3. SITE SELECTION AND REASONABLE ALTERNATIVES

3.1 Introduction

Article 5(1)(d) of Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification) as amended by Directive 2014/52/EU (the EIA Directive) requires that the Environmental Impact Assessment Report (EIAR) prepared by the developer contains *"a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment."*

Article 5(1)(f) of the EIA Directive requires that the EIAR contains *"any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected."*

Annex IV of the EIA Directive states that the information provided in an EIAR should include a *"description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

As detailed in Section 1.1.1 in Chapter 1, for the purposes of this EIAR, the various project components are described using the following references: 'Proposed Development', 'the Site', 'Wind Farm Site' and 'Grid Connection'. This section of the EIAR contains a description of the reasonable alternatives that were studied by the developer, which are relevant to the Proposed Development and its specific characteristics, in terms of site location and other renewable energy technologies as well as site layout incorporating size and scale of the Proposed Development, connection to the national grid and transport route options to the Site. This section also outlines the design considerations in relation to the renewable energy development, including the construction compounds and Grid Connection. It provides an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects. The consideration of alternatives is an effective means of avoiding environmental impacts. As set out in the '*Guidelines on The Information to be Contained in Environmental Impact Assessment Reports' (Environmental Protection Agency, 2022),* the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

Hierarchy

EIA is concerned with projects. The Environmental Protection Agency (EPA) guidelines state that in some instances neither the applicant nor the competent authority can be realistically expected to examine options that have already been previously determined by a higher authority, such as a national plan or regional programme for infrastructure.

Non-environmental Factors

EIA is confined to the environmental effects that influence consideration of alternatives. However, other non-environmental factors may have equal or overriding importance to the developer of a project, for example project economics, land availability, engineering feasibility or planning policy.

Site-specific Issues

The EPA guidelines state that the consideration of alternatives also needs to be set within the parameters of the availability of the land, i.e., the site may be the only suitable land available to the developer, or the need for the project to accommodate demands or opportunities that are site-specific. Such considerations should be on the basis of alternatives within a site, for example design and layout.

3.2 Consideration of Reasonable Alternatives

3.2.1 Methodology

The EU Guidance Document (EU, 2017) on the preparation of EIAR outlines the requirements of the EIA Directive and states that, in order to address the assessment of reasonable alternatives, the Developer needs to provide the following:

- A description of the reasonable alternatives studied; and
- An indication of the main reasons for selecting the chosen option with regards to their environmental impacts.

There is limited European and National guidance on what constitutes a 'reasonable alternative' however the EU Guidance Document (EU, 2017) states that reasonable alternatives "*must be relevant to the proposed project and its specific characteristics, and resources should only be spent assessing these alternatives".*

The guidance also acknowledges that "*the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative".*

The EPA Guidelines (EPA, 2022) state that "*It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account is deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required."*

Consequently, taking consideration of the legislative and guidance requirements into account, this chapter addresses alternatives under the following headings:

- 'Do Nothing' Alternative
- Alternative Site Locations
- Alternative Renewable Energy Technologies
- Alternative Turbine Numbers and Model;
- Alternative Turbine Layout and Development Design;
- Alternative Design of Ancillary Structures
- Alternative Grid Connection Cabling Route Options;
- Alternative Transport Route and Site Access; and
- Alternative Mitigation Measures.

Each of these is addressed in the following sections.

When considering the Wind Farm Site, given the intrinsic link between layout and design, the two will be considered together in this chapter.

3.2.2 'Do-Nothing' Alternative

Annex IV, Part 3 of the EIA Directive states that the description of reasonable alternatives studied by the developer should include *"an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge."* This is referred to as the "do nothing" alternative. EU guidance (EU, 2017) states that this should involve the assessment of *"an outline of what is likely to happen to the environment should the Project not be implemented – the so-called 'do-nothing' scenario."*

An alternative land-use option to developing a renewable energy project at the Proposed Development site would be to leave the Site as it is, with no changes made to the current land-use practices of low intensity agriculture and forestry on the Wind Farm Site; and public road corridor, public open space, discontinuous urban fabric and agriculture along the Grid Connection. In doing so, the environmental effects in terms of emissions are likely to be neutral however, the opportunity to capture the available renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment would also be lost. It is likely that the trends of population decline and rural deprivation that have been recorded within the Population Study Area would continue in the absence of investment, as discussed in Section 5 of this EIAR on Population and Human Health. Overall, the potential impact of this is considered to be long term, negative and slight.

The existing land uses can and will continue in conjunction with the Proposed Development. A comparison of the potential environmental effects of the 'Do-Nothing' Alternative when compared against the chosen option of developing a renewable energy project at this site are presented in Table 3-1 below.

Table 3-1 Comparison of environmental effects when compared against the chosen option of developing a renewable energy project

Environmental Consideration	Do Nothing Alternative	Chosen option of developing a renewable energy project
Population & Human Health	No increase in local employment and no long-term financial contributions towards the local community. No potential for shadow flicker and noise to affect sensitive receptors.	Up to approximately 100 jobs could be created during the construction, operation, and maintenance phases of the Proposed Development. Based on the assessment detailed in Chapter 5 and the mitigation measures proposed, there will be no significant effects related to shadow flicker and noise from the Proposed Development.
Biodiversity (including Birds)	No habitat loss. No potential for collision risk for birds and bats	As detailed in Chapter 6, the development has been designed to avoid or mitigate impacts on biodiversity. As detailed in the Bat Report in Appendix 6-2 of this EIAR, there is unlikely to be any significant increase in collision risk to bats from the Proposed Development.

		As detailed in Chapter 7, the Collision Risk Assessment (CRA) indicates that the impact of the Proposed Development on birds corresponds to a **Very Low** effect significance.
Land, Soils & Geology	Neutral	As detailed in the assessment in Chapter 8, there is no loss of topsoil, subsoil or bedrock as a result of the Proposed Development. Topsoil and subsoil will be relocated within the site.
Water	Neutral	As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air & Climate	Will not provide the opportunity for an overall increase in air quality or reduction of greenhouse gasses. Will not assist in achieving the renewable energy targets set out in the Climate Action Plan.	As detailed in the assessment in Chapter 10, over the proposed thirty year lifetime of the Proposed Development, 59,503 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.
Noise & Vibration	No potential for noise impacts on nearby sensitive receptors.	Based on the assessment detailed in Chapter 11 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise levels from the Proposed Development during the construction and operational phase..
Landscape & Visual	No potential for landscape and visual impacts on nearby sensitive receptors.	As detailed in the assessment in Chapter 12, the lack of nearby highly sensitive landscape and visual receptors, and the strategic siting of infrastructure will mitigate any potential for significant landscape and visual effects.
Cultural Heritage & Archaeology	No potential for impacts on unrecorded, subsurface archaeology.	As detailed in the assessment in Chapter 13, the significance of direct effects will be slight - not significant and no significant effects will occur. There will be no significant direct or indirect impacts on Cultural Heritage.
Material Assets	Neutral	As detailed in Chapter 14, there will be short term negative imperceptible to slight impact on traffic volumes during the construction phase of the

		Proposed Development. A detailed Traffic Management Plan incorporating all the mitigation measures will be agreed with the roads authority prior to construction works commencing on site.

3.2.3 Alternative Site Locations

The process of identifying a suitable wind farm site is influenced by a number of factors. While wind speeds, the area of suitable or available land, proximity to a grid connection point and planning policy are all very important, a wind farm project must be commercially viable/competitive, as otherwise it will never attract the necessary project finance required to see it built.

3.2.3.1 Strategic Site Selection

As the cost of building each megawatt of electricity-generating capacity in a wind farm is in the region of €1.5 million, it is critical that the most suitable site for the Proposed Development is chosen.

As set out in Section 1.3 of this EIAR the applicant company, Umma More Ltd. is associated with Enerco Energy Ltd. which is an Irish-owned Cork-based company with extensive experience in renewable energy and is responsible for projects throughout Ireland. The group as a whole has over 825MW of wind generating capacity under construction or in commercial operation, with a further 400MW in its portfolio at various stages of development/approval. All of which urgently need to be provided to assist Ireland in meeting its renewable energy targets. Enerco Energy Ltd. invests a significant amount of time and resources identifying and investigating sites for renewable energy proposals throughout the Country.

Sites selected for the development of a wind farm must be suitable for consideration under a number of criteria, such as:

- Site location relative to Westmeath County Development Plan Wind Energy Capacity's classification of areas considered that have capacity for wind farm development from a planning policy perspective;
- Access to the national electricity grid possible within a viable distance;
- Located outside areas designated for protection of ecological species and habitats;
- Sufficient area of unconstrained land that could potentially accommodate a wind farm development and turbine spacing requirements;
- Consistently high average annual wind speeds;
- Low population density; and
- Visual Amenity.

The criteria above will be explained further below in so far as they influenced the site selection exercise undertaken.

3.2.3.1.1 *Westmeath County Development Plan 2021-2027*

The Westmeath County Development Plan 2021 – 2027 (WCDP) was adopted by the council on the 22nd March 2021 and came into effect on the 3rd May 2021. The WCDP provides the strategic framework for land-use planning in the county and sets out the Vision and Strategic Aims for the county, which are supported by a number of policies and objectives. In relation to energy, it is an aim of the WCDP "*to provide for the development of indigenous energy resources, with an emphasis on renewable energy supplies".*

Section 10.22 of the Plan sets out the relevant policies and objectives of Westmeath County Council in relation to renewable energy sources, as follows:

- **Policy CPO 10.139:** Support local, regional, national and international initiatives for limiting emissions of greenhouse gases through energy efficiency and the development of renewable energy sources which make use of the natural resources in an environmentally acceptable manner and having particular regard to the requirements of the Habitats Directive.

Section 10.23.2 of the Plan sets out the relevant policies and objectives of Westmeath County Council in relation to large-scale wind energy projects, as follows:

- **Policy CPO 10.142:** Have regard to the principles and planning guidance set out in Department of Housing, Planning and Local Government publications relating to 'Wind Energy Development' and the DCCAE Code of Practice for Wind Energy Development in Ireland and any other relevant guidance which may be issued in relation to sustainable energy provisions.

