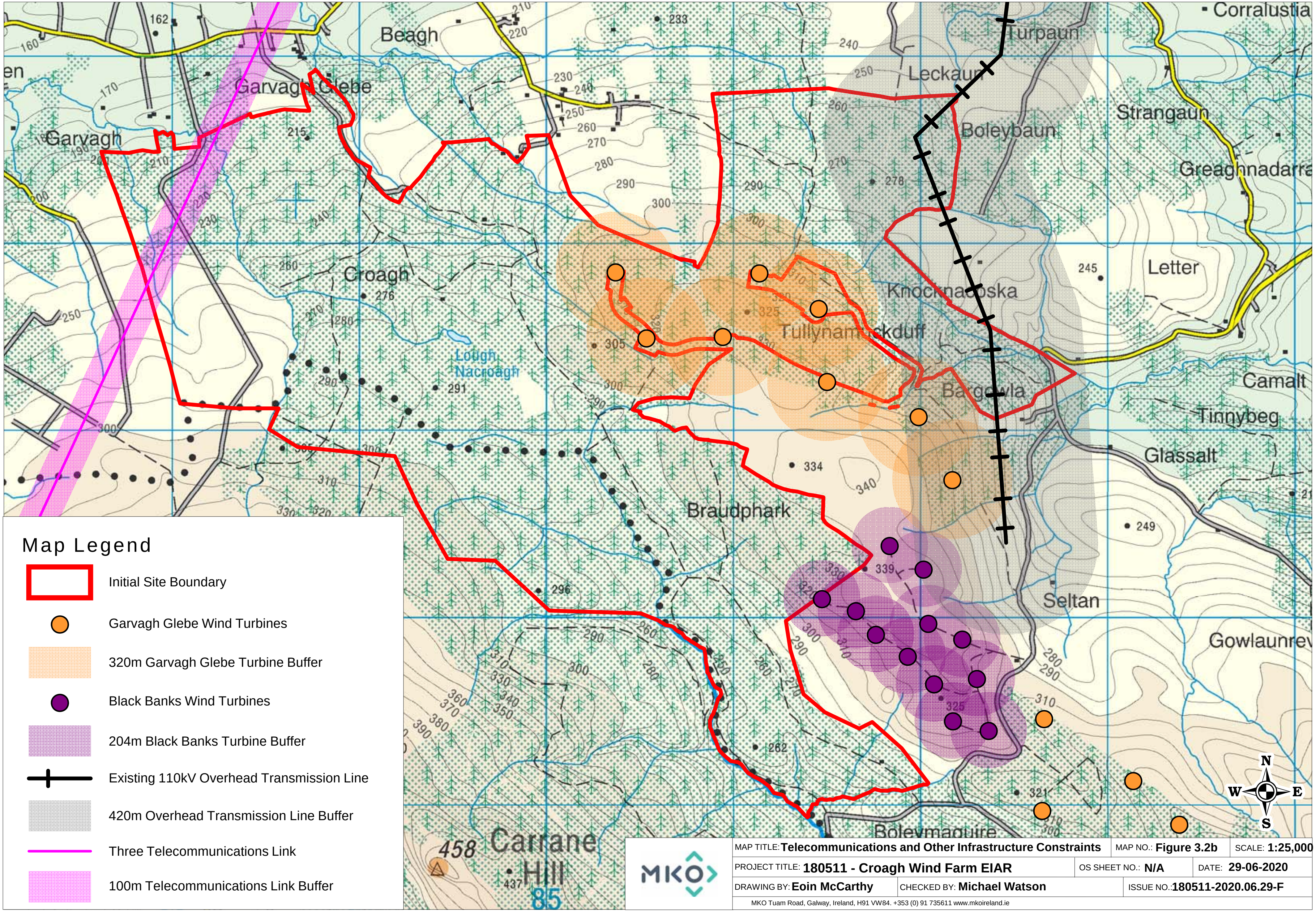

Map Legend
Initial Site Boundary
Garvagh Glebe Wind Turbines
320m Garvagh Glebe Turbine Buffer
Black Banks Wind Turbines
204m Black Banks Turbine Buffer
Existing 110kV Overhead Transmission Line
420m Overhead Transmission Line Buffer
Three Telecommunications Link
100m Telecommunications Link Buffer
Corralustia
Beagh
Turpaun
Leckaun
Garvagh Glebe
Garvagh
Boleybaun
Strangaun
Greaghnadarra
Croagh
Letter
Knocknaboska
Tullynamackduff
Lough Nacroagh
Bargowla
Camalt
Tinnybeg
Glassalt
Braudphark
Seltan
Gowlaunrev
Bolevmaguire
Carrane Hill
MKO
MAP TITLE: Telecommunications and Other Infrastructure Constraints
MAP NO.: Figure 3.2b
SCALE: 1:25,000
PROJECT TITLE: 180511 - Croagh Wind Farm EIAR
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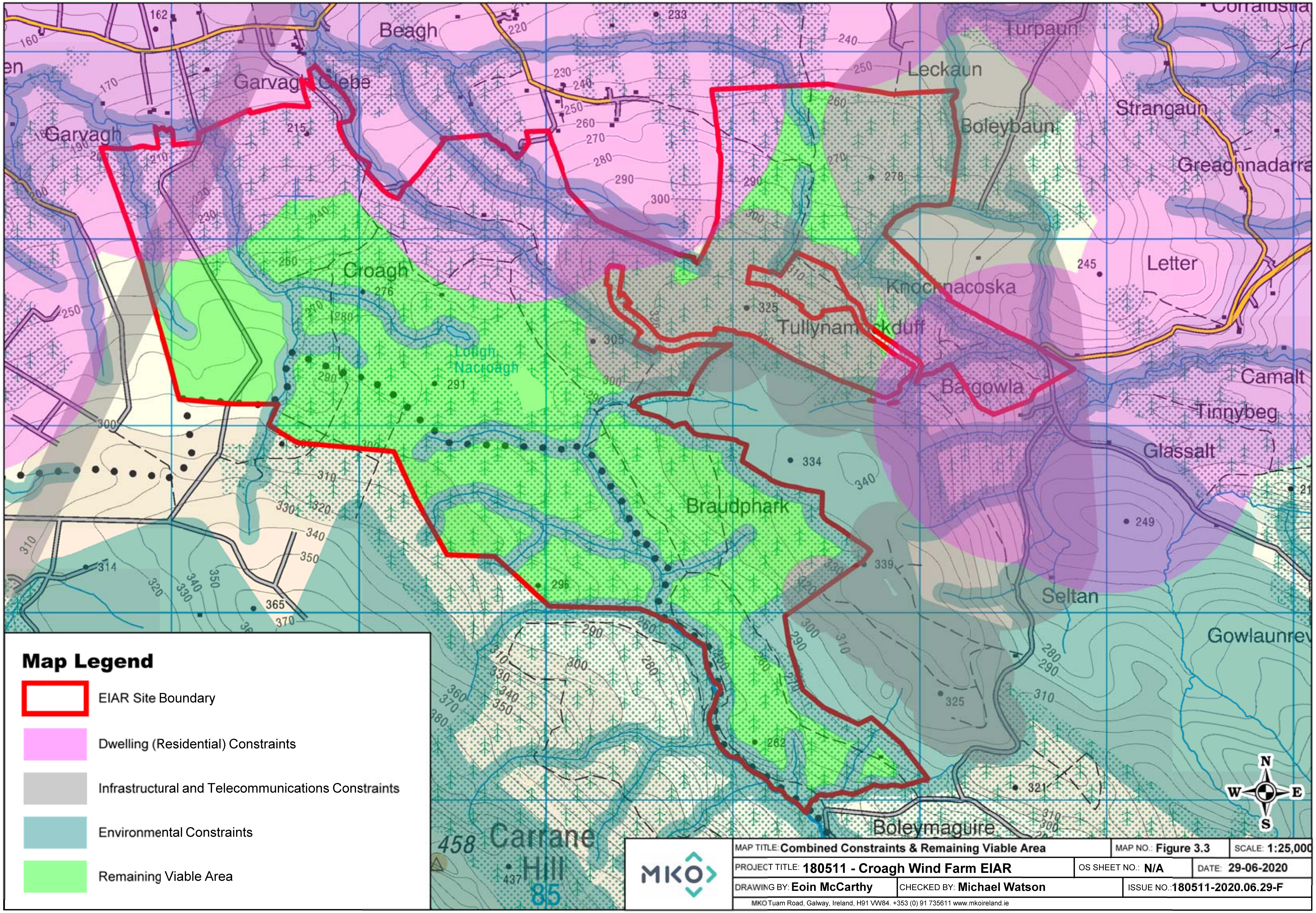
Beagh
Garvagh Glebe
Garvagh
Turpaun
Leckaun
Boleybaun
Strangaun
Greaghnadarra
Croagh
Lough Nacroagh
Knocknacoska
Tullynamackduff
Letter
Bargowla
Camalt
Tinnybeg
Glassalt
Braudphark
Seltan
Gowlaunrev
Carrane Hill
Boleymaguire
Map Legend
EIAR Site Boundary
Dwelling (Residential) Constraints
Infrastructural and Telecommunications Constraints
Environmental Constraints
Remaining Viable Area
MAP TITLE: Combined Constraints & Remaining Viable Area
MAP NO.: Figure 3.3
SCALE: 1:25,000
PROJECT TITLE: 180511 - Croagh Wind Farm EIAR
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ruled out of consideration. The turbine layout for the proposed wind farm was also informed by wind data and the results of noise assessments as they became available.

3.5.2 Turbine Layout

The final proposed turbine layout takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on a combination of the results of all site investigations that have been carried out during the EIAR process and the community engagement process that began in June 2018. As information regarding the site of the proposed development was compiled and assessed, the proposed layout has been revised and amended to take account of the physical constraints of the site and the requirement for buffer zones and other areas in which no turbines could be located, as well as cumulative impacts.

The selection of turbine number and layout has also had regard to wind-take, noise and shadow flicker impacts and the separation distance to be maintained between turbines. The EIAR and wind farm design process was an iterative process, where findings at each stage of the assessment were used to further refine the turbine layout, always with the intention of minimising the potential for environmental impacts.

There were a number of reviews of the specific locations of the various turbines during the optimisation of the site layout. The initial constraints study identified a significant viable area within the overall study area, suitable for approximately 10 no. turbines. The initial turbine layout, shown in Figure 3-4, occupied the viable area within the wider study area, however the proposed turbine layout was refined following feedback from the project team, applicant and local residents. The chosen turbine layout is considered optimal as the alternative, earlier iterations of the layout had the potential for greater environmental effects in relation to shadow flicker, noise, habitat loss and visual amenity.

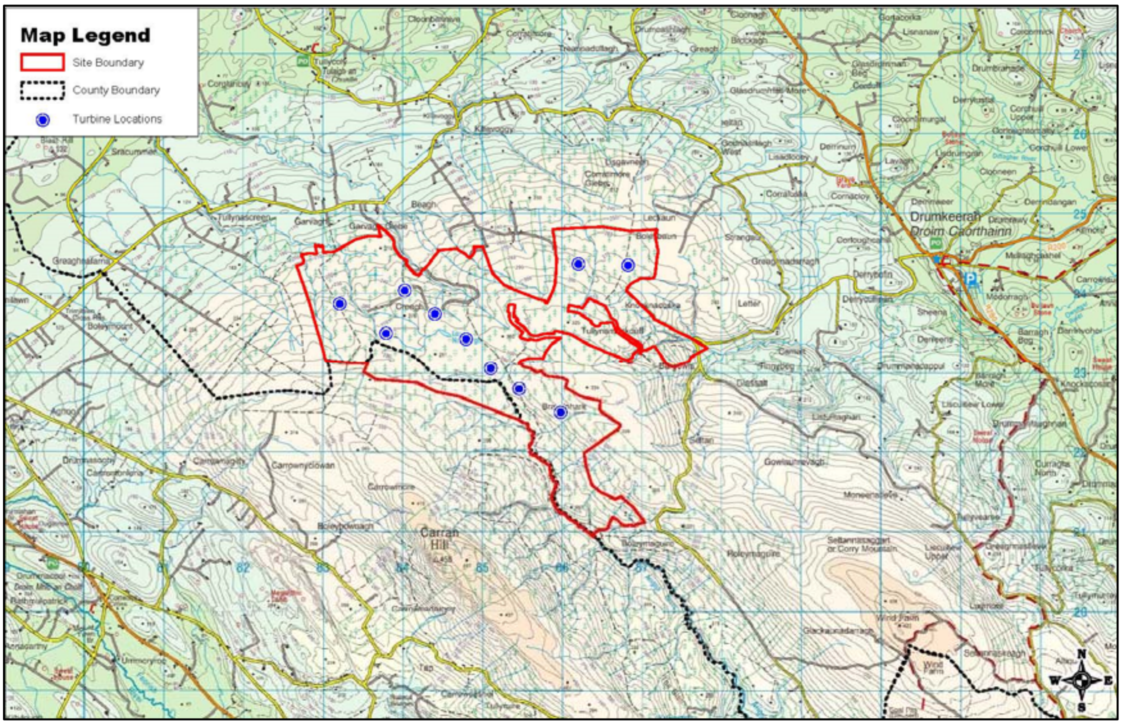


Figure 3-4 Initial Turbine Layout

The first iteration of the turbine layout, shown in Figure 3-5, involved rotating the axis of the two turbines to the northeast from an east-west to a north-south orientation. This achieved a greater separation distance from the nearest residential dwellings. However, this iteration of the proposed turbine layout, in combination with the existing Garvagh Glebe Wind Farm would have left the nearest residential dwellings with turbines to their east, west and south. This version of the layout had the potential for significant adverse effects in relation to noise, shadow flicker and visual amenity.

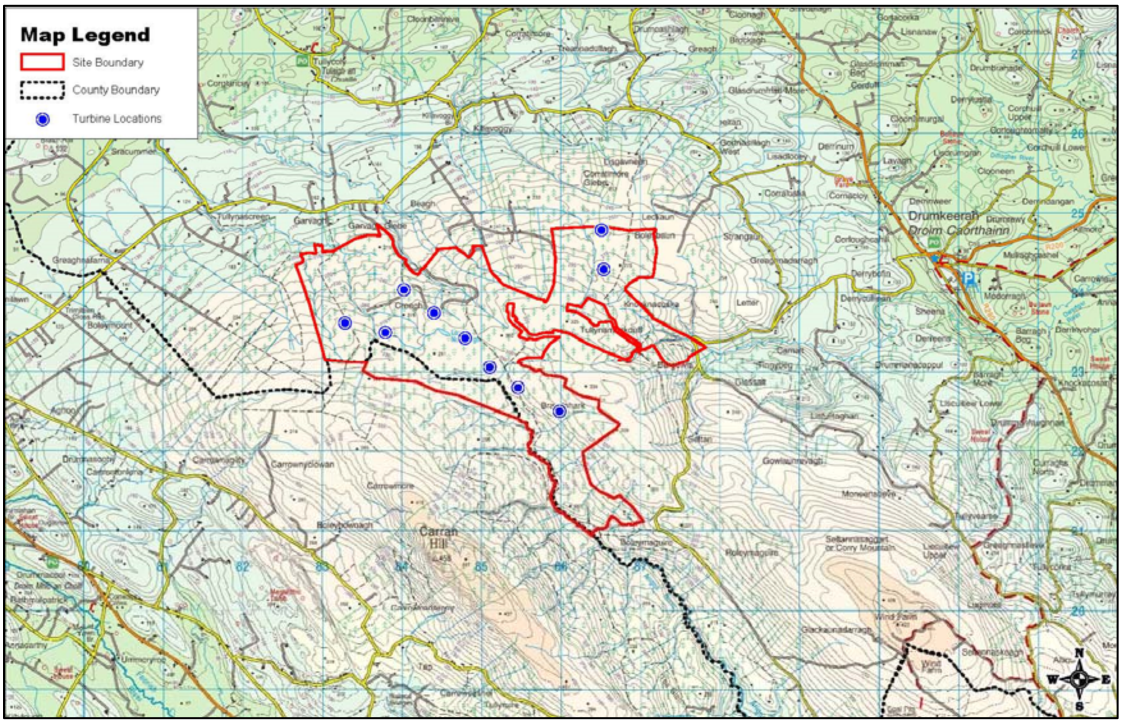


Figure 3-5 First Iteration of the Turbine Layout

The second and final iteration of the proposed turbine layout, illustrated in Figure 3-6 below, saw the relocation of the two north-eastern turbines to subsequently identified, suitable locations to the southwest of the other 8 no. turbine locations. The relocation of these turbines further increased the separation distance between the proposed turbine locations and the nearest residential dwelling, thereby reducing the potential for noise and shadow flicker effects and gave rise to a more visually coherent turbine layout (visual amenity) amalgamating the two turbine clusters in to a single cluster. The relocation of these turbines also reduced the potential for increased habitat loss by decreasing the size of the overall development footprint . For these reasons, this iteration of the turbine layout was the preferred option. The second and final iteration of the turbine layout involved some very minor micrositing of turbine locations based on the rigorous assessment of local ground conditions until the final turbine locations were adopted for the planning application.

It was also at this point that the site boundary for the purposes of the EIAR was defined. The initial site boundary was amended to focus on the final iteration of the turbine layout, the chosen grid connection route (refer to Section 3.5.4.3 below) and the construction access route for the proposed development (refer to Section 3.6.2 below).

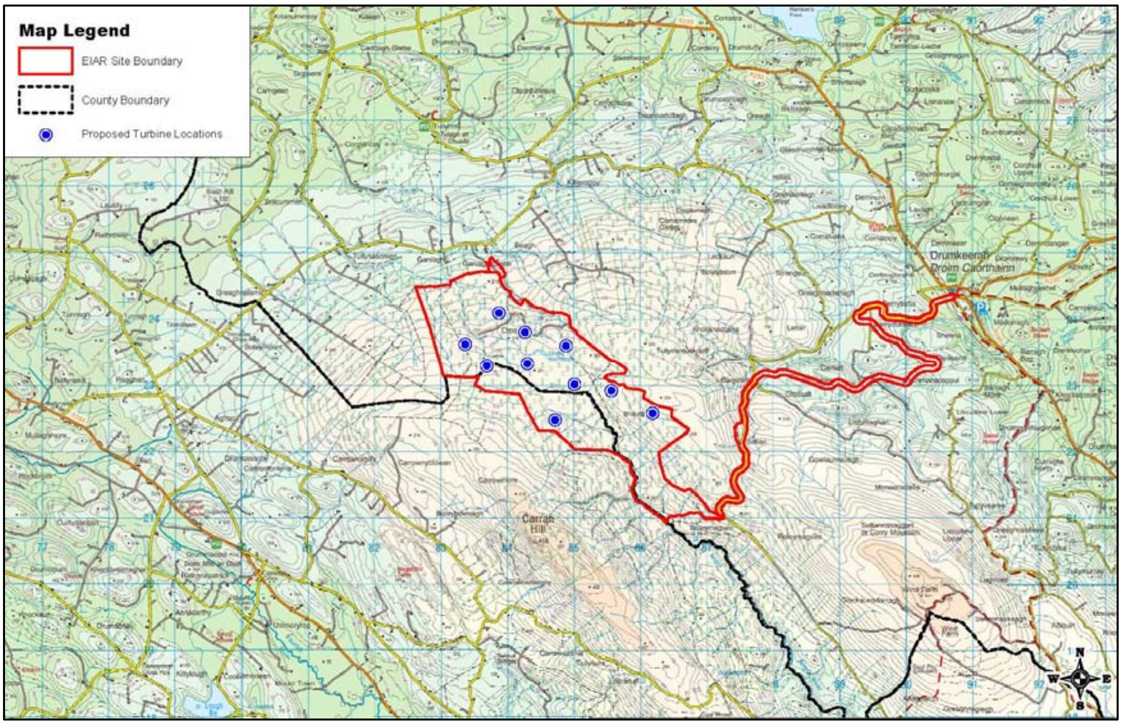


Figure 3-6 Second and Final Iteration of the Turbine Layout

A comparison of the potential environmental effects of initial and first iterations of the turbine layout when compared against the second and final turbine layout are presented in Table 3-4 below.

Table 3-4 Comparison of environmental effects when compared against the chosen option (final turbine layout)

Environmental Consideration	Initial Layout	First Iteration
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health. Potential for increased shadow flicker duration at nearby sensitive receptors.	No material environmental difference for population or human health. Potential for increased shadow flicker duration at nearby sensitive receptors.
Biodiversity & Ornithology	No significant environmental difference for either biodiversity or birds. Larger development footprint linked to additional road infrastructure being required,would lead to an increase in habitat loss however this would have occurred within the constrained out area i.e. viable area.	No significant environmental difference for either biodiversity or birds. Larger development footprint would lead to an increase in habitat loss however this would have occurred within the constrained out area i.e. viable area.
Land, Soils & Geology	Larger development footprint would lead to an increase in peat and spoil volumes to be	Larger development footprint would lead to an increase in peat and spoil volumes to be

	excavated and would require more crushed stone to be extracted for construction. Overall, no significant environmental difference.	excavated and would require more crushed stone to be extracted for construction. Overall, no significant environmental difference.
Geotechnical	This layout was amended following more detailed geotechnical investigations to reduce risk of peat instability and reduce the volume of peat and spoil to be managed.	This layout was amended following more detailed geotechnical investigations to reduce risk of peat instability and reduce the volume of peat and spoil to be managed.
Water	The amendment of this layout resulted in reduce risk of peat instability and reduce the volume of peat and spoil to be managed which in turn reduces potential for water quality effects	The amendment of this layout resulted in reduce risk of peat instability and reduce the volume of peat and spoil to be managed which in turn reduces potential for water quality effects
Air & Climate	Neutral	Neutral
Noise & Vibration	Potential for greater noise impacts due to reduced separation distance between turbines and closest sensitive receptors.	Potential for greater noise impacts due to reduced separation distance between turbines and closest sensitive receptors.
Landscape & Visual	Potential for greater visual impacts due to the wider visual extent of the proposed turbines.	Potential for greater visual impacts due to the wider visual extent of the proposed turbines.
Cultural Heritage & Archaeology	No material environmental difference for cultural heritage	No material environmental difference for cultural heritage
Material Assets	Larger development footprint would lead to an increase in construction traffic volumes and traffic impacts across a greater extent of the public road network.	Larger development footprint would lead to an increase in construction traffic volumes and traffic impacts across a greater extent of the public road network.

3.5.3 Road Layout

Access tracks are required onsite in order to enable transport of infrastructure and construction materials within the proposed development. Such tracks must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was decided at an early stage during the design of the proposed development that maximum possible use would be made of existing roadways and tracks where available to minimise the potential for impacts by using new roads as an alternative.

As the overall site layout was finalised, the most suitable routes between each component of the development were identified, taking into account the extensive network of existing roads and the physical constraints of the site. Locations were identified where upgrading of the existing road would be required and where new roads are to be constructed, in order to ensure suitable access to and linkages between the various project elements, and efficient movement around the site.

An alternative option to making maximum use of the existing road network within the site would be to construct a new road network, having no regard to existing roads or tracks. This approach was not favourable, as it would create the potential for additional significant environmental effects to occur in relation to land, soils and geology (increased excavation and aggregate requirements), hydrology (increased number of new watercourse crossings) and biodiversity (increased habitat loss).

A comparison of the potential environmental effects of constructing an entirely new road network when compared against maximising the use of the existing road network is presented in Table 3-5 below.

Table 3-5 Comparison of environmental effects when compared against the chosen option (maximising the use if the existing road network))

Environmental Consideration	New Road Network
Population & Human Health (incl. Shadow Flicker)	Neutral
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss.
Land, Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated and stored. Larger volume of stone required from on-site borrow pit and off-site quarries for road construction.
Geotechnical	Neutral
Water	Larger development footprint and increased number of new watercourse crossings, therefore, increasing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit and off-site quarries. Potential for greater vehicular emissions due to and increased volume of construction traffic.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors during the construction of the new roads.
Landscape & Visual	Potential for greater visual and landscape impacts due to the construction of new roads.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.

3.5.4 Location of Ancillary Structures

The ancillary infrastructure required for the construction and operation of the proposed development include temporary construction compounds, an electricity substation and associated grid connection and borrow pit.

3.5.4.1 Construction Compounds

The two proposed construction compounds will be used for the storage of all construction materials and turbine components. The use of multiple temporary construction was deemed preferable to the alternative of a single large compound at the southern end of the site for a number of reasons. Principally, it will facilitate more efficient construction practices and will result in shorter distances for traffic movements within the site during construction. As a result, vehicle emissions and the potential for dust arising will be reduced.

A comparison of the potential environmental effects of constructing a single, large construction compound when compared against constructing multiple, smaller compounds is presented in Table 3-6 below.

Table 3-6 Comparison of environmental effects when compared against the chosen option (multiple construction compounds)

Environmental Consideration	Single Large Construction Compound
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site which could have adverse health effects.
Biodiversity & Ornithology	Neutral
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to longer distance of traffic movements within the site.
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Less efficient construction practices due to longer movements of construction vehicles, plant and materials within the site.

3.5.4.2 Electricity Substation

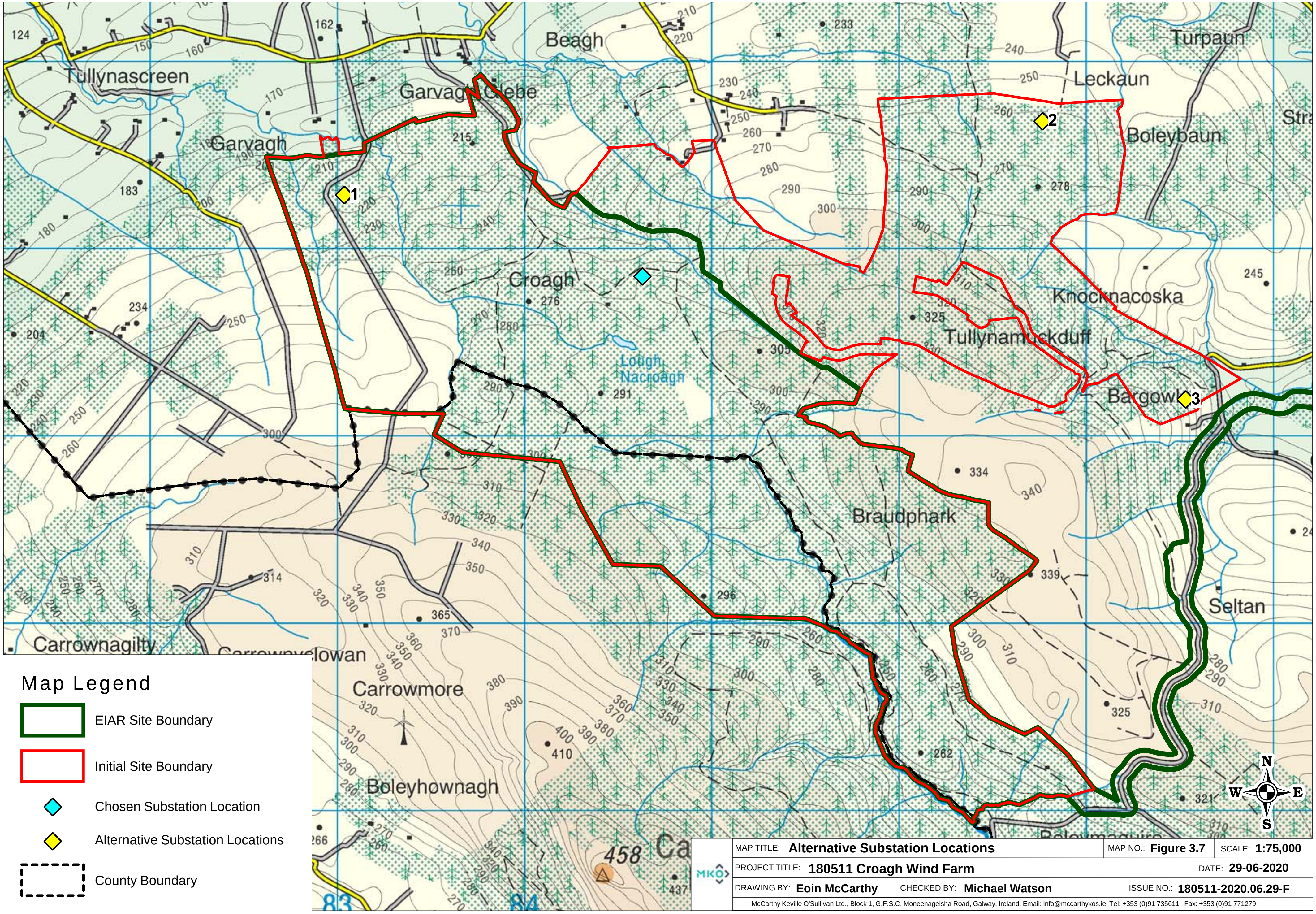
The selection of the location of the on-site substation has had regard to the constraints of the site, outlined in Section 3.6.1 above. Ease of access and minimising distance from turbines were also taken into consideration. It should also be noted that while the operational lifespan of the proposed turbines is expected to be 30 years (following which they may be replaced or decommissioned) the electricity substation and associated infrastructure will become an ESB asset and will be a permanent feature of the proposal as it will be required to continue to form part of the electrical infrastructure of the area in the event of the remainder of the site being decommissioned.

