4. DESCRIPTION OF THE PROPOSED PROJECT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the Proposed Project and all its component parts. A planning application, relating to the Proposed Project, will be made to An Coimisiún Pleanála (ACP). Construction methodologies for the main infrastructural components of the development are also included in this chapter (or its associated appendices) of the EIAR.

Planning Notice Proposed Project Description

i. *The construction of 14 no. wind turbines with an overall turbine tip height of 185 metres; a rotor blade diameter of 163 metres; and hub height of 103.5 metres, and associated foundations and hard standing areas;*
ii. *A permanent 110kV substation compound (2 no. control buildings with welfare facilities, all associated electrical plant and equipment, security fencing, entrance on to existing track, all associated underground cabling, wastewater holding tank, site drainage and all ancillary works;*
iii. *Underground internal wind farm electrical cabling and communications cabling connecting the wind turbines to the proposed on-site 110kV electrical substation and associated ancillary works;*
iv. *A meteorological mast of 103.5m in height, and associated foundation and hard-standing area;*
v. *All works associated with the upgrade of the existing agricultural access off the L1154 local road (including the installation of fencing and steel gates) to serve as the main site entrance for the wind farm;*
vi. *The provision of 4 no. new access points along the L1154;*
vii. *The provision of 4 no. new access points along the L-5117;*
viii. *The provision of 5 no. new access/egress point L-5206;*
ix. *The provision of 2 no. new access points along the L-52061;*
x. *Upgrade of existing tracks/ roads and junctions and provision of new site access roads and junctions;*
xi. *3 no. temporary construction compounds with temporary offices and staff welfare facilities;*
xii. *Accommodation works along the public road network in the townlands of Camus, Ballynahinch, Kilshenane, Dundrum, Gortarush Lower, Carrow, Scarrough, and Moheragh, Co. Tipperary to facilitate the delivery of turbine components and other abnormal loads;*
xiii. *2 no. Borrow Pits;*
xiv. *Spoil Management;*
xv. *Site Drainage;*
xvi. *Tree Felling and hedgerow removal;*
xvii. *Biodiversity Management and Enhancement Measures;*
xviii. *Operational stage site signage;*
xix. *Battery Energy Storage System and all associated electrical plant and equipment, security fencing, 2 no. static water storage tanks and a firewater retention tank, and all associated infrastructure and apparatus;*
xx. *The provision of underground electrical (110kV) and communications cabling from the proposed on-site 110kV electrical substation to the existing Killonan 110kV electrical substation to facilitate the connection to the national grid (RPS S018);*
xxi. *Provision of 58 no. joint bays, communication chambers and earth sheath links along the proposed underground electrical cabling route;*
xxii. *Reinstatement of land, road and track surface above the proposed cabling trench; and*
xxiii. *All related site works and ancillary development considered necessary to facilitate the proposed development, including landscaping and the reinstatement of land.*

The application is seeking a ten-year planning permission for development and a 35-year operational life from the date of commissioning of the entire wind farm.

Section 1.1.1 of Chapter 1 of this EIAR provides a definition of the various project references used throughout the document. The 'Proposed Project', which encompasses the 'Proposed Wind Farm' and 'Proposed Grid Connection' has been assessed within this EIAR. The Proposed Project is located within the EIAR Site Boundary or the 'Site' which measures approximately 1,564 hectares (ha). The 'Proposed Wind Farm site' refers to the portion of the Site surrounding the Proposed Wind Farm but excluding the portion of the site surrounding the Proposed Grid Connection underground cabling route. The overall layout of the Proposed Project is illustrated on Figure 4-1a.

All elements of the Proposed Project are provided in the list above, and described in this chapter, have been assessed as part of this EIAR.

4.2 Proposed Project Layout

The layout of the Proposed Project has been designed to minimise potential environmental effects of the wind farm, while at the same time maximising the energy yield of the wind resource passing over the Proposed Wind Farm site. A constraints study, as described in Section 3.2.5.2.1 of Chapter 3 of this EIAR, has been carried out to ensure that turbines and all ancillary infrastructure are located in the most appropriate areas of the Proposed Wind Farm site.

The overall layout of the Proposed Project is shown on Figure 4-1a. A drawing focusing on the core of the Proposed Wind Farm site is shown on Figure 4-1b. This drawing shows the proposed locations of the wind turbines, electricity substation, part of the grid connection route, spoil management areas, construction compounds, internal roads layout and the main site entrance. The EIAR Site Boundary does not encompass the turbine delivery accommodation works, however, these temporary works are included as part of this planning application and are fully assessed as part of the EIAR. The locations of the turbine delivery accommodation works is shown on Figure 4-1a.

Detailed site layout drawings of the Proposed Project are included in Appendix 4-1 to this EIAR.

County Clare

County Tipperary

County Limerick

Limerick City

Cappamore

Doon

Hollyford

Dundrum

Glenpaudeen

Moheragh

Barraderry

Barr an Doire

Bonarea

Carrow

Scarrough

Cillin

T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14

Map Legend

- EIAR Site Boundary
- Proposed Turbine Location
- Proposed Hardstand
- Proposed Met Mast
- Proposed Existing Public Roads to be Maintained
- Proposed New Road
- Proposed Existing Road Upgraded
- Temporary Construction Compound
- Proposed Spoil Management Areas
- Proposed Borrow Pits
- Proposed 110kV Underground Grid Connection Cable
- Proposed 110kV Substation with Battery Storage
- Existing Killonan 110kV Substation
- Location of Temporary Accommodation Works
- Proposed Riparian Buffer
- Proposed Wet Grassland Management
- Proposed Woodland Management
- County Boundary

Drawing Title: Proposed Project

Project Title: Carrow Wind Farm

Drawn By	Checked By
ER	EMC
Project No.	Drawing No.
231102	Figure 4-1a
Scale	Date
1:120,000	2026-03-25

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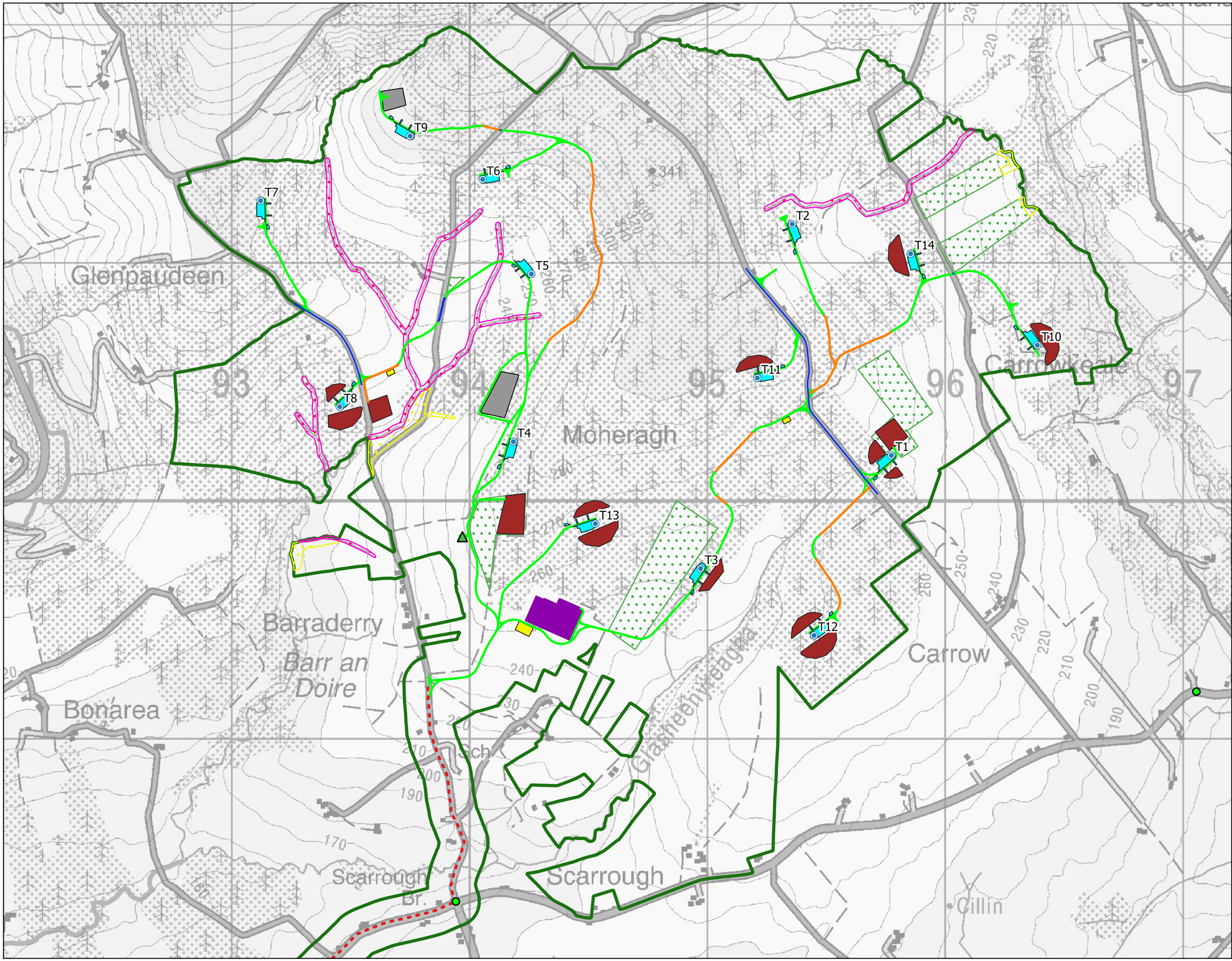

Map Legend

- EIAR Site Boundary
- Proposed Turbine Location
- Proposed Hardstand
- Proposed Met Mast
- Proposed Existing Public Roads to be Maintained
- Proposed New Road
- Proposed Existing Road Upgraded
- Temporary Construction Compound
- Proposed Spoil Management Areas
- Proposed Borrow Pits
- Proposed 110kV Underground Grid Connection Cable
- Proposed 110kV Substation with Battery Storage
- Location of Temporary Accommodation Works
- Proposed Riparian Buffer
- Proposed Wet Grassland Management
- Proposed Woodland Management

Drawing Title: Proposed Wind Farm site

Project Title: Carrow Wind Farm

Drawn By	Checked By
ER	EMC
Project No.	Drawing No.
231102	Figure 4-1b
Scale	Date
1:14,000	2026-03-25

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4.3 Proposed Project Components

This section of the EIAR describes the components of the Proposed Project. Further details regarding Access and Transportation (Section 4.4), Community Gain (Section 4.5), Site Drainage (Section 4.6), Construction Management (Section 4.7) and Construction Methodologies (Section 4.7) are provided subsequently in this chapter.

4.3.1 Proposed Wind Farm

4.3.1.1 Wind Turbines

4.3.1.1.1 *Turbine Locations*

The Proposed Wind Farm turbine layout has been verified using industry standard wind farm design software ensuring that it maximises the energy yield from the Proposed Project, while maintaining sufficient distances between the proposed turbines so as 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 finished top of foundation 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		Existing Elevation (m OD)
	X (ITM)	Y (ITM)	
T1	595726	650235	261
T2	595309	651206	272
T3	594925	649760	251
T4	594137	650293	270
T5	594213	650997	255
T6	594008	651395	293
T7	593075	651305	300
T8	593407	650439	216
T9	593703	651577	318
T10	596339	650698	201

T11	595163	650560	293
T12	595401	649479	260
T13	594482	649948	265
T14	595807	651082	241

4.3.1.1.2 Turbine Type

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

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

Plate 4-1 Wind turbine components

The proposed wind turbines to be installed on the site will have the following dimensions:

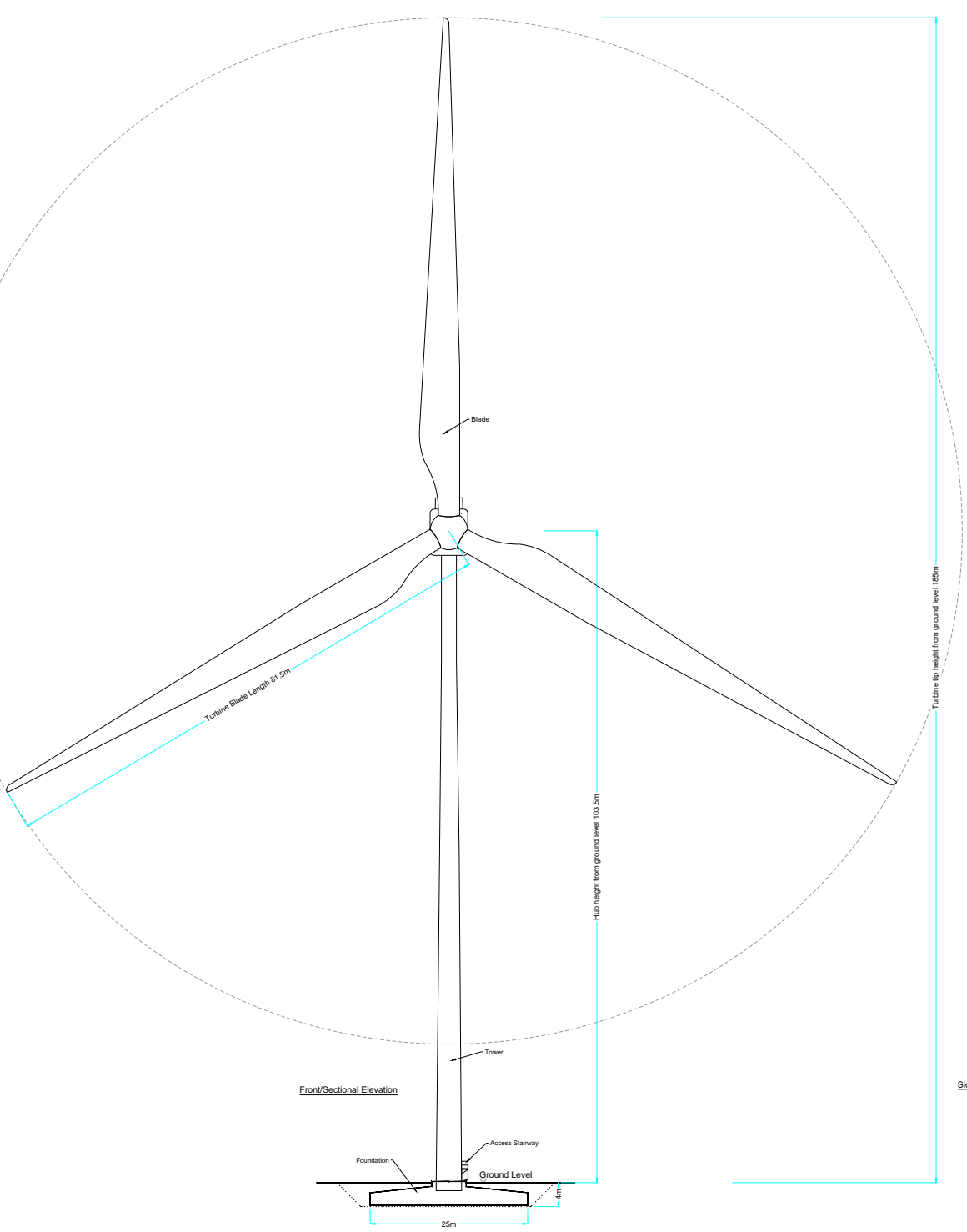
- Turbine Tip Height – 185 metres
- Hub Height – 103.5 metres
- Rotor Diameter - 163 metres.
  - Blade length – 81.5 metres

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 Proposed Wind Farm 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.

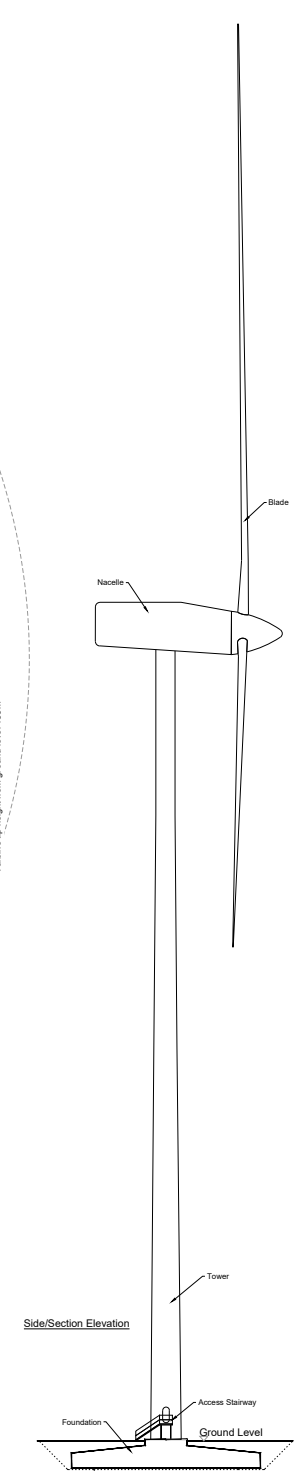
It should also be noted that the assessment of the development footprint of the Proposed Wind Farm site, within this EIAR, is based on the maximum potential footprint for all of the infrastructural elements. This precautionary approach is taken as the assessment of the maximum development footprint will, in the absence of mitigation measures, give rise to the greatest potential for significant effects. Should the development footprint be less than the maximum, the potential for significant effects will also be reduced.

A drawing of the proposed wind turbine is shown in Figure 4-2.

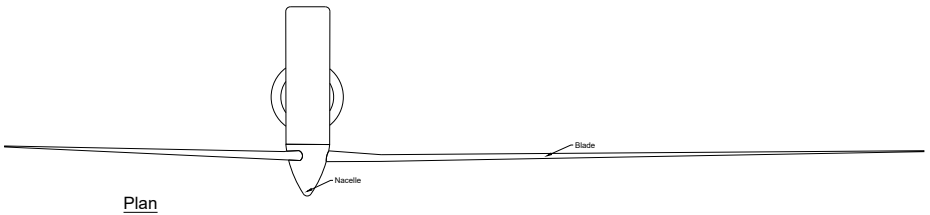
Figure 4-2 also shows the turbine base layout, including turbine foundation, hard standing area, assembly area, access road and surrounding works area.



Front/Sectional Elevation



Side/Section Elevation



Plan

Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of 185m, blade length of 81.5m and hub height of 103.5m
2. Ground level represents the top of turbine foundation.

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary & Co. Limerick

DRAWING TITLE:
Wind Turbine Elevation & Plan

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-2	1:500 @ A1

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
JOB	AC	25.03.2026	P02

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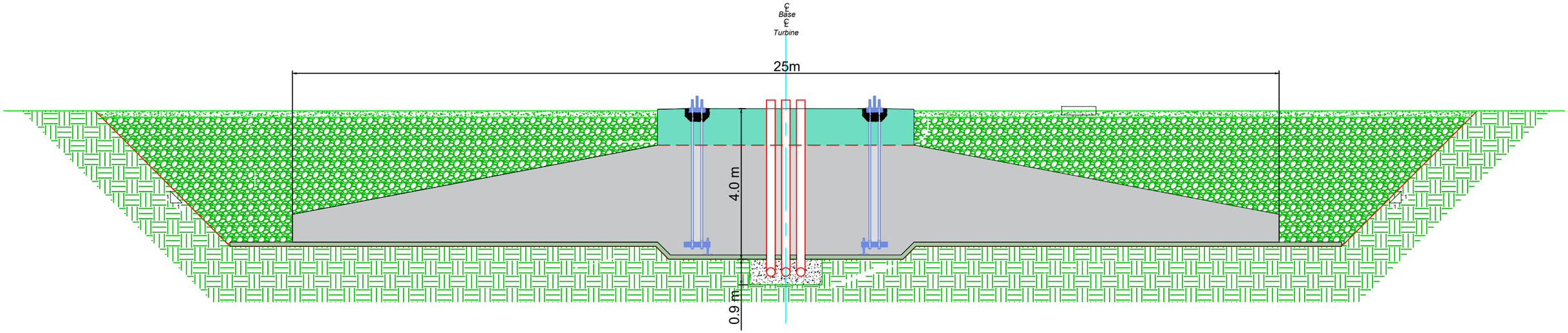
4.3.1.1.3 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier and a foundation area large enough to accommodate modern turbine models has been assessed in this EIAR. The turbine foundation transmits any load on the wind turbine into the ground. Where ground conditions do not favour the use of the excavate and replace method (gravity), piles (bored or driven) will be installed to formation level. All foundation options have been assessed in this EIAR and are shown in Figure 4-3, Figure 4-4 and Figure 4-5.

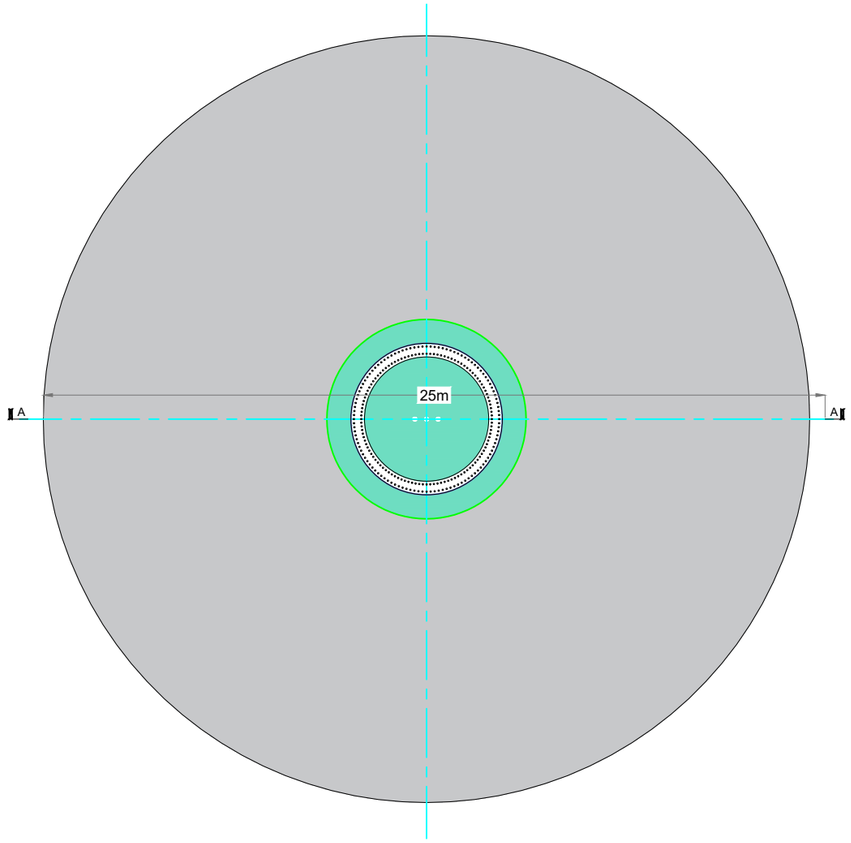
The maximum horizontal and vertical extent of the turbine foundation will be 25m and 4m respectively, which has been assessed in the EIAR.

After the foundation level of each turbine has been formed on competent strata (i.e. bedrock or subsoil of sufficient load bearing capacity) or using piling methods, the “Anchor Cage” (anchors the first section of the turbine tower to the foundation) is levelled and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level (Plate 4-2 below).

Section A-A
Scale 1:100



Plan
Scale: 1:200



PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Gravity Foundations Details**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-3**	SCALE: **As Shown @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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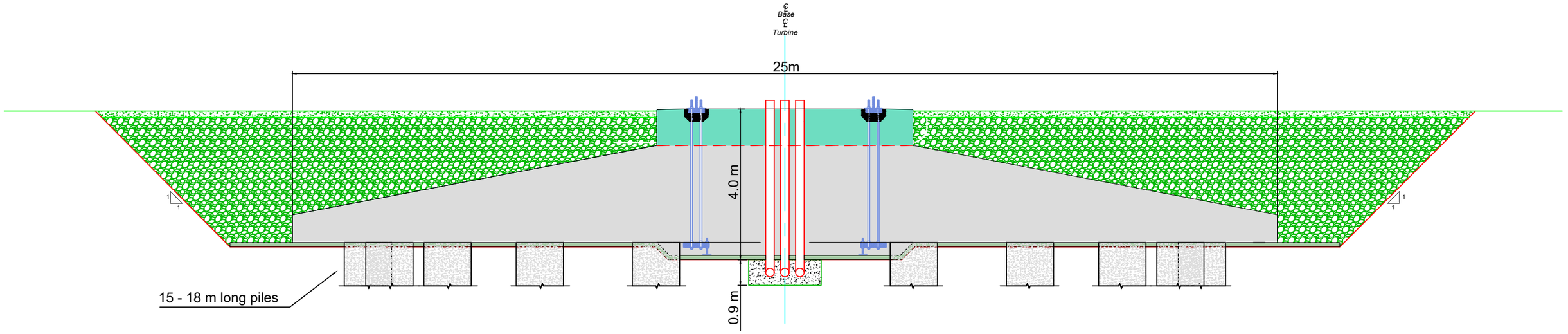
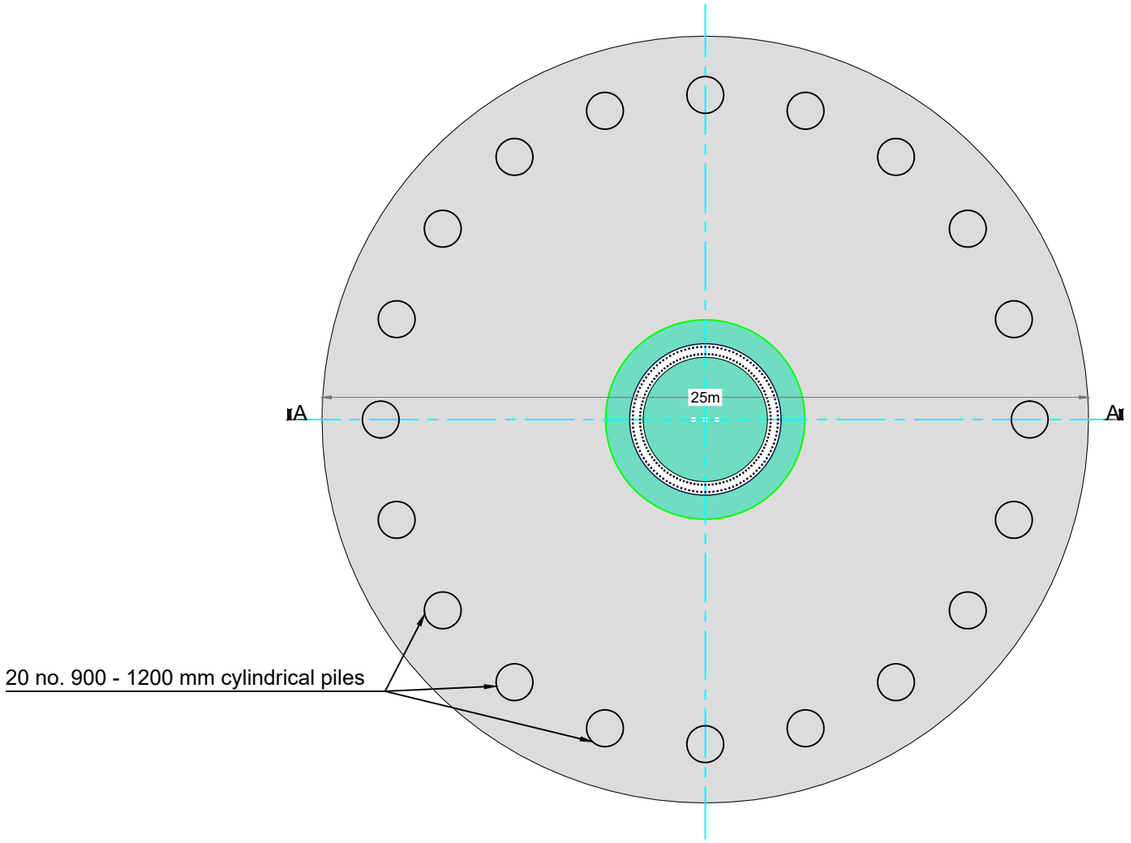
Section A-A
Scale 1:100



Plan
Scale: 1:200



PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**

DRAWING TITLE: **Bored Pile Foundations Details**

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-4	As Shown @ A3

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JOB	AC	25.03.2026	P02

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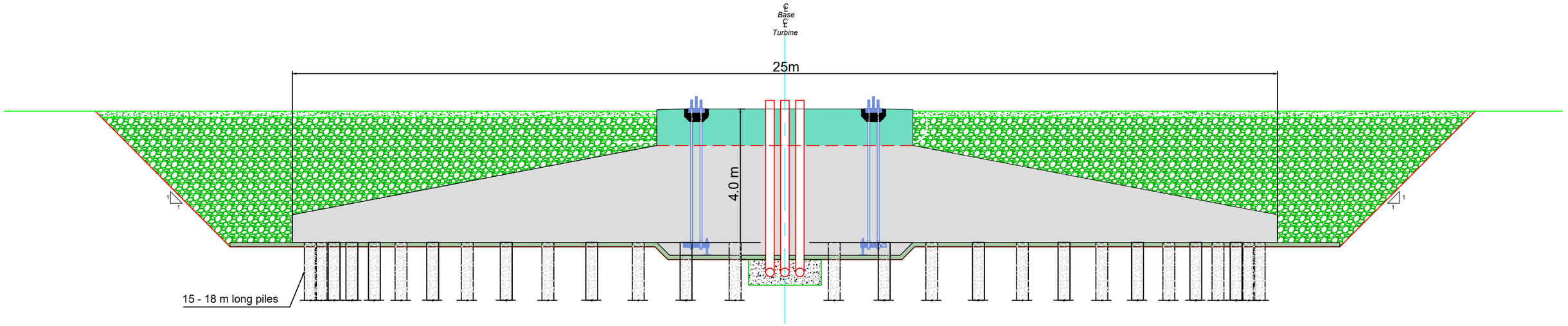
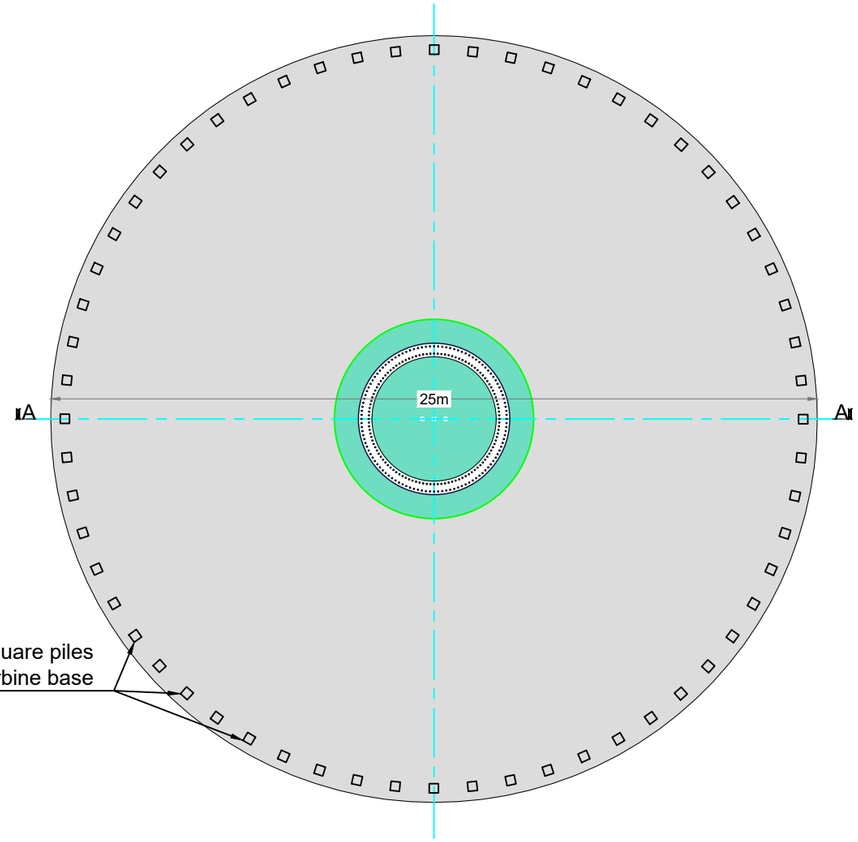
Section A-A
Scale 1:100



Plan
Scale: 1:200



50 - 70 no. 300 x 300 mm square piles
Spaced evenly around the perimeter of the turbine base

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**

DRAWING TITLE: **Driven Pile Foundations Details**

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-5	As Shown @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
JOB	AC	25.03.2026	P02

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

4.3.1.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base. These will facilitate access, turbine assembly and turbine erection. The hard-standing areas are used to accommodate cranes used in the assembly and erection of the turbine. The hardstands also allow for the 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 completed, by placing crushed stone over the foundation. The arrangement and positioning of hard standing areas are dictated by turbine suppliers. All crane hardstand areas will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads. The proposed hard standing areas for each individual turbine are shown as part of the detailed layout drawings included in Appendix 4-1 and represent the maximum sizes required. However, the extent of the required areas at each turbine location may be optimised on-site within the parameters set out and assessed in this EIAR. This will depend on the turbine supplier's exact requirements.

