within each of the study areas is assessed using the criteria set out in the *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* (NRA, 2005) and presented below in Table 6-1.

Table 6-1 Estimation of Importance of Soil and Geology Criteria (NRA, 2005)

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Moderately sized existing quarry or pit. Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes.

Importance	Criteria	Typical Example
	Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.

The statutory guidelines (EPA, 2017, 2003 and 2002) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, complexity, probability, duration, frequency, reversibility and trans-frontier nature (if applicable). The descriptors used in the EIAR are those set out by the EPA (EPA, 2017) Glossary of Impacts as shown in Chapter 1 of the EIAR which accompanies the application. In addition, the two impact characteristics, proximity and probability, are described for each impact, and these are defined in Table 6-2.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of impacts are related to examples of potential impacts on the hydrology and morphology of the existing environment, as listed in Table 6-3.

Table 6-2 Additional Impact Characteristics

Impact Characteristic	Degree / Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

Table 6-3 Impact Descriptors Related to the Receiving Environment

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative Only	Profound	Widespread permanent impact on: - The extent or morphology of a cSAC. - Regionally important aquifers. - Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: -The extent or morphology of a cSAC / ecologically important area.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
		-A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). -Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: - The extent or morphology of a cSAC / NHA / ecologically important area. - A minor hydrogeological feature. - Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends.
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

6.2 Proposed Replanting Lands

6.2.1 Geology and Subsoils

Information on the main geological formations and subsoils underlying the replanting area is shown in Table 6-4.

Table 6-4 Information on geology and subsoil information – Magheraboy, Co. Roscommon.

Geological Formation	Subsoil Type
› Boyle Sandstone Formation	› Cutover peat

The site is underlain by cutover peat over the Boyle Sandstone Formation which is comprised of sandstones and red-green conglomerates.

The surrounding area is largely underlain with similar bedrock to the site with the Kilbryan Limestone Formation also present. Additional subsoils identified in the surrounding area include alluvium and till derived from Devonian and Carboniferous sandstones and shales.

6.2.1.1 Geological Resource Importance

The GSI online Aggregate Potential Mapping Database shows that the proposed site is located within an area mapped as having a 'Very Low' Potential in terms of crushed rock aggregate potential. The GIS database shows the Proposed Site does not have granular aggregate potential (i.e. potential for gravel reserves).

The bedrock at the site could be classified as "Low" importance. The bedrock could be used on a "sub-economic" local scale for construction purposes. The bedrock at the site has not been used in the past for this purpose and the proposed replanting does not propose to do so.

The peat deposits at the site could be classified as "low" importance. While peat has not been cut at this site, it is not designated in this area, is of a small volume, is used for agricultural purposes and is poorly drained. Refer to Table 6-1 for criteria.

6.2.1.2 Geological Heritage and Designated Sites

There are no recorded Geological Heritage sites, mineral deposit sites or mining sites (current or historic) within the proposed replanting area.

6.2.1.3 Potential Impacts

6.2.1.3.1 *'Do-Nothing' Scenario*

The lands have been Technically Approved and will be afforested should the Coole Wind Energy Development proceed or not. If the land was not replanted, the current landuse would continue at the site i.e. grazed wet grassland.

6.2.1.4 Planting Phase

6.2.1.4.1 *Likely and Significant Impacts and Associated Mitigation Measures*

The likely impacts of the proposed planting and mitigation measures that will be put in place to eliminate or reduce them are described below.

Construction of Drains and Planting of Trees

There will be some minor disturbance of soils, associated with the construction of drains through the site. Planting of trees will be carried out by hand using the slit planting method, so soil disturbance from this will be insignificant. There are no likely impacts of this afforestation on the underlying geology.

Site Roads & Tracks Construction

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required.

6.2.1.4.2 *Mitigation Measures*

Planting of trees will be carried out by hand. Any drains will be generally shallow and will be constructed in accordance with the measures outlined in the *Forestry Standards Manual* and *Environmental Requirements for Afforestation* described in detail in Section 2.3. Soils will remain in situ at the site and will not be removed offsite.

6.2.1.5 Operational Phase

There will be no significant indirect or direct impacts on soils and geology once the site has been afforested.

6.2.1.5.1 *Residual Impact*

There will be no impacts on soils and geology associated with the proposed afforestation.

6.2.1.6 Significance of the Effects

Based on the above, there will be no significant effects on soils and geology at this site.

6.2.1.7 Cumulative Impacts

The geological impact assessment undertaken above outlines that significant effects are unlikely. Impacts on land soil and geology will not extend beyond the immediate vicinity of the replanting site.

A planning history search of applications in the vicinity of the proposed replanting lands has also been carried out, as described in Section 3.2 of this report. There are no developments located in the vicinity of the site that would give rise to cumulative impacts in conjunction with the proposed replanting lands.

7. HYDROLOGY AND HYDROGEOLOGY

7.1 Introduction

7.1.1 Background and Objectives

MKO was engaged to undertake an assessment of the potential impacts and associated effect of forestry planting at the replanting site on water aspects (hydrology and hydrogeology) of the receiving environment. The objective of the assessment is to:

- Produce a baseline study of the existing water environment (surface and groundwater) in the area of the site locations;
- Identify likely positive and negative impacts of the proposed development on surface and groundwater during all phases of the development; and,
- Identify mitigation measures to avoid, remediate or reduce significant negative impacts.

This section of the report provides baseline information on the environmental setting of the approved afforestation sites in terms of hydrology and hydrogeology and discusses the potential impacts that the activity may have on them. Where required, appropriate mitigation measures to limit any identified significant impacts to site hydrology and hydrogeology are recommended.

7.1.2 Methodology

7.1.2.1 Desk Study

A desk study of the site and the surrounding areas involved collecting all relevant geological, hydrological, hydrogeological and meteorological data for the area. This included consultation with the following resources:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland – Spatial Resources Map (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive “WaterMaps” Map Viewer (www.wfdireland.ie);
- OPW Flood Maps (www.floodinfo.ie); and
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie).

7.1.2.2 Impact Assessment Methodology

Please refer to Chapter 1 of the EIAR which accompanies the application for details on the impact assessment methodology (EPA, 2002, 2003 & 2017). In addition to the above methodology the sensitivity of the water environment receptors were assessed on completion of the desk study. Levels of sensitivity which are defined in Table 7-1 are then used to assess the potential effect that the proposed replanting may have on them.

Table 7-1 Receptor Sensitivity Criteria (adapted from www.sepa.org.uk)

Sensitivity of Receptor	
Not Sensitive	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as A3 waters or seriously polluted), fish sporadically present or restricted). Heavily engineered or artificially modified and may dry up during summer months. Environmental equilibrium is stable and is resilient to changes which are considerably greater than natural fluctuations, without detriment to its present character. No abstractions for public or private water supplies. GSI groundwater vulnerability “Low” – “Medium” classification and “Poor” aquifer importance.
Sensitive	Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as A2. Salmonid species may be present and may be locally important for fisheries. Abstractions for private water supplies. Environmental equilibrium copes well with all natural fluctuations but cannot absorb some changes greater than this without altering part of its present character. GSI groundwater vulnerability “High” classification and “Locally” important aquifer.
Very Sensitive	Receptor is of high environmental importance or of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as A1 and salmonid spawning grounds present. Abstractions for public drinking water supply. GSI groundwater vulnerability “Extreme” classification and “Regionally” important aquifer.

7.2 Proposed Drainage

The proposed replanting lands will be drained in accordance with the measures outlined in the *Forestry Standards Manual* and *Environmental Requirements for Afforestation* described in detail in Section 2.3.3. Forestry plantations are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains are generally spaced approximately every 15m. Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. A schematic of a typical standard forestry drainage network and one which is representative of the proposed site drainage network is shown in Figure 2-2 of this report.

7.3 Baseline Environment and Local Hydrology

Ground level elevations at the replanting site are at approximately 70m OD.

There are no streams or rivers within the Proposed Site boundary, however the Lung River flows in easterly direction along the southern boundary of the site. An unnamed stream flows in a southerly direction along the western site boundary discharging into the Lung River at the southwest of the site.

There are numerous manmade drains within the site and surrounds that are in place predominately to drain the surrounding lands for agricultural purposes.

7.3.1 Water Balance

While the process of afforestation may result in a slight alteration in the water runoff of the site, the small size of the site (0.165 km^2) when compared with the Upper Shannon Catchment 26B (674km^2) means that any potential impacts this may have would be insignificant. The afforestation will lead to an imperceptible reduction in the runoff volumes in the longer term as the trees mature.

7.3.2 Regional Hydrology

The site is located within the Upper Shannon Catchment IE_26B and forms part of the Lung subcatchment_SC_020. The Upper Shannon Catchment comprises six subcatchments, with 28 river and 15 lake water bodies, and eight groundwater bodies.

7.3.3 Flood Risk Identification

OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), Department of Environment, Community and Local Government on-line planning mapping (www.myplan.ie) were consulted to identify those areas as being at risk of flooding.

No records or risks associated with flooding were identified in the published data sets. The OPW flood map notes that the Lung River and unnamed stream forms part of an arterial drainage scheme which is maintained by the OPW. The OPW maps also notes that the site was also drained as part of the scheme.

7.3.4 Surface Water Hydrochemistry

Slightly acidic pH values of surface waters would be typical of peatland environments due to the decomposition of peat. In addition, the limestone bedrock (and related till subsoils) which underlie the area would have slightly acidic groundwater characteristics which would have some effect on surface water chemistry specifically during dry periods when baseflow is likely to be more prevalent.

7.3.5 Hydrogeology

According to the GSI www.gsi.ie, the site is underlain by the Boyle Sandstone Formation which is comprised of sandstones and red-green conglomerates (refer to Section 6 – Soils & Geology). The GSI has classified the bedrock formation here as a Locally Important Aquifer (Ll) - bedrock which is moderately productive only in local zones.

7.3.5.1 Groundwater Vulnerability

The GSI and EPA has assigned a groundwater vulnerability rating of 'Low' which would indicate the presence of at least 10m of low permeability till in these sections of the site.

7.3.6 Surface Water Body Status

The EU Water Framework Directive aims to protect, enhance and restore all waters with aim to achieve at least good status by 2027.

The Water Framework Directive Status Report 2013 - 2018, published by the EPA has classified the Lung River and the unnamed stream as having a 'Good' status and not at risk.

7.3.7 Groundwater Body Status

The EPA has classified the groundwater within the aquifer underlying the site as being of 'Good' status and not at risk.

7.3.8 Designated Sites and Habitats

Designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (SACs) Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The proposed forestry replanting site is not located within any designated conservation-site. Designated sites in proximity to the proposed replanting site are described Section 5 Biodiversity.

7.3.9 Water Resources

There are no borehole wells within or adjacent to the site. The nearest well (GSI name: 1429SEW016) is located 360m to the north of the proposed replanting area and was constructed in 1899.

7.3.10 Receptor Sensitivity

As afforestation is a near-surface construction activity, impacts on groundwater are largely negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the site is from nutrients associated with fertilisers.

Based on criteria set out in Table 7-1 groundwater at the site can be classed as Sensitive to pollution because the sandstone bedrock is classified as a locally important Aquifer. However, the site is covered in blanket peat and sandstone and shale till which acts as a protective cover to the underlying aquifer. Any contaminants which may be accidently released on-site are more likely to travel to nearby streams within surface runoff.

Surface waters such as the Lung River and unnamed stream are sensitive to potential contamination. Surface water mitigation and controls are outlined below to ensure protection of all downstream receiving waters. Mitigation measures will ensure that surface runoff from the afforested areas of the site will be of a high quality and will therefore not impact on the quality of downstream surface water bodies.

7.3.11 Proposed Site Drainage

The site will be drained in accordance with the measures outlined in the *Forestry Standards Manual* and *Environmental Requirements for Afforestation*. Forestry plantations are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains are generally spaced approximately every 15m. As illustrated in Figure 2-2, Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. A schematic of a typical standard forestry drainage network and one which is representative of the proposed site drainage network is shown above as Figure 2-2.

7.3.12 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against impacts on surface water bodies. Two distinct methods will be employed to manage drainage water within the proposed replanting site. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features. The second method involves collecting any drainage waters from planted areas within the site that might carry silt or sediment, and nutrients, using cut off drains to control direct discharge into streams.

7.4 Potential Impacts

The potential impacts of the proposed replanting and mitigation measures that will be put in place to eliminate or reduce them are set out below.

7.4.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Coole Wind Energy Development proceed or not. If the land was not replanted, the current land use would continue at the site i.e. grazed wet grassland.

7.4.2 Likely and Significant Impacts and Associated Mitigation Measures – Planting Phase

7.4.2.1 Excavation of Forestry Drains and Planting

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters and associated dependent ecosystems.

Potential Impacts: Indirect, negative, slight, short term, medium probability impact.

Shallow forestry drains will be constructed using an excavator throughout the site to a similar drainage pattern as Figure 2-2. There are no surface watercourses on the site and so the drains will ultimately discharge to the existing offsite field drain networks.

Potential impacts during drain construction occur mainly from:

- Exposure of soil and subsoils due to excavation, vehicle tracking, and skidding resulting in a source of suspended sediment which can become entrained in surface water runoff and enter drains; and,
- Nutrient release.

7.4.2.2 Harvesting Operations

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters and associated dependant ecosystems.

Potential Impacts: Indirect, negative, moderate, short term, medium probability impact.

Potential impacts during tree felling occur mainly from:

- Exposure of soil and subsoils due to vehicle tracking, and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

7.4.2.3 Site Access

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required.

7.4.3 Proposed Mitigation Measures

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:

- Forestry Standards Manual (DAFM, 2015);
- Environmental Requirements for Afforestation (Forest Service (2016);
- Forests and Water Guidelines, Fourth Edition. Publ. (Forestry Commission, Edinburgh 2004);
- Forest Operations & Water Protection Guidelines (Coillte 2013);
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures.

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which are set out as follows:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of excavation and felling, and which will minimise surrounding soils disturbance;
- Where possible, existing drains will not be disturbed during drainage works;
- Drains and sediment traps will be installed during ground preparation and felling. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour; and,
- Drains and silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled.

Buffer Zones

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the *Environmental Requirements for Afforestation* (DAFM 2016) are shown in Table 7-2.

Table 7-2 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	20 m
Steep	(15 – 30%)	15 m	25 m
Very steep	(>30%)	20 m	25 m

7.4.3.1.2 *Residual Impact*

Indirect, slight, short term, low probability impact.

7.4.3.2 Potential Release of Hydrocarbons during drainage works

Pathway: Groundwater flow paths and site drainage network.

Receptor: Groundwater and surface water.

Potential Impact: Indirect, negative, slight, temporary, medium probability impact to surface water quality.

Indirect, negative, slight, temporary, medium probability impact to local groundwater quality.

The replanting will be carried out by hand, but it may be necessary to employ one excavator to create shallow drainage channels prior to planting. There is the potential for minor leaks from the excavator.

7.4.3.2.1 *Proposed Mitigation Measures*

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Maintenance will not be carried out on site.
- Fuels will not be stored on site.
- The plant used will be regularly inspected for leaks and fitness for purpose.

7.4.3.2.2 *Residual Impact*

Indirect, negative, imperceptible, short term, low probability impact.

7.4.3.3 Potential Hydrological Impacts on Designated Sites

The proposed afforestation site is located within the Upper Shannon 26B catchment. There will however be no direct discharges from the site and the hydrological regime locally will not be altered by the afforestation due to its small scale.

Pathway: Surface water flow paths.

Receptor: Down-gradient water quality & designated sites.

Potential Impact: Indirect, negative, imperceptible, short term, low probability impact.

7.4.3.3.1 *Impact Assessment & Proposed Mitigation Measures*

The proposed mitigation measures which will include buffer zones and drainage control measures (*i.e.* cut off drains, tapered drains before buffer zones) will ensure that the quality of runoff from proposed replanting areas will be very high. The proposed replanting site is located in the Upper Shannon catchment. There could potentially be an "*imperceptible, short term, low probability impact*" on local streams and rivers but this would be very localised and over a very short time period (*i.e.* hours).

7.4.3.3.2 *Residual Impact*

No residual impacts.

7.4.3.4 Operational Phase

There will be no significant indirect or direct impacts on hydrology and hydrogeology once the site has been afforested.

7.4.3.4.1 *Residual Impact*

No residual impacts.

7.4.3.5 Cumulative Impacts

The impact assessment undertaken above outlines that significant effects from the proposed replanting lands on hydrology and hydrogeology are unlikely. A planning history search of applications in the vicinity of the proposed replanting lands has also been carried out, as described in Section 3.2 of this report. There are no developments located in the vicinity of the site that would give rise to cumulative impacts in conjunction with the proposed replanting lands.

8. LANDSCAPE AND VISUAL

8.1 Introduction

This section of the report addresses the landscape and visual impacts of the proposed replanting area. It includes a description of Roscommon County Council landscape policy and describes the site's landscape values and sensitivity. The landscape is described in terms of its character, which includes a description of landform and landcover. An impact assessment of the proposed replanting is then undertaken. Documents consulted include:

- 'Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities' (Department of the Environment and Local Government 2000).
- 'Guidelines for Landscape and Visual Impact Assessment' (The Landscape Institute/Institute of Environmental Management & Assessment, 2013).
- 'Forestry and the Landscape Guidelines' (Forest Service, 2000).

8.1.1 Baseline Landscape Assessment Methodology

In order to carry out this assessment, a desk study was undertaken which identified relevant policies and guidelines, both at national and local level. This includes policies on forestry, landscape and landscape character, designated landscapes, and scenic routes. Maps and aerial images of the proposed replanting site were also studied.

8.2 Landscape Policy Context

This section of the report refers to policies of the Roscommon County Development Plan 2014 – 2020 (CDP), as well as to the Forest Service Landscape Guidelines.

8.2.1 Roscommon County Development Plan 2014-2020

8.2.1.1 Forestry Policy and Objectives

Section 9: *'Development Management Guidelines and Standards'* of the Roscommon County Development Plan deals with policies and objectives relating to forestry. The planning authority acts as a consultee rather than an assessor in relation to forestry. Policies in the Roscommon CDP relating to forestry can be found in Table 3-2 of Section 3.

8.2.1.2 Landscape Policy and Objectives

This section of the report refers to the Roscommon CDP and the Landscape Character Assessment of the county, as well as to the Environmental Requirements for Afforestation document.

8.2.1.2.1 *Landscape Character Assessment of County Roscommon*

Section 11 of the Roscommon CDP comprises the Landscape Character Assessment of the county. The aim of the assessment is to provide technical background for the local planning authority to formulate a set of Landscape Objectives and Policy Recommendations for the county. The objectives and policies aim to strike a balance between boosting rural economic diversity, job creation and tackling climate change with landscape suitability and environmental sensitivity. Particular emphasis is laid on the following development types when assessing landscape sensitivity:

- Housing (including housing in existing settlements as well as single rural dwellings relating to the guidance set out in the Sustainable Rural Housing Guidelines for Planning Authorities);
- Quarries;
- Wind farms;
- Afforestation; and
- Rural buildings and alternative enterprise proposals (an increase of farm buildings is anticipated as a result of the recent EU Nitrates Directive).

The main sensitivities and areas of concern when assessing the above developments are:

- The conservation and enhancement of the landscape diversity, character and quality of the County; Protection of sensitive areas from development that would detract from or be injurious to the amenity of the area;
- Provision for development and change that would benefit the economy of the county including the rural economy while protecting and enhancing the landscape;
- Identification of suitable 'working' landscapes where there is potential to accommodate development.
- The landscape objectives and policy recommendations focus on the following five specific development types:
- Heritage Landscapes.

The CDP identifies thirty six landscape character areas (LCA). The site is located within both LCA 22: Cloona Lough and Lung River Bogland Basin. LCA 22 is defined by the catchment of the Lung River which drains in a north easterly direction from a cluster of lakes close to the border with County Mayo. LCA 22 is described as being of moderate value.

8.2.1.2.2 *Scenic Routes*

There are a total of 9 existing and proposed Scenic Routes and a total 25 existing and proposed Scenic Views within the county and can be found in Appendix 1 of the Landscape Character Assessment of the CDP. The need to preserve scenic routes and views are highlighted throughout the CDP and are taken into consideration, along with sites of special value and immediate and long-distance views, when processing all types of development within the county. The proposed replanting site is not located along or adjacent to a scenic route.

8.2.2 Forestry and the Landscape Guidelines

As of 2011, almost 21,000ha (8.7%) of forestry has been planted within the county, with 13,000 if this on private land and 8,000ha in public ownership. The grant-driven Forest Environment Protection Scheme (FEPS) maintains public interest in this type of agricultural diversification. The Landscape Assessment of the CDP follows the national guidelines produced by the Department of Agriculture and outlined in Chapter 3 Table 3.2 to ensure that sustainable Forest Management is implemented throughout the county.

8.3 Baseline Landscape

8.3.1 Landscape character

The topography, vegetation and anthropological features on the land surface in an area combine to set limits on the amount of the landscape that can be seen at any one time. These physical restrictions form individual areas or units, known as physical units, whose character can be defined by aspect, slope, scale and size. A physical unit is generally delineated by topographical boundaries and is defined by landform and landcover.

The proposed replanting site is located approximately 260 metres to the south of the R293 Regional road. Cunniffes Ballaghaderreen Bacon Factory is located approximately 65 metres to the north of the site. The land to the east and west is bordered by wet grassland. Field boundaries are evident. The site lies at 70m OD. There are existing forestry plantations located approximately 995 metres to the southeast, 967 metres to the southwest and approximately 1.5 kilometres to the north of the site.

The proposed replanting area is located within the Upper Shannon Catchment 26B. There are no streams or rivers within the site boundary, however the Lung River flows in easterly direction along the southern boundary of the site and an unnamed stream flows in a southerly direction along the western site boundary discharging into the Lung River at the southwest of the site.

The landcover of the site is composed primarily of grazed wet grassland.

8.3.1.1 Landscape Sensitivity

The sensitivity of a landscape to development and therefore to change varies according to its character and to the importance that is attached to any combination of landscape values. The sensitivity of a landscape is derived from consideration of designations such as Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Natural Heritage Areas (NHAs) and National Parks, from information such as tourist maps, guidebooks and brochures, and from the evaluation of indicators such as uniqueness, popularity, distinctiveness, and quality of the elements of the area.

A desktop assessment of landscape sensitivity in the vicinity of the replanting site was carried out. The methodology for this assessment was based on that set out in the Department of the Environment and Local Government (DoEHLG) guidance document *'Landscape and Landscape Assessment – Consultation Draft of Guidelines for Planning Authorities'* (2000). This document recommends an assessment of landscape sensitivity based on an evaluation of individual features, such as the quality, integrity, etc. The results of the assessment are presented in Table 8-1.

Table 8-1 Landscape Sensitivity

Feature	Description
Quality	The quality of the landscape in this area can be described as modified due to agriculture and urban development .
Integrity	The current replanting site has been modified by the interaction of man with the environment.
Distinctiveness	There are no distinctive features on the site.
Popularity	A sense of popularity is created where landscape features are widely recognised or appreciated. There are no popular features on the replanting site.
Rarity	There are no Natura 2000 sites within the vicinity of the site.
Cultural Meaning	A sense of cultural meaning arises where a site or features within a site are deemed to explain, represent or inspire cultural values. There are two recorded archaeological features on the study site – a Ringfort – rath (RO008-039) and an Earthwork (RO008-040). An exclusion zone has been placed around these recorded monuments.
Sense of Public Ownership & Social Importance	A sense of public ownership arises due to ease of accessibility, visibility or a widely shared meaning. The site is privately owned and has no special social importance.

The replanting site is therefore considered to be of Medium landscape sensitivity.

8.3.1.2 Landscape Context and Site Visibility

Views towards the site would be westwards from the N5 National Road and southwards from the R293 Regional Road. In general views towards the site would be partially screened either by existing vegetation, trees and buildings.

8.3.2 Impact Assessment

8.3.2.1 'Do-Nothing' Scenario

In the 'Do Nothing' scenario, the subject site would be afforested in any case, as per Technical Approval that has been issued for the site. If the land was not replanted, the current land use of grazed wet grassland would continue at the site.

8.3.2.2 Site Preparation and Planting Phase

8.3.2.2.1 *Impacts on Landscape Character –Temporary Imperceptible Neutral Impact*

The planting of forestry will entail site works in terms of woody weed clearance and construction of forestry drains and will use the angle notch planting method described in Section 2.3.2 above. These activities will have a temporary neutral impact on the landscape character, which is that of a rural working landscape with agricultural, commercial and residential land uses. A neutral impact is a change which does not affect the quality of the environment (EPA, 2017). The site clearance and replanting activities will assimilate well into the receiving environment, and are therefore classed as an imperceptible impact, i.e. an impact capable of measurement but without noticeable consequences.

8.3.2.2.2 *Impacts on Visual Amenity - Temporary Imperceptible Neutral Impact*

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.3.2.3 Operational Phase

8.3.2.3.1 *Impacts on Landscape Character – Long Term Imperceptible Neutral Impact*

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations with open land. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.3.2.3.2 *Impacts on Visual Amenity - Long Term Imperceptible Neutral Impact*

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations with open land. Felling will be carried out in accordance with the Environmental Requirements for Afforestation. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.3.2.4 Proposed Mitigation Measures

8.3.2.4.1 *Site Preparation and Planting Phase*

Mitigation measures for the construction of the drainage and planting methods have been included in the Technical Approval document. The planting method will be as per Section 2 above and mound drains will be constructed. The proposed replanting will be carried out in line with the recommendations of the Forestry and the Landscape Guidelines.

8.3.2.5 Residual Impacts

Following mitigation, the Residual Impact on Landscape Character will be Long Term Imperceptible Neutral Impact while the Residual Impact on Visual Amenity will be Long Imperceptible Term Neutral Impact.

8.3.2.6 Cumulative Impacts

Cumulative impacts are described as additional changes to the landscape or visual amenity caused by the proposed replanting site in conjunction with other developments or actions that occurred in the past, present or are likely to occur in the foreseeable future. The cumulative impact assessment is based on the Planning History search carried out and described in Section 3.2 and the existing land-uses. The cumulative impact arising from the proposed replanting site in conjunction with the existing land uses and future development is assessed as Long Term, Imperceptible Neutral Impact.

9. CULTURAL HERITAGE

9.1 Introduction

This section presents the results of an archaeological and cultural heritage impact assessment for the proposed afforestation of the replanting areas.

The purpose of this section is to assess the potential impacts of the afforestation on the surrounding archaeological, architectural and cultural heritage landscape. An assessment of potential impacts is presented and a number of mitigation measures are recommended where appropriate.

9.2 Methodology

A desk-based study of the proposed replanting areas was undertaken in order to assess the archaeological, architectural and cultural heritage potential of the area and to identify constraints or features of archaeological/cultural heritage significance within or adjacent to the sites. The proposed site has been Technically Approved for afforestation which will be completed in accordance with the *'Forestry and Archaeology Guidelines' (2000) (the Guidelines).* The guidelines provide specific mitigation measures to be employed for afforestation which will minimise potential impacts on this resource.

9.2.1 Statutory Context

9.2.1.1 Current Legislation

Archaeological monuments are safeguarded through national and international policy, which is designed to secure the protection of the cultural heritage resource. This is undertaken in accordance with the provisions of the European Convention on the Protection of the Archaeological Heritage (Valletta Convention). This was ratified by Ireland in 1997.

Both the National Monuments Acts 1930 to 2004 and relevant provisions of the Cultural Institutions Act 1997 are the primary means of ensuring protection of archaeological monuments, the latter of which includes all man-made structures of whatever form or date. There are a number of provisions under the National Monuments Acts which ensure protection of the archaeological resource. These include the Register of Historic Monuments (1997 Act) which means that any interference to a monument is illegal under that Act. All registered monuments are included on the Record of Monuments and Places (RMP).

The Record of Monuments and Places (RMP) was established under Section 12 (1) of the National Monuments (Amendment) Act 1994 and consists of a list of known archaeological monuments and accompanying maps. The Record of Monuments and Places affords some protection to the monuments entered therein. Section 12 (3) of the 1994 Amendment Act states that any person proposing to carry out work at or in relation to a recorded monument must give notice in writing to the Minister (Environment, Heritage and Local Government) and shall not commence the work for a period of two months after having given the notice. All proposed works, therefore, within or around any archaeological monument are subject to statutory protection and legislation (National Monuments Acts 1930-2004).

Under the Heritage Act (1995) architectural heritage is defined to include *'all structures, buildings, traditional and designed, and groups of buildings including street-scapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents…'. A heritage building is also defined to* *include 'any building, or part thereof, which is of significance because of its intrinsic architectural or artistic quality or its setting or because of its association with the commercial, cultural, economic, industrial, military, political, social or religious history of the place where it is situated or of the country or generally'.*

9.2.1.2 Granada Convention

The Council of Europe, in Article 2 of the 1985 Convention for the Protection of the Architectural Heritage of Europe (Granada Convention), states that *'for the purpose of precise identification of the monuments, groups of structures and sites to be protected, each member State will undertake to maintain inventories of that architectural heritage'.* The Granada Convention emphasises the importance of inventories in underpinning conservation policies.

The National Inventory of Architectural Heritage (NIAH) was established in 1990 to fulfil Ireland's obligations under the Granada Convention, through the establishment and maintenance of a central record, documenting and evaluating the architectural heritage of Ireland. Article 1 of the Granada Convention establishes the parameters of this work by defining 'architectural heritage' under three broad categories of Monument, Groups of Buildings, and Sites:

- Monument: all buildings and structures of conspicuous historical, archaeological, artistic, scientific, social or technical interest, including their fixtures and fittings;
- Group of buildings: homogeneous groups of urban or rural buildings conspicuous for their historical, archaeological, artistic, scientific, social or technical interest, which are sufficiently coherent to form topographically definable units;
- Sites: the combined works of man and nature, being areas which are partially built upon and sufficiently distinctive and homogenous to be topographically definable, and are of conspicuous historical, archaeological, artistic, scientific, social or technical interest.

The Council of Europe's definition of architectural heritage allows for the inclusion of structures, groups of structures and sites which are considered to be of significance in their own right, or which are of significance in their local context and environment. The NIAH believes it is important to consider the architectural heritage as encompassing a wide variety of structures and sites as diverse as post boxes, grand country houses, mill complexes and vernacular farmhouses.

9.2.2 Desktop Assessment

A primary cartographic source and base-line data for the archaeological assessment was the consultation of the Sites and Monuments Record (SMR) and Record of Monuments and Places (RMP) through the electronic database of recorded monuments which may be accessed at www.archaeology.ie. All known recorded archaeological monuments are indicated on 6 inch Ordnance Survey (OS) maps and are listed in this record.

The following sources were consulted for this assessment report:

- Electronic database of recorded monuments (www.archaeology.ie).
- Aerial photographs (copyright of Ordnance Survey Ireland (OSI.ie).

9.2.2.1 Recorded Monuments and Places

The Sites and Monuments Record (SMR) and Record of Monuments and Places (RMP) is a record of all known recorded archaeological monuments. The SMR/RMP is not a complete record of all monuments as newly discovered sites may not appear in the list or accompanying maps. In conjunction with the consultation of the SMR and RMP, the electronic database of recorded monuments which may be accessed at www.archaeology.ie was consulted.

Aerial Photograph Analysis

Aerial photographs of the site were examined and no previously unrecorded archaeological features could be seen. Sources included Bing, Google Maps and Ordnance Survey of Ireland.

9.2.3 Archaeology

Archaeological heritage is a non-renewable resource. The overall objective of this assessment of impacts of the proposed afforestation is to ensure that where a potential impact has been identified that it can be mitigated against to ensure that the archaeological heritage will be available for future generations. The potential impacts on the recorded archaeological heritage are assessed here.

Potential impact are assessed on the basis of the impact classification terminology outlined in Table 1.1 of the EIAR, with the significance of impacts being defined as either imperceptible, slight, moderate, significant or profound, or if no impact is predicted to occur, 'No Impact'.

9.2.4 Potential Impacts

Potential afforestation impacts include direct destruction of recorded and unrecorded sites and indirect impacts on archaeological potential of nearby sites.

9.3 Existing Environment

The electronic database of recorded monuments (www.archaeology.ie) was used to compile a list of known sites which occur at and in the vicinity of the site. There are two recorded archaeological features on the study site – a Ringfort – rath (RO008-039) and an Earthwork (RO008-040). The Forest Service Inspectorate has also noted that a possible unrecorded archaeological feature may be present in the northern section of the site.

There are no structures listed in the NIAH located within or in the vicinity of the site.

9.4 Potential Impacts

9.4.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Coole Wind Energy Development proceed or not. If the land was not replanted, the current land use would continue at the site.

9.4.2 Potential Direct Impacts on the Archaeological/Architectural Heritage

Direct Impact refers to a 'physical impact' on a monument. The afforestation will require some minor earthmoving activities such as drainage and the provision of access tracks. Harvesting will require tree felling.

There are two archaeological features within the site. The ringfort – rath (RO008-039) is visible as a circular feature (diam. c. 30m) on aerial photographs (ACAP: V221/133-4), and situated on a low-lying level landscape. The earthwork (RO008-040) is visible as a curvilinear feature enclosing a subrectangular area (dims c. 40m NE-SW; c. 20m NE-SW). It is not visible at ground level in pasture. Specific archaeological conditions attached to the technical approval include the following:

- 20m archaeological exclusion zone to be established from the outermost extent of the ringfort, as illustrated.
- An exclusion zone as measured around the earthwork, as illustrated.
- No deep drains within 30m of the outermost extent of the ringfort or 10m outside the exclusion zone around the earthwork.
- Exclusion zones to be properly fenced off prior to works commencing.

The zone of notification will be maintained during the planting phase. Planting of trees outside of this zone will be carried out by hand using the methods described in Section 2.3 above. Drains will be constructed in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.3.