Three alternative substation locations were considered at a very early stage of the design of the proposed development, these locations are shown in Figure 3-7. While these locations would have decreased the required length of the grid connection cabling to the nearest existing substations, the footprint of the proposed development would have increased as existing roads to any of these locations would have required widening and Alternative Locations 2 and 3 would have also required the construction of new roads, thereby resulting in greater habitat loss, increased traffic movements and an increased requirement for construction materials. The length of internal cabling between the turbines and any of these alternative substations would have also increased significantly. The selection of Alternative Locations 1 and 3 would have brought the footprint of the proposed development much closer to residential dwellings (these locations are 392m and 133m from the nearest dwelling respectively whereas the chosen location is over 600m from the closest dwelling), resulting in a potential increase in noise and dust nuisances at these dwellings during construction and a potential increase in noise impacts during operation. All three alternative locations would be more visually exposed to the nearest residential dwellings when compared to the chosen location which is screened by a combination of forestry and topography.

A comparison of the potential environmental effects of the alternative locations when compared against chosen location is presented in Table 3-7 below.

Table 3-7 Comparison of environmental effects when compared against the chosen option

Environmental Consideration	Location 1	Location 2	Location 3
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site which could have adverse health effects.	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site which could have adverse health effects.	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site which could have adverse health effects.
Biodiversity & Ornithology	Increased habitat loss due to the requirement to widen more existing roads.	Increased habitat loss due to the requirement to widen more existing roads and construction of additional new roads.	Increased habitat loss due to the requirement to widen more existing roads and construction of additional new roads.
Land, Soils & Geology	Increased volume of peat and spoil to be excavated due to larger development footprint.	Increased volume of peat and spoil to be excavated due to larger development footprint.	Increased volume of peat and spoil to be excavated due to larger development footprint.



MAP TITLE: Alternative Substation Locations		MAP NO.: Figure 3.7	SCALE: 1:75,000
PROJECT TITLE: 180511 Croagh Wind Farm			DATE: 29-06-2020
DRAWING BY: Eoin McCarthy	CHECKED BY: Michael Watson		ISSUE NO.: 180511-2020.06.29-F

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Geotechnical	Neutral	Neutral	Neutral
Water	Requirement for the upgrade of additional watercourse crossings.	Requirement for the upgrade of additional watercourse crossings and the construction of additional new watercourse crossings.	Requirement for the upgrade of additional watercourse crossings and the construction of additional new watercourse crossings.
Air & Climate	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site
Noise & Vibration	Potential for increased noise impacts during construction and operational phases on nearby sensitive receptors due to location being closer to nearby sensitive receptors.	Neutral	Potential for increased noise impacts during construction and operational phases on nearby sensitive receptors due to location being closer to nearby sensitive receptors.
Landscape & Visual	Location is potentially more visually exposed to the nearest residential dwellings.	Location is potentially more visually exposed to the nearest residential dwellings.	Location is potentially more visually exposed to the nearest residential dwellings.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.

3.5.4.3 Grid Connection

A key consideration in determining the grid connection method for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line. While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. For this reason, it was considered that underground lines would be a preferable alternative to overhead lines. The draft Wind Energy Guidelines 2019 also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid.

The output of the windfarm is such that it needs to connect to a 110kV substation. There are 3 no. existing 110kV electricity substations located within 10km of the proposed development site, namely:

- Garvagh 110kV Electricity Substation
- Shrananagh 110kV Electricity Substation
- Corderry 110kV Electricity Substation

Therefore, an underground grid connection cabling route to each of these existing substations was considered and assessed in order to determine which route would be brought forward as part of the planning application. The three routes are shown in Figure 3-8 and are detailed below.

Option A is an underground grid connection cabling route, connecting the proposed onsite electricity substation to the existing Garvagh substation. The Garvagh substation is located approximately 3km southeast of the proposed onsite substation. The grid connection cabling route runs entirely along a combination of forestry and public roads. The cabling route measures approximately 6.2km in length.

Option B is an underground cabling route connecting the proposed onsite substation to the existing Shrananagh substation. The Shrananagh substation is located 9.9km northwest of the proposed onsite substation. This grid connection cabling route runs approximately 2.1km of forestry roads, 10.2km of public roads and includes 1.7km off road section over which a new access road would need to be constructed. The cabling route measures approximately 14km in length.

Option C is an underground cabling route connecting the proposed onsite substation to the existing Corderry substation which is located approximately 4.6km northeast of the proposed onsite substation. This cabling route runs along approximately 3km of forestry roads, 1.6km of private access tracks, 2.1km of public road and includes a 800m off road section over which a new access track would need to be constructed. The cabling route measures approximately 7.5km in length.

Grid Connection Option A is shorter than Options B and C and is also located within or alongside existing roads for its entire length. Options B and C have approximately 1km and 450m of off road sections, respectively, along which new roads would be required to be constructed, resulting in a larger development footprint and therefore increased volumes of peat and spoil to be excavated and managed and increased habitat loss.

Unlike Options B and C, there are no residential dwellings located along Grid Connection Route A. Therefore, Option A has the least potential to cause adverse impacts to local traffic or environmental nuisances to local residents in relation to noise, dust or vehicular emissions.

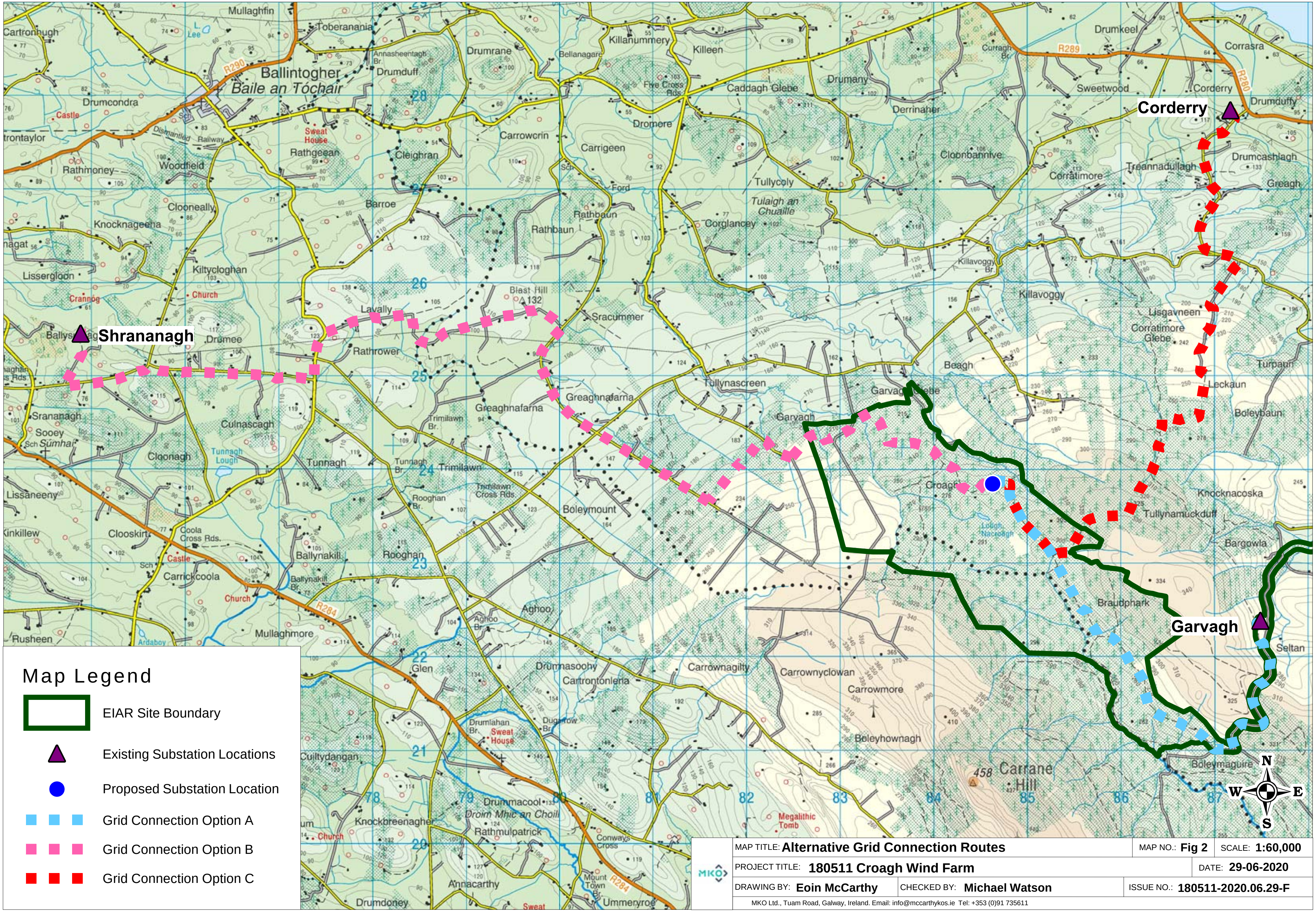
Option A is located entirely within lands under the control of the applicant whereas sections of Options B and C are located within third-party landholdings for which consent would be required if either of these options were to be included in the planning application for the proposed development.

Based on the environmental and land availability considerations outlined above, Grid Connection Option A was the most favoured option of those considered.

A comparison of the potential environmental effects of the alternative grid connection cabling routes when compared against the chosen option (option A) is presented in Table 3-8 below.

Table 3-8 Comparison of environmental effects when compared against the chosen option (Option A)

Environmental Consideration	Option B	Option C
Population & Human Health (incl. Shadow Flicker)	Potential for increased dust emissions from excavations and traffic movements along sections	Potential for increased dust emissions from excavations and traffic movements along sections


Corderry
Shrananagh
Garvagh
Ballintogher
Baile an Tóchair
Carrane Hill
Map Legend
EIAR Site Boundary
Existing Substation Locations
Proposed Substation Location
Grid Connection Option A
Grid Connection Option B
Grid Connection Option C
MAP TITLE: Alternative Grid Connection Routes
MAP NO.: Fig 2
SCALE: 1:60,000
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	of public road with residential dwellings either side, during the construction phase which could have adverse health effects.	of public road with residential dwellings either side, during the construction phase which could have adverse health effects.
Biodiversity & Ornithology	Increased habitat loss due to the requirement to construct new lengths of roads where the cable route is currently 'off-road',	Increased habitat loss due to the requirement to construct new lengths of roads where the cable route is currently 'off-road',
Land, Soils & Geology	Increased volume of peat, spoil and tar to be excavated due to longer route and the requirement for new roads along certain sections of the route.	Increased volume of peat, spoil and tar to be excavated due to longer route and the requirement for new roads along certain sections of the route.
Geotechnical	Neutral	Neutral
Water	Longer route would require more watercourse crossings which would increase the potential for silt-laden runoff and hydrocarbons to enter receiving watercourses.	Longer route would require more watercourse crossings which would increase the potential for silt-laden runoff to enter receiving watercourses. An off-road section of the route runs parallel and adjacent to the bank of a stream. The construction of a cable trench with in a new road along this section would also increase the potential for silt-laden runoff and hydrocarbons to enter the receiving watercourse.
Air & Climate	Potential for increased vehicular and dust emissions traffic movements along the cable route.	Potential for increased vehicular and dust emissions traffic movements along the cable route.
Noise & Vibration	Potential for increased noise and vibration nuisances during construction phase on sensitive receptors (residential dwellings) located along the public road sections of the cable route.	Potential for increased noise and vibration nuisances during construction phase on sensitive receptors (residential dwellings) located along the public road sections of the cable route.
Landscape & Visual	Neutral	Neutral
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development	Potential for greater traffic volumes during construction phase due to larger development

	footprint and requirement for more construction materials. As part of the cable route has residential dwellings located along it, there would be an increased potential for impacts on existing underground services and utilities.	footprint and requirement for more construction materials. As part of the cable route has residential dwellings located along it, there would be an increased potential for impacts on existing underground services and utilities.

3.5.4.4 Borrow Pit

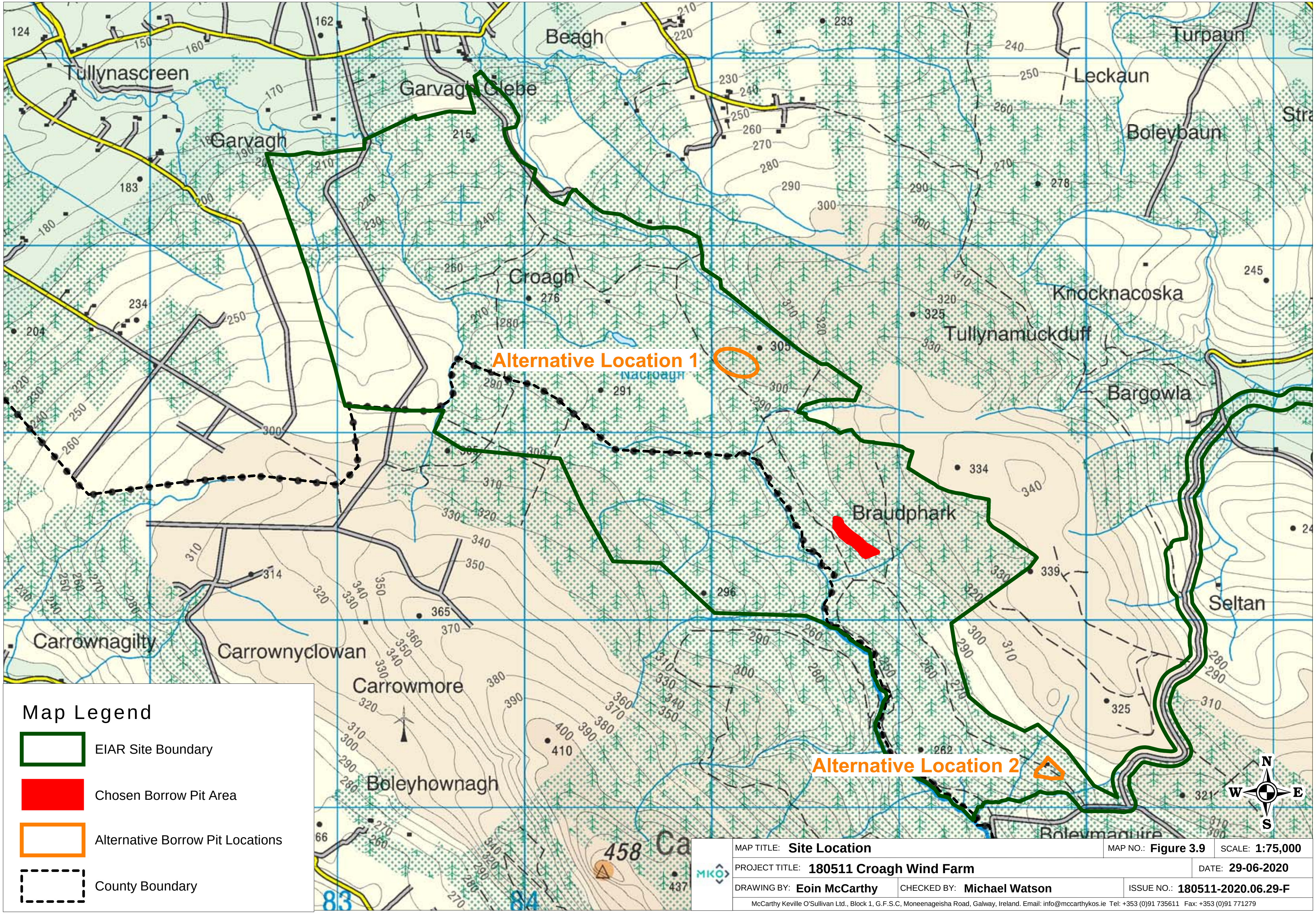
The majority of material required for the construction of access roads and turbine bases will be obtained from one borrow pit onsite which will be located approximately 430m to the west of Turbine No. 9. The use of an onsite borrow pit represents an efficient use of existing onsite resources and eliminates the need to transport large volumes of construction materials along the local public road network to the site. The location for the borrow pit was identified taking into account the site characteristics, including topography, ground conditions, habitat type and surface water features.

Two alternative potential borrow pit locations were considered during the design phase of the proposed development. These alternative locations are shown in Figure 3-9. Each potential location had regard to the constraints of the site, outlined in Section 3.6.1 above and was subject to detailed geotechnical site investigations that are outlined in Appendix 8.1 of this EIAR. The proposed borrow pit location was selected due to the presence of competent or usable rock at an acceptable level below existing surface level. Developing borrow pits at the other locations would result in a significant increase in the volumes of peat and spoil to be excavated in order to access the usable rock underneath and therefore much higher volumes of excavated material that would need to be managed onsite. The excavation of such increased volumes of peat and spoil has the potential to lead to adverse environmental effects in relation to peat instability and dust emissions.

A comparison of the potential environmental effects of the alternative borrow pit locations when compared against chosen location is presented in Table 3-9 below.

Table 3-9 Comparison of environmental effects when compared against the chosen option (chosen borrow pit area)

Environmental Consideration	Location 1	Location 2
Population & Human Health (incl. Shadow Flicker)	Neutral	Neutral
Biodiversity & Ornithology	Neutral	Neutral
Land, Soils & Geology	Increased volume of peat and spoil to be excavated and managed in order to get to usable rock.	Increased volume of peat and spoil to be excavated and managed in order to get to usable rock.
Geotechnical	The increased volume of peat and spoil that would be required to be excavated and managed could lead to peat instability.	The increased volume of peat and spoil that would be required to be excavated and managed could lead to peat instability.
Water	Neutral	Neutral



MAP TITLE: Site Location		MAP NO.: Figure 3.9	SCALE: 1:75,000
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Air & Climate	Potential increase in dust emissions due to increased volumes of peat and spoil to be excavated.	Potential increase in dust emissions due to increased volumes of peat and spoil to be excavated.
Noise & Vibration	Neutral	Neutral
Landscape & Visual	Neutral	Neutral
Cultural Heritage & Archaeology	Neutral	The development of a borrow pit at this location would have required the demolition of a derelict house which could potentially have an adverse impact on cultural heritage.
Material Assets	Neutral	Neutral

While a certain volume of more durable, crushed stone for the finished surface layer of site roads and hardstanding areas will be sourced from fully authorised, local quarries, an alternative to using an on-site borrow pit was the option of sourcing of all stone and hardcore materials from a licensed quarry or quarries in the vicinity of the site. The movement of the volume of material required for the construction of 10 no. turbine wind farm would result in a significant increase in construction traffic and heavy loads, in combination with a potential for an increase in noise and dust emissions along the haul routes, and was therefore considered a less preferable option.

3.6 Alternative Transport Route

Wind turbine components (blades, nacelles and towers) are not manufactured in Ireland and therefore must be imported from overseas and transported overland to the site of a proposed development. With regard to the selection of a transport route to the proposed development site, alternatives were considered in relation to turbine components, general construction-related traffic, and site access locations.

3.6.1 Port of Entry

The alternatives considered for the port of entry of wind turbines into Ireland for the proposed development include Dublin Port and the Port of Galway. Dublin Port is the county's principal seaport catering for approximately two-thirds of Ireland's port traffic. The Port of Galway also offers a roll-on roll-off procedure to facilitate import of wind turbines. Both ports and indeed others in the State (including Cork and Shannon-Foynes), offer potential for the importing of turbine components and therefore are equally viable alternatives.

3.6.2 Site Access and Turbine Delivery Route

For turbine components and construction material transport, cognisance was taken of the haul routes used for other wind farm developments in local area in addition to the general preference to minimise the requirement for significant accommodation or widening works along the public road network and associated environmental effects.

It was determined that any proposed turbine delivery route would comprise use of the N4 National Primary Road, given that the ports of entry outlined above are well connected to the motorway network, particularly the M4, from which the N4 originates. From the N4, delivery vehicles would turn on to the R299 at Drumsna, Co. Leitrim before then turning north onto the R280 and continuing towards Drumkeeran. From the R280, three potential routes were identified and considered for turbine component and abnormal load delivery to the site, as follows:

- Option A: The delivery vehicles would turn left off the R280 at the existing crossroads in the village of Drumkeeran and continue along the L4282 Local Road until they reach the main site entrance in the townland of Boleymaguire.
- Option B: The delivery vehicles would turn left off the R280 in the townland of Barragh More, approximately 1.3km south of Drumkeeran, using a new entrance into a third-party landholding. From here the delivery vehicles would follow a combination of new and existing roads in a generally westerly direction before emerging onto the L4282 in the townland of Bargowla. The delivery vehicles would then continue in a southerly direction (as per Option A) on the L4282 towards the site entrance in Boleymaguire.
- Option C: The delivery vehicles would enter an existing farmyard directly off the R280 in the village of Drumkeeran. The delivery vehicles would continue through the farmyard (minor alternations to two agricultural buildings would be required) and on to a new road through agricultural land west of the farmyard and turn left again on to the L4282. From here, the delivery vehicles would travel in a westerly direction on the L4282 (as per Option A) before turning south at new construction access junction in the townland of Derrycullinan The vehicles will travel in a south-easterly direction along existing forestry and new roads before turning to head in a westerly direction in the townland of Derreens and following the route, described in Option B, to the L4282 and then turning south and continuing towards the main site entrance in the townland of Boleymaguire.

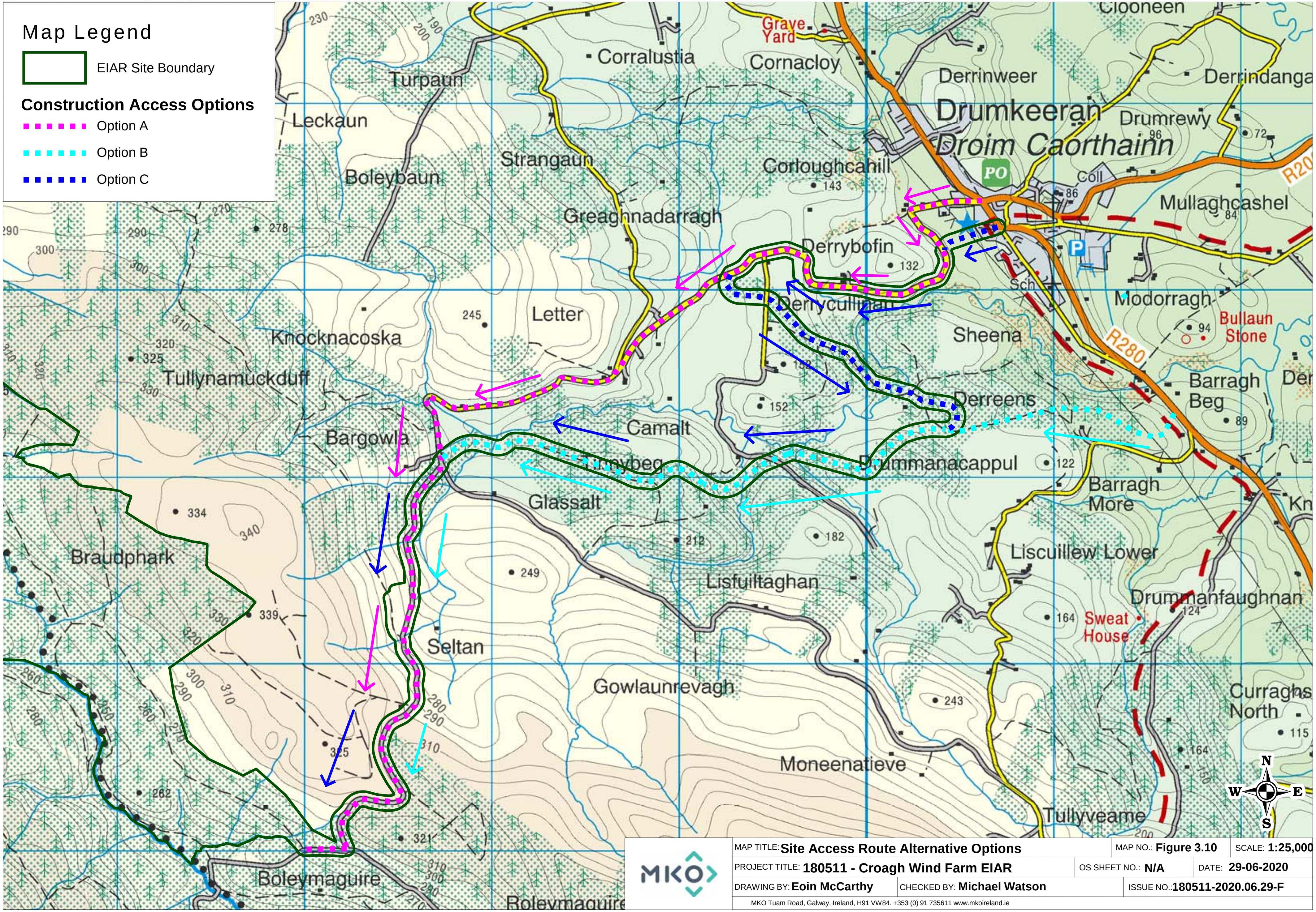
The three access route options are illustrated in Figure 3-10.

An assessment of all three options was carried out, taking account of criteria such as third-party land requirements, existing road upgrade and new road construction requirements and associated environmental effects. Option C was the chosen option given the availability of land under the control of the applicant and other participating third-party landowners between the village of Drumkeeran and the main site entrance in the townland of Boleymaguire.

Whilst the potential environmental effects of Option A could be less than Option C as it does not require the construction of new roads, the number of locations where third-party party land was required (5 locations) to facilitate the delivery of large turbine components, including major widening works at a hairpin bend with an existing watercourse crossing on the L4282, rendered this option unviable.

Option B is considered to have a similar potential for environmental effects as Option C, however, the construction of a new junction off the R280 instead of using an existing access point off the same road (the farmyard in the Village of Drumkeeran) was considered less preferable.

A comparison of the potential environmental effects of the alternative access route options when compared against chosen option is presented in Table 3-10 below.



MAP TITLE: Site Access Route Alternative Options	MAP NO.: Figure 3.10	SCALE: 1:25,000
PROJECT TITLE: 180511 - Croagh Wind Farm EIAR	OS SHEET NO.: N/A	DATE: 29-06-2020
DRAWING BY: Eoin McCarthy	CHECKED BY: Michael Watson	ISSUE NO.: 180511-2020.06.29-F

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Table 3-10 Comparison of environmental effects when compared against the chosen option (chosen site access route)

Environmental Consideration	Option A	Option B
Population & Human Health (incl. Shadow Flicker)	Neutral	Neutral
Biodiversity & Ornithology	Decreased habitat loss due to use of existing roads for entire route.	Neutral
Land, Soils & Geology	Decrease in volume of overburden to be excavated and managed as no new roads required.	Neutral
Geotechnical	Decreased risk of peat instability due to use existing roads along entire route.	Neutral
Water	No new watercourse crossings required so decreased potential for silt-laden water entering watercourses.	Neutral
Air & Climate	The potential for dust emissions is reduced as no new roads required.	Neutral
Noise & Vibration	Increased potential for noise and vibration nuisances at residential dwellings along the route.	Reduced potential for noise and vibration nuisances at residential dwellings as none located along this route.
Landscape & Visual	Neutral	Neutral
Cultural Heritage & Archaeology	Decreased potential for impact on unrecorded, sub-surface archaeology as no new roads require along this route.	Neutral
Material Assets	Increased potential for adverse traffic impacts on local road users as entirety of route is located on the public road network.	The construction of a new junction off the R280 instead of using an existing access point off the same road (the farmyard in the Village of Drumkeeran) was considered to have a greater effect on local road users.