4.3.1.1.5 Assembly Area

Levelled assembly areas will be located on either side of the hard-standing area. These assembly areas are required for offloading turbine blades, tower sections and hub from trucks until such time as they are ready to be lifted into position by cranes and to assist the main crane during turbine assembly. The extent of the area required for the assembly areas is shown on the detailed drawing in Appendix 4-1.

4.3.1.1.6 Power Output

Current and future wind turbine generator technology will ensure that the wind turbine model, chosen for the Proposed Project, will have an operational lifespan greater than the 35-year operational life that is being sought as part of the planning application. Each of proposed wind turbines will have a generating capacity of 6.2 MW. 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 Proposed Wind Farm site and will be determined by the selected manufacturer.

For the purposes of this EIAR, a rated output of 6.2 MW has been chosen to calculate the power output of the proposed 14-turbine renewable energy development, which would result in an estimated installed capacity of 86.8 MW.

Assuming an installed capacity of 86.8 MW, the Proposed Wind Farm therefore has the potential to produce up to 273,733 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 36% is applied here[1].

C = ... Rated output of the wind turbines: 86.8 MW

The 273,733 MWh of electricity produced by the Proposed Wind Farm would be sufficient to supply approximately 65,174 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity[2] (this latest figure is available from the March 2017 CER Review of Typical Consumption Figures Decision Paper). For context, according to the latest Census 2022 data, there are 62,232 households located in Co. Tipperary.

4.3.1.2 Site Roads

4.3.1.2.1 *Road Construction Types*

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

1. *Buildability considerations;*
2. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles*
3. *Horizontal longitudinal and cross-fall gradient of the roads;*
4. *Minimisation of excavation arisings;*
5. *Making use of existing infrastructure where possible;*

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.

It is proposed to upgrade approximately 2.6 km of existing site roads and tracks, and to construct approximately 12.9 km of new access road on the Proposed Project site. It is proposed to construct passing bays along the proposed access road network to allow construction traffic to safely pass each other. Areas such as wide junctions and proposed hardstands will also be used as passing bays throughout the construction phase of the Proposed Wind Farm site.

Upgrade of Existing Access Roads or Tracks

As noted above, approximately 2.6 km of existing roads and access tracks will be upgraded as part of the Proposed Wind Farm construction phase. The existing tracks onsite were constructed using the excavate and replace construction technique, therefore proposed road widening will be founded on competent stratum. Cross section details of the upgrade of existing roads are shown as Figure 4-6. Details on the construction methodology for the upgrading of existing tracks and roads is outlined below in Section 4.8.1.2.2.

[1] *Eirgrid, 2022 Enduring Connection Policy 2.2 Constraints Report for Area H2 Solar and Wind* ECP-2-2-Solar-and-Wind-Constraints-Report-Area-H2-v1.0.pdf (eirgridgroup.com)
[2] *March 2017 CER (CRU) Review of Typical Consumption Figures Decision Paper* https://www.cru.ie/document_group/review-of-typical-consumption-figures-decision-paper/

Construction of New Roads

As noted above, approximately 12.9km of new roads will be constructed in order to facilitate the Proposed Wind Farm. Due to the ground conditions, new access tracks proposed on site are proposed to be founded and located on competent stratum. The make-up of the founded access tracks is a stone thickness of c. 400mm. A cross section detail of a new excavated road is also shown in Figure 4-6.

The details on the construction methodology for new excavated roads is outlined below in Section 4.8.1.2.1.

4.3.1.2.2 *Public Road Maintenance and Widening*

The Proposed Project includes for the use of approximately 1.6km of the local road network situated within the core of the Proposed Wind Farm site, as illustrated in Figure 4-1b. Widening works are required along certain sections to facilitate the construction phase of the project. Specifically, the works will involve widening the existing road corridor to achieve a running width of approximately 5 meters and to provide passing opportunities for construction vehicles travelling in opposite directions.

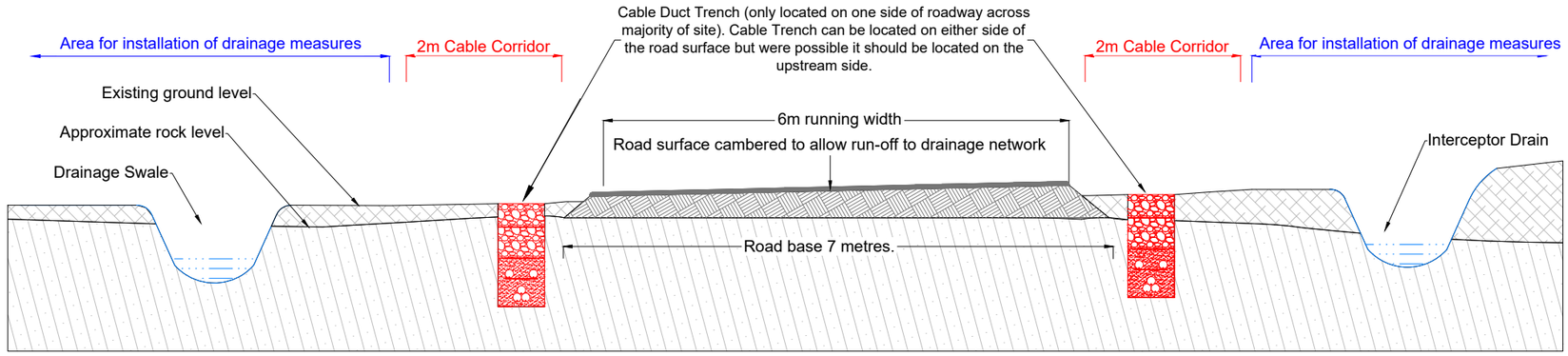
The process of widening the section alongside the current public road will adhere to the road construction methodologies outlined in Section 4.8.1.2.2 below.

Upon completion of the construction phase, the public road corridor's boundaries will be reinstated to their original width or to meet the requirements of the Roads Section of the Local Authority. This restoration process will involve the use of stock-proof fencing or an earthen/granular fill berm where necessary. The widening and boundary reinstatement is illustrated in Figure 4-7.

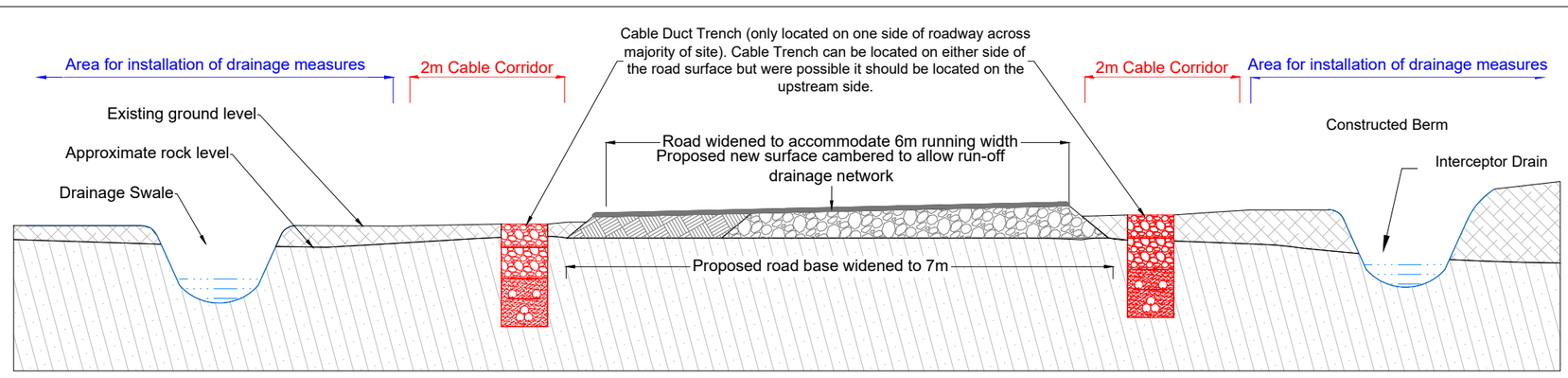
Whilst no works are proposed to the existing local road carriageways, a pre- and post-construction condition survey will be undertaken and upon completion of the construction phase, the surface of the public road carriageway along the relevant sections of local will be reinstated as per the specifications of Tipperary County Council.

Drawing Notes

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



Typical excavated road section.



Typical existing excavated road widening section.

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Excavated Road Sections**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-6**	SCALE: **1:75 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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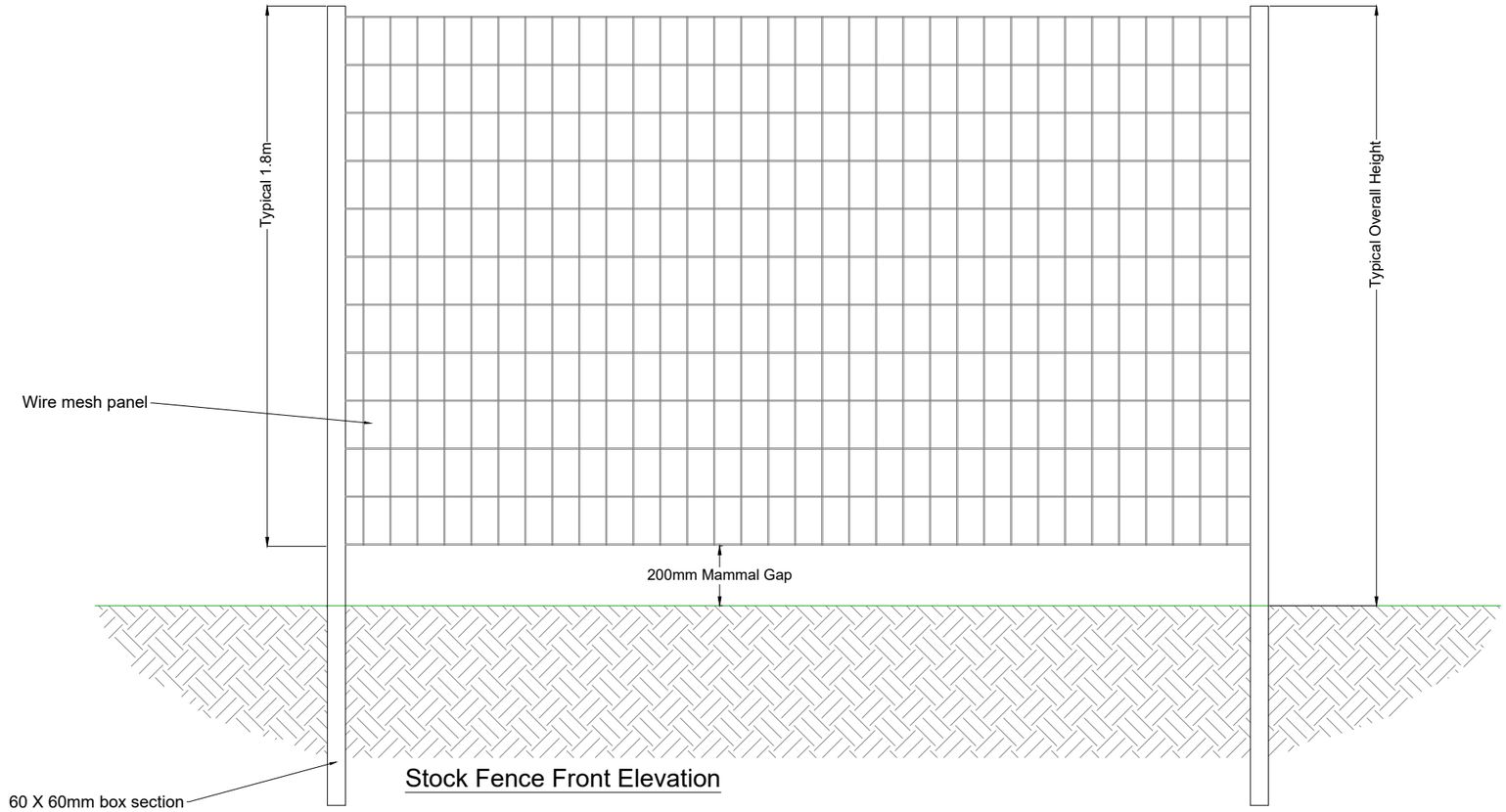
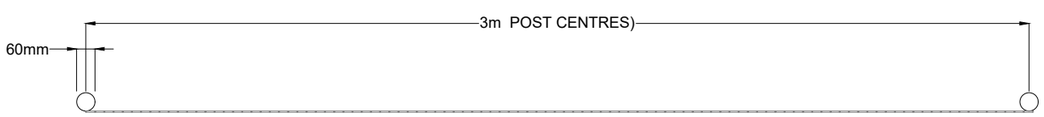


Stock Fence Front Elevation



Stock Fence Plan

INDICATIVE IMAGE

INDICATIVE IMAGE

Note:

All dimensions are in millimetres, unless noted otherwise.

All dimensions to be checked on site and any discrepancy to be reported to the engineer.

Figured dimensions only to be used, drawings not to be scaled. If in doubt ask.

For illustration purposes only. Exact size and appearance of unit subject to manufacturer selection.

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Stock Fence Detail, Elevation & Indicative Images**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-7**	SCALE: **1:20 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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4.3.1.3 Site Underground Electrical and Communications Cabling

Each turbine and the meteorological mast (refer to Section 4.3.1.4 below) will be connected to the on-site electricity substation via underground (kilovolt) electricity cabling. Fibre-optic cables will also connect each wind turbine and the met mast to the onsite substation. The electricity and fibre-optic cabling connecting to the onsite substation compound will be run in cable ducts in the road or direct buried alongside the internal tracks approximately 1.2 metres beneath ground level to the top of the cable. The route of the cable will follow the access track to each turbine location and are illustrated on the site layout drawings included as Appendix 4-1, the exact number and configuration of cable may vary within the cabling trench. Figure 4-8 below shows two variations of a typical site cabling trench, one for off-road trenches and one for on-road trenches. The cabling may be placed on either side of the roads, on both sides of the road or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

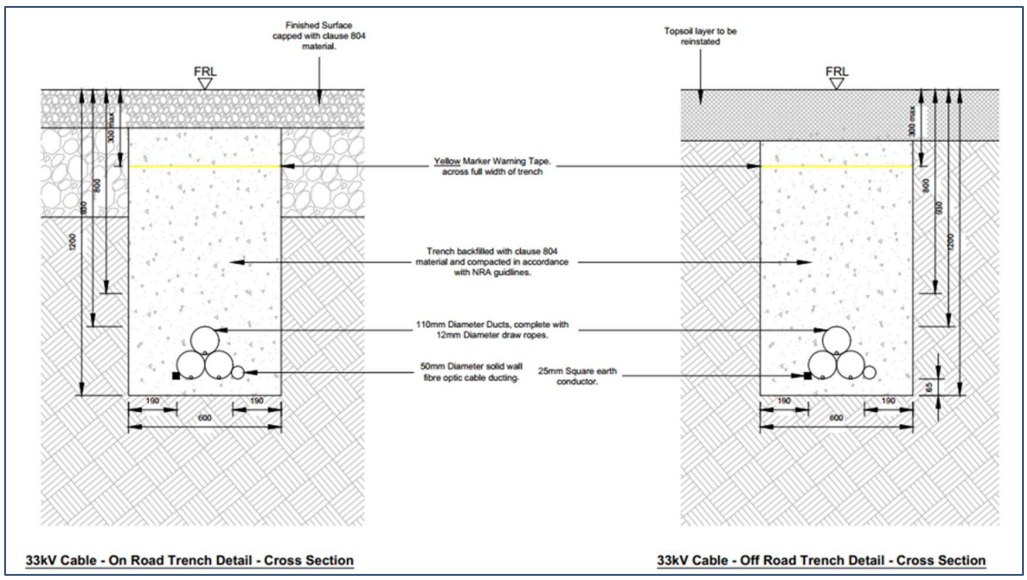
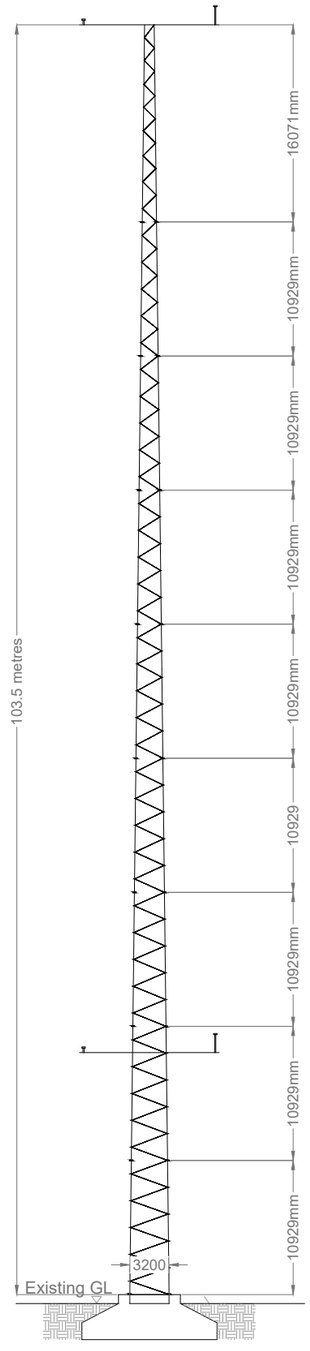


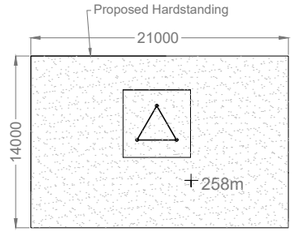
Figure 4-8 Cabling trench cross section detail

Clay plugs (water flow barrier) will be installed at regular intervals of not greater than 50 metres along the length of the trenches where required to prevent the trenches becoming conduits for runoff water. Backfill material will be compacted in layers with approved engineer's specified material, which may be imported onto the Proposed Wind Farm site should sufficient volumes of suitable material not be encountered during the excavation phase of the proposed infrastructure.

4.3.1.4 Meteorological Mast

One meteorological (met) mast is proposed as part of the Proposed Wind Farm site. The met mast will be equipped with wind monitoring equipment at various heights. The proposed met mast will be located at N593923, E649893 (ITM) as shown on the Proposed Wind Farm layout drawing in Figure 4-1b. The mast will be a free-standing slender lattice structure 103.5 metres in height. The mast will be constructed on a hard-standing area sufficiently large to accommodate the equipment that will be used to erect the mast. The proposed meteorological mast is shown in Figure 4-9.





Met Mast Compound Plan

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary & Co. Limerick

DRAWING TITLE:
Free Standing Met Mast

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-9	1:500 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
JOB	AC	25.03.2026	P02

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4.3.1.5 Temporary Construction Compounds

Three temporary construction compounds will be located within the Proposed Wind Farm site. The primary construction compound will be located opposite the Proposed 110kV Substation, measuring approximately 2,610 square meters (m^2) in area. The second construction compound will be located approximately 240m northeast of Turbine 8 and a third construction compound will be located approximately 200m southeast of Turbine No. 11, both measuring approximately 650 m^2.

The locations of the proposed temporary construction compounds are shown on the Proposed Project site layout drawing in Figure 4-1b. The layouts of the temporary construction compounds are shown on Figure 4-10, Figure 4-11 and Figure 4-12.

The temporary construction compounds will consist of temporary site offices, staff welfare facilities, construction materials storage and car-parking areas for staff and visitors.

Temporary toilets, located within staff 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 a permitted waste collector to wastewater treatment plants. There will also be a water supply on site for hygiene purposes, by way of a temporary storage tank.

The temporary construction compounds will also include a bunded refuelling and containment area for the storage of oil, lubricants and site generators etc, and full retention oil interceptor.

Once the Proposed Wind Farm has been commissioned these compounds will be removed. These areas will be reinstated with previously excavated spoil, and either be reseeded or left to revegetate naturally.

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

4.3.1.6 Biodiversity Management and Enhancement Plan

A Biodiversity Management and Enhancement Plan (BMEP) has been prepared for the Proposed Project and is included as Appendix 6-1 of this EIAR. This plan has been developed to offset the loss of habitats identified within the Proposed Wind Farm site, and further enhance the biodiversity of the site and its environs. It is proposed to manage and bolster approximately 3.3 ha of semi-natural woodland habitat within the Proposed Wind Farm site. This measure will create additional habitat for commuting and foraging fauna, including bats, badger and other protected fauna, within the Proposed Wind Farm site. Approximately 30.2 ha of important wet grassland habitat will be managed to enhance marsh fritillary habitat. It is proposed to plant approximately 9.9 ha of riparian woodland either side of mapped watercourses within the Proposed Wind Farm site. This measure will create a linear feature for commuting and foraging fauna, including bats, badger and other protected fauna, within the Proposed Wind Farm site.

4.3.1.7 Tree Felling

As part of the Proposed Project, tree felling will be required within and around the development footprint to allow for the construction of the turbine bases, access roads underground cabling, and the other ancillary infrastructure.

Further details on tree felling required within and around development footprint on the Proposed Project site is detailed in Chapter 6 of this EIAR.

A significant portion (66%) of the Proposed Wind Farm site comprises commercial forestry. A total of approximately 51.6 hectares of commercial forestry will be permanently felled as part of the Proposed

Project along with existing treeline boundaries as detailed in Chapter 6, Section 6.5.2.2.1. Figure 4-13 shows the extent of the commercial forestry to be permanently felled as part of the Proposed Project.

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

4.3.1.7.1 *Forestry Replanting*

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

The estimated 51.6 hectares that will be permanently felled for the footprint of the Proposed Project infrastructure will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that will be issued in respect of the Proposed Project. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement of the 51.6 hectares of forestry can occur anywhere in the State subject to licence. The replacement of forestry, felled as part of the Proposed Project, may occur on any lands, within the state, benefitting from Forest Service Technical Approval[3] for afforestation, should the Proposed Project receive planning permission. Under the Forestry Regulations 2017, all applications for licences for afforestation require the prior written approval (technical approval) of the Minister for Agriculture, Food and the Marine. Before the Minister can grant approval, he/she must first determine if the project is likely to have significant effects on the environment (for EIA purposes) and assess if the development, individually or in combination with other plans or projects is likely to have a significant effect on a European site (for Habitats purposes).

4.3.1.8 Borrow Pit

It is estimated that approximately 247,720 cubic metres (m^3) of stone material will be required to construct the Proposed Project (refer to Table 4-2 below). It is intended to obtain the majority of materials for the construction of the Proposed Project from the proposed on-site borrow pits (engineer's specified material may be imported onto the Site should sufficient volumes of suitable material not be encountered during the excavation phase of the proposed infrastructure, to come from local licenced quarries). Please see Figure 4-14 and Figure 4-15 for details of the proposed borrow pits. The primary borrow pit is located approximately 107m northwest of T4 and measures approximately 16,910m^2 in area. The second borrow pit will be located approximately 130m north of Turbine 9 and measures approximately 7,390 m^2

Access to the primary borrow pit will be via a proposed new access road running along the western edge of the borrow pit. Please see Figure 4-1b for details. Access to the secondary borrow pit will be via a proposed new access road running along the western edge of the borrow pit. Please see Figure 4-1b for details. Post-construction, the borrow pits will be reinstated with excavated spoil and profiled to match the existing ground levels, insofar as possible. The borrow pit areas will then be reseeded. A

[3] *All proposed forestry developments where the area involved is greater than 0.1 hectare must receive the prior written approval of the Forest Service. The application for approval is known as Pre-Planting Approval – Form 1.*

stock-proof fence will be erected around the borrow pit areas, to prevent unauthorised access, during the construction phase and until the borrow pits have been fully reinstated.

The extraction of material from the borrow pits is a construction phase activity only of the Proposed Project which will be a temporary operation run over a short period of time during the construction phase. The topsoil and subsoil will be stripped back and temporarily stockpiled using standard tracked excavators. Hardcore materials will be extracted from the borrow pits (and some turbine locations, if necessary), principally by means of rock breaking. Depending on the hardcore volume, blasting may also be used as a more effective rock extraction method, capable of producing significant volumes of rock in a matter of milliseconds. Blasting will only be carried out after notifying any potentially sensitive receptors. These two rock extraction methods are discussed below. The processing and crushing of boulders may be required to achieve the grading requirements for use in construction. The potential noise and vibration impact on sensitive receptors associated with the rock extraction measures, detailed below, are assessed in Section 12.5.2.4 of Chapter 12 of this EIAR. Post-construction, any unsafe areas around the borrow pit areas will be permanently secured and a stock-proof fence will be erected around the borrow pit areas to prevent access to these areas. Appropriate health and safety signage will also be erected on this fencing and at locations around the fenced areas.

Please see Section 4.8.1.7 below for the methodologies for the breaking and extraction of rock from the borrow pit.

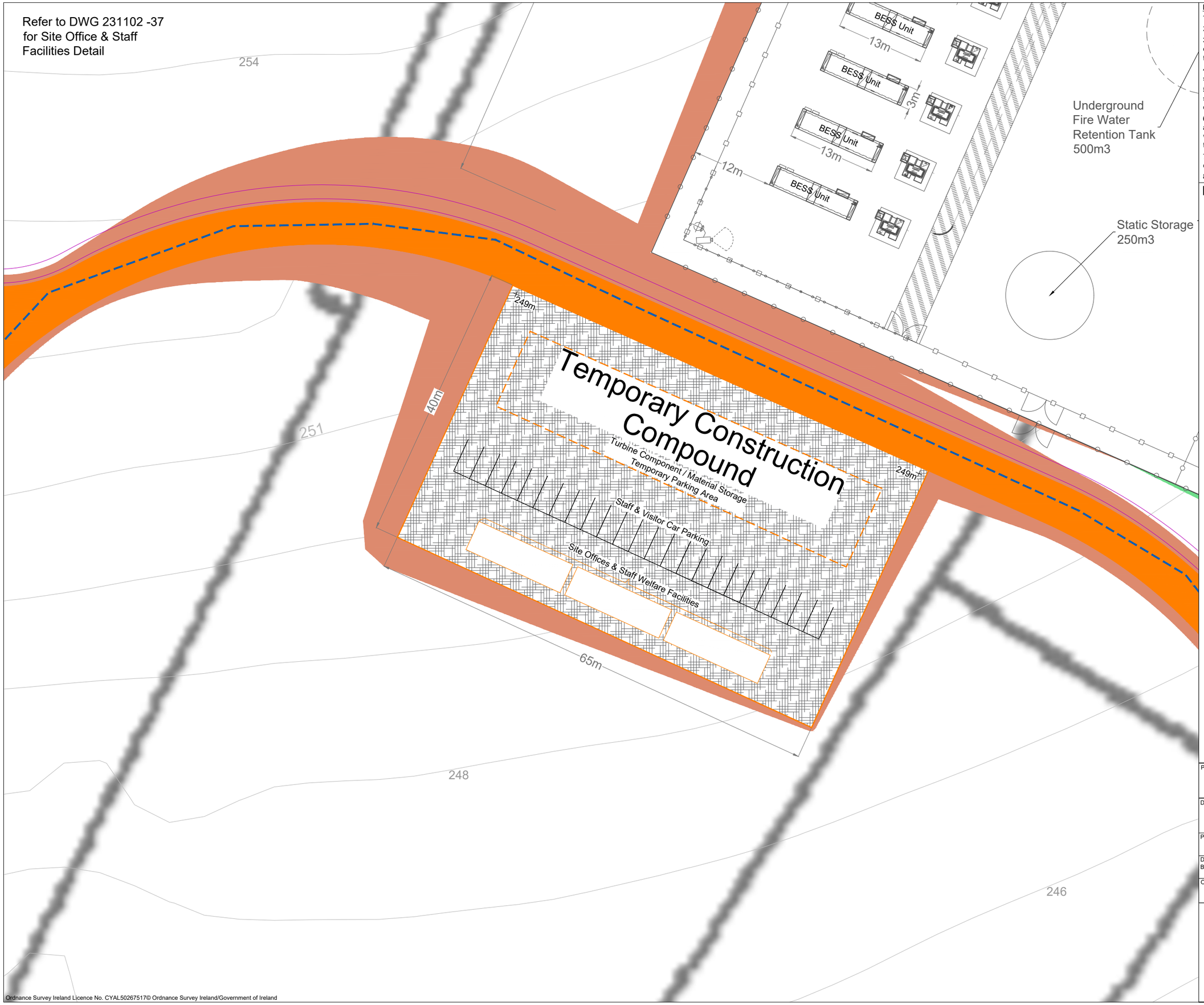
4.3.1.8.1 *Spoil Management Plan*

The total estimated volume of spoil to be managed following excavations during the construction phase of the Proposed Project is approximately 399,565 m^3 (refer to Table 4-2 below).