- **Policy CPO 10.143:** Provide the following separation distances between wind turbines and residential dwellings:

  - 500 metres, where the tip height of the wind turbine blade is greater than 25 metres but does not exceed 50 metres.
  - 1000 metres, where the tip height of the wind turbine blade is greater than 50 metres but does not exceed 100 metres.
  - 1500 metres, where the tip height of the wind turbine blade is greater than 100 metres but does not exceed 150 metres.
  - More than 2000 metres, where the tip height of the wind turbine blade is greater than 150 metres.

- **Policy CPO 10.144:** Ensure the security of energy supply by supporting the potential of the wind energy resources of the County in a manner that is consistent with proper planning and sustainable development of the area.

- **Policy CPO 10.146:** To strictly direct large-scale energy production projects, in the form of wind farms, onto cutover cutaway peatlands in the County, subject to environmental, landscape, habitats and wildlife protection requirements being addressed. In the context of this policy, industrial scale/large-scale energy production projects are defined as follows:

  Projects that meet or exceed any of the following criteria:

  - Height: over 100m to blade tip, or
  - Scale: More than five turbines, or
  - Output: Having a total output of greater than 5MW

  Developments sited on peatlands have the potential to increase overall carbon losses. Proposals for such development should demonstrate that the following has been considered:

  - Peatland stability; and
  - Carbon emissions balance

In the context of the Westmeath County Development Plan and particularly Policy CPO 10.146, the Proposed Development is classed as an industrial-scale or large-scale wind energy project located on agricultural land.

Map 69 in Volume 2 of the County Development Plan presents the Wind Energy Development map for Co. Westmeath. This map is based on the Landscape Character Assessment map for the County, which defines 11 no. distinct Landscape Character Areas (LCAs). Each LCA is classified by the Plan in terms of its capacity for wind energy development, according to the following terms:

- Low Capacity: 10 no. LCAs
- No Capacity: 1 no. LCA;

All but one LCA of the county are classified as 'Low Capacity' for wind energy development. The Western Lowlands LCA, in which the Wind Farm Site is located, is one of the 10 No. LCAs classified as 'Low Capacity' for wind energy development, as shown in Figure 3-1.

The Western Lowlands LCA was designated as 'Medium Capacity' for wind energy development in the Westmeath County Development Plan (2014-2020) that was adopted on the 18th February 2014. This designation was subsequently changed to 'Low Capacity' by way of variation no. 1 to the Development Plan (2014-2020) on 23rd September 2016. The Wind Energy Capacity designations remain unchanged in the recently adopted Westmeath County Development Plan (2021-2027).

On the 16th April 2021, the Minister for Local Government and Planning issued a notice to Westmeath County Council pursuant to section 31AM(8) of the Planning and Development Act, as amended, on the basis that, having considered the Westmeath County Development Plan 2021-2027, the Office of the Planning Regulator is of the opinion that:

"...the Office [of the Planning Regulator] *remains of the view that the inclusion of the policy objective CPO 10.132 (renumbered CPO 10.143) and an unchanged Wind Energy Capacity Map in the adopted Development Plan create a significant limitation or constraint on renewable energy projects which is inconsistent with the SPPR* [Specific Planning Policy Requirements] *and would also significantly restrict other policy objectives supporting wind energy development such as policies CPO 10.139, CPO 10.142 and CPO 10.144."*

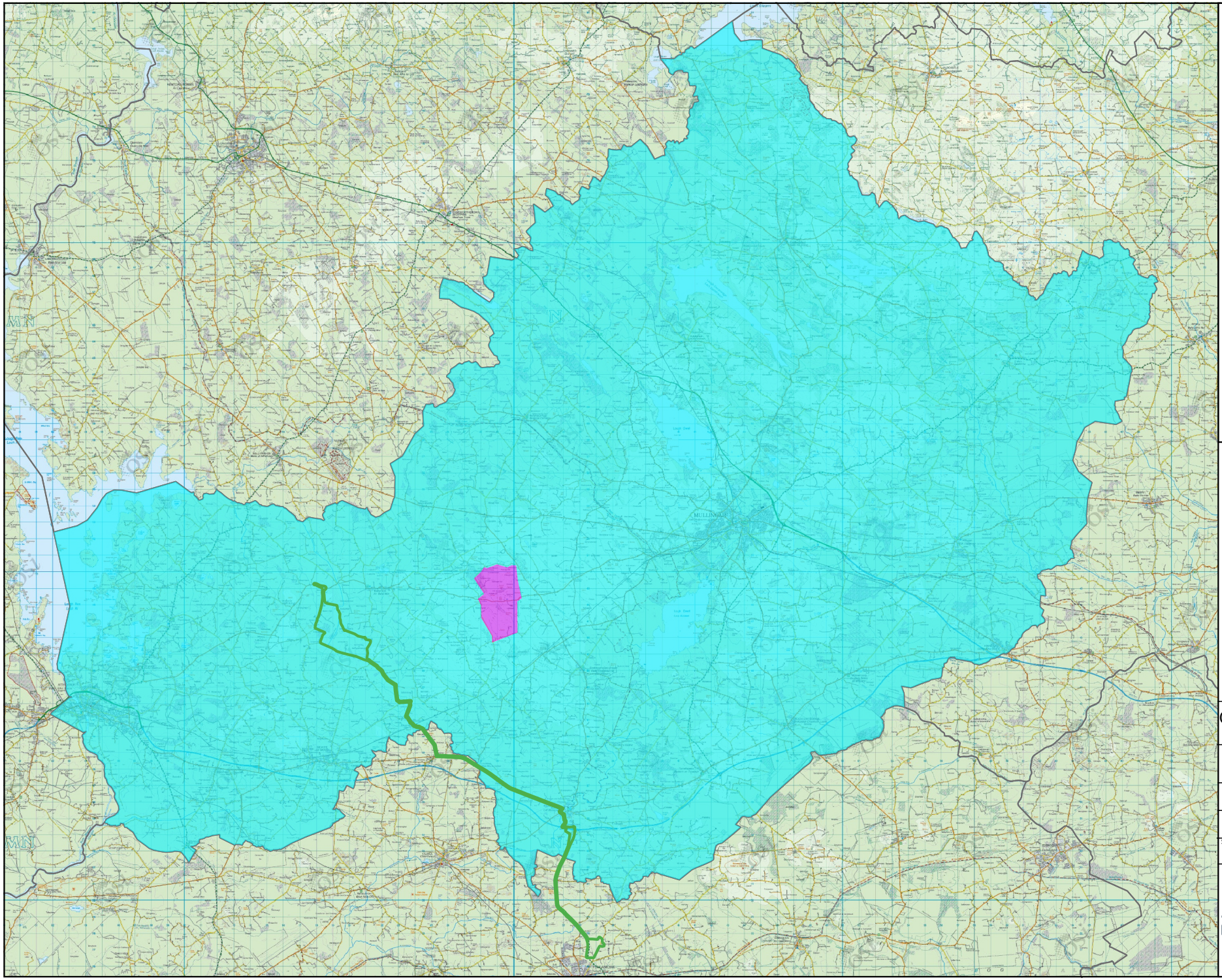
The Office of the Planning Regulator advised Westmeath council to:

i. *Delete wind energy policy objective CPO 10.143 in its entirety from section 10.23.2 of the Development Plan.*

ii. *Take such steps as are required to identify, on an evidence-basis and using appropriate and meaningful metrics, the wind energy production (in megawatts) which County Westmeath can contribute in delivering its share of overall Government targets on renewable energy and climate change mitigation over the plan period, consistent with the requirements set out in the Specific Planning Policy Requirement in the Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change (July 2017).*

Such steps shall be accompanied by revisions to the Wind Energy Capacity Map and Landscape Character Assessment, and coordination of the objectives for wind energy development in the Development Plan with those of the neighbouring counties as are necessary to ensure a coordinated approach with wind energy objectives of adjoining local authorities having regard to requirements of section 9(4) of the Act.

The consultation period in relation to the Draft Ministerial Direction set out above, has now ended and the Chief Executive's Report on submissions dated 18th June 2021 has been provided, recommending that Objective CPO10.143 be omitted from the County Development Plan and committing the council to carrying out an assessment of how the implementation of the plan will contribute to realising overall national targets and climate change mitigation.



Map Legend

EIAR Site Boundary

Westmeath County Development Plan 2021-2027

Low Wind Capacity

No Wind Capacity

Drawing Title
County Westmeath Wind Energy Designations

Project Title
Umma More Renewable Energy Development

Drawn By	Checked By
BT	EC
Project No.	Drawing No.
201050	Figure 3-1
Scale	Date
1:300,000	2023-02-02

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3.2.3.1.2 Designated Sites

The Proposed Development site is not located within any area designated for ecological protection.

The nearest Natura 2000 site to the Wind Farm Site, i.e., Special Area of Conservation (SAC) or Special Protection Area (SPA) is Lough Sewdy SPA, the boundary of which is located approximately 3 kilometres to the northeast of the Wind Farm Site, at its nearest point. The nearest Natura 2000 site to the Grid Connection is Split Hills and Lough Esker SAC, the boundary of which is located approximately 2.6 kilometres to the northeast of the Grid Connection, at its nearest point.

The nearest national designated site to the Wind Farm Site, i.e., Natural Heritage Area (NHA) or proposed Natural Heritage Area (pNHA) is Ballynagrenia and Ballinderry Bog NHA, which is located approximately 2 kilometres to the south of the Wind Farm Site. The nearest national designated site to the Grid Connection is Ballynagrenia and Ballinderry Bog NHA, the boundary of which is located approximately 0.9 kilometres to the west of the Grid Connection, at its nearest point.

3.2.3.1.3 Wind Speeds

The Irish Wind Atlas produced by Sustainable Energy Ireland shows average wind speeds for the country. A suitable wind regime and consistent wind speeds are required for the development of a wind energy project. The Irish Wind Atlas produced by Sustainable Energy Ireland shows average wind speeds for the country. Wind speeds in the midlands are typically between 7 – 8 m/s. While the wind resource of Ireland's midlands is lower than that of coastal and elevated regions, it is still very good in comparison with many parts of Europe. On-site monitoring of the wind resource, which is ongoing, will further verify that with a sufficient turbine height and blade diameter, the wind resource of the site is commercially viable.

3.2.3.1.4 Available Set-Back from Sensitive Receptors

The applicants sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity, the study area has emerged as suitable to accommodate the Proposed Development. The population density of the Population Study Area as described in the Population and Human Health section of this EIAR is 23.46 persons per square kilometre, as described in Chapter 5 of this EIAR. This is significantly lower than the average national population density of 70.05 persons per square kilometre.