9.4.3 Potential Indirect Impacts on the Archaeological/ Architectural Heritage

Potential indirect impacts may arise where a monument or area of archaeological or architectural potential is situated in relatively close proximity to a proposed development but is not directly (physically) affected by the development. In such cases the impact on the setting of the monument or views to and from it are assessed.

There are a further seven archaeological features within 500m of the replanting site. Three features are located within the graveyard and are not visible externally, one is no longer visible at ground level, one feature is a redundant record, and two features are screened by vegetation and hedgerows. Therefore, impacts on the features are considered not significant.

9.4.4 Operational Phase

There will be no significant indirect or direct impacts on cultural heritage once the site has been afforested.

9.4.5 Cumulative Impacts

A planning history search of applications in the vicinity of the proposed replanting lands has also been carried out, as described in Section 3.2 of this report. There are no developments of a similar scale and nature located in the vicinity of the site that would give rise to cumulative impacts in conjunction with the proposed replanting on features of cultural heritage significance. The cumulative impact of the replanting site is assessed as Long Term Imperceptible Neutral Impact in conjunction with the existing and future developments in the vicinity.

9.4.6 Significance of the Effects

Based on the above, there will be no significant effects, on cultural heritage or archaeology, associated with afforestation at this site.

10. AIR, CLIMATE AND NOISE

10.1 Air

10.1.1 Background

The primary land-uses within the vicinity of the replanting site comprise agriculture, housing and a commercial property. Due to the non-industrial nature of afforestation and the general character of the surrounding environment, air quality sampling was deemed to be unnecessary for this study. It is expected that air quality in the existing environment is good, since there are no major sources of air pollution (e.g. heavy industry) in the vicinity of the sites.

The growth of forestry has no direct atmospheric emissions. Some minor indirect emissions associated with site preparation, planting and harvesting include vehicular and dust emissions.

10.1.2 Air Quality Standards

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, deals with polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air.

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for PM2.5 (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM10) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 10-1 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre (µg/m3) and parts per billion (ppb). The notation PM10 is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. PM2.5 represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

Table 10-1 Limit values of Directive 2008/50/EC, 1999/30/EC and 2000/69/EC (Source: EPA)

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001
Sulphur dioxide (SO_2)	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM_{10})	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1st Jan 2005

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Particulate matter 2.5 ($PM_{2.5}$)	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015
Particulate matter 2.5 ($PM_{2.5}$) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C_6H_6)	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

The Ozone Daughter Directive 2002/3/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 10-2 presents the limit and target values for ozone.

Table 10-2 Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8 hour mean	120 mg/m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m^3
Protection of vegetation	AOT_{40} calculated from 1 hour values from May to July	18,000 mg/m^3.h averaged over 5 years	6,000 mg/m^3.h
Information Threshold	1 hour average	180 mg/m^3	-
Alert Threshold	1 hour average	240 mg/m^3	-

AOT_{40} is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 g/m^3 and is expressed as g/m3 hours.

10.1.3 Air Quality Zones

The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The sites for afforestation lie within Zone D, which represents rural areas located away from large population centres.

10.1.4 Likely and Significant Impacts and Associated Mitigation Measures

10.1.4.1 'Do-Nothing' Impact

The land has been Technically Approved and will be afforested should the proposed Coole Wind Energy Development proceed or not.

10.1.4.2 Long Term Slight Positive Impact

The growth of trees will result in the fixation of atmospheric carbon, and the production of oxygen.

10.1.4.3 Short-term Imperceptible Negative Impact

10.1.4.3.1 *Exhaust Emissions*

Some minor emissions associated with the use of an excavator for site drainage works are expected. This potential impact will not be significant and will be restricted to the duration of the drainage works.

Mitigation

All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.

Residual Impact

Short-term Imperceptible Negative impact.

Significance of the Effects

Based on the above, there will be no significant effects, on air quality, associated with afforestation at the five sites.

10.1.4.3.2 *Dust Emissions*

Potential dust emission sources include the working of an excavator. This potential impact will not be significant and will be restricted to the duration of the drainage works.

Mitigation

Areas of excavation will be kept to a minimum, and all works will be carried out in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

Residual Impact

Short-term Imperceptible Negative Impact.

Significance of the Effects

Based on the above, there will be no significant effects, on air quality, associated with afforestation at the five sites.

10.2 Climate

10.2.1 Climate Change and Greenhouse gases

Although climate change is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

10.2.2 International Policy

10.2.2.1 United Nations Framework Convention on Climate Change

In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC), as a framework for international efforts to combat the challenge posed by climate change. The UNFCCC seeks to limit average global temperature increases and the resulting climate change. In addition, the UNFCCC seeks to cope with impacts that are already inevitable. It recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The framework set no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. Instead, the framework outlines how specific international treaties (called "protocols" or "Agreements") may be negotiated to set binding limits on greenhouse gases.

Ireland is a Party to the Kyoto Protocol, which is a protocol to the UNFCCC. The Kyoto Protocol is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding. Further details on Ireland's obligations under the Kyoto Protocol are presented below.

10.2.2.2 Kyoto Protocol Targets

Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions of 8% below 1990 levels in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

10.2.2.3 Doha Amendment to the Kyoto Protocol

In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of 5% against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first.

Under the protocol, countries must meet their targets primarily through national measures, although market based mechanisms (such as international emissions trading) can also be utilised.

10.2.2.4 COP21 Paris Agreement

COP21 was the 21st session of the Conference of the Parties (COP) to the UNFCCC. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30thNovember to 12thDecember 2015.

COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The 12-page text, made up of a preamble and 29 articles, provides for a limitation of the global average temperature rise to well below 2°C above pre-industrial levels and to limit the increase to 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions. Ireland formally ratified the agreement on the 27th October 2016, and it entered into force on the 4th November 2016.

10.2.3 Baseline Environment

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Claremorris which is located approximately 34 kilometres from the site, is the nearest weather and climate monitoring station to the proposed replanting site that has meteorological data recorded for the 30-year period from 1971 - 2000. Meteorological data recorded at Claremorris over the 30-year period from 1979 - 2008 is shown in Table 10-3 overleaf. The wettest months are October and December, and April is usually the driest. July is the warmest month with an average temperature of 18.9° Celsius.

Table 10-3 Data from Met Éireann Weather Station at Claremorris, 1971 to 2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
Mean daily max	7.5	8.1	9.8	12.1	14.9	17.0	18.9	18.7	16.4	13.1	9.9	8.1	12.9
Mean daily min	1.7	1.8	2.9	3.9	6.1	8.8	11.0	10.6	8.6	6.4	3.5	2.5	5.7
Mean temperature	4.6	4.9	6.3	8.0	10.5	12.9	15.0	14.7	12.5	9.8	6.7	5.3	9.3
Absolute max.	13.3	13.6	16.2	22.3	25.4	29.8	30.5	28.0	25.1	19.9	15.9	14.3	30.5
Absolute Min.	-11.7	-9.1	-8.0	-5.5	-3.1	0.7	0.6	2.6	-1.2	-4.3	-5.3	-12.9	-12.9
Mean No. of Days with Air Frost	8.7	7.3	5.2	3.3	0.8	0.0	0.0	0.0	0.1	1.2	5.3	7.6	39.5
Mean No. of Days with Ground Frost	15	14	12	10	5	0	0	0	2	5	12	14	89
RELATIVE HUMIDITY (%)													
Mean at 0900UTC	90.7	90.3	88.7	82.5	79.3	80.4	83.6	86.2	88.1	91.6	91.2	91.0	87.0
Mean at 1500UTC	85.6	79.8	75.7	67.9	68.0	71.1	73.2	73.4	74.7	80.2	84.4	88.1	76.8
SUNSHINE (Hours)													
Mean daily duration	1.3	1.9	2.6	4.3	5.0	4.4	3.7	3.8	3.2	2.4	1.7	0.9	2.9
Greatest daily duration	7.9	9.3	10.8	13.4	15.1	15.8	14.8	13.7	11.4	9.3	8.6	6.7	15.8
Mean no. of days with no sun	9.5	7.3	5.7	2.8	2.0	2.2	2.2	2.1	3.4	5.0	8.1	10.8	61.1
RAINFALL (mm)													
Mean monthly total	127.9	102.1	101.6	63.7	68.1	64.5	70.1	95.7	94.3	128.2	127.7	129.6	1173.6
Greatest daily total	31.5	107.0	26.8	34.0	51.3	38.0	42.2	49.7	41.0	46.7	54.9	41.2	107.0
Mean num. of days with >= 0.2mm	21	18	21	16	16	15	17	18	18	21	21	22	224
Mean num. of days with >= 1.0mm	18	15	17	12	12	11	12	13	14	17	18	17	176
Mean num. of days with >= 5.0mm	9	7	7	4	4	4	4	6	5	8	8	9	75
WIND (knots)													
Mean monthly speed	10.2	10.3	10.2	8.7	8.1	7.7	7.2	6.8	7.7	8.7	8.9	9.7	8.7
Max. gust	96	85	74	74	62	51	66	78	58	70	67	81	96
Max. mean 10-minute speed	59	48	45	41	41	34	39	32	37	46	40	52	59
Mean num. of days with gales	1.4	0.9	0.7	0.1	0.1	0.0	0.0	0.0	0.1	0.3	0.4	0.8	4.8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WEATHER (Mean No. of Days With:)													
Snow or sleet	5.7	4.4	3.8	1.6	0.2	0.0	0.0	0.0	0.0	0.1	1.2	3.1	20.0
Snow lying at 0900UTC	2.3	0.7	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	4.6
Hail	4.4	3.2	5.4	3.2	1.6	0.4	0.1	0.0	0.7	0.8	2.6	2.7	25.2
Thunder	0.3	0.1	0.2	0.2	0.4	0.7	0.7	0.2	0.2	0.2	0.3	0.5	4.0
Fog	3.4	2.3	1.6	1.8	1.2	1.4	2.0	3.2	3.3	3.2	2.6	3.4	29.5

10.2.3.1 Potential Impacts – Planting Phase

10.2.3.1.1 *Short Term Imperceptible Negative Impact*

The use of machinery during the drainage works will result in the emission of greenhouse gases. Operations such as the transport of materials are typical examples of machinery use. This impact is considered to be imperceptible only, given the insignificant quantity of greenhouse gases that will be emitted. Planting will be carried out by hand.

Proposed Mitigation Measures

Planting of trees will be carried out by hand using the methods described in Section 2.3.2 above. Any drains will be constructed in accordance with the measures outlined in the *Forestry Standards Manual* and *Environmental Requirements for Afforestation* described in detail in Section 2.

10.2.3.2 Potential Impacts – Operational Phase

10.2.3.2.1 *Long Term Slight Positive Impact*

The growth of forestry allows for the fixation of atmospheric carbon as it grows.

10.2.3.3 Residual Impacts

On balance there will be positive impacts on air and climate associated with the proposed afforestation at this site.

10.2.3.4 Significance of the Effects

Based on the above, there will be no significant effects, on climate, associated with afforestation the at this site.

10.3 Noise

10.3.1 Receiving Environment

The nearest sensitive location to the afforestation site is the residential estate located approximately 250 metres to the northwest of the site. In general, the existing noise climate is typical of a rural agricultural location. The R293 Regional road and Cunniffes Ballaghaderreen Bacon Factory are located approximately 260 and 65 metres to the north of the site, respectively.

10.3.2 Likely and Significant Impacts and Associated Mitigation Measures

10.3.2.1 'Do-Nothing' Scenario

The land has been Technically Approved and will be afforested should the proposed Coole Wind Energy Development proceed or not. If the land was not replanted, the current land use of grazed wet grassland would continue at the site.

10.3.2.2 Planting Phase

10.3.2.2.1 *Construction Activities*

There will potentially be an increase in noise levels in the vicinity of the proposed replanting site during the planting phase, as a result of the use of an excavator for drainage works. These impacts will be short-term in duration and are not considered potentially significant. The noise levels will be similar to the existing agricultural machinery in use in the vicinity of the lands which is a working rural environment. Noise at any given noise sensitive location will be variable throughout the works, depending on the distance from the excavator to the receiving properties. This is likely to have a Short-term Negative Imperceptible Impact.

Mitigation

Best practice measures for noise control will be adhered to onsite during the planting phase of the afforestation site in order to mitigate the potentially imperceptible short-term negative impact associated with this phase of the replanting. The measures include:

- Noise will be controlled by prescribing that all work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- The excavator used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

10.3.2.3 Operational Phase

10.3.2.3.1 *Negative Slight Short-term Impact*

There will be an intermittent increase in noise levels in the vicinity of the proposed replanting site during the operational phase, as a result of the use of machinery for timber harvesting works. These impacts will be short-term in duration. Noise at any given noise sensitive location will be variable throughout the harvesting works, depending on the distance from the machinery to the receiving properties.

Mitigation

Best practice measures for noise control will be adhered to onsite during the timber harvesting at the proposed afforestation site in order to mitigate the slight short-term negative impact associated with this phase of the replanting. The measures include:

- Harvesting noise will be controlled by prescribing that all construction work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- The machinery used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

Residual Impacts

Potential residual impacts will be imperceptible and temporary in nature and not dissimilar to the existing noise sources of a working rural environment.

Significance of the Effects

Based on the above, there will be no significant effects, in relation to noise, associated with afforestation the at this site.

11. POPULATION AND HUMAN HEALTH

This section of the report describes the potential impacts of the proposed afforestation on Population & Human Health, and has been completed in accordance with the guidance set out by the Environmental Protection Agency in *'Draft Guidelines on the Information to be contained in Environmental Impact Statements'* (EPA, 2017*).*

One of the principle concerns in the development process is that people, as individuals or communities, should experience no diminution in their quality of life from the direct or indirect impacts arising from the construction and operation of a development. Ultimately, all the impacts of a development impinge on human health, directly and indirectly, positively and negatively. The key issues examined in this section of the replanting assessment include population, employment, health and safety, land-use, community facilities and services, and tourism.

11.1 Baseline Environment

The proposed replanting site is located approximately 1.4km to the east of Ballaghaderreen town centre. The replanting site is located within the District Electoral Division (DED) of Edmondstown. The number of households recorded within the DED during the 2016 Census was 166 households. The nearest sensitive location to the afforestation site is the residential estate located approximately 250 metres to the northwest of the site. The R293 Regional road and Cunniffes Ballaghaderreen Bacon Factory are located approximately 260 and 65 metres to the north of the site, respectively.

11.1.1.1 Employment

Socio-economic grouping divides the population into categories depending on the level of skill or educational attainment required. The 'Higher Professional' category includes scientists, engineers, solicitors, town planners and psychologists. The 'Lower Professional' category includes teachers, lab technicians, nurses, journalists, actors and driving instructors. Skilled occupations are divided into 'Manual Skilled', such as bricklayers and building contractors; 'Semi-skilled', e.g. roofers and gardeners; and 'Unskilled', which includes construction labourers, refuse collectors and window cleaners.

The highest level of employment within the Edmondstown DED is within the 'All others gainfully occupied and unknown', 'Non-manual' 'Semi Skilled' and 'Farmers' categories at 76 persons, 65 persons, and 63 persons, respectively. The total population in this DED in Census 2016 was 418.

11.1.1.2 Land-use

The current land-use on the proposed replanting area is grazed wet grassland. This site is located within a rural, working landscape in which agriculture, commercial development and residential development forms the primary land-uses. There are existing forestry plantations located approximately 995 metres to the southeast, 967 metres to the southwest and approximately 1.5 kilometres to the north of the site.

11.1.1.3 Community Facilities and Amenities

The nearest schools and community facilities to the proposed planting site are located in the town of Ballaghaderreen, approximately 1.4 km west of the site.

11.1.1.4 Tourism

Ireland is divided into seven tourism regions. The West Region, in which the site of the replanting site is located, comprises Counties Galway, Mayo and Roscommon.

The nearest tourist attractions to the replanting area are Ballaghaderreen Cathedral located approximately 1.4km to the northwest of the site and Ballaghaderreen Golf Course located approximately 3.1km to the southwest of the site.

There are no scenic views or routes located near the replanting site.

11.1.2 Impact Assessment and Proposed Mitigation Measures

11.1.2.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Coole Wind Energy Development proceed or not. If the land was not replanted, the current use of land for grazing would continue at the site.

11.1.2.1.1 *Population*

Afforestation of the replanting site will have no impact on population trends or population density in the vicinity of the site.

11.1.2.1.2 *Employment*

The preparation and planting of the proposed replanting lands will provide short-term employment for three people; one person to operate an excavator for installation of drainage features, and two people to plant the site by hand.

In the longer-term, maintenance and felling of the site will provide part-term employment for two people.

11.1.2.1.3 *Health and Safety*

Health and safety in forestry is the concern of all those involved, including forest owners, managers, supervisors, operators, recreational users and trespassers *('Code of Best Forest Practice'*, Forest Service, 2000). Forest practice must ensure that operations do not endanger workers and others. In the absence of the correct health and safety measures, forestry-related activities have the potential to have a significant negative effect on the health and safety of workers and members of the public, on and in the vicinity of the site.

The Forest Service's *'Code of Best Forest Practice'* states that the Safety, Health and Welfare at Work Act 1989 and the Safety, Health and Welfare at Work (General Application) Regulations 1993 place responsibilities on all involved in work activities and set out a basis for managing health and safety in all workplaces. Forest owners have legal responsibilities to ensure that the workplace and all articles and substances situated there are safe and free from health risk. This involves informing contractors of potential hazards, work agreements and monitoring. Employers, self-employed and employees all have clear responsibility to ensure safe working practices for themselves and others.

All Forest Service guidelines and Health and Safety legislation will be adhered to during all forestry-related activities at the proposed replanting lands. The residual potential for a significant negative impact on worker and public health and safety is therefore reduced to minimal.

11.1.2.1.4 *Land-use*

Afforestation of the replanting site will result in a long-term change in use of the site, from agriculture to forestry. This change in land-use is in keeping with the character of the surrounding landscape, as forestry is already an established land-use in the general area. The impact of the change in land-use is therefore neutral, i.e. a change which does not affect the quality of the environment.

11.1.2.1.5 *Residential Amenity*

Planting at the site will have no impact on the residential amenity of the area.

11.1.2.1.6 *Community Facilities and Amenities*

There are no community facilities or amenities located on or in the immediate vicinity of the proposed replanting land. No recreational walks are located close to the proposed replanting site. There will be no impact to these or any other community amenities within the wider area. All appropriate health and safety measures, including signage, will be adopted at the site to ensure the safety of workers and the general public.

11.1.2.1.7 *Tourism*

Afforestation of the proposed replanting lands will have no impact on tourism. There are no tourist facilities or attractions located at the replanting lands or within the vicinity of the site. Forestry and peat land is a well-established land-use in this area; and a common feature in the landscape.

11.1.2.2 Significance of the Effects

Based on the above, there will be no significant effects, on human beings, population or health, associated with afforestation the at this site.

11.1.2.3 Cumulative Effects

It is considered that based on the assessment above, the proposed replanting site with other projects in the area will not cumulatively affect population and human health in the wider area.

12. MATERIAL ASSETS

Material Assets are resources that are valued and intrinsic to specific places. Economic assets of natural heritage include non-renewable resources such as minerals or soils, and renewable resources such as wind and water. These assets are dealt with in Sections 6, 7 and 8 of this report. Cultural assets are discussed in Section 9. Transportation infrastructure and land-use practices, which are economic assets of human origin, are discussed in this section of the report.

12.1 Transportation

The site is accessed via the off the R293 Regional Road to the north of the site. Traffic movements associated with the preparation and planting of the site will be minimal. Preparation of the site will require the use of an excavator for drainage, and travel to the site by the driver. Planting of the site will be by hand and will be carried out by one to two people over a two-week period approximately.

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required.

12.2 Land-Use

Land-use on the site will change from agriculture to coniferous forestry. Forestry, like agriculture, is an extractive industry, i.e. it produces a raw material which is then processed to add value.

12.3 Potential Impacts

12.3.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Coole Wind Energy Development proceed or not. If the land was not replanted, the current land use would continue at the site.

12.3.2 Transportation

Planting of the proposed site will have an imperceptible impact on local traffic, given the low volume of traffic associated with planting and felling.

12.3.3 Land-Use

Land-use on the site will change from agriculture to coniferous forestry. Forestry, like agriculture, is an extractive industry, i.e. it produces a raw material which is then processed to add value. The use of the proposed replanting lands for coniferous forestry will have a positive effect on the economic assets of the site.

12.3.4 Significance of the Effects

Based on the above, there will be no significant effects, on land use and traffic, associated with afforestation the at this site.

12.3.5 Cumulative Effects

A planning history search of applications in the vicinity of the proposed replanting lands has also been carried out, as described in Section 3.2 of this report. There are no developments located in the vicinity of the site that would give rise to cumulative traffic impacts in conjunction with the proposed replanting lands.

APPENDIX 1

TECHNICAL APPROVAL DOCUMENT

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

RECEIVED
14 DEC 2018

SWS FORESTRY LTD
GATE LODGE
WEST CORK TECHNOLOGY PARK
CLONAKILTY
CO CORK

-MD
KF

12/12/2018

Application for Technical Approval for an Afforestation Licence

Forest Owner	FO132649T
Contract Number	CN80274
Townland	Magheraboy
County	Roscommon
Approved Area (ha)	16.53
Fencing Length (lm)	1,755.00

James Cunniffe

This is technical approval for an afforestation licence only and is not grant approval. You should note that the project will not be eligible for grant aid unless prior financial approval has been given in writing in advance of commencement of planting. Also, to qualify for Afforestation grant and premiums applicants must own, lease or be in joint management of the lands proposed for planting. You should consult with your registered forester about applying for financial approval under the Scheme.

I refer to your application for an afforestation licence as described above and shown on the enclosed map. Your application has been assessed and a licence is hereby issued on the basis that the works will be undertaken in accordance with the prescription set out in Appendix A, attached herewith. You are now required to remove your site notice immediately.

This scheme is financed by the State and payment of the grant, if financial approval is given, is subject to the following conditions:

1. Availability of funds in each financial year.

2. Submission of a fully completed and signed Form 2 (Application for Payment) and the following documents to support this application.

Proof of Ownership (including removal of any constraints on ownership)
Valid Mandate
Current Tax Clearance Certificate(s)
C2 Certificate
Provenance Certificates
Fencing Map
Biodiversity Map
Certified Species Map

3. Satisfactory completion of the work not later than 12/12/2021.

4. Compliance with Operational Proposals and Specifications enclosed.

5. Compliance with Departmental guidelines and requirements for Landscape, Water Quality, Harvesting, Biodiversity and Archaeology.

6. Compliance with Ecological Survey and Management Plan as submitted (if applicable).

7. The work is carried out by the registered company or forester specified on the original application. If it is intended to have a different company or forester undertake the work, it will be necessary to submit a new application (Form 1) to the Forest Service.

8. All applications are subject to the provisions of the penalty schedules as set out in the Afforestation Grant and Premium Scheme document.

9. All applications are subject to Cross Compliance checks with other grant schemes.

10. Grant payment may be subject to the netting policy of the Department of Agriculture, Food and the Marine.

11. This licence is issued subject to the terms and conditions of the Forestry Standards and Procedures Manual.

12. Your acceptance that the responsibility for the ultimate success of the plantation rests with you, the applicant. Plantations which fail to establish successfully will result in grant and premium recoupment.

13. Additional Environmental & Silvicultural Conditions

- Adhere fully to Archaeological conditions and setbacks,
- 15% ADB to be planted for this site as per revised scheme rules,
- Adhere to Environmental Requirements for Afforestation,
- All guidelines to apply

Specific Archaeological Conditions:
20m archaeological exclusion zone to be established from the outermost extent of the ringfort, as illustrated.
Fencing, plus access.
In addition no deep drains within 30m of the monument.
See attached archaeological report and accompanying illustrative map for further details.

You are required to notify the Department of Agriculture, Food and the Marine in writing if any of the details of your application have changed. Changes to your application may invalidate this licence.

In order to allow for the possibility of appeals, you must not commence any works until 28 days from the date of this letter have elapsed. If an appeal is lodged, this licence will be suspended and no work may commence until the appeal process has concluded.

If you wish to appeal any condition attached to this licence, where applicable, you should do so in writing within 28 days of the date of this letter to the Forestry Appeals Committee. You must set out the grounds of your appeal and include a statement of the facts and contentions upon which you intend to rely along with any documentary evidence you wish to submit in support of your appeal. The appeal must be sent to the Forestry Appeals Committee, Kilminchy Court, Portlaoise, Co. Laois, Lo-Call 076 1064418 or 057 8631900.

Yours sincerely

COLIN GALLAGHER
Approval Section
Forestry Division

APPENDIX

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

Department of Agriculture, Food and the Marine

Operational Proposals for Technical Approval for an Afforestation Licence

Forest Owner Number	FO132649T
Contract Number	CN80274
Townland	Magheraboy
County	Roscommon
Area Approved	16.53(ha)
Fencing Length (LM)	1,755.00

All applications must be developed in accordance with detailed standards and procedures as described in the current Forestry Schemes Manual. Certain specific operational proposals particular to this application are described below. No change is permitted to these proposals and species approved unless approved in advance by the Department. The Department may insist that proposed changes constitutes a new application.

Operational Proposal Details

Agro Forestry (GPC 11)		
1.	Tree Shelters	Not Entered
2.	Plant Size and Stocking	Not Entered
Drainage		
1.	Drainage	Not Required
2.	Drainage Comment	Not Entered
Fertiliser		
1.	Zero	Not Entered
2.	350 Kg Granulated Rock Phosphate	Not Entered
3.	250 Kg Granulated Rock Phosphate	Yes
4.	Split Application	Not Entered
5.	Other Details	Not Entered
Firebreaks/Res.		
1.	Firebreaks/Res	Not Required
Forestry for Fibre (GPCs: 12a and 12b))		
1.	Is Land Free Drainage arable or pasture soils	Not Entered
2.	Are there surface water gleys without a peat layer	Not Entered
3.	Do you intend to use improved genetic material	Not Entered
4.	Details	Not Entered
Ground Prep.		
1.	Woody Weed Removal	Yes
2.	Ripping	Not Entered
3.	Pit Plant	Not Entered
4.	Mole Drainage	Not Entered
5.	Mounding	Yes
6.	Ploughing	Not Entered
9.	Other Details	Not Entered
Planting Method		
1.	Angle Notch	Not Entered
2.	Pit	Not Entered
3.	Machine	Not Entered

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Bia agus Mara
Department of Agriculture,
Food and the Marine

4. Slit	Yes				
5. Other Details	Not Entered				
Road Access					
1. Road Access	Provided				
Standard Stocking					
1. Standard Stocking	Yes				
2. Details	Not Entered				
Weed Control					
1. Herbicide Control yr0	Yes				
2. Herbicide Control yr1	Yes				
3. Herbicide Control yr2	Yes				
3. Herbicide Control yr4	Not Entered				
4. Manual	Yes				
4. Herbicide Control yr3	Yes				
Fencing Details (metres)	Stock	0	Stock-Sheep	1755	
	Stock-Rabbit	0	Upgrade to Deer	0	
	Deer-Rabbit	0	Deer	0	
	Upgrade Existing Fence(s)	0	Tree Shelter (Hectares)	0	
	Upgrade Details: None Entered				

Species Approved

The species approved in this proposal relate to the digitised certified species map attached.

Species Approved for Afforestation

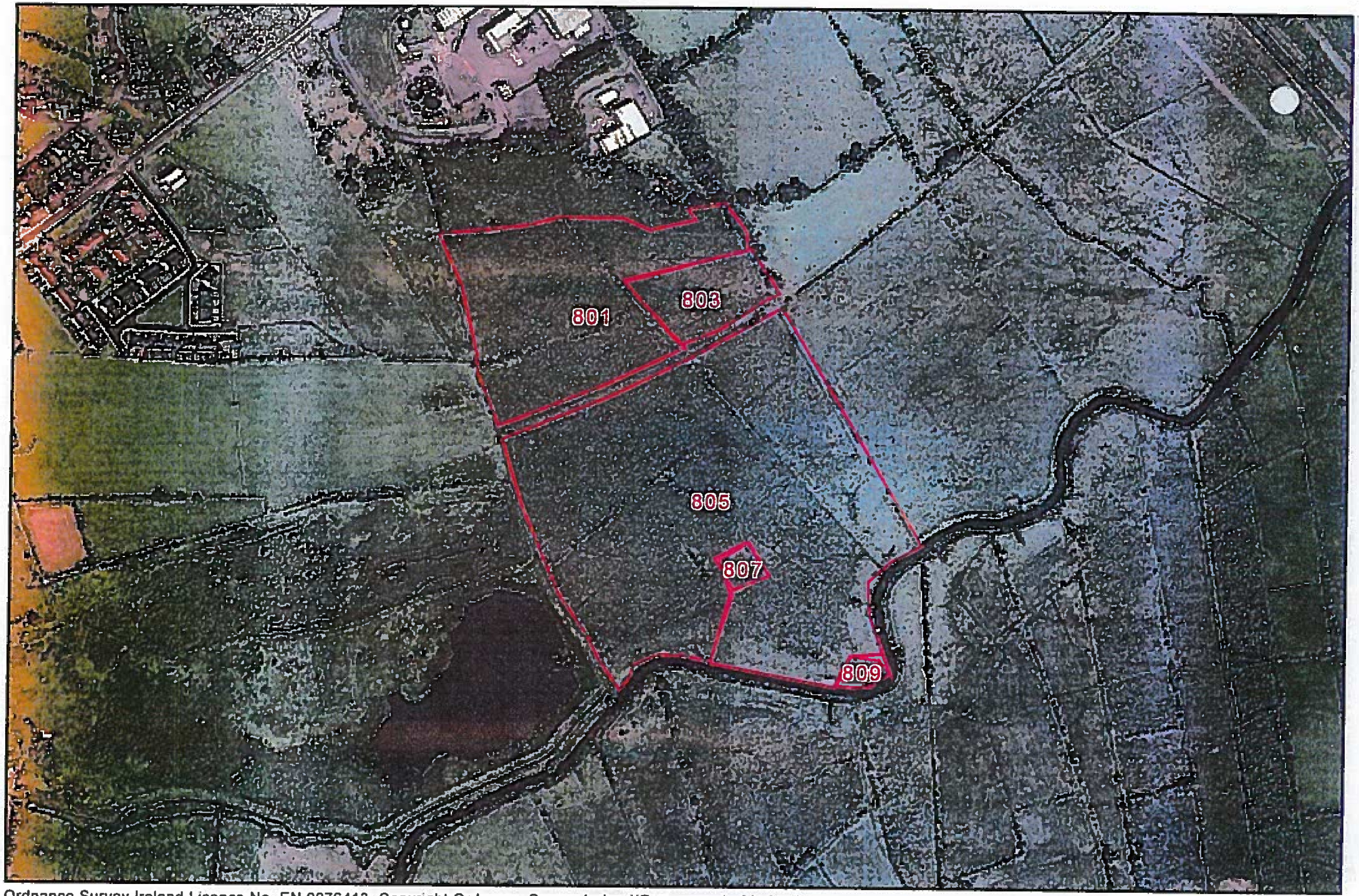
Plot	Area	GPC	Land Type	Species	Species Area	Yield Class	Mixture Type	Exclusion	Exclusion Type
1	4.19	GPC 3	CHF	SS	3.77	20	Pure		
				ADB	.42	8			
2	.91	GPC 3	Bio				None		
3	11.13	GPC 3	CHF	SS	10.02	20	Pure		
				ADB	1.11	8			
4	.16	GPC 3	Bio				None		
5	.14	GPC 3	Bio				None		

Additional Silvicultural and Environmental Conditions

In addition to the Department's environmental and silvicultural guidelines the following specific conditions apply to this proposal:

Silvicultural and Environmental Conditions

Adhere fully to Archaeological conditions and setbacks,
15% ADB to be planted for this site as per revised scheme rules,
Adhere to Environmental Requirements for Afforestation,
All guidelines to apply



Contract: **CN80274** Scale 1: 5000

Certified Species Information

Contract Number	CN80274
Townland	Magheraboy
County	Roscommon
6" OS No:	RN8

Plot No	GPC	Parcel No	GPC Area(H)	Land Use Type	Species Area	Species	Mixture Type	Excl Area(h)	Excl Type
1	3	45731801	4.19	CHF	4.19	ADB,SS	Pure	0	
2	3	45731803	.91	Bio	0		None	0	
3	3	45731805	11.13	CHF	11.13	ADB,SS	Pure	0	
4	3	45731807	.16	Bio	0		None	0	
5	3	45731809	.14	Bio	0		None	0	
		TOTALS	**16.53**		**15.32**			**0**	

Remarks:

Area Surveyed By: **Date:**

Species Certified By: **Date:**

(1)

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

FOREST SERVICE
Johnstown Castle Estate
Wexford
- 8 JUN 2018
RECEIVED

Approvals Section,
Forest Service,
Department of Agriculture, Food and the Marine,
Johnstown Castle Estate,
Co. Wexford,
Y35 PN52.

8th June 2018

Re: CN 80274 – Magheraboy, Co. Roscommon

Dear Sir / Madam,

I am writing to you with regard to the revised application for a licence for afforestation in respect of certain lands at Magheraboy, Co. Roscommon

The area proposed for afforestation contains two Recorded Monuments – an enclosure or ringfort (RO 008-039) and an earthwork (RO 008-039). In addition, a possible archaeological feature, hitherto unrecorded, is visible on recent aerial photographs at the northern part of the site.

Further to the conditions agreed with NMS, DCHG, in respect of a previous application for the same lands in August 2015 under CN72249, and the applicant's/Registered Forester's subsequent confirmation that Plot 2 will be retained exclusively a BIO Plot, i.e. open space with no planting or ground disturbance whatsoever, it is recommended that the archaeological conditions detailed on the accompanying page should be attached to any letter of approval.