A portion of the excavated material will be used as fill for the creation of level works areas for construction. The remaining volume of spoil to be placed within the spoil management areas, within linear berms alongside sections of Proposed Wind Farm site roads (where appropriate, avoiding environmentally constrained areas) and through backfilling of the proposed borrow pits void. The locations of the spoil management areas and borrow pits are shown on the Proposed Project site layout drawing in Figure 4-1b.

It is proposed that some of the spoil generated by the proposed cabling trench will be removed and accommodated within the spoil management areas or borrow pits within the Proposed Wind Farm site. The majority of excavated material from the Proposed Grid Connection route will transported to a Materials Recovery Facility (MRF). There is more than enough capacity to manage the total volume of spoil requiring management for both the Proposed Wind Farm and the Proposed Grid Connection as detailed in Table 4-2 below.

Refer to DWG 231102 -37
for Site Office & Staff
Facilities Detail



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

Drawing Legend

- Proposed New Road
- Cut
- Fill
- Proposed Underground Grid Connection Cabling Route
- Internal Electrical Cabling Trench

N

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary & Co. Limerick

DRAWING TITLE:
Temporary Construction Compound 1

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-10	1:500 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
JOB	AC	25.03.2026	P02

OS SHEET No.:
4744, 4745, 4746, 4747, 4748, 4749, 4750, 4751, 4752, 4753, 4754, 4755, 4814, 4815, 4804, 4805, 4806, 4807, 4808, 4809, 4810, 4811, 4812, 4813, 4877, 4878, 4867, 4868, 4869, 4870, 4871, 4872, 4873, 4874, 4875, 4876, 4938, 4939, 4940, 4929, 4930, 4931, 4932, 4933, 4934, 4935, 4936, 4937, 4989, 4990, 4991, 4992, 4993, 4994, 4995, 4996, 4997, 4998, 4999, 5000

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Refer to DWG 231102 -37 for Site Office & Staff Facilities Detail

281

280

278

276

274

Temporary Construction Compound

Staff & Visitor Car Parking

Site Offices & Staff Welfare Facilities

278m

278m

20m

33m

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

Drawing Legend

- Proposed New Road
- Cut
- Fill
- Internal Electrical Cabling Trench

N

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary & Co. Limerick

DRAWING TITLE:
Temporary Construction Compound 2

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-11	1:200 @ A3

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JOB	AC	25.03.2026	P02

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Refer to DWG 231102 -37
for Site Office & Staff
Facilities Detail

222

Temporary Construction Compound

221m

221m

Staff & Visitor Car Parking

Site Offices & Staff Welfare Facilities

20m

33m

220

219

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

Drawing Legend

- Existing Road to be Upgraded
- Cut
- Fill
- Internal Electrical Cabling Trench

N

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary & Co. Limerick

DRAWING TITLE:
Temporary Construction Compound 3

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-12	1:200 @ A3

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JOB	AC	25.03.2026	P02

OS SHEET No.:
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Map Legend

- EIAR Site Boundary
- Proposed Felling Area

Gortarush Lower, Co. Tipperary

Glenpaudeen
Moheragh
Barraderry
Carrow
Scarrough
Scarrough Br.
Gillin
Glasheenyteagha
93
94
95
96

Drawing Title: Commercial Forestry Felling

Project Title: Carrow Wind Farm

Drawn By	Checked By
ER	EMC
Project No.	Drawing No.
231102	Figure 4-13
Scale	Date
1:13,500	2026-03-25

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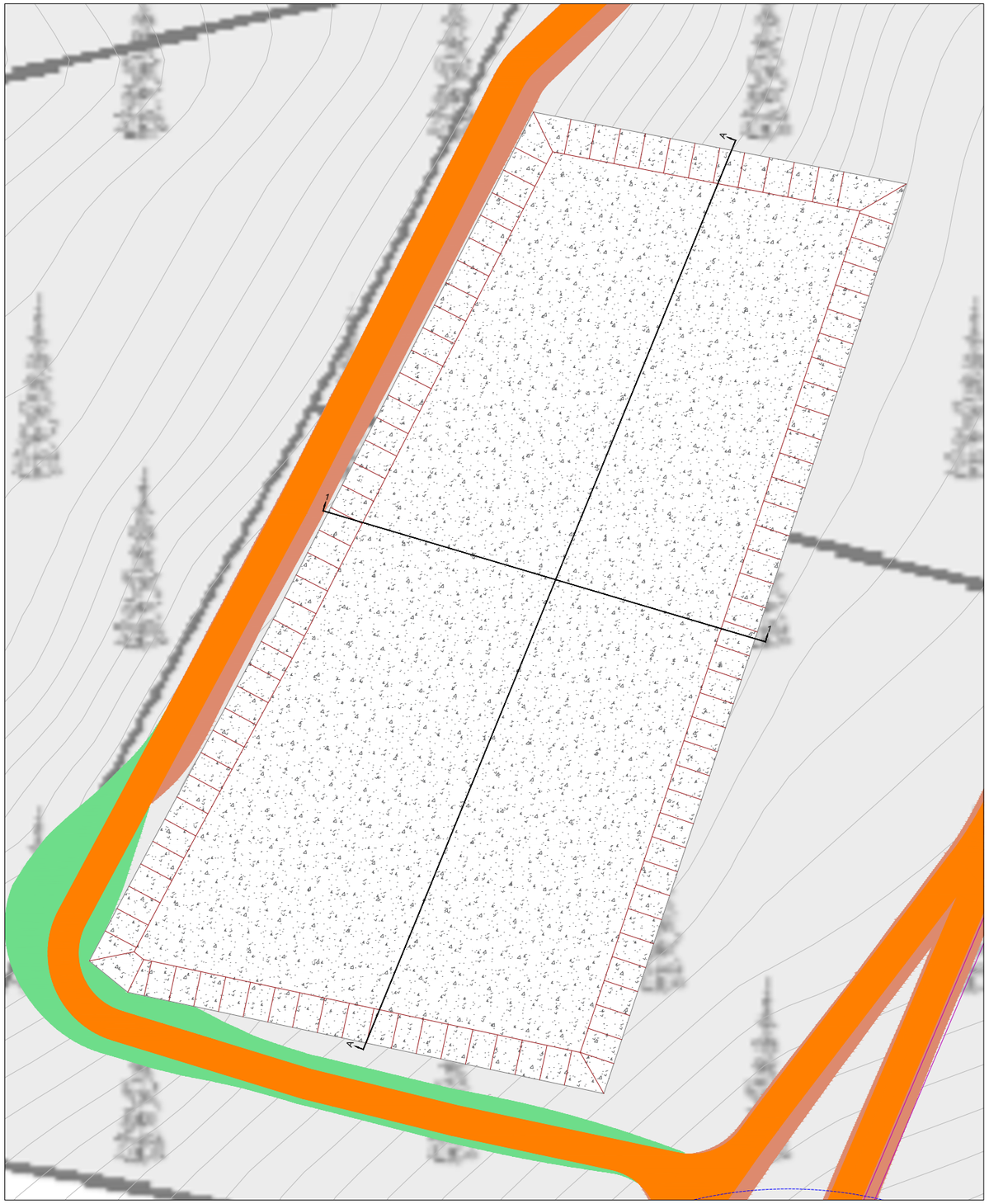
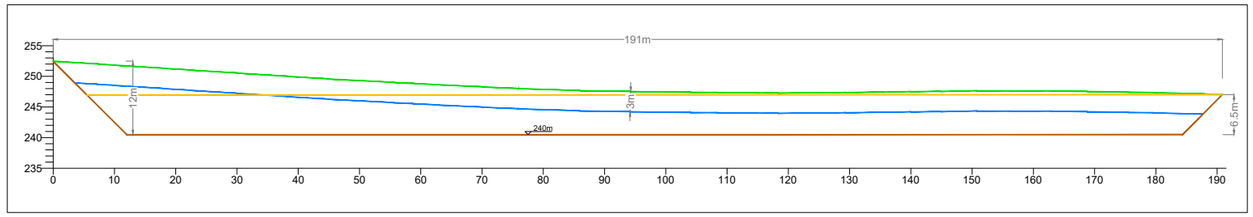
Website:
www.mkoireland.ie

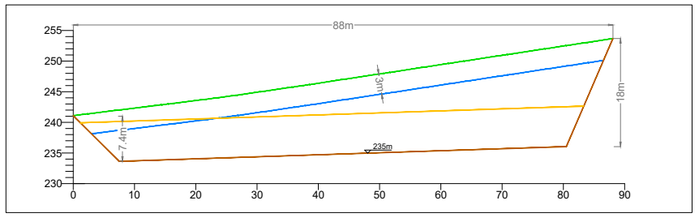


Drawing Legend

- Existing Ground
- Assumed Bedrock Level Assumed Bedrock Level (based on trial pit data)
- Proposed Excavation Level
- Proposed Backfill



Section A-A



Section 1-1

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**

DRAWING TITLE: **Borrow Pit 1 Layout & Sections**

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-14	1:500 @ A1

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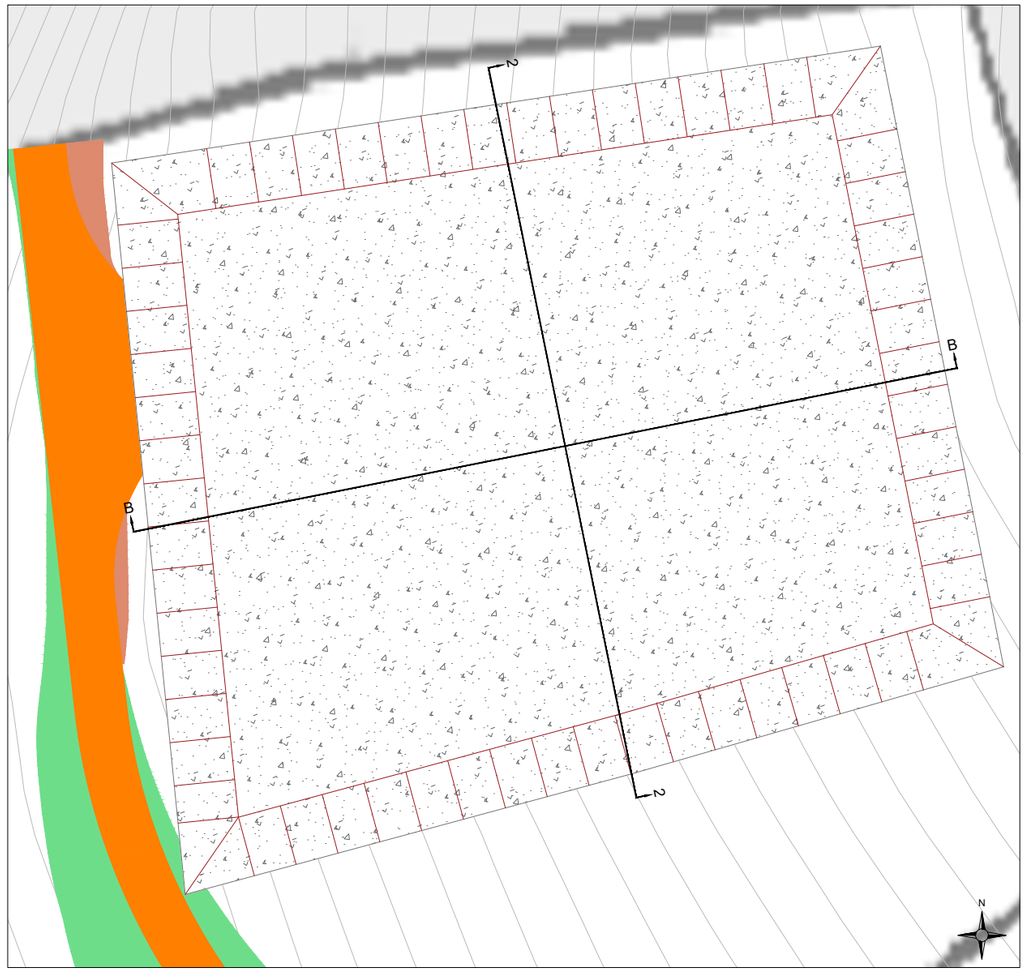
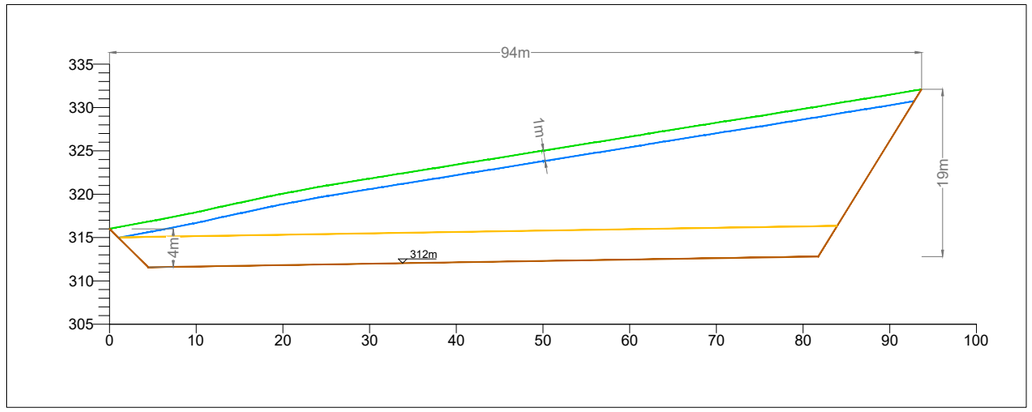
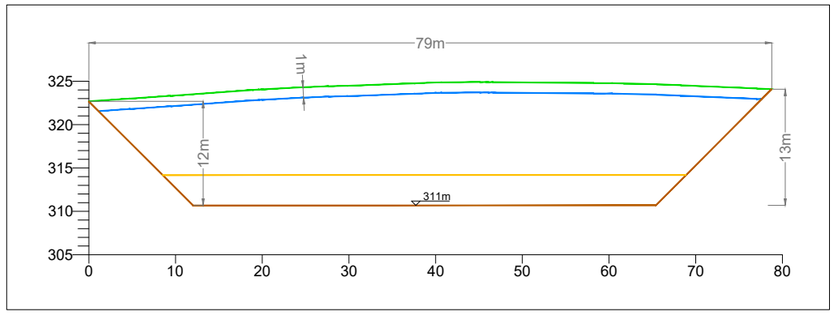
Drawing Legend

- Existing Ground
- Assumed Bedrock Level Assumed Bedrock Level (based on trial pit data)
- Proposed Excavation Level
- Proposed Backfill





Section B-B



Section 2-2

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**

DRAWING TITLE: **Borrow Pit 2 Layout & Sections**

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-15	1:500 @ A2

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4.3.2 Proposed Grid Connection Route

4.3.2.1 Onsite 110kV Substation

It is proposed to construct a 110kV electricity substation within the Proposed Wind Farm site, as shown in Figure 4-1a and Figure 4-1b. The proposed onsite 110kV substation is located within agricultural pastural land and will be accessed via the Proposed Wind Farm access roads.

The footprint of the proposed onsite 110kV substation compound measures approximately 26,550 m^2 in area and will include 2 no. control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the onsite 110kV substation to the national grid. The layouts and elevations of the Proposed onsite 110kV substation are shown on Figure 4-16 and 4-17. The construction and exact layout of electrical equipment in the on-site 110kV substation will be to EirGrid Networks specifications.

Further details regarding the connection between the onsite 110kV substation and the national electricity grid are provided in Section 4.8.2 below.

The onsite 110kV substation compound will include steel palisade fencing (approximately 2.5 metre high or as otherwise required by EirGrid), and internal fences will also segregate different areas within the main substation. The onsite substation will remain in place as it will be under the ownership and control of EirGrid and will form a permanent part of the national electricity grid.

4.3.2.2 Wind Farm Control Building

Two wind farm control buildings will be located within the Proposed 110kV Substation compound. The Independent Power Provider (IPP) Control Building will measure 20.1 metres by 10.6 metres and 6.1 metres in height. The Eirgrid Control Building will measure 25 metres by 18 metre and 8.4 metres in height. Layout and elevation drawings of the control buildings are included in Figure 4-18.

The wind farm control building will include staff welfare facilities for the staff that will work on the Proposed Project site during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the Proposed Project, there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the Proposed Project does not necessitate a potable source. It is proposed to either harvest rainwater from the roofs of the buildings or, alternatively, install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. A pump house is not required as an in-well pump will direct water to a water tank within the roof space of the control building. Bottled water will be supplied for drinking, if required.

It is not proposed to treat wastewater on-site. Wastewater from the staff welfare facilities in the control buildings will be managed by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

Such a proposal for managing the wastewater arising on site has become almost 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 Coimisiún 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. Full details of the proposed tank alarm system can be submitted to the Planning Authority in advance of any works commencing on-site. The wastewater

storage tank alarm will be part of a continuous stream of data from the Proposed Wind Farm turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007(as amended), will be employed to transport wastewater away from the Proposed Project site.

4.3.2.3 Battery Storage

A battery-based energy storage system (BESS) will adjoin the 110kV onsite substation and is located adjacent to the substation compound. The BESS compound will have a footprint of approximately 4,140m^2. The battery storage compound will include 10 no. Battery Storage modules and 10 no. transformers. Each battery storage module will measure 12.2m by 2.4m with a height of 2.6m.

Prior to installing the steel containers, clearance of the site area, levelling off the ground surface and creation of a hard stand will be undertaken. These containers and the adjacent infrastructure house the batteries, inverters, transformers, fire suppression equipment and associated electrical components. The containers will be mounted onto concrete plinth foundations. The containers shall be spaced to allow airflow around the containers, feeding their climate control systems.

In addition to the modular steel containers, other components of the development include:

- A grid transformer within the electrical compound;
- Above ground cable junction boxes/ cabling cabinets and cable racks/steel trunking facilitating the necessary electrical connections between containers;
- Underground ducting and cabling;
- A security fence around the perimeter of the compound;
- Communications equipment; and,
- Lightning protection poles.

The battery storage compound will operate continuously, linked to the on-site substation. It will be monitored in tandem with the overall development and there will be sporadic maintenance visits as required. The battery energy storage system will remain in place as it will form a permanent part of the national electricity grid.

A Fire Risk Management and Emergency Response Plan has been prepared for the Proposed Project and is included as Appendix 4-4 of this EIAR. The BESS containers are shown in Figure 4-19.

In the unlikely event of a fire within the BESS compound water is the preferred suppression agent due to its immediate cooling capacity, availability, and ease of onsite storage and transport. Firewater from a lithium-ion BESS fire will pick up toxic and corrosive by-products such as hydrofluoric acid, heavy metals, electrolytes, plastics, etc. The fire-water retention design for this BESS compound will include capture, contain, and hold contaminated runoff from the worst-credible fire scenarios while keeping it away from drains, groundwater, and off-site receptors. After the fire, the retained water will be sampled, treated, or removed by licensed hazardous-waste contractors.

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

Drawing Legend

- Planning Application Boundary
- Area not apart of Application
- Proposed New Road
- Cut
- Fill
- Proposed Underground Grid Connection Cabling Route
- Internal Electrical Cabling Trench

BESS Units Refer To Drg. 231102 - 29 for Details

Static Storage Tank 250m3

Compound Area

Underground Fire Water Retention Tank 500m3

Static Storage Tank 250m3

+FFL 249

Temporary Construction Compound

Turbine Component / Material Storage

Temporary Parking Area

Staff & Visitor Car Parking

Site Offices & Staff Welfare Facilities

145m

202m

65m

40m

24m

13m

12m

11m

20m

18m

25m

259

256

253

251

254

248

246

244

N

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary & Co. Limerick

DRAWING TITLE:
Site Substation Compound Layout

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-16	1:500 @ A1

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
JOB	AC	26.03.2026	P02

OS SHEET No.:
4744, 4745, 4746, 4747, 4748, 4749, 4750, 4751, 4752, 4753, 4754, 4755, 4814, 4815, 4804, 4805, 4806, 4807, 4808, 4809, 4810, 4811, 4812, 4813, 4877, 4878, 4867, 4868, 4869, 4870, 4871, 4872, 4873, 4874, 4875, 4876, 4938, 4939, 4940, 4929, 4930, 4931, 4932, 4933, 4934, 4935, 4936, 4937, 4989, 4990, 4991, 4992, 4993, 4994, 4995, 4996, 4997, 4998, 4999, 5000

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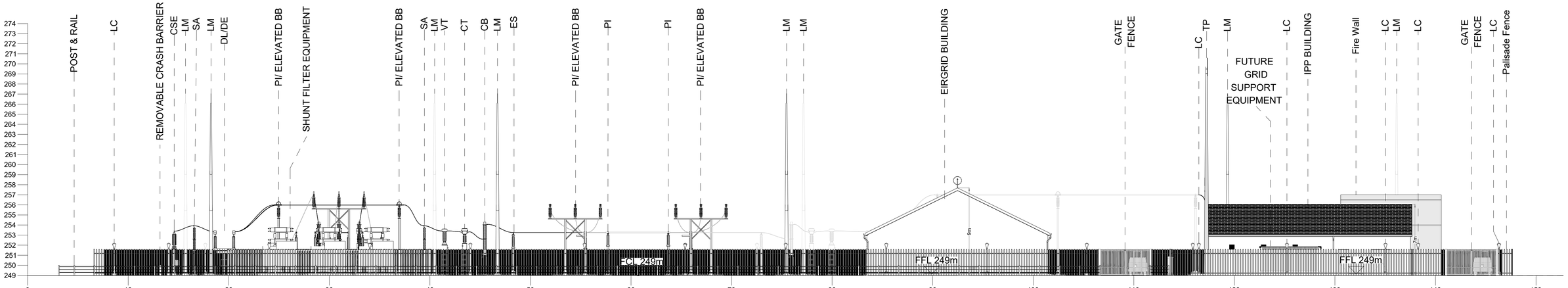
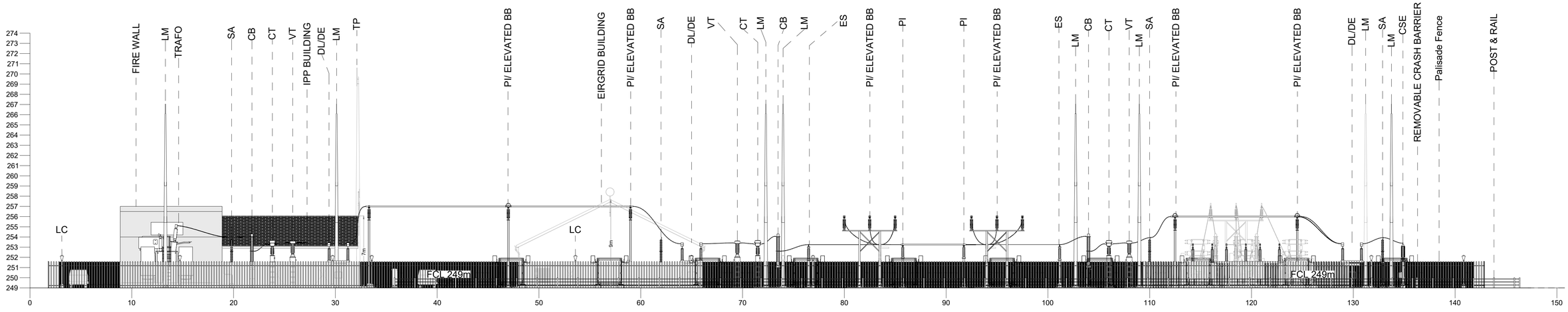
1. Layout and arrangements of substation buildings and electrical equipment is shown indicatively and for illustration purposes only as final specifications of buildings and electrical equipment is to be dictated by Eirgrid/ESB networks requirements.



East Elevation



West Elevation

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary

DRAWING TITLE:
Site Substation Sectional Elevations

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-17a	1:200 @ A1

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
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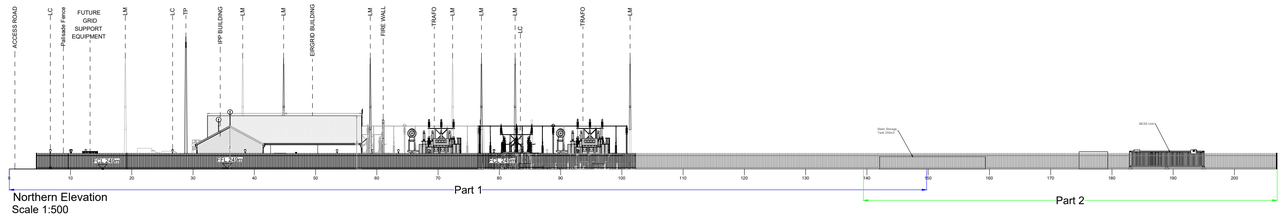
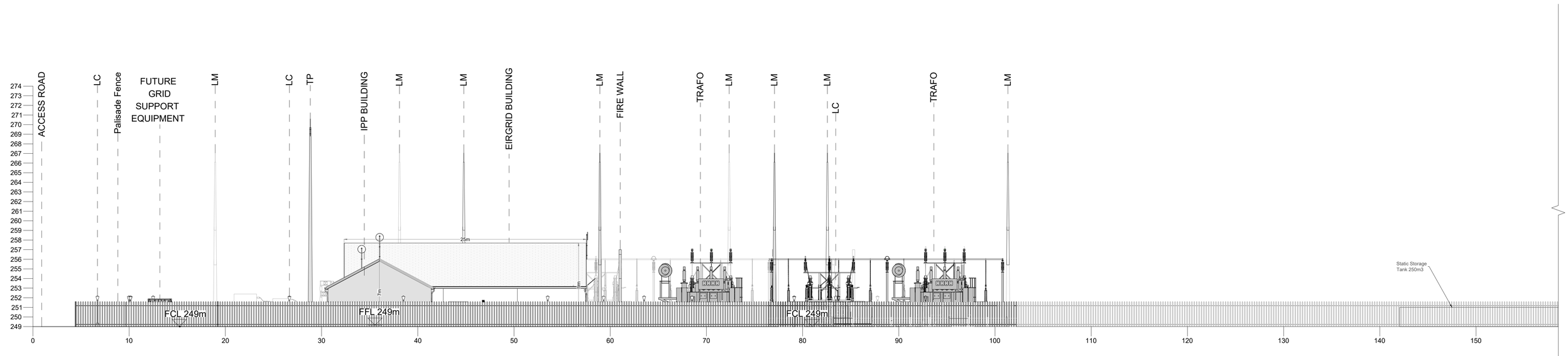
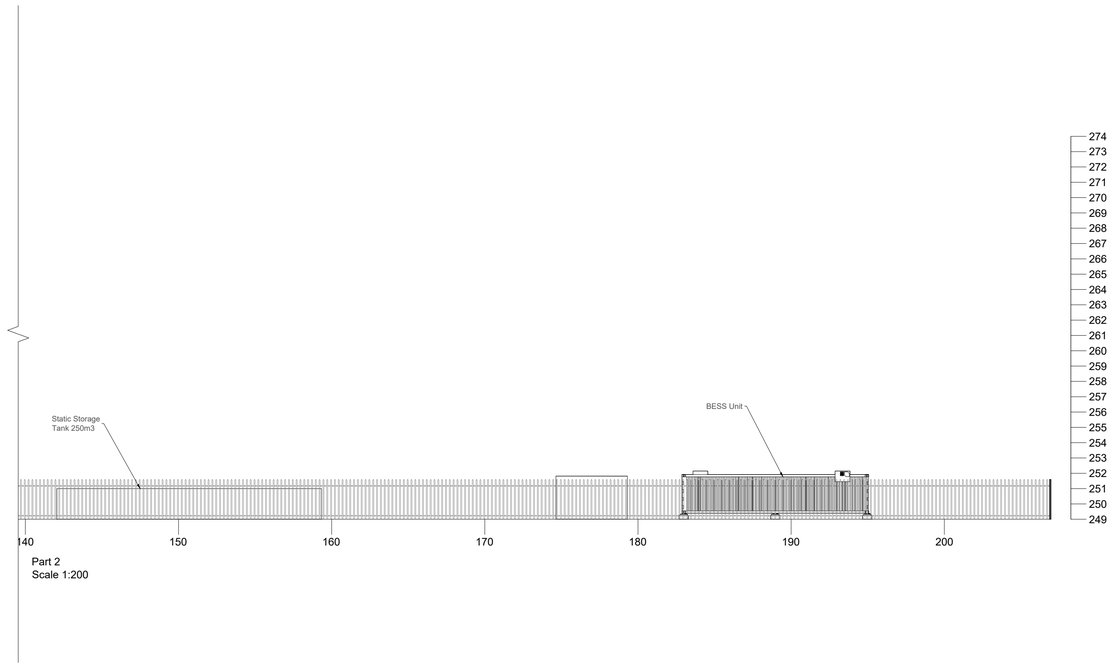


Northern Elevation
Scale 1:500



Northern Elevation

Part 1
Scale 1:200



Part 2
Scale 1:200

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary

DRAWING TITLE:
Site Substation Sectional Elevations

PROJECT No.:	DRAWING No.:	SCALE:
231102	**Fig 4-17b**	**As Shown @ A1**

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
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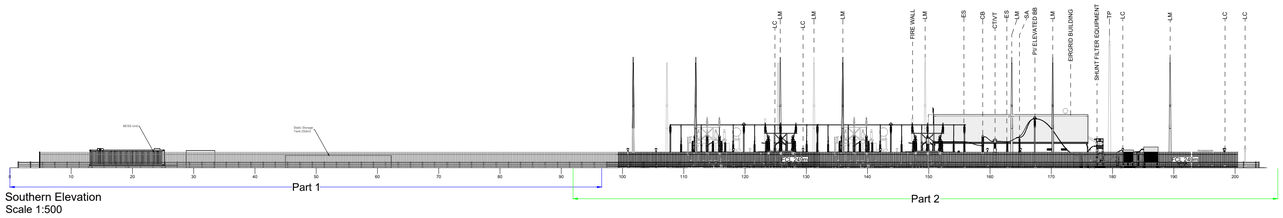
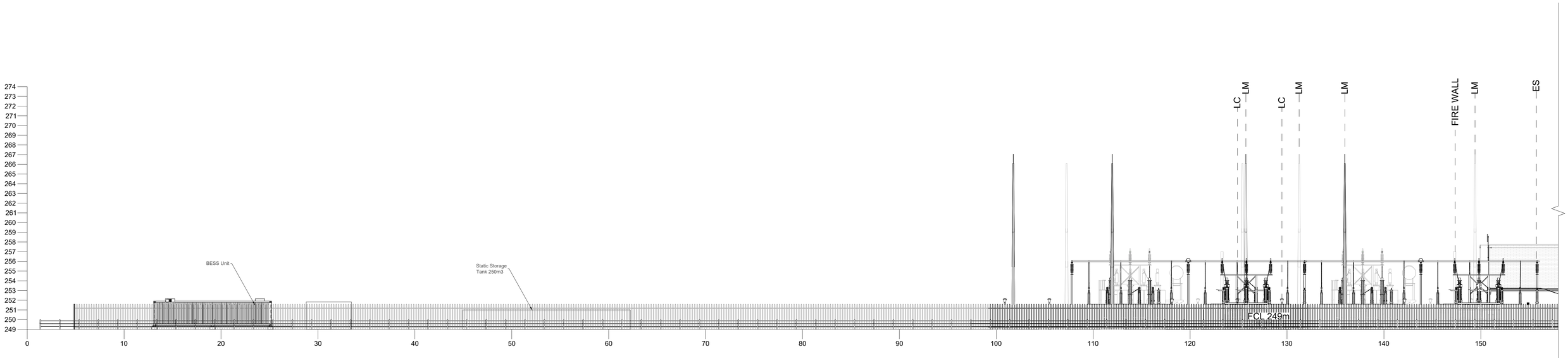
Drawing Notes

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.