It should be note that while large turbine components and other abnormal loads deliveries will be via the Option C access route exclusively, other general construction material deliveries will be via the existing junction between the R280 and the L4282 in the village of Drumkeeran and continue on the local road before reaching the construction access junction in Derrycullinan. It is intended that passenger vehicles carrying construction staff and some regular HGVs delivering construction materials will turn onto the L4282 at the crossroads in Drumkeeran and continue to the main site entrance in Boleymaguire via the local road without using the construction access road.

The geometric assessment of large turbine components and other abnormal load deliveries during the construction of the proposed wind energy development is based on the use extended articulated trucks which is the standard and most common delivery vehicle technology for turbine blades. This assessment is included in Section 14.1 of this EIAR. However, alternative delivery vehicle technologies such as blade adapters or lifters may be considered, should they be deemed economically viable and readily available at the time of construction of the wind farm and to fall within all assessment envelopes identified in this EIAR.

3.6.3 Alternative Mitigation Measures

Mitigation by avoidance has been a key aspect of the proposed project's evolution through the selection and design process. Avoidance of the most ecologically sensitive areas of the site limits the potential for environmental effects. As noted above, the site layout aims to avoid environmentally sensitive areas. Where loss of habitat occur within the site, this has been mitigated by proposing enhancement lands as described in Chapter 6 of this EIAR. The alternative to this approach is to encroach on the environmentally sensitive areas of the site and accept the potential adverse environmental effects associated with this.

The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks and have been designed to break the pathway between the site and any identified environmental receptors. The alternative is to either not propose these measures or propose measures which are not best practice and /or effective and neither of these options is acceptable or sustainable.

4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the development and its component parts which is the subject of a proposed application for planning permission to Leitrim County Council and Sligo County Council, ('the Proposed Development'). The Proposed Development comprises:

i. *Construction of 10 No. wind turbines with a maximum overall blade tip height of up to 170 metres, and associated hardstand areas;*
ii. *1 no. 38kV permanent electrical substation including a control building with welfare facilities, all associated electrical plant and equipment, security fencing, all associated underground cabling, waste water holding tank and all ancillary works;*
iii. *1 no. permanent Meteorological Mast with a maximum height of up to 100 metres;*
iv. *All associated underground electrical and communications cabling connecting the turbines to the proposed wind farm substation;*
v. *All works associated with the connection of the proposed wind farm to the national electricity grid, via underground cabling to the existing Garvagh substation;*
vi. *Upgrade of existing tracks and roads, provision of new site access roads and hardstand areas;*
vii. *The partial demolition and alteration of two agricultural buildings in the townlands of Sheena and associated junction access and road works to the existing yard, agricultural buildings and agricultural lands in the townlands of Sheena and Derrybofin to provide a link road primarily for construction traffic off the R280. This link road will be used for the delivery of abnormal loads to the site during the construction period and may be used during the operational period if necessary or to facilitate the decommissioning of the wind farm. Following construction, access to the link road will be closed off and the yard/agricultural building will revert to its use for agricultural purposes except if and when required for delivery of abnormal loads during the operational period of the windfarm or to facilitate the decommissioning of the wind farm;*
viii. *1 no. borrow pit;*
ix. *2 no. peat and spoil repository areas*
x. *2 no. temporary construction compounds;*
xi. *Recreation and amenity works, including marked trails, boardwalk and viewing area provision of a permanent amenity car park, and associated recreation and amenity signage*
xii. *Site Drainage;*
xiii. *Permanent Signage;*
xiv. *Ancillary Forestry Felling to facilitate construction and operation of the proposed development; and*
xv. *All associated site development works*

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

The development of the proposed wind farm development will require the felling of approximately 55.1 hectares of commercial forestry which will require replanting elsewhere in the state. Details regarding the area to be felled are outlined in Section 4.3.10 below. The Forest Service policy on the granting of felling licences requires replanting of forestry on a hectare by hectare basis. Three potential forestry replacement lands have been identified for assessment purposes. These lands, located in Counties Cavan, Roscommon and Wicklow, have all been granted Forest Service Technical Approval for afforestation and these or similarly approved lands will be used for replanting should the Proposed Development receive planning permission.

All elements of the Proposed Development described in the list above and the forestry replacement lands have been assessed as part of this EIAR.

4.2 Development Layout

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

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

4.3 Development Components

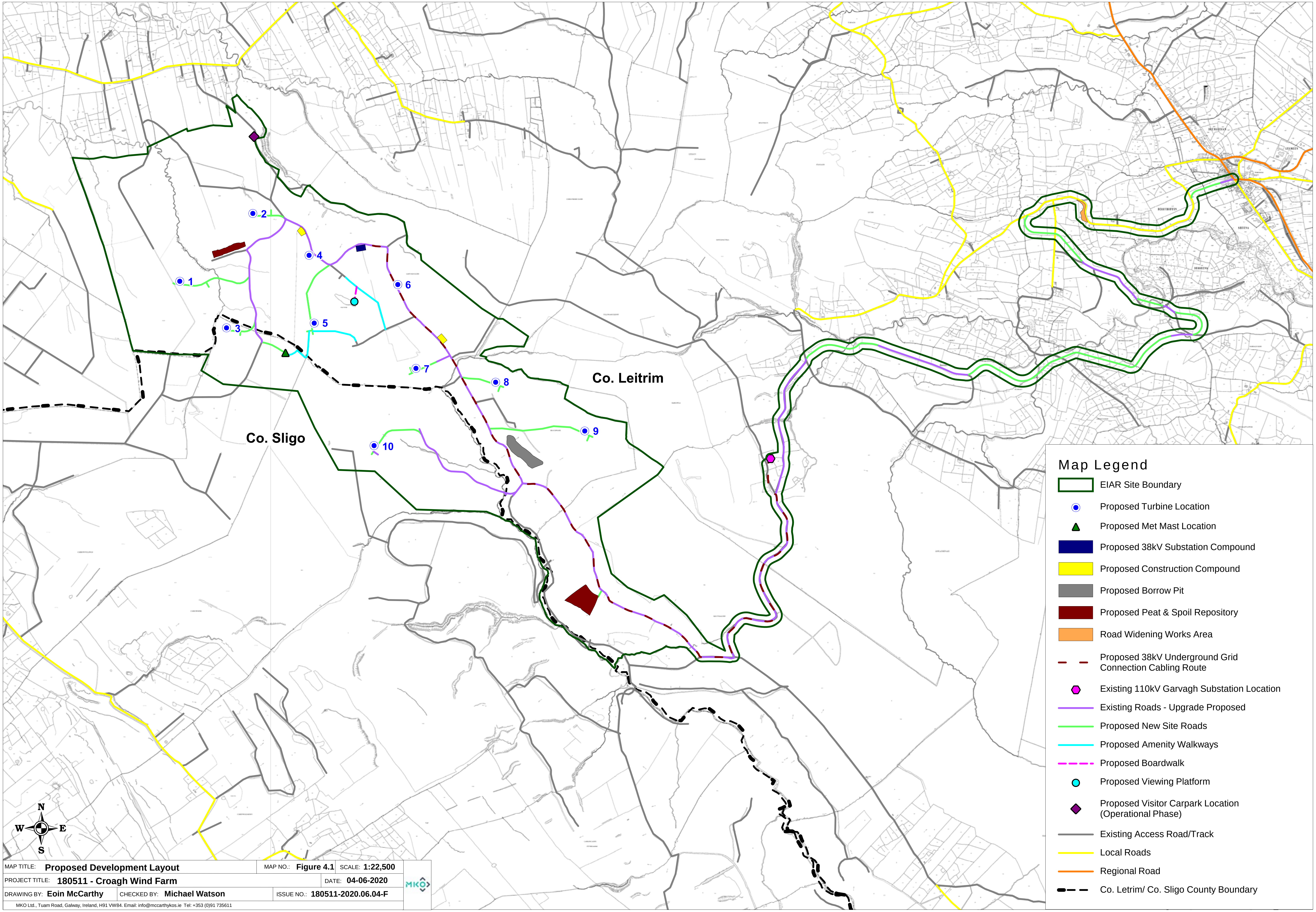
4.3.1 Wind Turbines

4.3.1.1 Turbine Locations

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

Table 4-1 Propose Wind Turbine Locations and Elevations

Turbine No.	Irish Transverse Mercator Co-ordinates		Elevation (m OD)
	Easting (m)	Northing (m)	
1	583322	823639	271
2	583831	824112	241
3	583648	823314	287
4	584,223	823,820	277
5	584259	823347	294
6	584841	823616	294
7	584968	823032	291
8	585523	822935	300
9	586144	822595	323
10	584676	822493	298



MAP TITLE: **Proposed Development Layout**	MAP NO.: **Figure 4.1**	SCALE: **1:22,500**	MKO
PROJECT TITLE: **180511 - Croagh Wind Farm**		DATE: **04-06-2020**	
DRAWING BY: **Eoin McCarthy**	CHECKED BY: **Michael Watson**	ISSUE NO.: **180511-2020.06.04-F**	

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4.3.1.2 Turbine Type

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

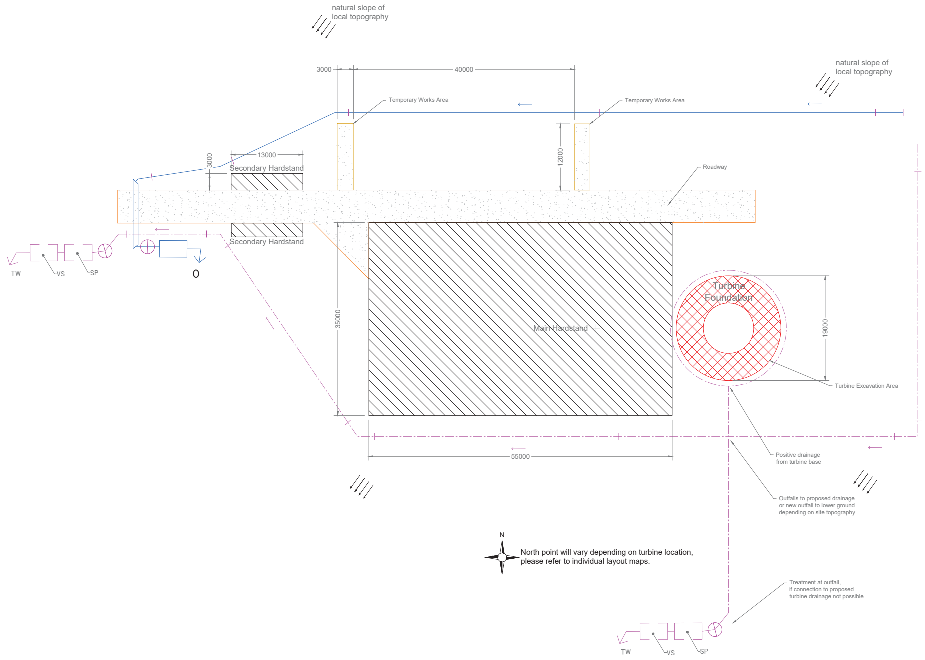
- Foundation unit
- Tower
- Nacelle (turbine housing)
- Rotor

Plate 4-1 Wind turbine components

The proposed wind turbines will have a tip height of up to 170 metres. Within this size envelope, various configurations of hub height, rotor diameter and ground to blade tip height may be used. The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed a tip height of up to 170 metres. Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics, with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times. The turbines will be grey matt in colour.

For the purposes of this EIAR, various types and sizes of wind turbines within the 170-metre tip height envelope have been selected and considered in the relevant sections of the EIAR to assess the worst-case scenario. Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds), as addressed elsewhere in this EIAR. In each EIAR section that requires the consideration of turbine parameters as part of the impact assessment, the worst-case turbine design parameters that have been used in the impact assessment are specified.

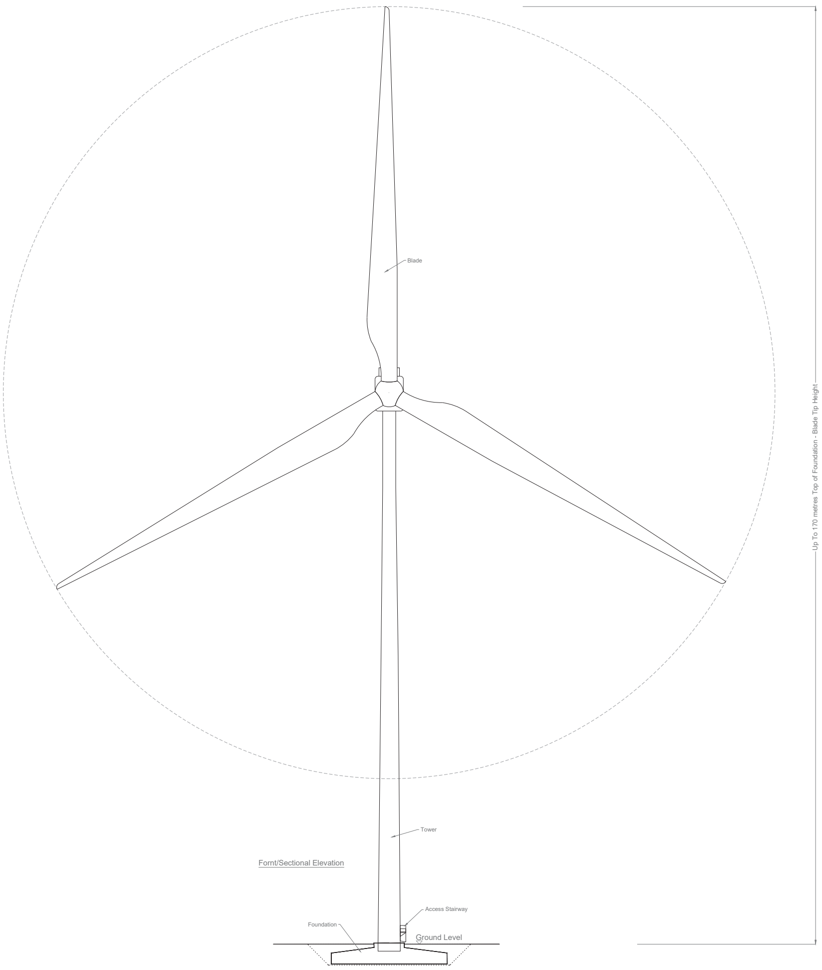
A drawing of the proposed wind turbine is shown in Figure 4-2. The individual components of a typical geared wind turbine nacelle and hub are shown in Figure 4-3 below.

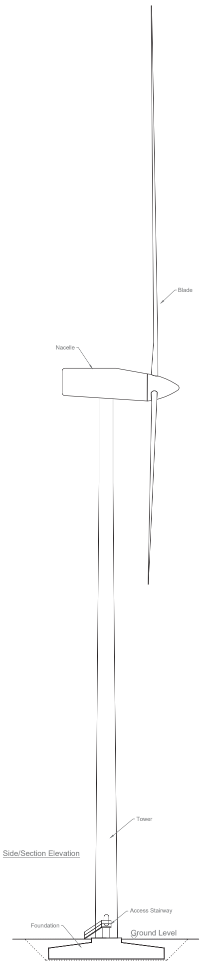


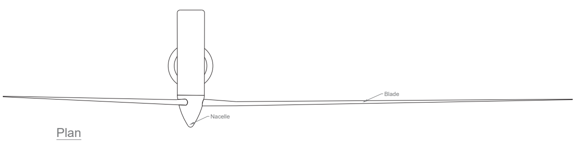
Drawing Legend

- Upstream Interceptor Drain
- Swales/Downstream Collector Drain
- Direction of Flow
- Settlement Pond - Vegetation Filter - Level Spreader
- Check Dam 'Type A'
- Check Dam 'Type B'
- Interceptor Ditch Culvert
- Collector Ditch Culvert
- O — Overland Flow Discharge
- TW — Treated Water Discharge
- SP — Settlement Pond
- VS — Semi-Natural Vegetation Swale / Filter Bed /secondary SP

Proposed Drainage







Drawing Notes

1. Proposed wind turbines to have a maximum ground to blade tip height of up to 170m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Turbine foundation diameter may vary.
5. Ground level represents the top of turbine foundation.

Figure 4-2

DRAWING TITLE: **Typical Wind Turbine Hardstanding & Elevations**	
PROJECT TITLE: Croagh Wind Farm, Co. Leitrim	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **180511**	DRAWING No.: **180511 - 45**
SCALE: **1:500 @A1**	DATE: **03.07.2020**

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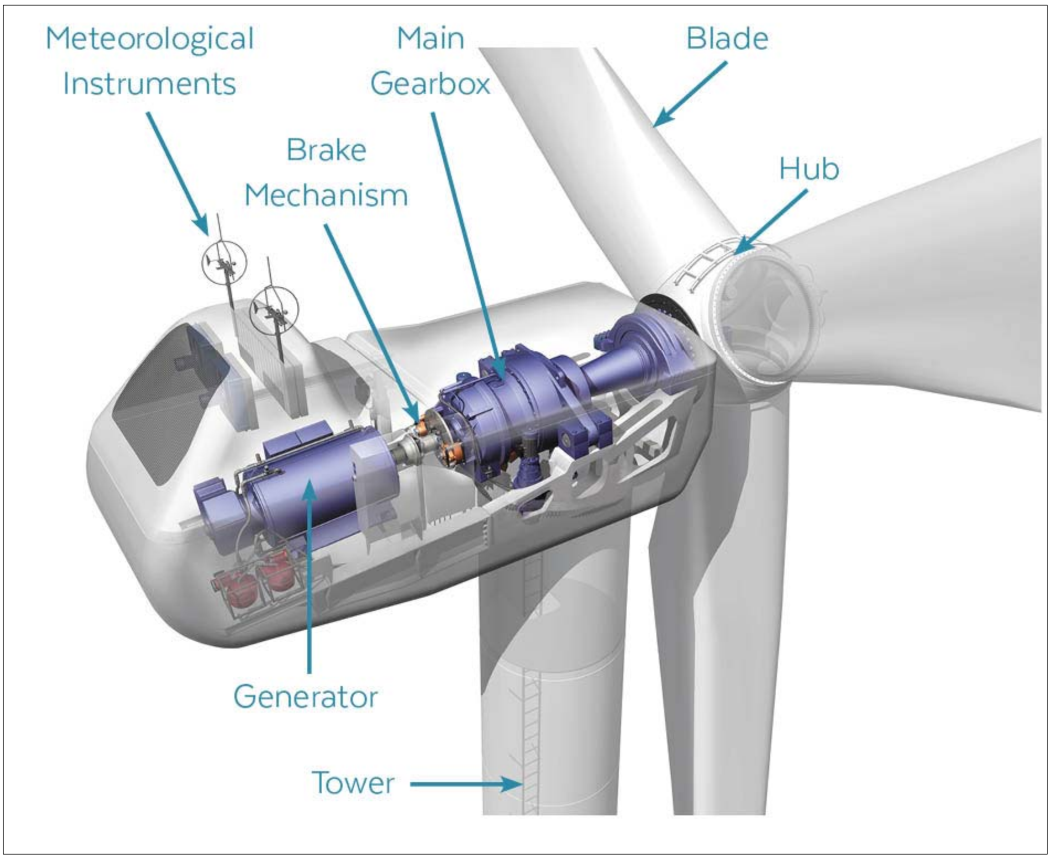


Figure 4-3 Turbine nacelle and hub components

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

4.3.1.3 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbine foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier 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. The typical horizontal and vertical extent of a turbine's foundation is shown in Figure 4-2.

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


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

4.3.1.4 Hard Standing Areas

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

4.3.1.5 Assembly Area

Levelled assembly areas will be located on either side of the hard-standing area as shown on Figure 4-2. These assembly areas are required for offloading turbine blades, tower sections and hub from trucks until such time as they are ready to be lifted into position by cranes and to assist the main crane during turbine assembly. The exact location and number of assembly areas will be determined in consultation with the selected turbine manufacturer.

4.3.1.6 Power Output

It is anticipated the proposed wind turbines will have a rated electrical power output in the 3 to 5-megawatt (MW) range depending on further wind data analysis and power output modelling. Turbines of the exact same make, model and dimensions can also have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. For the purposes of this EIAR, a rated output of 4.8MW has been chosen to calculate the power output of the proposed 10-turbine wind farm, which would result in an estimated installed capacity of 48MW.

Assuming an installed capacity of 48 MW, the Proposed Development therefore has the potential to produce up to 147,168 MWh (megawatt hours) of electricity per year, based on the following calculation:

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

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

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

C = ... Rated output of the wind farm: 48 MW

The 147,168 MWh of electricity produced by the Proposed Development would be sufficient to supply 35,040 Irish households with electricity per year, based on the average Irish household using 4.2 MWh[1] of electricity.

The 2016 Census of Ireland recorded a total of 50,815 households in Co. Leitrim and Co. Sligo combined. Per annum, based on a capacity factor of 35%, the Proposed Development would therefore produce sufficient electricity for the equivalent of approximately 69% of all households in Co. Leitrim and Co. Sligo.

4.3.2 Site Roads

4.3.2.1 Road Construction Types

To provide access within the site of the Proposed Development and to connect the wind turbines and associated infrastructure approximately 10.9 kilometres of existing roads and tracks will need to be upgraded and approximately 6.9 kilometres of new access roads will need to be constructed. The road construction preliminary design has taken into account the following key factors as stated in the Fehily Timoney & Company's (FTC) Peat & Spoil Management Plan in Appendix 4-2:

1. *Buildability considerations*
2. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles*
3. *Minimise excavation arising*
4. *Requirement to minimise disruption to peat hydrology*

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

The proposed upgrade to existing roadways and construction of new roadways will incorporate passing bays to allow traffic to pass easily while traveling around the site.

4.3.2.1.1 *Upgrade to Existing Roads or Tracks*

The general construction methodology for upgrading of existing sections of excavated and floating roads or tracks, as presented in FTC's Peat & Spoil Management Plan in Appendix 4-2, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

1. *For upgrading of existing excavated access tracks the following guidelines apply:*
    a. *Excavation will be required on one or both sides of the existing access track to a competent stratum.*
    b. *Granular fill to be placed and compacted in layers in accordance with the designer's specification.*
    c. *The surface of the existing access track should be overlaid with up to 500mm of selected granular fill.*
    d. *Access roads to be finished with a layer of capping across the full width of the road.*
    e. *A layer of geogrid/geotextile may be required at the surface of the existing access road in areas where the existing track shows signs of excessive rutting, etc.*

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

   f. *For excavations in peat and spoil, side slopes shall be not greater than 1 (v):3 (h). Where areas of weaker peat are encountered then shallower slopes will be required to ensure stability.*
2. *For upgrading of existing floated access tracks the following guidelines apply:*
   a. *The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are localised variations in the make-up of the existing floated access tracks on site, frequently no tree brash/trunks were used in the make-up and the presence of a geogrid was also noted in localised sections of the existing track.*
   b. *The surface of the existing access track will be levelled prior the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).*
   c. *Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid will be placed on top of the existing floated access track.*
   d. *Where fine granular/cohesive type material has been used in the existing floated access road make-up (as is the case on some of the existing access roads in the southeast of the site), a layer of geotextile will be required as a separator layer with a layer of geogrid.*
   e. *The geogrid will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers.*
3. *The finished road width will have a running width of 5m, with wider sections on bends and corners.*
4. *On side long sloping ground any road widening works required will be done on the upslope side of the existing road where possible.*
5. *At transitions between new floating and existing excavated roads a length of road of about 10 to20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.*
6. *A final surface layer shall be placed over the existing access track, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

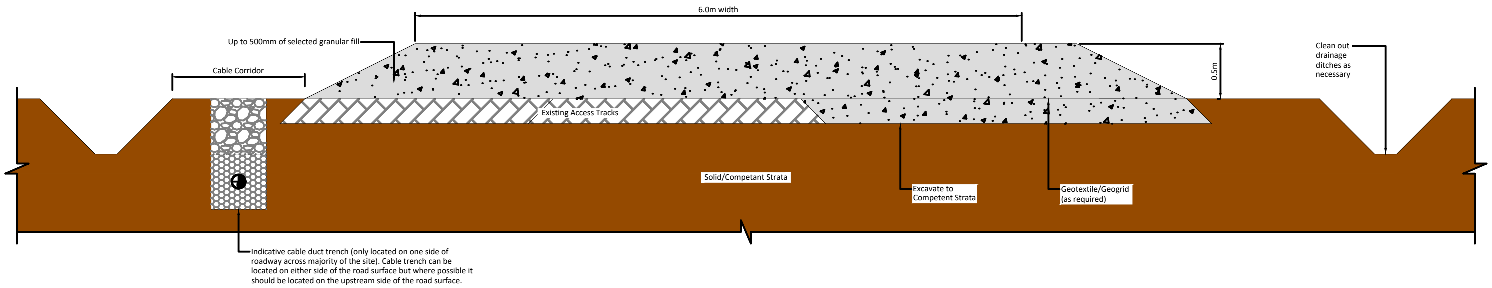
A typical section of existing excavated road for upgrade is shown in Figure 4-4. A typical section through an existing floating road to be upgraded is shown in Figure 4-5.

4.3.2.1.2 Construction of New Excavated Roads

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique on this site.