For the purposes of the EIA Screening Form and the Forestry Regulations 2017 this constitutes:

	Yes	*No*	*N/A*
- Adherence to the normal standards of the Forestry and Archaeology Guidelines	X		
- Specific conditions regarding buffer zones etc	X		
- Archaeological Monitoring during ground preparation or drainage works		X	
- Archaeological Assessment		X	
- Refusal in part		X	
- Refusal		X	

For the purposes of the IFORIS summary notes this constitutes:

Archaeological Conditions: Extra

Yours sincerely,

Emmet Byrnes

Emmet Byrnes
Senior Archaeologist
Forestry Inspector Grade 1

RECEIVED
08 JUN 2018
APPROVALS

An Roinn Talmhaíochta, Bia agus Mara,
An Teach Talmhaíochta, Sráid Chill Dara, Baile Átha Cliath 2, D02 WK12
Department of Agriculture, Food and the Marine
Agriculture House, Kildare Street, Dublin 2. D02 WK1
T +353 1 607 2229 | emmet.byrnes@agriculture.gov.ie
www.agriculture.gov.ie

(2)

CN 80274

Magheraboy, Co. Roscommon

Revised Archaeological conditions

The area proposed for afforestation contains two Recorded Monuments – an enclosure or ringfort (RO 008-039) and an earthwork (RO 008-039). In addition, a possible archaeological feature, hitherto unrecorded, is visible on recent aerial photographs at the northern part of the site.

It is of concern that every effort should be made to prevent damage to this Recorded Monument pair and the potential new site and to ensure that there would be an appropriate response should any other previously unrecorded archaeology be discovered during the course of the works.

Consequently, the following conditions should be adhered to during the proposed afforestation works:

1. As always, at all times during the proposed afforestation operations the terms of the *'Environmental Requirements for Afforestation'* should be adhered to.

2. **Specifically, the areas highlighted in yellow with red hatching on the accompanying map, should be entirely excluded from the proposed afforestation works.**

   That means an exclusion zone 20m in width from the outermost extent of the enclosure or ringfort (RO 008-039), as illustrated.

   That means an exclusion zone as measured around the earthwork (RO 008-039), as illustrated.

3. **In addition, no deep drains should be excavated within 30m of the outermost extent of the ringfort or 10m outside the exclusion zone around the earthwork.**

4. These exclusion zones should be properly fenced off prior to works commencing and all operational staff should be apprised of the location of the exclusion zone and the monument within each.

5. <u>Existing pedestrian access from the monuments to the nearest forest track or road should be respected and if not present, established. Such access tracks should at a minimum be 4m wide.</u>

6. **Furthermore, Plot 2 containing the possible new archaeological site, as per the applicant's own revised plan, is required to be retained exclusively a BIO Plot, i.e. open space with no planting or ground disturbance whatsoever.**

7. These archaeologically excluded areas may be eligible in whole or in part as an ABE/open space; see the Forest Standards Manual for details and rules.

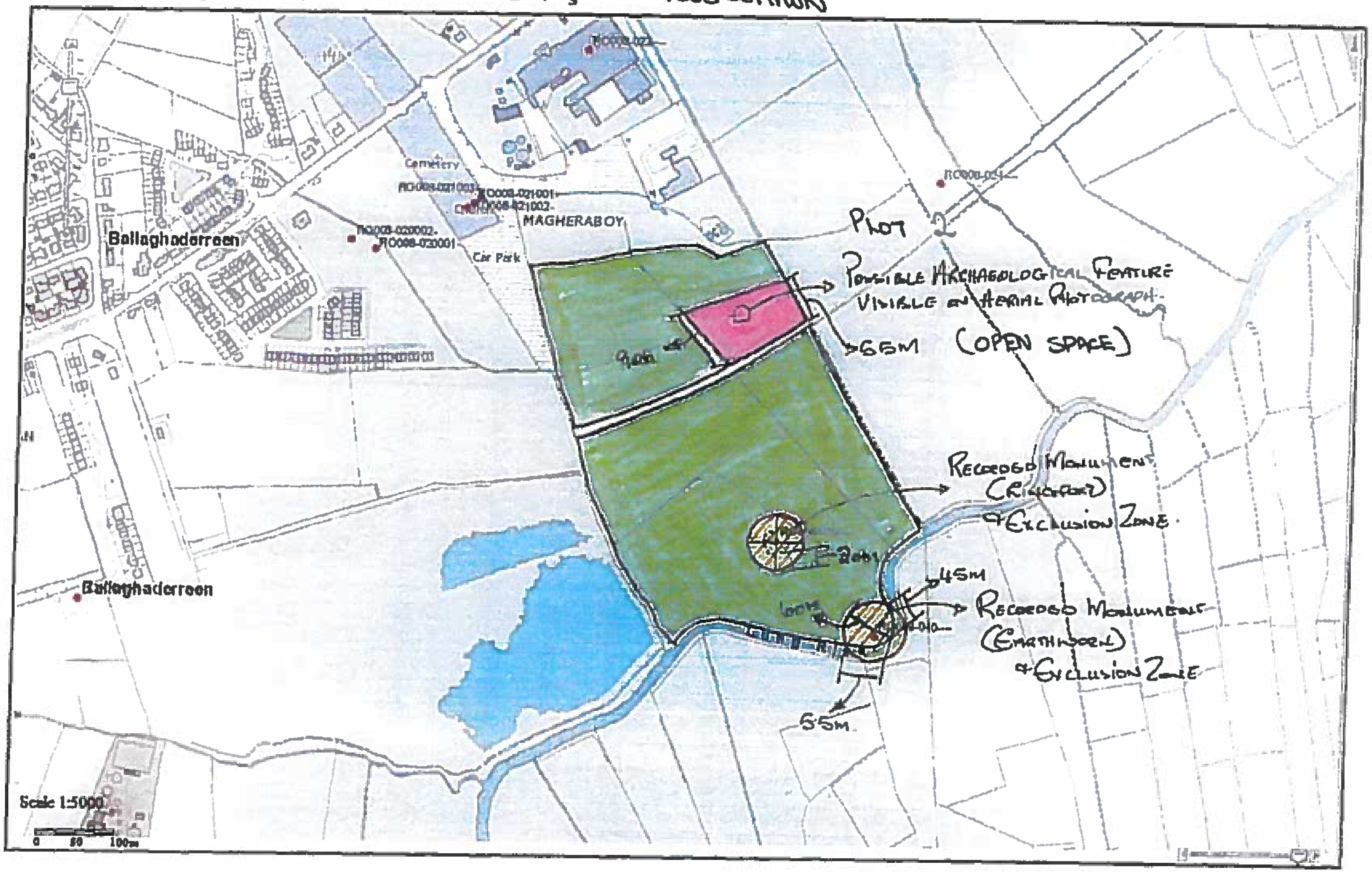
8. Any previously unrecorded archaeological site or artefact discovered during the course of the works on site must be left undisturbed and the relevant authorities notified immediately. A minimum exclusion zone of 20m, preferably 100m or more, must be created until the any such site has been properly investigated. The relevant authorities include the duty archaeologist in the Forest Service, DAFM, and in the case of the discovery of human remains An Garda Síochána and the Local Coroner.

9. Otherwise, no known archaeological objections.

Emmet Byrnes

Emmet Byrnes
Forest Service Inspectorate
Ph.: 01-6072229
Mobile.: 087-2283697

CN 80274- Magheraboy, Co. Roscommon



, Magheraboy, Co. Roscommon.

OK for Forestry —

Exclusion Zones —

Bio Plot- Open Space / No Planting / Ground Disturbance —
Only

APPENDIX 4-7

ELS COOLE WIND FARM DELIVERY ROUTE SELECTION AND ASSESSMENT

Coole Wind Farm

Route Assessment

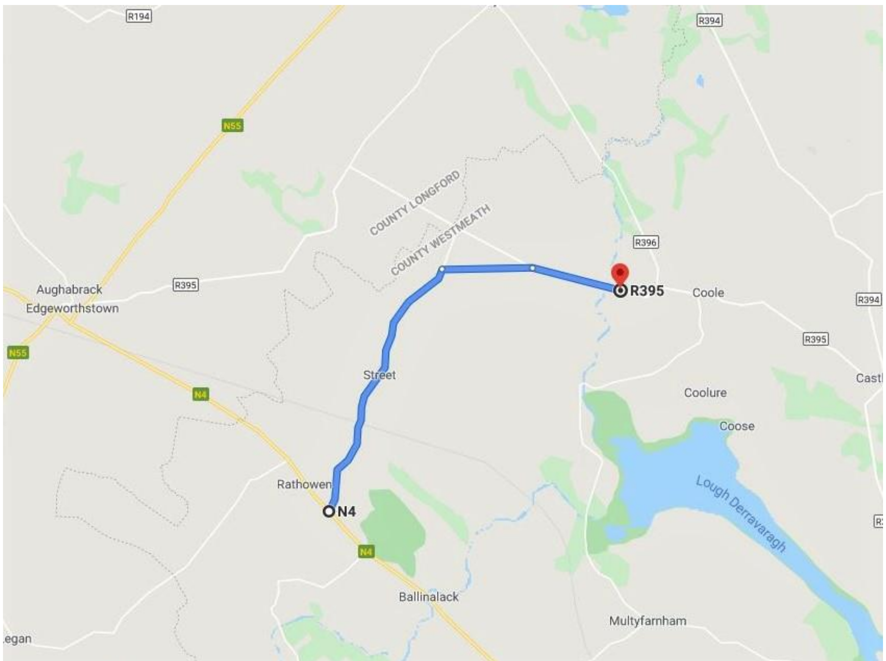
(N4 to Kiltareher)

21 - 08 - 2020

Exceptional Load Services Ltd, Ballymoyle, Arklow, Co Wicklow, Ireland

T: +353-402-31229. E. permits@wide-loads.com

Customer	**Statkraft** Building 4200 Cork Airport Business Park Cork Ireland. T12 D23C
Project	Coole WF, Co Westmeath
Survey Date	21/08/2020
Survey Personnel	Edwin Sunderland, ELS John Webb, ELS
Load Dimensions	85x 4.5 x 4.5 x 65t (with 15m overhang)
Route Surveyed	L1927 – L5828 – R395
Route Distance	11.5km
Route Assesment Criteria	This route was surveyed and assessed on 21/08/2020 for transport of Wind Turbine Blades of 77.5m length from the National road network (N4) to the R395 entrance. Assessment based on moving a convoy of three blades or two or three tower sections.
Route Requirements	The route from the N4 to site will require enabling works for passage of blades and towers. The proposed works are assessed and proposed on the basis of: • Ease of build • Least disruption to safety related street furniture • Safety of other road users during transport phase. • Safety and ease of passage for transport.

Site Location	 ©Google Maps **Figure 1**
Proposed Route from N4 M4 – L1927 – L5828 – R395 – R396 - to site	 **Figure 2**

Area 1.
N4 – L1927 Junction.
(53.649735, -7.510959).

This area will require load bearing works on road verge and rear oversail into third party land.

Area on roadside is 40m x 9m approx.

Figure 3

Area 1.
N4 – L1927 Junction.

Grass verge (red box) should be made load bearing.

Green line denotes oversail area

Figure 4

Area 1.
N4 – L1927 Junction.

All signs and bollards should be removed for transport of blades to facilitate mid oversail of load.
No load bearing required.

Figure 5

Area 2.
Culvin Railway Crossing
53.669308, -7.499583

This area will require works on the right side to allow a clear path across railway without the need to remove railway signs and/or level crossing barriers.

There is a land agreement in place for these works.

Figure 6

Area 2.

Area opposite house should be widened by 4m.
Grass verge should be filled to load bearing from lead into curve.

Figure 7

Area 3.
Burgesland (Right Curve)

53.686285, -7.489249

Hedge should be lowered for mid-oversail

Figure 8

Area 3.
Burgesland (Right Curve)

Hedge should be lowered between poles.

2nd pole should be moved 5m off bend, which can be undertaken in consultation with ESB.

Figure 9

Area 4.
Ballykildevin.

(53.700793, -7.473397)

This right curve will require mid oversail on the right.

The oversail is over a stone wall.

Figure 10

Area 4.
Ballykildevin.

Figure 11

Area 5.
Boherquill

(53.704445, -7.467809)

This area requires load bearing land take for right turn.
There is a land agreement in place for these works.

Figure 12

Area 6.
Kiltareher
Junction with R395/L5828
(53.704848, -7.433631)

An area on the left side of the R395 should be filled to load bearing for truck headroom. (30m x 3m approx).
All works can be accommodated within the road boundary.

Figure 13

Conclusions	This route if modified and upgraded as per above report would be suitable for movement of wind turbine blades up to 77.5m and tower sections on Tower Clamp Adapters. Swept Path Analysis should be carried out on all areas/ pinch points to establish required dimensions. Overhead cables have not been assessed. **An early trial run is recommended to verify clearances.** Special consideration should be given to the Dublin -Sligo rail crossing as it would have a regular passenger service during daytime but also a freight service which may impact on night moves. A corridor of W6.00m x H5.50m free of vegetation and cables is required for entire route from the N4.

Revision Record		
Date	Author	Description
25/08/20	Edwin Sunderland	Report. (V1)
01/12/20	Edwin Sunderland	Revision 02

Apendix I.

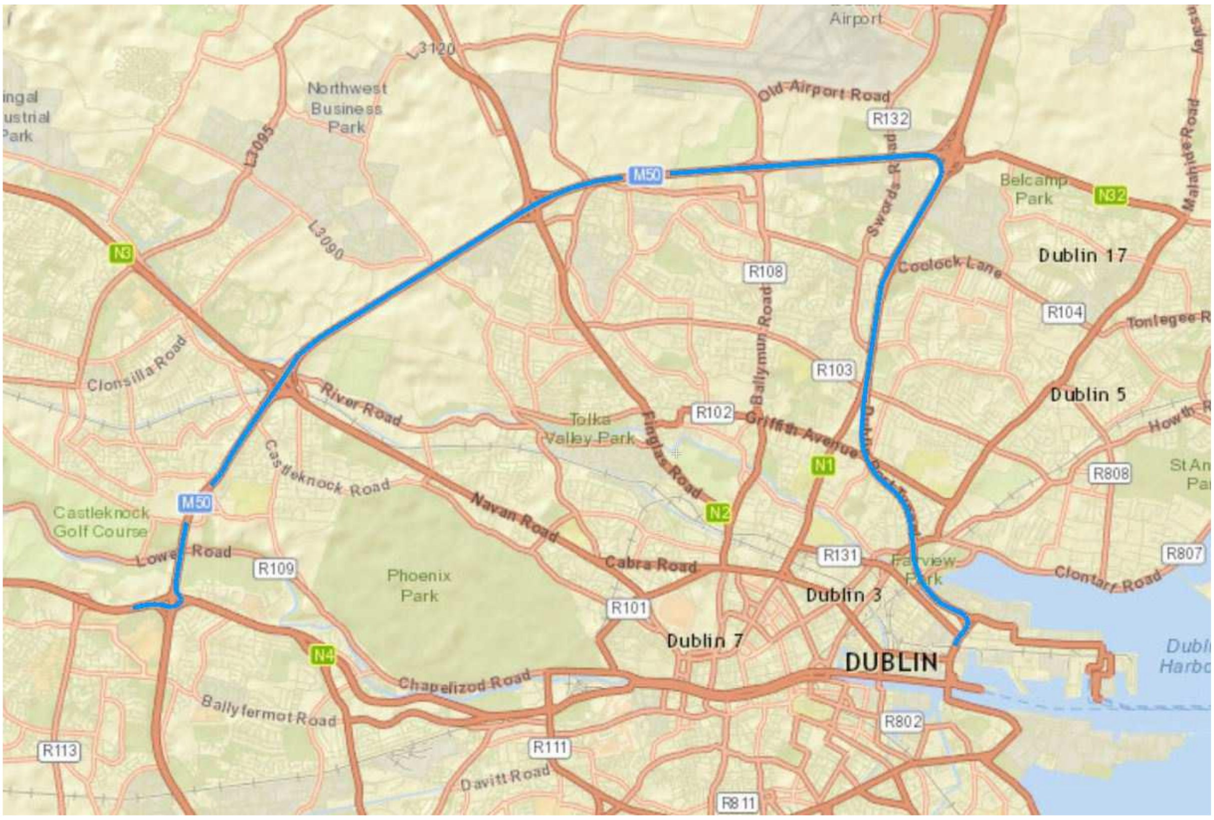
Port Alternatives

A number of components will enter the country though the ports including the blades, towers sections and nacelles. Three ports have been assessed as potential delivery locations for the various components. A combination of these ports may be used as there is the potential that different components will come through different ports. The access routes from Dublin, Waterford and Ringaskiddy ports to the site have been assessed herein. All routes will use the M6 to access the site.

Overview Map

1. Dublin Port

Dublin Port is currently being upgraded. Delivery from the port exit to the site would be through the Port Tunnel and onto the M50 and M4. This route would require alterations to the current Alexandra Road and East Wall Road Junction requiring the relocation of the traffic islands and associated signage and street furniture in order to accommodate the delivery of blades. The turn-in to the Port Tunnel Emergency By-pass Lane (EBL) would also require widening works to accommodate blade delivery.



Dublin Port to N4

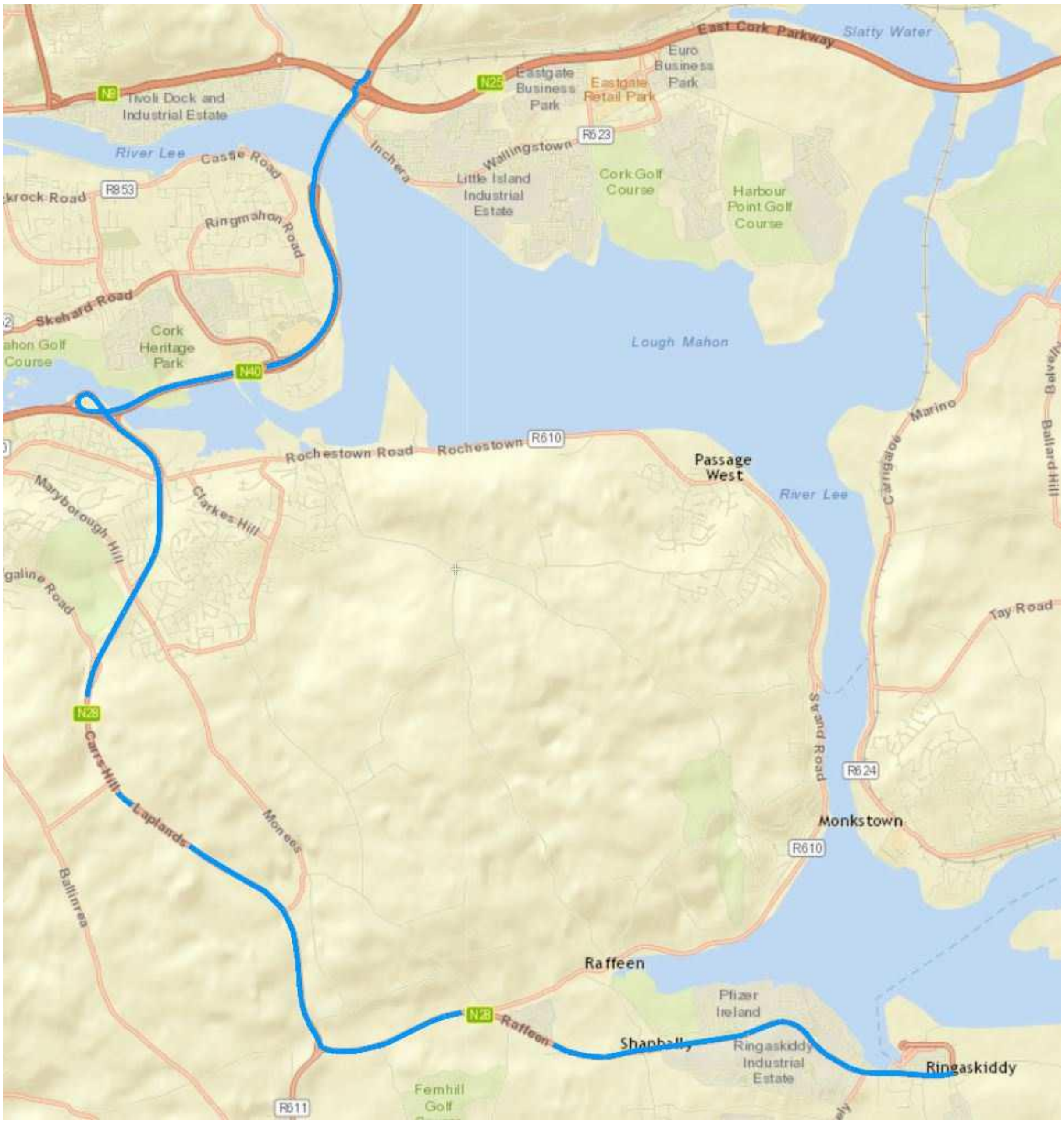
2. Waterford Port

Waterford Port has the capacity to accommodate the delivery and storage of all components. Access to site would be via the N29, N25, M9, M7, N7, M50, M4 and M6. Accommodation works would be required at the four roundabout locations on this route including temporary street furniture relocation, barrier alterations and localised load bearing works.

Waterford Port (Belview) to M9

3. Ringaskiddy Port

Ringaskiddy Port has the capacity to accommodate the delivery and storage of all components. Access to site would be via the N28, N40 (South Ring Road), The Jack Lynch Tunnel, M8, M7, N7, M50 M4 and M6. Enabling works would be required at the four roundabout locations on this route including temporary street furniture relocation and localised load bearing works.



Ringaskiddy Port to M8

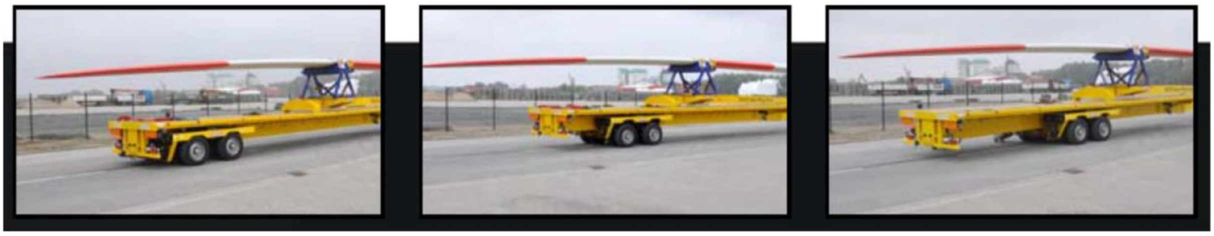
Apendix II.

Alternative Delivery Methods
In order to minimise the impact on the existing environment during turbine component deliveries there are several alternative options available.

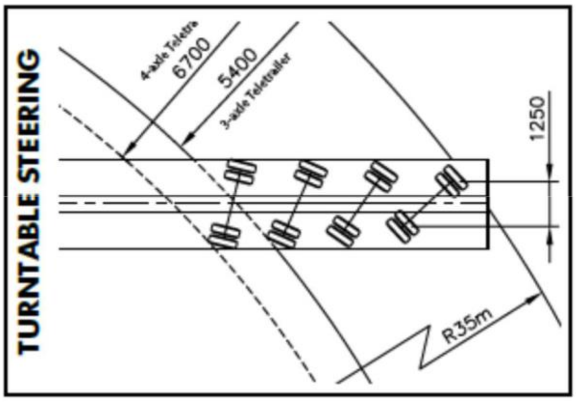
The above report details the alterations needed for the delivery of the largest turbine component using an extendable rear steer trailer.

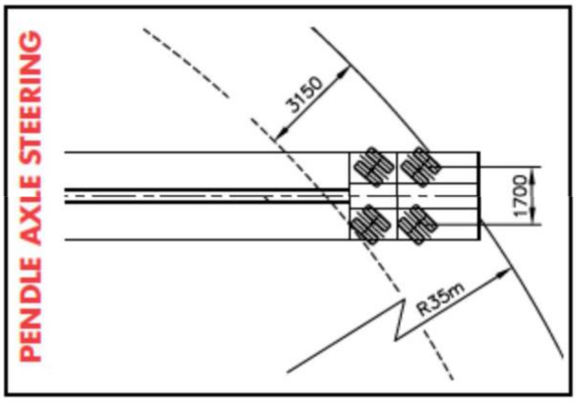
1. Multi Adapt Blade Trailers
See below details of the Nooteboom Mega Wing blade transporter currently in use on wind farm sites.

- Rectractable Axle Assembly - (helps to reduce the turning area of the trailer)



- Pendle Axle Steering – rear axle steering requires less hardcore area and offers a tighter turning radius





Conventional Rear wheel steer New Pendle axle steering

• Height Adjustable Trailer – The trailer load can be raised by up to 1.2m above FRL

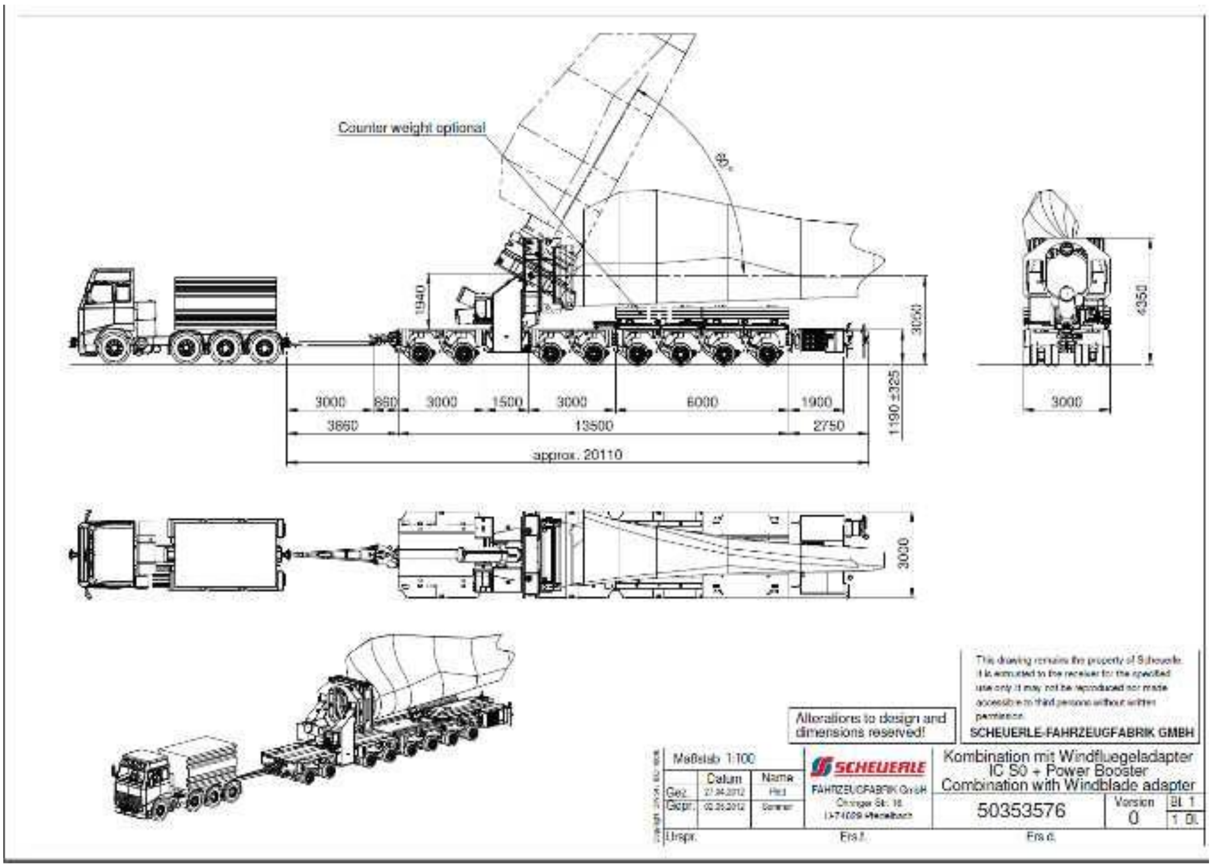


2. Blade Adaptor

Depending on the site location, some access routes may not have the physical landscape to allow alterations be carried out. This can happen on narrow access roads where there is no option to cut/fill at bends. Circumstances on delivery routes could change resulting in a node too tight to get around with the blade in the conventional position i.e. horizontal. If this situation arises, a blade adaptor can be used whereby the blade is connected to a specially adapted motorised unit, tilted up to 60deg into the air and transported through the restricted area. By tilting, the blade length is effectively reduced to 30m thus the land area needed for transport is reduced. A detailed topographical survey will be needed to ensure the public road is capable of taking the load in the adapted position. The transport company is to ensure all overhead utilities are locally diverted or temporarily lowered. More details can be seen on the following site; http://www.spedition-bender.com/blade-transporters.html

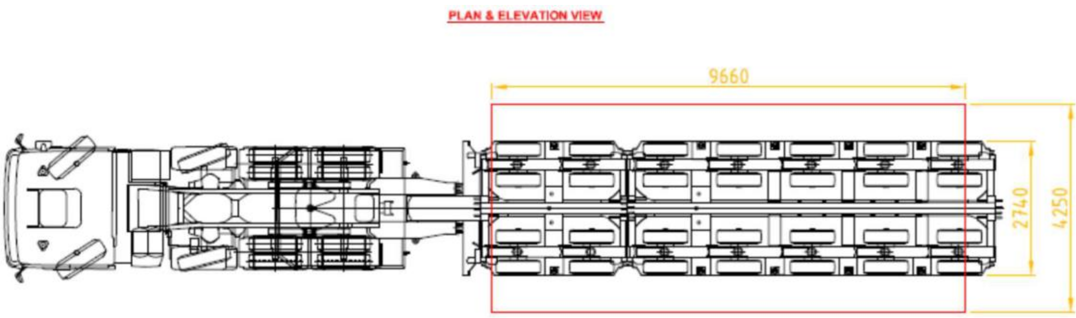
Blade connected to the blade adaptor

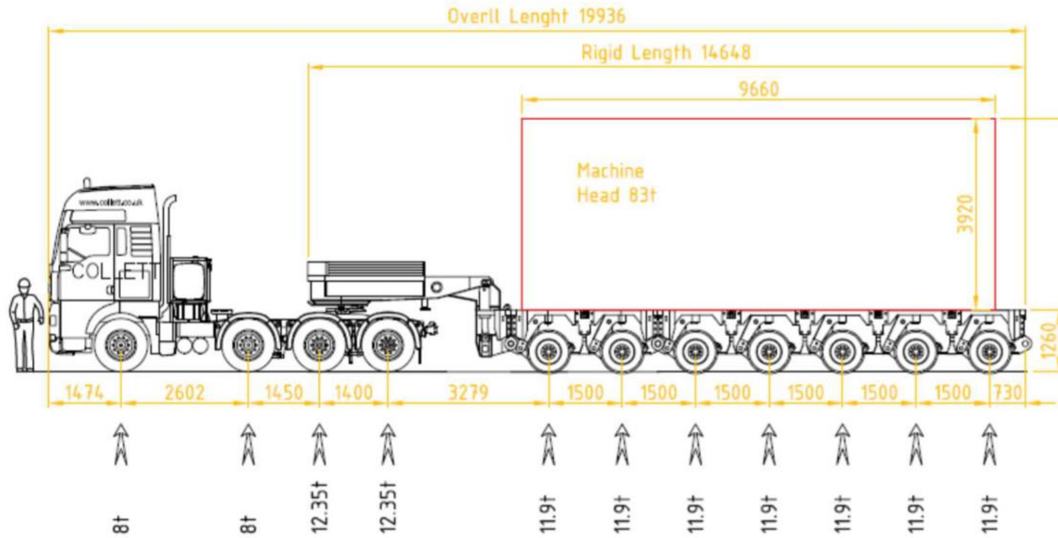

See below Blade adaptor considered on another Wind Farm project in Ireland



Counter weight optional
1940
3050
4350
3000
860
1500
6000
1900
3860
13500
2750
1190 ±325
approx. 20110
Alterations to design and dimensions reserved!
SCHEUERLE-FAHRZEUGFABRIK GMBH
Maßstab 1:100
SCHEUERLE
Kombination mit Windfluegeladapter
IC 50 + Power Booster
Combination with Windblade adapter
50353576

Nacelle Transport Options
Option 1 – Multi Axel Semi Loader – 20m long x 5.1m high




Overll Lenght 19936
Rigid Length 14648
9660
Machine
Head 83t
3920
5180
1260
COLLETT
1474
2602
1450
1400
3279
1500
1500
1500
1500
1500
1500
730
8t
8t
12.35t
12.35t
11.9t
11.9t
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APPENDIX 4-8

CONSTRUCTION AND ENIRONMENTAL MANGEMENT PLAN (CEMP)

APPENDIX 4-9

DRAINAGE DRAWINGS

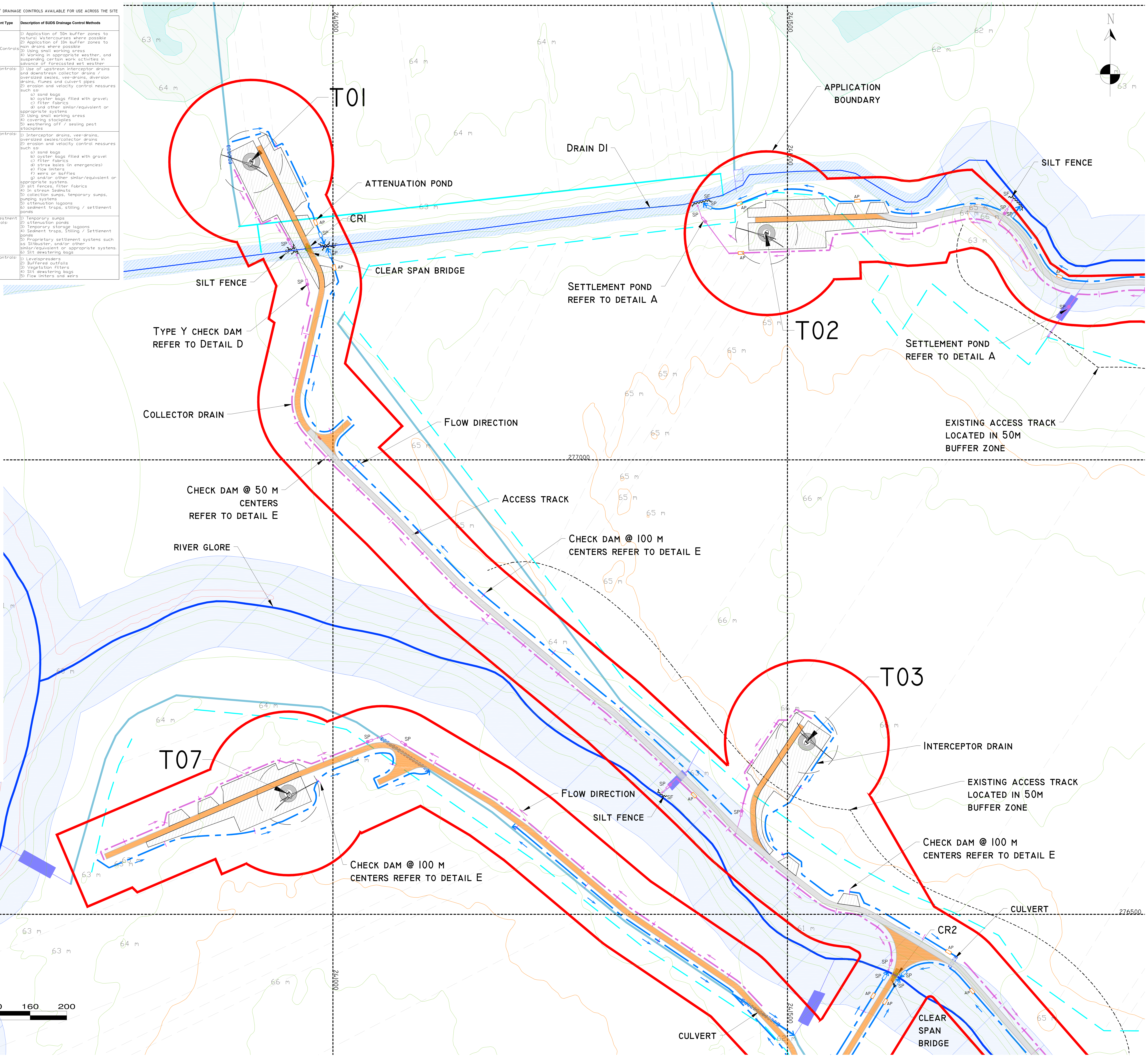
Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Key Plan



Drawing Legend :

- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt Fence (SF)
- Headland Drain
- Field Drain
- CR - New Stream/River Crossing Location
- Clear Span Bridge
- Existing Settlement Pond

Proposed Drainage

- Application Boundary
- Existing Ground Surface Majour Contour (5 m Interval)
- Existing Ground Surface Minor Contour (1 m Interval)
- Rivers/Streams
- Lakes
- Natural Rivers/Streams 50m Buffer
- Drain 10m Buffer
- Lake 50m Buffer
- Turbine and Swept Area
- Turbine Foundation
- Regional Road
- Local Road
- Proposed Road
- Existing Road to be Upgraded
- Passing Bay
- Crane Platform
- Borrow Pit

Project Design Drawing Notes

1. Drawings issued are for planning application purposes only.
2. Drawings not to be used for construction /contract conditions.
3. Copyright, all rights reserved. No part here with may be copied or reproduced partially or wholly in any form whatsoever without the prior notice of the copyright owner Hydro-Environmental Services.
4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, weather main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.