Southern Elevation
Scale 1:500



Southern Elevation

Part 1
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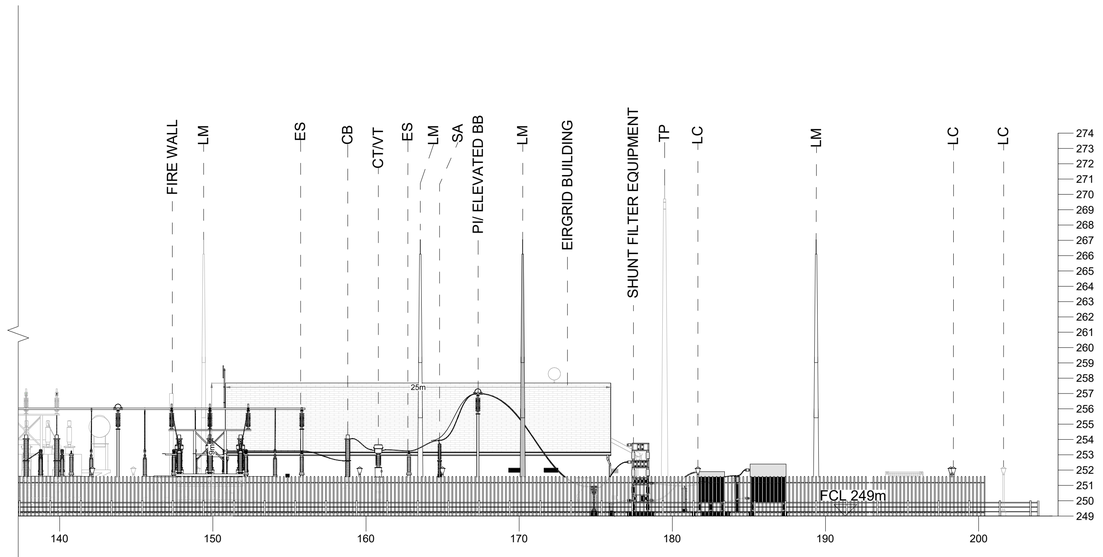

Part 2
Scale 1:200

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary

DRAWING TITLE:
Site Substation Sectional Elevations

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-17c	As Shown @ A1

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
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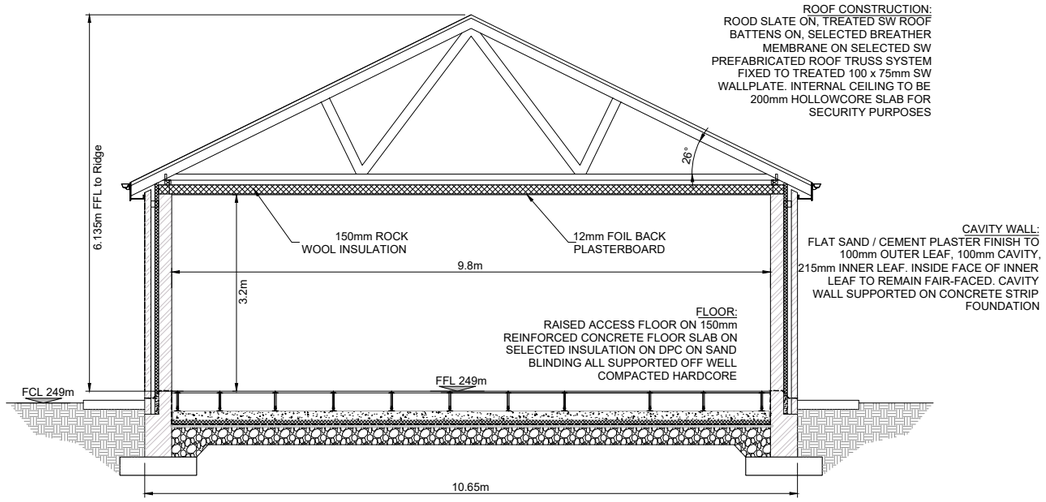
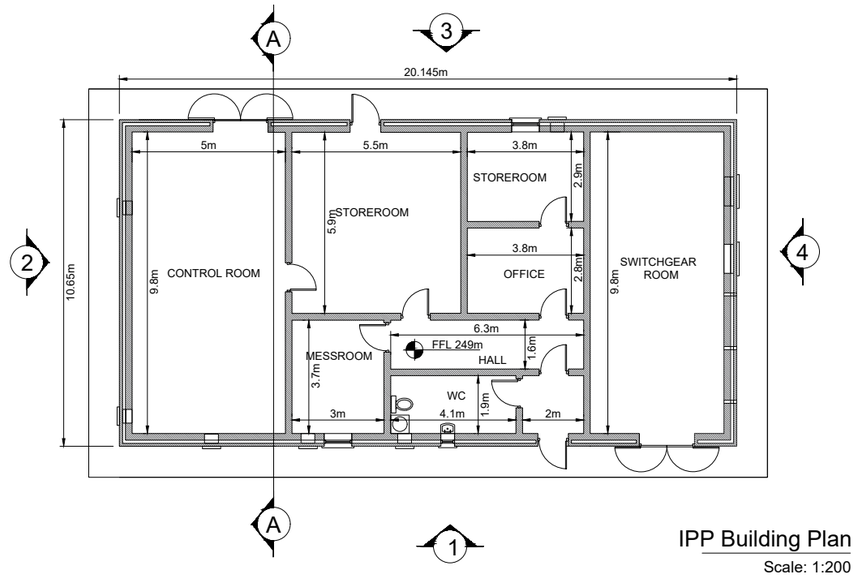


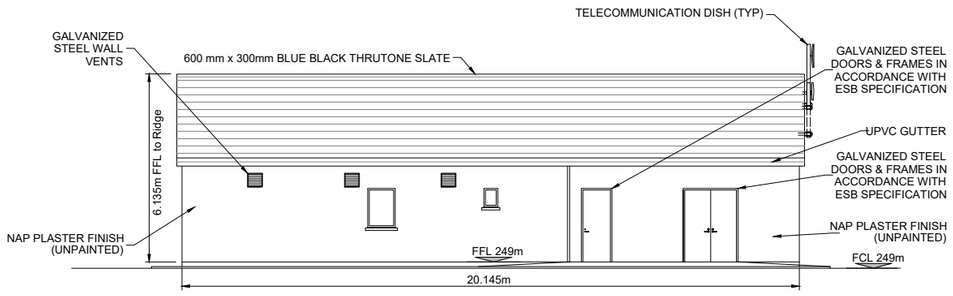
IPP Building Section A-A

Scale: 1:100



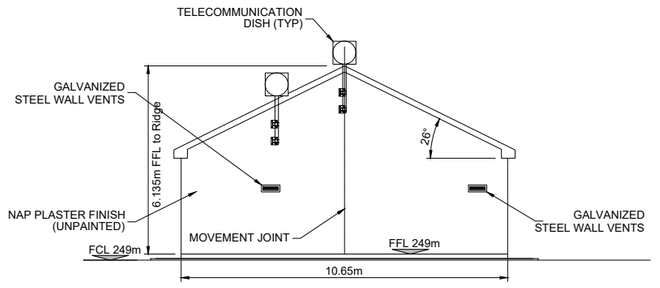
IPP Building Plan

Scale: 1:200



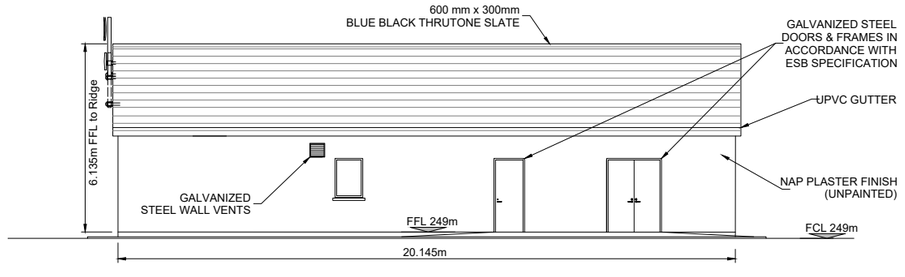
IPP Building Elevation 1

Scale: 1:200



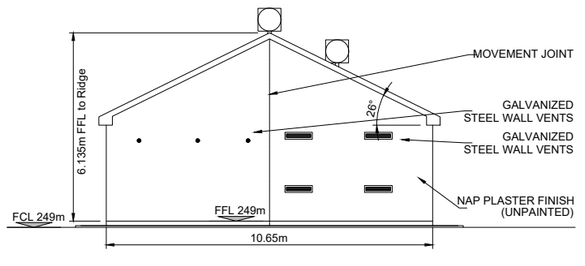
IPP Building Elevation 2

Scale: 1:200



IPP Building Elevation 3

Scale: 1:200



IPP Building Elevation 4

Scale: 1:200

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary

DRAWING TITLE:
IPP Building Plan & Elevations

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-18	As Shown @ A3

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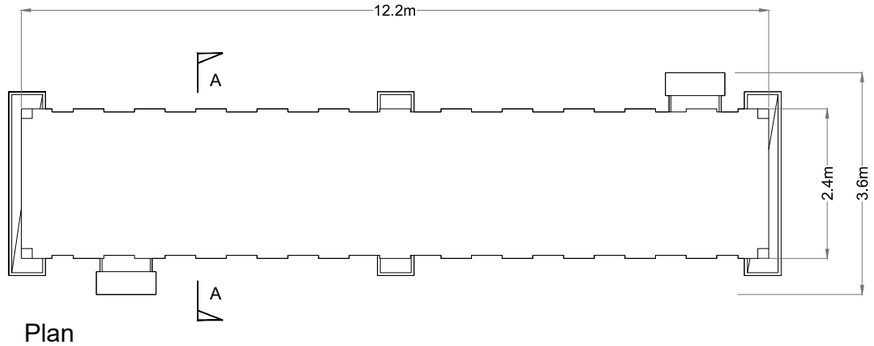
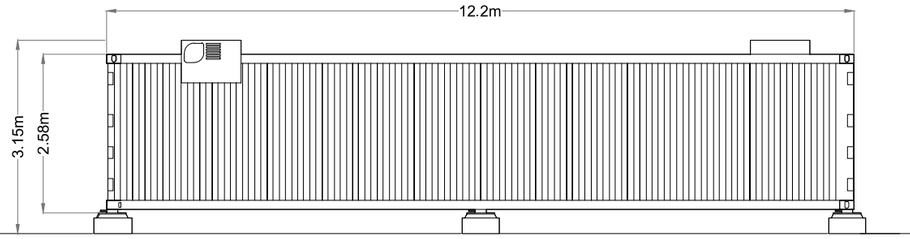
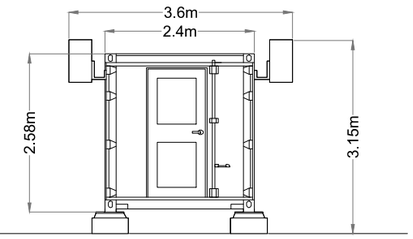


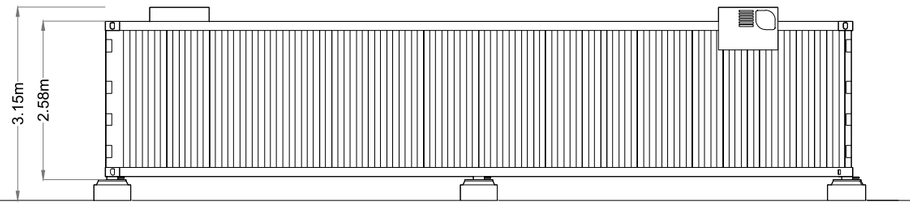
Plan
SCALE 1:100



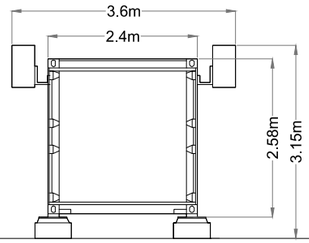
Front Elevation
SCALE 1:100



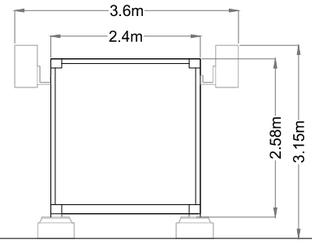
End Elevation
SCALE 1:100



Rear Elevation
SCALE 1:100



End Elevation
SCALE 1:100



Section A-A
SCALE 1:100

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary

DRAWING TITLE:
Battery Storage Container

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-19	1:100 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
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4.3.2.4 Underground Grid Connection Cabling Route

A 110kV grid connection between the Proposed Wind Farm and the national electricity grid will be necessary to export electricity from the Proposed Wind Farm. It is proposed to connect the Proposed Carrow Wind Farm development to the national electricity grid via a 110kV underground electrical cabling connection to the existing 110kV Killonan substation, in the townland of Milltown, approximately 5.6km southeast of Limerick City, Co. Limerick. The underground electrical cabling route measures approximately 37.6km in length, the majority of which is located within the curtilage of the public road network.

The exact location of the grid connection cabling within the curtilage of the public road network may be subject to minor modification following confirmatory site investigations, to be undertaken prior to construction of the proposed wind farm development. A Road Opening Licence will be sought from the Roads Authority i.e. Tipperary County Council and Limerick County Council requiring all details to be confirmed before the licence is granted and work can commence.

The Proposed Grid Connection underground cabling route will originate at the proposed 110kV onsite substation, in the townland of Moheragh, Co. Tipperary, and run west for 0.9km adjacent with the Proposed Wind Farm site road network, towards the L-1154 local road. The underground cabling route will then continue south along the L-1154 for approximately 1.0km before following the L-1155 southwest for 2.9km. The underground cabling route then follows the R505 Regional Road west for 0.3km before turning south for 0.6km on the R497. The underground cabling route will turn west onto the L-1156 local road for 6.8km. From here it will join the R505 in the townland of Toomaline Upper, Co Limerick and travel northwest for 14.6km. In the townland of Brittas, Co. Limerick the underground cabling route will leave the public road and travel west through agricultural pastoral land for 0.2km. Upon re-entering the public road corridor, the underground cabling route continues west on the L-5100 local road for 2.8km before turning south on the L-1132 local road for 0.3km. The underground cabling route will then continue west on the L-5101 local road for 1.9km. In the townland of Clognadromin, Co. Limerick the underground cabling route will leave the public road and travel west through agricultural pastoral land for 1.0km. Within the agricultural pastoral land in the townland of Kishyquirk, Co. Limerick, the underground cable will cross beneath the Killonan Junction to Limerick Junction railway line via horizontal direction drilling (refer to Section 4.8.2.6.1 below) and continue south before rejoining the public road in the townland of Kishyquirk, Co. Limerick. The underground cabling route continues west on the L-5102 local road for 1.3km before joining the N24 National Primary Road in the townland of Clooncunna south, Co Limerick and travel northwest for 3.1km and turn left into the existing 110kV Killonan Substation compound in the townland of Milltown, Co. Limerick.

The methodology for construction of the Proposed Grid Connection underground electrical cabling is presented in Section 4.8.2 below. The underground electrical cabling route is illustrated in Figure 4-1a and detailed layout drawings are included in Appendix 4-1 of this EIAR. 110kV underground cabling trench cross sections are shown in Figure 4-20.

4.3.2.4.1 *Joint Bays*

Joint bays are typically pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They will be located at various points along the ducting route generally between 500 to 800 metres intervals or as otherwise required by ESB/EirGrid and electrical requirements. Joint Bays are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level.

Based on the separation distances outlined above, there are 58 no. joint bays proposed along the Proposed Grid Connection underground cabling route. There are no joint bays proposed within the Proposed Wind Farm access roads, 27 no. joint bays are proposed along the existing local road network, 22 no. joint bays are proposed along the regional roads, 5 no. joint bay is proposed along the N24 national road, and 4 no. joint bays are proposed within private agricultural fields.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the onsite 110kV substation and the existing 110kV Killonan substation. Earth Sheath Link Chambers are also required approximately every second joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, installed in a flat formation, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will be precast concrete structures with an access cover at finished surface level. The locations of the joint bays and chambers are shown on the site layout drawings included in Appendix 4-1 of this EIAR. Standard joint bay and communication chamber details are shown in Figures 4-21 and 4-22 and Section 4.8.2.5 for joint bay construction methodology.

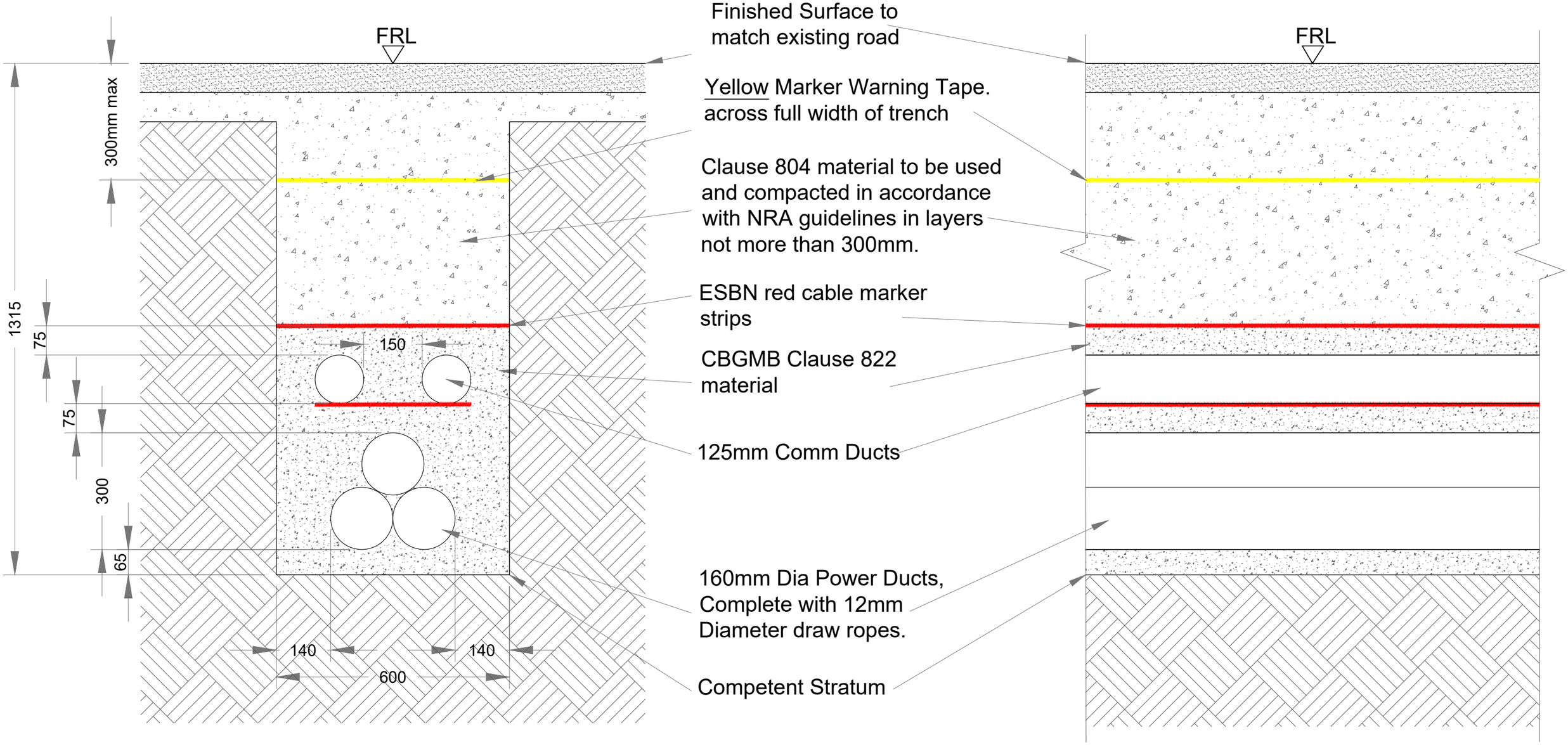
4.3.2.4.2 Watercourse and Service Crossings

There are 23 no. watercourse crossings, referenced on EPA/OSI mapping, located along the Proposed Grid Connection cabling route. The construction methodology for the 23 no. EPA/OSI mapped watercourse crossings has been designed to eliminate the requirement for in-stream works at these locations. The various crossing methodologies to be employed along the Proposed Grid Connection underground cabling route include the following:

- Type A: Crossing using standard trefoil formation (Figure 4-23)
- Type B Flatbed formation under (Figure 4-24)
- Type C: Flatbed Formation over (Figure 4-25)
- Type D: Horizontal Directional Drilling (Figure 4-26)

A general description of the construction methods employed at watercourse crossings and at the Irish Rail crossing are described in Section 4.8.2.6 and 4.8.2.7 below. The HDD crossing of the railway line is shown in Figure 4-27. An illustration of the proposed crossing methodology at the 23 no. EPA/OSI mapped crossing locations is included within the detailed site layout drawings in Appendix 4-1. A description of proposed methodologies for the crossing of services along the proposed underground cable route is included in Section 4.8.2.4 below.

An additional 12 no. drainage crossing points were identified during surveys of the underground cable route. These culverts will be crossed using one of the above methodologies.



PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Roadside Cable Trench Cross Section**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-20**	SCALE: **1: 10 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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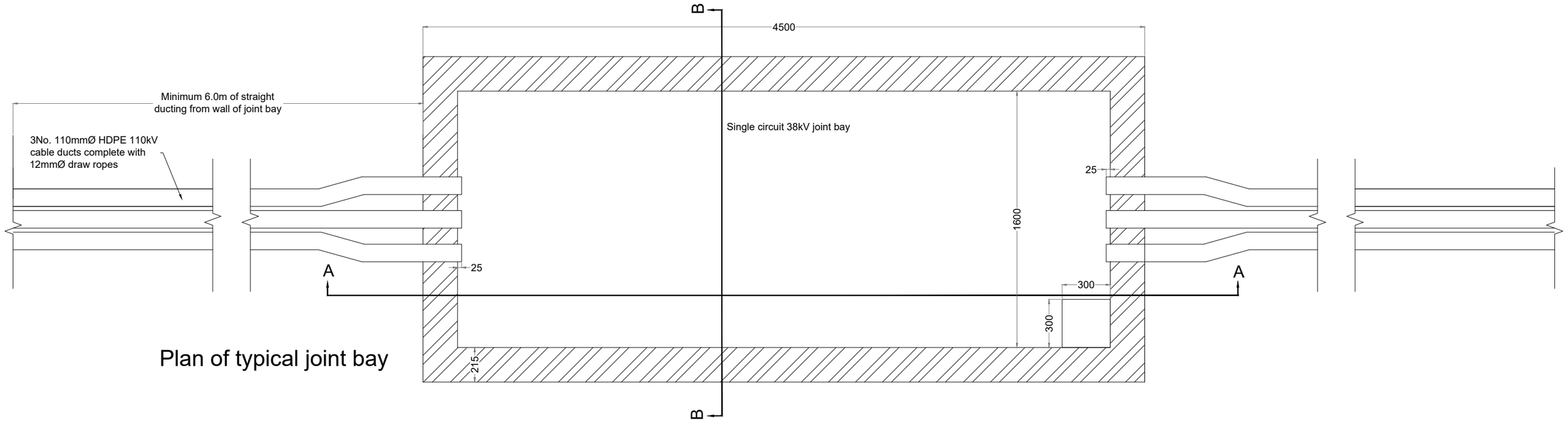
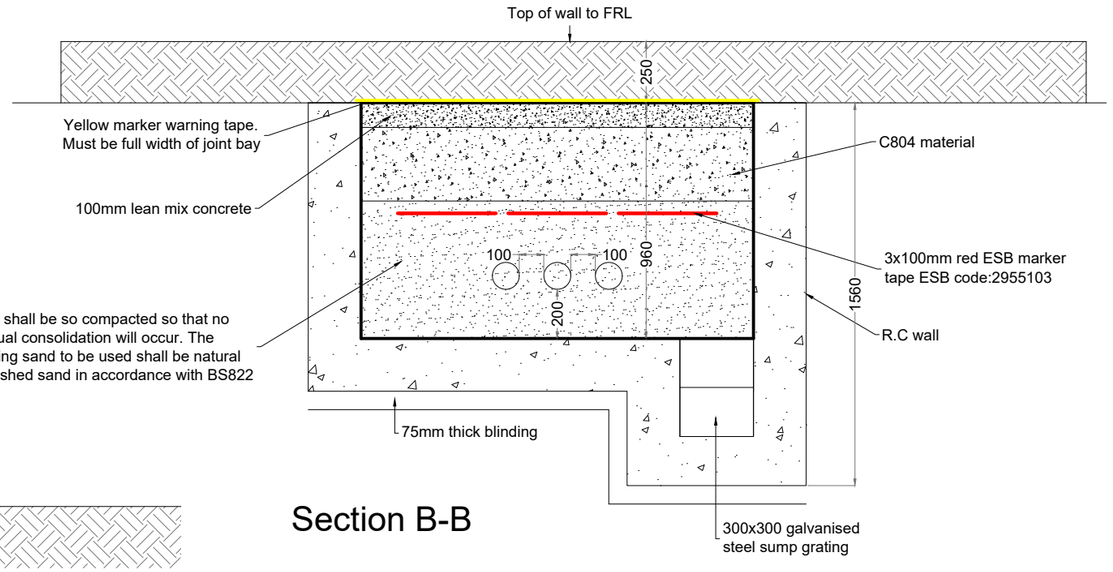
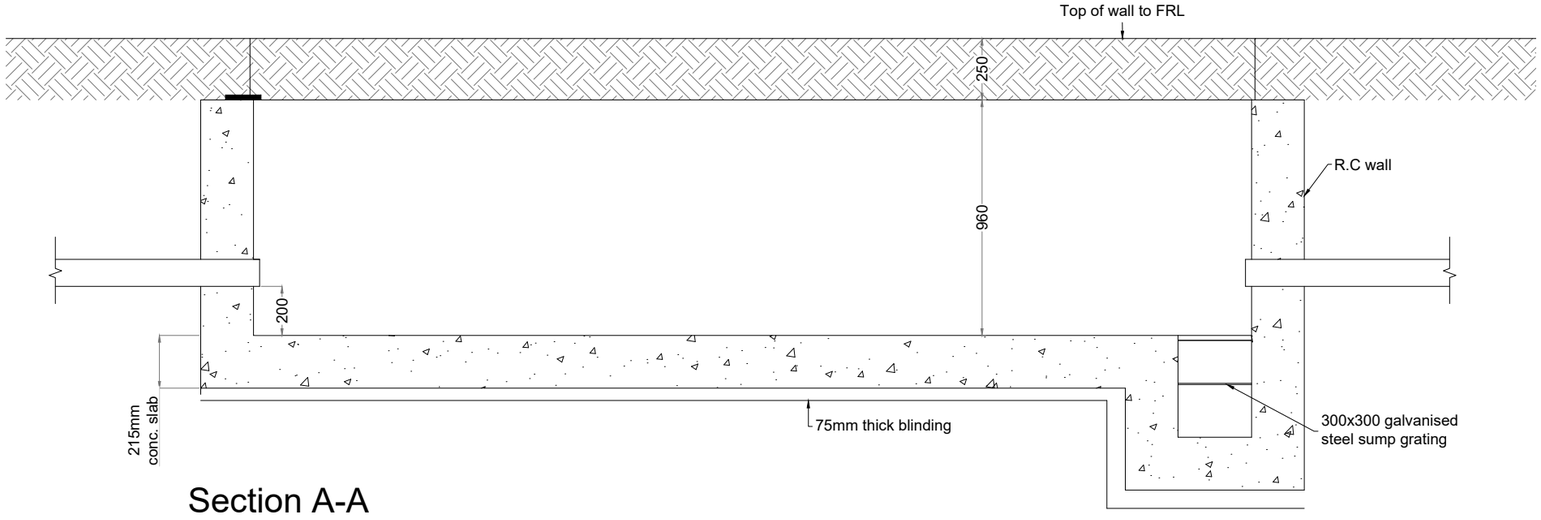