The general methodology for the construction of excavated roads, as presented in FTC's Peat & Spoil Management Plan in Appendix 4-2, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

1. *Prior to commencing road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.*
2. *Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.*
3. *Excavation will take place to a competent stratum beneath the peat.*
4. *Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without replacement with stone fill.*
5. *Excavation of materials with respect to control of peat stability.*



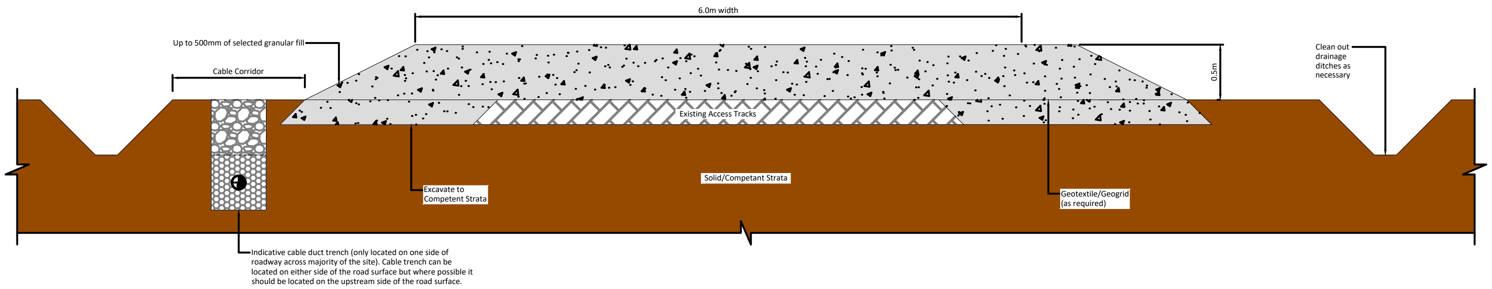


Figure 4-4

DRAWING TITLE:
Upgrade of Existing Excavated Access Roads

PROJECT TITLE: Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 180511	DRAWING No.: 180511 - 46
SCALE: 1:50 @ A3	DATE: 03.07.2020
OS SHEET No.:	

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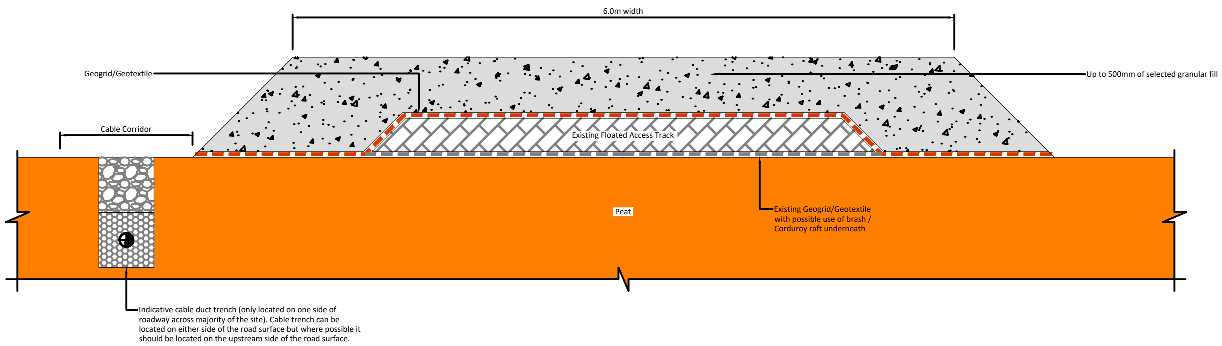

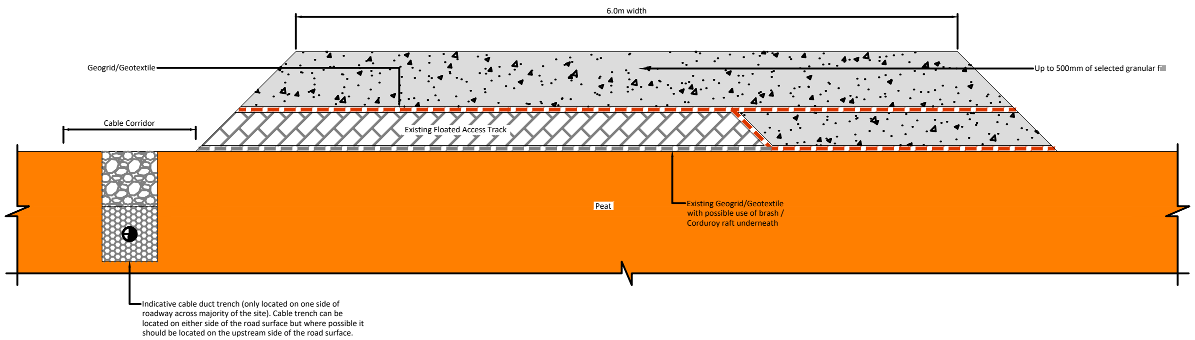

Figure 4-5

DRAWING TITLE:
Upgrade of Existing Floated Access Roads

PROJECT TITLE:
Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 180511	DRAWING No.: 180511 - 47
SCALE: 1:50 @ A3	DATE: 03.07.2020
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   a. *Acrotelm (top about 0.3 to 0.4m of peat) is generally required for landscaping and shall be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping shall be undertaken prior to main excavations.*
   b. *Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.*
   c. *All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the borrow pit or peat repositories.*
6. *Side slopes in peat shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then shallower slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.*
7. *The excavated access road will be constructed of up to 1000mm of selected granular fill.*
8. *Access roads to be finished with a layer of capping across the full width of the road.*
9. *A layer of geogrid/geotextile may be required at the surface of the competent stratum.*
10. *At transitions between floating and excavated roads a length of road of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.*
11. *Where steeper slopes are encountered along with relatively deep peat (i.e. typically greater than 1m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.*
12. *A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.*

A typical section of a new excavated road is shown in Figure 4-6.

4.3.2.1.3 Construction of New Floating Roads

In a number of areas across the site of the Proposed Development it will be necessary to construct floating roads over peat.

A confirmatory stability analysis to affirm the conditions predicted in this EIAR will be carried out by the designer where it is proposed to install floating access roads over the peat prior to any construction work commencing on site.

Floating roads minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavated type access road is more suitable.

The general construction methodology for the construction of floating, as presented in FTC's Peat and Spoil Management Plan in Appendix 4-2, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

1. *Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 3m.*
2. *Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.*
3. *The typical make-up of the new floated access road is a minimum of 1000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a basal layer of tree trunks/brash.*
4. *Granular fill to be placed in layers and compacted in accordance with the TII Specification for Road Works.*

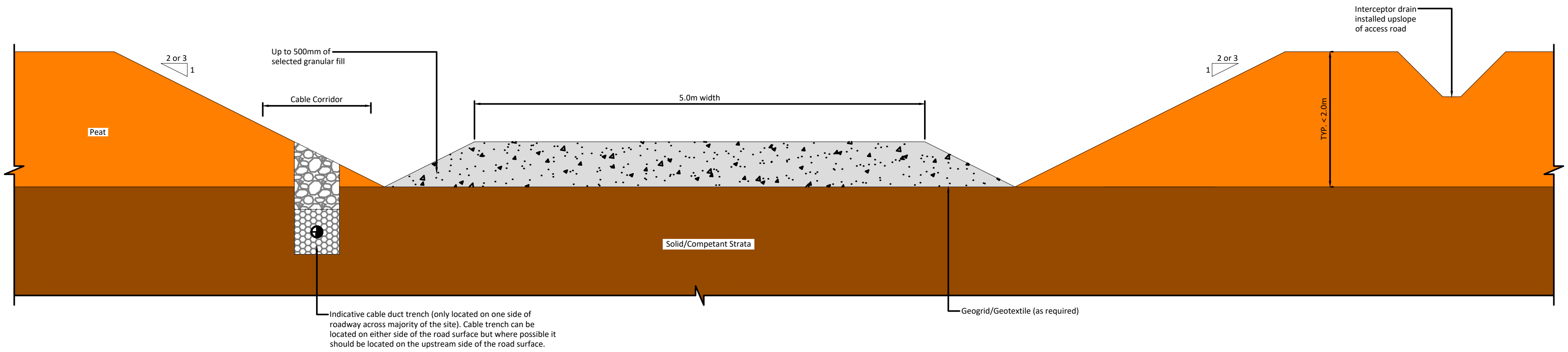

Figure 4-6

DRAWING TITLE:
New Excavate and Replace Access Road

PROJECT TITLE: Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY:	POR	CHECKED BY:	IH
PROJECT No.:	180511	DRAWING No.:	180511 - 48
SCALE:	1:50 @ A3	DATE:	03.07.2020
OS SHEET No.:			

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5. *During construction of the floated access roads it may be necessary to include pressure berms either side of the access road in some of the deeper/weaker peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road at such locations will reduce the likelihood of potential bearing failures beneath the access road.*
6. *The finished running width of the road will be 5m, with wider sections on bends and corners.*
7. *Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.*
8. *To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.*
9. *Where it is not possible to end-tip over a 10m length of constructed floating road due to the presence of weak deep peat then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.*
10. *Following end-tipping a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.*
11. *A final surface capping layer shall be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and turbine delivery traffic.*

A typical section of a new floating road is shown in Figure 4-7.

4.3.3 Borrow Pits

4.3.3.1 Description

It is proposed to develop an on-site borrow pit as part of the Proposed Development. It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the proposed development from the on-site borrow pit. The borrow pit is located adjacent to an existing site road. Usable rock may also be won from other infrastructure construction including the substation and the turbine base excavations.

The proposed borrow pit is located approximately 430 metres west of Turbine No. 9, measures approximately 20,930m^2 in area and is shown on Figure 4-1 and on the detailed site layout drawings included as Appendix 4-1 to this EIAR. Figure 4-8 below shows detailed sections through the proposed borrow pits. The borrow pits will, on removal of all necessary and useful rock, be reinstated with excavated peat and subsoils as described in Section 4.3.4 below.

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

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

Hardcore materials will be extracted from the borrow pit (and some turbine locations, if necessary), principally by means of rock breaking. Depending on the hardcore volume requirements, blasting may also be used as a more effective rock extraction method, capable of producing significant volumes of rock in a matter of milliseconds. Blasting will only be carried out after notifying any potentially sensitive local residents. The potential noise and vibration impact on sensitive receptors associated with the rock extraction measures, detailed below, are assessed in Chapter 11 of this EIAR.

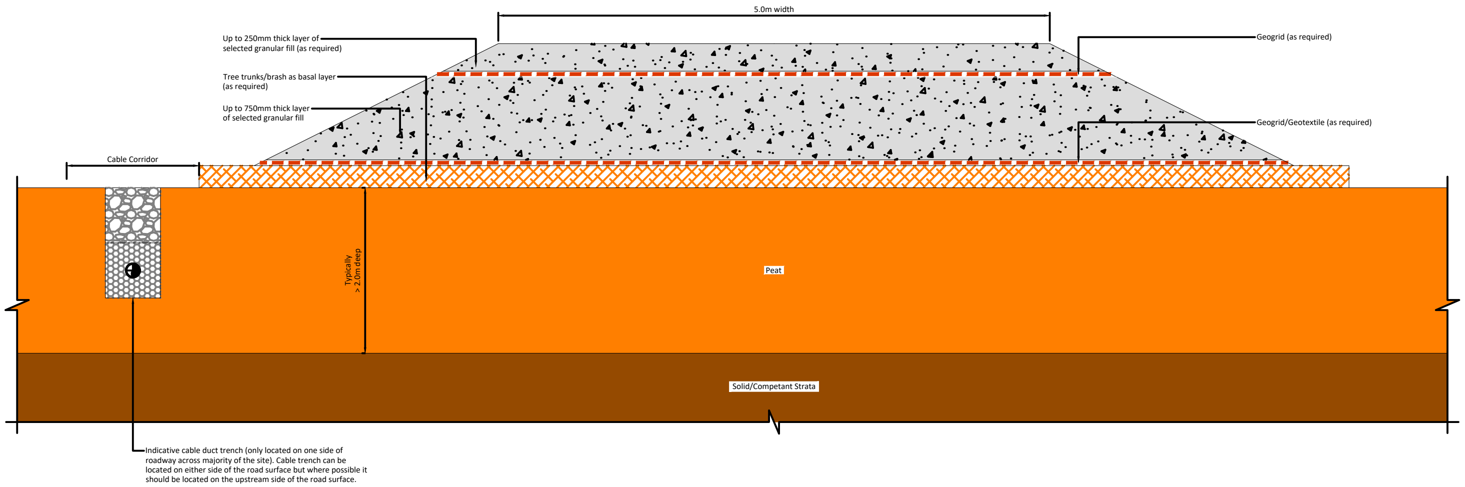

Figure 4-7

DRAWING TITLE:
New Floating Access Road

PROJECT TITLE:
Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 180511	DRAWING No.: 180511 - 49
SCALE: 1:50 @ A3	DATE: 03.07.2020
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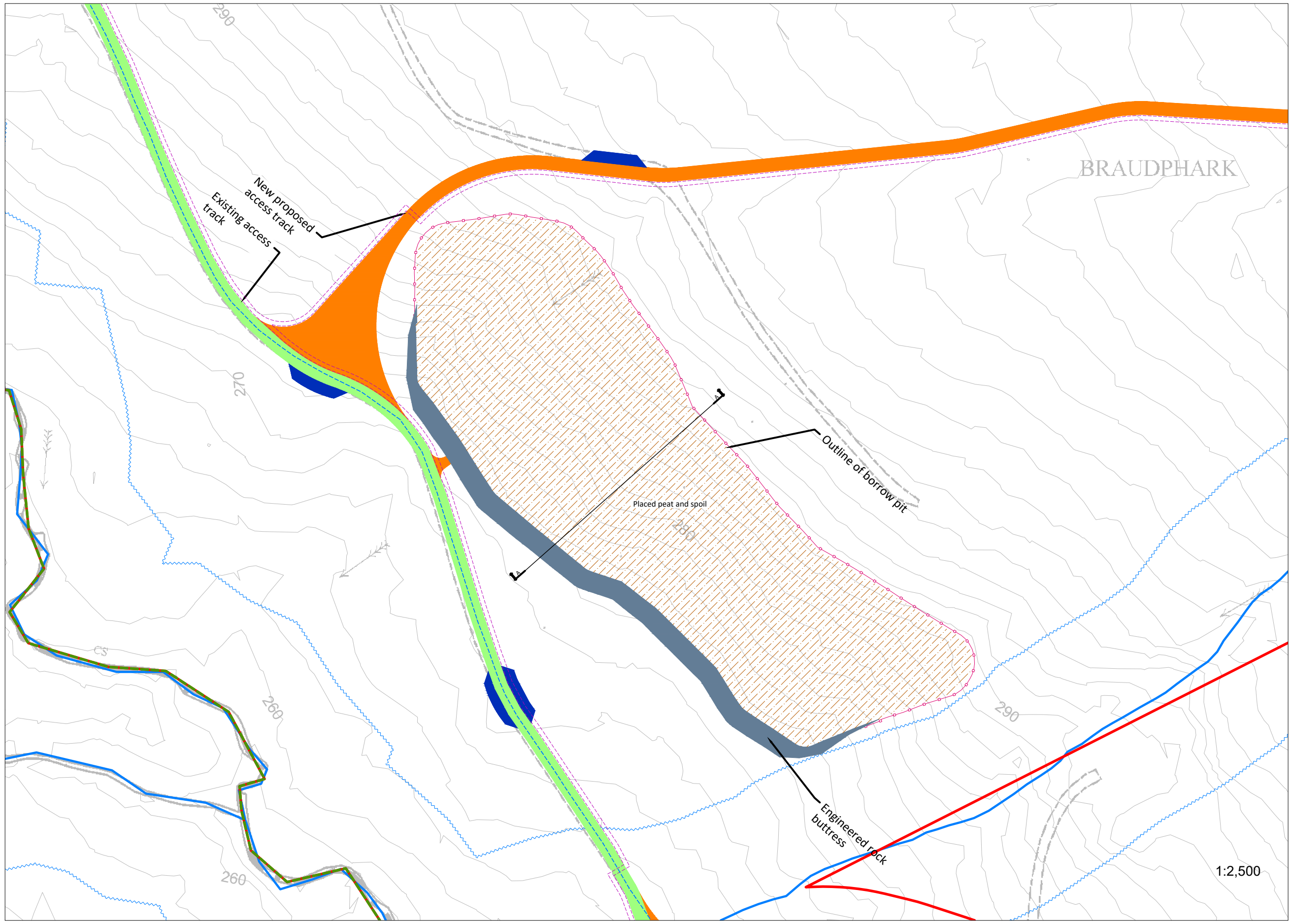

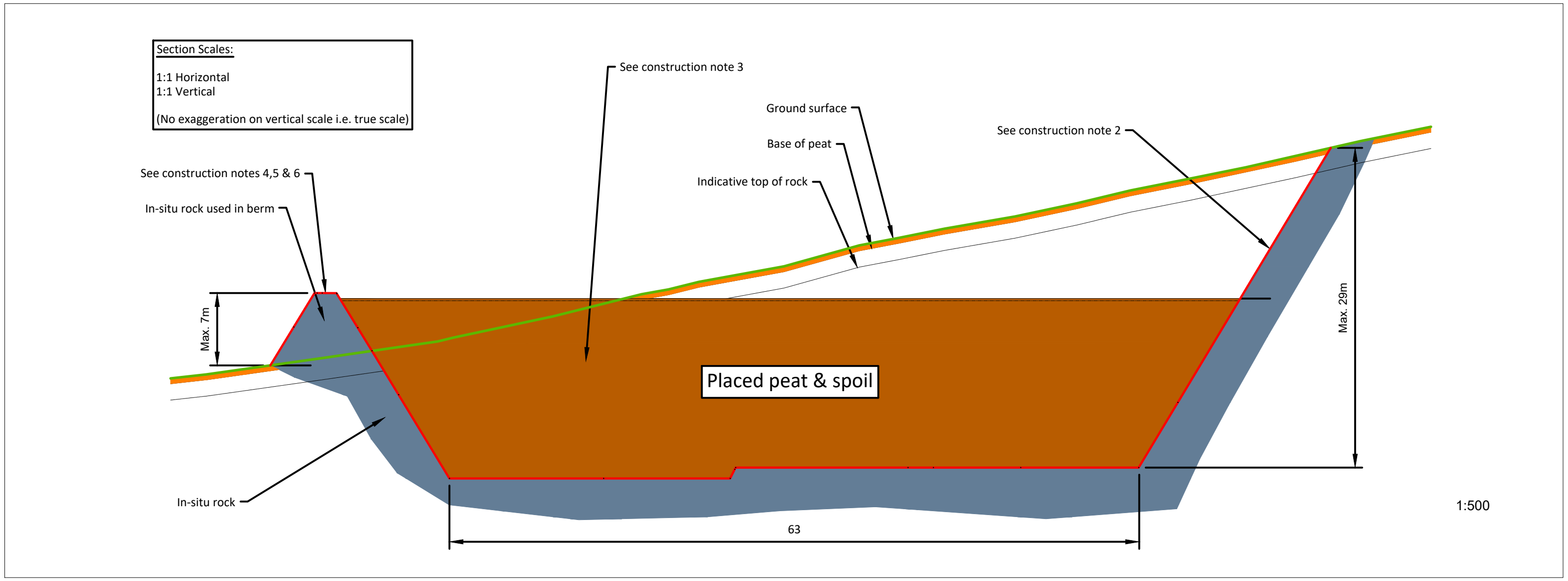

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Construction Notes Borrow pit

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

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

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

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

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

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

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

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

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

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

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

Figure 4-8

DRAWING TITLE:
Borrow Pit Layout and Sections

PROJECT TITLE:
Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 180511	DRAWING No.: 180511 - 41
SCALE: As Shown @ A3	DATE: 03.07.2020

OS SHEET No.: 4315, 4316, 4317, 4318, 4373, 4374, 4375, 4376, 4431, 4432, 4333, 4334, 4490, 4491, 4492, 4493

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It is anticipated that a certain volume of finer, crushed stone, used to provide the final surface layer for site roads and hardstanding areas will be brought to the site from local, appropriately authorised quarries. Five quarries located within 20 km of the proposed development have been selected for the purposes of assessment throughout this EIAR. The locations of these quarries are shown in Figure 4-9.

The two proposed extraction methods are detailed below.

4.3.3.2 Rock Extraction Methods

The extraction of rock from the borrow pit is a workstage of the Proposed Development which will be a temporary operation run over a short period of time relative to the duration of the entire project. As described above, there is a layer of overburden present at the borrow pit location, which will be stripped back and stockpiled using standard tracked excavators. Two extraction methods have been assessed for breaking out the useful rock below; rock breaking and blasting.

4.3.3.2.1 *Rock Breaking*

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

A large rock breaking excavator progressively breaks out the solid rock from the ground in the borrow pit area. The large rock breaker is typically supported by a smaller rock breaker which can often be in the 30-40 tonne size range and works to break the rocks down to a size that they can be fed into a crusher.

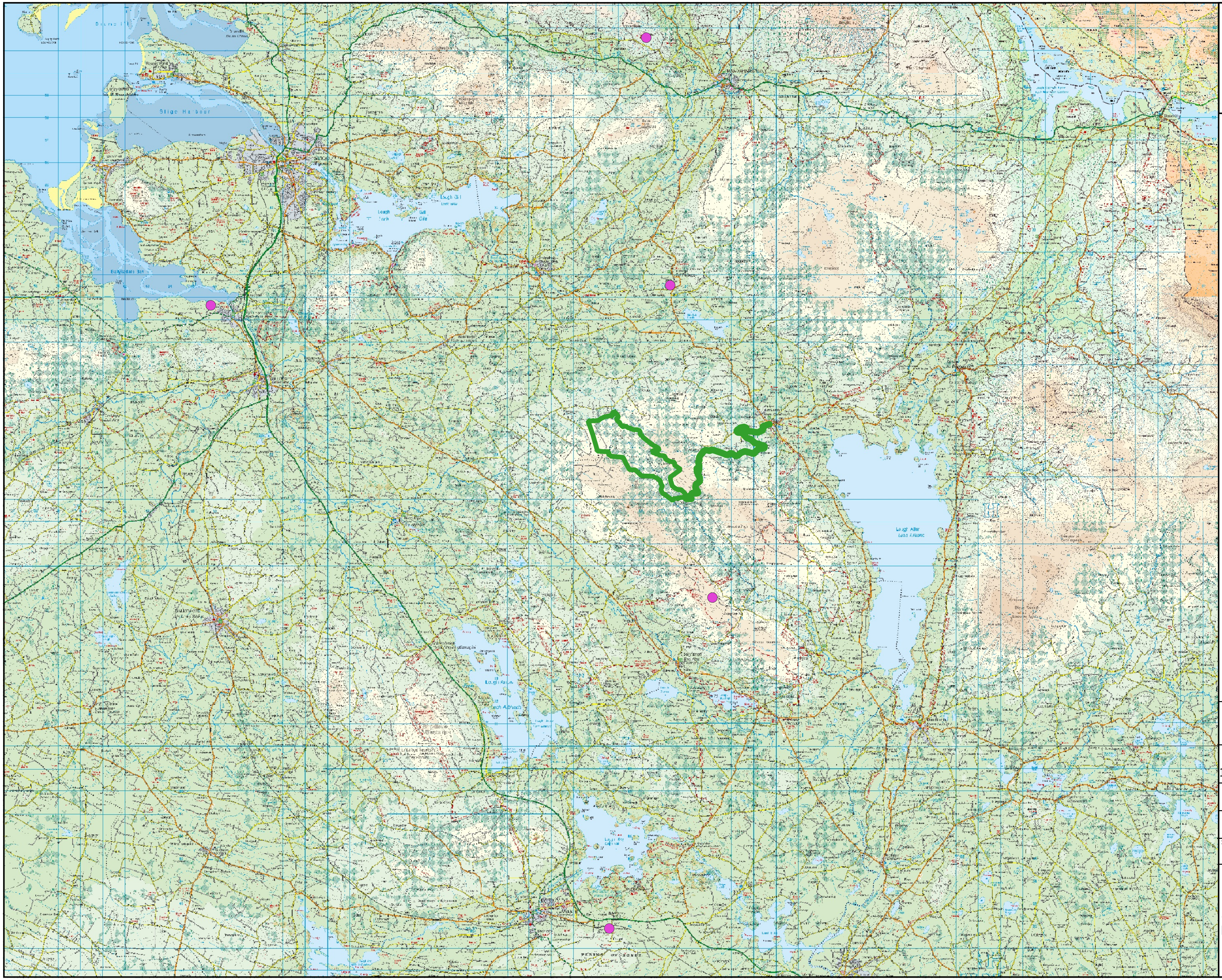
The extracted broken rock is typically loaded into a mobile crusher using a wheeled loading shovel and crushed down to the necessary size of graded stone required for the on-site civil works. The same wheeled loader takes the stone from the crusher conveyor stockpile and stockpiles it elsewhere away from the immediate area of the crusher until it is required elsewhere on the site of the Proposed Development.

4.3.3.2.2 *Rock Blasting*

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

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

A properly designed blast should generate rock of a size that can be loaded directly into a mobile crusher, using the same wheeled loader description outlined above. From that point on, the same



Map Legend

EIAR Site Boundary

Quarry Locations

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Drawing Title: Existing Quarry Locations	
Project Title: 180511 - Croagh Wind Farm EIAR	
Drawn By: Daire O'Shaughnessy	Checked By: Eoin McCarthy
Project No.: 180511	Drawing No.: Fig 4-9
Scale: 1:220,000	Date: 29.06.20

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method is used for processing the rock generated from a blast, as would be used to process rock generated by rock breaking. It would be likely that a drilling rig would recommence drilling blast holes for the next blast as soon one blast finished. The potential impacts associated with noise and vibration are assessed in Chapter 11: Noise and Vibration.

4.3.4 Peat and Spoil Management Plan

4.3.4.1 Quantities

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

Table 4-2 Peat and Spoil Volumes requiring management

Development Component	Area (m2) (approx.)	Peat Volume (m3) (approx.)	Spoil Volume(m3) (approx.)
10 no. Turbines and Hardstanding Areas	22,800	65,925	48,635
2 no. Construction Compound Platform	4,800	7,940	17,095
1 no. Substation Platform & Building	2,600	2,810	
Anemometry Mast Platform	280	425	
Access Roads	67,200	103,500	93,550
1 no. Borrow Pit	20,930	14,820	34,580
2 no. Repository Areas	34,530	15,000	3,000
Total		**209,970**	**196,860**
Total Peat & Spoil to be managed (m^3)		406,830	

4.3.4.2 Peat and Spoil Usage in Restoration of Borrow Pits

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

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

A temporary access track, will be placed around the perimeter of the borrow pit area to allow for the tipping of peat over the edge of the borrow pit area.

Where possible, the acrotelm peat that has been excavated and not retained for reinstatement and landscaping works will be stored with the vegetated side facing up so as to promote the growth of vegetation across the surface of the stored peat within the borrow pit area.

4.3.4.2.1 Placement of Peat and Spoil in Repository Areas

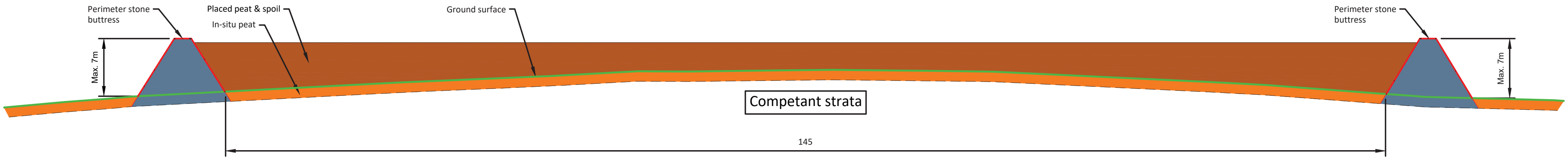
Two locations have been identified as suitable peat and spoil repository areas and are shown in Figure 4-1. The peat depth within the footprint of the repositories is generally less than 1.5m. Repository No. 1 is located approximately 1,080m south of Turbine No. 9 and measures approximately 24,770 square metres. Repository No. 2 is located approximately 210m southwest of Turbine No. 2 and measures approximately 9,760 square metres. Both repository areas are located adjacent to existing roads.

Both repository areas have a perimeter buttress which will contain and ensure the placed peat and spoil remains stable in the long-term. Prior to the placement of any excavated peat and spoil, the permanent stone buttresses shall be constructed around the perimeter of the repository areas. Construction details for each of the repository areas are shown on Figures 4-10 and 4-11.

The presence of perimeter buttresses will help prevent the flow of any saturated peat which may occur at the surface of the placed peat over the life time of the repository and will also allow some drainage of the placed peat and spoil within the repository areas.