3.2.3.1.5 Access to the National Grid

The Proposed Development intends to connect to the National Grid via an underground electrical cabling route through the Local, Regional and National Roads connecting the Wind Farm Site to the Thornsberry 110kV substation, in the townland of Derrynagall or Ballydaly, near Tullamore, Co. Offaly. Details regarding potential alternative Grid Connection options considered are presented in Section 3.2.8 below.

3.2.3.1.6 Summary

From the review of the criteria set out above, the Wind Farm Site was identified as a suitable location for the provision of a renewable energy development of the scale proposed. The Wind Farm Site is located on agricultural land and existing commercial forestry which allows the site to take advantage of existing access roads (which will be upgraded) and highlights the suitability of the Wind Farm Site as it can make sustainable use of these established items of infrastructure. The Wind Farm Site is also designated as a 'Low Capacity' within the functional area of Westmeath County Council for the provision of wind farm development, does not overlap with any environmental designations, the Wind Farm Site is accessible in terms of connection to the national grid and is also located in an area with a relatively low population density with appropriate annual wind speeds.

Once the current Wind Farm Site emerged as a suitable location for the provision of the Proposed Development, the applicants approached the landowners in order to assemble the Wind Farm Site. Arising from the site assembly discussions the current proposed Wind Farm Site was identified and brought forward as being capable of accommodating a cohesive viable area of sufficient size to cater for the Proposed Development. While the outcome of the site selection process has identified the Wind Farm Site as a suitable location for a renewable energy development of the nature proposed, it does not preclude other sites within the vicinity being brought forward for consideration in the future.

From the review of the criteria set out above, the Grid Connection was identified as a suitable location for the provision of a connection of the Wind Farm Site to the National Grid. The underground electrical cabling route is located primarily in the public road corridor and does not overlap with any environmental designations.

3.2.4 Alternative Renewable Energy Technologies

The proposed wind farm will be located on a site where agriculture and commercial forestry will continue to be carried out around the footprint of the Wind Farm Site.

Both onshore and offshore wind energy development will be required to ensure Ireland reaches the target set in the Climate Action Plan to source 80 per cent of our electricity from renewable energy by 2030. It is not a case of 'either' 'or'. When considering other renewable energy technologies in the area, the Applicant considered commercial solar energy production as an alternative on the Wind Farm Site.

Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic (PV) arrays (panels). During the initial stages of the Proposed Development design, a combination of solar energy and wind energy were considered for the Proposed Development at this site, however this was subject to land availability at the time and the proposed Wind Farm Site was progressed. To achieve the same electricity output from solar energy as is expected from the proposed Wind Farm Site (c. 55.8MW), a larger development footprint would be required. As detailed in Section 1.1.1 in Chapter 1, the EIAR Site Boundary encompasses an area of approximately 949 hectares and the permanent footprint of the Proposed Development measures approximately 8.2 hectares, which represents approximately 0.9% of the Site. In order to achieve a c. 55.8MW output using solar PV arrays, there would be a requirement of approximately 86.4 ha[1], which represents approximately 9.1% of the Site.

In addition, a solar development would have a higher potential environmental effect on Traffic & Transport (construction phase) and Biodiversity and Birds (habitat loss) at the site, as detailed below. Taking into account the hydrology and farming practices in the area, it has been determined that wind energy is the most suitable renewable energy technology for the site.

A comparison of the potential environmental effects of the development of a solar PV array when compared against the chosen option of developing wind turbines at the Wind Farm Site is presented in Table 3-2 below.

Table 3-2 Comparison of environmental effects when compared against the chosen option (wind turbines)

Environmental Consideration	Solar PV Array (with up to 55.8 MW Output)	Chosen Option (Wind Turbines)
Population & Human Health	Relatively lower long-term financial contributions towards the local	Higher long-term financial contributions towards the local

[1] *Approximately 1.6 - 2 ha are required for each MW of solar panels installed based on approximately 4000 panels per MW (taken from the Sustainable Energy Authority Solar Energy FAQ publication which can be accessed here: https://www.seai.ie/publications/FAQs_on_Solar_PV.pdf). For the purposes of comparison, a minimum value of 1.6 ha has been assumed.*

Environmental Consideration	Solar PV Array (with up to 55.8 MW Output)	Chosen Option (Wind Turbines)
(incl. Shadow Flicker)	community (i.e., community benefit fund) on a per MWh basis). No potential for shadow flicker to affect sensitive receptors. Potential for glint and glare impacts on local receptors.	community (i.e., community benefit fund) on a per MWh basis). Based on the assessment detailed in Chapter 5 and the mitigation measures proposed, there will be no significant effects related to shadow flicker from the Proposed Development. No potential for glint and glare impacts on local receptors.
Biodiversity & Ornithology	Larger development footprint would result in greater potential habitat loss. No potential for collision risk for birds. Potential for glint and glare impacts on birds.	As detailed in Chapter 6, the development has been designed to avoid or mitigate impacts on biodiversity. As detailed in Chapter 7, the Collision Risk Assessment (CRA) indicated that the impact of the Proposed Development on birds corresponds to a **Very Low** effect significance. No potential for glint and glare impacts on birds.
Land, Soils & Geology	Shallower excavations involved in solar PV array developments would result in reduced volume of spoil to be excavated.	As detailed in the assessment in Chapter 8, no significant effects on soils and subsoils will occur.
Water	Shallower excavations involved in solar PV array developments would result in reduced volume of spoil to be excavated, therefore reducing the potential for silt-laden runoff to enter receiving waterbodies.	As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air & Climate	Reduced capacity factor of solar PV array technology would result in less carbon offset.	As detailed in the assessment in Chapter 10, over the proposed thirty year lifetime of the Proposed Development, 59,503 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.
Noise & Vibration	Potential for short-term noise impacts on nearby sensitive receptors during the construction phase.	Based on the assessment detailed in Chapter 11 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise levels from the Proposed Development during the

Environmental Consideration	Solar PV Array (with up to 55.8 MW Output)	Chosen Option (Wind Turbines)
		construction and operational phase..
Landscape & Visual	Panelling potentially less visible from surrounding area due to screening by vegetation and topography.	As detailed in the assessment in Chapter 12, the lack of highly sensitive landscape and visual receptors, and the strategic siting of infrastructure will mitigate any potential for significant landscape and visual effects.
Cultural Heritage & Archaeology	Neutral	As detailed in the assessment in Chapter 13, the significance of direct effects will be slight - not significant and no significant effects will occur. There will be no significant direct or indirect impacts on Cultural Heritage.
Material Assets	Neutral	As detailed in Chapter 14, there will be short term negative imperceptible to slight impact on traffic volumes during the construction phase of the Proposed Development. A detailed Traffic Management Plan incorporating all the mitigation measures will be agreed with the roads authority prior to construction works commencing on site.

For the reasons set out above, the proposal for a wind energy development at the Wind Farm Site was considered to be the most efficient method of electricity production with the lesser potential for significant environmental effects.

3.2.5 Alternative Turbine Numbers and Model

The proposed wind turbines will have a potential power output in the 4 and 7 megawatt (MW) range. It is proposed to install 9 turbines at the Wind Farm Site which could achieve approximately 55.8 MW output (mid-range capacity). Such a wind farm could also be achieved on the proposed Wind Farm Site by using smaller turbines (for example 2.5 MW machines). However, this would necessitate the installation of over 22 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the Wind Farm Site. A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the Wind Farm Site, with a larger amount of supporting infrastructure being required (i.e., roads etc) and increasing the potential for environmental impacts to occur. The proposed number of turbines takes account of all site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the Wind Farm Site. The 9 turbine layout selected for the Proposed Development has the smallest development footprint of the other alternatives considered, while still achieving the optimum output at a more consistent level than would be achievable using different turbines. The other alternatives considered included an 12 turbine layout which is discussed in further detail in Section 3.2.6 below.

The turbine model to be installed on the Wind Farm Site will have an overall ground-to-blade tip height of 185 metres; a rotor diameter of 162 metres; and hub height of 104 metres. This EIAR provides a robust assessment of a candidate turbine that is within the overall development description. The use of alternative smaller turbines at the Wind Farm Site would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the Wind Farm Site and would potentially require a larger development footprint. This alternative would potentially lead to additional environmental effects.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing a smaller number of larger wind turbines on the Wind Farm Site is presented in Table 3-3 below.

Table 3-3 Comparison of environmental effects when compared against the chosen option (larger wind turbines)

Environmental Consideration	Larger number of smaller turbines	Chosen option of a 9 no. turbine layout
Population & Human Health (incl. Shadow Flicker)	Likely potential for increased shadow flicker impacts on nearby sensitive receptors due to the increased number of turbines.	Based on the assessment detailed in Chapter 5 and the mitigation measures proposed, there will be no significant effects related to shadow flicker from the Proposed Development.
Biodiversity & Ornithology	Larger development footprint would result in greater potential habitat loss.	Smaller footprint would result in less habitat being lost. As detailed in Chapter 6, the development has been designed to avoid or mitigate impacts on biodiversity. As detailed in Chapter 7, the Collision Risk Assessment (CRA) indicated that the impact of the Proposed Development on birds corresponds to a **Very Low** effect significance.
Land, Soils & Geology	Larger development footprint would result in greater volume of spoil to be excavated and stored.	Smaller footprint would result in smaller volume of soils to be excavated and managed. As detailed in the assessment in Chapter 8, no significant effects on soils and subsoils will occur.
Water	Larger development footprint, therefore, increasing the potential for silt-laden runoff to enter receiving watercourses.	Smaller footprint would result in less potential for silt-laden run-off to enter a watercourse. As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air & Climate	Increased potential for vehicle emissions and dust emissions due to an increased volume of material	A smaller footprint would result in less dust and vehicle emissions during the construction phase.

Environmental Consideration	Larger number of smaller turbines	Chosen option of a 9 no. turbine layout
	and turbine component deliveries to the site during the construction phase.	As detailed in the assessment in Chapter 10, over the proposed thirty year lifetime of the Proposed Development, 59,503 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors.	Potential for less noise impacts on nearby sensitive receptors during the construction and operational phase. Based on the assessment detailed in Chapter 11 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise levels from the Proposed Development during the construction and operational phase.
Landscape & Visual	Neutral.	Neutral.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	As detailed in the assessment in Chapter 13, the significance of direct effects will be slight - not significant and no significant effects will occur. There will be no significant direct or indirect impacts on Cultural Heritage.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.	Less traffic volumes due to smaller footprint and less component deliveries. As detailed in Chapter 14, there will be short term negative imperceptible to slight impact on traffic volumes during the construction phase of the Proposed Development. A detailed Traffic Management Plan incorporating all the mitigation measures will be agreed with the roads authority prior to construction works commencing on site.