Plan of typical joint bay

Note:
Comms Chamber, as shown in Dwg No. 231102-44, to be located adjacent to Joint Bay



Section B-B



Section A-A

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Joint Bay Detail**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-21**	SCALE: **1:25 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: **P02**

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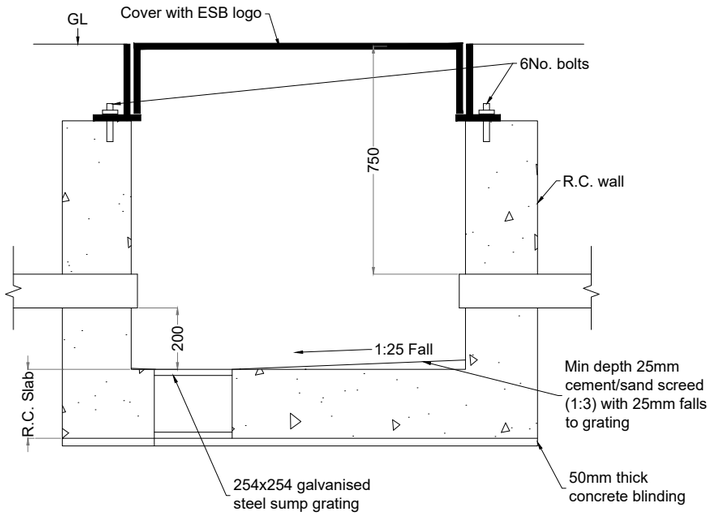
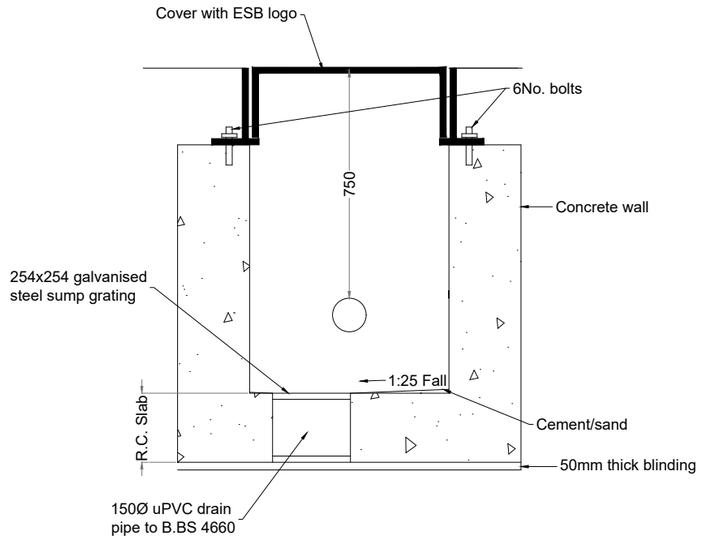


Section A-A



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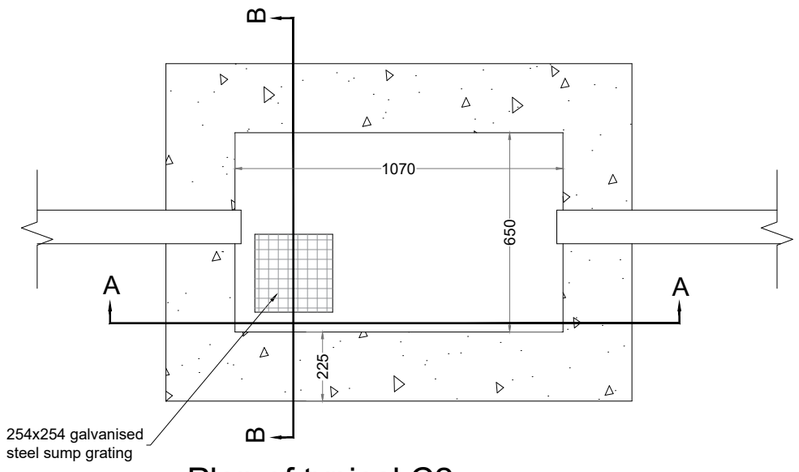

Plan of typical C2
communications chamber

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**

DRAWING TITLE: **C2 Comms Chamber Detail**

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-22	1:20 @ A3

DRAWN BY:	CHECKED BY:	DATE:	REVISION.:
JOB	AC	25.03.2026	P02

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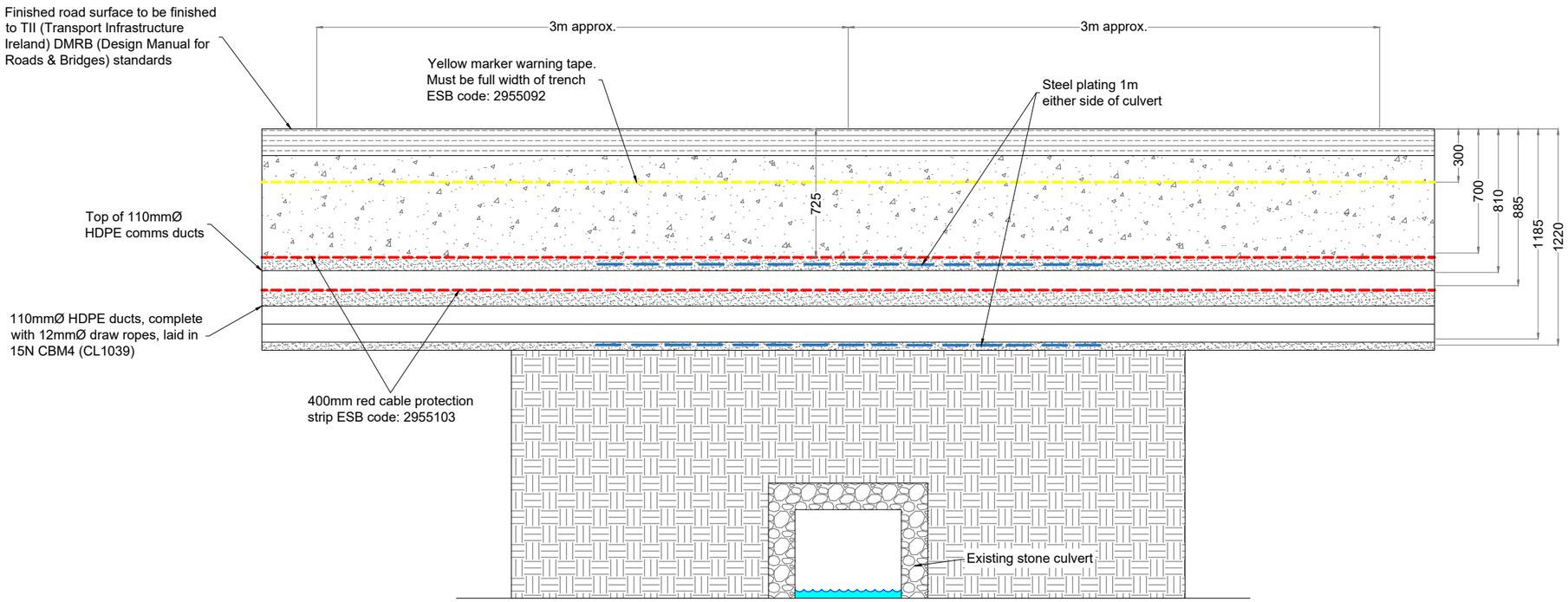
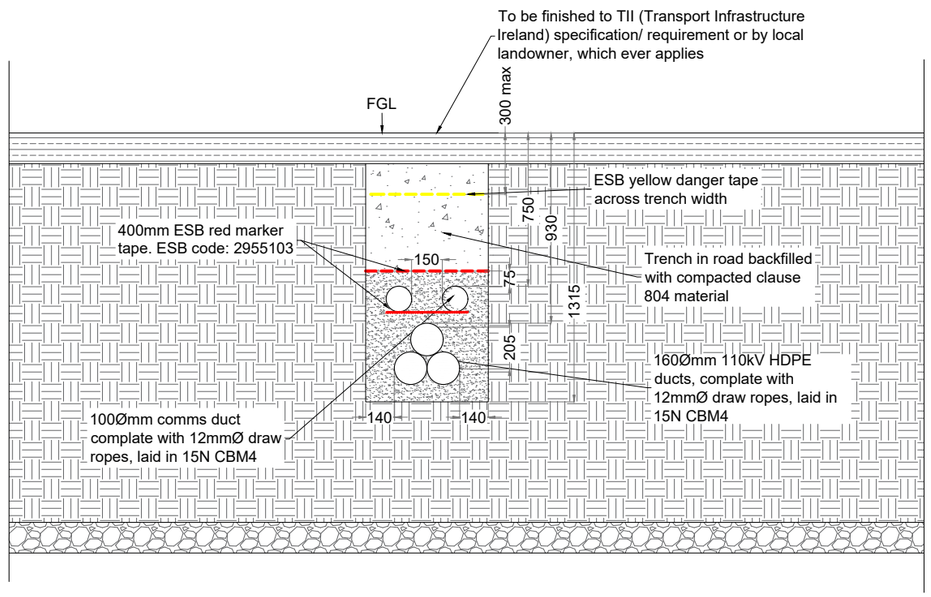


Longitudal section at watercourse crossing



Cross section at watercourse crossing

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Cable Trench Over Culvert**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-23**	SCALE: **1:30 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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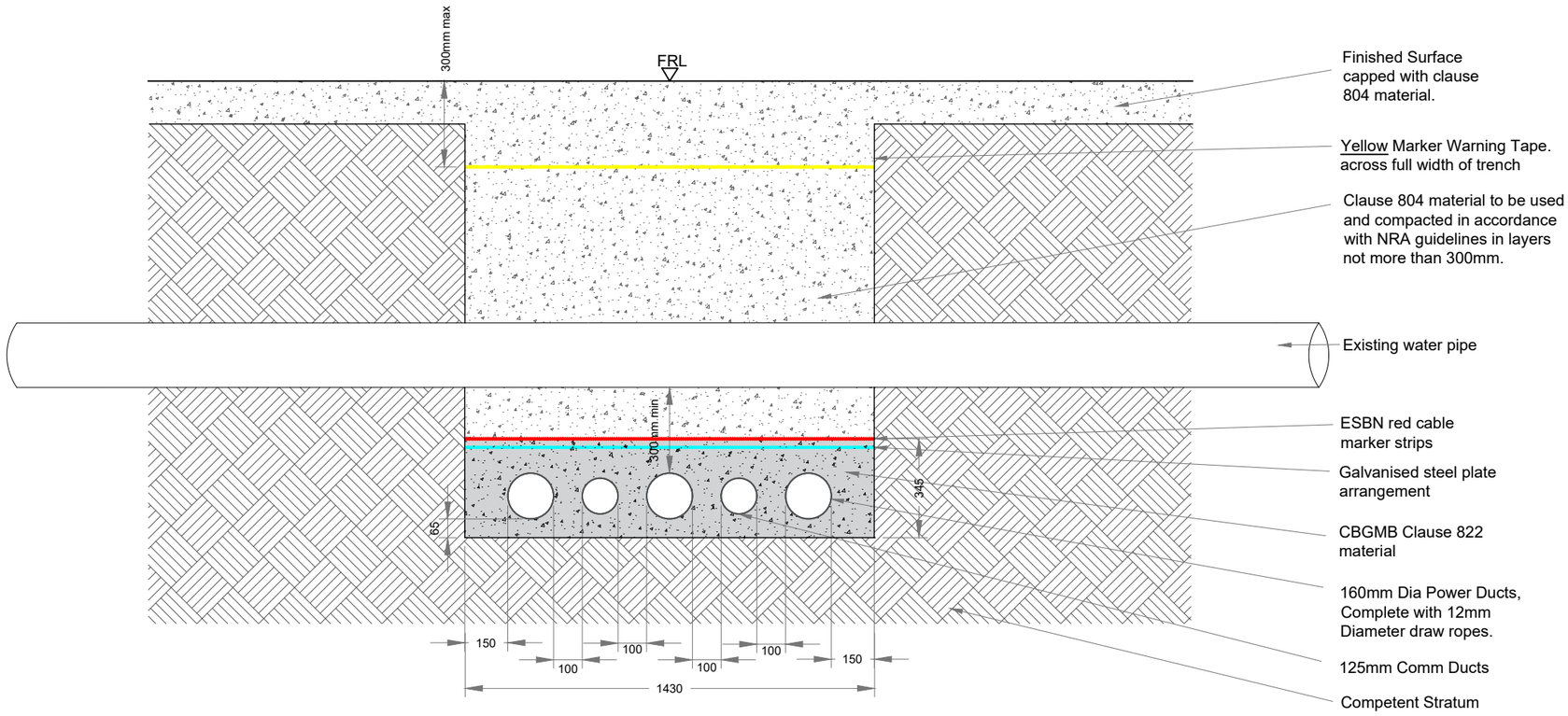
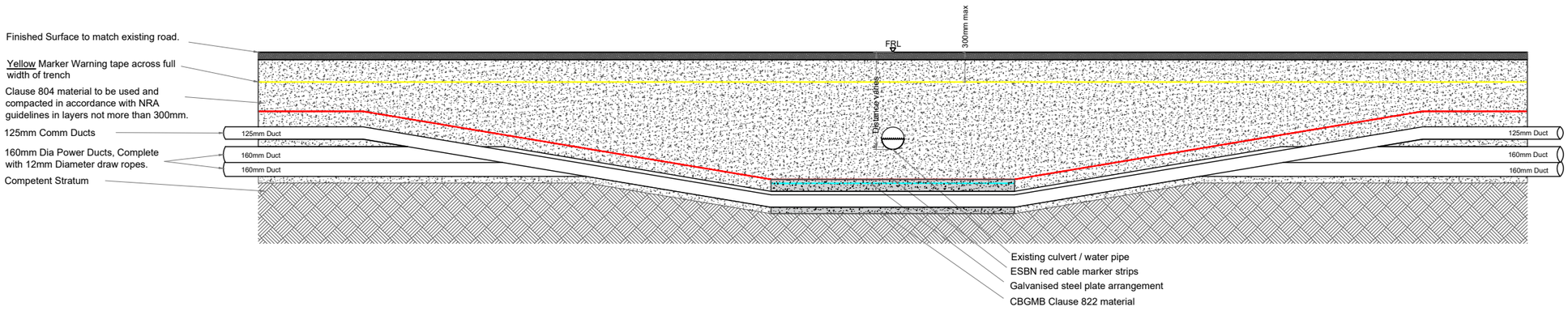


Flat bed under existing pipe - 110kV

SCALE 1:20



Flat bed under existing pipe - 110kV

SCALE 1:50

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Cable Trench Under Piped Culvert**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-24**	SCALE: **As Shown @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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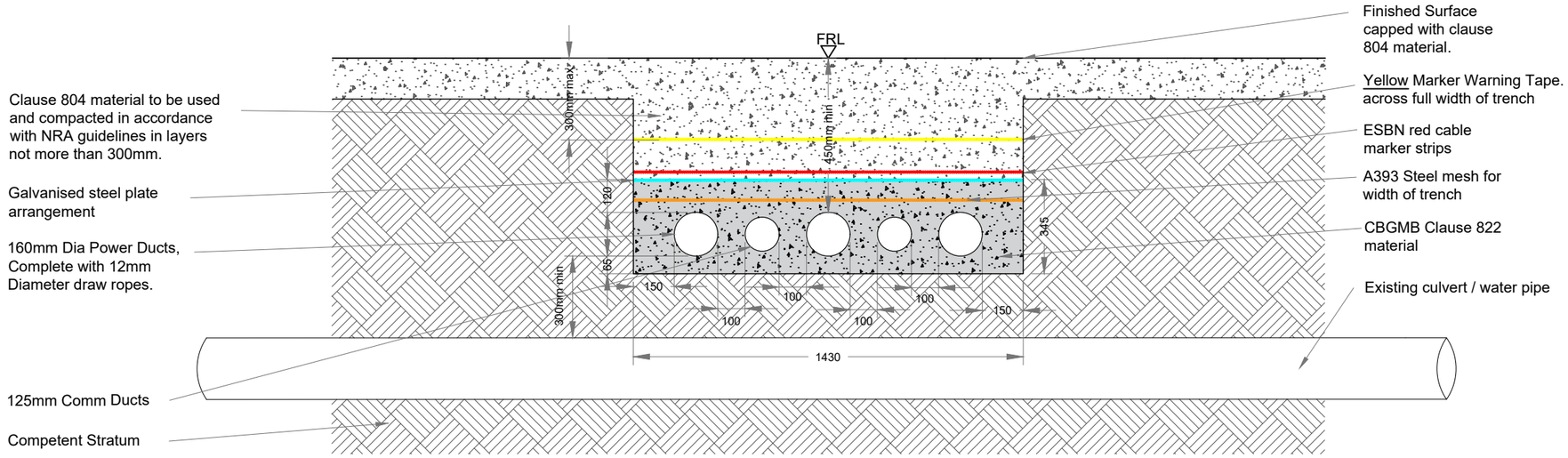
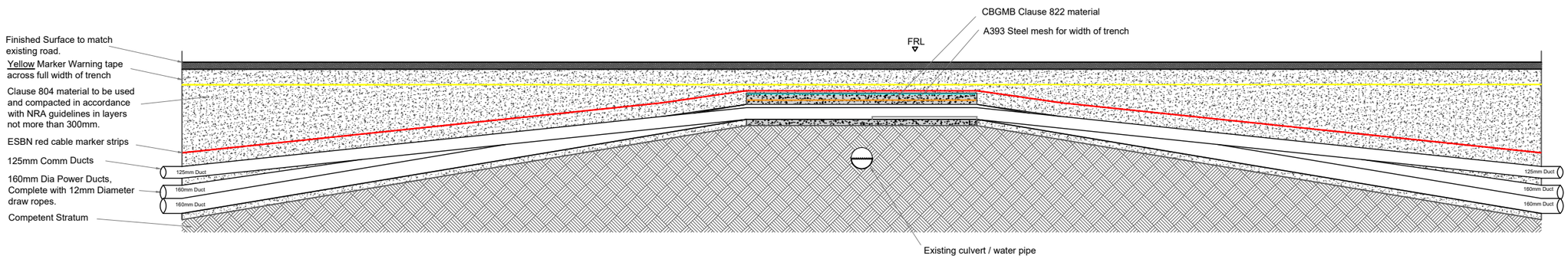


Flat bed over existing pipe - 110kV

SCALE 1:20



Flat Bed Over Existing Pipe - 110kV

SCALE 1:50

PROJECT TITLE:	Carrow Wind Farm, Co. Tipperary & Co. Limerick
DRAWING TITLE:	Cable Trench Flatbed Formation Over Piped Culvert
PROJECT No.: 231102	DRAWING No.: Fig 4-25
SCALE: As Shown @ A3	
DRAWN BY: JOB	CHECKED BY: AC
DATE: 25.03.2026	REVISION.: P02

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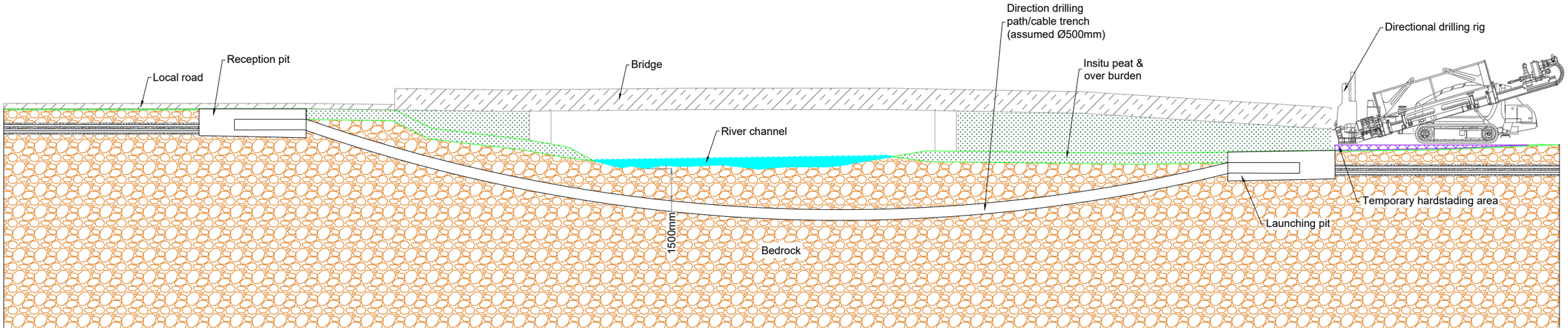

Directional Drilling Rig

Drilling Rig & Launch Pit

PROJECT TITLE:
Carrow Wind Farm, Co. Tipperary & Co. Limerick

DRAWING TITLE:
Directional Drilling

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-26	1:200 @ A3

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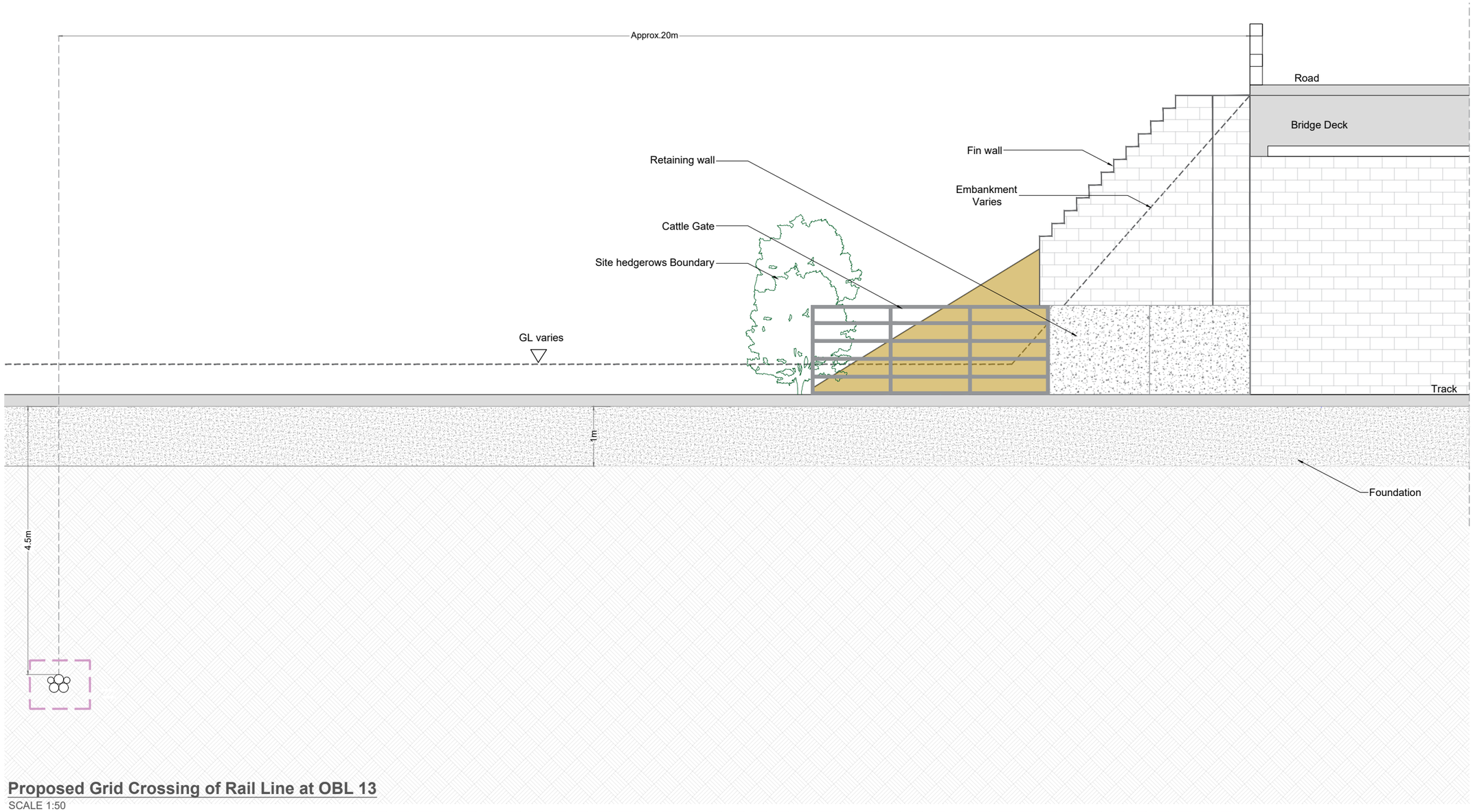
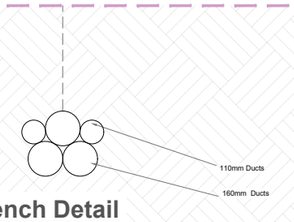


Proposed Grid Crossing of Rail Line at OBL 13

SCALE 1:50



Trench Detail

SCALE 1:20

In clause 4.1.2 of CCE-TMS-344 Requirement for Undertrack Crossings '300mm diameter or less is likely to be treated as a minor impact project'. The proposed duct cluster will be in this size order

Fin Wall

PROJECT TITLE:	Carrow Wind Farm, Co. Tipperary & Co. Limerick
DRAWING TITLE:	Proposed Grid Crossing Adjacent to OBL 13

PROJECT No.:	DRAWING No.:	SCALE:
231102	Fig 4-27	As shown @ A2

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4.3.3 Quantities of Spoil and Crushed Stone

4.3.3.1 Quantities

The construction of the Proposed Project will require the excavation of spoil. The quantities of spoil, requiring management on the Proposed Wind Farm site has been calculated, as presented in Table 4-2 below. In addition, the volume of stone required to build the Proposed Project infrastructure is noted below.

Table 4-2 Spoil and Stone Volumes requiring management

Development Component	Spoil Volume (m3) (approx.)	Crushed Stone Requirement (m3) (approx.)
Proposed Wind Farm		
14 no. Turbines and Hardstanding Areas (including foundations)	93,175	60,040
Access Roads (including met mast hardstand and security cabin)	108,065	134,150
Temporary Construction Compounds	6,550	2,905
Borrow Pits	64,670	n/a
Total	**272,460**	**197,095**
Proposed Grid Connection		
Onsite Substation	52,135	29,840
Cabling Trench	34,125	15,910
Total	**86,260**	**45,750**
Turbine Delivery Route		
Temporary Accommodation Areas	**4,520**	**4,875**
Total	**363,240**	**247,720**
Total (including 10% contingency)	**399,565**	**n/a**

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

It is proposed that some of the spoil generated by the proposed cabling trench will be removed and accommodated within the spoil management areas or borrow pits within the Proposed Wind Farm site. The majority of excavated material from the Proposed Grid Connection route will transported to a

Materials Recovery Facility (MRF). Any road material containing tar will be managed separately. Further detail on this can be found in Chapter 15: Traffic and Transport.

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

4.3.4 Site Activities

4.3.4.1 Environmental Management

All proposed activities on the site of the Proposed Project will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Project and is included in Appendix 4-3 of this EIAR.

The CEMP includes details of drainage, spoil management and waste management, and clearly outlines the mitigation measures and monitoring proposals that are required to be adhered to in order to comply with the environmental commitments outlined in the EIAR. In the event planning permission is granted for the Proposed Project, 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.

4.3.4.2 Refuelling

Wherever possible, vehicles will be refuelled off-site, particularly for regular road-going vehicles. On-site refuelling of machinery will be carried out at designated refuelling areas at various locations throughout the Site. Heavy plant and machinery will be refuelled on-site by a fuel truck that will come to the Site as required on a scheduled and organised basis. All refuelling will be carried out outside designated watercourse buffer zones. 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 used during refuelling operations as required. All plant and machinery will be equipped with fuel absorbent material and pads to deal with any event of accidental spillage.

4.3.4.3 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The quarries that could potentially provide stone and ready-mix concrete for the Proposed Project are detailed below in Section 4.4.2.

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

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area. Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plate 4-3 below.

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

Plate 4-3 Concrete washout area

Alternatively, a Siltbuster-type concrete wash unit or equivalent (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) may be used. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility.

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 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.

4.3.4.4 Concrete Pouring

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 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.

4.3.4.5 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/settlement ponds in the Proposed Wind Farm site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and temporary construction compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, 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.

4.3.4.6 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. A wheel wash facility will be provided and a layout of the same is shown in Figure 4-28. 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 Project.

4.3.4.7 Waste Management

The CEMP, Appendix 4-3 of this EIAR, provides a waste management plan (WMP) which outlines the best practice procedures during the construction phase of the Proposed Project. The WMP has been produced in line with the following guidance *'Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects'* (EPA, 2021)[4]. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the Proposed Project. 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.