The repository areas in particular the stone buttresses shall be constructed as follows:

1. *All stone buttresses required within the repository areas will be founded on mineral soil or bedrock i.e. competent strata. The founding stratum for each stone buttress will be inspected and approved by a geotechnical engineer or competent person.*
2. *In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttresses will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size. Alternatively, drains will be placed through the buttresses to allow excess water to drain.*
3. *The height of the stone buttresses constructed will be greater than the height of the stored peat and spoil to prevent any surface run-off. The height of the stone buttresses will be a minimum of 0.5m above the height of the placed peat and spoil to prevent any potential for saturated peat to flow out of the repository area.*
4. *The side slopes of the stone buttresses shall be constructed at 45 degrees. The stone buttresses will be widened to allow construction traffic access for tipping purposes during the placement of the excavated peat and spoil.*
5. *An interceptor drain will also be installed upslope of the repository areas. The drain will divert any surface water away from the repository area and hence prevent water from ponding in the area.*
6. *A settlement pond will be required at the lower side of the repository areas.*
7. *A granular layer of material will be required at the base of the stored spoil immediately upslope of the stone buttresses to act as a drainage layer. This drainage layer will aid in preventing a build-up of pore water pressure behind the stone buttress.*
8. *The placement of the excavated spoil will commence at the downslope edge of the repository area against the stone buttress and placement will then continue upslope against the stone buttress and placement will then continue upslope.*
9. *It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.*
10. *Supervision by a geotechnical engineer or appropriately competent person is required for the construction of the repository area.*



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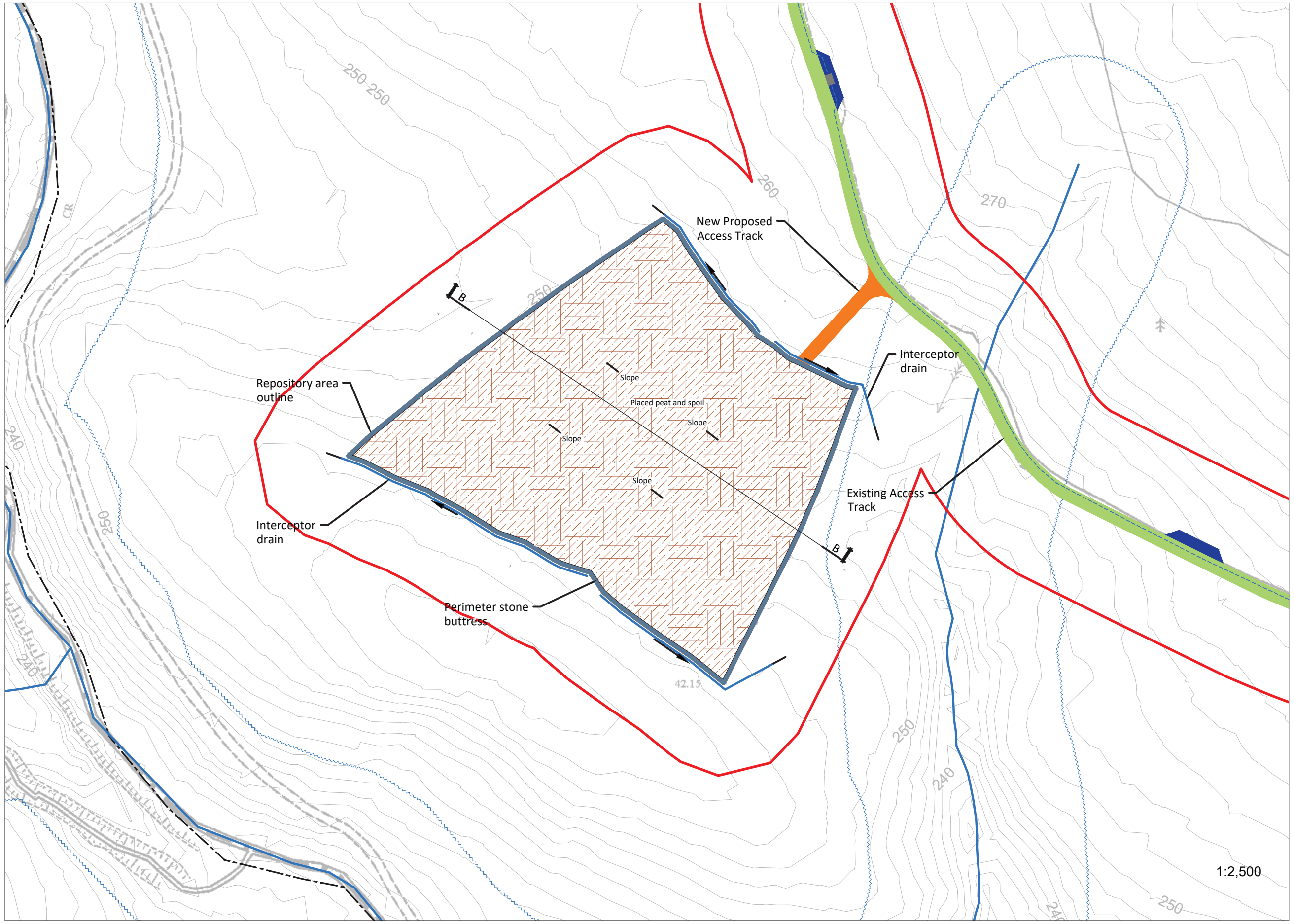

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Construction Notes Borrow pit

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

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

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

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

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

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

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

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

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

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

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

Figure 4-10

DRAWING TITLE: Peat and Spoil Repository 1 Layout and Sections	
PROJECT TITLE: Croagh Wind Farm, Co. Leitrim/ Co. Sligo	
DRAWING BY: POR	CHECKED BY: IH
PROJECT No.: 180511	DRAWING No.: 180511 - 42
SCALE: As Shown @ A3	DATE: 03.07.2020
OS SHEET No.: 4315, 4316, 4317, 4318, 4373, 4374, 4375, 4376, 4431, 4432, 4333, 4334, 4490, 4491, 4492, 4493	

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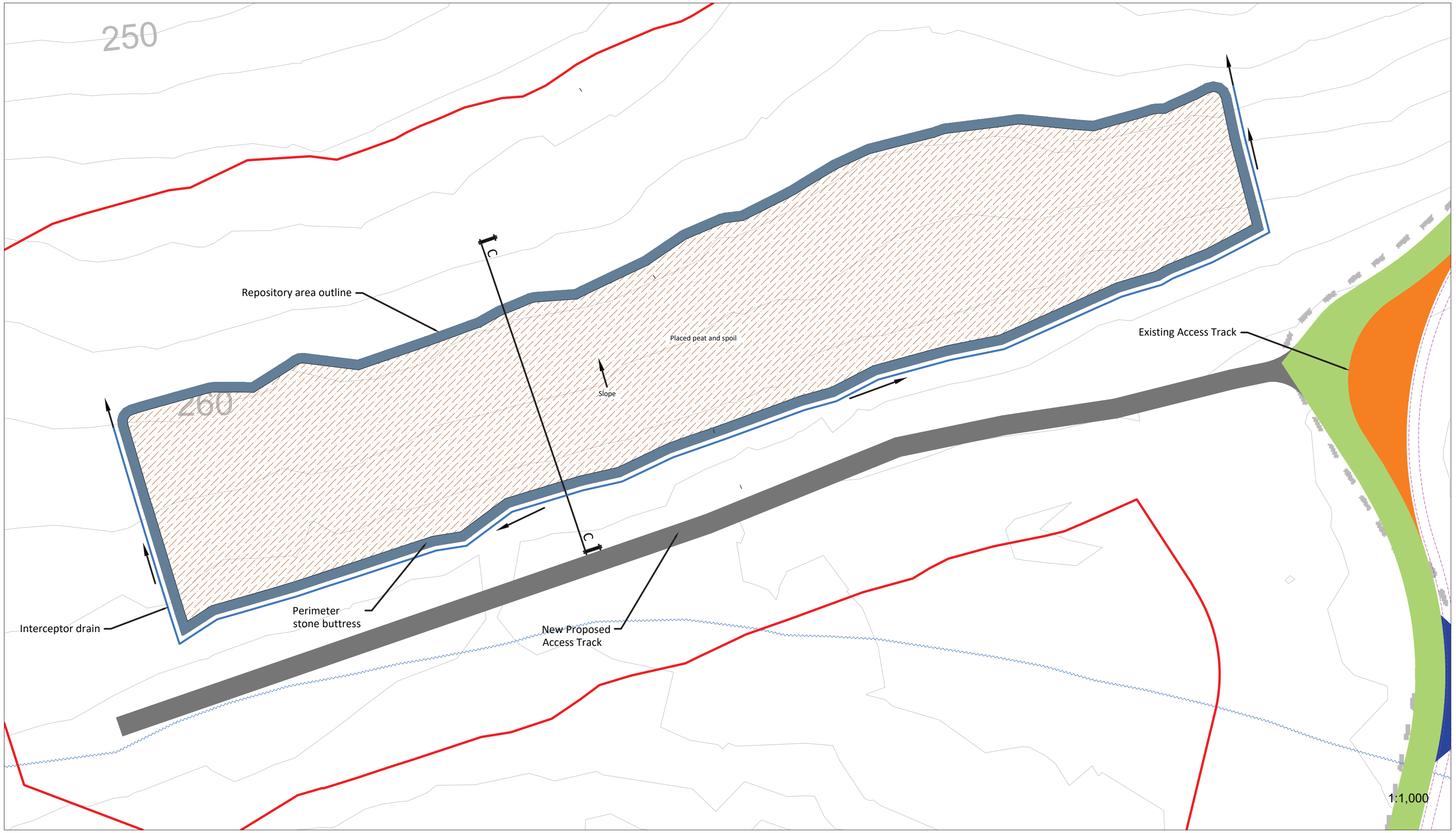

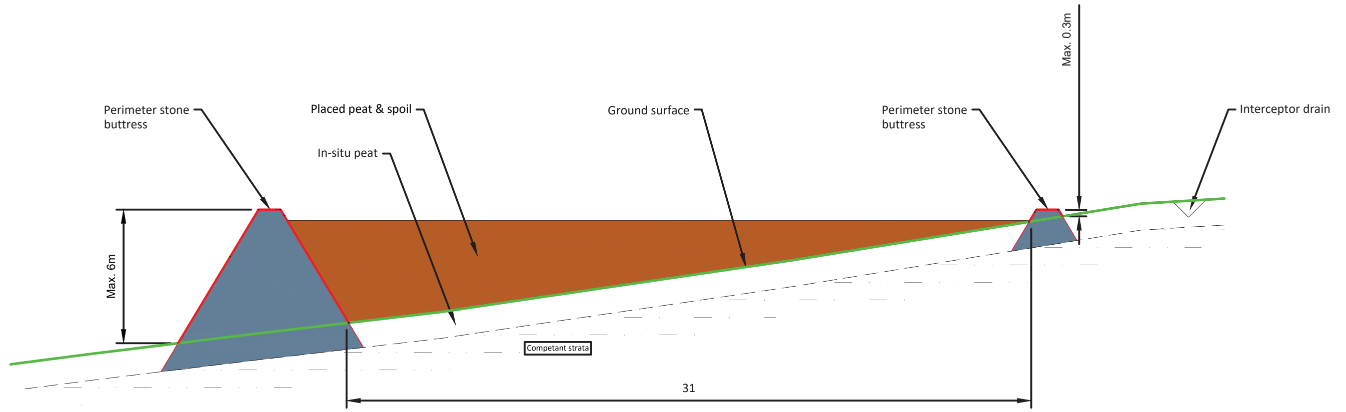

Construction Notes Borrow pit

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

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

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

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

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

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

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

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

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

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

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

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Figure 4-11

DRAWING TITLE:
Peat and Spoil Repository 2
Layout and Sections

PROJECT TITLE:
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PROJECT No.: 180511	DRAWING No.: 180511 - 43
SCALE: As Shown @ A3	DATE: 03.07.2020

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

4.3.5 Electricity Substation

It is proposed to construct a 38kV electricity substation within the site of the Proposed Development as shown in Figure 4-1. The proposed substation site is located within an area of forestry adjacent to an existing access road.

The footprint of the proposed onsite electricity substation compound measures approximately 1,058 square metres, and will include a wind farm control building and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid. Further details regarding the connection of the onsite substation to the national electricity grid are provided in Section 4.3.7 below.

The layout and cross-section of the proposed onsite substation is shown on Figure 4-12. The substation compound will be surrounded by an approximately 2.6-metre-high steel palisade fence (or as otherwise required by ESB), and internal fences will also segregate different areas within the main substation. The construction and exact layout of electrical equipment in the onsite electricity substation will be to ESB Networks specifications.

4.3.5.1 Wind Farm Control Building

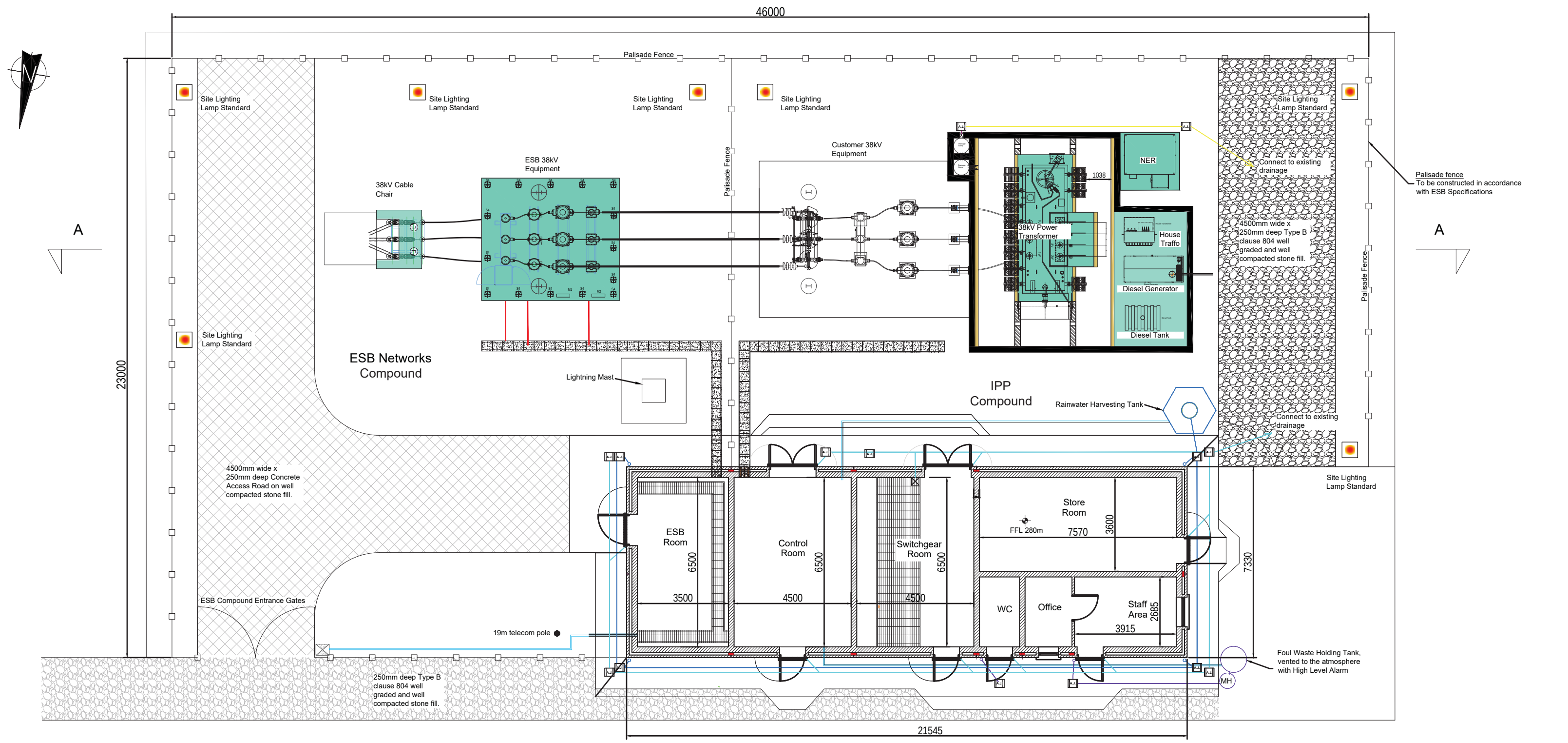
The wind farm control building will be located within the substation compound and will measure 21.8 metres by 7.3 metres and six metres in height. Layout and elevation drawings of the control building are included in Figure 4-13.

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

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

Such a proposal for managing the wastewater has become almost standard practice on wind farm sites, which are often in areas where percolation requirements for on-site treatment are challenging. This type of wastewater management proposal has been accepted by numerous planning authorities and An Bord Pleanála as an acceptable proposal.

The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. 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 site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management

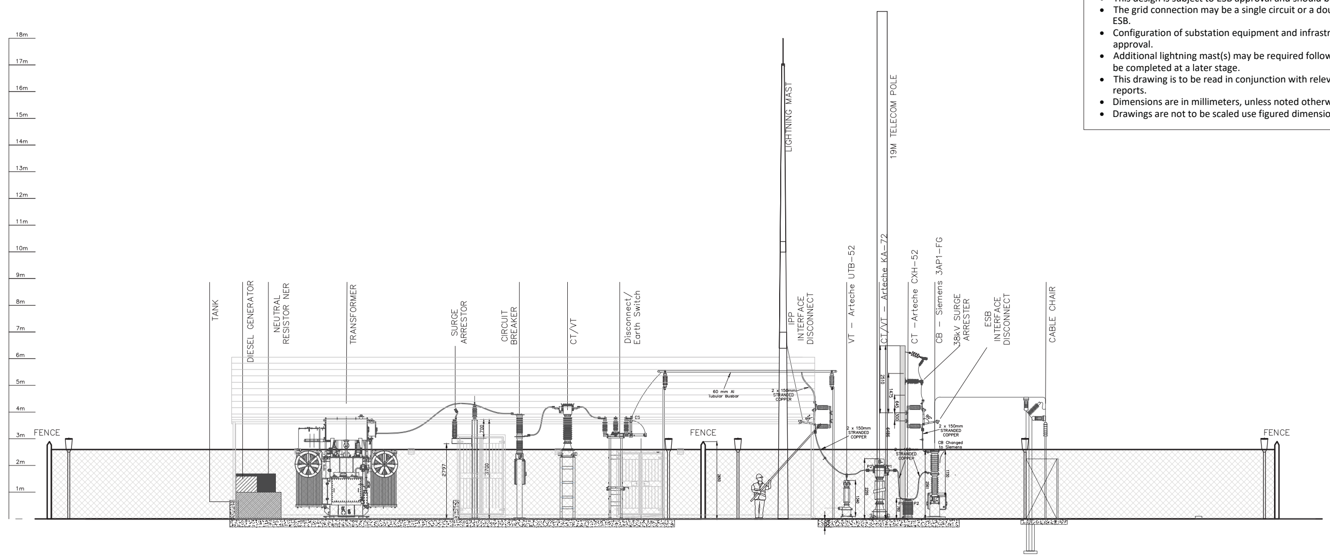


Windfarm-Substation Compound Layout

SCALE 1:100

PLEASE NOTE THAT THE SUBSTATION LAYOUT AND SUBSTATION COMPONENTS ILLUSTRATED ON THIS DRAWING ARE INDICATIVE ONLY. THE FULL SPECIFICATION AND DETAIL WILL BE DETERMINED FROM THE ELECTRICAL EQUIPMENT SUPPLIER, ESB FUNCTIONAL SPECIFICATION AND EIRGRID FUNCTIONAL SPECIFICATION

NOTES:
- This design is subject to ESB approval and should be used for planning purposes only.
- The grid connection may be a single circuit or a double circuit as to be agreed with ESB.
- Configuration of substation equipment and infrastructure is subject to ESB design approval.
- Additional lightning mast(s) may be required following a lightning protection study to be completed at a later stage.
- This drawing is to be read in conjunction with relevant drawings, specifications and reports.
- Dimensions are in millimeters, unless noted otherwise.
- Drawings are not to be scaled use figured dimensions only.



Section A-A

SCALE 1:100

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PROJECT

Croagh Wind Farm

38kV Grid Connection

CLIENT

COILLTE

CONSULTANTS

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NOTES: -

- See notes in main drawing window

LEGEND: -

Figure 4-12

ISSUE/REVISION

I/R	DATE	DESCRIPTION
04	01.07.20	Issued for Planning
03	12.06.20	Issued for Planning
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00	29.08.19	Issued for Information

PROJECT NUMBER

05-649

SHEET TITLE

Windfarm-Substation Compound Layout & Section

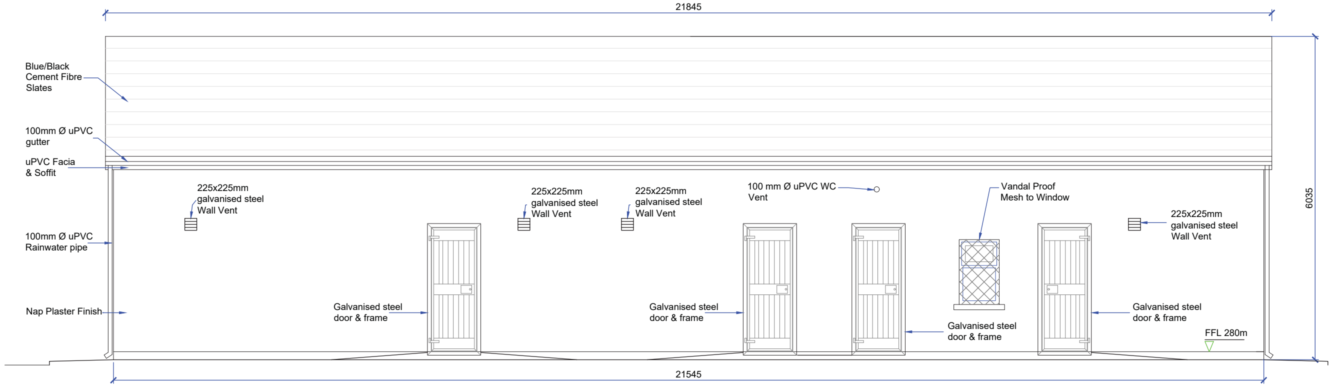
SHEET NUMBER

05649-230 (0511-67)

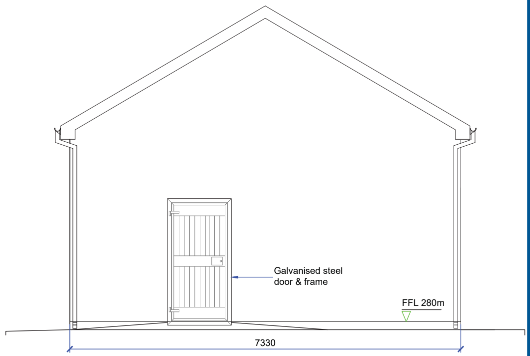
ISO A1 594mm x 841mm

Project Management Initials: Designer: CH Checked: SK Approved: RG

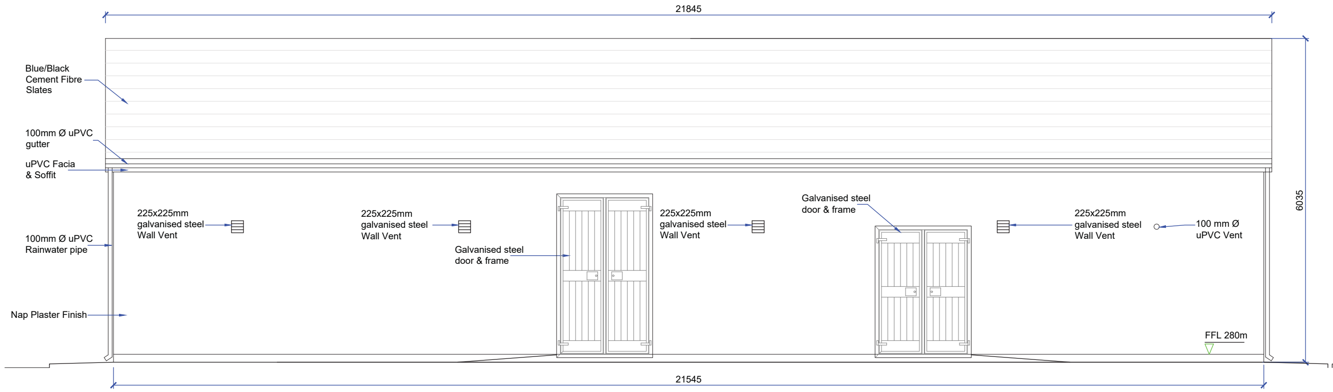
ISO A1 594mm x 841mm



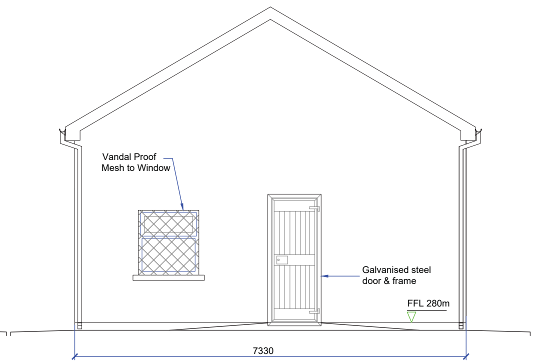
Front Elevation
SCALE 1:50



Side Elevation
SCALE 1:50



Rear Elevation
SCALE 1:50



Side Elevation
SCALE 1:50

PLEASE NOTE THAT THE SUBSTATION LAYOUT AND SUBSTATION COMPONENTS ILLUSTRATED ON THIS DRAWING ARE INDICATIVE ONLY. THE FULL SPECIFICATION AND DEATIL WILL BE DETERMINED FROM THE ELECTRICAL EQUIPMENT SUPPLIER, ESB FUNCTIONAL SPECIFICATION AND EIRGRID FUNCTIONAL SPECIFICATION

Project Management Initials: Designer: CH Checked: SK Approved: RG

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PROJECT

Croagh Wind Farm
38kV Grid Connection

CLIENT

COILLTE

CONSULTANTS

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NOTES: -

- This design is subject to ESB approval and should be used for planning purposes only.
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LEGEND: -

Figure 4-13

ISSUE/REVISION

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01	12.06.20	Issued for Planning
00	29.08.19	Issued for Information

PROJECT NUMBER
05-649

SHEET TITLE
Windfarm-Substation Building Elevations

SHEET NUMBER
05649-231 (0511-68)

(Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site to an appropriately licensed facility.

4.3.6 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 20 or 33kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building at the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in trenches that will be approximately 1.3 metres in depth and 0.6m in width, along the sides of roadways. The route of the cable ducts will follow the access track to each turbine location and are visible on the site layout drawings included as Appendix 4-1 to this report. The position of the internal site cable trench relative to the roadways is shown in section in Figure 4-4 to Figure 4-7 above. Figure 4-14 below shows two variations of a typical cable trench, one for off-road trenches (to be installed on areas of soft ground that will not be trafficked) and one for on-road trenches (to be used where trenches run along or under a roadway).

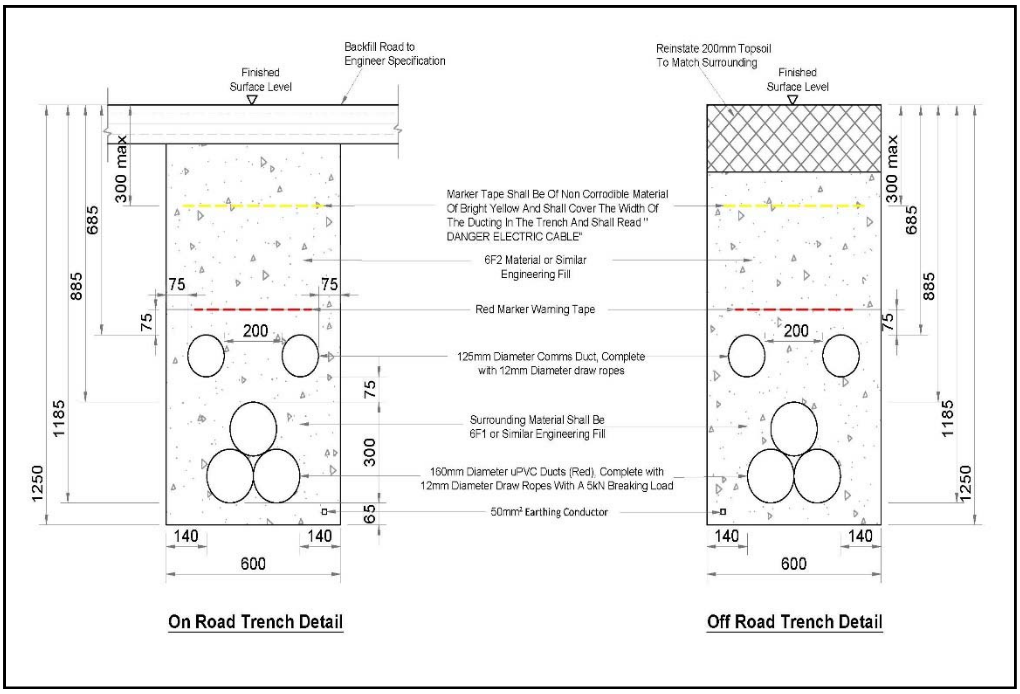


Figure 4-14 Typical Onsite Cable trench cross-section detail

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

4.3.7 Grid Connection Cabling

A 38kV connection between the Proposed Development and the national electricity grid will be necessary to export electricity from the proposed wind farm. This connection will originate at the proposed onsite substation and will run southeast along the existing site roads before tuning northeast and running along the local public road and substation access road, within Coillte property, to the existing Garvagh 110kV Electricity Substation, located within the site in the townland of Seltan. The grid connection cabling route is approximately 6.2 kilometres in length. This connection route is illustrated in Figure 4-1. All works required to connect the proposed wind farm to the national grid can be undertaken within the site boundary.