Date	Description	Chkd	Signed

Revisions

HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
Dungarvan
Co. Waterford
Ireland
tel: +353 (0) 58-44122
tel: +353 (0) 58-44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

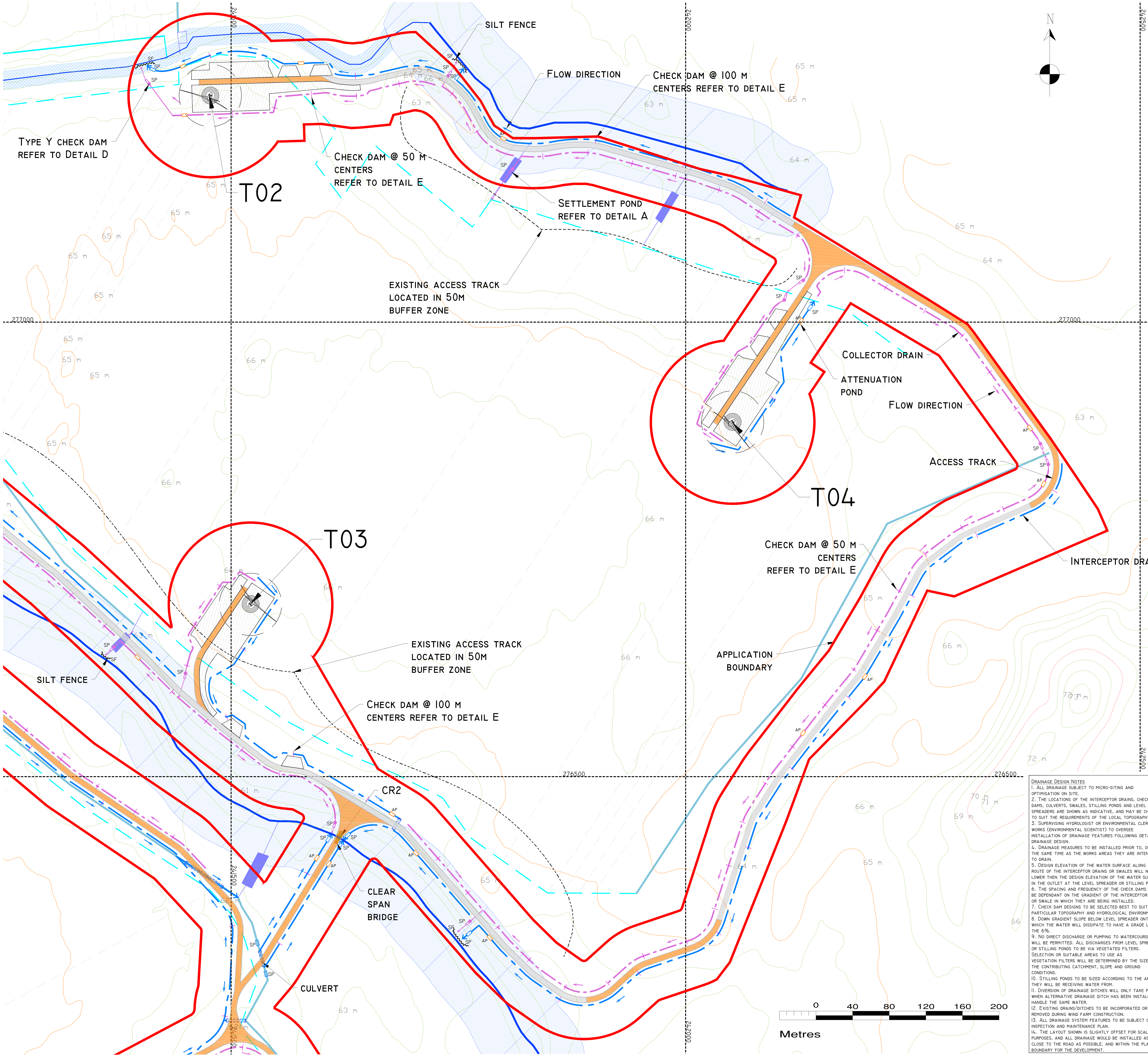
Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 1 of 7

Figure No: D101

Drawing No: P1320-2-0221-A1-D101-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



DRAWING LEGEND :

- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

PROPOSED DRAINAGE

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

PROJECT DESIGN DRAWING NOTES

1. DRAWINGS ISSUED ARE FOR PLANNING APPLICATION PURPOSES ONLY.
2. DRAWINGS NOT TO BE USED FOR CONSTRUCTION /CONTRACT CONDITIONS.
3.
4. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.
5. ALL CONTRACTORS, WEATHER MAIN OR SUB-CONTRACTORS, MUST VISIT THE SITE AND ARE RESPONSIBLE FOR TAKING AND CHECKING ANY AND ALL DIMENSIONS AND LEVELS THAT RELATE TO THE WORKS.
6. THE USE OF OR RELIANCE UPON THIS DRAWING SHALL BE DEEMED TO BE ACCEPTANCE OF THESE CONDITIONS OF USE UNLESS OTHERWISE AGREED IN WRITING, SUCH WRITTEN AGREEMENT TO BE SOUGHT FROM AND ISSUED BY THE COPYRIGHT HOLDER TO THE USE OR RELIANCE UPON THIS DRAWING.
7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

Date	Description	Chkd	Signed

Revisions

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

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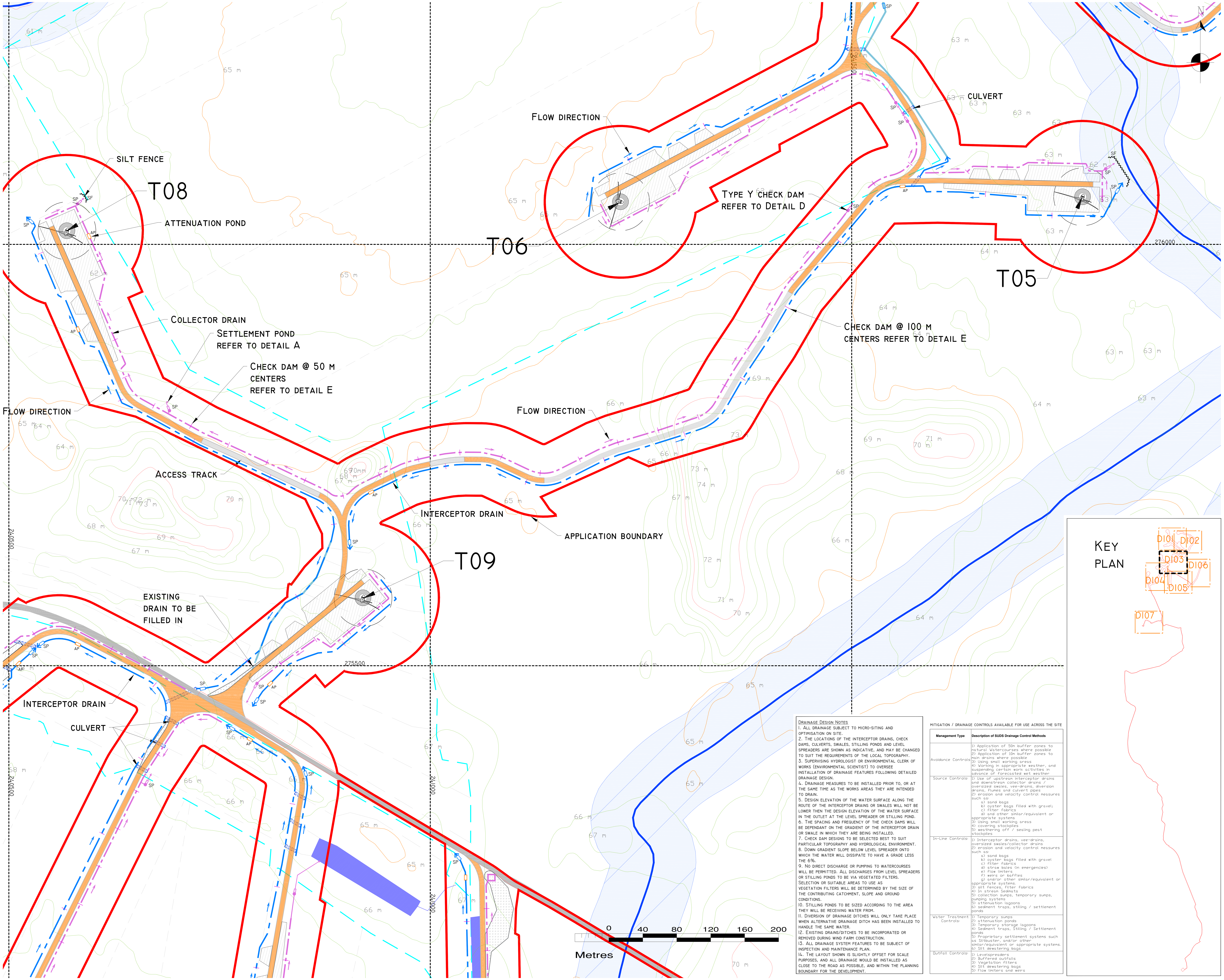
Client: MKO

Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 2 OF 7

Figure No: D102

Drawing No: P1320-2-0221-A1-D102-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



Drawing Legend :

- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt Fence (SF)
- Headland Drain
- Field Drain
- CR - New Stream/River Crossing Location
- Clear Span Bridge
- Existing Settlement Pond

Proposed Drainage

- Application Boundary
- Existing Ground Surface Major Contour (5 m interval)
- Existing Ground Surface Minor Contour (1 m interval)
- Rivers/Streams
- Lakes
- Natural Rivers/Streams 50m Buffer
- Drain 10m Buffer
- Lake 50m Buffer
- Turbine and Swept Area
- Turbine Foundation
- Regional Road
- Local Road
- Proposed Road
- Existing Road to be Upgraded
- Passing Bay
- Crane Platform
- Borrow Pit

Project Design Drawing Notes

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4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, weather main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Date	Description	Chkd	Signed

Revisions

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Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 3 of 7

Figure No: D103

Drawing No: P1320-2-0221-A1-D103-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
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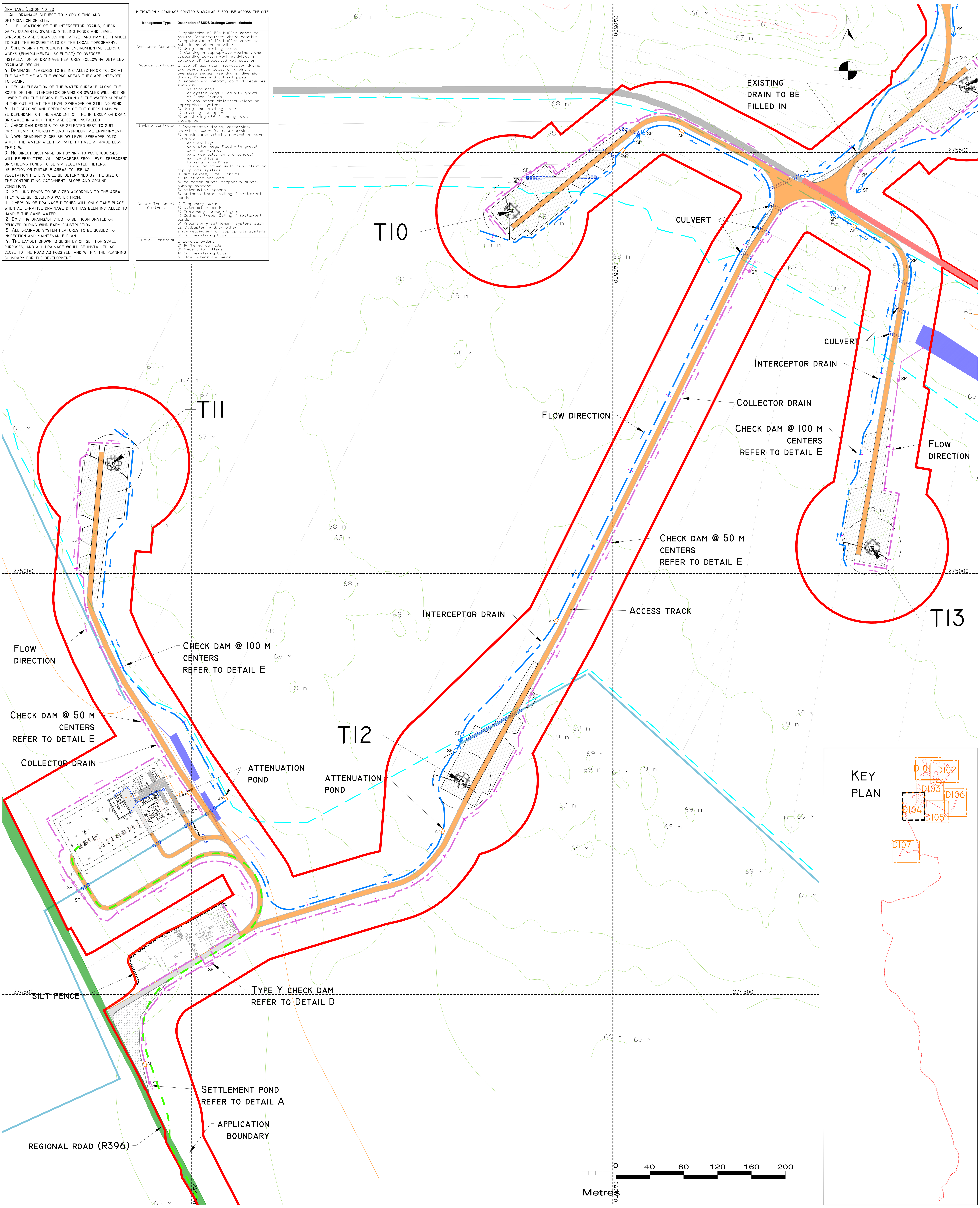
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

Mitigation / drainage cointrols available for use across the site

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



Drawing Legend :

- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt fence (SF)
- Headland drain
- Field drain
- CR - New stream/river crossing location
- Clear span bridge
- Existing settlement pond

Proposed Drainage

- Application boundary
- Existing ground surface majour contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- Rivers/streams
- Lakes
- Natural rivers/streams 50m buffer
- Drain 10m buffer
- Lake 50m buffer
- Turbine and swept area
- Turbine foundation
- Regional road
- Local road
- Proposed road
- Internal existing road to be upgraded
- External existing road to be upgraded
- Passing bay
- Crane platform
- Borrow pit

Drawing Notes

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4. All dimensions are in metres.

Date	Description	Chkd	Signed

Revisions

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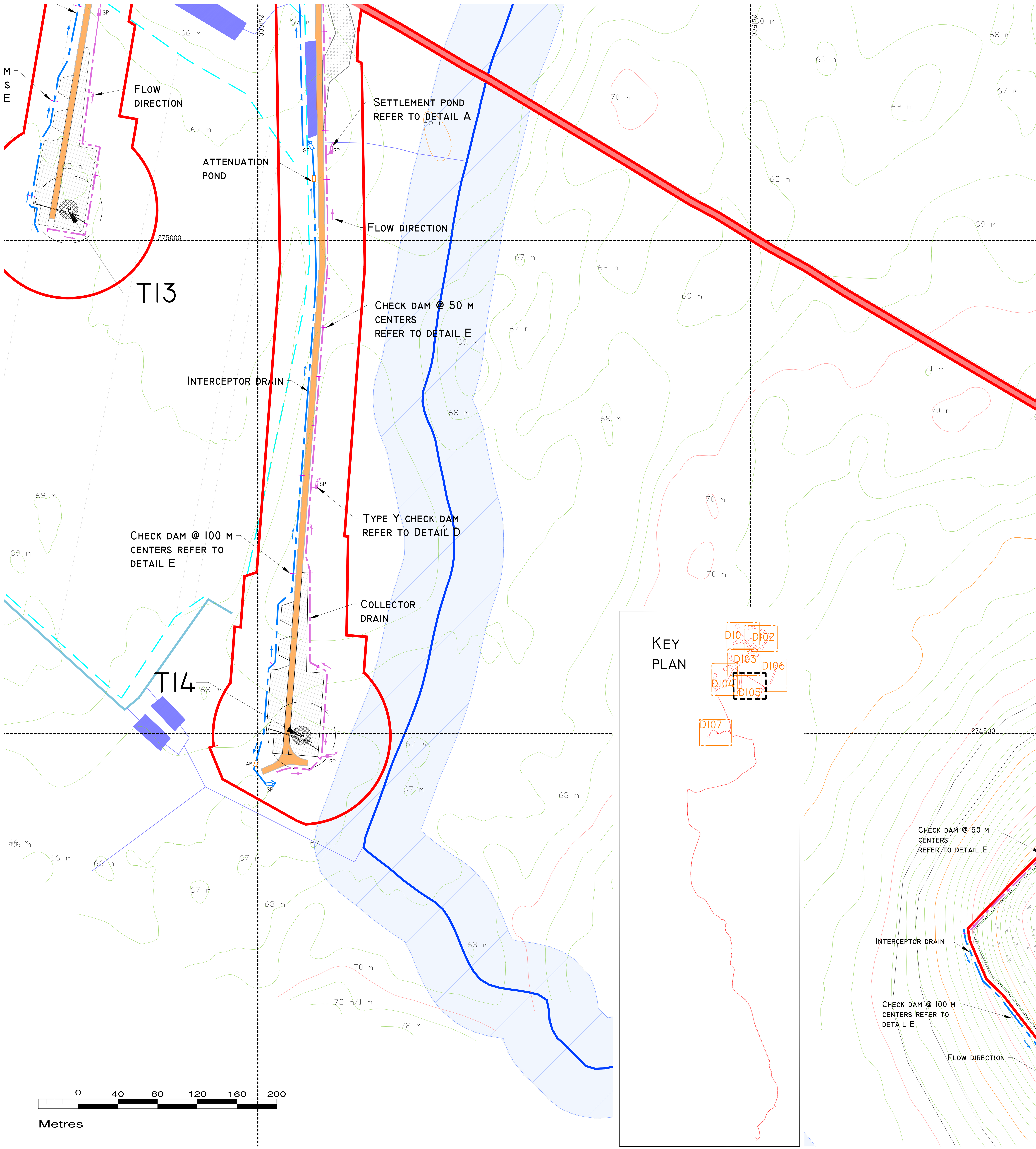
Client: MKO

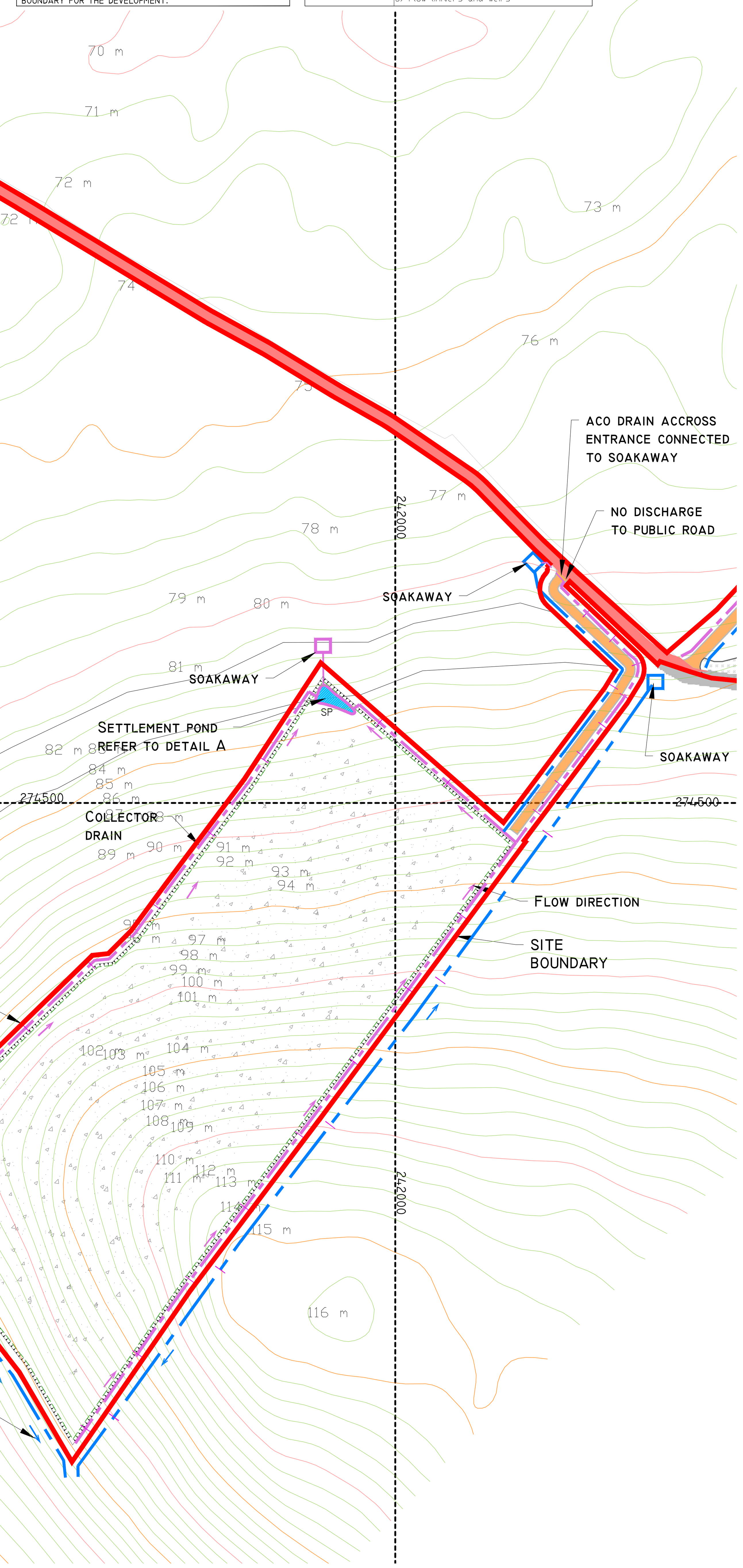
Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 4 of 7

Figure No: D104

Drawing No: P1320-2-0221-A1-D104-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG





Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
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7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
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Mitigation / Drainage Cointrols Available for Use Across the Site

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
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Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Drawing Legend :

Proposed Drainage:
- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt Fence (SF)
- Headland Drain
- Field Drain
- CR - New Stream/River Crossing Location
- Clear Span Bridge
- Existing Settlement Pond

- Application Boundary
- Existing Ground Surface Majour Contour (5 m interval)
- Existing Ground Surface Minor Contour (1 m interval)
- Rivers/Streams
- Lakes
- Natural Rivers/Streams 50m Buffer
- Drain 10m Buffer
- Lake 50m Buffer
- Turbine and Swept Area
- Turbine Foundation
- Regional Road
- Local Road
- Proposed Road
- Internal Existing Road to be Upgraded
- External Existing Road to be Upgraded
- Passing Bay
- Crane Platform
- Borrow Pit

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6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.

Date	Description	Chkd	Signed

Revisions

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Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 5 of 7

Figure No: D105

Drawing No: P1320-2-0221-A1-D105-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
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5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
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12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
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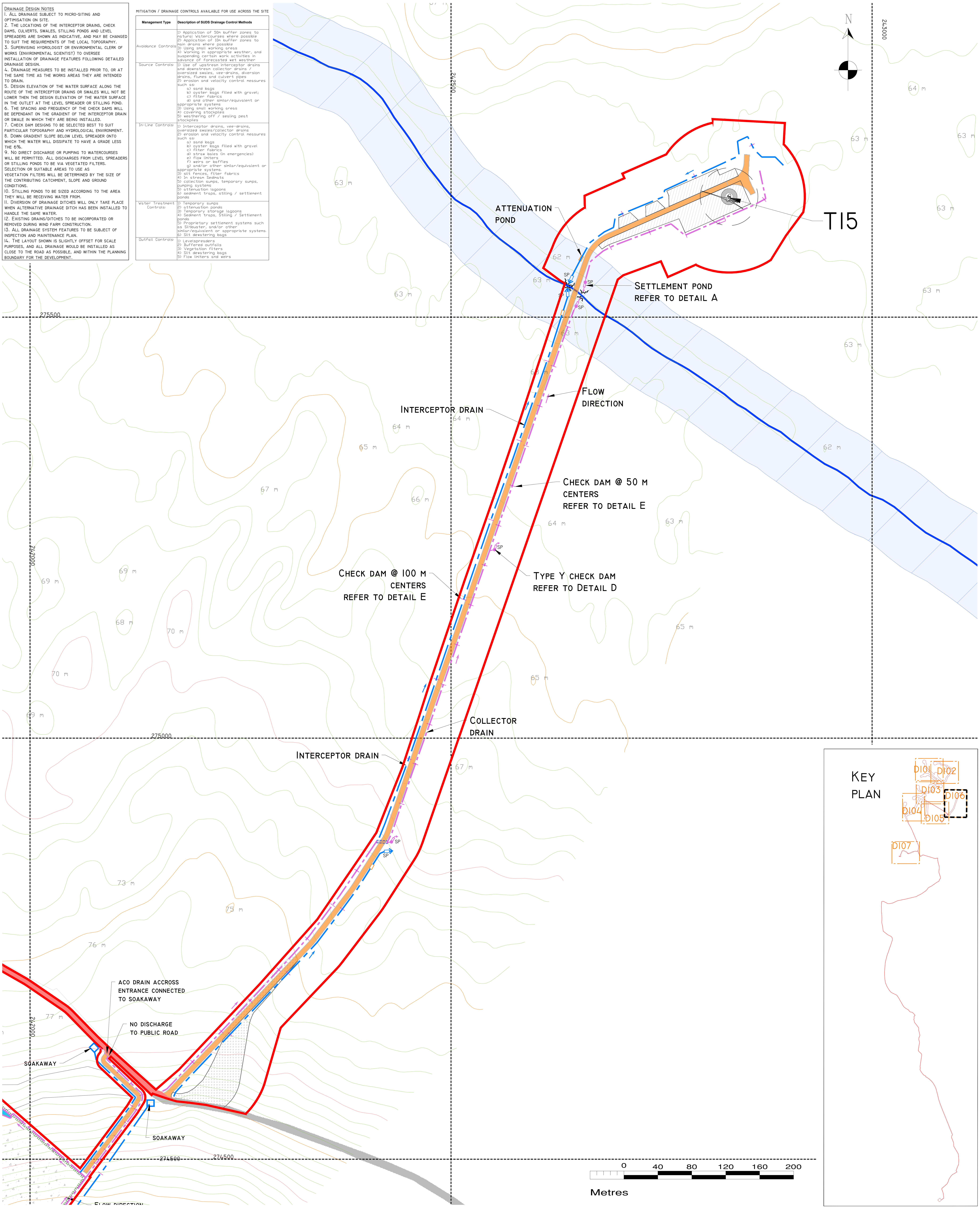
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



Drawing Legend :

Proposed Drainage:
- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt fence (SF)
- Headland drain
- Field drain
- CR - New stream/river crossing location
- Clear span bridge
- Existing settlement pond

- Application boundary
- Existing ground surface majour contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- Rivers/streams
- Lakes
- Natural rivers/streams 50m buffer
- Drain 10m buffer
- Lake 50m buffer
- Turbine and swept area
- Turbine foundation

- Regional road
- Local road
- Proposed road
- Internal existing road to be upgraded
- External existing road to be upgraded
- Passing bay
- Crane platform
- Borrow pit

Drawing Notes

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2.
3. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
4. All dimensions are in metres.