3.2.6 Alternative Turbine Layout and Development Design

The design of the Wind Farm Site has been an informed and collaborative process from the outset, involving the designers, developers, engineers, landowners, environmental, hydrological and geotechnical, archaeological specialists and traffic consultants. The aim being to reduce potential for environmental effects while designing a project capable of being constructed and viable.

Throughout the preparation of this EIAR, the layout of the Wind Farm Site has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities as detailed in Section 2.5 of Chapter 2.

3.2.6.1 Constraints and Facilitators Mapping

The design and layout of the Proposed Development follows the recommendations and guidelines set out in the *'Wind Energy Development Guidelines'* (Department of the Environment, Heritage and Local Government, 2006) (the Guidelines) and the *'Best Practice Guidelines for the Irish Wind Energy Industry'* (Irish Wind Energy Association, 2008).

The '*Wind Energy Development Guidelines for Planning Authorities'* (DoEHLG, 2006) (the Guidelines) were the subject of a targeted review. The proposed changes to the assessment of impacts associated with onshore wind energy developments were outlined in the document Draft Wind Energy Development Guidelines (December 2019) (draft Guidelines). A consultation process in relation to the draft Guidelines closed on 19th February 2020. The proposed changes presented in the draft Guidelines give certain focus on the setback distance from residential properties (four times the proposed maximum tip height), along with shadow flicker and noise requirements relative to sensitive receptors. At time of writing, the draft Guidelines have not yet been adopted, and the relevant guidelines for the purposes of section 28 of the Planning and Development Act 2000, as amended, remain those issued in 2006. The constraints mapping process involves the placing of buffers around different types of constraints so as to clearly identify the areas within which no development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented in the Guidelines.

Notwithstanding this, however, due to the timelines associated with the planning process for renewable energy projects and the commitment within the Climate Action Plan 2021 to publish the final version of the guidelines in Q2 of 2023 (refer to Section 1.5.1.1 in Chapter 1), it is possible that the draft Guidelines are adopted during the consideration period for the Proposed Development. Should the draft Guidelines be adopted in advance of a planning decision being made on the Proposed Development, the Wind Farm Site will be capable of achieving the requirements of the draft Guidelines as currently proposed.

The constraints map for the Wind Farm Site, as shown in Figure 3-2, was produced following a desk study of all site constraints. Figure 3-2 encompasses the following constraints and associated buffers:

- Residential dwellings plus a minimum 720-metre buffer (achieving the requirement for a 4 x tip height separation distance from properties in line with the new draft Guidelines). There is a derelict property that is located approximately 571m from the nearest proposed turbine location (T4).
- Natura 2000 sites plus 200-metre buffer;
- Telecommunication Links plus operator specific buffer;
- Natural Watercourses plus 50-metre buffer;
- Site Specific Flood Modelling for 100-yr and 1000-yr events; and
- Archaeological Sites or Monuments, 30-metre buffer, plus 'Zone of Notification' as required by the National Monuments Service (ROI).

Facilitators at the site build on the existing advantages and include the following:

- Available lands for development;
- Good wind resource;
- Existing access points and general accessibility of all areas of the site due to existing road infrastructure; and
- Limited extent of constraints.

The inclusion of the constraints on a map of the study area allows for a viable area to be identified. An initial turbine layout is then developed to take account of all the constraints mentioned above and their associated buffer zones and the separation distance required between the turbines. Following the mapping of all known constraints, detailed site investigations were carried out by the project team. The ecological assessment of the Wind Farm Site encompassed habitat mapping and extensive surveying of birds and other fauna. This assessment, as described in Chapter 6 of this EIAR on Biodiversity, optimised the decision on the siting of turbines and the carrying out of any development works, such as the construction of roads. The hydrological assessment of the Wind Farm Site encompassed site specific flood modelling for 100-yr and 1000-yr events. This assessment, as described in Chapter 9 of this EIAR on Water, optimised the decision on the siting of turbines, roads and the onsite substation. Where specific areas were deemed as being unsuitable for the siting of turbines or roads, etc., alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the Wind Farm Site has also been informed by the results of noise, landscape and visual and shadow flicker assessments as they became available.

3.2.6.2 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 the results of all site investigations that have been carried out during the EIAR process. As information regarding the Wind Farm Site was compiled and assessed, the number of turbines and the proposed layout have been revised and amended to take account of the physical constraints of the Wind Farm Site and the requirement for buffer zones and other areas in which no turbines could be located. 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 Site design process was an iterative process, where findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts.

The development of the final Wind Farm Site layout has resulted following feedback from the various studies and assessments carried out as well as ongoing negotiations and discussions with landowners and the local community.

There were several reviews of the specific locations of the various turbines during the optimisation of the Wind Farm Site layout. The initial constraints study identified a significant viable area within the overall study area of the Proposed Development site. The initial turbine layout comprised 12 no. turbines within a larger study area, however the proposed 9-turbine layout was refined following feedback from the project team, landowners, neighbours and the need to ensure sufficient separation distances are maintained for on-site constraints. The Wind Farm Site went through 8 separate iterations. All 8 turbine layout iterations have not been included, but Figure 3-3 to Figure 3-6 below gives an indication of how the design of the turbine layout evolved during the design process.

Map Legend

- EIAR Site Boundary
- Watercourses
- 50m Watercourse Buffer
- 100-yr Site Specific Flood Modelling
- 1000-yr Site Specific Flood Modelling
- Arachaeological Sites
- 30m Archaeological Buffer
- Bat Roost Exclusion Zone
- 3rd-Party Properties
- 740m 3rd-Party Property Buffer
- Operator Specific Telecoms Buffer

N

Drawing Title
Constraints and Facilitators

Project Title
Umma More Renewable Energy Development

Drawn By	Checked By
BT	EC
Project No.	Drawing No.
201050	Figure 3-2
Scale	Date
1:25,000	2023-02-07

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3.2.6.2.1 *Proposed Layout Iteration No. 1*

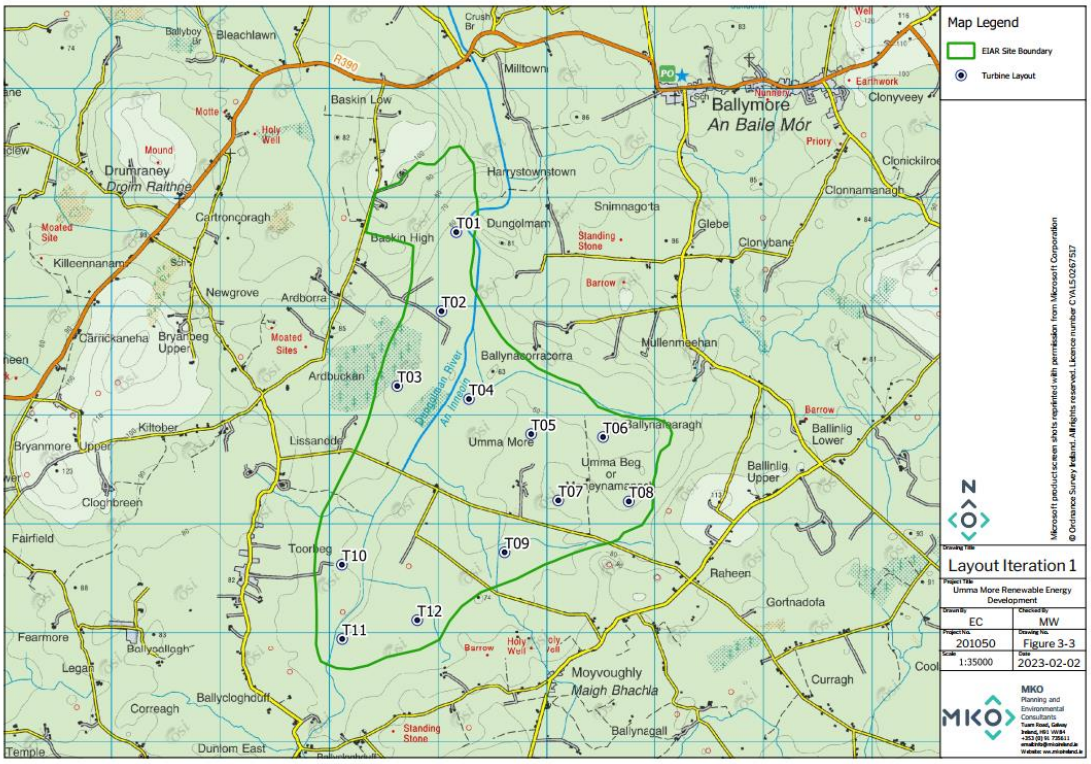

Figure 3-3: Proposed Layout Iteration No. 1

Iteration No. 1 which is presented in Figure 3-3 is the initial turbine layout which was based on a preliminary constraint mapping exercise and identification of a viable area for turbine siting. A larger viable area for the 12 no. turbine layout was identified within the overall study area during the constraints mapping process. It was determined that it would be more environmental sensitive and efficient to allow for fewer turbines and a larger turbine model within this area.