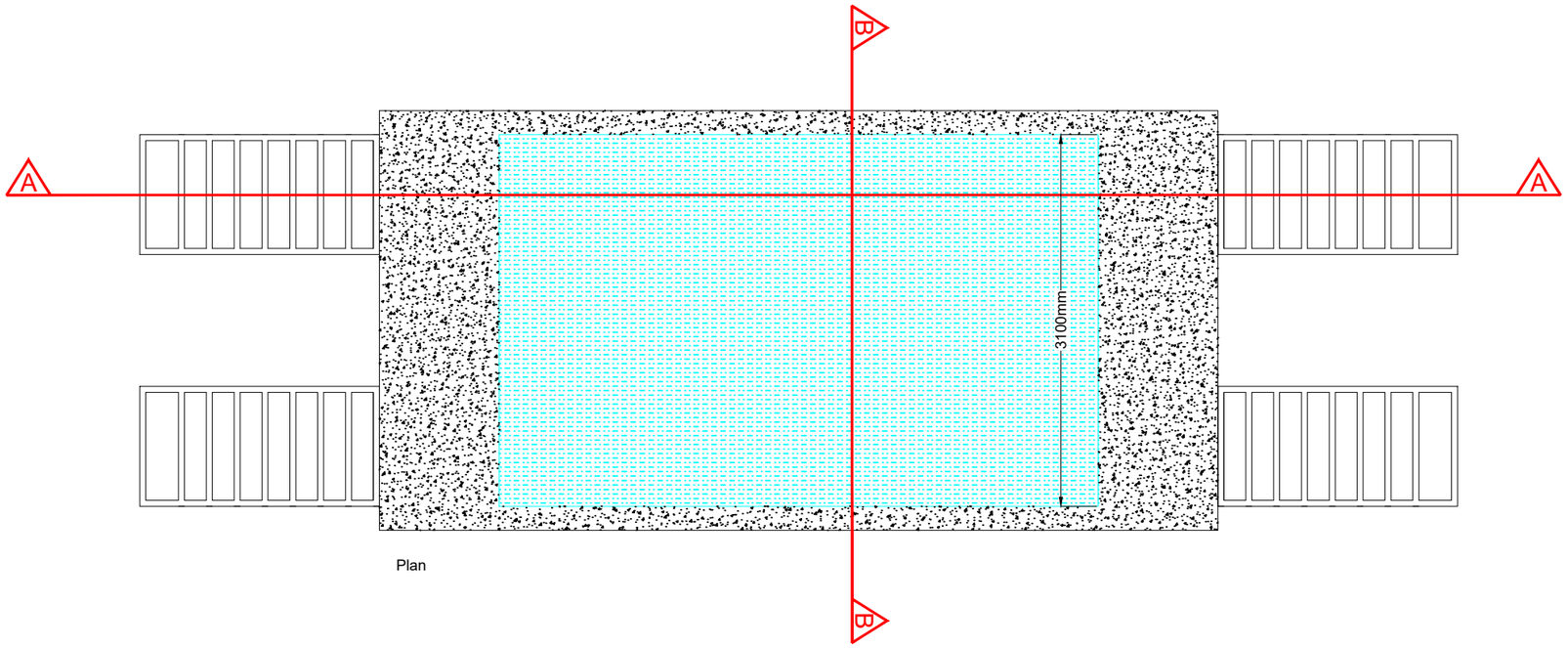
The Act requires that any waste related activity must have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the Proposed Project to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits to ensure that the waste is delivered 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.

[4] *EPA 2021 Best practice guidelines for the preparation of resource & waste management plans for construction & demolition projects. Available at: https://www.epa.ie/publications/circular economy/resources/CDWasteGuidelines.pdf*

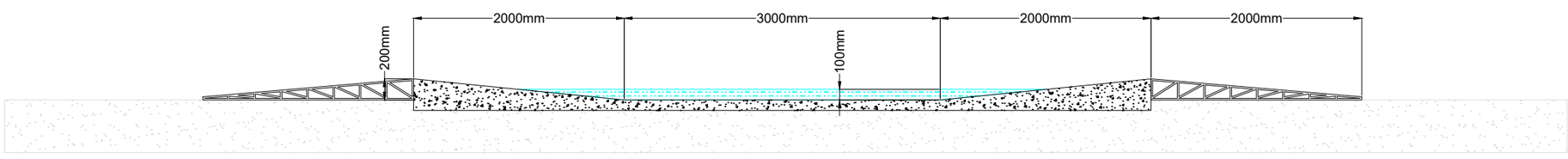
Prior to the commencement of the development, a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the 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.

Note
Wheel washes will be appropriately located at all entrances used during construction of the wind farm



Plan



Section A-A

Section B-B

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Wheel Wash Detail**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-28**	SCALE: **1:50 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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4.4 Access and Transportation

4.4.1 Site Entrances

Main Site Entrance

During the construction phase, the Proposed Wind Farm site will be accessed via an existing agricultural access point off the L-1154 local road. The L-1154 runs along the south western boundary of the Proposed Wind Farm site in the townland of Moheragh, Co. Tipperary. This entrance will be upgraded and will be used as the main site entrance for HGVs and other abnormal loads during the construction phase of the Proposed Wind Farm. For the purposes of delivering large turbine components and other abnormal loads to the Proposed Wind Farm site, a temporary abnormal load site entrance is proposed approximately 90m south of the main site entrance. During the construction phase, this entrance will closed off outside of abnormal load delivery periods. The existing boundary along the L-1154 will be reinstated upon commissioning of the Proposed Wind Farm.

It is also proposed to access the Proposed on-site 110kV Substation, during both the construction and operational phases of the Proposed Wind Farm, via this entrance.

The location of Proposed Wind Farm main site entrance and temporary abnormal load site entrance is shown in Figure 4-29 and Appendix 4-1 of this EIAR.

Access and Egress Points

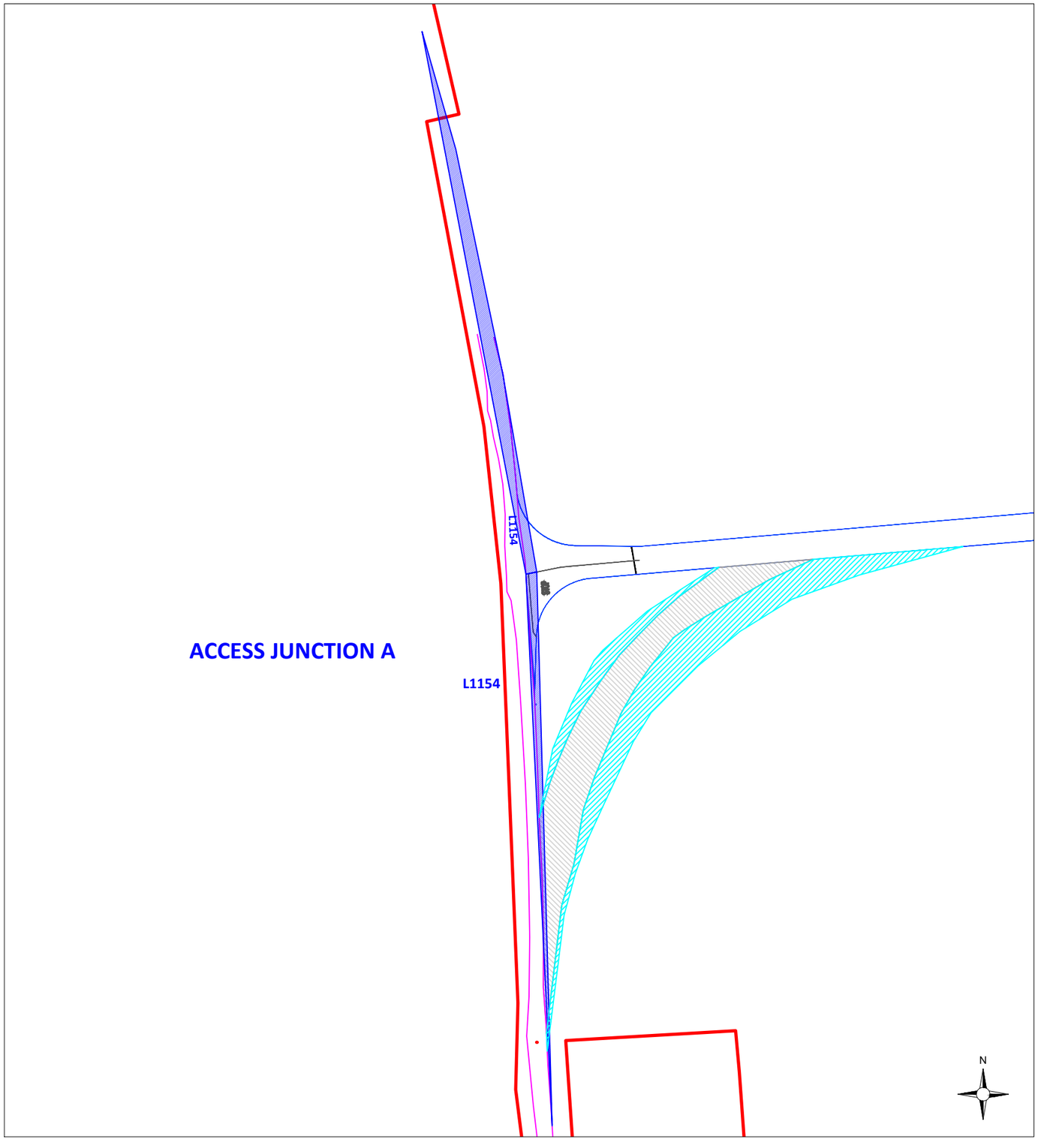
The Proposed Wind Farm site is traversed by a number of existing public roads and forestry/farm tracks. It is proposed to utilise 5 no. existing access/egress points and construct 11 no. new access/egress points at various locations across the site. These access and egress will be used throughout the construction, operation, and decommissioning phases of the Proposed Wind Farm site to facilitate the movement of HGVs, abnormal load delivery vehicles, and operation and maintenance vehicles to and from the various turbine locations within the site.

Appropriate sightlines will be established for the safe access and egress of traffic during both the construction and the operational phases, please see Section 15.1 of Chapter 15 for further information. The locations of Proposed Wind Farm access and egress points is shown in Figure 4-30.

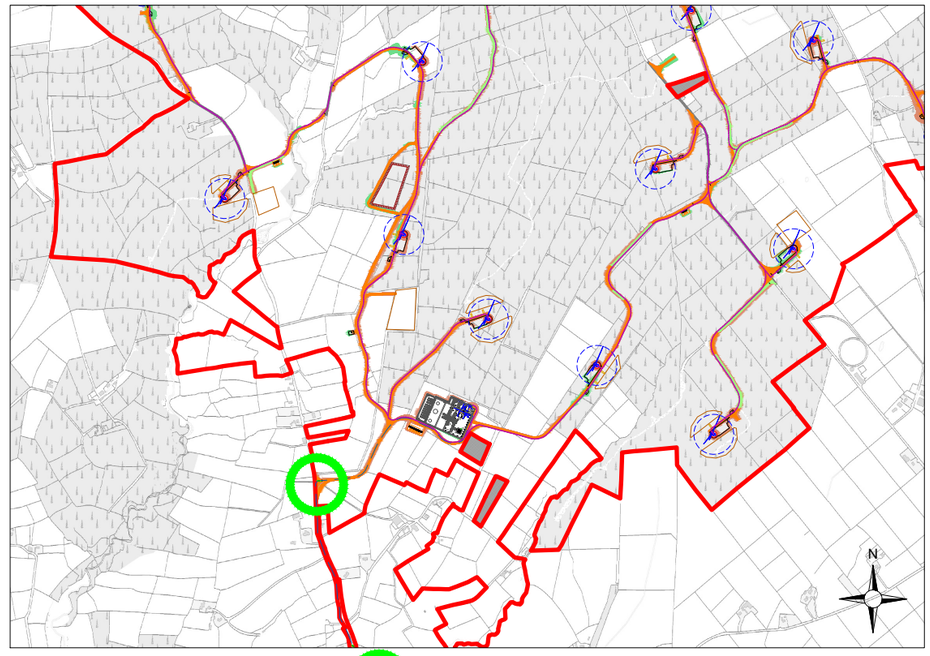
Please see Table 4-3 below for details on the locations of these entrances and their proposed use.

Drawing Legend

- Existing Road Edge
- Proposed Road
- Sight Line
- Transport Runover Area
- Oversail Area



ACCESS JUNCTION A



1:25,000 Location on Context Map

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Proposed Access Junction A**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-29**	SCALE: **1:1,000 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Location
- Proposed Hardstand
- Proposed Met Mast
- Proposed Access and Egress Locations
- Proposed Existing Public Roads to be Maintained
- Proposed New Road
- Proposed Existing Roads to be Upgraded
- Temporary Construction Compound
- Proposed Spoil Management Areas
- Proposed Borrow Pits
- Proposed 110kV Underground Grid Connection Cable
- Proposed 110kV Substation with Battery Storage
- Location of Temporary Accommodation Works
- Proposed Riparian Buffer
- Proposed Wet Grassland Management
- Proposed Woodland Management

Drawing Title: Proposed Access and Egress Locations

Project Title: Carrow Wind Farm

Drawn By	Checked By
ER	EMC
Project No.	Drawing No.
231102	Figure 4-30
Scale	Date
1:14,000	2026-03-25

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Table 4-3 Proposed Construction and Operational Phase Site Entrances

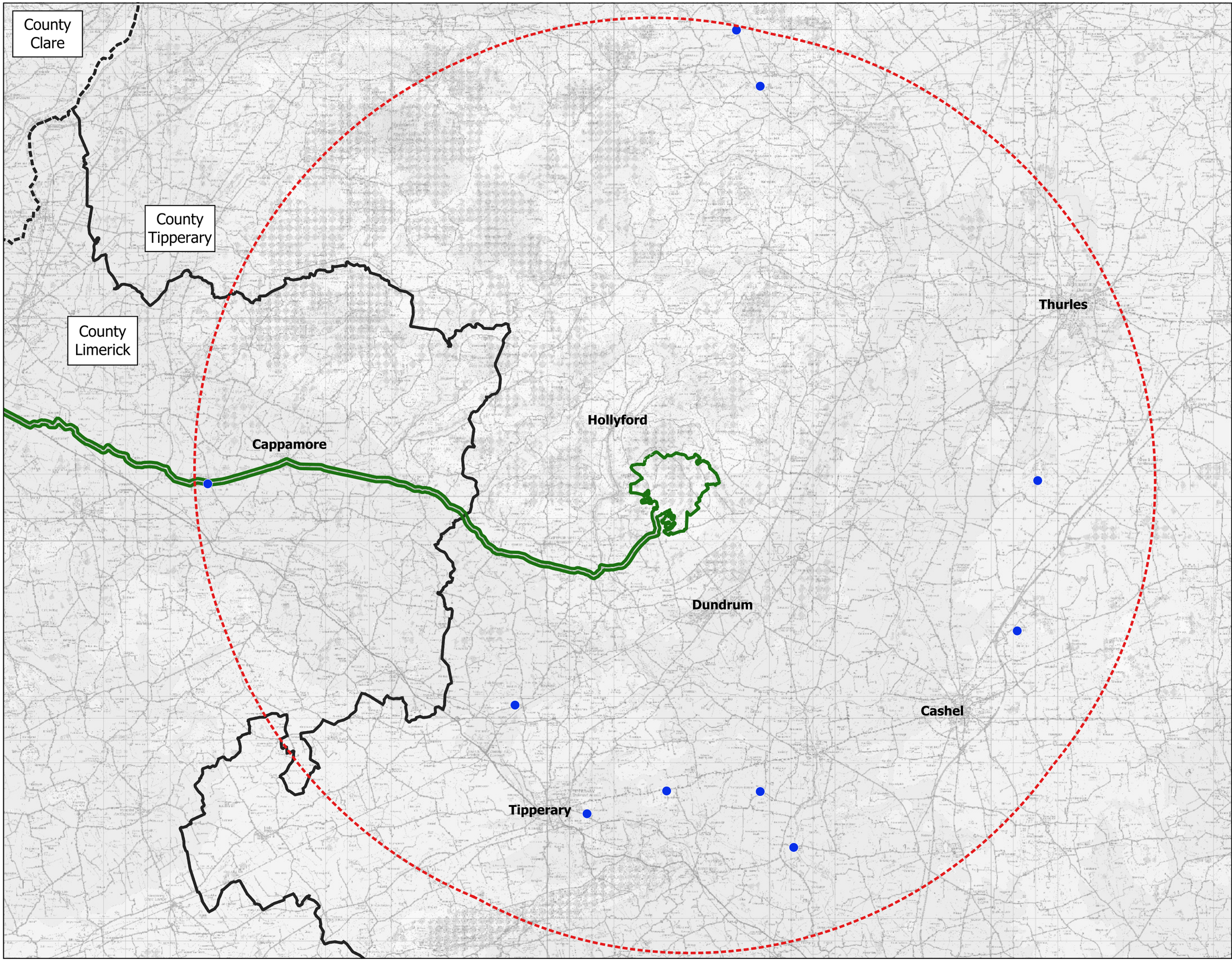
Access and Egress No.	Description	Used for Turbine Delivery	Used during Construction Phase	Used During Operational Phase (maintenance and monitoring)	Existing Entrance	New Entrance	Security Compound (✓) or Gate (☒)
1	Located on the L-1154 local road this will be used by the construction/turbine delivery vehicle as site entrance into the Proposed Wind Farm site.	✓	✓	✓	✓		✓
2	Located on the L-5117 local road this will be used by the construction/turbine delivery vehicle as an egress point onto the local road heading south towards Turbine 8.	✓	✓	✓		✓	☒
3	Located on the L-5117 local road this will be used by the construction/turbine delivery vehicle as an access point off the local road to access other wind farm infrastructure.	✓	✓			✓	☒
4	Located on the L-1154 local road this will be used by the construction/turbine delivery vehicle as an access point onto the local road heading west to Turbine 8	✓	✓			✓	☒
5	Located on the L-1154 local road this will be used by the construction/turbine delivery vehicle as an access/egress point on the local road to Turbine 8.	✓	✓	✓		✓	☒
6	Located on the L-1154 local road this will be used by the construction/turbine delivery vehicle as an access/egress point on the local road to of Turbine 7	✓	✓	✓	✓		☒

7	Located on the L-5117 local road this will be used by the construction/turbine delivery vehicle as an egress point onto the local road and in turn access Turbine 9.	✓	✓	✓		✓	☒
8	Located on the L-5117 local road this will be used by the construction/turbine delivery vehicle as an access point off the local road and in turn access Turbine 9.	✓	✓	✓	✓		☒
9	Located on the L-5206 local road this will be used by the construction/turbine delivery vehicle as an access point onto the local road heading north to Turbines 11 and east to Turbines 2, 10 and 14	✓	✓	✓	✓		☒
10	Located on the L-5206 local road this will be used by the construction/turbine delivery vehicle as an access/egress point on the local road for Turbine 11	✓	✓	✓		✓	☒
11	Located on the L-5206 local road this will be used by the turbine delivery vehicle as a turning area for Turbine 11	✓	✓			✓	☒
12	Located on the L-5206 local road this will be used by the construction/turbine delivery vehicle as an egress point on the local road heading south to Turbines 1 and 12	✓	✓	✓		✓	☒
13	Located on the L-5206 local road this will be used by the construction/turbine delivery vehicle as an access/egress point on the local road to Turbine 12	✓	✓	✓	✓		☒
14	Located on the L-5206 local road this will be used by the construction/turbine delivery vehicle as an access/egress point on the local road to Turbine 1	✓	✓	✓		✓	☒

15	Located on the L-52061 local road this will be used by the construction/turbine delivery vehicle as an egress point onto the local road heading west to Turbine 10	✓	✓	✓		✓	☒
16	Located on the L-52061 local road this will be used by the construction/turbine delivery vehicle as an access point off the local road heading west to Turbine 10	✓	✓	✓		✓	☒

4.4.2 Deliveries of Stone and Ready-Mix Concrete from Quarries

While it is proposed to source the majority of crushed stone for the construction of the Proposed Project from the onsite borrow pits, a certain volume of crushed stone and hardcore materials and all ready-mix concrete that will be required during the construction phase will be sourced from local, appropriately authorised quarries. For the purposes of assessment within the EIAR, construction materials will be delivered to the Site via selected haul routes that will be determined based on the source of the construction material. All construction materials will ultimately access the wider Proposed Wind Farm site via the main site entrance off the L-1154 local road. Quarries within a 20km range of the Proposed Wind Farm site, that could potentially provide stone and concrete, are illustrated on Figure 4-31. Traffic movements generated by the Proposed Project are discussed in Section 15.1 of Chapter 15, Material Assets.



Drawing Title
Licensed Quarries within 20km

Project Title
Carrow Wind Farm

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Project No.	Drawing No.
231102	Figure 4-31
Scale	Date
1:150,000	2026-03-25

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4.4.3 Turbine Delivery Route

It is envisaged that large wind turbine components will be delivered to the Proposed Wind Farm site, from the Port of Cork (Ringaskiddy) (other ports such as Galway Port, Shannon Foynes or Dublin Port could also be used), via the N28 and N40 national primary road, the M8 Motorway, N74 National Secondary Road, R639 and R505 regional roads followed by the L1291, L1283, L1282 and L1154 local roads. The proposed turbine delivery route (TDR) from the M8 to the Proposed Wind Farm site is shown on Figure 15-1a of Chapter 15 of this EIAR.

From the Port of Cork (Ringaskiddy), the turbine component delivery vehicles will travel north via the N28 and N40 National Primary Roads before merging onto the M8 Motorway. At Junction 9 (Cashel), the vehicles will exit the M8 and travel north for approximately 2km on the N74 National Secondary Road and the R639/R505 through Cashel, Co Tipperary. From Cashel the turbine component delivery vehicles will travel north for approximately 13.3km on the R505 to the village of Dundrum, Co. Tipperary. From here the turbine component delivery vehicles will travel north on the L1291 local road for approximately 2km to Gortussa Cross in the townland of Gortussa, Co. Tipperary, the turbine delivery vehicles will then travel northeast on the L1283 local road for approximately 3km, before turning left into agricultural land in the townland of Carrow in Co. Tipperary. The turbine delivery vehicles will travel north for approximately 0.3km through the agricultural land, through which a proposed temporary access track will be constructed. The vehicles will then head west for approximately 4.1km on the L1282 local road to the L1282/L1154 junction in the townland of Scarrough, Co. Tipperary. The turbine delivery vehicles will turn north and travel for approximately 0.9km on the L1154 to the Proposed Wind Farm site entrance.

It is also envisaged that general construction traffic (including materials and staff) will travel to the site via the public road network to the south west of the site. Traffic movements generated by the Proposed Project are discussed in Section 15.1. of Chapter 15, Material Assets.

4.4.3.1 Turbine Delivery Route Accommodation Areas

Road and junction widening are sometimes required along proposed TDRs to accommodate the large vehicles used to transport turbine components to Proposed Project sites. The proposed transport route for the Proposed Wind Farm has been the subject of a route assessment to determine if any works are required along its length. Full details of the assessment are included as part of the traffic impact assessment set out in Section 15.1 of this EIAR and summarised below. There are sections on the route where the vertical alignment may require specialist transport vehicles. It is proposed to use a clamp and dolly system for the turbine blade delivery. Plate 4-4 below shows an example of this type of blade adapter. These sections will be further considered by the appointed transport company following turbine procurement process.

Plate 4-4 Clamp and Dolly system

Minor temporary accommodation works will be required at various locations along the TDR on the national and regional road networks between the port of arrival in Cork and the Proposed Wind Farm site. These will be limited to temporary measures including overruns of roundabout islands and temporary relocation of some signs and street furniture.

Temporary accommodation works will be required at eight locations along the TDR to facilitate the delivery of turbine components and other abnormal loads to the Proposed Wind Farm during the construction phase. Descriptions and locations of the proposed temporary accommodation works are reference below. The locations of the temporary accommodation works are shown on Figure 4-1a and these works are fully assessed as part of this EIAR.

The works described at Locations 1 through to 8 below will facilitate the movement of the turbine component and other abnormal load delivery vehicles through these locations. Once the accommodation areas have been reinstated, they will only be used again in the very unlikely event that an oversized delivery is required for wind turbine maintenance purposes. The construction methodology for the accommodation areas will be similar to that of the proposed new site roads, as outlined in Section 4.8.1.2.1.

The locations of the temporary accommodation areas are shown in Appendix 4-1.

Location 1 – R505, Camus, Co. Tipperary

Figure 15.7 of Chapter 15 of this EIAR

It is proposed to carry out temporary accommodation works within the private green space of a residential dwelling located north of the R505 Regional Road, in the townland of Camus, Co. Tipperary.

The existing boundary wall, gates and shrubbery, within the private green space will be temporarily removed for the duration of the turbine component delivery phase. It is proposed to construct an accommodation area, using crushed stone, measuring approximately 550m^2.

Upon completion of the turbine component delivery phase, the boundary walls, gates and green space will be reinstated.

Location 2 – R505, Ballynahinch, Co. Tipperary

Figure 15.8 of Chapter 15 of this EIAR

It is proposed to carry out temporary accommodation works within the private green space of a residential dwelling and adjacent agricultural land located south of the R505 Regional Road, in the townland of Ballynahinch, Co. Tipperary.

The existing wall and gates within the private green space will be temporarily removed for the duration of the turbine component delivery phase. The trees and hedgerow within and around the agricultural land will be removed for the duration of the turbine component delivery phase. The temporary removal of electricity/telecommunication pole and temporary realignment of electricity/telecommunication cabling will be required. It is proposed to construct an accommodation area, using crushed stone, measuring approximately 330m^2.

Upon completion of the turbine component delivery phase, the accommodation area will be covered with a layer of topsoil and reseeded. Trees and hedgerow that were removed during the turbine component delivery phase will be replanted. The wall, gates and electricity/telecommunication pole will be reinstated.

Location 3 – R505, Kilshenane, Co. Tipperary

Figure 15.9 of Chapter 15 of this EIAR

It is proposed to carry out temporary accommodation works within agricultural land located north of the R505 Regional Road, in the townland of Kilshenane, Co. Tipperary.

Short sections of hedgerow will be removed for the duration of the turbine component delivery phase. It is proposed to construct an accommodation area, using crushed stone, measuring approximately 2,100m^2.

Upon the completion of the turbine component delivery phase, the accommodation area will be covered with a layer of topsoil and reseeded. The trees and hedgerow that were removed during the turbine component delivery phase will be replanted.

Location 4 – R505, Dundrum, Co. Tipperary

Figure 15.10 of Chapter 15 of this EIAR

It is proposed to carry out temporary accommodation works within agricultural land located north of the R505 Regional Road, in the townland of Dundrum, Co. Tipperary.

The existing fence, a small number of trees and electricity/telecommunication pole within and around the agricultural land will be removed for the duration of the turbine component delivery phase. It is proposed to construct an accommodation area, using crushed stone, measuring approximately 695m^2.

Upon the completion of the turbine component delivery phase, the accommodation area will be covered with a layer of topsoil and reseeded. The electricity/telecommunication pole and fence will be reinstated. The trees that were removed during the turbine component delivery phase will be replanted.

Location 5 – L-1283, Gortarush Lower, Co. Tipperary

Figure 15.11 of Chapter 15 of this EIAR

It is proposed to carry out temporary accommodation works within the forestry located at the junction located R505 Regional Road and the L-1283 Local Road, in the townland of Gortarush Lower, Co. Tipperary.

The existing electricity/telecommunication poles within and around the proposed accommodation area will be removed for the duration of the turbine component delivery phase. It is proposed to fell approximately 0.14 ha of forestry to accommodate the turbine component delivery phase and construct an accommodation area, using crushed stone, measuring approximately 730m^2.

Upon the completion of the turbine component delivery phase, the accommodation area will be covered with a layer of topsoil and reseeded. The electricity/telecommunication pole and fence will be reinstated. The trees that were removed during the construction phase will not be replanted as the location may be used again in the very unlikely event that an oversized delivery is required for wind turbine maintenance purposes.

Location 6 – L-1283, Carrow, Co. Tipperary

Figure 15.12 of Chapter 15 of this EIAR

It is proposed to construct a temporary new access road within the agricultural land to accommodate the movement of turbine components and abnormal loads between the L-1283 Local Road and L-1282 Local Road. This accommodation area is located in the townland of Carrow, Co. Tipperary.

The existing trees, hedgerow and electricity/telecommunication pole within and around the agricultural land will be removed for the duration of the turbine component delivery phase. It is proposed to construct a temporary new access road , using crushed stone, measuring approximately 3,045m^2. The temporary new access road will join the southern side of the L-1282 local road.

Upon the completion of the turbine component delivery phase, the temporary new access road will be covered with a layer of topsoil and reseeded. The electricity/telecommunication pole will be reinstated. The trees and hedgerow that was removed during the turbine component delivery phase will be replanted.

Location 7 – L-1282, Carrow, Co. Tipperary

Figure 15.13 of Chapter 15 of this EIAR

It is proposed to carry out temporary accommodation works within the agricultural land located on the northern side of the L-1282 Local Road, in the townland of Carrow, Co. Tipperary.

The existing wall on the western side of the agricultural land will be temporarily removed for the duration of the turbine component delivery phase. The trees and hedgerow within and around the agricultural land will be removed for the duration of the turbine component delivery phase. It is proposed to construct an accommodation area, using crushed stone, measuring approximately 720m^2.

Upon completion of the turbine component delivery phase, the accommodation area will be covered with a layer of topsoil and reseeded. Trees and hedgerow that were removed during the turbine component delivery phase will be replanted and the wall will be reinstated.

Location 8 – L-1282, Scarrough, Co. Tipperary

Figure 15.14 of Chapter 15 of this EIAR

It is proposed to carry out temporary accommodation works within the agricultural land located on the northern side of the L-1282 Local Road, in the townland of Scarrough, Co. Tipperary.

The existing trees and hedgerow within and around the agricultural land will be removed for the duration of the turbine component delivery phase. It is proposed to construct an accommodation area, using crushed stone, measuring approximately 1,565m^2.