For the purposes of the grid connection design for this planning application, it is assumed that the export capacity of the of the proposed wind farm will be 48MW as per Section 4.3.1.6. Whether this export capacity will require a single circuit or double circuit 38kV connection to Garvagh Substation will be determined by ESB/EirGrid following more detailed analysis as part of the grid connection offer process. For the purposes of the planning application a double circuit connection has been designed, however, design details for a single circuit connection have also been provided. The difference between the two connection types is the number of ducts, the number of cables and the width of the trench and associated joint bay chambers.

Typical 38kV single and double circuit trench cross sections are shown in Figures 4-15 and 4-16. Further details in relation to the grid connection for the proposed development is outlined in Section 4.9.6.

4.3.8 Meteorological Mast

One permanent meteorological mast is proposed as part of the Proposed Development. The anemometry masts will be equipped with wind monitoring equipment at various heights. The mast will be located at E584,049 N823,136 as shown on the site layout drawing in Figure 4-1. The mast will be a slender structure up to 100 metres in height. The mast will be a free-standing structure. The mast will be constructed on a hard-standing area sufficiently large to accommodate the crane that will be used to erect the mast, adjacent to an existing track. The typical design of the proposed anemometry mast is shown in Figure 4-17.

4.3.9 Temporary Construction Compounds

A temporary construction compound measuring approximately 60 metres by 40 metres and 2,370 square metres in area is proposed for the centre of the site, adjacent to the existing access road approximately 270 metres northeast of Turbine No. 7. The location of the proposed construction compound is shown on the site layout drawing in Figure 4-1.

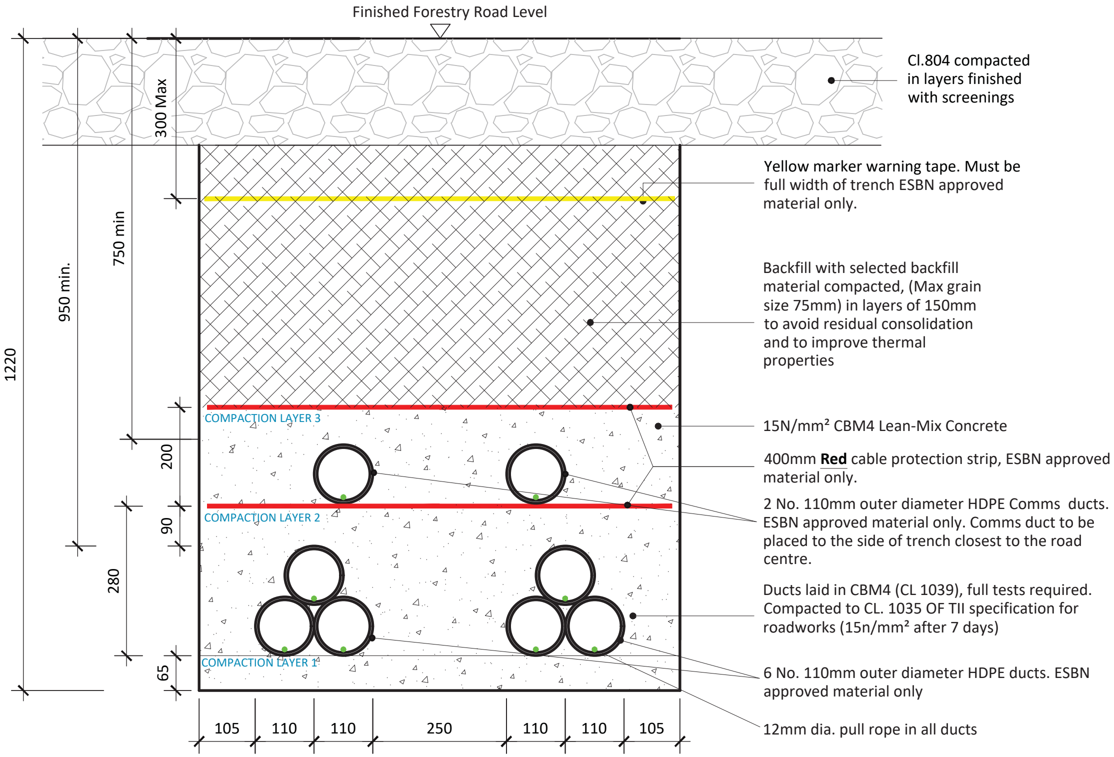
The construction compound will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors. The layout of this construction compound is shown on Figure 4-18. Construction materials and turbine components will be brought directly to the proposed turbine locations following their delivery to the site.

Temporary port-a-loo toilets located within a staff portacabin will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by a permitted waste collector to wastewater treatment plants.

There will be a second temporary construction compound located adjacent to an existing road approximately 140 metres north of Turbine No. 4 in the southwest of the proposed site. This temporary compound will measure approximately 2,110 square metres in area. This temporary construction compound will include staff facilities and a temporary port-a-loo and is also shown in Figure 4-1. The layout of this construction compound is shown in Figure 4-19

Upon commissioning of the proposed wind farm, all temporary structures will be removed from the construction compounds and the areas will be covered with previously excavated peat and spoil and reseeded.

38kV DOUBLE CIRCUIT DETAILS



Typical Section Through Forestry Road

SCALE 1:10

Note:
- The proposed design is subject to ESB approval and should be used for planning purposes only.
- This drawing is to be read in conjunction with relevant drawings, specifications and reports.
- Dimensions are in millimeters, unless noted otherwise.
- Drawings are not to be scaled use figured dimensions only.

ALL REINSTATEMENT WORKS ARE TO BE IN ACCORDANCE WITH LANDOWNERS REQUIREMENTS

Figure 4-15

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PROJECT
Croagh Wind Farm
38 kV Grid Connection

SHEET TITLE
38kV Double Circuit - Typical Ducting Details through Forestry Road

PROJECT NUMBER
05-649

SHEET NUMBER
05649-219(0511-75)

DRAWING STATUS
For Planning

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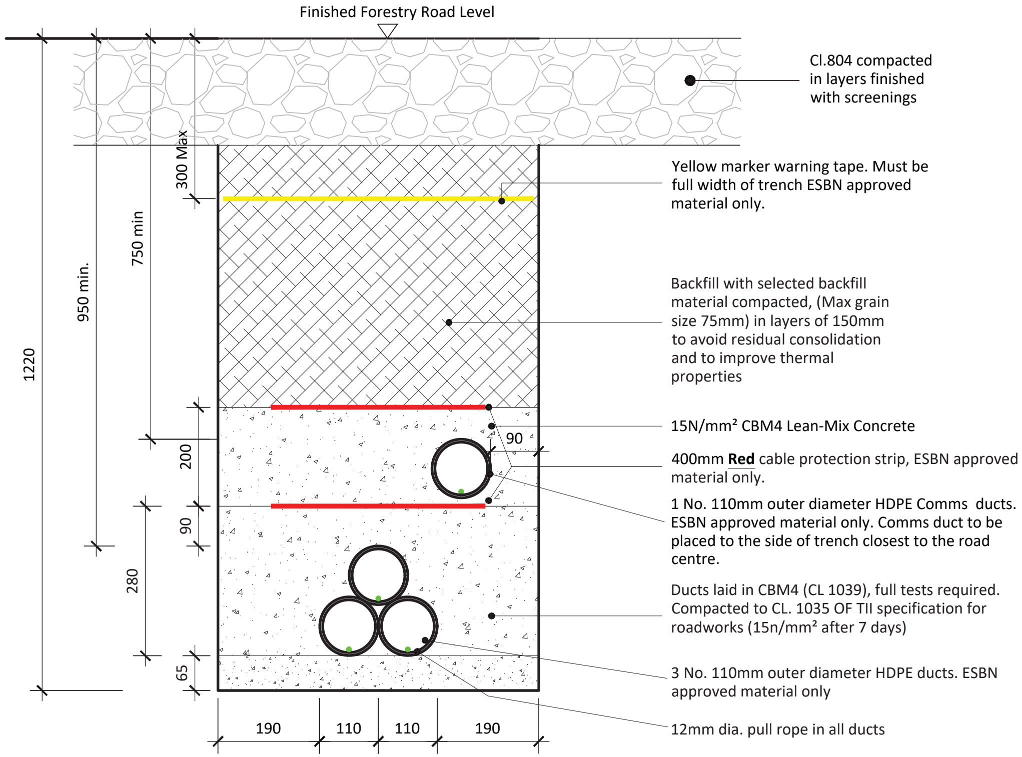

Typical Section Through Forestry Road

SCALE 1:10

Note:
- The proposed design is subject to ESB design approval and should be used for planning purposes only.
- This drawing is to be read in conjunction with relevant drawings, specifications and reports.
- Dimensions are in millimeters, unless noted otherwise.
- Drawings are not to be scaled use figured dimensions only.

ALL REINSTATEMENT WORKS ARE TO BE IN ACCORDANCE WITH LANDOWNERS REQUIREMENTS

Figure 4-16

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PROJECT
Croagh Wind Farm
38 kV Grid Connection

SHEET TITLE
38kV Single Circuit - Ducting through Forestry Road Section

PROJECT NUMBER
05-649

SHEET NUMBER
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DRAWING STATUS
For Planning

ISSUE/REVISION

I/R	DATE	DESCRIPTION
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4.3.10 Tree Felling and Replanting

4.3.10.1 Tree Felling

The majority of the site (86%) currently comprises commercial coniferous forestry plantation. As part of the Proposed Development, tree felling will be required within and around the development footprint to allow the construction of turbine bases, access roads and the other ancillary infrastructure.

A total of 55.1 hectares of forestry will be permanently felled within and around the footprint of the Proposed Development in order to facilitate infrastructure construction and turbine erection. Figure 4-20 shows the extent of the areas to be permanently felled as part of the Proposed Development.

The tree felling activities required as part of the Proposed Development 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 Development be submitted with the felling licence application; therefore, the felling license cannot be applied for until such time as planning permission is obtained for the Proposed Development.

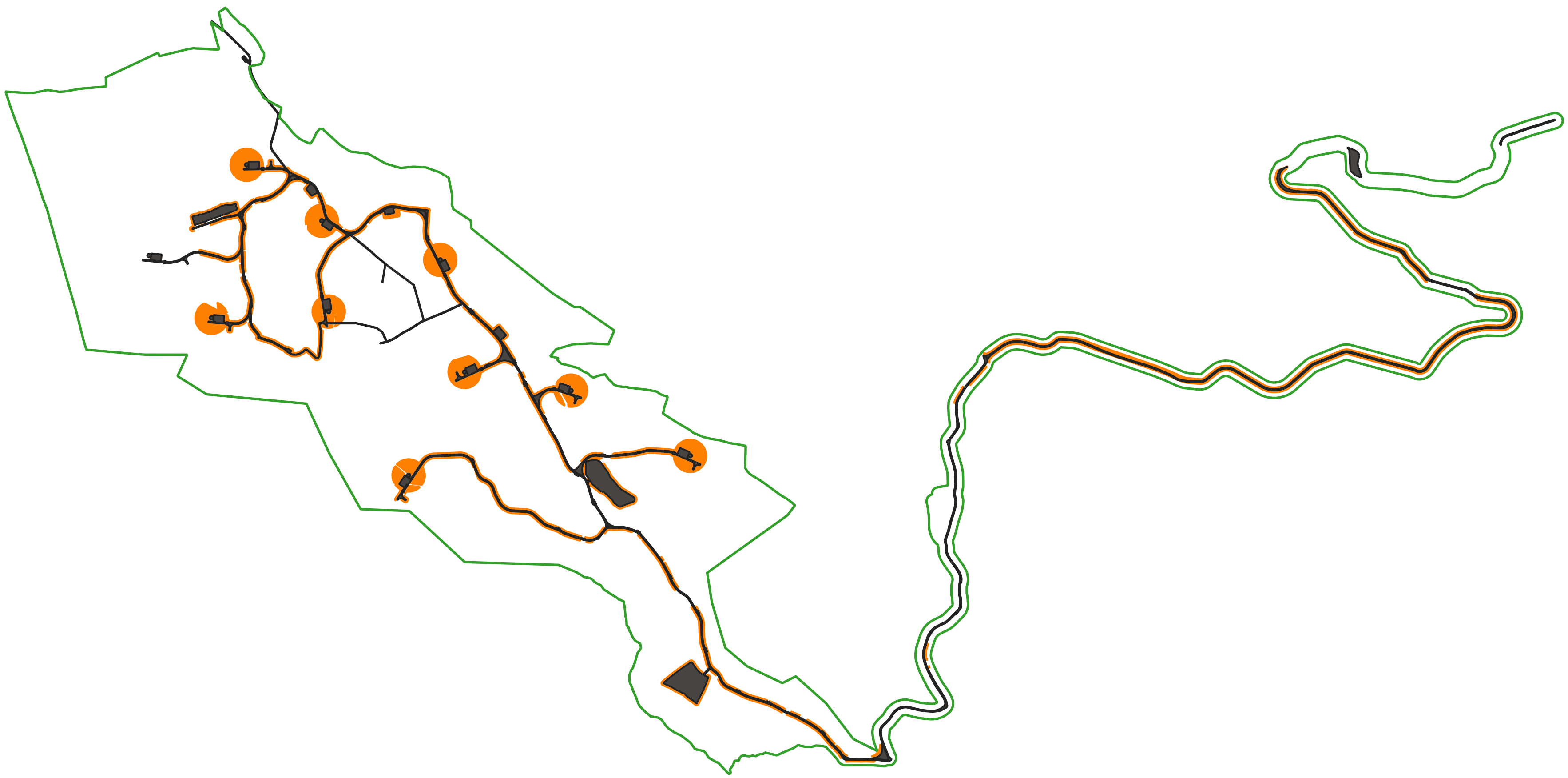
4.3.10.2 Forestry Replacement

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

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

The estimated 55.1 hectares that will be permanently felled for the footprint of the turbines and the other infrastructure and turbine erection will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that might be issued in respect of the proposed wind farm development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement of the 55.1 hectares of forestry can occur anywhere in the State subject to licence. Three potential forestry replacement areas, listed in Table 4-3 below have been identified for assessment purposes, with a combined availability of 59.33 hectares. These lands have been granted Forest Service Technical Approval for afforestation, and these or similarly approved lands will be used for replanting should the proposed wind farm receive planning permission. A description of the proposed replanting lands and an assessment of the potential impacts including cumulative impacts associated with afforestation at this location are provided in Appendix 4-3 of this EIAR.



Map Legend

- EIAR Site Boundary
- Development Footprint
- Felling Area (55.1ha)

Drawing Title	
Proposed Felling Area	
Project Title	
180511 - Croagh Wind Farm EIAR	
Drawn By: Daire O'Shaughnessy	Checked By: Eoin McCarthy
Project No.: 180511	Drawing No.: Fig 4-20
Scale: 1:35,000	Date: 29.06.20

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Table 4-3 Proposed Replanting Lands

Location No.	Property Name	Location	Technically Approved Area (hectares)
1	Stranamart	Co. Cavan	12.57
2	Brackloon	Co. Roscommon	7.2
3	Ballard	Co. Wicklow	39.56
Total Area Available			59.33

4.3.11 Site Activities

4.3.11.1 Environmental Management

All proposed activities on the site of the Proposed Development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Development and is included in Appendix 4-4 of this EIAR. The CEMP sets out the key environmental considerations to be taken into account by the contractor during construction of the proposed development. The CEMP also details the mitigation measures to be implemented in order to comply with the environmental commitments outlined in the EIAR. The contractor will be contractually obliged to comply with all such measures. In the event planning permission is granted for the Proposed Development, the CEMP will be updated prior to the commencement of the development, to address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned and will be submitted to the Planning Authority for written approval.

4.3.11.2 Refuelling

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

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

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

4.3.11.3 Concrete Deliveries

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

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) or equivalent. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility. 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 Plates 4-3 and 4-4 below.

Plate 4-3 Concrete washout area

Plate 4-4 Concrete washout area

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

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

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

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

4.3.11.4 Concrete Pouring

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

- Using weather forecasting to assist in planning large concrete pours and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- Disposing of any potential, small surplus of concrete after completion of a pour in suitable locations away from any watercourse or sensitive habitats.

4.3.11.5 Dust Suppression

In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

4.3.11.6 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. A wheelwash facility will be provided and a typical detaild of the same is shown in Figure 4-21. The site roads will be well finished with non-friable, compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the Proposed Development.

4.3.11.7 Waste Management

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

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

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

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

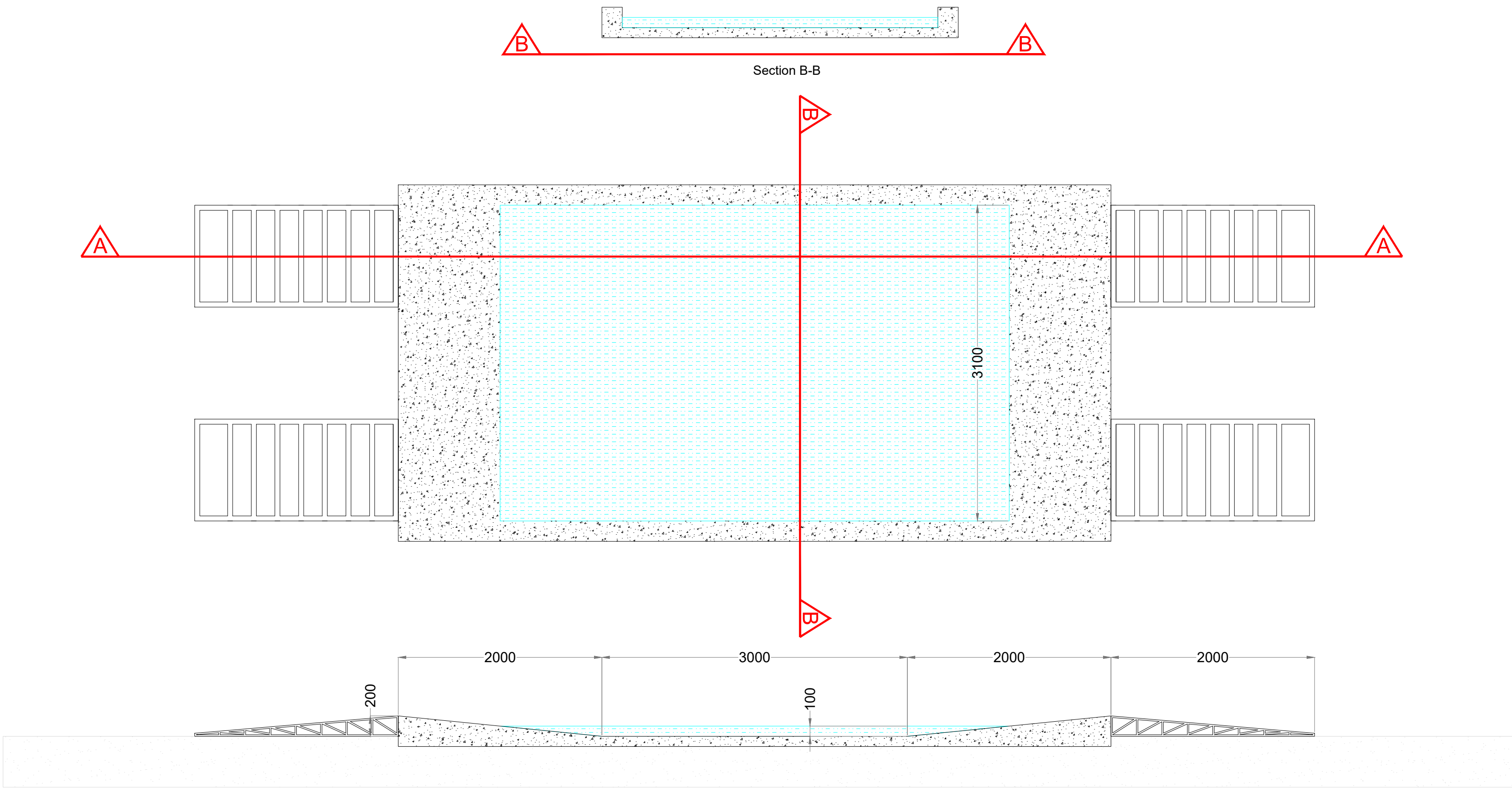

Figure 4-21

DRAWING TITLE:
Typical Wheel Wash Detail

PROJECT TITLE:
Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY: Joseph O Brien	CHECKED BY: Eoin McCarthy
PROJECT No.: 180511	DRAWING No.: 180511 - 54
SCALE: 1: 50 @ A3	DATE: 03.07.2020

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ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

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

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

4.4 Access and Transportation

4.4.1 Site Entrances

During the construction of the proposed development, the Croagh Wind Farm site will be accessed via a proposed new construction phase entrance and access road off the L4282 Local Road in the townland of Derrycullinan, Co. Leitrim. This entrance will be used as the primary site entrance during the construction phase of the proposed development. The boundary with the L4282 will be reinstated with fencing upon the completion of the construction stage.

The main site entrance that will be used to access the wind farm site, during both the construction and operational phases of the proposed development, is an existing entrance off the L4282 in the townland of Boleymaguire. The existing entrance will be upgraded to accommodate the delivery of turbine components and abnormal loads during the construction phase of the proposed development. This entrance will be used as the primary site entrance during the operational phase for the access and egress of operational and maintenance staff.

Both site entrances are shown on Figure 4-1 and on the layout drawings included in Appendix 4-1 of this EIAR.

As outlined in Section 4.6.1.1 below, visitors to the site, during the operational phase, will access thesite via an existing entrance off the local road in the townland of Garvagh Glebe.

Both site entrances are shown on Figure 4-1 and on the layout drawings included in Appendix 4-1 of this EIAR.

4.4.1.1 Link Road and Construction Access Road

The site of the proposed development is currently accessed, from the R280 to the west, via the local road network. To facilitate the delivery of large turbine components and other abnormal loads during the construction of the wind farm, this application includes for the construction of:

- a link road between the R280 in the village of Drumkeeran and the L4282 in the townland of Derryboffin; and,
- a construction phase access road between the L4282 at Derrycullinan and the same local road at Bargowla.

Link Road

HGVs and vehicles delivering large turbine components and other abnormal loads to the site of the proposed development will turn west off the R280, in Drumkeeran village, into an existing farmyard. In this yard, there will be temporary removal of a wooden fence adjacent to the R280, partial demolition of a small agricultural storage building and the removal of part of the rear wall of the larger, livestock shed to allow vehicles to continue through the yard. Once through the larger shed, the vehicles will continue west on a proposed new road, measuring approximately 260m, through agricultural land before turning south onto the L4282 in the Derryboffin. The vehicles will travel west along the L4282 before turning south at the new proposed construction site entrance in the townland of Derrycullinan. A plan view of the link road arrangement is shown in detail in Figure 4-22.

Upon completion of the construction phase, corrugated steel gates will be installed in place of a rear masonry wall at the back of the large, livestock shed and stockproof fencing and a gate will also be installed to reinstate the boundary between the agricultural land west of the farm yard and the L4282. The road that will be constructed through this agricultural land will be left in place and the embankments of the road will be seeded or be allowed to revegetate. Existing elevations and details of the proposed works to the agricultural buildings area shown in Figures 4-23 to 4-28. Details of these works are outlined in Section 4.9.7 below.

This link road is only intended for use during the construction phase of the proposed development for the delivery of large turbine components and other abnormal loads. However, it will be used during the operational phase only in the exceptional and unlikely event of the delivery of a replacement turbine component or other abnormal load required for the operational maintenance of the wind farm.

Construction Access Road

From the proposed construction phase site entrance in the townland of Derrycullinan, the construction access road will comprise a combination of proposed new roads and the upgrade of existing forestry roads. The construction access road will from a new junction with L4282 in the townland of Bargowla. The construction access road is shown in Figure 4-1 and in the drawings in Appendix 4-1.

This access road will accommodate the delivery of all of the turbine components and the vast majority of all other construction materials, thereby, significantly reducing the volume of traffic, associated with the construction of the proposed development, using the local road network in the vicinity of the site.

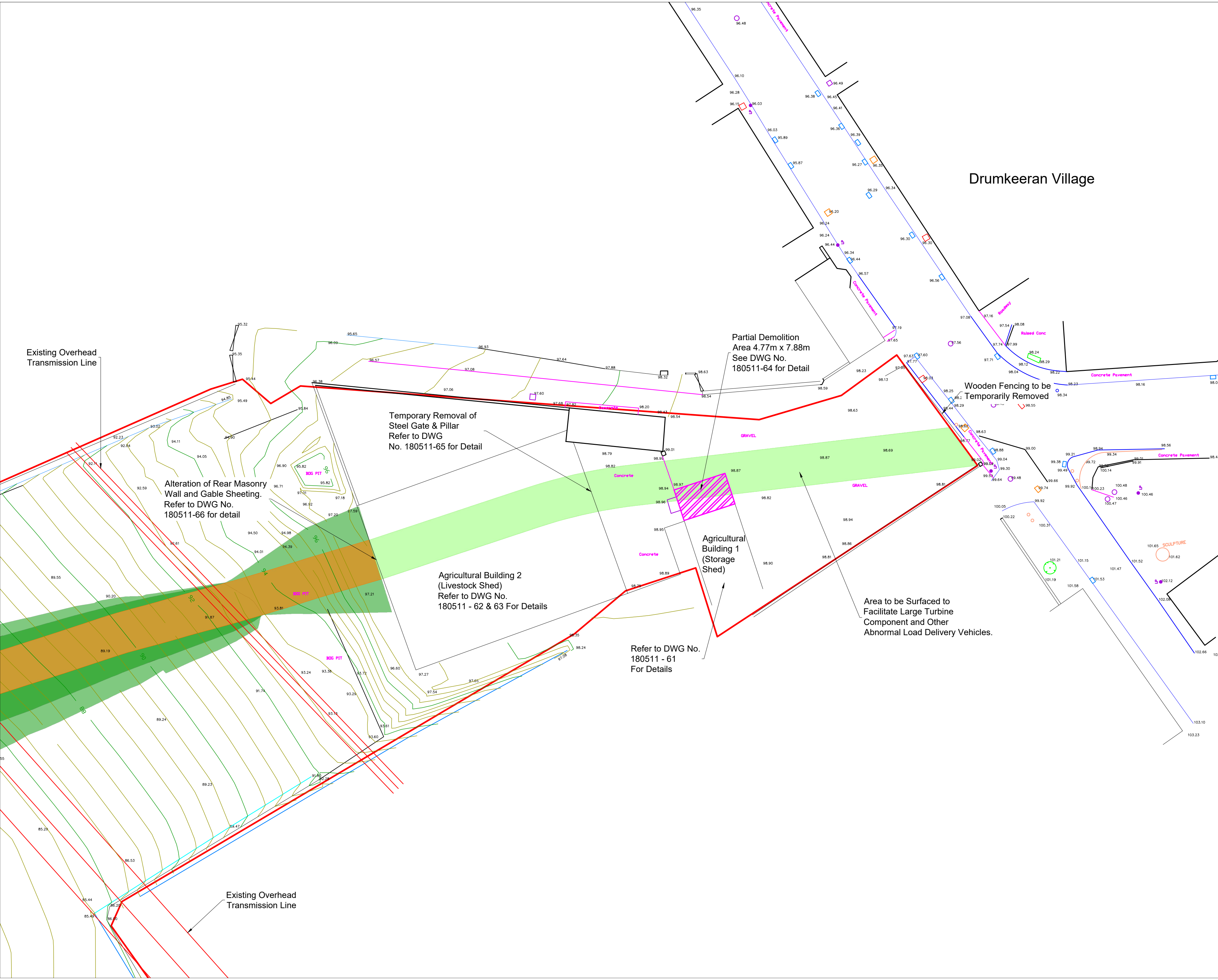
Once the proposed Croagh Wind Farm is operational, the sections of the contructon access road, under the control of the applicant, will remain in use for forestry operations. The road will also be used in the event of the delivery of a replacement turbine component or other abnormal load required for the operational maintenance of the wind farm.

The proposed new junctions in Derrycullinan and Bargowla will be closed off using stockproof fencing and steel barriers or gates.

Road Widening Works Area

As illustrated in Figure 4-1, a hardstanding area will be constructed within agricultural land, adjacent to the L4282, in order to widen the local road between two sharp bends in the townland of Derrycullinan. This widening area is required to facilitate the delivery of large turbine components and other abnormal loads.