3.2.6.2.2 *Proposed Layout Iteration No. 2*

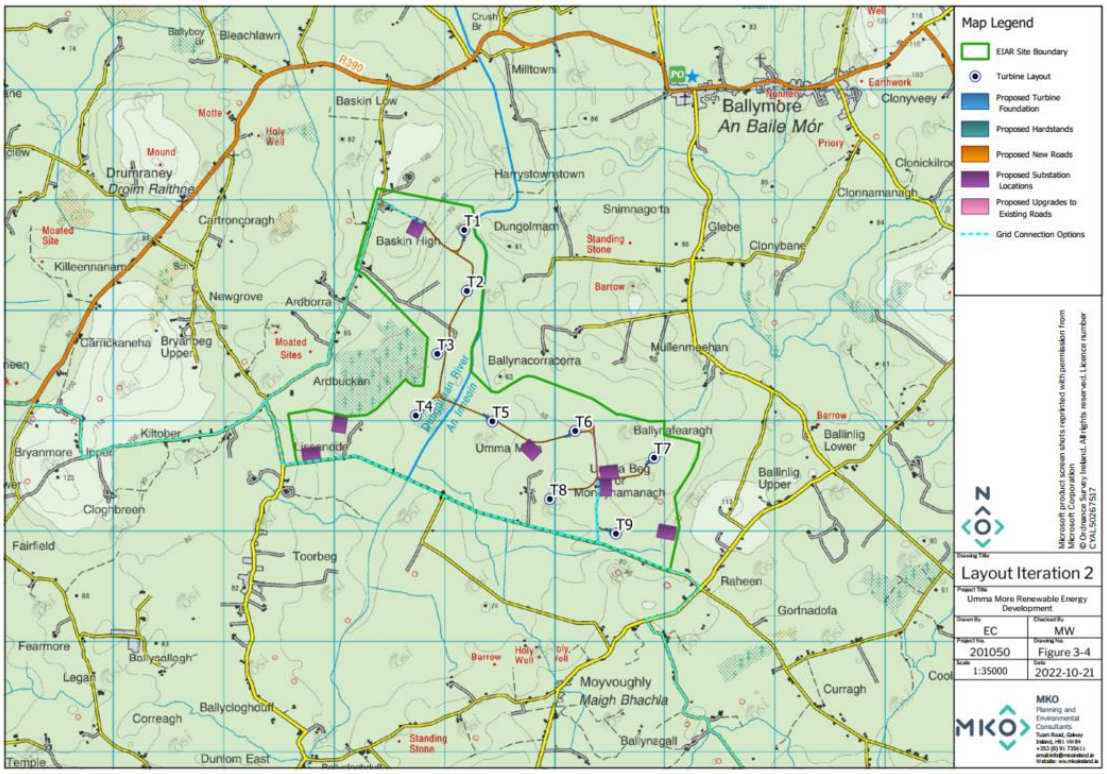

Figure 3-4: Proposed Layout Iteration No. 2

Iteration No. 2 which is presented in Figure 3-4 comprised of 9 No. turbines, hardstands and access roads. There are seven substation options, the locations of which are associated with the underground electrical cabling routes that were under consideration at that time. The alternative underground electrical cabling routes are further detailed in Section 3.2.7 below.

The layout in Iteration No. 2 was presented to the project team for detailed investigations and assessment. These investigations included habitat mapping, ecological surveying, hydrological and geotechnical investigations of the site of the Proposed Development. Detailed hydrological monitoring also commenced for the Wind Farm Site for the purposes of site-specific flood modelling.

3.2.6.2.3 *Proposed Layout Iteration No. 3*

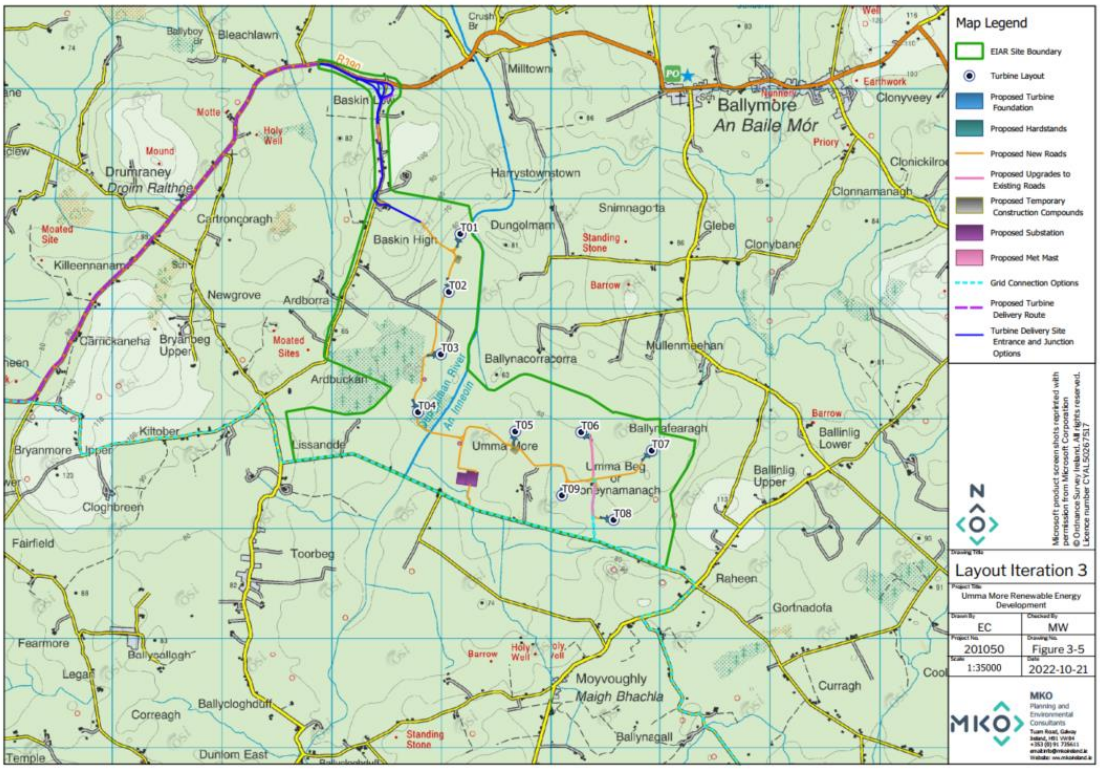

Figure 3-5: Proposed Layout Iteration No. 3

Iteration No. 3 which is presented in Figure 3-5 comprised of 9 No. turbines, two meteorological (met) mast options, two temporary construction compounds, one onsite substation location and two underground electrical cabling route options which are further detailed in Section 3.2.7 below. As mentioned in Section 3.3.6.2.2, Iteration No. 2 was subject to detailed investigations which led to further refinement of the layout.

For Iteration No. 3 the following changes were made:

- Turbines 2 and 5, along with associated hardstands and the road layout were relocated to outside the modelled flood zones (100-yr and 1000-yr) to address flood risk.
- Turbine No. 8 was relocated to avoid a telecoms operator specific set back buffers
- Turbine No. 9 was relocated to avoid an identified bat roost.
- The road layout was realigned to avoid sensitive ecological receptors.

Turbine delivery site entrance and junction options were also included for consideration by the EIAR team and subject to site investigations.

3.2.6.2.4 *Proposed Layout Iteration No. 4 – Final Wind Farm Site Layout*

Figure 3-6 Proposed Layout Iteration No. 4 – Final Wind Farm Site Layout

Iteration No. 4 as presented in Figure 3-6 comprised of 9 No. turbines with a maximum overall ground-to-blade tip height of 185 metres; rotor diameter of 162 metres; hub height of 104 metres, one met mast, two construction compounds, one onsite substation and one underground electrical cabling route which is further detailed in Section 3.2.7. For this layout, the met mast was repositioned to the other side of the road. A reduced substation footprint which accords with Eirgrid substation design requirements was decided upon and with that, the relocation of a temporary construction compound adjacent to the onsite substation. The second construction compound was repositioned along the internal road network to a location opposite the spur road to Turbine No. 1. Informed by detailed auto-track assessments, refinements were made to the Wind Farm Site access junction to facilitate turbine delivery, and alignments of the internal road network, and with this, turbine hardstand positioning. The turbine numbering for Turbine No. 8 and Turbine No. 9 was swapped and it was also at this point that the study boundary for the purposes of the EIAR was defined. The initial site boundary was amended to focus on the final iterations of the layout.

The revisions to the layout were found to have no greater environmental, ecological, and hydrological effects when compared to the other options considered (Iteration No. 1 to 3).

The final proposed turbine layout as presented in Figure 3-6 takes account of all site constraints (e.g., ecology, ornithology, hydrology, etc.) and design constraints (e.g., setback distances from houses and distances between turbines on-site etc.). The layout also takes account of the results of all site investigations and baseline assessments that have been carried out during the EIAR process.

The final chosen turbine layout is considered the optimal layout given it has the least potential for environmental effects.

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

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

Environmental Consideration	Initial Turbine Layouts and all associated infrastructure	Chosen Option of the Final 9. No Turbine Layout and all associated infrastructure
Population & Human Health (incl. Shadow Flicker)	Likely potential for increased shadow flicker impacts on nearby sensitive receptors due to the increased number of turbines	Potential for reduced shadow flicker impacts on nearby sensitive receptors due to the reduced number of turbines Based on the assessment detailed in Chapter 5 and the mitigation measures proposed, there will be no significant effects related to shadow flicker from the Proposed Development.
Biodiversity & Ornithology	Larger development footprint would result in greater potential habitat loss. Greater potential impact on identified sensitive ecological receptors due to location of infrastructure within designated set-back buffers (i.e. identified bat roost).	As detailed in Chapter 6, the development has been designed to avoid or mitigate impacts on biodiversity. As detailed in Chapter 7, the Collision Risk Assessment (CRA) indicated that the impact of the Proposed Development on birds corresponds to a **Very Low** effect significance.
Land, Soils & Geology	Neutral	Smaller footprint would result in smaller volume of soils to be excavated and managed. As detailed in the assessment in Chapter 8, no significant effects on soils and subsoils will occur.
Water	Increased potential for displacement of flood waters during 100-yr and 1000-yr events due to location of infrastructure in site-specific flood modelled zones.	The proposed layout has been designed to avoid flood modelled zones. As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air & Climate	Neutral	Neutral
Noise & Vibration	A larger number of turbines could have a greater noise impact.	Based on the assessment detailed in Chapter 11 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise levels from the Proposed Development during the construction and operational phase.
Landscape & Visual	A larger number of turbines could have a greater visual impact.	As detailed in the assessment in Chapter 12, the lack of highly sensitive

Environmental Consideration	Initial Turbine Layouts and all associated infrastructure	Chosen Option of the Final 9. No Turbine Layout and all associated infrastructure
		landscape and visual receptors, and the strategic siting of infrastructure will mitigate any potential for significant landscape and visual effects.
Cultural Heritage & Archaeology	Neutral	Neutral
Material Assets	Neutral.	Neutral.

3.2.6.3 Road Layout

Access tracks are required onsite in order to enable transport of infrastructure and construction materials within the Wind Farm Site. 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 Wind Farm Site 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 Wind Farm Site layout was finalised, the most suitable routes between each component of the development were identified, taking into account the existing roads and the physical constraints of the Wind Farm 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 within the Wind Farm Site.