Upon the completion of the turbine component delivery phase, the accommodation area will be covered with a layer of topsoil and reseeded. The trees and hedgerow that was removed during the turbine component delivery phase will be replanted.

Turbine 11 – Turbine Delivery Accommodation Area

It is proposed to construct a temporary accommodation area within the agricultural land to facilitate a reverse manoeuvre by abnormal load delivery vehicles for the delivery of turbine components to Turbine No. 11. This accommodation area is located on the eastern side of the L-5206 Local Road, in the townland of Carrow, Co. Tipperary.

The existing trees, hedgerow and electricity/telecommunication pole within and around the agricultural land will be removed for the duration of the turbine component delivery phase. It is proposed to construct a new access road, using crushed stone, measuring approximately 2,610m^2.

Upon the completion of the turbine component delivery phase, the accommodation area will be covered with a layer of topsoil and reseeded. The electricity/telecommunication pole will be reinstated. The trees and hedgerow that was removed during the turbine component delivery phase will be replanted.

4.4.4 Traffic Management

A turbine with the maximum blade length of 81.5 metres has been used in assessing the traffic impact of the Proposed Project. The blade transporter for such a turbine blade would have a total vehicle length of 87.5 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 Proposed Wind Farm site will be smaller than the design test vehicles. The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the Proposed Wind Farm site access junctions, as detailed in Section 15.1 of this EIAR.

The need to transport turbine components on the public roads is not an everyday occurrence in the vicinity of the site of the Proposed Project. However, the procedures for transporting abnormal size loads on the country's roads are well established. While every operation to transport abnormal loads is different and requires careful consideration and planning, escort vehicles, traffic management plans, drive tests, road marshals and convoy escorts from the Garda Traffic Corps are all measures that are regularly employed to deliver oversized loads from origin to destination. With just under 400 No. wind farms already built and operating in Ireland (Republic and Northern Ireland combined, as per latest available figures on www.windenergyireland.com), transport challenges are something the wind energy industry and specialist transport sector has become particularly adept in finding solutions to.

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

Plate 4-5 Blade adaptor transport system

A detailed TMP has been prepared as part of the traffic impact assessment set out in Chapter 15 of this EIAR. The deliveries of turbine components to the Proposed Wind Farm site may be made in convoys of three to four vehicles at a time, and at night when roads are quietest. Convoys will be accompanied by escorts at the front and rear operating a "stop and go" system. Although the turbine delivery vehicles are large, they will not prevent other road users or emergency vehicles passing, should the need arise. The delivery escort vehicles will ensure the turbine transport is carried out in a safe and efficient manner with minimal delay or inconvenience for other road users.

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

Prior to the TMP being finalised, a full dry run of the transport operation along the potential routes will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the TMP for agreement with the relevant Authorities. All turbine deliveries will be provided for in a TMP which will be finalised in advance of oversized load deliveries, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. Such a traffic management plan is typically submitted to the relevant Authorities for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

4.4.4.1 Traffic Management of Other Construction Materials

Aside from the delivery of the large turbine components and other abnormal loads, the construction of the Proposed Project will require the delivery of a large volume of other construction materials (including all crushed stone and cement required) mainly by HGVs. A detailed TMP has been prepared as part of the traffic and transport impact assessment and is included as Appendix 15-2 of this EIAR. The purpose of the TMP is to set out the various traffic management measures that will be implemented during the construction stage of the Proposed Project. The successful completion of the

Proposed Project will require significant coordination and planning and a comprehensive set of mitigation measures will be put in place before and during the construction phase of the Proposed Project in order to minimise the effects of the additional traffic generated on the surrounding road network.

All traffic management measures that are to be implemented during the construction phase of the Proposed Project will be agreed with Tipperary County Council, Limerick County Council, and the Roads and Traffic Sections will be consulted throughout the construction phase.

4.5 Community Gain Proposal

4.5.1 Background

Carrow Wind Farm has the potential to bring significant positive benefit to the local community. The project will create sustainable local employment, it will contribute annual rates to the local authority, and it will provide opportunity for local community investment in the project. A community benefit fund will be put in place for the lifetime of the project to provide direct funding to those areas surrounding the project.

4.5.2 Renewable Energy Support Scheme

The Renewable Energy Support Scheme (RESS) Terms and Conditions, published by the Department of Communications, Climate Action and Environment on the 29th October 2021, make some high level provisions for how this type of benefit fund will work. Any project which wants to export electricity to the national grid must abide by these broad principles. These include the following:

1. *a minimum of €1,000 shall be paid to each household located within a distance of a 1-2 kilometre radius from the Project;*
2. *a minimum of 40% of the funds shall be paid to not-for-profit community enterprises whose primary focus or aim is the promotion of initiatives towards the delivery of the UN Sustainable Development Goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives.*
3. *a maximum of 10% of the funds may be spent on administration. This is to ensure successful outcomes and good governance of the Community Benefit Fund.*
4. *the balance of the funds shall be spent on initiatives successful in the annual application process, as proposed by clubs and societies and similar not-for-profit entities, and in respect of Onshore Wind RESS 1 Projects, on "near neighbour payments" for households located outside a distance of 1 kilometre from the Project but within a distance of 2 kilometres from such Project.*

4.5.3 Community Benefit Fund

Carrow Renewable Energy Ltd. expects that for each megawatt hour (MWh) of electricity produced by the wind farm, the project will contribute €2 into a community fund for the RESS period or the first 15 years of operation. If this commitment is improved upon in upcoming Government Policy, we will adjust accordingly.

If this project is constructed as currently designed, we estimate that a total of approximately €7.3 million will be available in the local area for community funding over the lifetime of the project. The above figure is indicative only and will be dependent on the generation capacity of the wind farm which is influenced by a number of factors including:

1. *Number of wind turbines.*
2. *Capacity and availability of energy production of those turbines.*

3. *Quantity of wind.*

4.5.4 Community Investment Opportunity

The Renewable Energy Support Scheme (RESS) sets out that future renewable energy project proposals enable the possibility for local communities to invest in projects in a meaningful way as a means to directly gain from the financial dividends that a project can provide should it be consented, built and operated. In response to this, the applicant has been working hard with external agencies to develop workable models of Community Investment. As with the benefit fund, the applicant aims to take this work into the community during 2025/2026, to continue to explore this exciting possibility and see how best to embed its design within the community.

4.6 Site Drainage

4.6.1 Introduction

The drainage design for the Proposed Project 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, and the number of best practice guidance documents referred to in the Bibliography 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 Proposed Project.

The drainage design for the Proposed Project has been planned with the intention of having no significant negative impact on the water quality of the Site and its associated rivers, and consequently no impact on downstream catchments and ecological ecosystems. The assessment of potential impacts on hydrology and hydrogeology due to the construction, operation and decommissioning of the Proposed Project is included in Chapter 9: Hydrology and Hydrogeology.

No routes of any natural drainage features will be altered as part of the Proposed Project. Turbine locations and associated new roadways were designed to avoid natural watercourses with existing roads to be used wherever possible. There will be no direct discharges to any natural watercourses or land drains, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses and drains. A self-imposed 50m buffer from streams/rivers (natural watercourses) was applied during the constraints mapping and will be maintained during the construction phase.

4.6.2 Existing Drainage Features

A detailed description of the local hydrology of the Site is provided in Chapter 9 of this EIAR.

There will be no direct discharges to natural watercourses or drains. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at an appropriate distance from watercourses. Buffer zones around the existing natural drainage features have informed the layout of the Proposed Wind Farm and are indicated on the drainage design drawings.

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

Existing artificial drains in the vicinity of existing Site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas post treatment, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

4.6.3 Drainage Design Principles

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

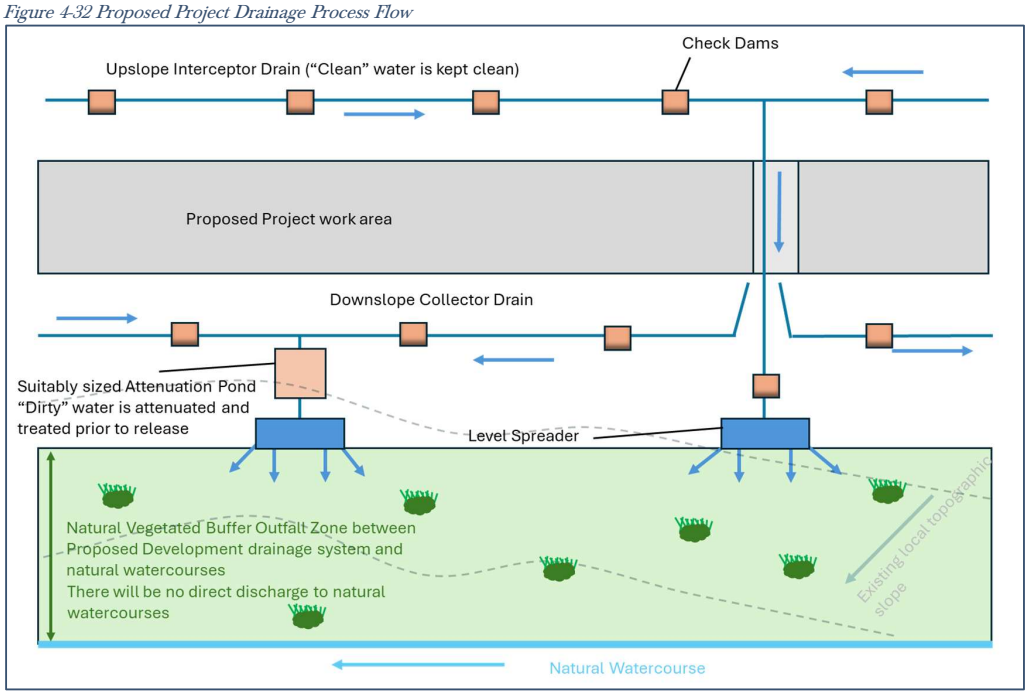
- Keep clean water clean by intercepting it where possible, upgradient of works areas, and divert it around the works areas for discharge as diffuse overland flow or for rewetting of land.
- Collect potentially silt-laden runoff from works areas via downgradient collector drains and manage via series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

Drainage water from any works areas of the 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 4-32 below.

Figure 4-32 Proposed Project Drainage Process Flow



4.6.4 Drainage Design

A drainage design for the Proposed Project, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-2 to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- Forest Service, (2000): Code of Best Forest Practice – Ireland. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- National Roads Authority (2005): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (September 1996);
- Southern Regional Fisheries Board: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Scottish Natural Heritage, 2019 Good Practice During Wind Farm Construction
- UK Guidance Note 2020 GPP1 - General Guide to Prevention of Pollution (UK Guidance Note);
- UK Guidance Note 2018 GPP5 – Works or Maintenance in or Near Watercourses

- Construction Industry Research and Information Association (CIRIA) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- Construction Industry Research and Information Association (CIRIA) 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

4.6.4.1 Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the Site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water to infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting of conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction. Figure 4-33 below shows an illustrative drawing of an interceptor drain.

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

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

4.6.4.2 Swales

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

design to interceptor drains and collector drains described above. Figure 4-33 below, shows an illustrative example of a drainage swale.

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

Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

4.6.4.3 Check Dams

The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the swale is non-erosive.

Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the Site, downstream of where drainage swales connect in.

The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4–6-inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator. Figure 4-33, below, shows illustrative examples of check dams.

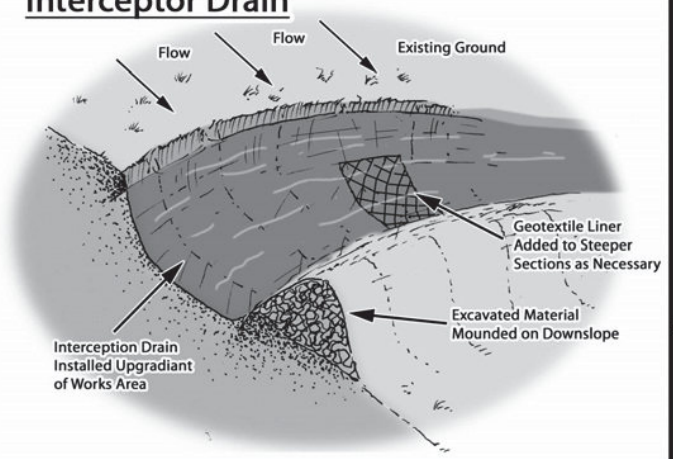
The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges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

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

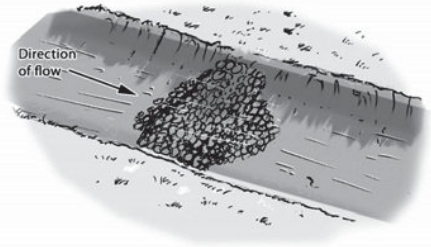
Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained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

Drainage Design Measures

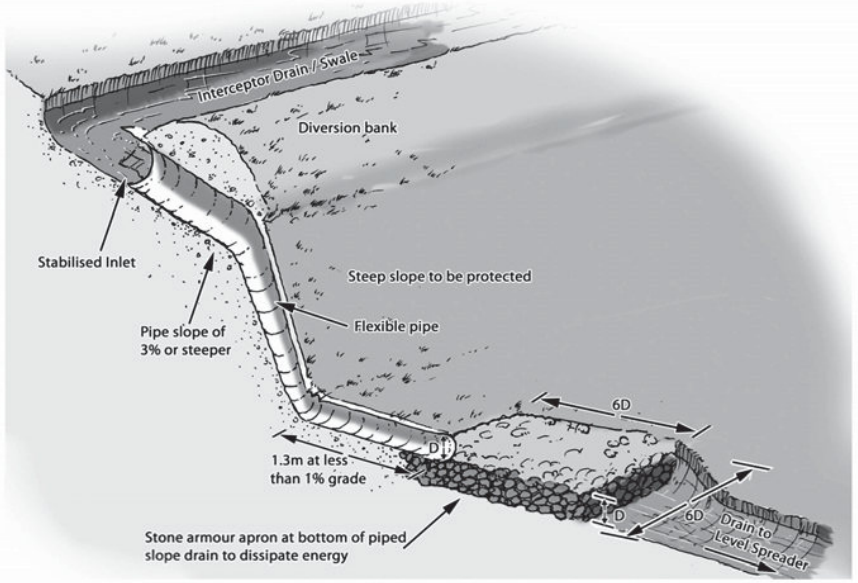
Interceptor Drain



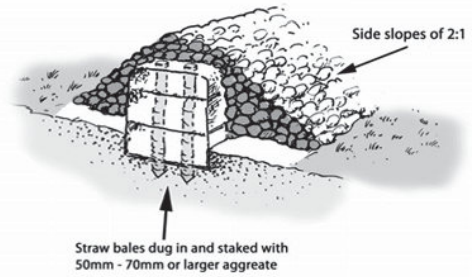
Check Dam (Stone Dam in Drain)



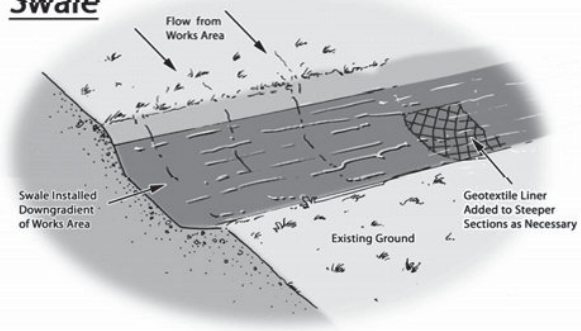
Slope Pipe Drain



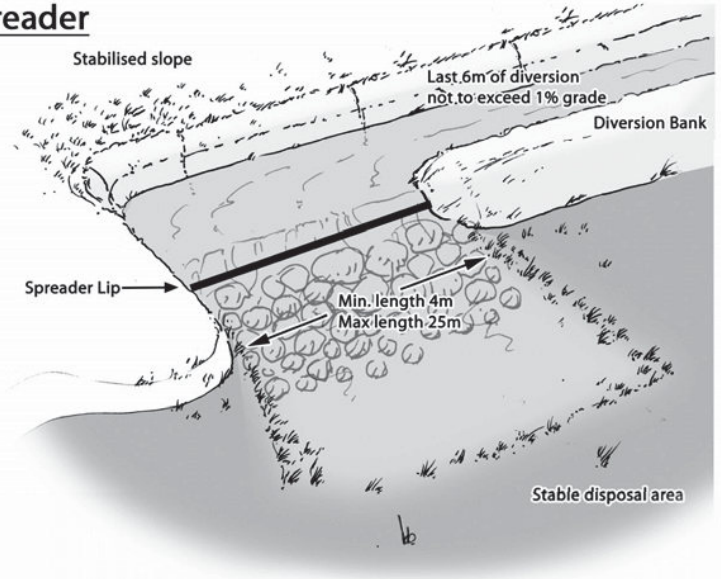
Check Dam
(Straw Bale & Stone Dam - Cross Section)



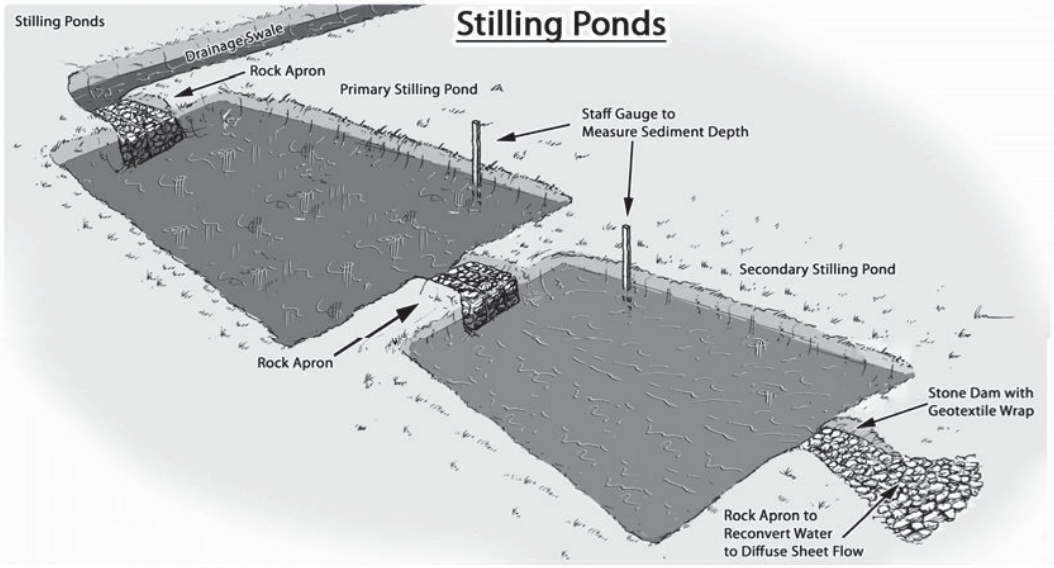
Swale



Level Spreader



Stilling Ponds



Drawing Title: Drainage Design Measures	Drawing No.: Figure 4-33	Scale: NTS	
Project Title: Carrow Wind Farm		Date: 25.03.2026	
Drawn By: Edward Ryan	Checked By: Eoin McCarthy	Project No.: 231102	

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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.

The water carried in interceptor drains will not have come in contact with works areas of the Site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be reconcentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. Figure 4-33, above, shows an illustrative example of a level spreader.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders. If a slope grade of less than 6% is not available in the immediate area downgradient of a works area at the end of a diversion drain, a piped slope drain (see Section 4.6.4.5 below) will be used to transfer the water to a suitable location.

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

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

4.6.4.5 Piped Slope Drains

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

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

The rock apron at the outlet will consist of 6-inch stone to a depth equal to the diameter of the pipe, a length six times the diameter of the pipe. The width of the rock apron will be three times the diameter of the pipe where the pipe opens onto the apron and will fan out to six times the diameter of the pipe over its length. Figure 4-33, above, shows a diagrammatic example of a piped slope drain and rock apron.

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

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

4.6.4.6 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

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

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

4.6.4.7 Stilling Ponds (Settlement Ponds)

Stilling or settlement ponds will be used to attenuate runoff from works areas of the Proposed Project during the construction phase and will remain in place to handle runoff from roads and hardstanding areas of the Proposed Wind Farm 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 to the appropriate size at each required location as shown on the drainage design drawings included in Appendix 4-2 (Appendix A) of this EIAR. 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 stilling ponds will reduce the velocity of flows in order to allow settlement of silt to occur. Water will flow out of the 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 have been sized according to the size of the area they will be receiving water from and are large enough to accommodate a 10-year return rainfall event. The settlement ponds are designed for 11hr and 24hr retention times used to settle out medium silt (0.006mm) and fine silt (0.004mm) respectively (EPA, 2006)[5]. 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.

[5] Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006)

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.

A water level indicator such as a staff gauge will be installed in each stilling pond with marks to identify when sediment is at 10% of the stilling pond capacity. Sediment will be cleaned out of the still pond when it exceeds 10% of pond capacity. Stilling ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. An illustration of a stilling pond is shown in Figure 4-33.

4.6.4.8 Siltbuster

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

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

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4-34 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.

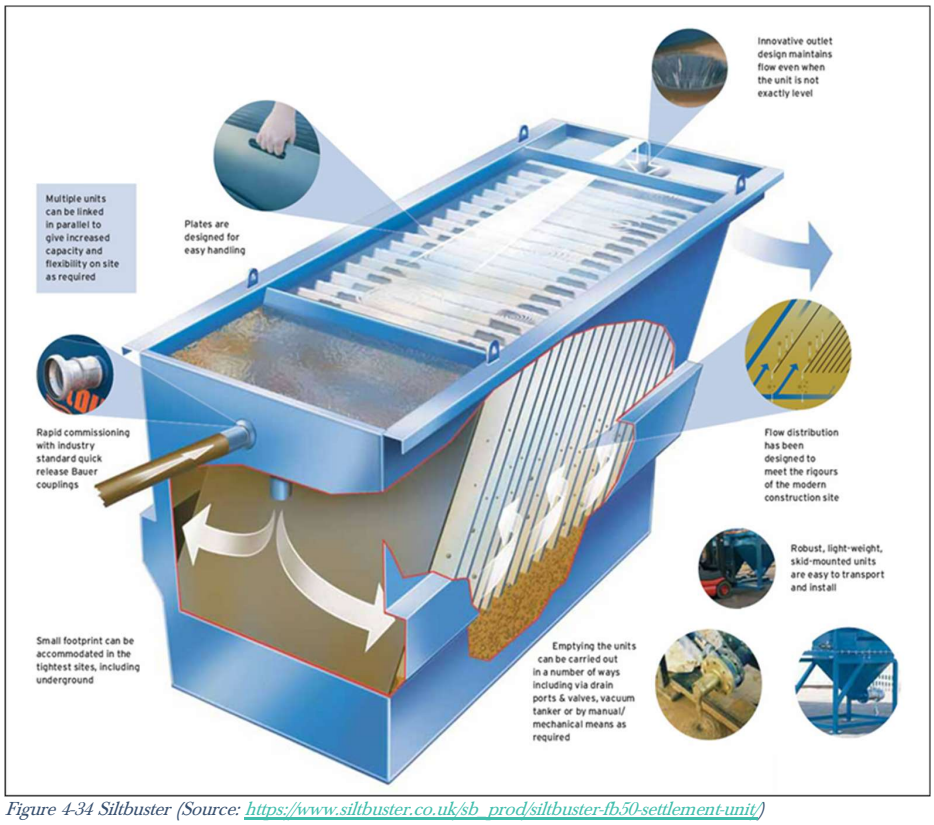


Figure 4-34 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

4.6.4.9 Silt Bags

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

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

The dewatering silt bag that will be used will be approximately 3 metres in width by 4.5 metres (see Plate 4-6 and Plate 4-7 below) in length and will be capable of trapping approximately four tonnes of silt. The dewatering silt bag, when full, will be removed from site by a waste contractor with the necessary waste collection permit, who will then transport the silt bag to an appropriate, fully licensed waste facility.

Plate 4-6 Silt bag with water being pumped through

Plate 4-7 Silt bag under inspection

4.6.4.10 Sedimats

Sediment entrapment mats (see Plate 4-8 below), 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.

Plate 4-8 Typical Sedimat Details (Source: https://www.hy-tex.co.uk/).

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 Project, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow as necessary.

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

4.6.4.12 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone of a stream or 100m buffer zone of a lake, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the Proposed Project. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the drainage design drawings included in Appendix 4-2.

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

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

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

4.6.4.13 Hydrocarbon Interceptors

A hydrocarbon (or petrol) interceptor is a trap used to filter out hydrocarbons from surface water runoff. A suitably sized hydrocarbon interceptor will be installed wherever it is intended to store hydrocarbons and oils (i.e., construction compounds and substation compound) or where it is proposed to park vehicles during the construction and operational phases of the Proposed Project (i.e., construction compounds and substation compound).

4.6.5 Drainage Management and Maintenance

A Surface Water Management Plan (SWMP) has been prepared for the Proposed Project. It is intended, as an accompanying document to the Construction and Environmental Management Plan (CEMP). It compiles the proposed surface water drainage control and treatment measures, set out in the EIAR, the drainage management and maintenance measures and the proposed surface water monitoring programme, set out in the CEMP, in a single document. The SWMP is included as Appendix 4-5 of this EIAR.

The SWMP also provides details in relation to the activity specific drainage control and mitigation measures including those measures to be implemented for the following:

- Cabling Trench Drainage Refuelling,
- Fuel and Hazardous Material Storage
- Cement Based Product Handling.

4.7 Construction Management

It is estimated that the construction phase of the Proposed Project will take approximately 18-24 months from starting on site to the commissioning of the electrical system. In the interest of breeding birds, construction will not commence during the bird breeding season which runs from the 1st of March to the 31st of August inclusive. Construction may commence at any stage from September onwards to the

end of February, so that construction activities are ongoing by the time the next breeding bird season comes around and can continue throughout the next breeding season.

4.7.1 Construction Sequencing

The construction phase can be broken down into three main phases, which overlap partially and will take approximately 18-24 months to complete 1) civil engineering works - 10 months, 2) electrical works including grid connection works - 8 months, and 3) turbine erection and commissioning – 6 months. The main task items under each of the three phases are outlined below.

Civil Engineering Works

- Construct new Site roads to temporary compound.
- Clear and hardcore area for temporary Site offices. Install same.
- Construct bunded area for oil storage.
- Construct new Site roads and hard-standings and crane pads.
- Construct drainage ditches, culverts etc. integral to road construction.
- Excavate for turbine bases. Place blinding concrete to turbine bases. Fix reinforcing steel and anchorage system for tower section. Construct shuttering. Fix any ducts etc. to be cast in. Pour concrete bases. Cure concrete. Remove shutters after 1-2 days.
- Excavate trenches for Site cables, lay cables and backfill. Provide ducts at road crossings.
- Backfill tower foundations and landscape with previously stored topsoil.
- Complete Site works, reinstate Site.
- Remove temporary Site offices. Provide any gates, landscaping, signs etc. which may be required.

Electrical Works

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

Turbine and Meteorological Mast Erection

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

The phasing and scheduling of the main construction task items are outlined in Figure 4-35 below, where the 1st January has been selected as an arbitrary start date for construction activities.

		Year 1				Year 2			
ID	Task Name	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Site Health and Safety								
2	Grid Connection								
3	Site Compounds								
4	Site Roads								
5	Substation and Electrical Works								
6	Turbine Hardstands								
7	Turbine Foundations								
8	Backfilling and Landscaping								
9	Turbine Delivery and Erection								
10	Substation Commissioning								
11	Turbine Commissioning								

Figure 4-35 Indicative Construction Schedule

4.7.2 Construction Phase Monitoring and Oversight

The requirement for a Construction and Environmental Management Plan (CEMP) to be prepared in advance of any construction works commencing on any development site and submitted for agreement to the Planning Authority is now well-established. The proposed procedures for the implementation of the mitigation measures outlined in such a CEMP and their effectiveness and completion is typically audited by the Ecological Clerk of Works (ECoW) on behalf of the Project Developer, in an and objective manner. The basis for auditing is presented in Section 7 of the CEMP (Appendix 4-3) which effectively lists all mitigation measures prescribed in any of the planning documentation. 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 findings of the audit. 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 Project and is included in Appendix 4-3 of this EIAR. The CEMP includes details of drainage, spoil management, waste management etc, and describes how the above-mentioned audit will function and how the findings are presented.

In the event planning permission is granted for the Proposed Project, the CEMP will be updated prior to the commencement of the development, to address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned and will be submitted to the Planning Authority for written approval.

The on-site construction staff will be responsible for implementing the mitigation measures specified in the EIAR and compiled in Section 6 of the CEMP. 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

This section of the chapter outlines the construction methodologies to be used for the various elements of the Proposed Wind Farm and Proposed Grid Connection. Further details in relation to construction methodologies is included in Section 2 of the CEMP, included as Appendix 4-3 of this EIAR.

4.8.1 Proposed Wind Farm

4.8.1.1 Turbine and Met Mast Foundations

Each of the turbines to be erected on the Site will have a reinforced concrete base that is installed below the finished ground level. It is anticipated that the turbine foundations will be formed on competent strata (i.e., bedrock or subsoil of sufficient load bearing capacity). Where the ground conditions do not have a competent stratum of sufficient load bearing capacity, piling method will be utilised. A methodology for piled foundations is included in Section 2 of the CEMP, Appendix 4-3 of this EIAR.

Overburden will be stripped off the foundation area to a suitable formation using a 360° excavator and will be stored locally for later reuse in backfilling around the turbine foundation. A two-metre-wide working area will be required around each turbine foundation, 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 and/or landscaping the working area around the turbine foundation. The excavated material will be sealed using the back of the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur.

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

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

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

The anchor cage is delivered to the Site in two or more parts depending on the turbine type. A 360° excavator or crane with suitable approved lifting equipment will be used to unload sections of the anchor cage and reinforcing steel. The anchor cage is positioned in the middle of the turbine foundation base and is assembled accordingly. When the anchor cage is in final position it is checked and levelled by using an appropriate instrument. The anchor cage is positioned 250mm – 300mm from formation level by use of adjustable legs. Reinforcement bars are then placed around the anchor cage, first radial bars, then concentric bars, shear bars and finally the superior group of bars. Earthing material is attached during the steel foundation build up. The level of the anchor cage will be checked again prior to the concrete pour and during the concrete pour. As noted in Section 4.8.1.6 below, the transformer in each turbine is connected to the on-site substation through a network of buried electrical cables which are installed through the centre of the anchor cage.