Date	Description	Chkd	Signed

Revisions

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web: www.hydroenvironmental.ie

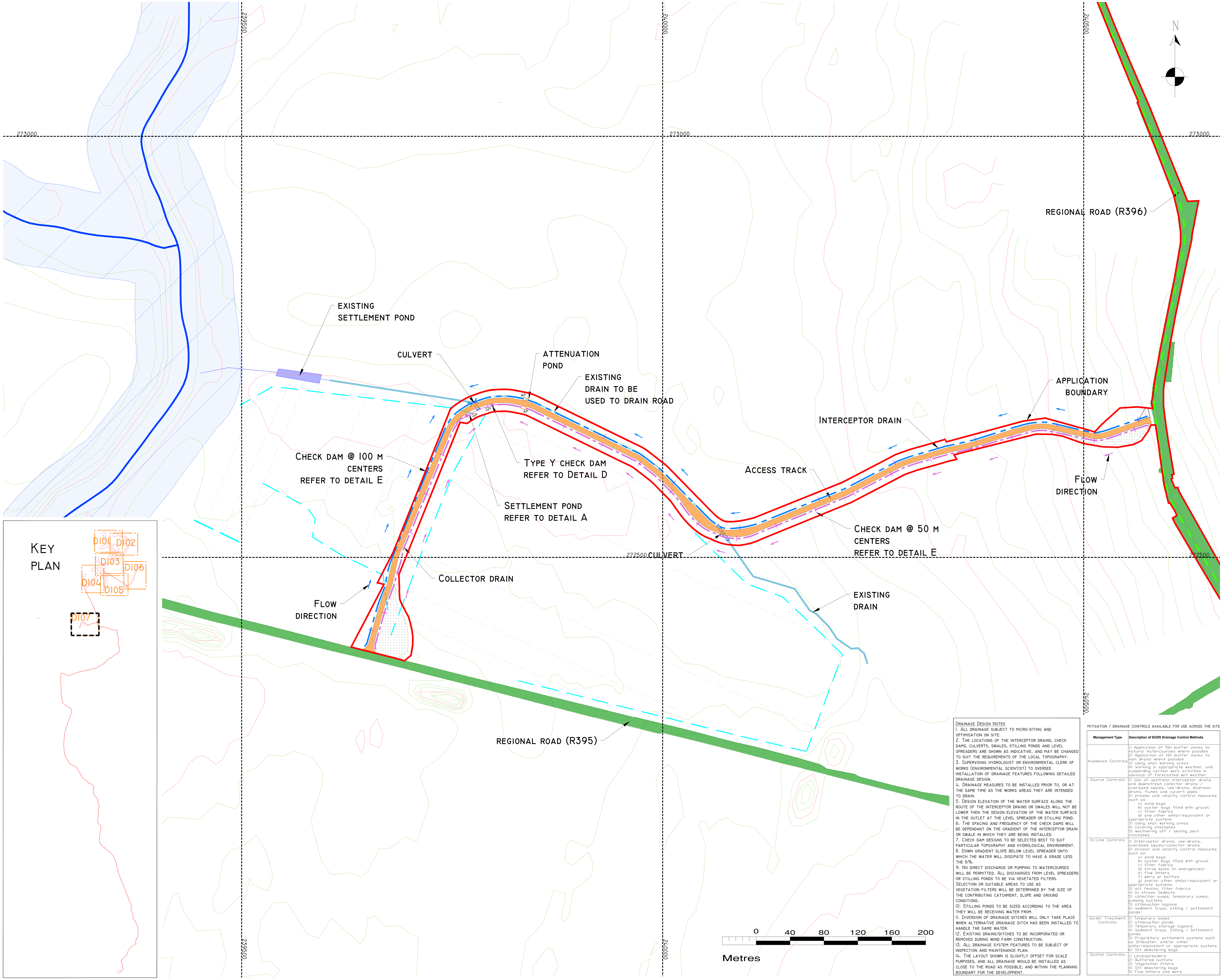
Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 6 of 7

Figure No: D106

Drawing No: P1320-2-0221-A1-D106-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



DRAWING LEGEND :

- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

PROPOSED DRAINAGE

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- INTERNAL EXISTING ROAD TO BE UPGRADED
- EXTERNAL EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

PROJECT DESIGN DRAWING NOTES

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6. THE USE OF OR RELIANCE UPON THIS DRAWING SHALL BE DEEMED TO BE ACCEPTANCE OF THESE CONDITIONS OF USE UNLESS OTHERWISE AGREED IN WRITING, SUCH WRITTEN AGREEMENT TO BE SOUGHT FROM AND ISSUED BY THE COPYRIGHT HOLDER TO THE USE OR RELIANCE UPON THIS DRAWING.
7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

Date	Description	Chkd	Signed

Revisions

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

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web: www.hydroenvironmental.ie

Client: MKO

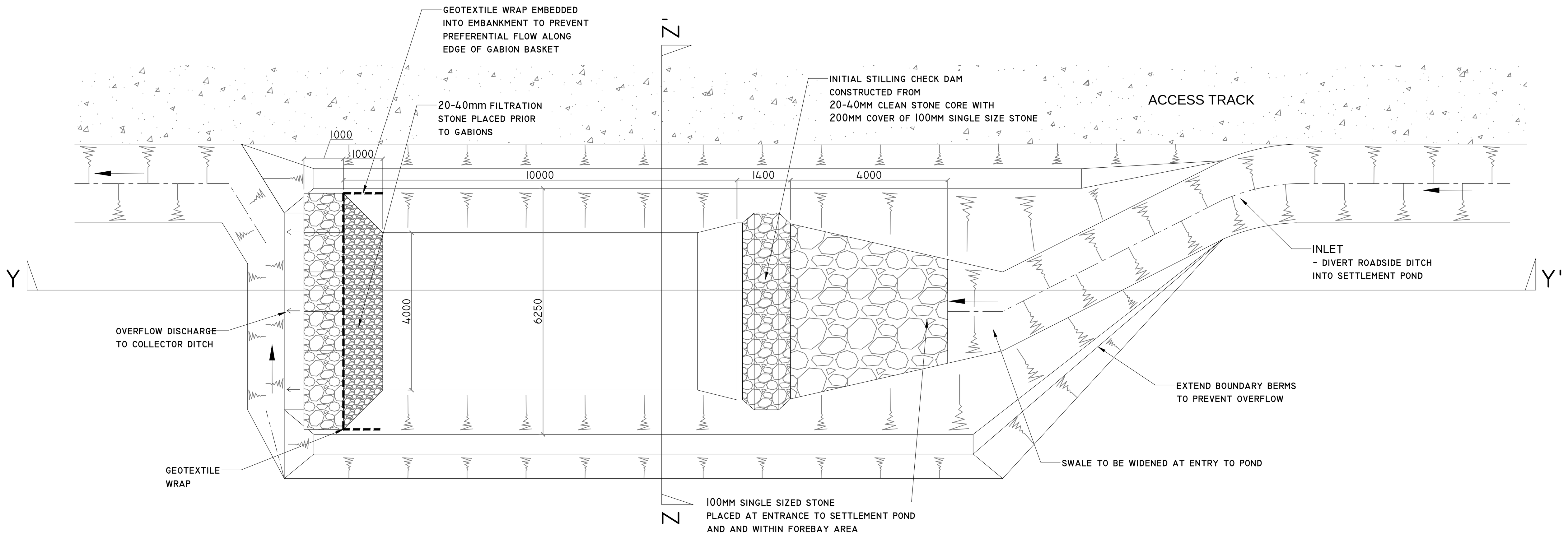
Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 7 OF 7

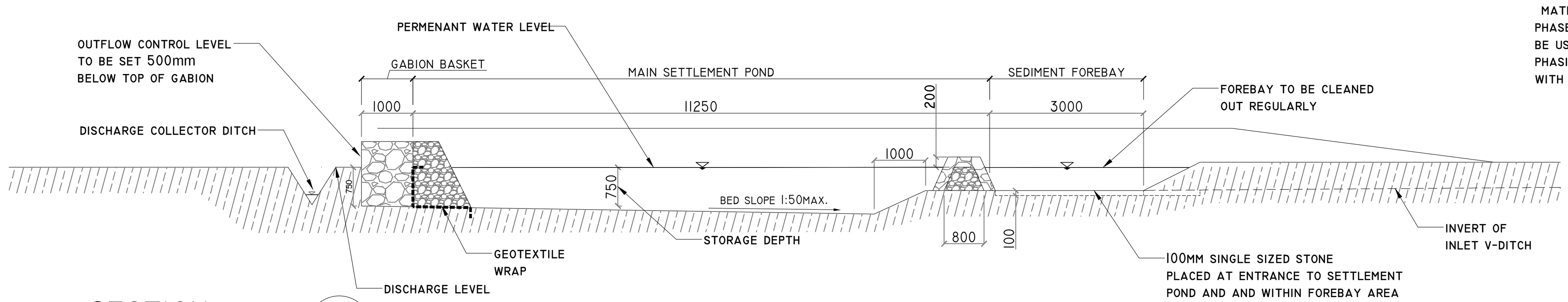
Figure No: D107

Drawing No: P1320-2-0221-A1-D107-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

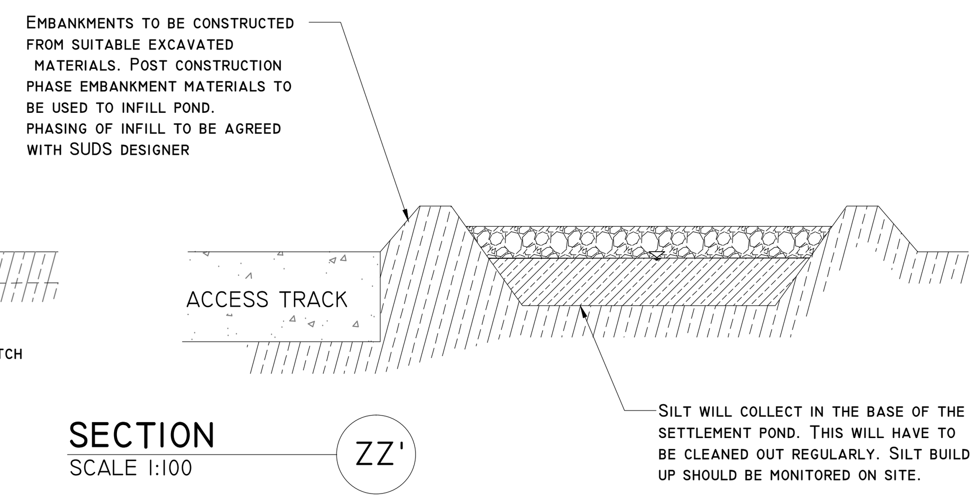
DETAIL A



TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE)



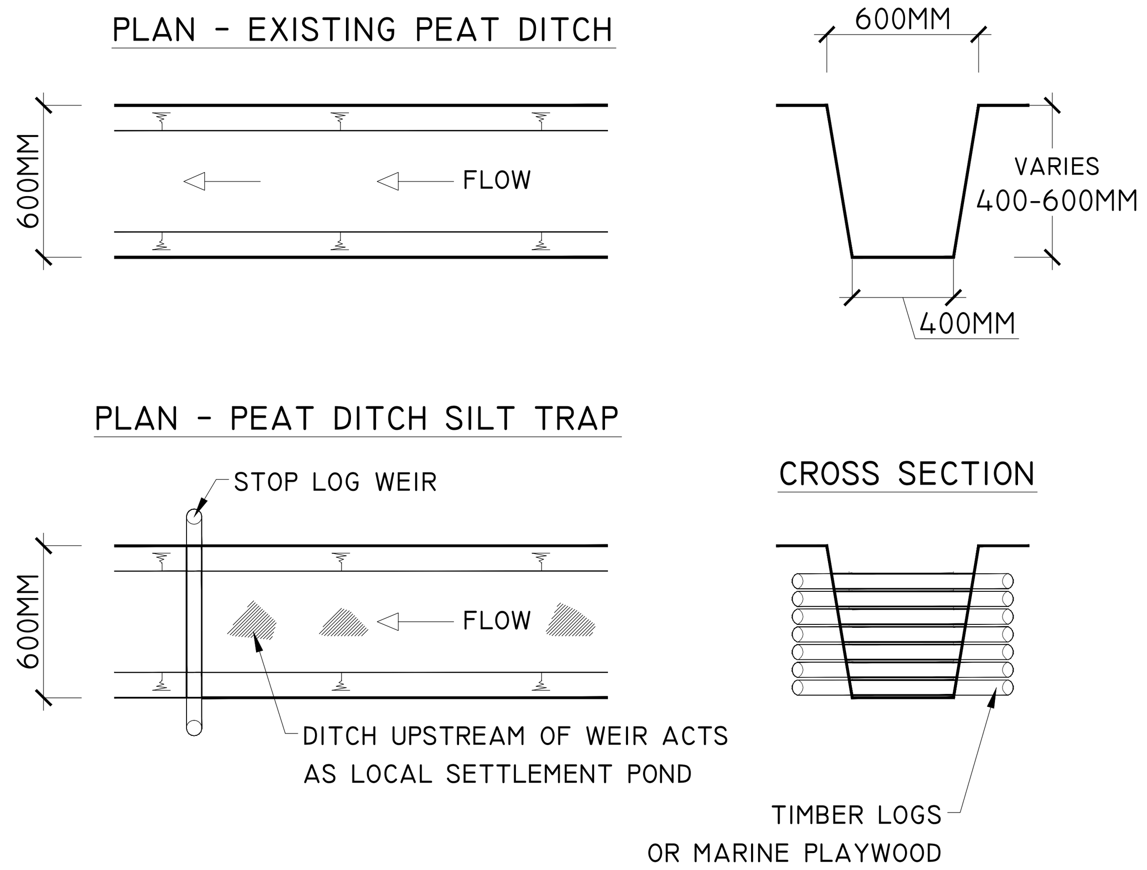
SECTION YY'
SCALE 1:100



SECTION ZZ'
SCALE 1:100

DETAIL B

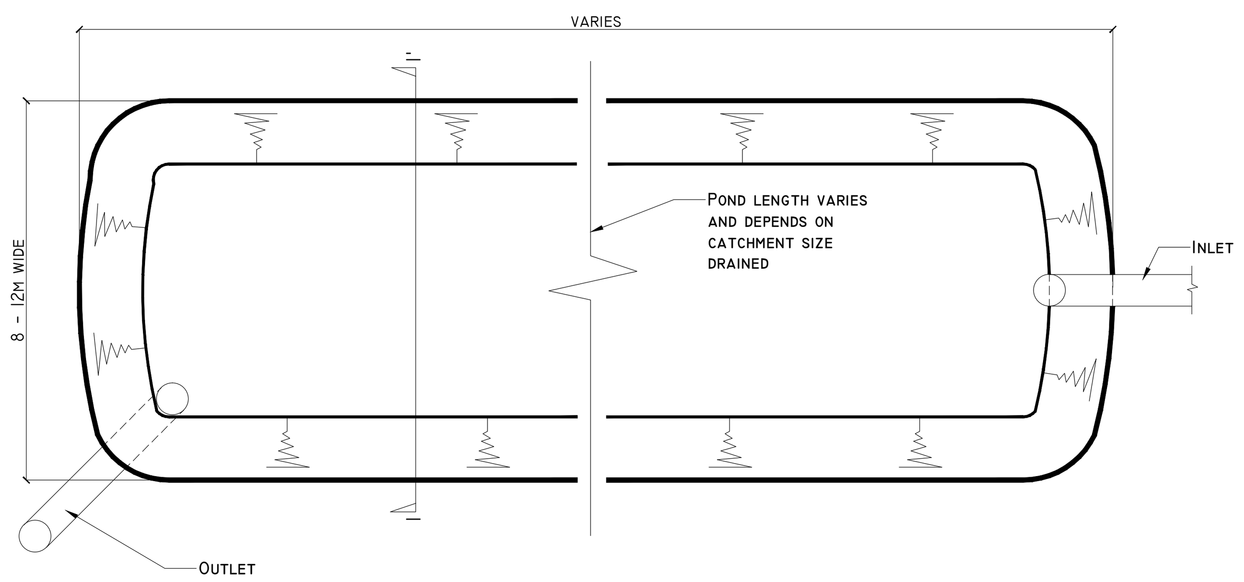
PEAT DITCH SILT TRAP
SCALE 1:25



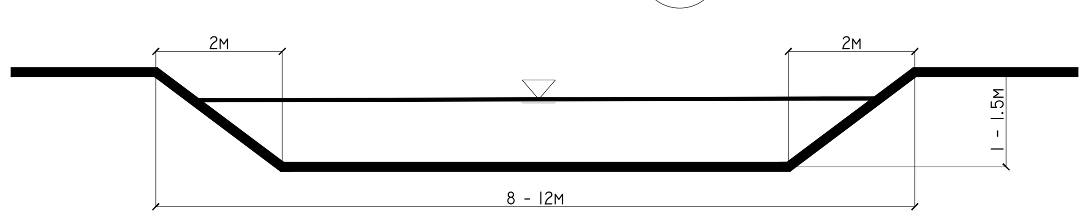
DETAIL C

Typical Peatland Site Settlement pond detail
SCALE 1:200

PLAN

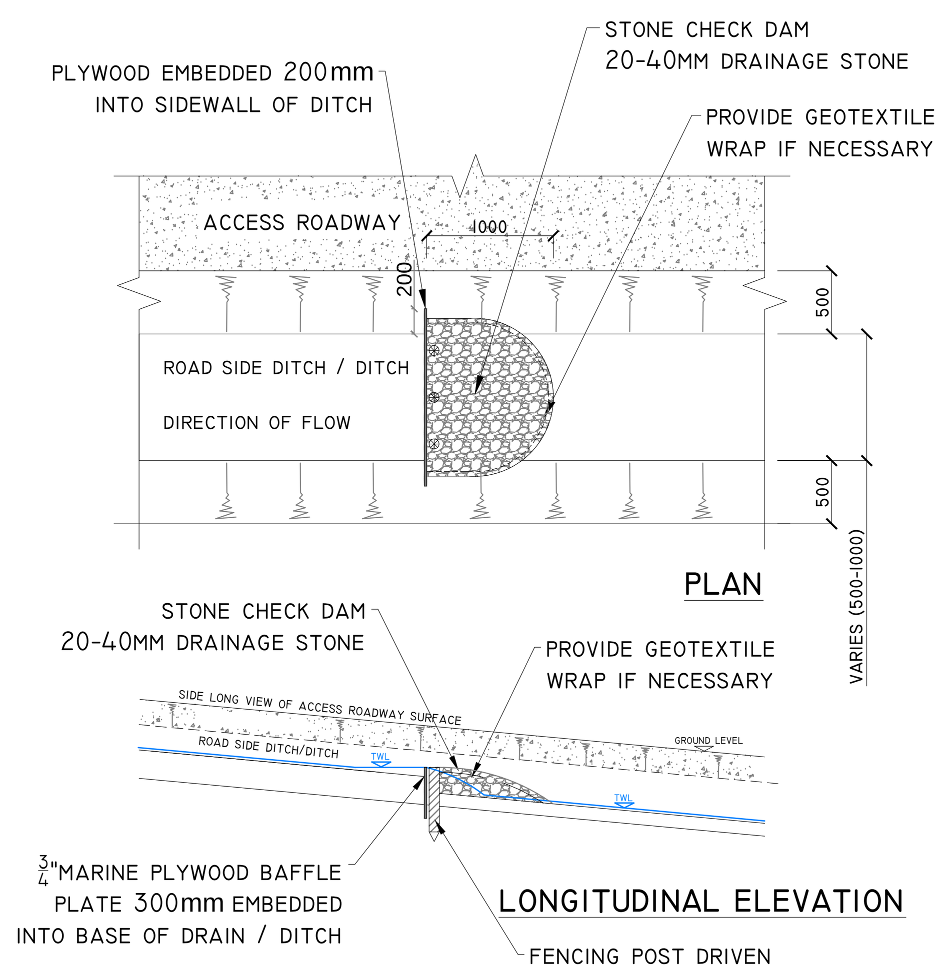


SECTION II'
SCALE 1:100



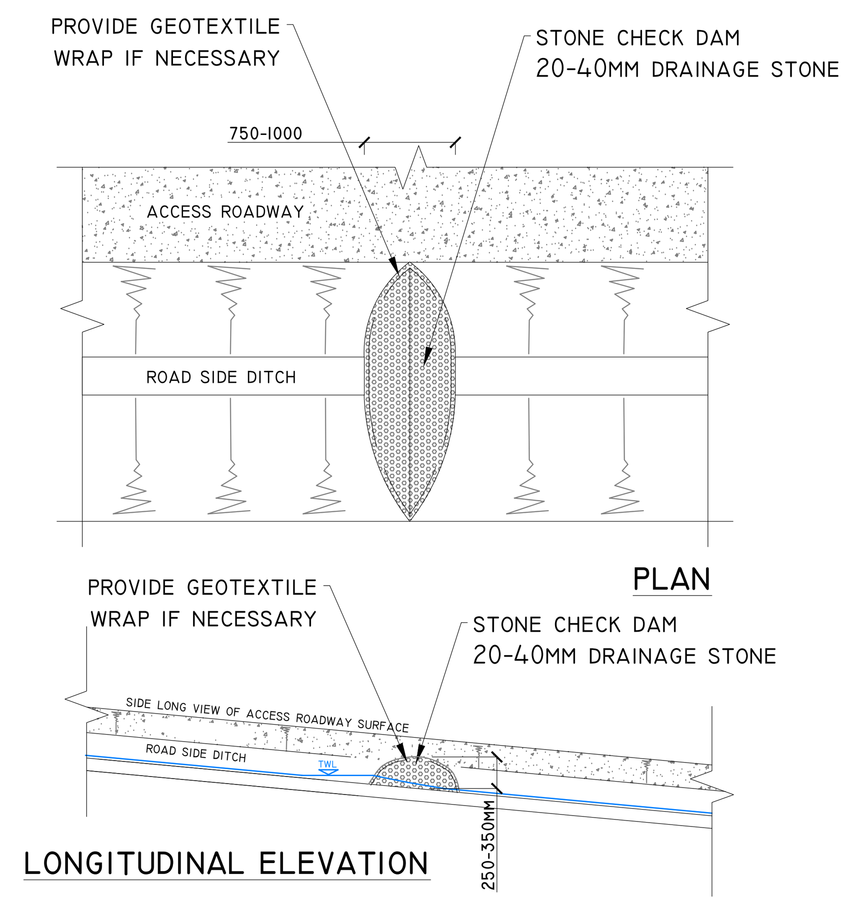
NOTES-
- All settlement ponds operate to licence requirements of IPPC licence Reg No. P0914-01 and P0974-01.
- Sizing likely based on accumulation of 100 m^3/ha/year silt
- ponds typically cleaned minimum twice a year (i.e. silt design capacity of lagoons, min 50 m^3 per net Ha of bog serviced), once before ditching and once before harvesting, or as inspections may dictate
- generally - 8 - 12 m wide, and 1 - 1.5 m deep
- likely velocity threshold of 0.1 m/sec

DETAIL D



TYPE Y - CHECK DAM DETAIL
SCALE 1:50

DETAIL E



TYPE X - CHECK DAM DETAIL
SCALE 1:50

Project Design Drawing Notes
1. Drawings issued are for planning application purposes only. Please note this drawing is for planning purposes only, and furthur detailed specification will be required for the completion of the works to ensure they meet required design standards, and planning conditions.
2. Drawings not to be used for construction /contract conditions.
3. Copyright, all rights reserved. No part here with may be copied or reproduced partially or wholly in any form whatsoever without the prior notice of the copyright owner Hydro-Environmental Services.
4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. drainage systems are offset at a distance appropriate to the scale of this drawing. all drainage will be located adjacent to infrastructure, as appropriate across the site.

Drainage Design Notes
1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, settlement ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or settlement pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade <6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Settlement ponds to be sized according to the catchment area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage will be installed as close to access tracks/roads as possible.

Date	Description	Chkd	Signed
08.02.21	Planning - Rev A	M.G.	M.Gill

Revisions

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Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Details 1

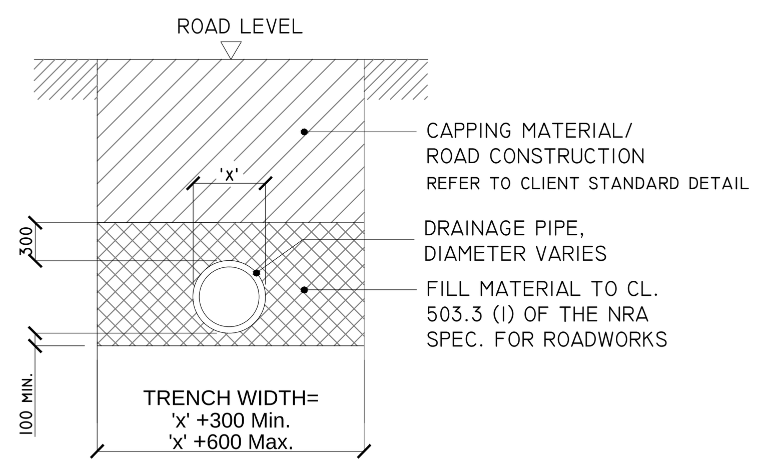
Figure No: 501

Drawing No: P1320-2-0221-A1-501-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: as shown (A1)	Drawn By: M.Gill
Date: 17/02/2021	Checked By: M.G.

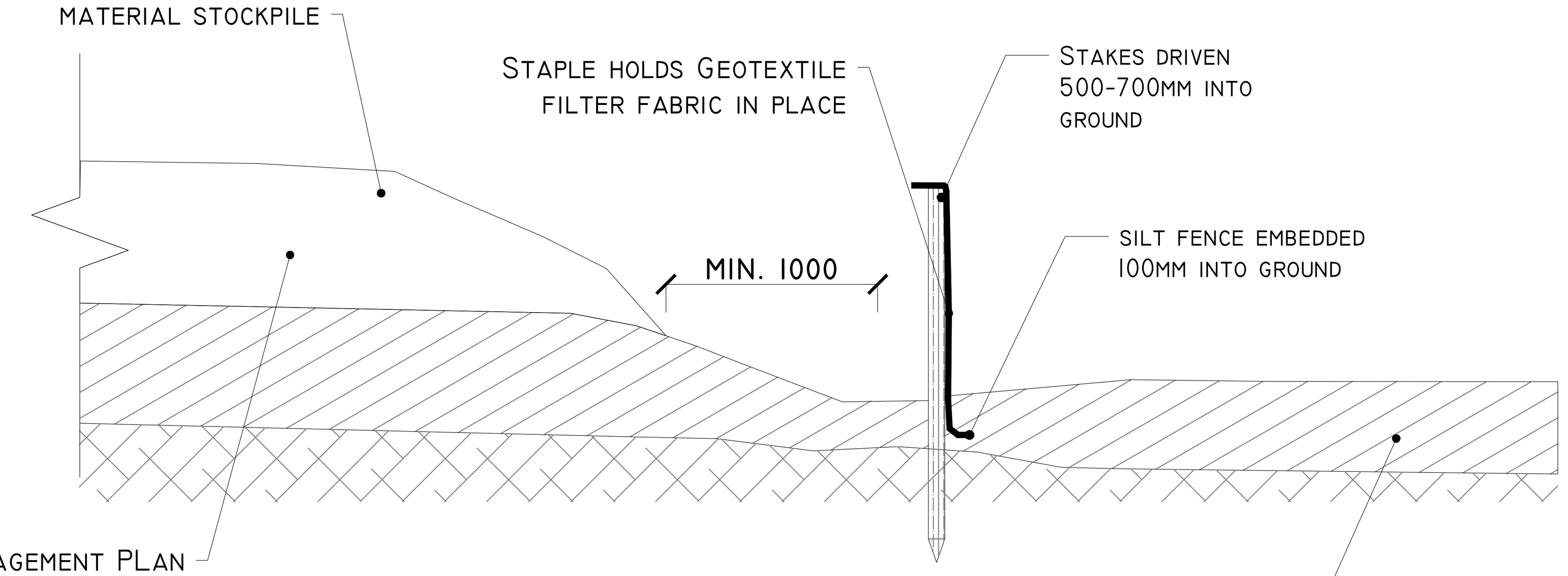
DETAIL F

'TYPE B' CULVERT - DRAINAGE CROSSING BENEATH EXCAVATED ROAD

SCALE 1:50



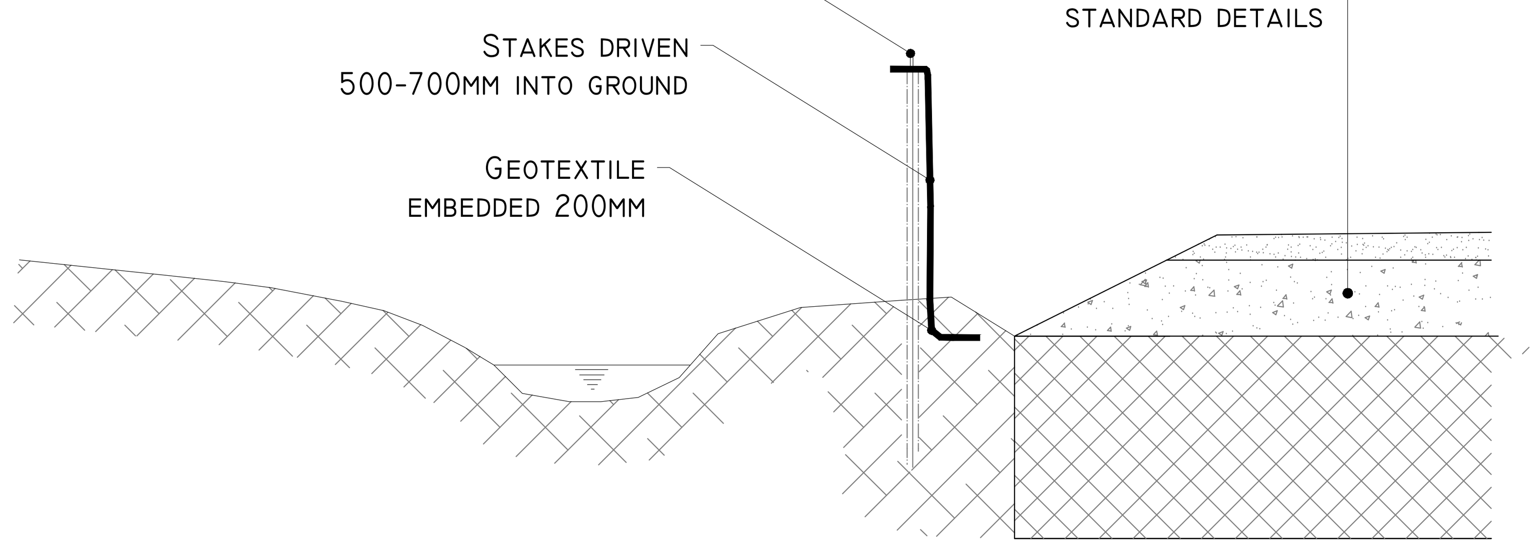
DETAIL G-I



SILT FENCE

SCALE 1:25

DETAIL G-II



SILT FENCE FOR WATERCOURSE PROTECTION

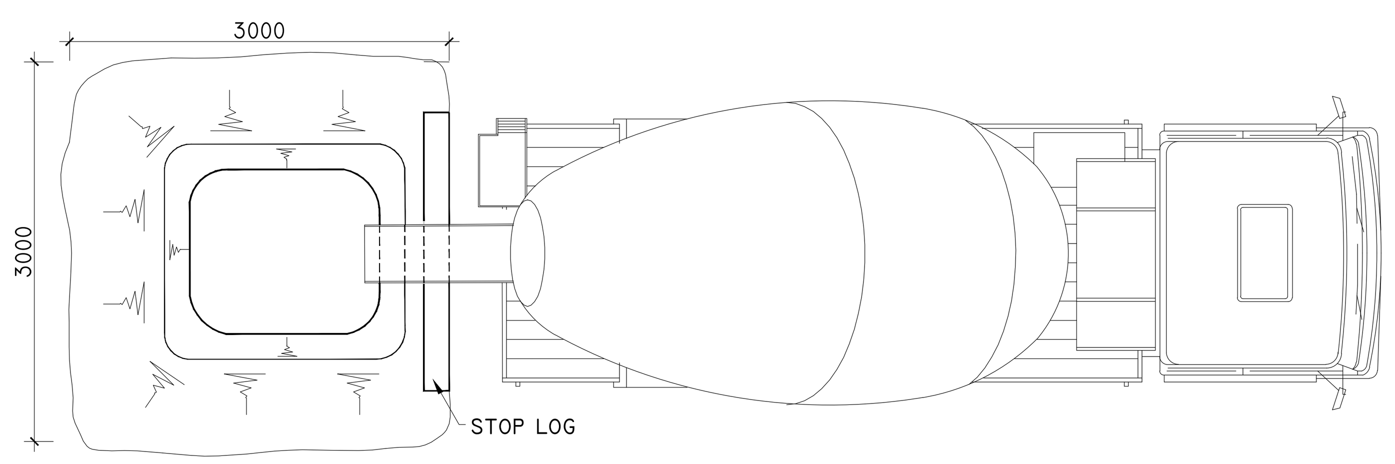
SCALE 1:25

DETAIL I

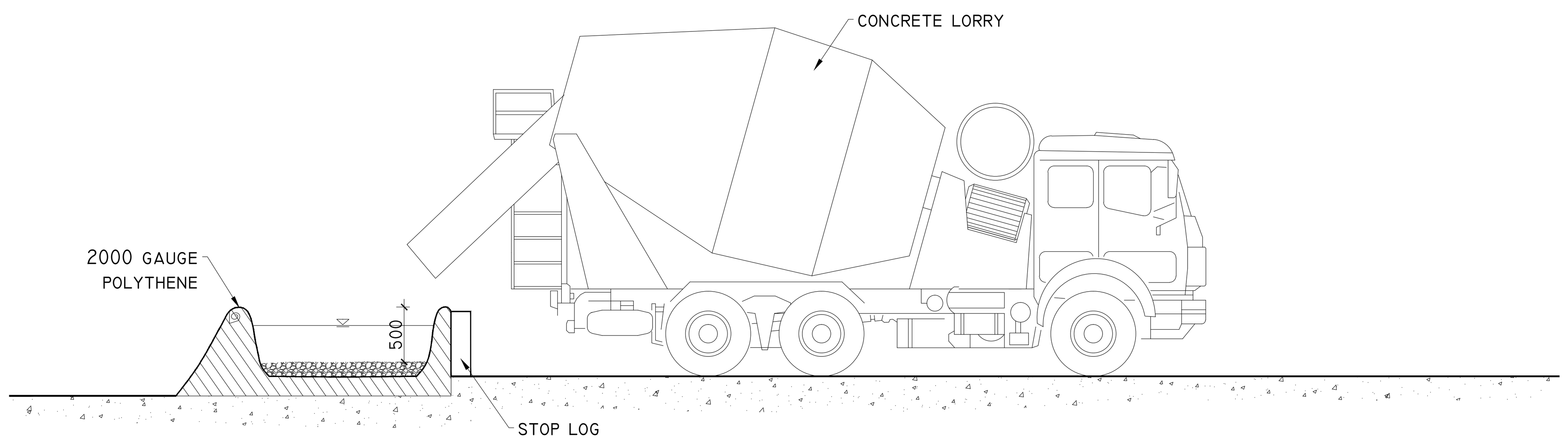
TEMPORARY CONCRETE WASH OUT PIT

SCALE 1:25

PLAN



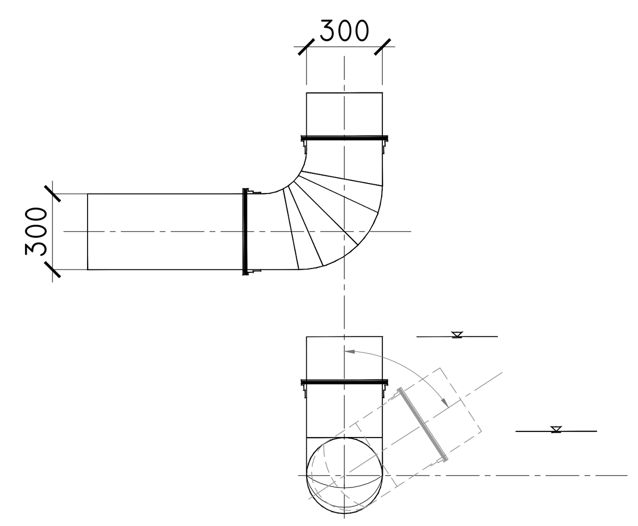
ELEVATION



DETAIL H

90° U BEND AND WATER LEVEL CONTROL MECHANISM

SCALE 1:25



PROJECT DESIGN DRAWING NOTES

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7. DRAINAGE SYSTEMS ARE OFFSET AT A DISTANCE APPROPRIATE TO THE SCALE OF THIS DRAWING. ALL DRAINAGE WILL BE LOCATED ADJACENT TO INFRASTRUCTURE, AS APPROPRIATE ACROSS THE SITE.