An alternative option to making maximum use of the existing road network within the Wind Farm Site would be to construct a new road network, having no regard to existing roads or tracks. This approach was not favoured, as it would require unnecessary disturbance to the Wind Farm Site and create the potential for additional environmental impacts to occur. It would also result in an unnecessary requirement for additional cut and fill material to be used in the construction of new roads.

3.2.7 Alternative Design of Ancillary Structures

The ancillary structures required for the Proposed Development include construction compounds, on-site substation and Wind Farm Site underground electrical cabling.

3.2.7.1 Construction Compounds

The temporary construction compounds will be used for the storage of all construction materials, turbine components, staff facilities and car-parking areas for staff and visitors. The use of two temporary construction compounds was deemed preferable to the alternative of a single large compound. Principally, it will result in shorter distances for traffic movements within the site during construction. The construction compounds are located strategically within each section of the site to facilitate the construction of the various infrastructure components. As a result, vehicle emissions and the potential for dust arising will be reduced.

3.2.7.2 Deliveries of Materials from Nearby Quarries

In order to facilitate the construction of the Proposed Development, materials will need to be imported from nearby quarries. The quarries that could potentially provide stone and concrete for the Proposed Development are as follows;

1. *Midlands Stone Company Ltd. – Stone,*
2. *Master Stonemasons, Athlone – Stone,*
3. *Roadstone, Tullamore – Stone,*
4. *Spollen Concrete, Glasson – Concrete,*
5. *John Gannon Concrete Ltd. – Concrete*

The locations of these quarries and Ready-Mix Concrete (RMC) batching plants together with the routes to the Proposed Development site are shown in Figure 4-23 of Chapter 4. Deliveries of stone and ready-mix concrete for use in construction of the Wind Farm Site and Grid Connection, are discussed in further detail in Chapter 14 of this EIAR.

Site investigation works were carried out at the Wind Farm Site to determine if it would be feasible to provide onsite borrow pits as an alternative to sourcing materials from nearby quarries. The use of onsite borrow pits would eliminate the need to transport large volumes of construction material along the local public road network to the site. However, when considering the site characteristics, including topography, ground conditions, and surface features, it was determined that onsite borrow pits would not be feasible as they would create a larger local impact than the minor traffic generation associated with deliveries of materials from off-site sources to the Wind Farm Site.

A comparison of the potential environmental effects of the chosen option of obtaining all stone material offsite when compared to the alternative of using onsite borrow pits is presented in Table 3-7 below.

Table 3-5 Comparison of environmental effects when compared against the chosen option (Deliveries of Materials from Nearby Quarries)

Environmental Consideration	Obtaining all stone from onsite borrow pits	Chosen Option of obtaining all stone material offsite (Deliveries of Materials from Nearby Quarries)
Population & Human Health	Less potential for impact on residential amenity when compared to quarries, due to vehicular and dust emissions from additional traffic associated with movement of material on and off-site. Potential for increased impact on residential amenity due to increased noise and dust emissions associated with excavation of material at onsite borrow pits.	Potential for increased impact on residential amenity due to increased vehicular and dust emissions from increased traffic movements. Potential for reduced impact on residential amenity due to reduced noise and dust emissions associated with the absence of excavation of material at onsite borrow pits. Based on the assessment detailed in Chapter 5 and the mitigation measures proposed, there will be no significant effects on residential amenity from the Proposed Development.
Biodiversity & Ornithology	Larger development footprint which would result in larger amounts of habitat loss due to onsite excavations.	No borrow pit exaction therefore no habitat loss. As detailed in Chapter 6, the development has been designed to avoid or mitigate impacts on biodiversity.
Land, Soils & Geology	Potential for increased impact on lands, soils and geology due to	No borrow pit exaction therefore no impact on land, soils and geology. As

Environmental Consideration	Obtaining all stone from onsite borrow pits	Chosen Option of obtaining all stone material offsite (Deliveries of Materials from Nearby Quarries)
	excavation of material at onsite borrow pits.	detailed in the assessment in Chapter 8, no significant effects on bedrock, soils and subsoils will occur.
Water	A drainage plan for onsite borrow pits would be required to be incorporated into project drainage design.	No requirement for drainage from onsite borrow pits to be incorporated into Proposed Development drainage design. As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air & Climate	Potential for less vehicular and dust emissions compared to delivery of materials to site which would result in additional traffic associated with movement of material on and off-site. Potential for more dust emissions due to onsite excavation of borrow pits.	Potential for increased vehicular and dust emissions which would result in increased traffic associated with movement of material on and off-site. Potential for reduced dust emissions due to the absence of onsite excavation of borrow pits. As detailed in the assessment in Chapter 10, no significant effects on air quality and climate will occur. Over the proposed thirty year lifetime of the Proposed Development, 59,503 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.
Noise & Vibration	Potential for increased noise and vibration impacts on nearby sensitive receptors due to excavation of material from onsite borrow pits. Potential during construction phase of reduced noise and vibration impacts on nearby sensitive receptors due to reduced traffic movements.	Potential during construction phase for reduced noise impacts on nearby sensitive receptors due to the absence of excavation of material from onsite borrow pits. Potential during construction phase of increased noise and vibration impacts on nearby sensitive receptors due to increased traffic movements. Based on the assessment detailed in Chapter 11 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise levels from the Proposed Development, during the construction phase.
Landscape & Visual	Neutral (as onsite borrow pits would be reinstated following use)	Neutral

Environmental Consideration	Obtaining all stone from onsite borrow pits	Chosen Option of obtaining all stone material offsite (Deliveries of Materials from Nearby Quarries)
Cultural Heritage & Archaeology	Larger development footprint, therefore increasing potential for impacts on sub-surface archaeology	No borrow pit exaction therefore no impact on sub surface archaeology. As detailed in the assessment in Chapter 13, the significance of direct effects will be slight - not significant and no significant effects will occur. There will be no significant direct or indirect impacts on Cultural Heritage.
Material Assets	Less potential for impact on public road network compared to delivery of materials to site which would cause additional traffic.	Increased potential for impact on public road network compared to the development of an on-site borrow pit however as detailed in Chapter 14, the impact will be slight and short term. A detailed Traffic Management Plan incorporating all the mitigation measures will be agreed with the roads authority prior to construction works commencing on site.

3.2.8 Alternative Grid Connection Cabling Route Options

The Wind Farm Site will connect to the national grid via underground electrical cabling, located primarily within the public road corridor. Underground electrical cables will transmit the power output from each wind turbine to the proposed onsite 110kV substation, and from there to the existing Thornsberry 110 kV substation, via an underground electrical cabling route, measuring approximately 31 km in length.

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 Wind Energy Guidelines (DoHLG, 2006) (the Guidelines) also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid. The underground electrical cabling will follow the route of existing public roads, thereby minimising the amount of ground disturbance required.

The Megawatt (MW) output of the Wind Farm Site is such that it needs to connect to a 110kV substation. There are 3 no. existing 110kV electricity substations located within 25km of the Wind Farm Site, namely:

- Athlone 110kV Electricity Substation
- Thornsberry 110kV Electricity Substation
- Mullingar 110kV Electricity Substation

Initial grid studies identified that Mullingar 110kV substation is already congested and therefore it was discounted as a viable option. Therefore, an underground grid connection cabling route to both Athlone 110kV substation (Option 1) and Thornsberry 110kV substation (Option 2) were considered and assessed in order to determine which route would be brought forward as part of the planning

application. This assessment outlines a number of routes from the Wind Farm Site to both connection points, which were considered during the iterative design process. The Grid Connection to Thornsberry 110kV substation and the proposed underground electrical cabling route have been revised and refined to take account of the findings of the site investigations and baseline assessments, which have brought the design from its initial Grid Connection option as presented in Figure 3-7 to the current layout as presented in Figure 3-10.

3.2.8.1.1 Grid Connection Route Options Iteration No. 1

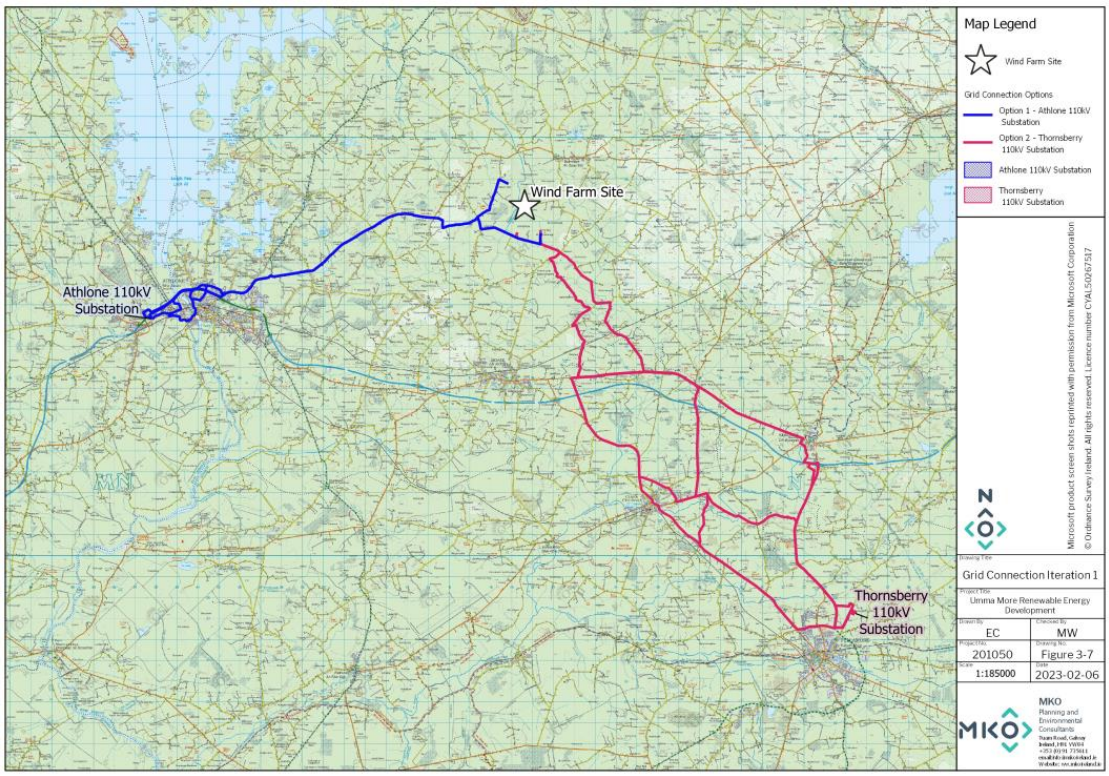

Figure 3-7 Grid Connection Route Options – Iteration 1

The layout in Grid Connection Route Option Iteration No. 1 as presented in Figure 3-7 comprises two Grid Connection Options:

- Option 1: Grid connection to Athlone 110kV substation;
- Option 2: Grid connection to Thornsberry 110kV substation

Option 1 included for a number of underground electrical cabling route options from the Wind Farm Site, through Athlone town and connecting to the existing Athlone 110kV substation. There were three route options that originated from the Wind Farm Site which accommodate the onsite substation options under consideration, as detailed in Section 3.2.6.2.2. Upon approach to Athlone, there were a number of routes considered on local, regional and national roads with particular attention paid to crossing the Shannon River.

