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# Environmental Impact Assessment Report (EIAR)

## Carrig Renewables Wind Farm - EIAR

Chapter 3 – Reasonable Alternatives

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# 3. CONSIDERATION OF 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'. 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 project, connection to the national grid and transport route options to the Proposed Development. 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 Proposed Development, 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 study area as it is, with no changes made to the current land-use practices of low intensity agriculture, peat harvesting and forestry on the Proposed Development, 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.<br><br>No potential for shadow flicker and noise to affect sensitive receptors. | Up to approximately 70 jobs could be created during the construction, operation, and maintenance phases of the Proposed Development.<br><br>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.<br><br>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.<br><br>As detailed in the Bat Report in Appendix 6-2 of this EIAR, there is unlikely to be any significant effect in relation to collision risk to bats from the Proposed Development. |

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| | | As detailed in Chapter 7, the Collision Risk Assessment (CRA) indicates that the impact of the Proposed Development on birds corresponds to a **Low – Very Low** effect significance. |
| Land, Soils & Geology | Neutral | As detailed in the assessment in Chapter 8, no significant effects on land, landuse, peat, soil and bedrock will occur. |
| Water | Neutral | As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur. |
| Air | Neutral | As detailed in Chapter 10, there will be a significant positive effect on air quality due to the operation of the Proposed Development. |
| 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 11, over the proposed 35-year lifetime of the Proposed Development, 40,512 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 12 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. |
| 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 – imperceptible. and no significant effects will occur. There will be no significant direct or indirect impacts on Cultural Heritage. |
| Landscape & Visual | No potential for landscape and visual impacts on nearby sensitive receptors. | As detailed in the assessment in Chapter 13, there are no 'Significant' landscape effects and the only 'Significant' visual effects deemed to arise were in relation to a very low number of residential properties located within 800m of the proposed turbines. |

| | | |
|---|---|---|
| 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 Proposed Development 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. The Irish Government has outlined the 2030 energy targets for both onshore and offshore wind projects in the Climate Action Plan 2023 (CAP). The CAP states that the target for both onshore and offshore wind energy is 9 Gigawatts (GW) and 5GW respectively. However, at the beginning of the site selection process for this project, the planning legislation and regulations surrounding offshore wind energy was limited whilst the legislation and regulations relating to onshore wind energy is well developed and established. The certainty behind the onshore wind planning policies attracted the developers to select an onshore project due to the numerous unknowns regarding offshore wind planning policies, legislation, and regulations. At the time of writing, the Minister for the Environment, Climate and Communications had issued 'Maritime Area Consents' to the first phase of seven offshore wind energy developments on 23rd December 2022, highlighting the infancy of the offshore wind planning policy area in Ireland.

### 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.

MKO, on behalf of the Atlantic Infrastructure Renewables (AIR), undertook a detailed site identification process, through Geographical Information Spatial (GIS) software, within multiple counties which has led to a number of sites which AIR wishes to bring forward to planning including the Proposed Development sites and further sites in Co. Galway and Co. Kilkenny.

MKO, on behalf of the applicant's parent company (Atlantic Infrastructure Renewables – AIR), undertook a detailed screening process, through Geographical Information Spatial software (GIS), using multiple criteria and a two-phase process to identify possible sites, within numerous counties, with the potential to accommodate a wind energy development. The GIS database drew upon a wide array of key spatial datasets such as, , house location data, transport, existing wind energy and grid infrastructure data, land use data and environmental data such as ecological designations, landscape designations and wind energy strategy designations available at the time.

The following is a summary of the methodology used in the screening process. The screening process included the following phases:

- Phase 1 – Proximity to National Grid
- Phase 2 – Screening

#### 3.2.3.1.1 *Phase 1 – Proximity to National Grid*

As part of the site selection process, it was necessary to consider the potential for grid connection, including in terms of distance to potential connection nodes and the grid capacity at the nodes in the local area, to accommodate the connection. In this stage of the process, Mullan Grid undertook grid capacity assessments for numerous counties which focussed the site screening process to areas within close proximity to connection nodes with potential capacity.