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, SETTLEMENT PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR SETTLEMENT POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE <6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. SETTLEMENT PONDS TO BE SIZED ACCORDING TO THE CATCHMENT AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WILL BE INSTALLED AS CLOSE TO ACCESS TRACKS/ROADS AS POSSIBLE.

Date	Description	Chkd	Signed
08.02.21	Planning - Rev A	M.G.	M.Gill

Revisions

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web: www.hydroenvironmental.ie

Client: MKO

Job: COLLE WF, CO. WESTMEATH

Title: DRAINAGE DETAILS 2

Figure No: 502

Drawing No: P1320-2-0221-A1-502-00A

Sheet Size: A1	Project No.: P1320-2
Scale: as shown (A1)	Drawn By: M.Gill
Date: 17/02/21	Checked By: M.G.

APPENDIX 4-10

EIRGRID STANDARD SPECIFICATION

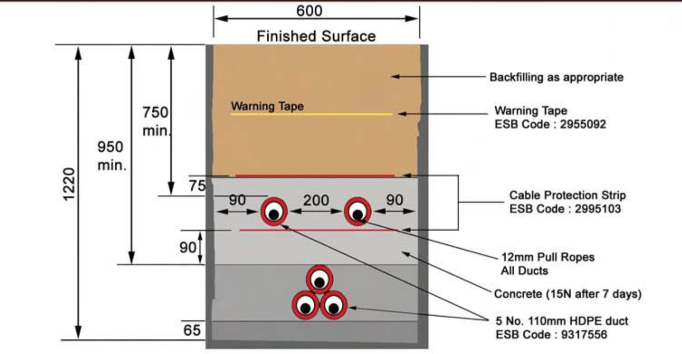
Standard Specification for ESB 38kV Networks Ducting/Cabling (Minimum Standards)

Note 1 : ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/110kV/220kV cable
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

ESB Networks

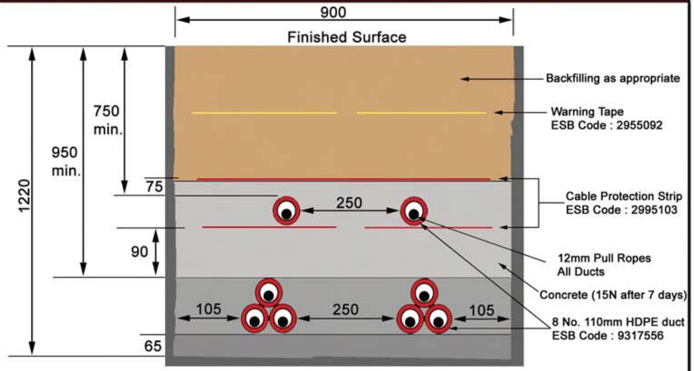
Rev 0: Date 08-09
Approved:

1A 38kV Single Circuit Standard Trench Cross-Section



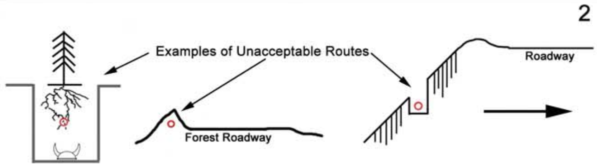
Note : Only 1 ESB comms duct maybe required if ESB specify
Note : Maximum duct depth ≤ 1.5m to top of trefoil group

1B 38kV Double Circuit Standard Trench Cross-Section



1C Trench Installation Sequence

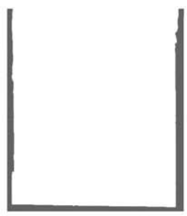
1



WARNING:
Always agree trench route with ESB before excavation commences.
Unstable, insecure & poor access routes will not be accepted by ESB.

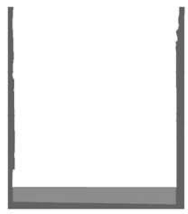
NB Semi-dry concrete to be used always

2



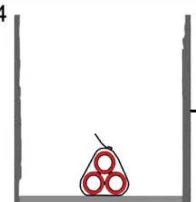
Excavate trench to required dimensions.

3



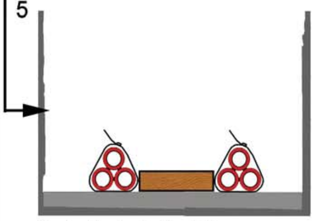
Lay in & level 65mm bedding layer of CBM4 (15N after 7 days) concrete

4



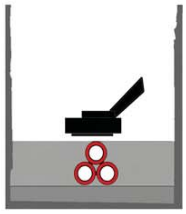
Lay in, joint and trefoil 110mm HDPE power ducts using cable ties. (Code 1131071) at 3m intervals.

5



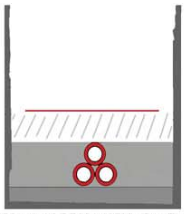
For double circuits it is vital to space power ducts 250mm apart using timber or other suitable spacers.

6



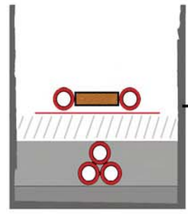
Lay in and thoroughly compact 300mm layer of CBM4 (15N after 7 days) concrete around and above ducts

7



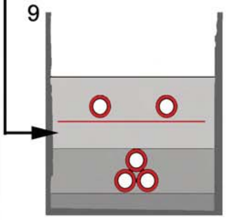
-Lay in 1st 90mm of CBM4 (15N after 7 days) concrete
-Install 400mm wide red marker strip, code 2995103. (1 strip for sigle circuit, two for double circuit)

8



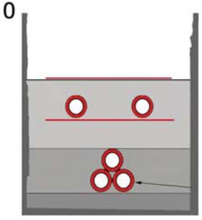
Install two 110mm HDPE comms cable ducts, spaced as per drawings above equidistant from both trench edges. Use timber or other suitable spacers to maintain the required spacing.

9



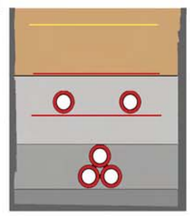
Install further 185mm layer of CBM4 (15N after 7 days) concrete and compact thoroughly.

10



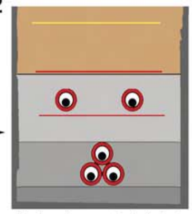
Lay in another 400mm wide marker strip as outlined in fig. 6

11



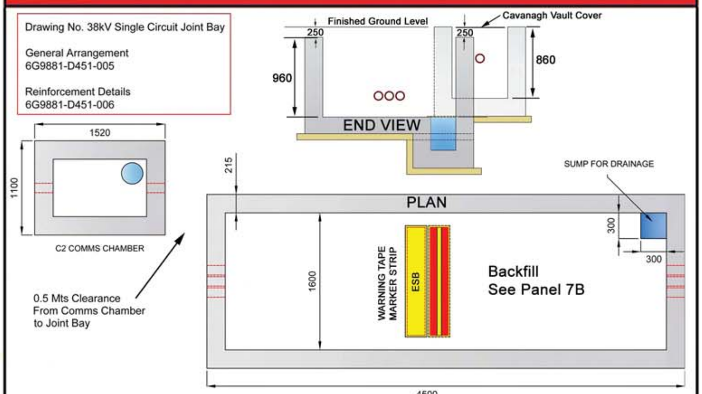
- Lay in 500mm wide yellow warning tape (1 width for single circuit, 2 for double circuits)
- Backfill the top 300mm of trench per appropriate local authority or other agreed specification

12

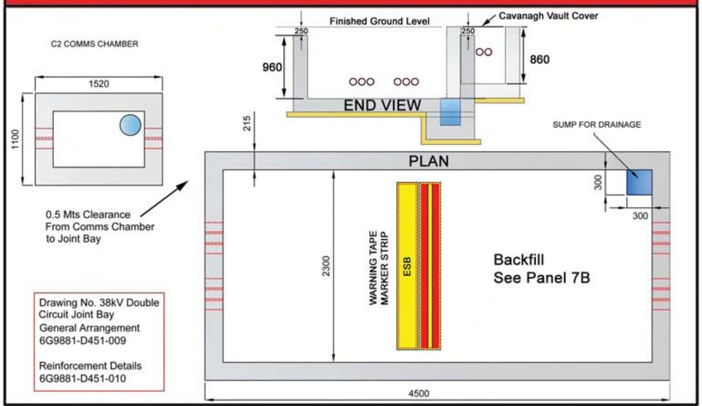


Thoroughly brush, mandrel all ducts & install 12mm polyproplene draw rope, then seal all ducts with screw type end plug - Jack Moon type

2A 38kV Single Circuit Joint Bay



2B 38kV Double Circuit Joint Bay

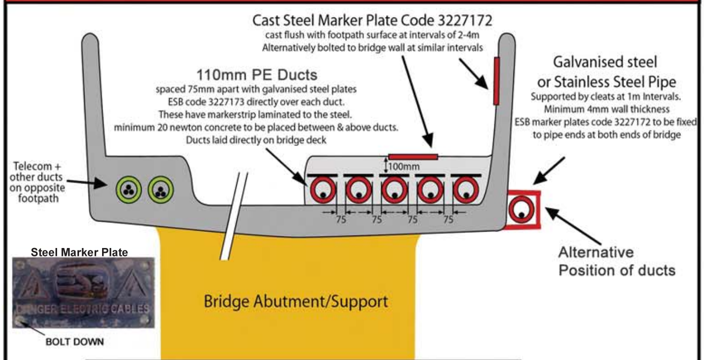


Standard Specification for ESB 38kV Networks Ducting/Cabling (Minimum Standards)

Note 1 : ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/110kV/220kV cable
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

Rev 0: Date 08-09
Approved:

5A Bridge Crossings: Restricted Footpath Designs

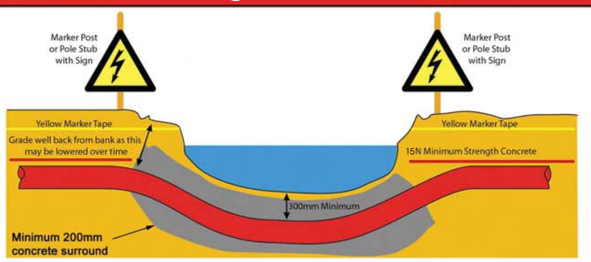


2nd Comms duct may be omitted by agreement

5B Bridge Crossings: Restricted Footpath Designs

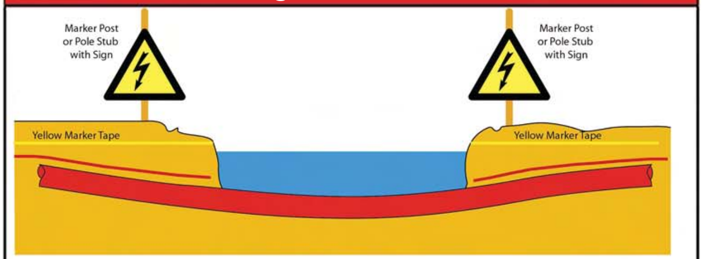
1. The design must be agreed with the bridge authority. Position in footpath is preferred.
2. Minimum cover over ducts on footpath 100mm.
3. Where duct cover is > 300mm, marker strip & surface marker plates can be used.
4. Red ducting is not suitable for cable run external to bridges.
5. Where possible galvanised steel/stainless steel piping should be used, all joints must be free of weld burrs on inside. Alternatively heavy duty 10mm wall thickness black HDPE material with cast steel marker plates attached must be used to permanently warn of presence of electric cable.

6A River/Stream Crossings: Standard Where Burial/Drilling IS Possible



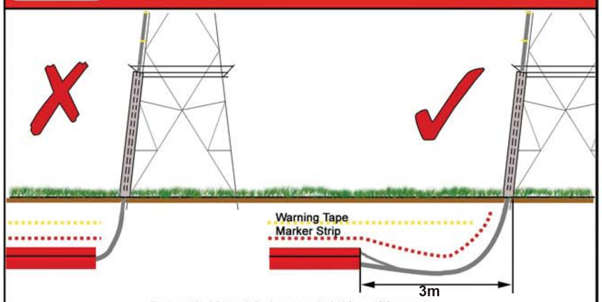
1. Depth of burial below bottom of river or stream to be agreed with relevant authority (if applicable)
2. If normal red ducting is installed by trenching, it must be encased in CBM4 (15N after 7 days) conrete to prevent uplift and to provide mechanical protection. Seal any joints to prevent concrete entering duct.
3. If drilled crossing is practical, use heavy red wall coiled HPPE duct **(sections 2.2 & 2.9 in MV/LV manual)**
4. Install an ESB marker post on both sides of the crossing - ESB code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
5. Where circumstances require it a large steel pipe can be installed, into which a number of standard ESB duct sizes are pulled in **(see section 2.9.4 of MV/LV manual for guidance)**
6. If crossing a tidal area, a foreshore licence will be required.

6B River/Stream Crossings: Standard Where Burial/Drilling IS NOT Possible



1. Installation on base of river or stream to be agreed with relevant authority (if applicable)
2. Heavy wall steel pipe to be used free of weld beads/swarf. Minimum 8mm steel wall thickness to be used. Encase in CBM4 (15N after 7 days) concrete for corrosion protection, minimum 100mm surround
3. Install an ESB marker post on both sides of the crossing - ESB code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
4. Ensure a smooth connection using rubber coupler between crossing pipe size and ESB standard duct as the steel pipe size will usually differ from the standard ESB ducting. Alternatively run ESB ducting right through the steel pipe
5. If crossing tidal area, a foreshore licence will be required.

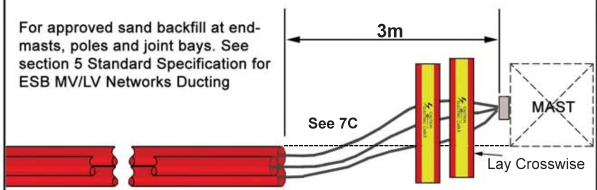
7A Cable End Mast Position



Ensure that trench is deepened at this position and cable is supported all round so that it does not tighten further during Backfilling

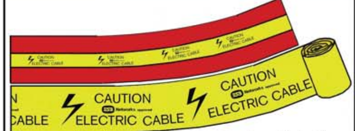
7B Cable End Mast Position

For approved sand backfill at end-masts, poles and joint bays. See section 5 Standard Specification for ESB MV/LV Networks Ducting

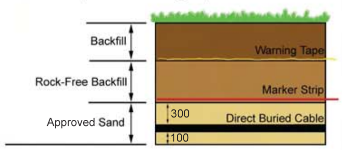


Offset trefoil to line up with edge of mast for ease of cable pulling.
Never install ducting right up to mast or 3-pole base with long radius bend attached.
Both marker strip and warning tape to be used between duct and mast (laying the marker strip crosswise as shown above).

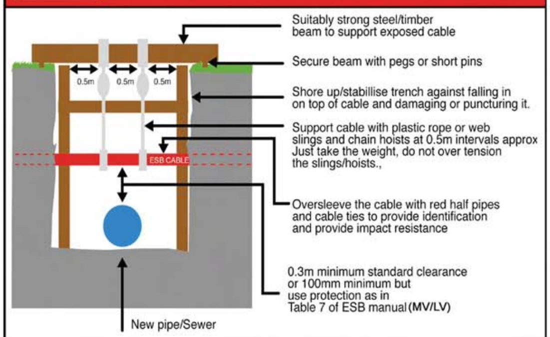
7C Cable End Mast - Marker Strip/Tape



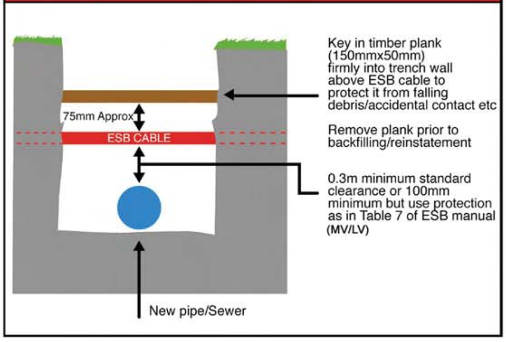
Cover cable between duct and pole with both Marker Strip and Warning Tape.



8A Supporting ESB Cables/Ducts During Trenching Works



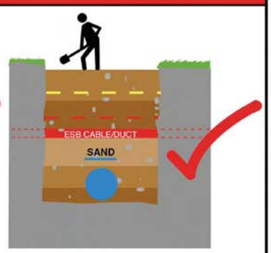
8B Supporting ESB Cables/Ducts During Trenching Works



9 Avoidance of Cable Damage Due to Improper Backfilling at Cable Crossings

Trench **AFTER** improper backfilling and Ramming

Excessive deflection resulting in a shearing action at the trench walls and risk of cable or duct failure later.



Trench **AFTER** carefull backfilling and Ramming

Layers all round the cable to be hand tamped. Cable to be well supported by firm bed of sand beneath the cable. No compaction machinery directly over cable/duct for 300mm minimum distance

Result : Very little cable deflection and shearing at edges of trench

Standard Specification for ESB 38kV Networks Ducting/Cabling (Minimum Standards)

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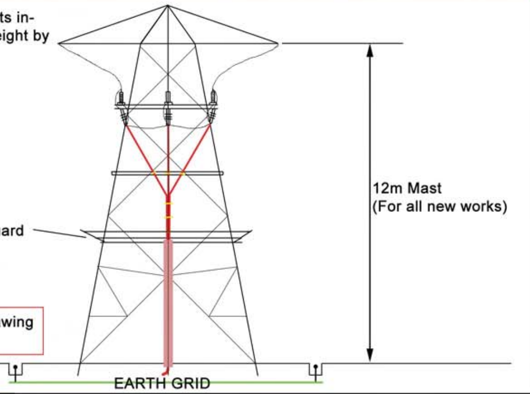
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

ESB Networks

Rev 0: Date 08-09
Approved:

3A End Mast Termination



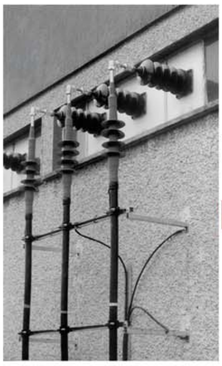
3B Triple Pole Structure

Cable Steel Work Code: 1286697

Made up anti-climbing guard

7m
Min Dimension to Bare Metal
Use 12m Pole

3C Station Termination



To Cubicle

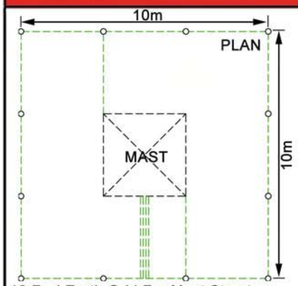
If Cable run <50m install lightning arrestors.

Assess need for mesh screen guard (Code: 3175003)

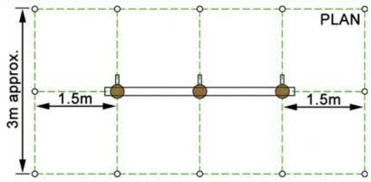
Drg. No A3205856

Clearances : Phase to:
- Phase 500mm outdoor
- Earth 500mm outdoor

3D Earth Grids



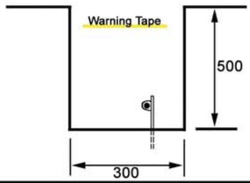
12 Rod Earth Grid For Mast Structure



12 Rod Earth Grid For 3-Pole Structure

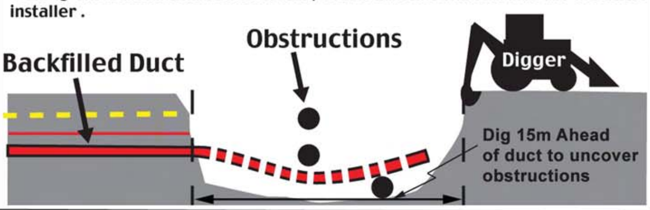
Earth Grid resistances <10 Ohms.
If ground is known to be high resistance, plan ahead and put additional earthwire into cable trench.

Drg. No. A4D 205343
PE424-D901-911-001-000



4A Obligation of Duct Installer to minimise the number and severity of duct bends

The duct installer must minimise the number and severity of preformed bends in ground with obstructions and other utility service crossings by opening ground 15m ahead of backfilled duct, wherever practical to do so. This safety obligation, which may require use of steel plating, allows the duct installer to pick the least bendy duct route through utility crossings and obstructions. Otherwise, numerous sharp unrecorded duct route deviations will be present making cable installation considerably more difficult and less safe for the cable installer.

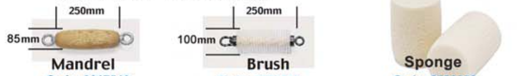


4B Standard for Brushing, Mandrelling, Roping and End-Capping of 38kV ducts

All Ducts must be:
- Thoroughly brushed and mandrelled to prove ducts against debris /excessive deflection
- Roped using 12mm polyproplene rope with certified safe breaking load of 1.5 tons -- all rope joints to be properly spliced and PVC taped over. Approved Supplier Silver Strand Bunclana Donegal, ph (074) 9382503 - 500m drum lengths available to minimise splicing/coil handling
- Sealed using endcaps against grit and water getting into them
  NB: Replace mandrels once mandrel wear indicators or grooves are worn down
  Replace brushes once brush diameter falls 5mm below dimensions in table below
- Approved endcaps, both disposable and reusable types, are available from suppliers of approved ESB ducting
- Approved ESB Mandrel and brush suppliers :

Brandon Agencies, Rathnew, Co Wicklow: Phone 0404 20500 (Brushes & Mandrels)
IS Varian, Greenhills industrial Estate, Walkinstown, Dublin 12 Phone: 01-4501150 (Brushes Only)
Clydesdale UK Phone 086 172 6665 (Brushes & Mandrels)
Tynagh Network Systems, Loughrea, Co Galway. Phone: 091 842206 (Brushes & Mandrels)

110mm HDPE Duct Size



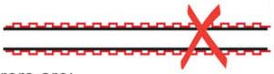
Mandrel
Code: 9317546

Brush
Code: 8783255

Sponge
Code: 8783252

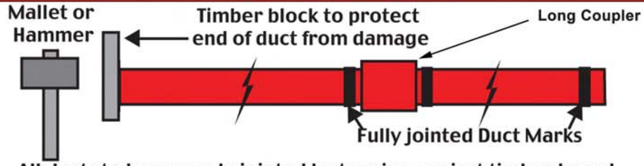
4C Approved ESB Ducting for 38kV Cables

- Use only solid wall high impact resistance ESB approved HDPE red ducting to IS 370 colour standard and ESB specification 16113 (6.3mm minimum wall thickness) Discoloured or unidentified ducting not acceptable. All duct material must be approved by ESB Networks.
- Lightweight flexible corrugated twinwall ducting is not acceptable to ESB irrespective of manufacturer



- Current approved HDPE Duct and duct bend manufacturers are:
  Lynplast (bend fittings only), Uponor-Radius Systems, Wavin, Quality Plastics

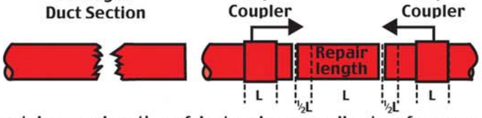
4D Specification for Duct Jointing for 38kV Cables



All ducts to be securely jointed by tapping against timber board on each duct until the black depth insertion mark is reached
Always smear duct lubricant on coupler rubber ring

4E Repair of Existing Ducts

Use only approved slip couplers from approved manufacturers in section 4C

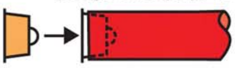


- **Cut out damaged section of duct and ensure all cut surfaces are square and free from sharp edges**
- **Slide, position and centre the repair couplers on the centering marks**

4F Sealing of Ducts

All ducts to be permanently sealed at both ends of duct run
Ducts to be temporarily sealed during installation using endcaps provided with each bale

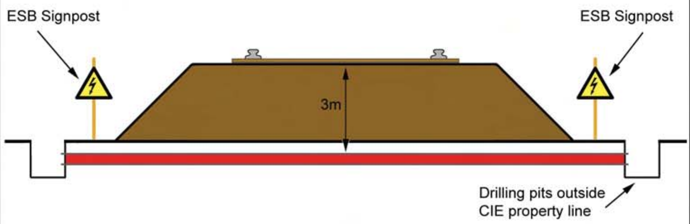
Endcap
Plain End



ESB Code 110mm: 9317569

Standard Specification for ESB 38kV Networks Ducting/Cabling

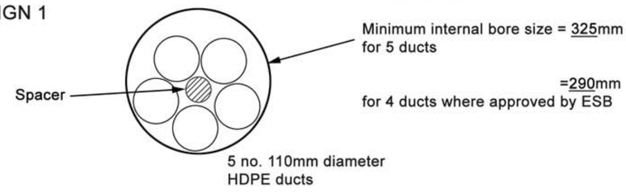
10A 38kV Railway Crossing Details



Formal licence for crossing and approval regquired from CIE.
Accurately record crossing location & erect marker posts.

10B Directional Drill/Thrust Bore Duct Bore Details

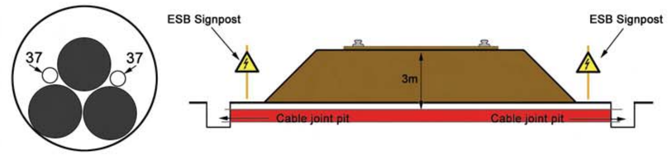
DESIGN 1



Alternatively use 2 x 37mm HDPE ducts for comms cables with C2 chamber on each side of the crossing to permit pulling along entire route. (See 10C)
Completed interstitial space to be bentonited thoroughly to maintain cable rating. Accurately record crossing location & erect marker posts.

10C Directional Drill/Thrust Bore Duct Bore Details

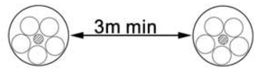
ALTERNATIVE DESIGN



Install 1 no. 200mm SDR 17.6 duct with ³ no. short length cables pulled into this pipe along with 2 x 37mm comms ducts.
Full cable joint bays are required on either side of crossing along with C2 chambers for this design .
This method is used where it is not not practical to install large diameter pipe -eg. risk of ground upheaval or presence of obstructions.
Completed interstitial space to be thoroughly bentonited to maintain cable rating.
Accurately record crossing location & erect marker posts.

10D Double Circuit Bore Crossing

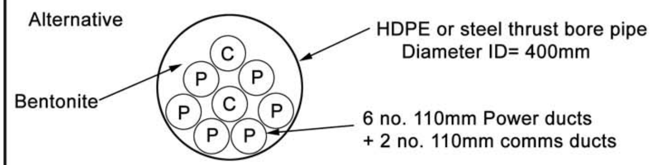
Standard Design



-Both Bentonited

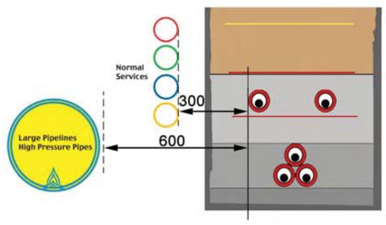
Separate drilling for each circuit crossing

Alternative



2 no. sets of 110mm HDPE ducts - 8 ducts in total.
All crossings to be accurately recorded and signposts erected given impracticality of marker tape. If both circuits = 40MVA then use 630 Cu cable

12 Mininimum Standard Clearances to Other Services

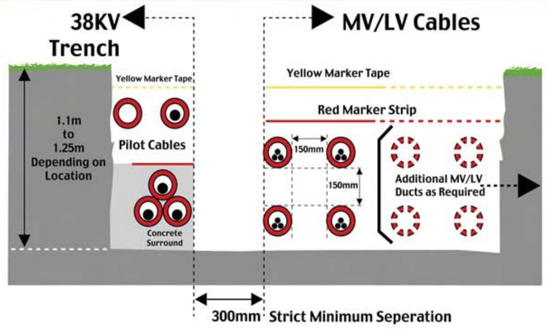


Clearances less than the above at pinch points and crossings requires placement of additional mechanical protection (concrete slab/brick) and agreement of ESB

ESB ducts must never be laid over other services on parallel runs, except with the written prior agreement of the other utilities and ESB

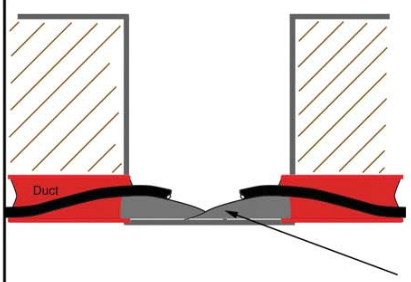
Other services must never be laid directly over ESB ducts on parallel runs

13 Combined MV & 38kV Cable Runs



Where it is impractical to avoid such trench runs, the seperation of 300mm should be strictly controlled and monitored to minimise derating (See MV/LV manual page 180)

14 Sealing and Protection of 38kV Cables Once They Exit Ducts



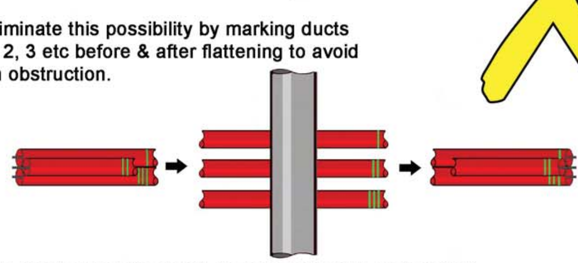
Ducts to be thoroughly using ESB approved water sealant and 4hr fire rating approved for firestop.
NB - All joint bay duct entries to be thoroughly sealed to prevent sand washout and subsidence.

Sandbags or other durable support for cable as it exits ducts to prevent damage to cable sheath

15 Duct Crossovers Are Not Allowed

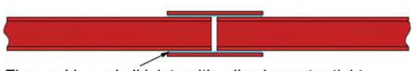
Be especially careful when going from flat to trefoil formation in vicinity of services

Eliminate this possibility by marking ducts 1, 2, 3 etc before & after flattening to avoid an obstruction.



NB. If using double circuit, tape mark power ducts 1 to 6

16 Crossing Dumps/Contaminated Ground

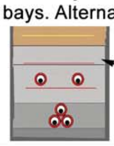


Thoroughly seal all joints with adhesive water-tight duct jointing compound and pressure test for airtightness.
Gasketed couplers alone are inadequate.

Fusion welded couplers are also acceptable but require red over-taping.

NB. Avoid whenever possible due to: Subsidence, methane gas & severe thermal derating risks.
Seek advice from ug networks section to ensure rating of cable is adequate (derating of 50% can occur)
NB. Waste oils and chemicals can also seriously damage cables

Seal all duct joints with duct adhesive compound or use continuous duct lengths & seal all duct ends in joint bays. Alternatively weld pipes.



Concrete is continued up to 300mm of final surface to offset derating
(CBM4 - 15N after 7 days)

Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

ESB Networks

Rev 0: Date 09-10

Approved:

Document No:DTIS-230908-BUV

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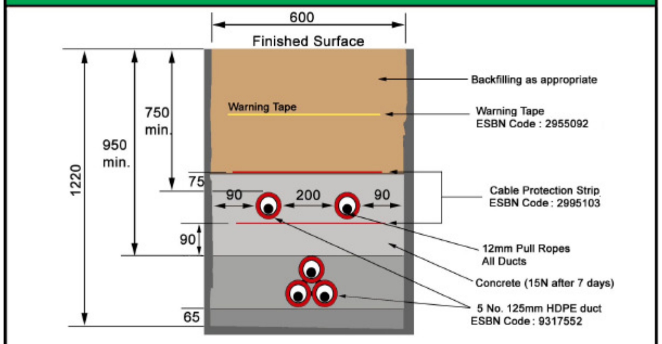
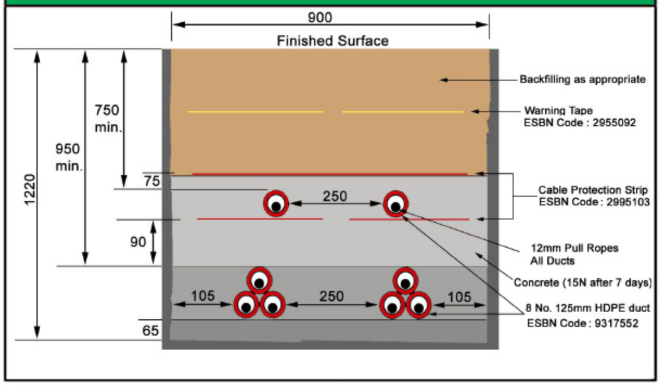
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

1A 110kV Single Circuit Standard Trench Cross-Section

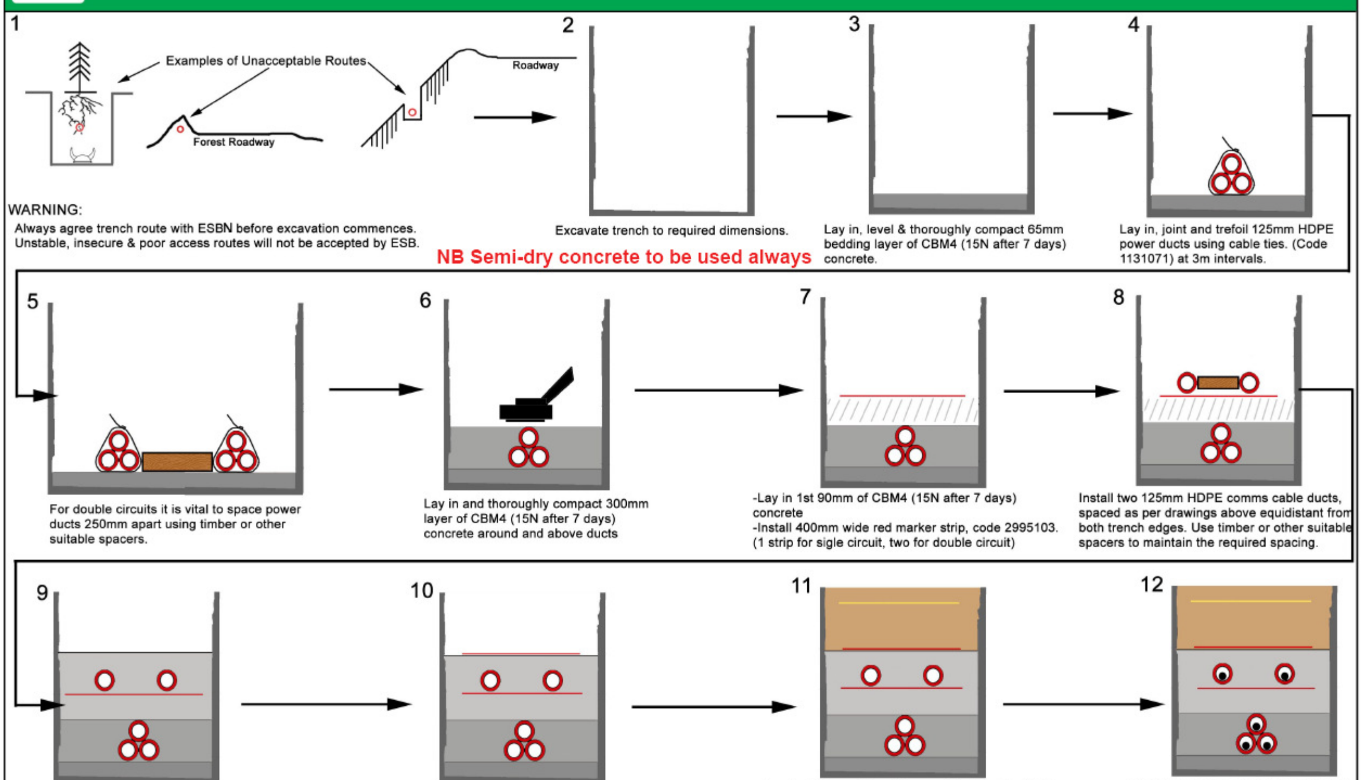


Note : Only 1ESBNcomms duct maybe required if ESBN specify
Note : Maximum duct depth ≤ 1.5m to top of trefoil group

1B 110kV Double Circuit Standard Trench Cross-Section



1C Trench Installation Sequence



WARNING:
Always agree trench route with ESBN before excavation commences.
Unstable, insecure & poor access routes will not be accepted by ESB.