For Option 1, it was identified that the underground electricity cabling route crossing the Shannon River via the N6 National Road bridge ("New Shannon Bridge") was the most suitable option primarily for the following reasons; avoidance of potential for disruption to the town of Athlone during the construction phase, and avoidance of a high number of archaeological national monument sites located within the town of Athlone. Therefore, a grid connection cabling route via the N6 National Road was brought forward in the iterative design process and is shown in Figure 3-8 below.

Option 2 is a proposed grid connection to Thornsberry 110kV substation. Option 2 included for four primary underground electrical cabling route options from the Wind Farm Site via local, regional and national roads to the existing Thornsberry 110kV substation. Two of the four proposed routes were found to be located along sections of public road where peat is present, there were a greater number of watercourse crossings required and there were sections of road located within ecological designated sites and were thus screened out of the iterative design process. For the remaining two routes, they were considered relatively similar in terms of ecology, archaeology, hydrology etc. however one such route was approximately 3km shorter in length and had fewer water crossing points.

Therefore, the shorter underground electrical cabling route via Kilbeggan town was brought forward in the iterative design process and is shown in Figure 3-8 below. This underground electrical cabling route option included for two alternative routes at the crossing point of the M6 Motorway south of Kilbeggan town and upon approach to Tullamore on the N52 near Thornsberry 110kV substation, and is further detailed below.

Ecological, Hydrological and Geotechnical Constraints and Facilitators

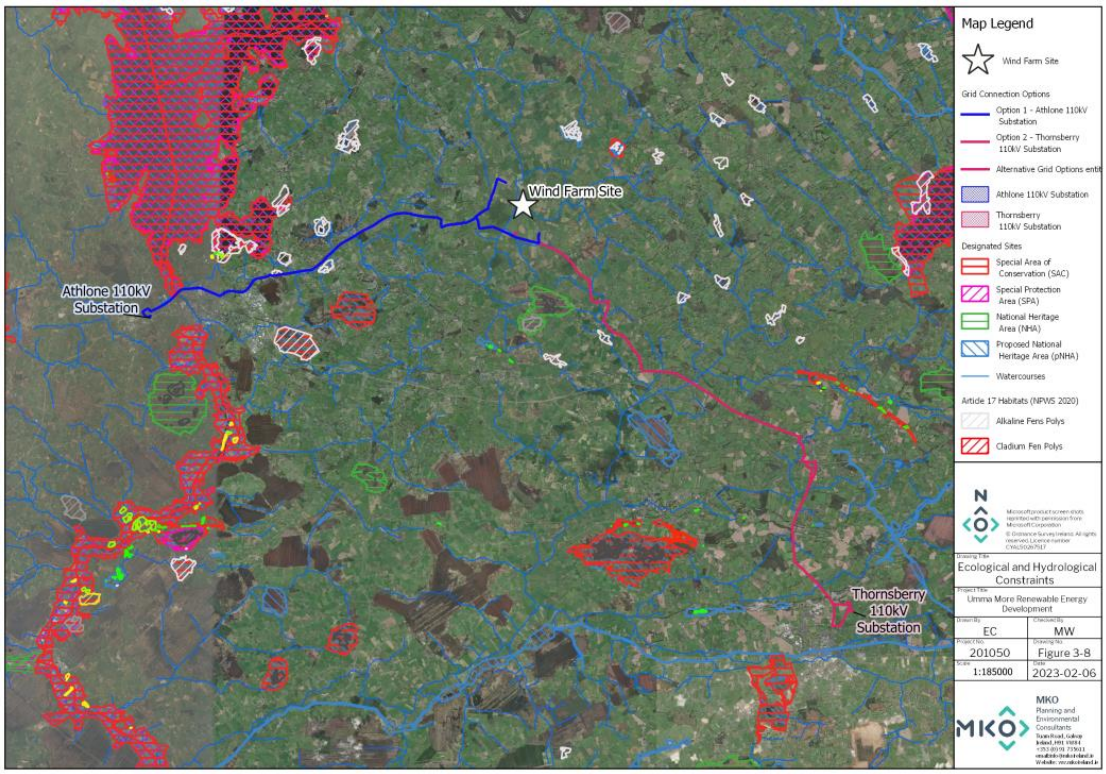

Figure 3-8 Ecological and Hydrological Constraints and Facilitators

The layout in Grid Connection Route Options Iteration No. 1 was presented to the project team for initial feasibility assessment, taking account of all site constraints (e.g., ecology, archaeology, hydrology, peat depths etc.), some of which are identified in Figure 3-8 above.

The chosen Option 2 to Thornsberry 110kV substation is considered the optimal route given it has the least potential for environmental effects when compared to Option 1, particularly when considering the location of Option 1 within an area designated for ecological protection, i.e the Natura 2000 site, Lough Ree SAC and SPA and proposed nationally designated site, Lough Ree pNHA.

The chosen Option 2 was presented to the project team for detailed investigations and assessment. These investigations included habitat mapping, ecological surveying, hydrological and geotechnical investigations.

3.2.8.1.2 Grid Connection Route Options Iteration No. 2

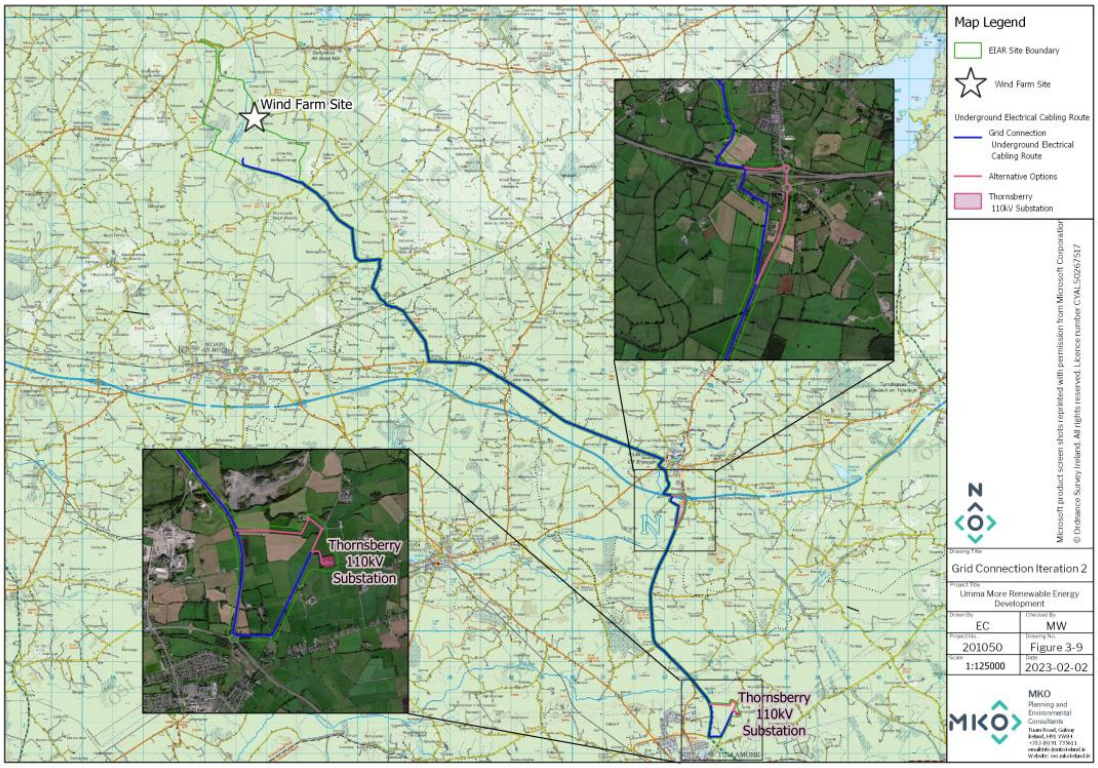

Figure 3-9 Grid Connection Route Option Iteration 2

The layout in Grid Connection Route Option Iteration No. 2 as presented in Figure 3-9 comprises a 31km of underground 110kV electrical cabling connecting the Wind Farm Site to the existing Thornsberry 110kV substation. This layout also includes for two alternative route options identified for crossing the M6 Motorway south of Kilbeggan town, and the approach to the Thornsberry 110kV substation.

The options for crossing the M6 are as follows:

- via an existing footpath underpass or,
- via the N52 underpass.

The former was chosen as the preferred option due to the fact that the N52 underpass is serviced by two roundabouts and the underpass would give rise to less obstructive works to the road network.

The second alternative option for the approach to the Thornsberry 110kV substation are as follows:

- via the N52 until it meets the Ardan roundabout at Tullamore and continue along the L1024 northwards to Thornsberry 110kV substation or,
- via the N52 until existing onto private lands to enter onto the L1024, continuing southwards and entering the Thornsberry 110kV substation.

It was not possible to secure this private land and so the former was chosen as the preferred option.