Upon completion of the construction phase of the proposed development, the boundary between the local road and the hardstanding area will be reinstated using stockproof fencing.



Drawing Legend

- Planning Application Boundary (Leitrim County Council)
- Existing Road to be Upgraded
- Proposed Road
- Fill

Figure 4-22

DRAWING TITLE:
Link Road Arrangement Detail

PROJECT TITLE: Croagh Wind Farm, Co. Leitrim/ Co. Sligo	
DRAWING BY: Joseph O Brien	CHECKED BY: Michael Watson
PROJECT No.: 180511	DRAWING No.: 180511 - 60
SCALE: 1:500 @ A3	DATE: 03.07.2020
OS SHEET No.: 1196, 1197, 1198, 1262, 1263, 1264, 1331, 1332, 1333	

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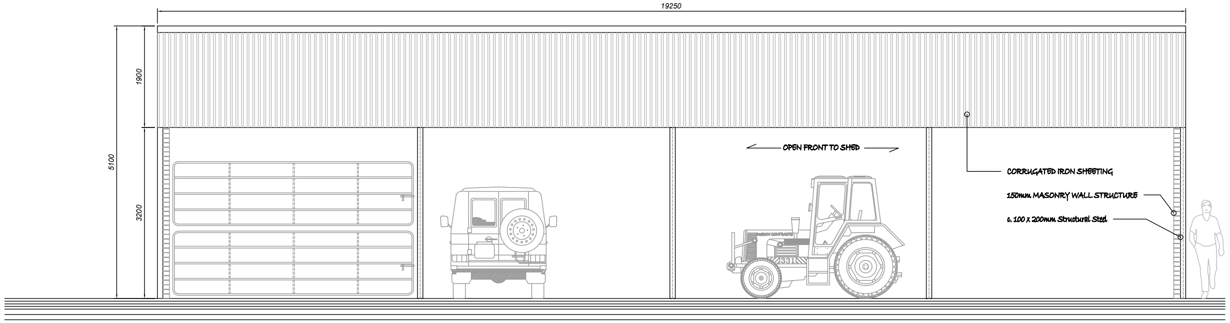
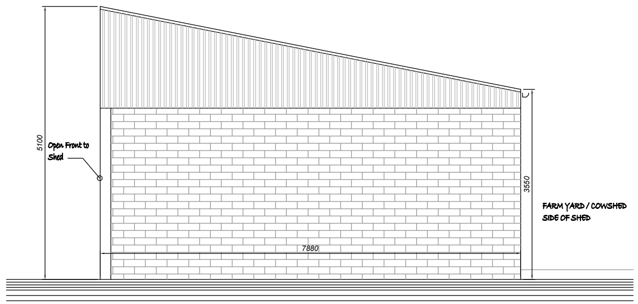
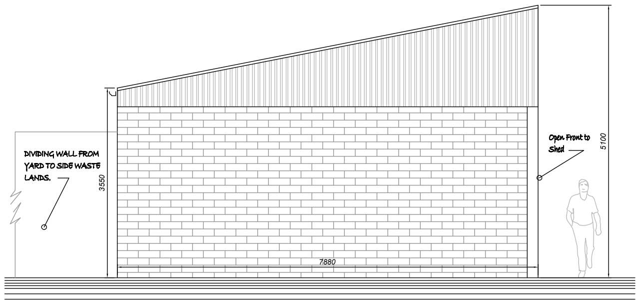


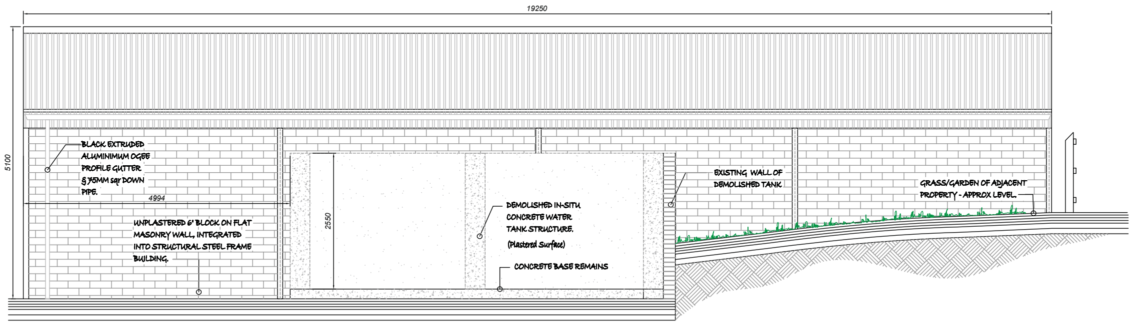
STORAGE SHED: EAST ELEVATION (Front)



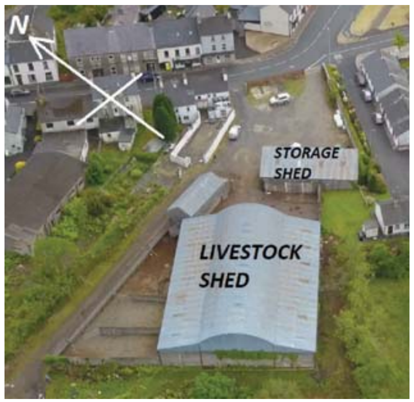
STORAGE SHED: NORTH ELEVATION



STORAGE SHED: SOUTH ELEVATION



STORAGE SHED: WEST ELEVATION (Rear)



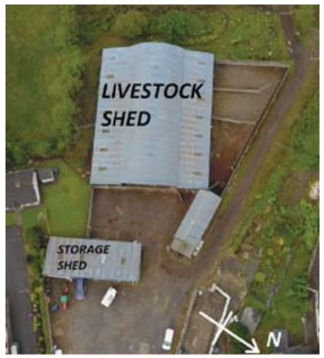


Figure 4-23

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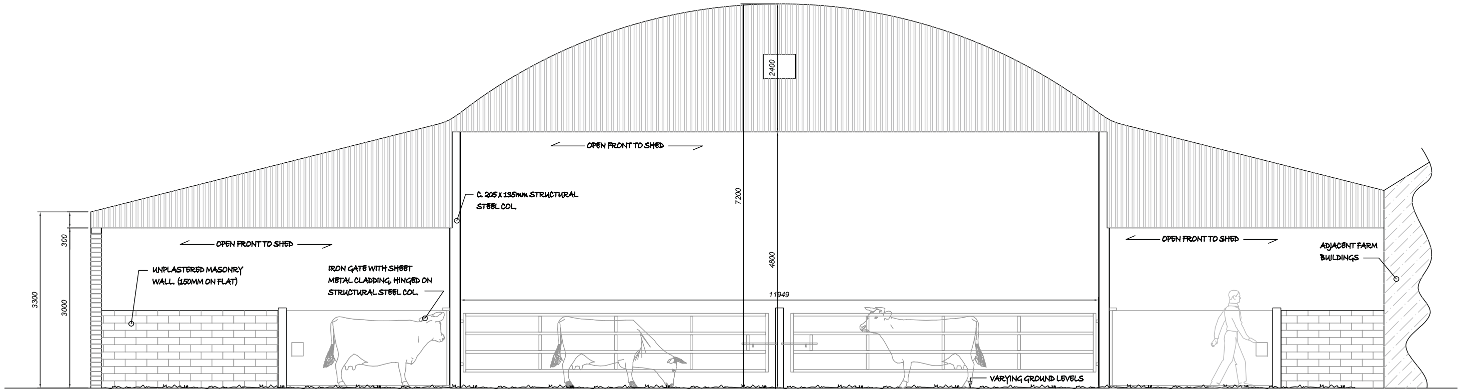
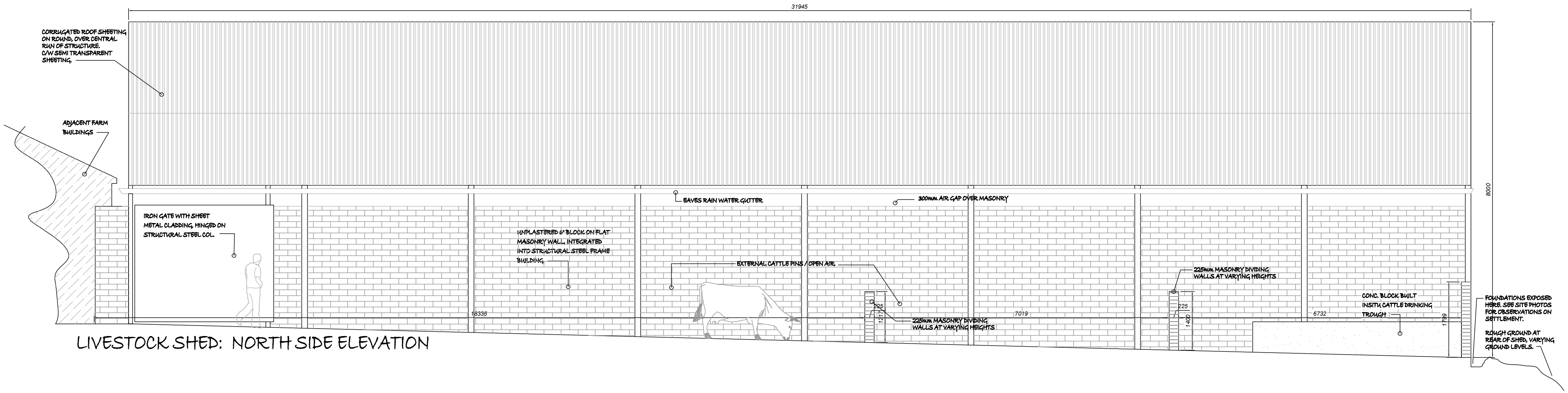
SCALE	1:100	DATE	03.07.2020
JOB NO	20057	DRG NO	DRG NO. 0511-61
CLIENT	Coillte		
PROJECT	Carrane Hill WF PA		
SITE ADDRESS	Drumkeeran, Co Leitrim.		
TITLE	Storage Shed - Existing Elevations		
DRAWING BY	Vincent Durkin		
APPROVED BY	Eoin McCarthy		



LIVESTOCK SHED: EAST ELEVATION (Front)



LIVESTOCK SHED: NORTH SIDE ELEVATION

Figure 4-24

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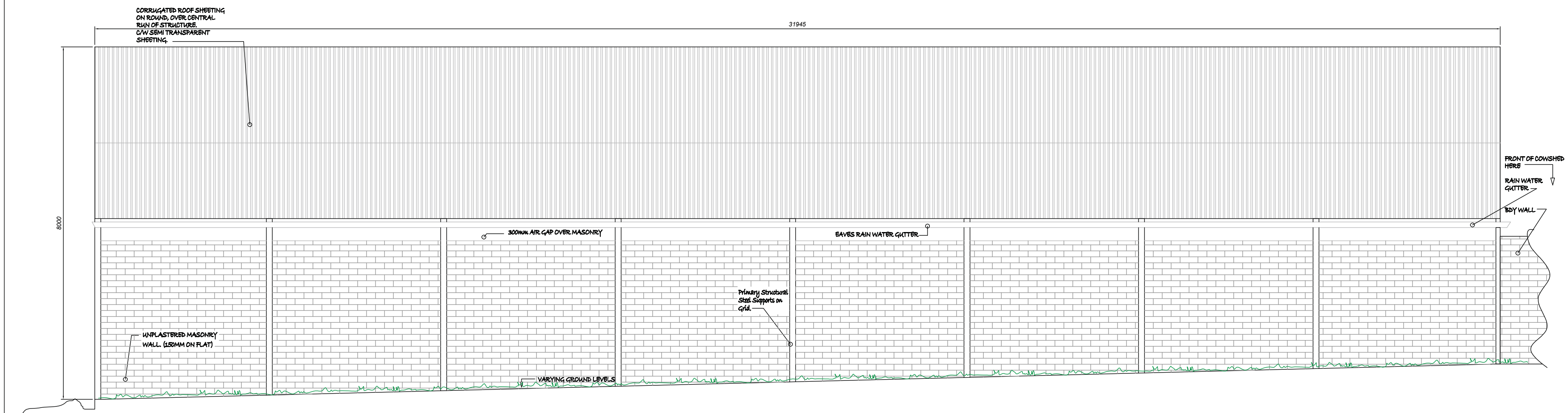
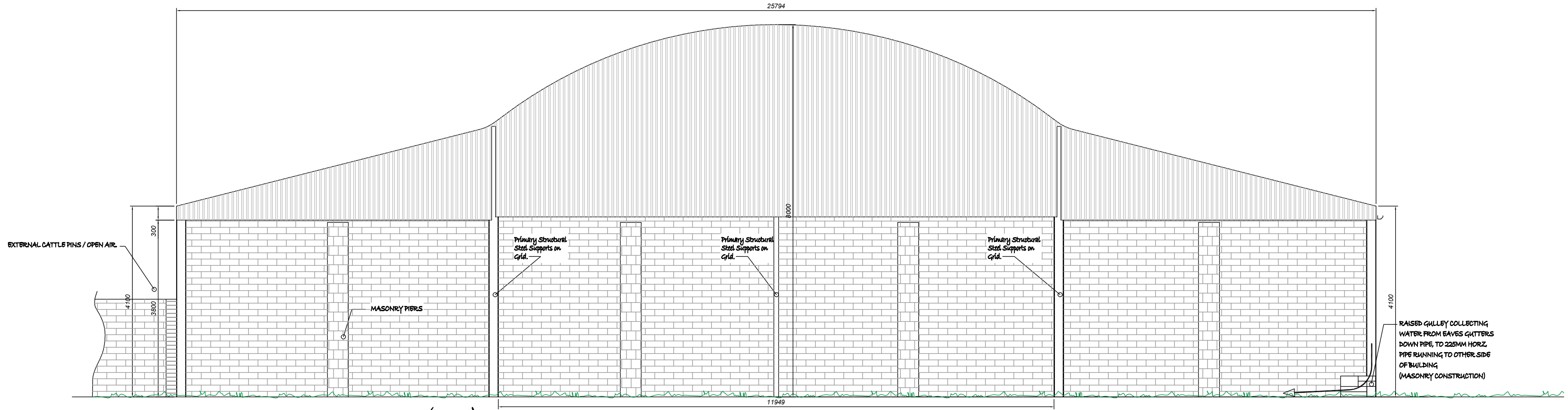
SCALE	1:100	DATE	03.07.2020
JOB NO	20057	DRG NO	DRG NO 0511-62
CLIENT	Coillte		
PROJECT	Carrane Hill WF PA		
SITE ADDRESS	Drumkeeran, Co Leitrim.		
TITLE	Livestock Shed - Existing North and East Elevations		
DRAWING BY	Vincent Durkin		
APPROVED BY	Eoin McCarthy		



LIVESTOCK SHED: SOUTH ELEVATION



LIVESTOCK SHED: WEST ELEVATION (Rear)

Figure 4-25

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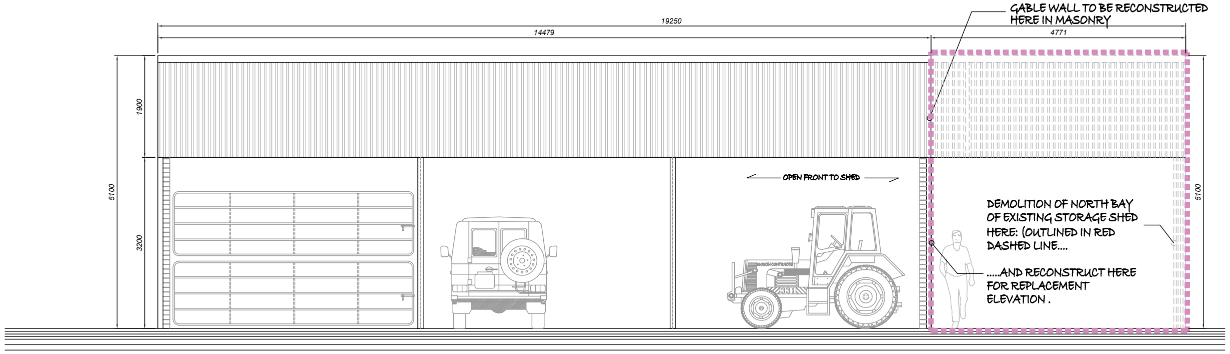
SCALE	1:100	DATE	03.07.2020
JOB NO	20057	DRG NO	DRG NO 0511-63
CLIENT	Coillte		
PROJECT	Carrane Hill WF PA		
SITE ADDRESS	Drumkeeran, Co Leitrim.		
TITLE	Livestock Shed - Existing South & West Elevations		
DRAWING BY	Vincent Durkin		
APPROVED BY	Eoin McCarthy		



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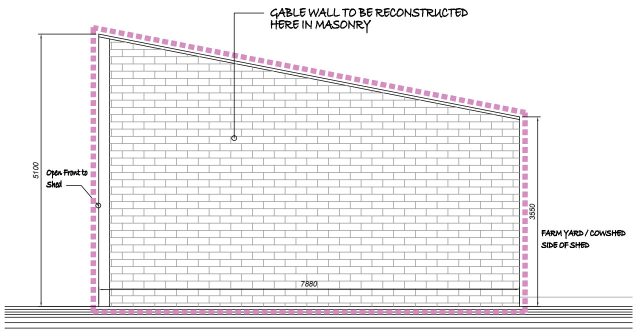
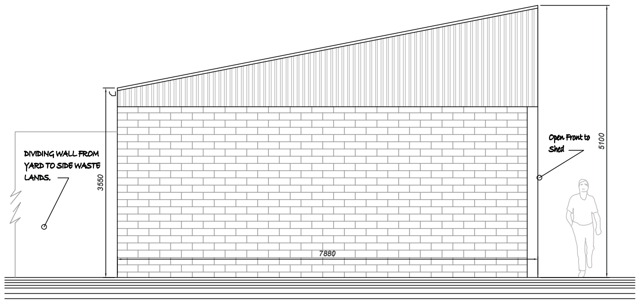
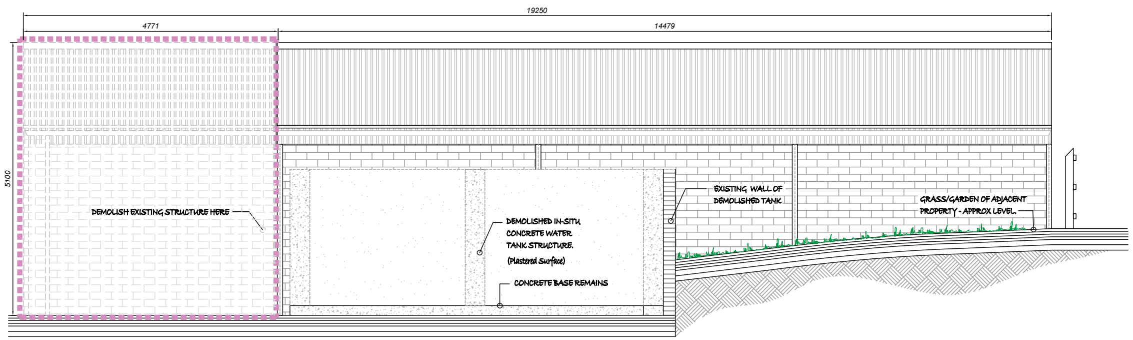


STORAGE SHED: NORTH ELEVATION



STORAGE SHED: SOUTH ELEVATION



STORAGE SHED: WEST ELEVATION (Rear)

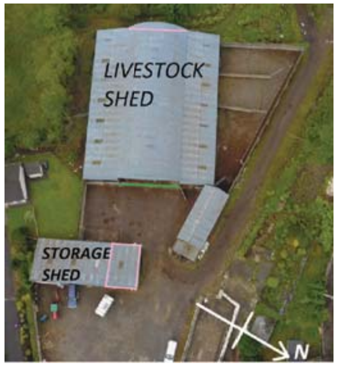


Figure 4-26

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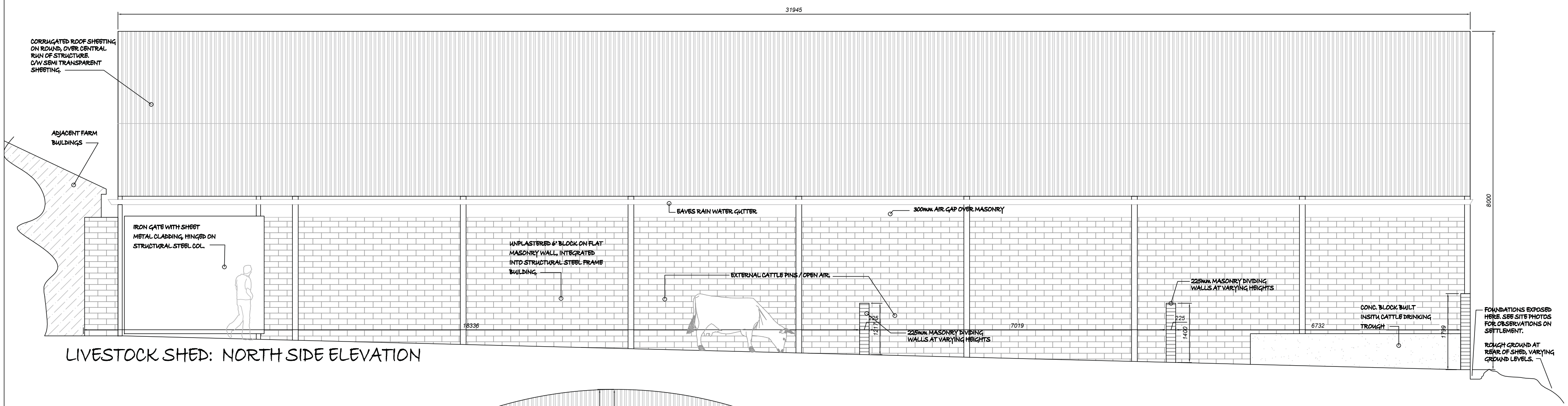
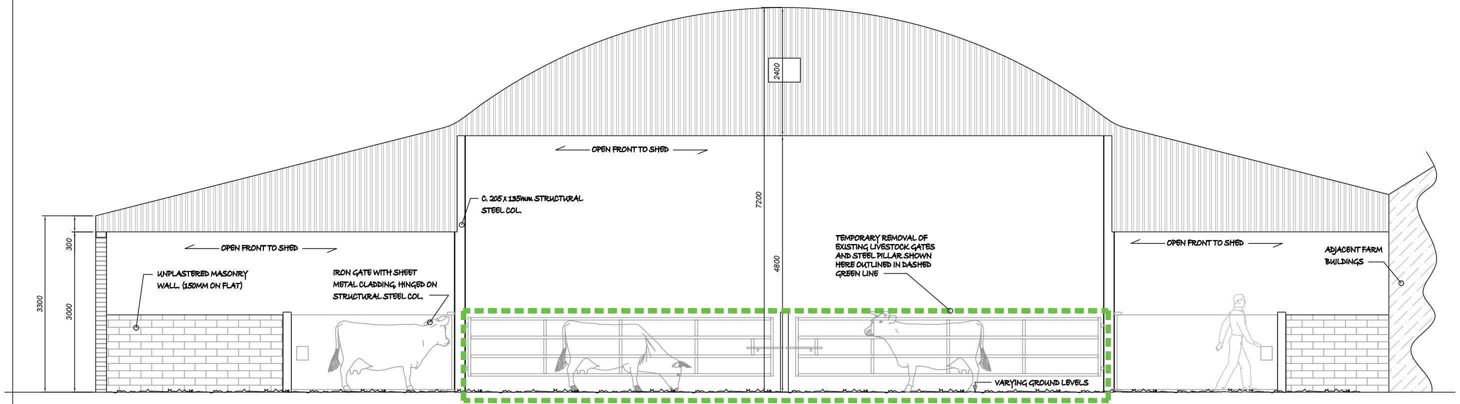
JOB NO	20057	DRG NO	DRG NO 0511-64
CLIENT	Coillte		
PROJECT	Carrane Hill WF PA		
SITE ADDRESS	Drumkeeran, Co Leitrim.		
TITLE	Storage Shed - Proposed Elevations		
DRAWING BY	Vincent Durkin		
APPROVED BY	Eoin McCarthy		



LIVESTOCK SHED: NORTH SIDE ELEVATION



LIVESTOCK SHED: EAST ELEVATION (Front)

Figure 4-27

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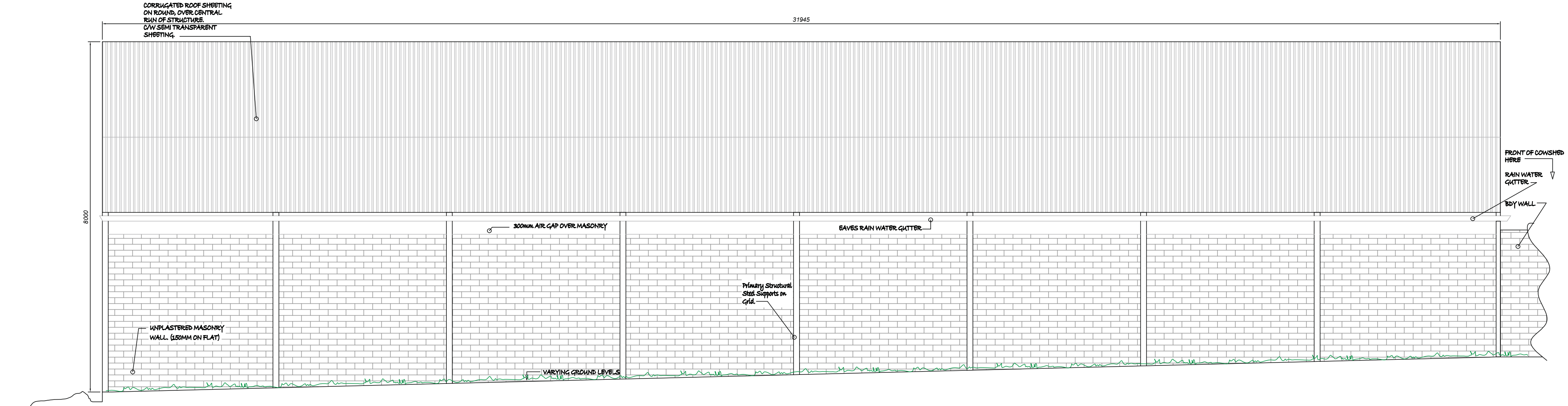
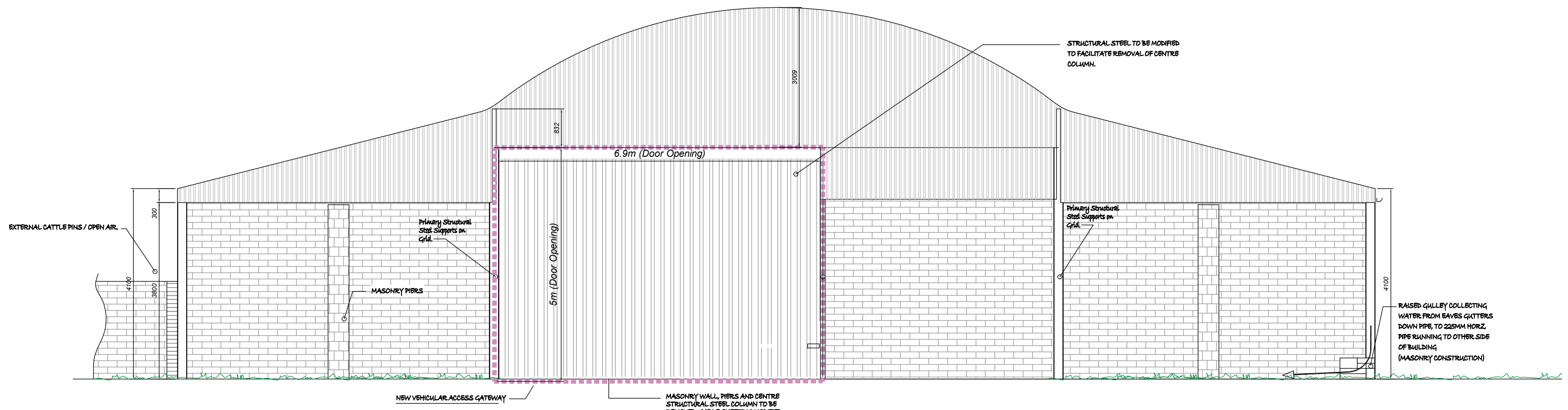
JOB NO	20057	DRG NO	DRG NO 0511-65
CLIENT	Coillte		
PROJECT	Carrane Hill WF PA		
SITE ADDRESS	Drumkeeran, Co Leitrim.		
TITLE	Livestock Shed North & East Elevations		
DRAWING BY	Vincent Durkin		
APPROVED BY	Eoin McCarthy		



LIVESTOCK SHED: SOUTH ELEVATION



LIVESTOCK SHED: WEST ELEVATION (Rear)

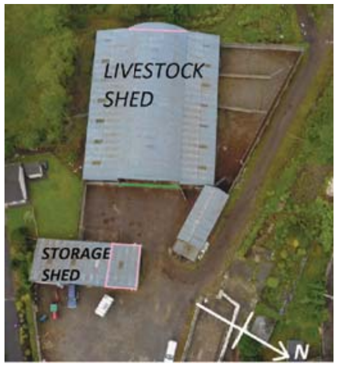


Figure 4-28

STATUS: Proposal Document only - Not for Construction

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SCALE	1:100	DATE	03.07.2020
JOB NO	20057	DRG NO	DRG NO 0511-66
CLIENT	Coillte		
PROJECT	Carrane Hill WF PA		
SITE ADDRESS	Drumkeeran, Co Leitrim.		
TITLE	Livestock Shed - Proposed South & West Elevations		
DRAWING BY	Vincent Durkin		
APPROVED BY	Eoin McCarthy		

4.4.2 Turbine and Construction Materials Transport Route

It is proposed that large wind turbine components will be delivered to the site of the proposed development, from Dublin Port or Galway Port, via the M4 Motorway which becomes the N4 National Primary Route at Knocksimon, Co. Westmeath. The delivery vehicles will continue northwest on the N4 before turning will turning on to the R299 Regional Road at Drumsna, Co. Leitrim. From here the delivery vehicles will travel northwest before turning right on to the R280 Regional Road and continuing north before turning left onto the proposed link road in the village of Drumkeeran, as described in Section 4.4.1.1 above. The delivery vehicles will turn south onto the L4282 in the townland of Derrybofin and continue west along the L4282 to the proposed new construction site access road at Derrycullinan, as described in Section 4.4.1.1 above. The delivery vehicles will travel southeast along the proposed construction access road before switching back in a westerly direction and then turning south again onto the L4282 and continue south towards the main site entrance in the townland of Boleymaguire. The proposed route is shown on Figure 4-29.