#### 3.2.3.1.2 *Phase 2 –Screening*

This stage in the selection process discounted lands that were not available for development under a number of criteria, as follows:

- Residential Dwelling Locations plus 700m buffer
- Transport corridors
- 110kV/220kV/400kV Electricity Transmission Corridors
- Watercourses/Waterbodies plus 50m buffer
- Designated Sites
- Existing wind farms developments and lands committed to permitted/proposed developments.

### 3.2.3.2 Results of the Screening Process

The application of the above criteria to identify a site relevant to the project and its specific characteristics, resulted in the selection of a candidate site located in north Co. Tipperary near the village of Carrig, within Faddan More and adjacent townlands, as a candidate site to be brought forward for more detailed analysis. The site is now known as Carrig Renewables Wind Farm.

Other sites that also emerged from the screening process, outlined above, for which Atlantic Infrastructure Renewables (AIR) are in the process of preparing separate planning applications are located in Co. Galway and Co. Kilkenny.

AIR intend to bring forward all of these sites for wind energy development as all were considered to be viable sites for a wind energy development. Each are projects in their own right which will be subject to EIA. As such a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen options with regards to their environmental impacts will be provided in the EIAR accompanying the applications for the same.

The alternative would be to bring forward a site that did not pass one or all of the above phases of the screening process. In that instance, there would be the potential for the construction and operation of a wind energy development to have an adverse effect on ecologically designated or sensitive areas and visually sensitive (scenic) or amenity areas. There would also be the potential for greater shadow flicker, noise and traffic impacts if the candidate site was located in an area with a higher number of residential dwellings.

### 3.2.3.3 Suitability of the Candidate Site

Carrig Renewables Wind Farm, as a candidate site, was further examined under the following headings in order to confirm its suitability for wind energy development.

- Wind Speeds
- Existing Grid Infrastructure
- Designated Sites
- Available Set Back from Sensitive Receptors

- Residential Density
- Planning Policy

#### 3.2.3.3.1 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 at a height of 100m. 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. Therefore, with a sufficient turbine height and blade diameter, the wind resource of the site is commercially viable.

#### 3.2.3.3.2 Existing Grid Infrastructure

The Carrig Renewables Wind Farm site is located within approximately 25km of 4 no. existing 110kV substations and 6 no. existing 38kV substations. Therefore, a wind energy development at this location has multiple potential options for connection to the national electricity grid. The closest 110kV substation (Dallow) to the site is located approximately 8.4km to the north. The closest 38kV substation (Birr) is located approximately 7.9km to the northeast.

Details regarding potential alternative grid connection options considered are presented in Section 3.2.8 below.

#### 3.2.3.3.3 Designated Sites

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

The nearest Natura 2000 site to the Proposed Development, i.e., SAC or SPA is Ballyduff/Clonfinane Bog SAC, the boundary of which is located approximately 110 metres (m) to the northeast of the Proposed Development, at its nearest point.

The nearest national designated site to the Proposed Development, i.e., NHA or pNHA is Arragh More Bog NHA, which borders the Proposed Development to the northwest.

A 100m setback buffer has been applied to all areas designated for ecological protection in the vicinity of the Proposed Development.

#### 3.2.3.3.4 Residential Density

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 16.36 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. Further to this, the closest dwelling to the Proposed Development is located 740m south of the nearest turbine. This meets the requirements as set out in the Guidelines for a setback distance from occupied dwellings of 4 x tip height from a turbine (i.e., 740m in this case). There are 16 no. residential properties located within 1km of the proposed turbines.

#### 3.2.3.3.5 Planning Policy

A Planning Policy Rationale report has been prepared in support of the Proposed Development and this report accompanies this planning application. The objective of this document is to present a planning policy rationale for the Proposed Development. Despite favourable site characteristics, the site

is currently zoned 'unsuitable' in Tipperary's Wind Energy Strategy 2016, which is included in the Tipperary Renewable Energy Strategy ('RES'). However, a robust analysis of wind energy constraints in Co. Tipperary has indicated that sites such as the Proposed Development site, do have development potential and can contribute towards the wind energy targets set out in international national and local policy. This report includes an assessment of the relevant international, national, regional and local planning and renewable energy policy that applies to the Proposed Development (Section 2) which highlights that the policy landscape has altered significantly since the adoption of the RES, resulting in a misalignment between local and international/national/regional policy.