NB Semi-dry concrete to be used always

2. Excavate trench to required dimensions.

3. Lay in, level & thoroughly compact 65mm bedding layer of CBM4 (15N after 7 days) concrete.

4. Lay in, joint and trefoil 125mm HDPE power ducts using cable ties. (Code 1131071) at 3m intervals.

5. For double circuits it is vital to space power ducts 250mm apart using timber or other suitable spacers.

6. Lay in and thoroughly compact 300mm layer of CBM4 (15N after 7 days) concrete around and above ducts

7. -Lay in 1st 90mm of CBM4 (15N after 7 days) concrete
-Install 400mm wide red marker strip, code 2995103. (1 strip for sigle circuit, two for double circuit)

8. Install two 125mm HDPE comms cable ducts, spaced as per drawings above equidistant from both trench edges. Use timber or other suitable spacers to maintain the required spacing.

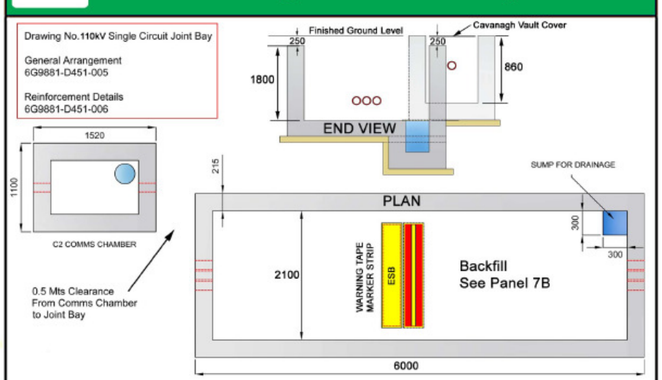
9. Install further 185mm layer of CBM4 (15N after 7 days) concrete and compact thoroughly.

10. Lay in another 400mm wide marker strip as outlined in fig. 6

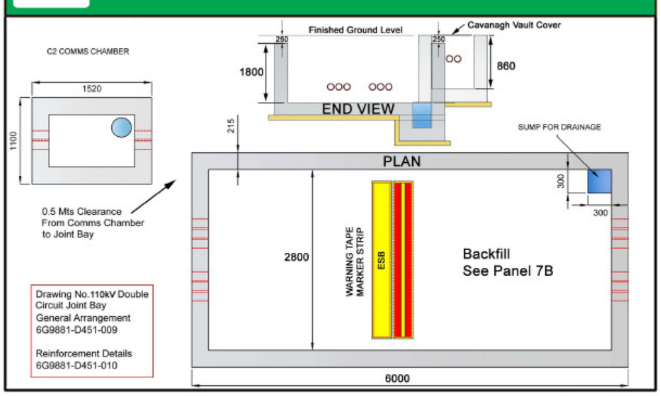
11. - Lay in 500mm wide yellow warning tape (1 width for single circuit, 2 for double circuits)
- Backfill the top 300mm of trench per appropriate local authority or other specification agreed with ESB

12. Thoroughly brush, mandrel all ducts & install 12mm polypropylene draw rope, then seal all ducts with screw type end plug - Jack Moon type

2A 110kV Single Circuit Joint Bay



2B 110kV Double Circuit Joint Bay



Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

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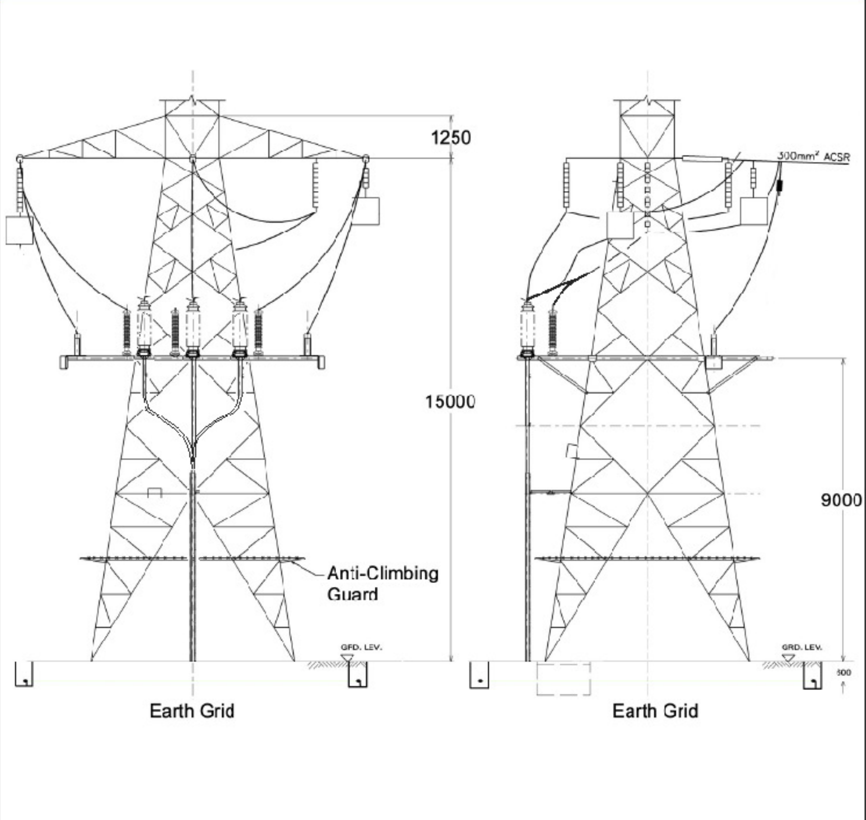
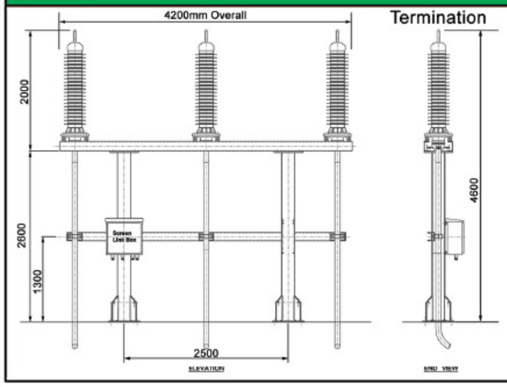
ESB Networks
Rev 0: Date 09-10
Approved:

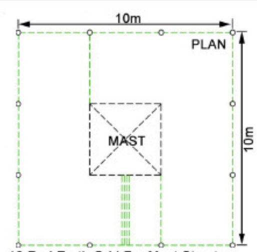
3A 110kV Cable End Mast Termination



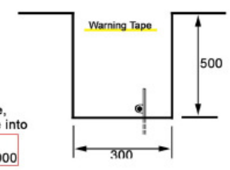
3B Typical 110kV Termiantion Arrangement for Substations



3C Earth Grids



12 Rod Earth Grid For Mast Structure



Earth Grid resistances <10 Ohms.
If ground is known to be high resistance, plan ahead and put additional earthwire into cable trench.

Drg. No.
PE424-D901-911-001-000

4A Obligation of Duct Installer to Minimise the Number and Severity of Duct Bends

The duct installer must minimise the number and severity of preformed bends in ground with obstructions and other utility service crossings by opening ground 15m ahead of backfilled duct, wherever practical to do so. This safety obligation, which may require use of steel plating, allows the duct installer to pick the least bendy duct route through utility crossings and obstructions. Otherwise, numerous sharp unrecorded duct route deviations will be present making cable installation considerably more difficult and less safe for the cable installer.

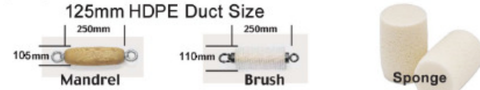
4B Standard for Brushing, Mandrelling, Roping and End-Capping of 110kV Ducts

All Ducts must be:

- Thoroughly brushed and mandrelled to prove ducts against debris /excessive deflection
- Roped using 12mm polyproplene rope with certified safe breaking load of 1.5 tons -- all rope joints to be properly spliced and PVC taped over. Approved Supplier Silver Strand Bunclana Donegal, ph (074) 9382503 - 500m drum lengths available to minimise splicing/coil handling
- Sealed using endcaps against grit and water getting into them
  NB: Replace mandrels once mandrel wear indicators or grooves are worn down
  Replace brushes once brush diameter falls 5mm below dimensions in table below
- Approved endcaps, both disposable and reusable types, are available from suppliers of approved ESBN ducting
- Approved ESBN Mandrel and brush suppliers :

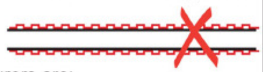
  Brandon Agencies, Rathnew, Co Wicklow: Phone 0404 20500 (Brushes & Mandrels)
  IS Varian, Greenhills industrial Estate, Walkinstown, Dublin 12 Phone: 01-4501150 (Brushes Only)
  Clydesdale UK Phone 0044 1234 855 855 (Brushes & Mandrels)
  Tynagh Network Systems, Loughrea, Co Galway. Phone: 091 842206 (Brushes & Mandrels)

125mm HDPE Duct Size



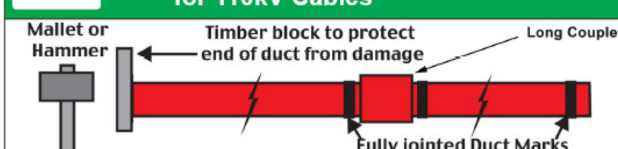
4C Approved ESBN ducting for 110kV cables

- Use only solid wall high impact resistance ESBN approved HDPE red ducting to IS 370colour standard and ESBN specification 16113 (7.1mm minimum wall thickness) Discoloured or unidentified ducting not acceptable. All duct material must be approved by ESB Networks.
- Lightweight flexible corrugated twinwall ducting is not acceptable to ESBN irrespective of manufacturer



- Current approved HDPE Duct and duct bend manufacturers are:
  Lynplast (bend fittings only), Uponor-Radius Systems, Wavin, Quality Plastics, Emtelle

4D Specification for Duct Jointing for 110kV Cables

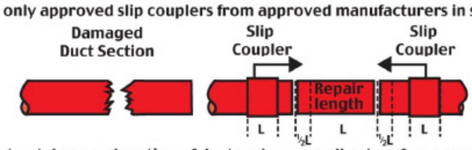


All ducts to be securely jointed by tapping against timber board on each duct until the black depth insertion mark is reached

Always smear duct lubricant on coupler rubber ring

4E Repair of Existing Ducts

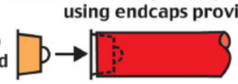
Use only approved slip couplers from approved manufacturers in section 4C



- **Cut out damaged section of duct and ensure all cut surfaces are square and free from sharp edges**
- **Slide, position and centre the repair couplers on the centering marks**

4F Sealing of Ducts

All ducts to be permanently sealed at both ends of duct run
Ducts to be temporarily sealed during installation using endcaps provided with each bale



ESBN Code 125mm: 9317583

Standard Specification for ESB 110kV Networks Ducting/Cabling (Minimum Standards)

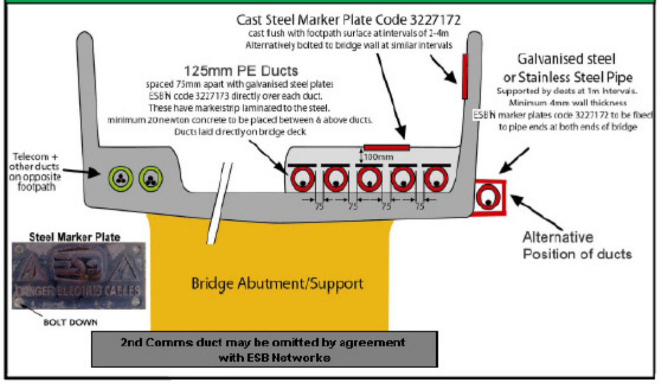
ESB Networks

Rev 0: Date 09-10

Approved:

Note 1 : ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/38kV/220kV cable
Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

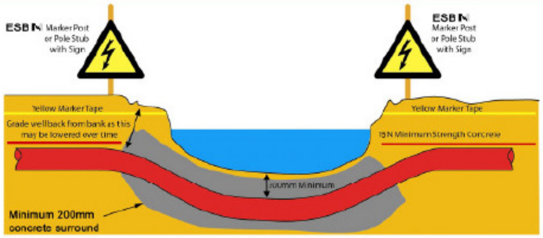
5A Bridge Crossings: Restricted Footpath Designs



5B Bridge Crossings: Restricted Footpath Designs

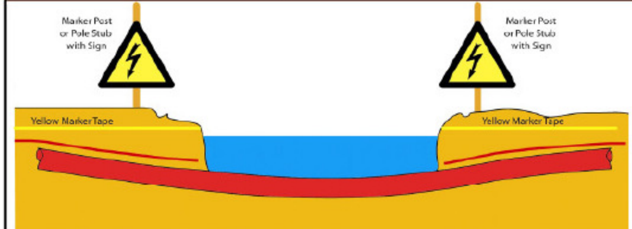
1. The design must be agreed with the bridge authority. Position in footpath is preferred.
2. Minimum cover over ducts on footpath 100mm.
3. Where duct cover is >600mm, marker strip 75mm above ducts and marker tape (300mm below surface) + steel surface markers suffice
4. Red ducting is not suitable for cable run external to bridges.
5. Where possible galvanised steel/stainless steel piping should be used, all joints must be free of weld burrs on inside. Alternatively heavy duty 10mm wall thickness black HDPE material with cast steel marker plates attached must be used to permanently warn of presence of electric cable.

6A River/Stream Crossings: Standard Where Burial/Drilling IS Possible



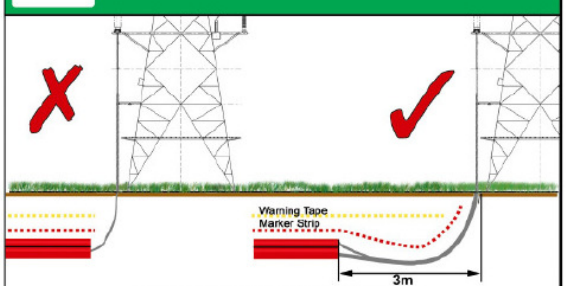
1. Depth of burial below bottom of river or stream to be agreed with relevant authority (if applicable)
2. If normal red ducting is installed by trenching, it must be encased in CBM4 (15N after 7 days) conrete to prevent uplift and to provide mechanical protection. Seal any joints to prevent concrete entering duct.
3. If drilled crossing is practical, use heavy red wall coiled HDPE duct **(sections 2.2 & 2.9 in MV/LV manual)**
4. Install an ESBN marker post on both sides of the crossing - ESBN code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
5. Where circumstances require it a large steel pipe can be installed, into which a number of standard ESBN duct sizes are pulled in **(see section 2.9.4 of MV/LV manual for guidance)**
6. If crossing a tidal section of a river or stream a foreshore licence will be required

6B River/Stream Crossings: Standard Where Burial/Drilling IS NOT Possible



1. Installation on base of river or stream to be agreed with relevant authority (if applicable)
2. Heavy wall steel pipe to be used free of weld beads/swarf. Minimum 8mm steel wall thickness to be used. Encase in CBM4 (15N after 7 days) concrete for corrosion protection, minimum 100mm surround
3. Install an ESBN marker post on both sides of the crossing - ESBNcode 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
4. Ensure a smooth connection using rubber coupler between crossing pipe size and ESBN standard duct as the steel pipe size will usualy differ from the standard ESBN ducting. Alternatively run ESBN ducting right through the steel pipe
5. If crossing a tidal section of a river or stream a foreshore licence will be required

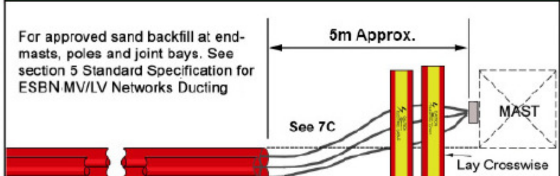
7A Cable End Mast Position



Ensure that trench is deepened at this position and cable is supported all round so that it does not tighten further during Backfilling

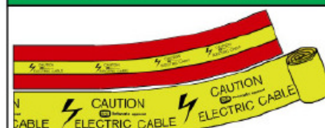
7B Cable End Mast Position

For approved sand backfill at end-masts, poles and joint bays. See section 5 Standard Specification for ESBN MV/LV Networks Ducting

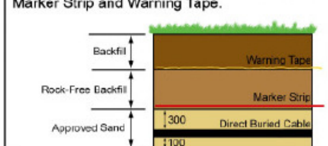


Offset trefoil to line up with edge of mast for ease of cable pulling.
Never install ducting right up to mast with long radius bend attached.
Both marker strip and warning tape to be used between duct and mast (laying the marker strip crosswise as shown above).

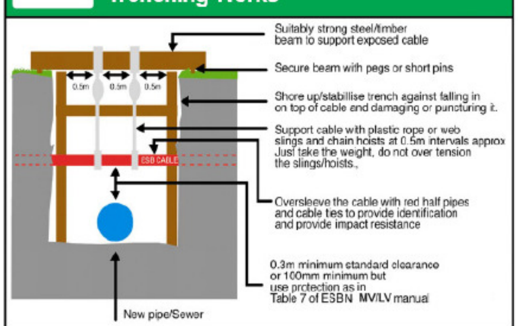
7C Cable End Mast - Marker Strip/Tape



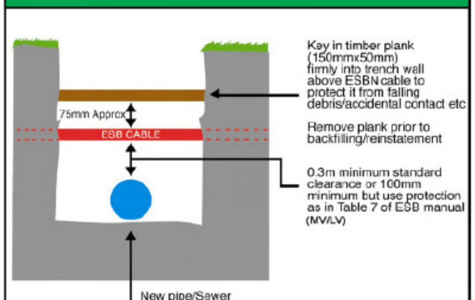
Cover cable between duct and mast with both Marker Strip and Warning Tape.



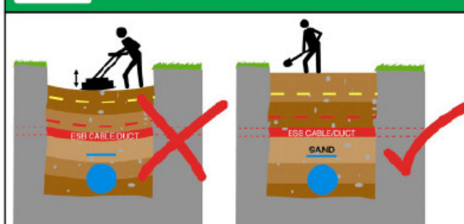
8A Supporting ESBN Cables/Ducts During Trenching Works



8B Supporting ESBN Cables/Ducts During Trenching Works



9 Avoidance of Cable Damage Due to Improper Backfilling at Cable Crossings



Trench **AFTER** improper backfilling and Ramming

Excessive deflection resulting in a shearing action at the trench walls and risk of cable or duct failure later.

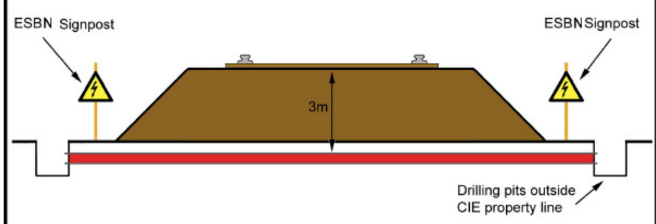
Trench **AFTER** carefull backfilling and Ramming

Layers all round the cable to be hand tamped. Cable to be well supported by firm bed of sand beneath the cable. No compaction machinery directly over cable/duct for 300mm minimum distance

Result : Very little cable deflection and shearing at edges of trench

Standard Specification for ESB 110kV Networks Ducting/Cabling

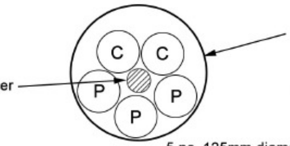
10A 110kV Railway Crossing Details



Formal licence for crossing and approval required from Iarnrod Eireann
Accurately record crossing location & erect marker posts.

10B TypicalDirectional Drill/Thrust Bore Duct Bore Details

DESIGN 1



Minimum internal bore size = 370mm for 5 ducts

=330mm for 4 ducts where approved by ESBN

Index

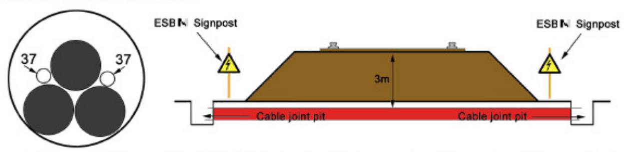
Duct C = comms
Duct P = power

5 no. 125mm diameter HDPE ducts

Alternatively use 2 x 37mm HDPE ducts for comms cables with C2 chamber on each side of the crossing to permit pulling along entire route. (See 10C)
All interstitial space to be bentonited thoroughly to maintain cable rating.
Accurately record crossing location & erect marker posts.

10C Typical Directional Drill/Thrust Bore Duct Bore Details

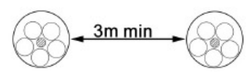
ALTERNATIVE DESIGN



Install 1 no. 300mm ID SDR 17.6 duct with 3 no. short length cables pulled into this pipe along with 2 x 37mm comms ducts.
Full cable joint bays are required on either side of crossing along with C2 chambers for this design .
This method is used where it is not not practical to install large diameter pipe -eg. risk of ground upheaval or presence of obstructions.
All interstitial space to be thoroughly bentonited to maintain cable rating.
Accurately record crossing location & erect marker posts.

10D Typical Double Circuit Bore Crossing

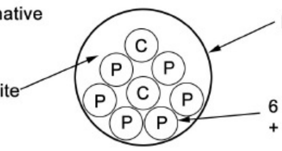
Standard Design



-Both Bentonited

Separate drilling for each circuit crossing

Alternative



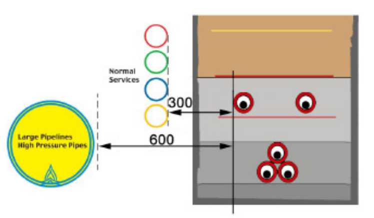
Bentonite

HDPE or steel thrust bore pipe Diameter ID= 500mm

6 no. 125mm Power ducts
+ 2 no. 125mm comms ducts

All crossings to be accurately recorded and signposts erected given impracticality of marker tape.

11 Minimum Standard Clearances to Other Services

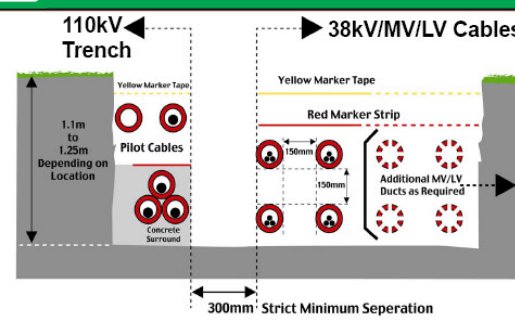


Clearances less than the above at pinch points and crossings requires placement of additional mechanical protection (concrete slab/brick) and agreement of ESBN

ESBN ducts must never be laid over other services on parallel runs, except with the written prior agreement of the other utilities and ESBN

Other services must never be laid directly over ESBN ducts on parallel runs

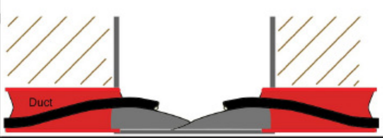
12 Combined 110kV & 38kV Cable Runs



NB. Where it is necessary to employ this formation, the seperation distance of 300mm should be strictly controlled and monitored to minimise derating (see MV/LV manual page 180)
Detailed calculations and design to be agreed between ESBN / ESBI

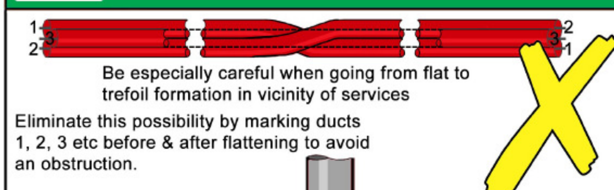
13 Sealing and Protection of 110kV Cables Once they Exit Ducts

Ducts to be thoroughly sealed using ESBN tyco approved water sealant and 4hr fire rating approved for firestop.
NB - All joint bay entries to be thoroughly sealed to prevent sand washout and subsidence.



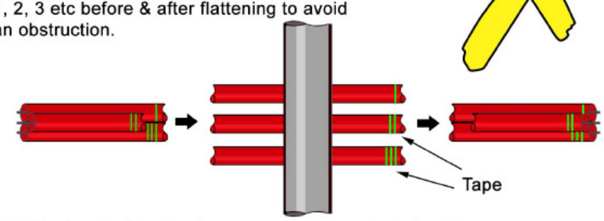
Sandbags or other durable support for cable as it exits ducts to prevent damage to cable sheath

14 Duct Crossovers Are Not Allowed



Be especially careful when going from flat to trefoil formation in vicinity of services

Eliminate this possibility by marking ducts 1, 2, 3 etc before & after flattening to avoid an obstruction.



NB. If using double circuit, tape mark power ducts 1 to 6

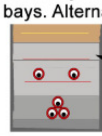
15 Crossing Dumps/Contaminated Ground

Thoroughly seal all joints with adhesive water-tight duct jointing compound and pressure test for airtightness.
Gasketed couplers alone are inadequate.

Fusion welded couplers are also acceptable but require red over-taping.

NB. Avoid whenever possible due to: Subsidence, methane gas & severe thermal derating risks.
Seek advice from ug networks section to ensure rating of cable is adequate (derating of 50% can occur)
NB. Waste oils and chemicals can also seriously damage cables

Seal all duct joints with duct adhesive compound or use continuous duct lengths & seal all duct ends in joint bays. Alternatively weld pipes.



Concrete is continued up to 300mm of final surface to offset derating (CBM4 - 15N after 7 days)

APPENDIX 4-11

DECOMMISSIONING PLAN

Planning and Environmental Consultants

Decommissioning Plan

Coole Wind Farm, Co. Westmeath

DOCUMENT DETAILS

Client:	**Coole Wind Farm Ltd.**
Project Title:	**Coole Wind Farm, Co. Westmeath**
Project Number:	**200445**
Document Title:	**Decommissioning Plan**
Document File Name:	**DP F- 2021.03.22-200445**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

MKO Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	02/03/2021	PH	EC
02	Draft	02.03.2021	PH	EC
03	Draft	16.03.2021	PH	OC/EC
04	Final	16/03.2021	PH	OC/EC

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TABLE OF FIGURES

1. INTRODUCTION

This Decommissioning Plan has been prepared by MKO on behalf of Coole Wind Farm Ltd. for the decommissioning of the proposed Coole Wind Energy Development and relevant infrastructure which is hereafter referred to as the Proposed Development. This document is being prepared alongside an Environmental Impact Assessment Report (EIAR) as part of an application for planning permission for the Proposed Development to An Bord Pleanála. Decommissioning of the Proposed Development will be scheduled to take place after the proposed 30-year lifespan of the project.

This report provides the environmental management framework to be adhered to during the decommissioning phase of the Proposed Development and it incorporates the mitigating principles to ensure that the work is carried out in a way that minimises the potential for any environmental impacts to occur.

1.1 Scope of the Decommissioning Plan

This report is presented as a guidance document for the decommissioning of the Coole Wind Energy Development including its connection to the national grid. Where the term 'site' is used in the Decommissioning Plan it refers to the site of the Proposed Development and all works associated including enabling works. The Decommissioning Plan clearly outlines the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner.

The report is divided into eight sections, as outlined below:

Section 1 provides a brief introduction as to the scope of the report.

Section 2 outlines the Site and Project details, detailing the targets and objectives of this plan along with providing an overview of works methodologies that will be adopted throughout decommissioning.

Section 3 sets out details of the environmental controls to be implemented on site including the mechanisms for implementation. A waste management plan is also included in this section.

Section 4 outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

Section 5 sets out a programme for the timing of the works.

Section 6 consists of a summary table of all mitigation measures to be adhered to during the decommissioning-phases.

Section 7 consists of a summary table of all monitoring requirements for the decommissioning-phases.

Section 8 outlines the proposals for reviewing compliance with the provisions of this report.

2. SITE AND PROJECT DETAILS

2.1 Site Location

The site of the proposed wind farm development is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. Table 2-1 sets out the townlands in all elements of the wind farm, grid connection route and ancillary works are located.

The proposed permanent footprint of the Proposed Development measures approximately 26.4 hectares. The overall layout of the proposed development is shown on Figure 2-1. Land-use on the subject site is associated with commercial peat harvesting, commercial forestry and pastoral agriculture. Land-use in the wider landscape comprises a mix of large-scale peat extraction, pastoral agriculture, low density residential and commercial forestry.

The site is partially bound by the Inny River to the west, agricultural land to the south and east, and coniferous forestry and an active peat harvesting bog to the north. The River Glore intersects the northern section of the site as it flows from southeast to northwest.

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 Corralanna. 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. A Traffic Management Plan is located in Section 4.12.3 of this CEMP with further information on traffic and transportation outlined in Chapter 14 of the EIAR.

The Proposed Development will connect to the national electricity grid via Mullingar 110 kV substation. The proposed grid connection route measures approximately 26km in length from the proposed wind farm site to the existing substation near Mullingar. 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.

It is proposed to upgrade the existing Mullingar 110kV substation to accommodate the connection of the Proposed Development consisting of the construction of an additional dedicated bay to facilitate connection of the cable..

Table 2-1 Townlands within which the Proposed Development is located

Development Works	Townland
Wind Farm, including Turbines and Access Roads, Substation, Construction Compound	Camagh, Carlanstown, Coole, Clonrobert, Clonsura, Doon, Monktown, Mullagh, and Newcastle.
Proposed Borrow Pit	Mullagh
Junction Accommodation Works	Boherquill, Coole, Corralanna, Culvin,Joanstown and Mayne
Grid Connection Route	Camagh, Monktown, Coole, Fearmore (Fore by), Newtown (Fore by), Mayne, Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava,

Development Works	Townland
	Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by)

2.2 Description of the Development

The proposed development will comprise the construction of up to 15 No. wind turbines and all associated works. The proposed turbines will have a maximum blade tip height of up to 175 metres. The site layout showing individual elements of the Proposed Development is shown in Figure 2-1. The full description of the Proposed Development is as follows:

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.