Formwork to concrete bases will be propped/supported sufficiently so as to prevent failure. Concrete for bases will be poured using a concrete pump. Each base will be poured in three stages. Stage 1 will see the concrete being poured and vibrated in the centre of the anchor cage to bring the concrete up to the required level inside the cage. Stage 2 will see the centre of the steel foundation being poured and vibrated to the required level. Stage 3 will see the remaining concrete being poured around the steel

foundation to bring it up to the required finished level. After a period of time when the concrete has set sufficiently the top surface of the concrete surface is to be finished with a power float.

Once the base has sufficient curing time it will be backfilled with suitable fill up to existing ground level and finished with the original material that was excavated.

4.8.1.2 Site Roads and Hardstand Areas

4.8.1.2.1 *New Site Access Road*

The construction methodology for the proposed new access roads and turbine hardstands is outlined as follows:

- Establish alignment of the new road from the construction drawings and mark out the centrelines with ranging rods or timber posts;
- All drainage measures prescribed in the detailed drainage design for the Proposed Project will be implemented around the works area;
- The road layout has been designed to avoid crossings of natural watercourses where possible;
- Where existing culverts are to be upgraded or extended, the works will be carried out to follow a method statement to be prepared in consultation with Inland Fisheries Ireland;
- The access tracks will be of single-track design with a width of 6m with localised widening at bends and changes in direction. (depending on the location within the Site)
- All spoil excavated will be managed on-site. It will be placed in designated Spoil Management Areas, within the borrow pits, placed around selected turbines bases and hardstands or placed alongside access roads within the Site. Some topsoil may be temporarily stockpiled locally for reuse for landscaping purposes.
- The subsoil will be excavated down to a suitable formation layer of competent stratum;
- The road will be constructed using well-graded granular fill (imported or site-won), spread and compacted in layers typically of 200mm and a suitable capping layer to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be subject to detailed design by Project Engineer in consultation with the Construction Manager based on the characteristics of the material and the compaction plant to be used;
- The new access roads will be constructed with a camber to aid drainage of surface water;
- Excavations side slopes shall not generally be greater than 1(V): 2 (H). Design slopes will be informed by the Geotechnical Engineer;
- At bends or steep inclines from the road, reflective snow poles will be erected to warn traffic on dark mornings and evenings that there is a turn in the road or a sharp incline beyond the road;
- Where underground services are to be traversed during the construction of new roads throughout the Proposed Wind Farm site, they will be traversed as per the methodology as outlined above.

4.8.1.2.2 *Upgrading of Existing Site Access Road*

Approximately 2.6km of the existing roads will require upgrading which will comprise widening of the roadway to a total running width of approximately six metres, with wider sections at corners and the laying of a new surface dressing on the existing section of roadway where necessary. The road widening will be undertaken as follows:

- If it is considered that the current road formation level is adequate to support required bearing, then no upgrade or widening works will be completed.
- Otherwise, where required, the subsoil in the existing road verge will be excavated down to a suitable formation layer.
- All spoil excavated will be managed on-site. It will be placed within the borrow pits or placed alongside access roads within the Site (which will be located outside identified watercourse 50m buffers). Some topsoil may be temporarily stockpiled locally for reuse for landscaping purposes.
- All drainage measures prescribed in the detailed drainage design for the Proposed Project will be implemented around the works area.
- Well-graded granular fill (imported or site-won) will be spread and compacted in layers up to 200mm to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used.
- These layers of granular fill will be brought to the same level as the top of the existing road surface.
- Where required, a layer of geogrid will be installed directly onto the top of the granular fill layer and the existing road surface.
- A layer of finer well graded stone for the running surface will be laid on the geogrid and compacted.
- Upon completion the upgraded roads will be a single-track design with a width of 6m with localised widening at bends and changes in direction (depending on the location within the Site).
- Prior to any works commencing on the upgrade of existing roads, the requirement for additional roadside drainage will be considered by the Project Hydrologist in line with the proposals outlined in Appendix 4-3 of the EIAR.

4.8.1.3 Clear-Span Watercourse Crossing

It is proposed to construct 9 no. new watercourse crossing (clear span bridge/culvert design) and upgrade of 2 no. existing crossings on forestry tracks will be required to facilitate the Proposed Wind Farm site infrastructure. The locations of these crossings are shown on the layout drawings included in Appendix 4-1 and Appendix 4-3. The clear-span watercourse crossing methodology presented below will ensure that no instream works are necessary. The standard construction methodology for the installation of a clear-span watercourse crossing is as follows:

- The access road on the approach either side of the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of each watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- A foundation base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of a temporary pre-cast concrete or metal bridge across the watercourse to provide temporary access for the excavator. Plant and equipment will not be permitted to track across the watercourse.
- Once the foundation base has been completed, the pre-cast concrete clear-span structure will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse.
- Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations.

- Underground cabling ducting will be contained within the road make-up of the proposed crossing.

A standard design drawing of a pre-cast concrete, clear span crossing is shown in Figure 4-36.

The watercourse crossing 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.

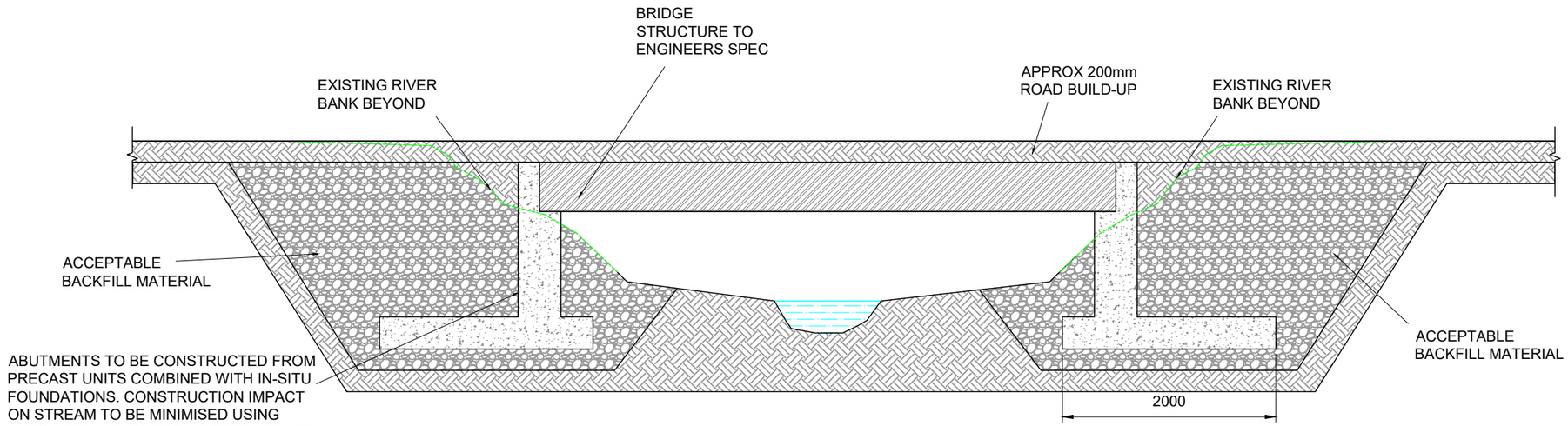
Confirmatory inspections of the proposed new watercourse crossing locations will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing.

4.8.1.4 Culvert Crossing

All new proposed culverts and proposed culvert upgrades at field drain crossings required for the Proposed Wind Farm 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 Wind Farm, 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 but will have a minimum 900mm diameter. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow as necessary.

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



ABUTMENTS TO BE CONSTRUCTED FROM PRECAST UNITS COMBINED WITH IN-SITU FOUNDATIONS. CONSTRUCTION IMPACT ON STREAM TO BE MINIMISED USING MITIGATION MEASURES AGREED WITH IFI & NPWS

Scale 1:50

PROJECT TITLE: **Carrow Wind Farm, Co. Tipperary & Co. Limerick**			
DRAWING TITLE: **Clear Span Watercourse Crossing**			
PROJECT No.: **231102**		DRAWING No.: **Fig 4-39**	SCALE: **1:50 @ A3**
DRAWN BY: **JOB**	CHECKED BY: **AC**	DATE: **25.03.2026**	REVISION.: P02

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4.8.1.5 Temporary Construction Compound

As discussed in Section 4.3.1.5, there are three proposed construction compounds; the primary construction compound will be located adjacent to the Proposed Substation. The second construction compound will be located approximately 240m northeast of Turbine 8 and third construction compound will be located approximately 200m south of Turbine No. 11. The compounds will be constructed in the same manner 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 as discussed below in Section 4.8.2.1;
- A layer of geo-grid will be installed where deemed necessary by the designer and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for Site offices and storage containers;
- A limited amount of fuel will have to be stored in appropriately bunded containers and a designated area for oil storage will be constructed within the compound.
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc;
- A waste storage area will be provided within the compound;
- The compound will be fenced and secured with locked gates if necessary; and,
- Upon completion of the Proposed Wind Farm, the temporary construction compounds will be decommissioned and allowed to vegetate naturally.

4.8.1.6 Underground Electrical (33kV) and Communication Cabling

The transformer in each turbine and the met mast is connected to the on-site substation through a network of buried electrical and communication cabling. The ground is trenched using a mechanical excavator. The top layer of soil (or road surface) is removed and saved so that it is replaced on completion. The cables will be bedded with suitable material. The cables will be laid at a depth of approximately 1.2m below ground level; a suitable marking tape is installed between the cabling and the surface (see Plate 4-9 below illustrating an example of a single cable trench). On completion, the ground will be reinstated. The route of the underground electrical and communication cabling will follow the access tracks as illustrated on the Proposed Wind Farm layout drawings included as Appendix 4-1 of the EIAR. The cabling may be placed on either side of the road footprint, on both sides of the road and/or within the road. The exact configuration of the underground cabling will be set by the requirements of the electrical designers at detailed design stage.

Plate 4-9 Typical Cable Trench View

4.8.1.7 Borrow Pit

The estimated volume to be extracted from the borrow pits for the construction of the Proposed Project is up to 247,720m^3. This figure presented is the anticipated maximum volumes; however, the actual volumes to be removed from the borrow pits will be confirmed at the time of construction and following detailed pre-construction site investigation works.

The borrow pits will be excavated and backfilled as follows:

- The area to be used for the borrow pits 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 initial borrow pit excavation will involve removal of soil to the top of bedrock. These materials will be stored temporarily in the borrow pits or placed alongside access roads;
- All drainage measures prescribed in the detailed drainage design for the Proposed Project will be implemented around the works area;
- The bedrock material will be extracted by breaking and blasting (section 4.8.1.7.1 and 4.8.1.7.2 below) from the borrow pits and stockpiled or used as required;
- The use of material won from the borrow pits will be sequential with new road construction or turbine foundation formations;
- Temporary stockpiling of aggregates will be required to accommodate the cut and fill operations within the borrow pits, and the progression of access roads and turbine excavations;
- As the borrow pit excavation progresses and becomes deeper, surface water and groundwater ingress will be removed via pumping to settlement ponds, and re-distribution locally across natural vegetated areas. Where required, additional specialist water treatment measures will be employed to ensure no deterioration in downstream water quality occurs;
- When extraction ceases within the borrow pits, the borrow pits will be backfilled with excavated spoil and its associated drainage measures will be removed.
- The extraction area of the borrow pits will have to be permanently secured and a stock-proof fence will be erected around the borrow pits to prevent access to these areas as well as the installation of appropriate health and safety signage.

Two extraction methods have been assessed for breaking out the useful rock below: rock breaking and blasting.

4.8.1.7.1 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. In areas where stronger rock is encountered and cannot be removed by means of excavating then a rock breaking methodology may be used. Rock breaking equipment comprises a large hydraulic 360-degree excavator with a rock breaker attachment. 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 areas. A smaller rock breaker, in the 30-40 tonne size range, then breaks the rocks down to a size that can then be fed into a crusher.

The extracted, broken rock is 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 within the borrow pits, away from the immediate area of the crusher, until it is required elsewhere within the Site.

4.8.1.7.2 Rock Blasting

Where blasting is used as an extraction method, a mobile drilling rig is used to drill vertical boreholes into the area of rock that is to be blasted. A drilling rig will drill the necessary number of boreholes required for a single blast in approximately 3 to 4 days. The locations, depth and number of boreholes are determined by the blast engineer. This is a specialist role fulfilled by the blasting contractor.

The blast engineer will arrange for the necessary quantity of explosive to be brought to site to undertake a single blast. The management of explosives on-site and the actual blasting operation will be agreed in advance with and supervised by An Gardaí Siochána. The blast engineer sets the explosives in place in the boreholes, sets the charges, and fires the blast.

A properly designed blast should generate rock of a size that can be loaded directly into a mobile crusher, using the same wheeled loader outlined above. The same method is used for processing the rock generated from a blast, as would be used to process rock generated by rock breaking. Generally, the drilling rig will recommence drilling blast holes for the next blast as soon as one blast is finished. The potential impacts and control measures associated with noise and vibration from this extraction method are assessed in Chapter 12: Noise and Vibration. Any blasting will be carried out in accordance with the *Guidance on the Safe Use of Explosives in Quarries* (Safety and Health Commission for the Mining and Other Extractive Industries, 2002)[6] and the British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*[7].

[6] https://www.hsa.ie/eng/Publications_and_Forms/Publications/Mines_and_Quarries/Guidance%20on%20the%20Safe%20Use%20of%20Explosives%20in%20Quarries.pdf
[7] https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSI&DocID=305965

4.8.1.8 Keyhole Forestry Felling

As part of the Proposed Project, keyhole felling of forestry will be required within and around the development footprint to enable the construction of turbine bases, access roads and the other ancillary infrastructure. Felling is also required around turbine bases for the reduction of potential effects on bats (refer to Appendix 6-2 of this EIAR). A total of 51.64 hectares of forestry will be permanently felled within and around the footprint of the Proposed Wind Farm in order to facilitate infrastructure delivery, construction and turbine erection.

The proposed methodology for the forestry felling activities is as follows:

Felling works will conform to current best practice Forest Service policies and strategic guidance documents as well as Coillte produced guidance documents, including the specific guidelines listed below, to ensure that the felling works provides minimal potential impacts to the receiving environment.

- 'Standards for Felling and Reforestation' (Department of Agriculture, Food and the Marine, 2019)
- 'Forest Operations & Water Protection Guidelines' (Coillte, 2009)
- 'Methodology for Clear Felling Harvesting Operations' (Coillte, 2009)
- 'Forestry and Water Quality Guidelines' (Forest Service, 2000)
- 'Forestry Biodiversity Guidelines' (Forest Service, 2000)
- 'Forestry Protection Guidelines' (Forest Service, 2002)
- 'Forestry Harvesting and Environmental Guidelines' (Forest Service, 2000)

The proposed methodology for the forestry felling activities is as follows:

- The extent of all necessary forestry felling areas will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected by the ECoW and contractor prior to any machinery being brought on site to commence the felling operation.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt/sediment traps (i.e., check dam / silt fence) 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.
- 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.
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated.
- Sediment removed from traps will be carefully disposed of in the spoil management areas.
- Machine combinations (i.e., hand-held or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; however, the general proposed machine combination will comprise a harvester and a low-ground pressure harvester with a 14-tonne bunk capacity.
- Trees will be cut manually inside the 50m construction watercourse buffer and using machinery to extract whole trees only.
- Brash mats will be put in place to support vehicles on soft ground, reducing mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur.
- Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.

- No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Brash which has not been pushed into the soil may be moved to facilitate the creation of mats elsewhere within the site.
- 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 prior to removal off site to authorised sawmills

4.8.2 Proposed Grid Connection

4.8.2.1 Onsite 110kV Electricity Substation and Control Buildings

A detailed drawing of the proposed onsite 110kV substation is shown in Figure 4-16. The proposed onsite 110kV substation will be constructed by constructed by the following methodology:

- The overall substation and battery compound is approximately 26,548m^2. This is made up of a Eirgrid 110kV GIS Compound, an IPP compound and a BESS compound. The BESS compound is approximately 4,800m^2.
- The area of the on-site substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and temporarily stockpiled for later use in landscaping. Any excess material will be sent to the borrow pits or placed alongside access roads.
- 1 no. control building will be built within the on-site substation compound.
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix.
- The block work walls will be built up from the footings to 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 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 transformer, electrical equipment, and storage container plinths will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix.
- Lightning poles will be erected at appropriate locations adjacent to the substation. All lightning poles will be appropriately earthed.
- The electrical equipment will be installed and commissioned.
- Perimeter fencing will be erected.
- The construction and components of the substation will be built to Eirgrid specifications.

4.8.2.2 Temporary Construction Compound

The temporary construction compound adjacent to the proposed onsite 110kV substation will be constructed as outlined above in Section 4.8.1.5.

4.8.2.3 Underground Cabling Trench

The underground cabling works will consist of the installation of ducts in an excavated trench to accommodate power cables, and a fibre communications cables to allow communications between the proposed 110kV onsite substation and the existing 110kV Killonan substation.

The Proposed Grid Connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000, as amended, from Tipperary County Council and Limerick County Council. A Traffic Management Plan (TMP) (Appendix 15-2 of this EIAR) will be agreed with the local authority prior to the commencement of the development where required. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with the local authority in advance of the works commencing.

The underground grid connection will be a single circuit connection consisting of 3 no. 110mm diameter HDPE power cable ducts and 1 no. 110mm diameter HDPE communications duct to be installed in an excavated trench, typically 825mm wide by 1,315mm deep. For trench designs there will be variations on the design to adapt to service crossings and watercourse crossings.

The underground electrical cabling will be laid beneath the surface of the Proposed Project site and the public road using the following methodology:

- Before works commence, updated surveying will take place along the proposed cable route, with all existing culverts identified. All relevant bodies i.e. ESB, Uisce Éireann Tipperary County Council, Limerick County Council etc. will be contacted and all up to date drawings for all existing services sought.
- When the cable is located on public roads, a traffic management plan will be prepared prior to any works commencing. A road opening licence will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- A tracked 360-degree excavator will then proceed to dig out the proposed trench, typically to a depth of 1315mm, within which the ducts will be laid.
- The cable ducts will be concrete surrounded where they pass under the public road and under drains or culverts.
- Trench supports will be installed, or the trench sides will be benched or battered back where appropriate and any ingress of ground water will be removed from the trench using submersible pumps, fitted with appropriate silt filtration systems, to prevent contamination of any watercourse.
- Once the trench has been excavated, a base-layer will be laid and compacted, comprising Clause 804, or 15 Newton CBM4 concrete as required.
- The ducting will be installed as per specification, with couplers fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions, the ends of the ducts will be shimmed up off of the bed of the trench, to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected. Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- As the works progress, the as-built location of the ducting will be recorded using a total station or GPS.
- As per the associated base-layer (Clause 804 material or 15 Newton CBM4 concrete) will be installed and compacted as per approved detail, with care not to displace the ducting.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the ducting.
- The remainder of the trench will be backfilled in two compacted layers with approved engineer's specified material.

- Yellow marker warning tape will be installed across the width of the trench, at 300mm depth,
- The finished surface is to be reinstated, as per original specification. Off-road cabling may be finished with granular fill to facilitate access to the trench for any potential maintenance that is required during the operational phase of the Proposed Project.
- Marker posts will then be placed at regular intervals (generally at joint bays and any change in direction) to denote the location of the underground power cables.

4.8.2.4 Existing Underground Services

The location and avoidance of existing underground services (e.g. watermains, other underground electricity cables, fibre broadband etc.) was a key consideration in determining the position and alignment of the Proposed Grid Connection underground electricity cabling route. However, notwithstanding this consideration, in order to facilitate the installation of an underground grid connection, it may be necessary to relocate existing underground services such as water mains or existing cables. In advance of any construction activity, the contractor will undertake additional surveys of the proposed route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

If existing low voltage underground cables are found be present, a trench will be excavated, and new ducting and cabling will be installed along the new alignment and connected to the network on either end. The trench will be backfilled with suitable material to the required specification. Warning strip and marking tape will be laid at various depths over the cables as required. Marker posts and plates will be installed at surface level to identify the new alignment of the underground cable, the underground cables will then be re-energised.

In the event that water mains are encountered the water supply will be turned off by the utility so work can commence on diverting the service. The section of existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the utility standards.

4.8.2.5 Joint Bays

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. Joint Bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible. During construction the joint bay locations will be completely fenced off once they have been constructed they will be backfilled until cables are being installed. Once the cabling is installed the joint bays will be permanently backfilled with the existing surface re-instated and there will be no discernible evidence of the joint bay on the ground.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the onsite 110kV substation and the existing 110kV Killonan substation. Earth Sheath Link Chambers are also required approximately every second joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, installed in a flat formation, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will be pre-cast concrete structures with an access cover at finished surface level. The locations of the joint bays and chambers are shown on the site layout drawings included in Appendix 4-1 of this EIAR. Standard joint bay and comms chamber details are shown in Figures 4-21 and 4-22.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers within the curtilage of the public road is subject to approval by ESBN and Eirgrid.

4.8.2.6 Underground Cable Watercourse Crossing

There is 23 no, identified EPA/OSI mapped watercourse, along the Proposed Grid Connection underground electrical cabling route. Please see Table 4-4 below for details on the watercourse crossing types and proposed directional drilling construction methodology for the crossing.

The directional drilling construction methodology for this crossing has been designed to eliminate the requirement for in-stream works or the construction of any clearspan crossing structure at this location.

4.8.2.6.1 *Horizontal Directional Drilling*

Horizontal Directional Drilling (HDD) is a method of drilling under obstacles such as bridges, culverts, railways, watercourses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible.

The HDD method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

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

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

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. Sufficient controls and monitoring will be put in place during drilling to prevent frack-out, such as the installation of casing at entry points where reduced cover and bearing pressure exits. The directional drilling methodology is further detailed in Figure 4-26.

4.8.2.7 Underground Culvert/Service Crossings

A general description of the various construction methods employed at culvert/ drain/service crossings are described in the following sections below.

In the event that an unidentified existing culvert/service crossing is located during the construction phase, the most appropriate proposed crossing methodology, as outlined below, will be used to traverse the culvert/service depending on culvert/service type, depth, size and local ground conditions.

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

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

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled "*Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites*", and these guidelines will be adhered to during the construction of the Proposed Project.

In the event that none of the above methods are appropriate, directional drilling, as described in Section 4.8.2.6.1 above, will be utilised.

4.8.2.7.1 *Crossing Using Standard Trefoil Formation Over – Option A*

Where adequate cover exists above a culvert/service or where a new bottomless box culvert or clear-span structure has been installed at a sufficient depth, the standard ESB approved trefoil arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert. The cable trench will pass over the culvert in a standard trench, as shown in Figure 4-23.

4.8.2.7.2 *Flatbed Formation Under– Option B*

Where cable ducts are to be installed under an existing watercourse or service crossing where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench, the depth of which will be determined by the location of the top of the obstacle or the depth of excavatable material under it. The ducts will be laid in this trench in a flatbed formation under the existing culvert/ service and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification as shown in Figure 4-24.

4.8.2.7.3 *Flatbed Formation over– Option C*

Where cable ducts are to be installed over a culvert or service crossing where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the obstacle or the depth of excavatable material over it. The ducts will be laid in this trench in a flatbed formation over the existing culvert and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification as shown in Figure 4-25.

Table 4-4 Proposed Watercourse Crossing Types

Crossing No.	Watercourse Type	Width of Channel (m)	Cover from Road Level to Top of Culvert (m)	Crossing Type Description	Watercourse Crossing Type	Extent of in-channel works
WC 1 (EPA Mapped WC – Groody River)	Stone Culvert	6	0.5	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 2 (EPA Mapped WC – Whitehall Stream)	Drain (no evidence of flow)	n/a	n/a	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 3 (EPA Mapped WC – Keyanna Stream)	Drain (no evidence of flow)	n/a	n/a	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 4(EPA Mapped WC –Kisyquirk)	Drain (no evidence of flow)	n/a	n/a	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 5(EPA Mapped WC –Killinure)	Stone Arch Bridge	1.75	0.4	Horizontal Directional Drilling	D	None. No in-stream works required.
WC 6 (EPA Mapped WC –Mulkear)	Stone Arch Bridge –	12	0.75	Horizontal Directional Drilling	D	None. No in-stream works required.

Crossing No.	Watercourse Type	Width of Channel (m)	Cover from Road Level to Top of Culvert (m)	Crossing Type Description	Watercourse Crossing Type	Extent of in-channel works
	Brittas Bridge - Protected					
WC 7 (EPA Mapped – Douglasha WC)	Stone Culvert	n/a	n/a	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 8 (EPA Mapped – Turagh WC)	Stone Arch Bridge	2.0	0.75	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 9 (EPA Mapped – Dooglasha WC)	Stone Culvert	n/a	n/a	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 10 (EPA Mapped – Bilboa WC)	Stone Arch Bridge (Protected)	20m (9.5:11)	1.1	Horizontal Directional Drilling	D	None. No in-stream works required.
WC 11 (EPA Mapped – Bilboa WC)	Stone Culvert	20	1.25	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 12 (EPA Mapped –	Stone Culvert	1.2	1.0	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.

Crossing No.	Watercourse Type	Width of Channel (m)	Cover from Road Level to Top of Culvert (m)	Crossing Type Description	Watercourse Crossing Type	Extent of in-channel works
Ballycoshown WC)						
WC 13 (EPA Mapped – Bottle Hill WC)	Stone Culvert	1.2	0.8	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 14 (EPA Mapped – Doon WC)	Stone Culvert	2.1	0.95	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 15 (EPA Mapped – Doon WC)	Roadside Pipe feeding into stream	n/a	n/a	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 16 (EPA Mapped – Lisgaugh WC)	Stone Culvert	n/a	n/a	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 17 (EPA Mapped – Cahermahallia WC)	Stone Arch Bridge (Cahermahallia Bridge)	4.0	0.8	Horizontal Directional Drilling	D	None. No in-stream works required.
WC 18 (EPA Mapped –	Stone Culvert	0.8	0.5	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.

Crossing No.	Watercourse Type	Width of Channel (m)	Cover from Road Level to Top of Culvert (m)	Crossing Type Description	Watercourse Crossing Type	Extent of in-channel works
Moher West WC)						
WC 19 (EPA Mapped – Toem WC)	Stone Arch Bridge (Toem)	1.9	0.9	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 20 (EPA Mapped – Druminda WC)	Stone Culvert	n/a	n/a	Flatbed Formation under Bridges/Culverts	C	None. No in-stream works required.
WC 21 (EPA Mapped – Cappawhite WC)	Stone Culvert	1.4	0.5	Flatbed Formation over Bridges/Culverts	C	None. No in-stream works required.
WC 22 (EPA Mapped – Multeen WC)	Stone Arch Bridge (Ironmills, protected)	n/a	n/a	Horizontal Directional Drilling	D	None. No in-stream works required.
WC 23 (EPA Mapped – Scarrough WC)	Stone Arch Bridge (Scarrough, protected)	6.0	0.45	Horizontal Directional Drilling	D	None. No in-stream works required.

4.9 Operation

The Proposed Wind Farm is expected to have a lifespan of approximately 35 years. As part of the Proposed Wind Farm site planning application, permission is being sought for a 35-year operation period commencing from the date of full operational commissioning of the Proposed Wind Farm. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding by means of meteorological equipment and control systems to changes in wind speed and direction.

The wind turbines will be connected together and data relayed from the wind turbines to a central control unit at the on-site substation which will facilitate off-site remote monitoring of the wind farm. Each turbine will be monitored off-site by the appointed Operations and Maintenance contractor (typically the wind turbine manufacturer) and also a wind farm operations management company. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored off-site by both parties 24-hours per day. Regular on-site visual inspections will also be carried out by the wind farm operations management company.

Certain Proposed Wind Farm site components will be subject to routine and periodic maintenance. Each turbine would be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition there is often a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically maintenance traffic will consist of four-wheel drive vehicles or vans. The site roads will also require periodic maintenance.

4.10 Decommissioning

The wind turbines proposed as part of the Proposed Project are expected to have a lifespan of approximately 35 years. Following the end of the operational life of the wind farm, the wind turbines may be retained and the operational life extended or replaced with a new set of turbines, subject to planning permission being obtained. In the event that neither of the above options are implemented, the Proposed Wind Farm will be decommissioned fully as agreed with the Planning Authority. The onsite substation will remain in place as it will be under the ownership of the ESB and will form a permanent part of the national electricity grid.

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

The underground electrical cabling connecting the turbines to the on-site substation will be removed from the cable ducts. The cabling will be pulled from the cable ducts using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at the original cable jointing pits which will be excavated using a mechanical excavator and will be fully re-instated once the cables are removed. The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance. The cable materials will be transferred to a suitable recycling or recovery facility.

All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in unnecessary environment emissions such as noise, dust and/or vibration.

Site roadways could be in use for purposes other than the operation of the Proposed Wind Farm by the time the decommissioning of the Proposed Wind Farm is to be considered, and therefore it may be more appropriate to leave the Site roads in situ for future use. It is envisaged that the roads will provide a useful means of transport as agricultural/forestry roads for the pastoral farming/commercial forestry on the Site.

The underground grid connection cabling and on-site substation will remain in place as it will be under the ownership and control of the ESB and Eirgrid.

A Decommissioning Plan has been prepared and included as Appendix 4-6 of this EIAR, which will be agreed with the local authority prior to any decommissioning. The plan provides details of the methodologies that will be adopted, throughout decommissioning, the environmental controls that will be implemented, the Emergency Response Procedure to be adopted, methods for reviewing compliance and an indicative programme of decommissioning works.

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 have been assessed in this 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".*