The report notes that the Proposed Development adheres to the recommendations and guidance outlined in the 'Draft Revised Wind Energy Development Guidelines - December 2019' and the 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012).
The report concludes that the Proposed Development is considered to be in the overriding public interest, as it will contribute to achieving the objectives of the REPowerEU plan, both in relation to the transition to clean renewable energy and energy security for the both the State and the European Union.

#### 3.2.3.3.6 *Summary*

From the review of the criteria set out above, the Carrig Renewables Wind Farm site was identified as a suitable location for the provision of a renewable energy development of the scale proposed. The candidate site is located on agricultural land, existing commercial forestry and cutover peatland which allows the site to take advantage of existing access roads (which will be upgraded) and highlights the suitability of the candidate as it can make sustainable use of these established items of infrastructure. The candidate 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 candidate site emerged as a suitable location, the applicants approached the landowners in order to assemble the Proposed Development site. Arising from the site assembly discussions the current site layout was identified and brought forward as being capable of accommodating a cohesive viable area of sufficient size to cater for the Proposed Development.

### 3.2.4 Alternative Renewable Energy Technologies

The proposed wind farm will be located on a site where agriculture, commercial forestry and peat harvesting will continue to be carried out around the footprint of the Proposed Development.

Both onshore and offshore wind energy development and solar energy developments 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 Proposed Development.

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 Development was progressed. To achieve the same electricity output as is expected from the Proposed Development (c. 43.4MW), from solar energy alone, 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 315 hectares and the permanent footprint of the Proposed Development measures approximately 6 hectares, which represents approximately 1.9% of the Proposed Development. In order to achieve a

c.43.4MW output using solar PV arrays, there would be a requirement of approximately 86.8 ha[1], which represents approximately 27.6% of the Proposed Development 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 Proposed Development 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 (incl. Shadow Flicker) | Relatively lower long-term financial contributions towards the local community (i.e., community benefit fund) on a per MWh basis).<br><br>No potential for shadow flicker to affect sensitive receptors.<br><br>Potential for glint and glare impacts on local receptors. | Higher long-term financial contributions towards the local community (i.e., community benefit fund) on a per MWh basis.<br><br>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.<br><br>No potential for glint and glare impacts on local receptors.<br><br>Based on the assessment included in Chapter 10, the Proposed Development will have a significant positive effect on human health due to the production of clean renewable energy and the offsetting of emissions (e.g., nitrogen, sulphur dioxide) which are produced from fossil fuel powered sources of electricity. |
| Biodiversity & Ornithology | Larger development footprint would result in greater potential habitat loss.<br><br>No potential for collision risk for birds. | As detailed in Chapter 6, the development has been designed to avoid or mitigate impacts on biodiversity.<br><br>As detailed in Chapter 7, the Collision Risk Assessment (CRA) indicated that the impact of the |

[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) |
|---|---|---|
| | Potential for glint and glare impacts on birds. | Proposed Development on birds corresponds to a **Low-Very Low** effect significance.<br><br>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 and the mitigation measures proposed, no significant effects on peat 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 and the mitigation measures proposed, no significant effects on surface water or groundwater quality will occur. |
| Air | Reduced capacity factor of solar PV array technology would result in more reliance on fossil fuels for energy generation and therefore decreased air quality improvements. | As detailed in the assessment in Chapter 10, the Proposed Development will provide an alternative to electricity generated from fossil fuel sources and will result in a long-term, significant, positive impact on air quality. |
| Climate | Reduced capacity factor of solar PV array technology would result in less carbon offset. | As detailed in the assessment in Chapter 11, over the proposed 35-year lifetime of the Proposed Development, 40,512 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 12 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. |
| Cultural Heritage & Archaeology | Neutral | As detailed in the assessment in Chapter 13, there will be no significant effects to known cultural heritage assets or recorded archaeological monuments. There will be no significant direct or indirect impacts on Cultural Heritage. |