3.2.8.1.3 Grid Connection Route Iteration No. 3 – Final Grid Connection Layout

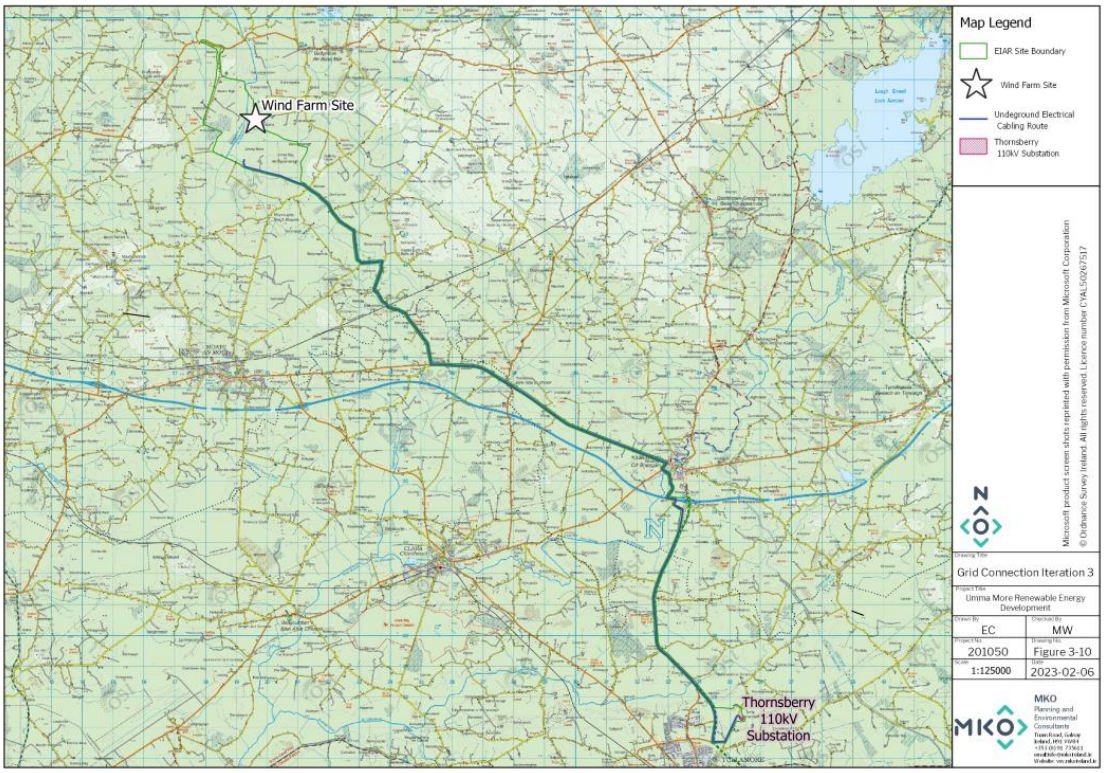

Figure 3-10 Grid Connection Route Options – Iteration 3 - Final Grid Connection Layout

The layout in Grid Connection Route Option Iteration No. 3 as presented in Figure 3-10 comprises 31km of underground 110kV electrical cabling connecting the Wind Farm Site to the existing Thornsberry 110kV substation. A detailed geotechnical survey has been carried out along sections of public road where peat is present, in which the underground electrical cabling route is located. It was identified that in those areas, peat was not widespread with shallow depths logged at certain locations and the underground electrical cabling route retained its proposed location along the public road network.

The revisions to the layout were found to have no greater environmental, ecological, and hydrological effects when compared to the other options considered (Iteration No. 1 and 2).

The final underground cable route as presented in Figure 3-10 takes account of all site constraints (e.g., ecology, archaeology, hydrology, peat depths etc.) and design constraints (e.g., third party lands). The final underground cable route also takes account of the findings from the site investigations and baseline assessments that have been carried out during the EIAR process.

A comparison of the potential environmental effects of Option 1 when compared against the chosen option (Option 2) is presented in Table 3-4 below.

Table 3-6 Comparison of environmental effects when compared against the chosen option (Option 2 – Thornsberry 110kV substation)

Environmental Consideration	Option 1 – Athlone 110kV Substation	Chosen Option 2 – Thornsberry 110kV Substation
Population & Human Health	Neutral - Option 1 is in the public road network. There is no material environmental effect difference between both options considered	Neutral - Option 2 is in the public road network. There is no material environmental effect difference between both options considered

Environmental Consideration	Option 1 – Athlone 110kV Substation	Chosen Option 2 – Thornsberry 110kV Substation
Biodiversity (including Birds)	Potential for greater impact on sensitive ecological receptors during the construction phase as Option 1 is located within Lough Ree SAC, Lough Ree SPA, and Lough Ree pNHA. There are also identified sections the public road network in which Option 1 is located that is adjacent to the following identified Article 17 Annexe 1 habitats: Transition Mires, Caldium Fens and Alkaline Fens.	Low potential for impact on sensitive ecological receptors during the construction phase. As detailed in Chapter 6, the nearest Natura 2000 Site is Split Hills and Long Hills Esker SAC, located 2.6km north of the Option 2 at its closest point. Ballynagrenia and Ballinderry Bog NHA is located 0.9 km west of the Option 2 at its closest point. As detailed in Chapter 6, the development has been designed to avoid or mitigate impacts on biodiversity.
Land, Soils & Geology	Neutral	Neutral - There is no material environmental effect difference between both options considered.
Geotechnical	Neutral	Neutral - There is no material environmental effect difference between both options considered.
Water	Option 1 has 7 no. EPA mapped Watercourse crossings	Option 2 has 11 no. EPA mapped Watercourse crossings. As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air & Climate	Given the maximum potential length of Option 1 is 22.9km and is approx. 9km shorter than that of Option 2 there is the potential for less dust emissions and vehicle emissions impacts associated with Option 1 when compared to Option 2.	Given the maximum potential length of Option 2 is 31.9 km which is 9 km greater than Option 1, there is the potential for greater dust emissions and vehicle emissions impacts associated with Option 1. As detailed in the assessment in Chapter 10, no significant effects on air quality and climate will occur. Over the proposed thirty year lifetime of the Proposed Development, 59,503 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.

Environmental Consideration	Option 1 – Athlone 110kV Substation	Chosen Option 2 – Thornsberry 110kV Substation
Noise & Vibration	Potential for noise impacts on nearby sensitive receptors during the construction phase. Given the maximum potential length of Option 1 is shorter than that of Option 2 there is the potential for less noise impacts associated with Option 1 when compared to Option 2.	Potential for increased noise impacts on nearby sensitive receptors during the construction phase. Given the maximum potential length of Option 2 is greater than that of Option 1 there is the potential for greater noise impacts associated with Option 2 when compared to Option 1. Based on the assessment detailed in Chapter 11 and the mitigation measures proposed, there will no significant effects on sensitive receptors due to an increase in noise levels from the Proposed Development, during the construction phase.
Landscape & Visual	Neutral	Neutral - There is no material environmental effect difference between both options considered.
Cultural Heritage & Archaeology	Neutral	Neutral - There is no material environmental effect difference between both options considered.
Material Assets	Potential for less traffic volumes during construction phase of Option 1 given the shorter length of cable when compared to Option 2.	Potential for greater traffic volumes during construction phase due to longer route and requirement for more construction materials and works required along the public road. Ss detailed in Chapter 14, the impact will be slight and short term. A detailed Traffic Management Plan incorporating all the mitigation measures will be agreed with the roads authority prior to construction works commencing on site.

3.2.9 Alternative Transport Route and Site Access

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

3.2.9.1 Port of Entry

The alternatives considered for the port of entry of wind turbines into Ireland for the Proposed Development include Port of Galway, Shannon Foynes Port and Dublin Port. Shannon Foynes Port is

the principal deepwater facility on the Shannon Estuary and caters for dry bulk, break bulk, liquid and project cargoes. Port of Galway and Dublin Ports also offers a roll-on roll-off procedure to facilitate import of wind turbines. All three ports and indeed others in the state, offer potential for the importing of turbine components. The primary chosen port of entry is Galway Port due to its proximity from the port to the M6 motorway, in which the exit to the national and regional roads towards the Wind Farm Site is accessible.

3.2.9.2 Delivery to Site

From the selected Port of Entry, Galway Port, the turbines will be transported along the M6 Motorway and N6 National Road before exiting northeast at Coosan/Cornamagh (Junction 10 on the N6) on to the N55 National Road. From the N6, the turbines will be transported northeast along the N55 for approximately 2.7km, before turning east onto the R390 Regional Road. The route continues along the R390 Regional Road for 13.5km before turning south onto the L5363 local road where the route continues south along this road for approximately 1km before turning east into the Wind Farm Site entrance.

In assessing the most suitable route for turbine transport, two options were considered for the turn from the R390 Regional Road south onto to the L5363 Local Road:

- Option 1: On approach from west, provision of a temporary road to take the turn before reaching the existing R390/L5363 junction via private lands
- Option 2: On approach from west, provision of a temporary road to take the turn after the existing R390/L5363 junction via private lands

Option 2 is the preferred turning option. This turbine option would have a reduced footprint when compared to Option 1. Option 1 would also require the removal of mature treeline, whilst Option 2 does not require any removal of mature treeline.

This route has been proven suitable for the transport of turbine components, and the transport analysis (as presented in Section 14.1 of this EIAR), shows that only minor accommodation works will be required to accommodate the proposed turbines. The turbine transport route will utilise the national and primary roads available to ensure the road network holds the capacity to manage large loads. When considering turbines transport routes, alternative routes comprising of a more direct route with greater stretches of secondary and local roads were considered less optimal due to the increased possibility of road and roadside disruption and a greater need to carry out works.

All construction traffic will use the designated haul routes only. An alternative to this would be to allow for more direct access to the site using multiple approach routes; however, this is more likely to give rise to additional traffic and road impacts.

The delivery of turbine components including blades, tower sections and nacelles is a specialist operation owing to the oversized loads involved. As detailed in Section 14.1 of this EIAR, turbines components will be delivered to site using a Super Wing Carrier There is one location on the turbine delivery route it will be required to raise the rear tip of the blade using a “blade lifter” in order to avoid a bank of trees . When considering turbines transport routes, alternative modes of transport were also considered. Alternatively, depending on the selected turbine delivery route and the turbine manufacturer, a blade adapter or blade transporter may also be used, if deemed appropriate, for delivery of turbines to the Wind Farm Site.

3.2.10 Alternative Mitigation Measures

Mitigation by avoidance has been a key aspect of the Proposed Development’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 any environmentally

sensitive areas. Where loss of habitat occurs in the Site, this has been mitigated with the proposal of habitat enhancement and improved habitat connectivity with hedgerow replanting on the Wind Farm Site. Any forestry felled within the footprint of the Wind Farm Site will be replaced offsite, with no net loss. The alternative to this approach is to encroach on the environmentally sensitive areas of the Site and accept the potential environmental effects and risk 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 effective and neither of these options is sustainable.