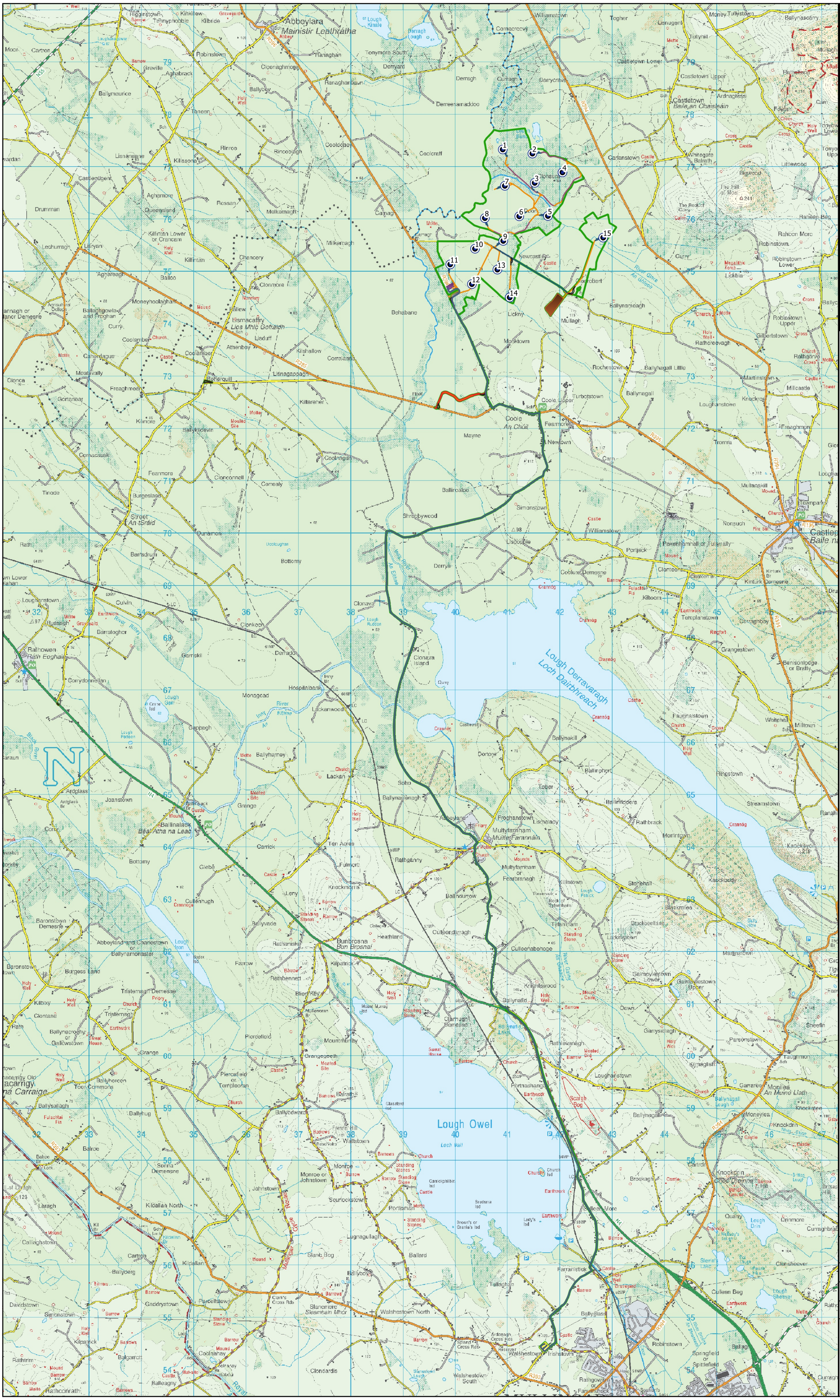
The developer and/or contractor for the main construction works will liaise directly with Westmeath County Council and An Garda Síochána in relation to securing any necessary permits to allow the works to take place including for example:

- Commencement notice
- Special Permits in relation to oversized vehicles on public roads
- Temporary Road Closures (if required)
- Road Opening Licence (if required)

As construction will be completed, elements of the project that will be developed as a temporary facilitator will either be removed, restored to its original condition or will naturally revegetate. These include the temporary construction compounds and the borrow pits.

All access roads and hardstanding areas form part of a site roadway network which will be required by the ongoing farming and land management operations, and therefore will be left in situ for future use. It is intended that decommissioning will remove all above ground components and underground cabling from the site (ducting left in-situ), and reinstate areas where infrastructure is removed. The following elements are included:

- Wind turbines dismantling and removal off site.
- Underground cabling removal (ducting remaining)
- Turbine foundation backfilling (Underground reinforced concrete remaining in-situ)



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 2-1a
Scale: 1:65000	Date: 11.02.2021

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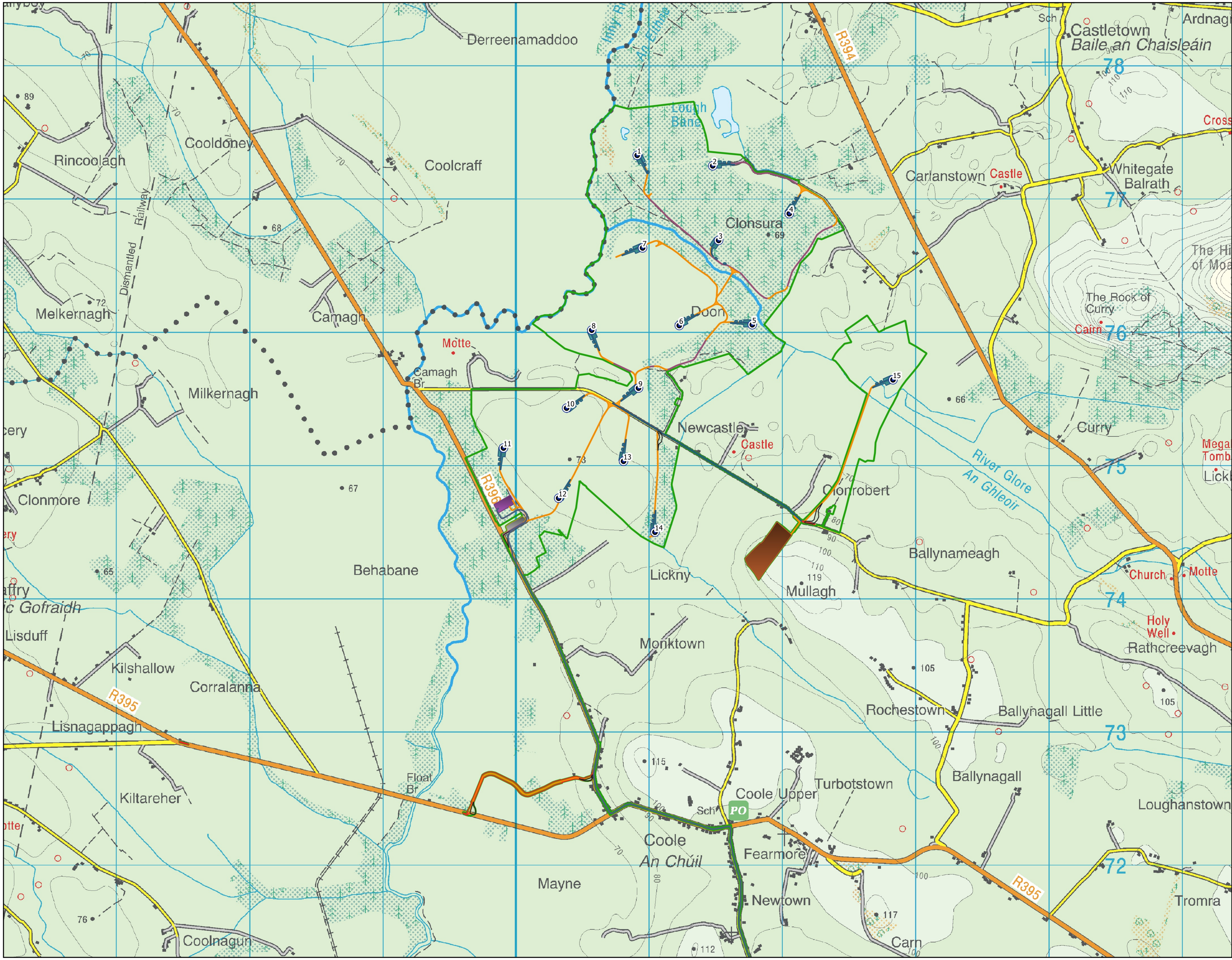
Website: www.mkoireland.ie



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N

Drawing Title
Proposed Site Layout

Project Title
Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No. 200445	Drawing No. Figure 2-1b
Scale 1:25000	Date 11.02.2021

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2.3 Targets and Objectives

The decommissioning phase works will be completed to approved standards as implemented during the construction phase by the appointed contractor, which include specified materials, standards, specifications and codes of practice as agreed with the Project Design Engineer. This decommissioning plan has considered environmental issues and that have the potential to be enhanced by the proposed decommissioning works.

The key site targets are as follows:

- Ensure decommissioning works and activities are completed in accordance with mitigation and best practice approach presented in the accompanying Environmental Impact Assessment Report (EIAR) and associated planning documentation.
- Ensure decommissioning works and activities have minimal impact/disturbance to local landowners and the local community.
- Ensure decommissioning works and activities have minimal impact on the natural environment.
- Adopt a sustainable approach to decommissioning; and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows:

- Using recycled materials if possible, e.g. soil and overburden material for backfilling and reinstatement.
- Ensure sustainable sources for materials supply where possible.
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place.
- Avoidance of vandalism.
- Keeping all watercourses free from obstruction and debris.
- Correct implementation of the sustainable drainage system (SuDS) drainage design principles.
- Keep impact of decommissioning works to a minimum on the local environment, watercourses, and wildlife.
- Correct fuel storage and refuelling procedures to be followed.
- Good waste management and housekeeping to be implemented.
- Air and noise pollution prevention to be implemented.

2.4 Decommissioning Methodologies Overview

2.4.1 Introduction

An experienced main contractor will be appointed to undertake the decommissioning of the Proposed Development. The main contractors will comply with the Construction and Environmental Management Plan (CEMP) prepared for the construction phase and any Operation and Environmental Management Plan implemented during operation. An overview of the anticipated decommissioning methodologies is provided below.

2.4.2 Decommissioning Methodologies

The proposed anticipated decommissioning methodology is summarised under the following main headings:

- Wind turbines
- Turbine Foundations.

- Underground Cabling.
- Transport Route Accommodation Works.
- Substation buildings and all associated infrastructure

2.4.2.1 Wind Turbines

Prior to any works being undertaken on wind turbines, they will be disconnected from the grid by the site operator in conjunction with ESB Networks and Eirgrid. The dismantling and removal of wind turbines of this scale is a specialist operation which will be undertaken by the turbine supplier or competent subcontractor. Turbine dismantling will be undertaken in reverse order to methodology employed during their construction. Cranes will be brought back to site utilising the hard stand areas that will be present after the construction phase. The dismantling of turbines will be bound by the same safety considerations as will be the case during construction in terms of weather conditions where works will not be undertaken during adverse weather conditions and in particular not during high winds.

The turbines will likely be removed from site in a similar manner to how they will be transported to the site originally in extended articulated trucks the details of which are assessed in Chapter 14 of the EIAR which accompany this application.

The transport of disassembled turbines from the site will be undertaken in accordance with a Transport Management Plan which will be issued to and agreed with the competent authority at that time as part of a permit application for the delivery of abnormal loads using the local roads under the Road Traffic (Special Permits for Particular Vehicles) Regulations 2007. The Transport Management Plan 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.

2.4.2.2 Turbine Foundations

On the dismantling of turbines, it is not intended to remove the concrete foundation from the ground. It is considered that its removal will be the least preferred options in terms of having potential effects on the environment. Therefore, the visible surface of the 15 no. turbine foundations will be backfilled and covered with soil material. If there is usable soil or overburden material on the site after construction, this material will be used. Alternatively, where material is not readily available on site, soil will be sourced locally and imported to site on heavy good vehicles (HGVs). The imported soil will be spread and graded over the foundation using a tracked excavator and revegetation enhanced by spreading of an appropriate seed mix to assist in revegetation and accelerate the resumption of the natural drainage management that will have existed prior to any construction.

2.4.2.3 Underground Cabling

The cabling within the wind farm site will be pulled from the cable duct using a mechanical winch which will extract the cable and re-roll it on to a cable drum.

The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance for an underground element that is not visible with no environmental impact associated with leaving the ducting in-situ.

2.4.2.4 Transport Route Accommodation Works

During the construction of the Proposed Development, a number of road and junction improvements and temporary works will be completed to provide access to the site during turbine delivery. All these accommodation areas will be re-used during decommissioning and turbine component removal. On completion of the turbine component removal from the site, the temporary accommodation area will be fully re-instated.

3. ENVIRONMENTAL MANAGEMENT

The following sections give an overview of the drainage design, dust and noise control measures, a waste management plan for the site and the implementation of the environmental management procedures for the site.

3.1.1 Site Drainage

The site drainage features for this site during its construction and operation are outlined in the EIAR which accompany this application. As this Decommissioning Plan is a working document and is presented as an Appendix to the EIAR, the drainage measures are not included in this document. When the final plan is prepared prior to decommissioning and presented as a standalone document, all drainage measures retained for the operational phases of the development will be included in that document. The drainage proposals will be developed further prior to the commencement of decommissioning if deemed necessary or scheduled maintenance of the operational phase drainage will occur prior to decommissioning at a minimum. However, it should be noted that by the time decommissioning is undertaken after the planned 30-year lifespan of the Proposed Development, the areas within the site will have revegetated resulting in a resumption of the natural drainage management that will have existed prior to any construction. It is not anticipated that the decommissioning phase will interrupt this restored drainage regime in any way with the works proposed. As a minimum measure, areas where freshly placed soil material as part of turbine foundation reinstatement work will be surrounded by silt fencing if deemed necessary until the area has naturally revegetated.

3.1.2 Refuelling; Fuel and Hazardous Materials Storage

The plant and equipment used during decommissioning will require refuelling during the works. Appropriate management of fuels will be required to ensure that incidents relating to refuelling are avoided. The following mitigation measures as prescribed for the construction phase are proposed for the decommissioning phase also to avoid release of hydrocarbons at the site:

- Road-going vehicles will be refuelled off site wherever possible.
- On-site refuelling will be carried out at designated refuelling areas at various locations throughout the site. Machinery will be refuelled directly by a fuel truck that will come to site as required
- Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
- Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately.
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the decommissioning phase to deal with accidental spillages will be developed. Spill kits will be available to deal with and accidental spillage in and outside the refuelling area.
- A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the decommissioning phase.

3.2 Dust Control

Dust can be generated from on-site activities during decommissioning such as backfilling of foundations and travelling on site roads during prolonged periods of dry weather. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Site traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures as prescribed for the construction phase are proposed for the decommissioning phase also to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions.
- The designated public roads outside the site and along the main transport routes to the site will be regularly inspected by the Site Manager for cleanliness and cleaned as necessary.
- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind.
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary.
- All site related traffic will have speed restrictions on un-surfaced roads to 15 kph.
- Daily inspection of the site to examine dust measures and their effectiveness.
- When necessary, sections of the haul route will be swept using a truck mounted vacuum sweeper

3.3 Noise Control

The operation of plant and machinery, including site vehicles, is a source of potential impact that will require mitigation at all locations within the site. Proposed measures as prescribed for the construction phase are proposed for the decommissioning phase also to control noise include:

- Diesel generators will be enclosed in sound proofed containers to minimise the potential for noise impacts.
- Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All plant and equipment to be used on-site will be modern equipment and will comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations.
- Regular maintenance of plant will be carried out in order to minimise noise emissions. Particular attention will be paid to the lubrication of bearings and the integrity of silencers.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works.
- Compressors will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machines, which are used intermittently, will be shut down during those periods when they are not in use.
- Training will be provided by the Site Manager to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation; and,
- Local areas of the haul route will be condition monitored and maintained, if necessary.

3.4 Invasive Species Management

The soil material that will be imported to site as part of the foundation backfilling will be free of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). The site manager will take steps to ensure this sourcing suitably clean material and verify the quality of the material by having it inspected prior to bringing it to site by a suitably qualified ecologist. Prior to decommissioning, a suitably qualified ecologist will complete an invasive species survey along the cable route and any areas of accommodation works along the transport route to identify invasive species.

3.5 Traffic Management

A Traffic Management Plan will be prepared in advance of any decommissioning works. The removal of turbines from site will be undertaken by a specialist haulier. The traffic management arrangements although similar to those that will be implemented for turbine delivery as outlined in the EIAR will be agreed in advance of decommissioning with the competent authority.

The grid connection from the wind farm site to the Mullingar substation will remain as part of the national grid system and will not be decommissioned.

3.6 Waste Management

This section of the Decommissioning Plan provides a waste management plan (WMP) which outlines the best practice procedures during the decommissioning of the Proposed Development. The WMP will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of decommissioning. Disposal of waste will be a last resort.

3.6.1 Legislation

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the proposed development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Department of the Environment provides a document entitled, 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects' (2006). It is important to emphasise that no demolition will take place at this site, however, this document was referred to throughout the process of completing this WMP.

3.6.2 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing in the following order:

Prevention and Minimisation:

The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste:

Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste:

There are several established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

3.6.3 Waste Arising from Decommissioning

The relevant components will be removed from site for re-use, recycling or waste disposal. Any structural elements that are not suitable for recycling will be disposed of in an appropriate manner. All lubrication fluids will be drained down and put aside for appropriate collection, storage, transport and disposal. Any materials which cannot be re-used or recycled will be disposed of by an appropriately licenced contractor.

The waste types arising from the decommissioning of the Proposed Development are outlined in Table 3-1 below.

Table 3-1 Expected waste types arising during the Decommissioning Phase

Material Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminium, lead and iron	17 04 07
Fibreglass	Turbine blade component	10 11 03
Hydrocarbons	Oils and lubricants drained from the turbines	13 01 01,13 02 04

3.6.3.1 Reuse

Many construction materials can be reused several times before they have to be disposed of:

- Electrical wiring can be reused on similar wind energy projects
- Elements of the turbine components can be reused but this will be determined by the condition that they are in.

3.6.3.2 Recycling

If a certain type of construction material cannot be reused onsite, then recycling is the most suitable option. The opportunity for recycling during decommissioning will be limited and restricted to components of the wind turbines.

All waste that is produced during the decommissioning phase including dry recyclables will be deposited in the on-site skip initially and sent for subsequent segregation at a remote facility. The anticipated volume of all waste material to be generated on the proposed development is low which provides the justification for adopting this method of waste management.

3.6.3.3 Implementation

3.6.3.3.1 *Roles and Responsibilities*

Prior to the commencement of the decommissioning, a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will oversee 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 decommissioning adheres to the management plan.

3.6.3.3.2 *Training*

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the waste management plan. All employees working on site during the decommissioning phase of the project will be trained in materials management and thereby, should be able to:

- Distinguish reusable materials from those suitable for recycling.
- Ensure maximum segregation at source.
- Co-operate with site manager on the best locations for stockpiling reusable materials.
- Separate materials for recovery; and
- Identify and liaise with waste contractors and waste facility operators.

3.6.3.3.3 *Record Keeping*

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.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and EWC Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material
- Signature of Confirmation of Dispatch detail
- Date and Time of Waste Arrival at Destination
- Site Address of Destination Facility

3.6.3.4 Waste Management Plan Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy should always be employed when designing the plan to ensure that the least possible amount of waste is produced during decommissioning. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

This WMP has been prepared to outline the main objectives that are to be adhered to during decommissioning.

3.7 Environmental Management Implementation

3.7.1 Roles and Responsibilities

A contractor will be appointed to undertake the decommissioning activities. The Site Manager and/or Environmental Clerk of Works (ECoW) will be key members of the Contractors team relating to decommissioning-related environmental issues.

In general, the ECoW will maintain responsibility for monitoring the decommissioning works and Contractors/Sub-contractors from an environmental perspective. The ECoW will act as the regulatory interface on environmental matters. The Site Manager will be responsible for reporting to and liaising with Westmeath County Council and other statutory bodies as required.

The Site Manager in consultation with the ECoW will be responsible for employing the services of a suitably qualified ecologist and any other suitably qualified professionals as required throughout the decommissioning works.

4. EMERGENCY RESPONSE PLAN

An Emergency Response Plan (ERP) is presented in this section of the Decommissioning Plan. It provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

4.1 Emergency Response Procedure

The site ERP includes details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP will require updating and submissions from the contractor/PSCS and sub-contractors as decommissioning progresses. Where sub-contractors that are contracted on site are governed by their own emergency response procedure a bridging arrangement will be adopted to allow for inclusion of the sub-contractor's ERP within this document.

4.1.1 Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Site Supervisor/Construction Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 4-1. In a situation where the Site Supervisor/ Construction Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command outlined in Figure 4-1. This will be updated throughout the various stages of the project.

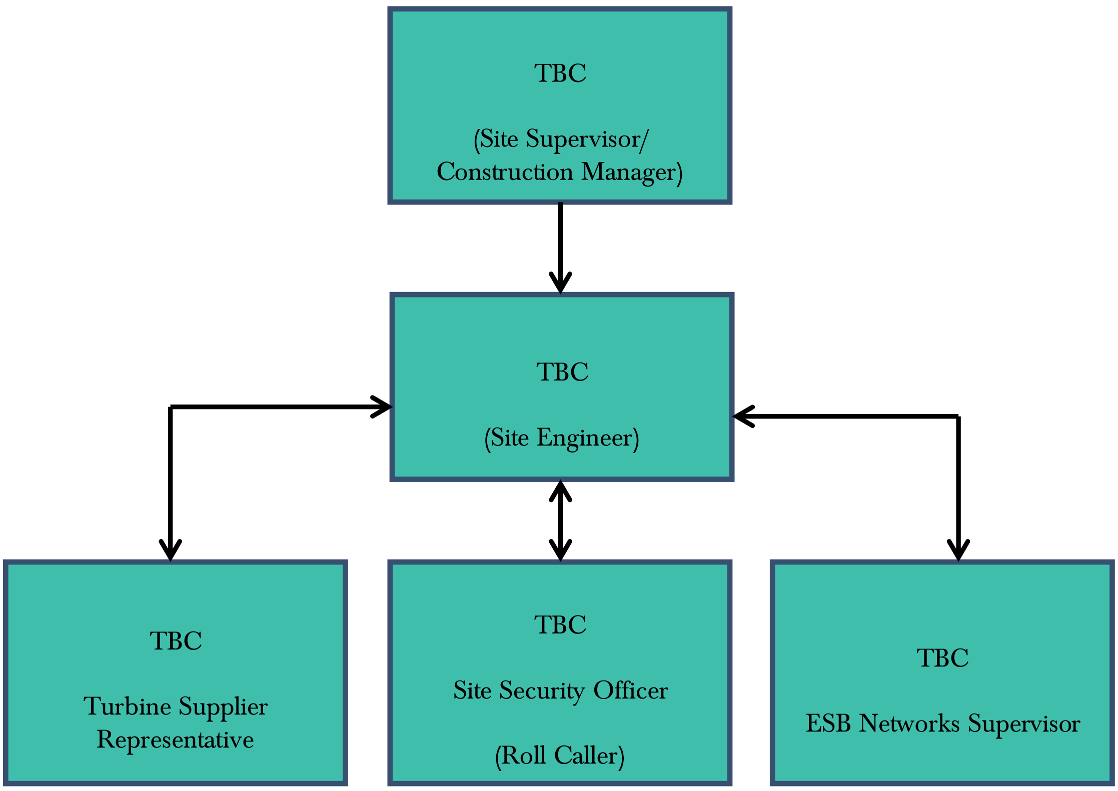

Figure 4-1 Emergency Response Procedure Chain of Command

4.1.2 Initial Steps

To establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 4-1 Hazards associated with potential emergency situations

Hazard	Emergency Situation
Construction Vehicles: Dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services
Fire	Injury to operative through exposure to fire
Falls from heights including falls from scaffold towers, scissor lifts, ladders, roofs and turbines	Injury to operative after a fall from a height
Sickness	Illness unrelated to site activities of an operative e.g. heart attack, loss of consciousness, seizure
Turbine Specific Incident	This will be included the turbine manufacturers' emergency response plan.

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in Table 4-2 the Site Supervisor/Construction Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/foghorn that activates an emergency evacuation on the site. The Site Supervisor/Construction Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare **and if there are no injured personnel at the scene that require assistance**. The Site Supervisor/Construction Manager will be required to use their own discretion at that point. In the case of fire, the emergency evacuation of the site should proceed, without exception. The site evacuation procedure is outlined in Section 4.1.3.
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g. if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone. If delegating the task, ensure that the procedures for contacting the emergency services as set out in Section 4.2 is followed.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g. cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g. ESB Networks the numbers for which as provided in Section 4.3.
- Contact the next of kin of any injured personnel where appropriate.

4.1.3 Site Evacuation/Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or foghorn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Supervisor/Construction Manager when all personnel have been accounted for. The Site Supervisor/Construction Manager will decide the next course of action, which be determined by the situation that exists at that time and will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills.

4.1.4 Spill Control Measures

Every effort will be made to prevent an environmental incident during the decommissioning phase of the project. Oil/fuel spillages are one of the main environmental risks that will exist on the site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. The following steps provide the procedure to be followed in the event of such an incident:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident.
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the ECoW immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The ECoW will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The ECoW will notify the appropriate regulatory body such as Westmeath County Council, and the Environmental Protection Agency (EPA), if deemed necessary.

The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The ECoW must be immediately notified.
- If necessary, the ECoW will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used

following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.

- If the incident has impacted on a sensitive receptor such as an archaeological feature the ECoW will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the ECoW and the Main Contractor. These records will be made available to the relevant authorities such as Westmeath County Council, EPA if required.

The ECoW will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative works methodologies or environmental sampling, and will advise the Main Contractor as appropriate.

4.2 Contact the Emergency Services

In the event of requiring the assistance of the emergency services the following steps should be taken:

Stay calm. It is important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.

Know the location of the emergency and the number you are calling from. This may be asked and answered a couple of times but do not get frustrated. Even though many emergency call centres have enhanced capabilities meaning they are able to see your location on the computer screen they are still required to confirm the information. If for some reason you are disconnected, at least emergency crews will know where to go and how to call you back.

Wait for the call-taker to ask questions, then answer clearly and calmly. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.

If you reach a recording, listen to what it says. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When the next call-taker or dispatcher is available to take the call, it will transfer you.

Let the call-taker guide the conversation. He or she is typing the information into a computer and may seem to be taking forever. There is a good chance, however, that emergency services are already being sent while you are still on the line.

Follow all directions. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly, and ask for clarification if you do not understand.

Keep your eyes open. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.

Do not hang up the call until directed to do so by the call taker.

Due to the remoteness of the site it may be necessary to liaise with the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable. A list of emergency contacts is presented in Table 4-3.

Table 4-2 Emergency Contacts

Contact	Telephone no.
Emergency Services – Ambulance, Fire, Gardaí	999/112
Doctor – Coole Surgery	044 9661104
Hospital – Midland Regional Hospital, Mullingar	044 9340221
ESB Emergency Services	1850 372 999
Bórd Gais Emergency	1850 20 50 50
Gardaí –Multyfarnham Garda Station	044 9371112
Health and Safety Co-oordinator - Health & Safety Services	TBC
Health and Safety Authority	1890 289 389
Inland Fisheries Ireland (IFI)	1890 347 424
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDS): McCarthy, Keville, O' Sullivan Ltd (MKO).	091 735611
Client – Coole Wind Farm	021 2427786

4.3 Procedure for Personnel Tracking

All operatives on site without any exception will have to undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.

In the event of a site operative being an emergency situation or where serious injury has occurred and hospitalisation has taken place, it will be the responsibility of the Site Manager or next in command if unavailable to contact the next of kin to inform them of the situation that exists.

4.4 Induction Checklist

Table 4-3 provides a list of items highlighted in this ERP which must be included or obtained during the mandatory site induction of all personnel that will work on the site. This will be updated throughout the various stages of the project.

Table 4-3 Emergency Response Plan Items Applicable to the Site Induction Process

ERP Items to be included in Site Induction	Status
All personnel will be made aware of the evacuation procedure during site induction	
Due to the remoteness of the site it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting	

ERP Items to be included in Site Induction	Status
point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.	
All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

5. PROGRAMME OF WORKS

5.1 Decommissioning Schedule

The decommissioning phase will take approximately 3 – 6 months to complete from commencing the removal of turbines to the final reinstatement of the site.

At this time, it is not possible to determine when decommissioning will take place.

The phasing and scheduling of the main decommissioning task items are outlined in Figure 5-1 below, where the 1st January has been shown as an indicative start date for decommissioning to commence.

ID	Task Name	Task Description
1	Site Health & Safety	
2	Turbine Decommissioning	Disconnect power output
3	Turbine Dismantling	Disassemble turbine components
4	Turbine Removal	Transport of all turbine components off site
5	Cable Removal	Remove underground cables from ducting
6	Turbine Foundations Backfill	Reinstate foundation areas by covering with soil material
7	Accomodation Areas Reinstatement	Reinstate soil berm and boundary treatments

Figure 5-1 Indicative Decommissioning Schedule

6. MITIGATION PROPOSALS

All mitigation measures relating to the pre-commencement, construction operational and decommissioning phases of the Proposed Development were set out in the various sections of the Environmental Impact Assessment Report (EIAR) and NIS prepared as part of the planning permission application to Westmeath County Council.

This section of the Decommissioning Plan groups together all of the mitigation measures presented for the decommissioning phase. The Mitigation Measures are presented in the following pages.

By presenting the mitigation proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the decommissioning phase of the project.

Table 6-1 Mitigation Measures

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Decommissioning Phase					
MM130	Drainage on Decommissioning	EIAR Chapter 9	Following decommissioning of the wind farm at the end of its life restoration of the hydrological regime will take place by the blocking of all the drains associated with the wind farm development. Some additional drains may also be blocked in order to restore natural drainage conditions of adjacent bog and peat habitat.		
MM131	Decommissioning	EIAR Chapter 4 DP Section 3	The following mitigation measures are proposed to avoid release of hydrocarbons at the site: - Road-going vehicles will be refuelled off site wherever possible; - On-site refuelling will be carried out at designated refuelling areas at various locations throughout the site. Machinery will be refuelled directly by a fuel truck that will come to site as required - Only designated trained and competent operatives will be authorised to refuel plant on site. - Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately; - The plant used will be regularly inspected for leaks and fitness for purpose; and, - An emergency plan for the decommissioning phase to deal with accidental spillages will be developed (refer to Section 4) Spill kits will be available to deal with and accidental spillage in and outside the refuelling area. A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the decommissioning phase.		
MM132	Decommissioning	EIAR Section 7	A Decommissioning Plan has been prepared (see Appendix 4-11 of the EIAR) The following measures are proposed for the decommissioning phase:		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- During the decommissioning phase, disturbance limitation measures will be as per the construction phase (see Chapter 7 of the EIAR). - Plant machinery will be turned off when not in use. - All plant and equipment for use will comply with the Construction Plant and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001 (S.I. No. 632 of 2001). A project ecologist will be appointed to oversee the decommissioning phase, with similar duties to those outlined above during the construction phase.		
MM133	Decommissioning	EIAR Chapter 4 DP Section 2	On removal of turbines, soil will be spread and graded over the foundation using a tracked excavator and revegetation enhanced by spreading of an appropriate seed mix to assist in revegetation and accelerate the resumption of the natural drainage management that will have existed prior to any construction		
MM134	Site rehabilitation during decommissioning	EIAR Chapter 8	In order to reverse or at least reduce some of the potential impacts caused during construction by rehabilitating construction areas such as turbine bases, hardstanding areas and site compound, covering with peatland vegetation/scraw or poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation is proposed.		
MM135	Noise	EIAR Chapter 8	The mitigation measures that will be considered in relation to any decommissioning of the site are the same as those proposed for the construction including: - managing the hours according to the CEMP [Appendix 4-8 during which site activities likely to create high levels of noise or vibration are permitted; - establishing channels of communication between the contractor/developer, Local Authority and residents;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- appointing a site representative responsible for matters relating to noise and vibration; - monitoring typical levels of noise and vibration during critical periods and at sensitive locations; - keeping site access roads even to mitigate the potential for vibration from lorries. Furthermore, a variety of practicable noise control measures will be employed. These include: - selection of plant with low inherent potential for generation of noise and/ or vibration; - placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and; - regular maintenance and servicing of plant items.		
MM136	Traffic	EIAR Chapter 14	In the event that the Proposed Development is decommissioned after the 30 years of operation, a decommissioning plan, including material recycling / disposal and traffic management plan will be prepared for agreement with the local authority.		
MM137	Ornithology	EIAR Chapter 7	- During the decommissioning phase, disturbance limitation measures will be as per the construction phase. - Plant machinery will be turned off when not in use. - All plant and equipment for use will comply with industry best practise Construction Plant and Equipment Permissible Noise Levels Regulations.		

7. MONITORING PROPOSALS

All monitoring proposals relating to the pre-commencement, construction operational and decommissioning phases of the Proposed Development were set out in the various sections of the Environmental Impact Assessment Report (EIAR) and NIS prepared as part of the planning permission application to Westmeath County Council.

This section of the Decommissioning Plan groups together all of the decommissioning monitoring proposals presented in the planning documentation. These are presented in the following pages.

By presenting the decommissioning monitoring proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the decommissioning phase of the project.

Table 7-1 Schedule of Monitoring Proposals

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
Decommissioning Phase			
MX39	Decommissioning	DP Section 3	The Site Manager in consultation with the ECoW will be responsible for employing the services of a suitably qualified ecologist and any other suitably qualified professionals as required throughout the decommissioning works.
MX40	Decommissioning	DP Section 3	Prior to decommissioning, a suitably qualified ecologist will complete an invasive species survey of any material proposed for use as part of foundation backfilling.

8. COMPLIANCE AND REVIEW

8.1 Site Inspections and Environmental Audits

Routine inspections of decommissioning activities will be carried out on a daily and weekly basis by the ECoW and the Site Supervisor/Construction Manager to ensure all controls to prevent environmental impacts, relevant to the decommissioning activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this Decommissioning Plan and all other planning application documents. Only suitably trained staff will undertake environmental site inspections.

8.2 Auditing

An Environmental audit will first be carried out prior to the construction phase of the development to ensure the implementation of pre-construction mitigation measures, completion of baseline studies and implementation of pre-construction felling mitigation measures. Further environmental audits will be carried on a monthly basis during the construction phase of the project and again after the commissioning of the wind turbines.

In contrast to monitoring and inspection activities, audits are designed to shed light on the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by the ECoW on behalf of the appointed contractor. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the Decommissioning Plan is being properly implemented and maintained. The results of environmental audits will be provided to the Wind Farm Operator will be made available to Westmeath County Council on request.

8.3 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction, operation and decommissioning of the renewable energy development:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the EMP.

8.4 Corrective Action Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Site Supervisor/Construction Manager, as advised by the Site Environmental Clerk of Works. Corrective actions may be required as a result of the following.

- Environmental Audits.
- Environmental Inspections and Reviews.
- Environmental Monitoring.
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Site supervisor/Construction Manager and the ECoW will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

8.5 Decommissioning Plan Review

This Decommissioning Plan will be reviewed and updated prior to commencement of an decommissioning works. Further updates will be completed to the plan during decommissioning works to adapt to specific situations or site conditions that are encountered that need to be considered by the plan.