Other construction materials will be delivered to the site via the existing junction between the R280 and the L4282 in the village of Drumkeeran and continuing on the local road before reaching the construction access junction in Derrycullinan. It is intended that some passenger vehicles carrying construction staff and regular HGVs delivering construction materials will turn onto the L4282 at the crossroads in Drumkeeran and continue to the main site entrance site entrance in Boleymaguire via the local road without using the construction access road.

Traffic movements generated by the proposed development are discussed in Section 14.1 of Chapter 14, Material Assets.

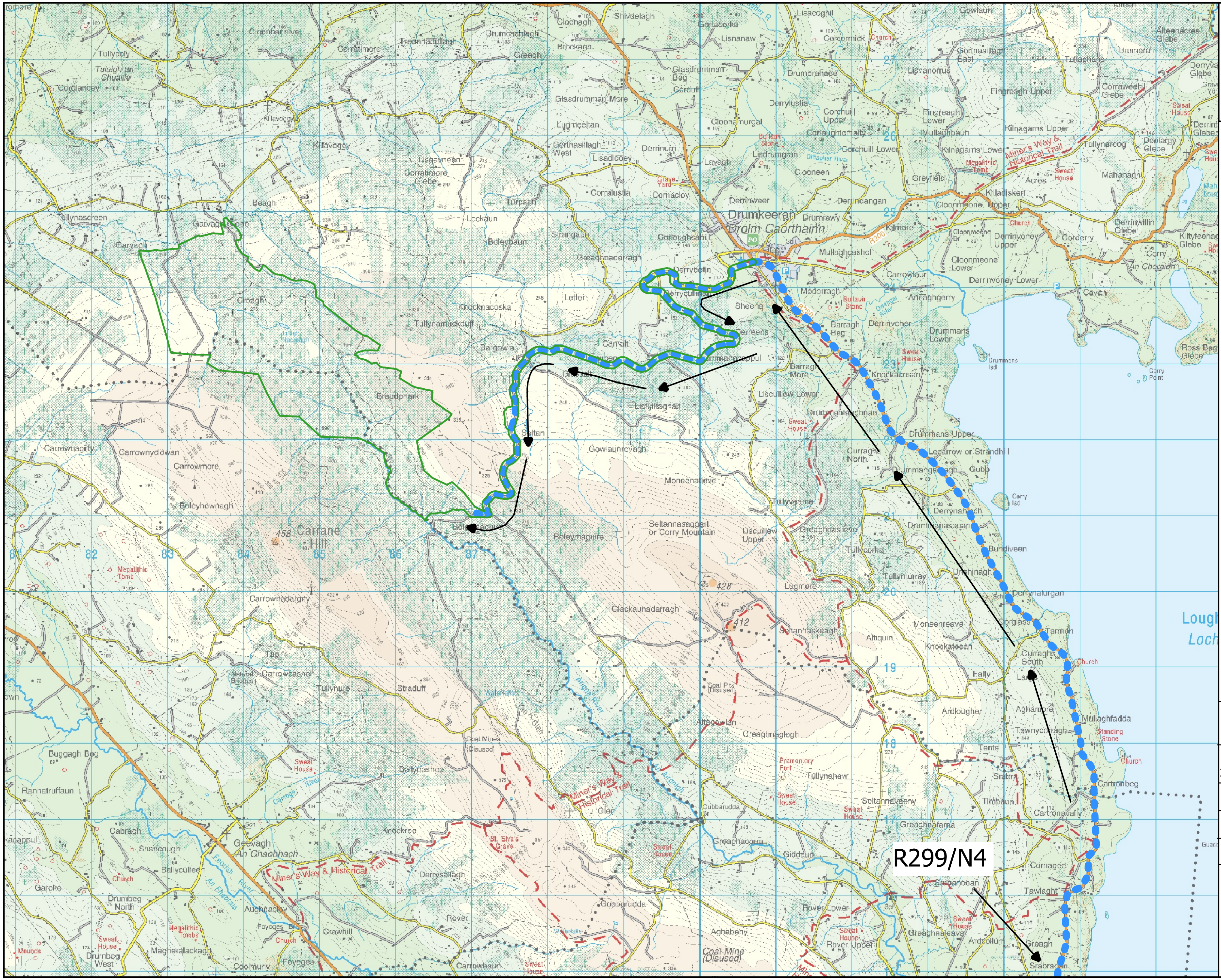
4.4.3 Traffic Management

A turbine with a blade length of 70 metres has been used in assessing the traffic impact of the Proposed Development. The blade transporter for such a turbine blade would have a total vehicle length of 76 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is approximately 50m 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, but shorter than the tower transporter. All other vehicles requiring access to the site of the Proposed Development will be regular road-going vehicles. The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the site access junctions, as detailed in Section 14.1 of this EIAR.

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

An outline f the Traffic Management Plan (TMP) has been prepared and set out in Appendix 14-2 of this EIAR. In the event planning permission is granted for the Proposed Development, the final outline Traffic Management Plan will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned. The plan will include:

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



Map Legend

- EIAR Site Boundary
- Turbine Delivery Route

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Drawing Title	
Turbine Delivery Route	
Project Title	
180511 - Croagh Wind Farm EIAR	
Drawn By	Checked By
Daire O'Shaughnessy	Eoin McCarthy
Project No.	Drawing No.
180511	Fig 4-29
Scale	Date
1:65,000	29.06.20

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

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

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

4.5 Community Gain Proposal

Croagh 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 in line with the new Renewable Energy Support Scheme. As with all wind farm projects which Coillte develop, 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.

4.5.1 Renewable Energy Support Scheme

The recent Renewable Energy Support Scheme (RESS) Terms and Conditions, published by the Department of Communications, Climate Action and Environment on the 27th February, 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 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.*

4.5.2 Community Benefit Fund

Coillte 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 i.e. first 15 years of operation and €1 per MWh for the remaining lifetime of the wind farm. 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 €5 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.*

4.5.2.1 Administration of the Benefit Fund

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about significant, positive change in the local area. To make this happen, our first task will be to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Fund. Coillte aim to commence this work in autumn 2020.

4.5.3 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, Coillte have been working hard with external agencies to develop workable models of Community Investment. As with the benefit fund, Coillte aim to take this work into the community during 2020, to continue to explore this exciting possibility and see how best to embed its design within the community.

4.6 Recreation and Amenity Proposals

The proposal to develop a wind farm on the subject site, provides an opportunity and a mechanism to open up the area for recreational and amenity use by the local community and general public. The scale of the site, extent of infrastructure already in place and proposed as part of the wind farm development, and the accessibility of the area from the public road network, provides a recreation and amenity opportunity of great potential. The recreational and amenity proposals for the site follow an emerging international trend to make wind farm sites accessible to the general public by providing recreation opportunities that complement the wind farm development. Although the site consists of a rural working landscape under commercial forestry plantation with many wind farm developments already permitted in the immediate vicinity and surrounding area, the site has a secluded and isolated feel, which adds to the attractiveness and potential of the area as a recreation location.

The recreation and amenity facilities proposed for the Croagh Wind Farm development are intended to appeal to walkers, cyclists, trail runners, amongst others, and are outlined in the below.

4.6.1 Recreation and Amenity Facilities

The proposed recreation and amenity facilities consist of a series of marked walkways, a boardwalk and a viewing point, complimented by waypoint signage and a visitor car park, each of which are detailed the below. The following proposals should be read in conjunction with Figure 4-30 which maps the proposed recreation and amenity proposals for the site of the Proposed Development.

4.6.1.1 Visitor Entrance and Car Park

Access to the site, for visitors during the operational phase, will be via the local road in the townland of Garvagh Glebe, north of the proposed visitor car park. It is proposed to use an existing site entrance, as shown on Figure 4-1, for public access to the site and associated amenity facilities during the operational phase. This existing entrance has adequate visibility splays for safe access and egress for passenger vehicles or cyclists. This entrance will not be used to provide access or egress for construction plant or vehicles during the construction or operational phase of the Proposed Development.

A visitor car park will be constructed on the western side of the amenity access track, the detail of which is shown in Figure 4-31. A vehicles height restriction barrier will be installed at the entrance to the car park and this is shown in Figure 4-32. The surface dressing of this car park will be level and compacted Clause 804 stone and will accommodate up to 24 vehicles.

The car park will act as a landing point or trailhead for recreation and amenity users arriving at the site. The car park will provide a safe and easily accessible landing point, allowing visitors to orientate themselves on the site.

4.6.1.2 Amenity Walkways and Viewing Platform

It is proposed to open sections of the wind farm site roads, in combination with proposed new gravel walkways, as marked trails for walkers, cyclists, trail runners and general outdoor recreation. Three separate sections of proposed new gravel walkways are proposed, forming a number of looped trails within the site of the proposed wind farm development. In total, there will be approximately 3.75 kilometres of amenity walkways constructed and linking into wind farm site roads. The proposed walkways are shown on Figure 4-1. All proposed walkways will have a 2.5 metre-running width, constructed in the same manner as the proposed new floating road sections, as described in Section 4.3.2 above, and will correspond to National Trails Office Class 3 Walking Trails standard, or better.

A wooden boardwalk will extend for approximately 90m from the amenity walkway north of Lough Nacroagh and will terminate at a viewing platform on the shores of the lake. Figure 4-33 shows typical cross section of the proposed boardwalk and viewing platform.

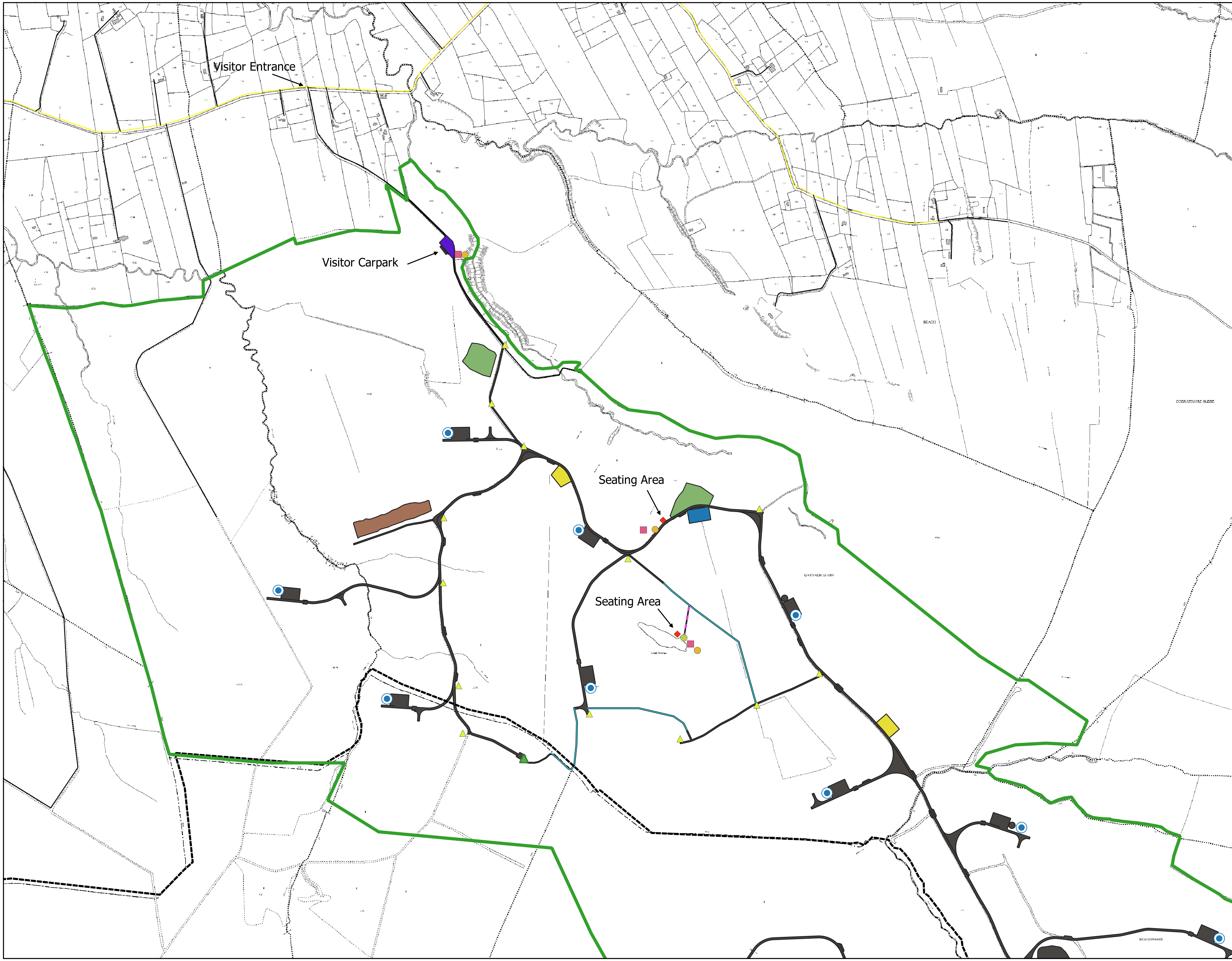
Areas along the amenity walkways and site roads will be targeted for planting with native broadleaved trees to create areas of interest and increase the biodiversity of the site. Further detail is provided in Chapter 6 and Appendix 6.4 of this EIAR.

4.6.1.3 Seating Areas

Seating areas will be provided at different locations along the amenity walkways, including the viewing platform, to allow visitors to rest and take advantage of the scenic views of the wider area from the site and to enjoy the area around Lough Nacroagh. A typical wooden bench is shown in Figure 4-33.

4.6.1.4 Visitor Information and Waypoint Signage

Three different forms of information and waypoint signage will be provided across the proposed recreation and amenity area. The proposed locations of the signage are indicated on Figure 4-30.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Location
- Proposed Met Mast Location
- Proposed 38kV Substation Compound
- Proposed Construction Compound
- Proposed Peat & Soil Repository
- Proposed Visitor Carpark
- Native Woodland Broadleaf Planting Areas
- Development Footprint
- Proposed Amenity Walkways
- Proposed Boardwalk
- Proposed Viewing Platform (Indicative Location)
- Proposed Seating Areas (Indicative Location)
- Proposed Information Signage (Indicative Location)
- Proposed Waypoint Signage (Indicative Location)
- Proposed 'You are Here' Signage (Indicative Location)
- Existing Forestry Access Road/Track
- Local Roads
- Co. Leitrim/ Co. Sligo County Border

N

Drawing Title: Recreation and Amenity Proposal	
Project Title: 180511 - Croagh Wind Farm EIAR	
Drawn By: Daire O'Shaughnessy	Checked By: Eoin McCarthy
Project No.: 180511	Drawing No.: 4-30
Scale: 1:10,000	Date: 29.06.20

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4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.
9. Exact location of grid connection cable/joint bay in the road curtilage to be subject to ESB specifications and agreement with Leitrim County Council.

Drawing Legend

Planning Application Boundary (Leitrim County Council)

Existing Road to be Upgraded

Existing Road no Upgrade Proposed

N

Figure 4-31

DRAWING TITLE:

Visitor Carpark

PROJECT TITLE: **Croagh Wind Farm, Co. Leitrim/ Co. Sligo**

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Michael Watson**
PROJECT No.: **180511**	DRAWING No.: **180511 - 50**
SCALE: **1:500 @ A3**	DATE: **03.07.2020**

OS SHEET No.: 1196, 1197, 1198, 1262, 1263, 1264, 1331, 1332, 1333

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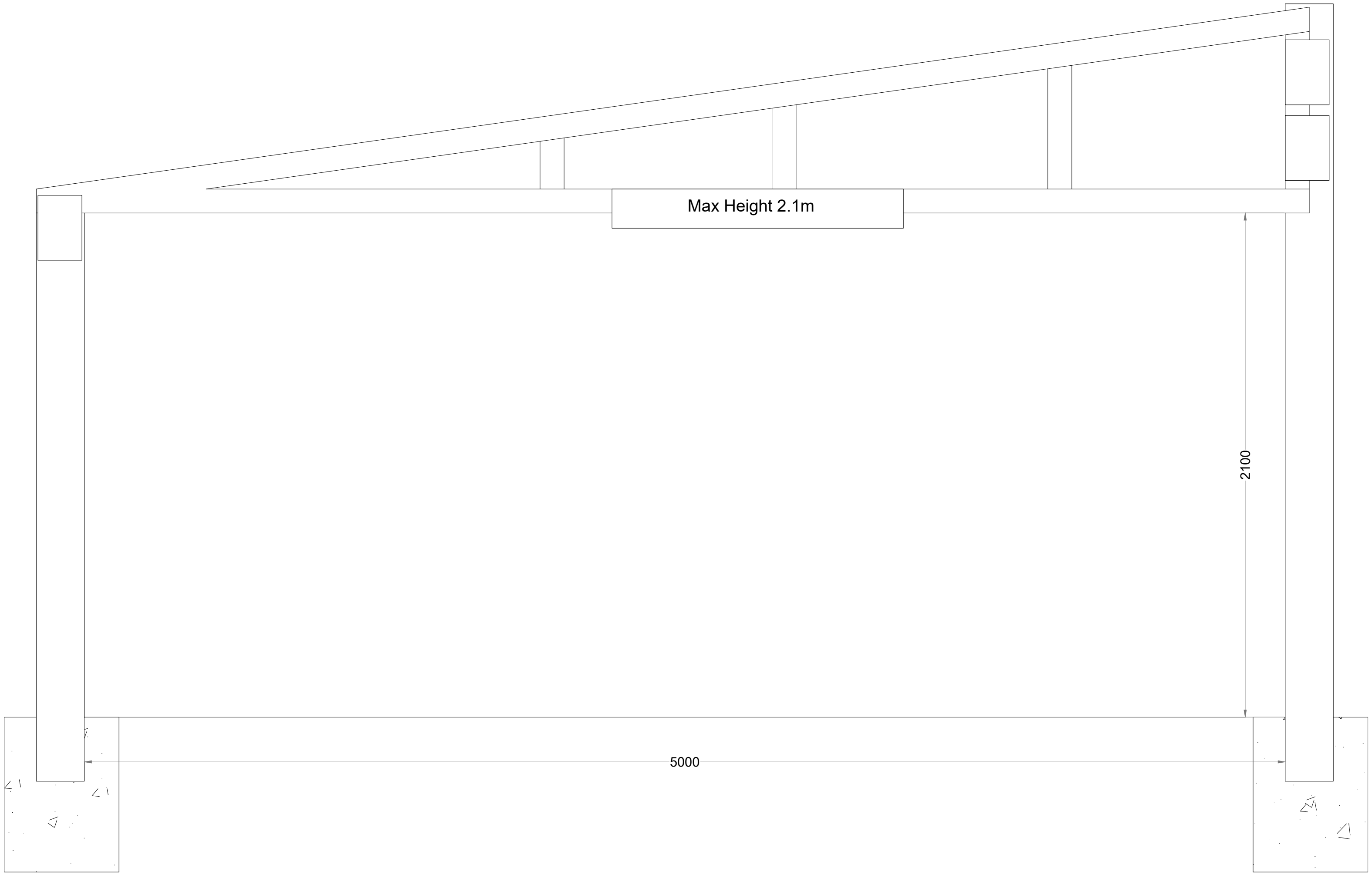

Figure 4-32

DRAWING TITLE:
Proposed Height Restriction Barrier Typical Detail

PROJECT TITLE:
Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No.: **180511**	DRAWING No.: **180511 - 51**
SCALE: **1 :20 @ A3**	DATE: **03.07.2020**

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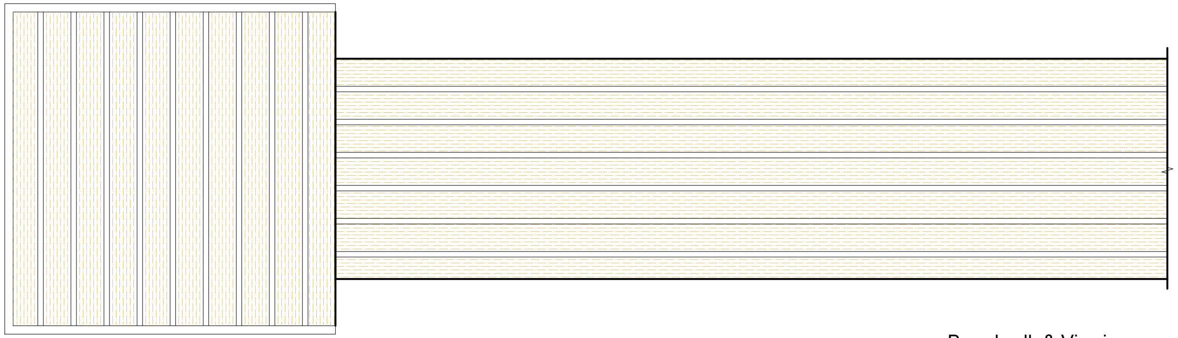
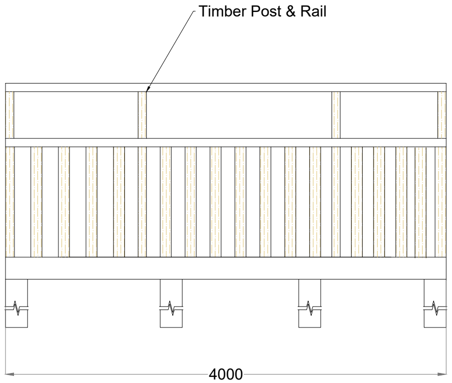
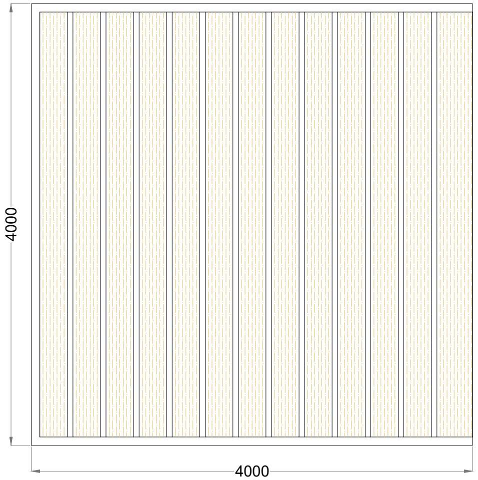


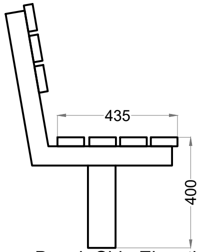
Boardwalk & Viewing
Area Plan
1:50

Viewing Area
Elevation
1:50

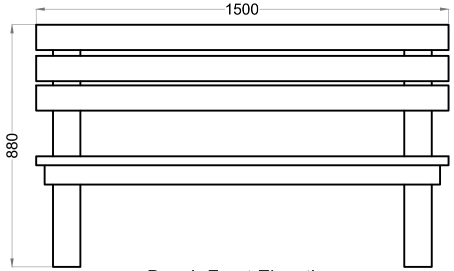


Viewing Area
Plan
1:50



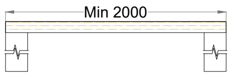


Bench Side Elevation
1:20



Bench Front Elevation
1:20

Boardwalk
Plan
1:50



Boardwalk
Elevation
1:50

Figure 4-33

DRAWING TITLE:
Proposed Boardwalk, Viewing Area & Bench Typical Detail

PROJECT TITLE:
Croagh Wind Farm, Co. Leitrim/ Co. Sligo

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Eoin McCarthy**
PROJECT No: **180511**	DRAWING No: **180511 - 52**
SCALE: **As Shown @ A3**	DATE: **03.07.2020**

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Entry point signage will be provided at various locations, where recreation users could enter the site, all at points on the marked walkways. The entry point information boards will clearly indicate each of the marked trails on a map, as well as outlining the distance, suitability and length of each trail. The signage will also indicate the principles of 'Leave No Trace'. Waypoint map information signage indicating the location of the sign in the context of the overall site will be provided at five locations across the site, which will indicate to users "You Are Here" and outline the options available to them for continuing through the recreation area and provide information in relation to wind energy and the flora and fauna present along the walkways and within the local area. Waypoint direction signage will be provided at all junctions or at least at every one kilometre along the trails as reassurance waymarkers, to indicate the recommended direction of travel and distance to trail end and return distance to trailhead and will be colour coded to indicate the marked trail(s) on the route being followed. Elevation drawings of the proposed typical signage is shown on Figure 4-34.

4.6.2 Further Potential

The proposed recreation and amenity proposals outlined above form part of the Proposed Development, and will be provided subject to planning permission being granted. It is acknowledged that any investment in the creation of recreation and amenity proposals on the site of the Proposed Development will have to be matched by an ongoing commitment from the wind farm developer to maintain the recreation amenities once they are put in place. The amenity proposals which have been included as part of the Proposed Development can operate as standalone destination amenity walks, however, they would also facilitate and augment any future amenity proposals which may be brought forward in the wider area in the future.

The site is very well placed within the wider recreational area with the existing Miners Way very close to the site. Coillte is already active in this area with Sligo & Leitrim County Councils and we propose that the project support the development of the wider area which could be uncovered as part of a wider regional strategy.

4.7 Site Drainage

4.7.1 Introduction

The drainage design for the Proposed Development has been prepared by Hydro Environmental Services Ltd. (HES), and by the firm's principal, Mr. Michael Gill. The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones of 100m and 50m around rivers and streams, respectively, have been used to inform the layout of the Proposed Development.

4.7.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Development. Turbine locations have been selected to avoid natural watercourses. Up to 9 no. new watercourse crossings and 16 no. potential crossing upgrades will be required as part of the Proposed Development. One new crossing would be required along the alternative construction access road.