| Environmental Consideration | Solar PV Array (with up to 55.8 MW Output) | Chosen Option (Wind Turbines) |
|---|---|---|
| Landscape & Visual | Panelling potentially less visible from surrounding area due to screening by vegetation and topography. | As detailed in the assessment in Chapter 14, the landscape value and sensitivity of the Proposed Development Site was deemed to be Low. Low sensitivity balanced with a substantial magnitude of change amounts to long-term landscape effects of Moderate significance upon the physical fabric of the landscape of the site. |
| Material Assets | Neutral | As detailed in Chapter 15, 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 site of the Proposed Development 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 of 6.2 megawatt (MW) range. It is proposed to install 7 turbines at the Proposed Development which could achieve approximately 43.4 MW output (mid-range capacity). Such a wind farm could also be achieved on the Proposed Development by using smaller turbines (for example 2.5 MW machines). However, this would necessitate the installation of over 17 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 Proposed Development. A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the Proposed Development, 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 Proposed Development. The 7-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 turbine model to be installed on the Proposed Development will have an overall ground-to-blade tip height range of 179.5m - 185m; a rotor diameter range of 149m - 163m; and hub height range of 103.5m - 110.5m. For the purposes of this EIAR a range of turbines within the proposed dimensions has been assessed (e.g. tallest turbine within defined range has been assessed for visual impact, widest rotor diameter within the defined range has been assessed for shadow flicker etc.). The EIAR therefore provides a robust assessment of the turbines that could be considered within the overall development

description. The use of alternative smaller turbines at the Proposed Development would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the Proposed Development 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 Proposed Development 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 7 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.<br><br>As detailed in Chapter 7, the Collision Risk Model (CRM) indicated that the potential impact of the Proposed Development on birds corresponds to a **Low-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.<br><br>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.<br><br>As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur. |
| Air | Increased potential for impacts on air quality due to an increased vehicles emissions and dust emissions due to an increased volume of material and turbine component deliveries to the site during the construction phase. | 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 7 no. turbine layout |
|---|---|---|
| Climate | Increased potential for vehicle emissions and dust emissions due to an increased volume of material and turbine component deliveries to the site during the construction phase. | As detailed in the assessment in Chapter 11, over the proposed 35-year lifetime of the Proposed Development, 40,512 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.<br><br>Based on the assessment detailed in Chapter 12 and the mitigation measures proposed, there will be significant effects on sensitive receptors due to an increase in noise levels from the Proposed Development during the construction and operational phase. |
| Cultural Heritage & Archaeology | Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology. | As detailed in the assessment in Chapter 13, there will be no significant effects to known cultural heritage assets or recorded archaeological monuments. |
| Landscape & Visual | A larger number of turbines would have a greater visual impact. | The Proposed Development is an appropriately designed and suitably scaled project, there are no 'Significant' landscape effects and the only 'Significant' visual effects deemed to arise were in relation to a very low number of residential properties located within 800m of the proposed turbines. |
| Material Assets | 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.<br><br>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 Proposed Development 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 Proposed Development 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 either using guidance presented in the Guidelines or based on industry best practice.

Notwithstanding this, however, due to the timelines associated with the planning process for renewable energy projects and the commitment within the Climate Action Plan 2023 to publish new draft guidelines in 2023 and final guidelines in 2024 (refer to Section 1.5.1 below), 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 Proposed Development will be capable of achieving the requirements of the Draft Guidelines as currently proposed.

The constraints map for the Proposed Development, as shown in Figure 3-1, was produced following a desk study of all site constraints. Figure 3-1 encompasses the following constraints and associated buffers:

- Residential dwellings plus a minimum 740-metre buffer (achieving the requirement for a 4 x tip height separation distance from properties in line with the new Draft Guidelines);
- Natura 2000 sites plus 100-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, 50-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.

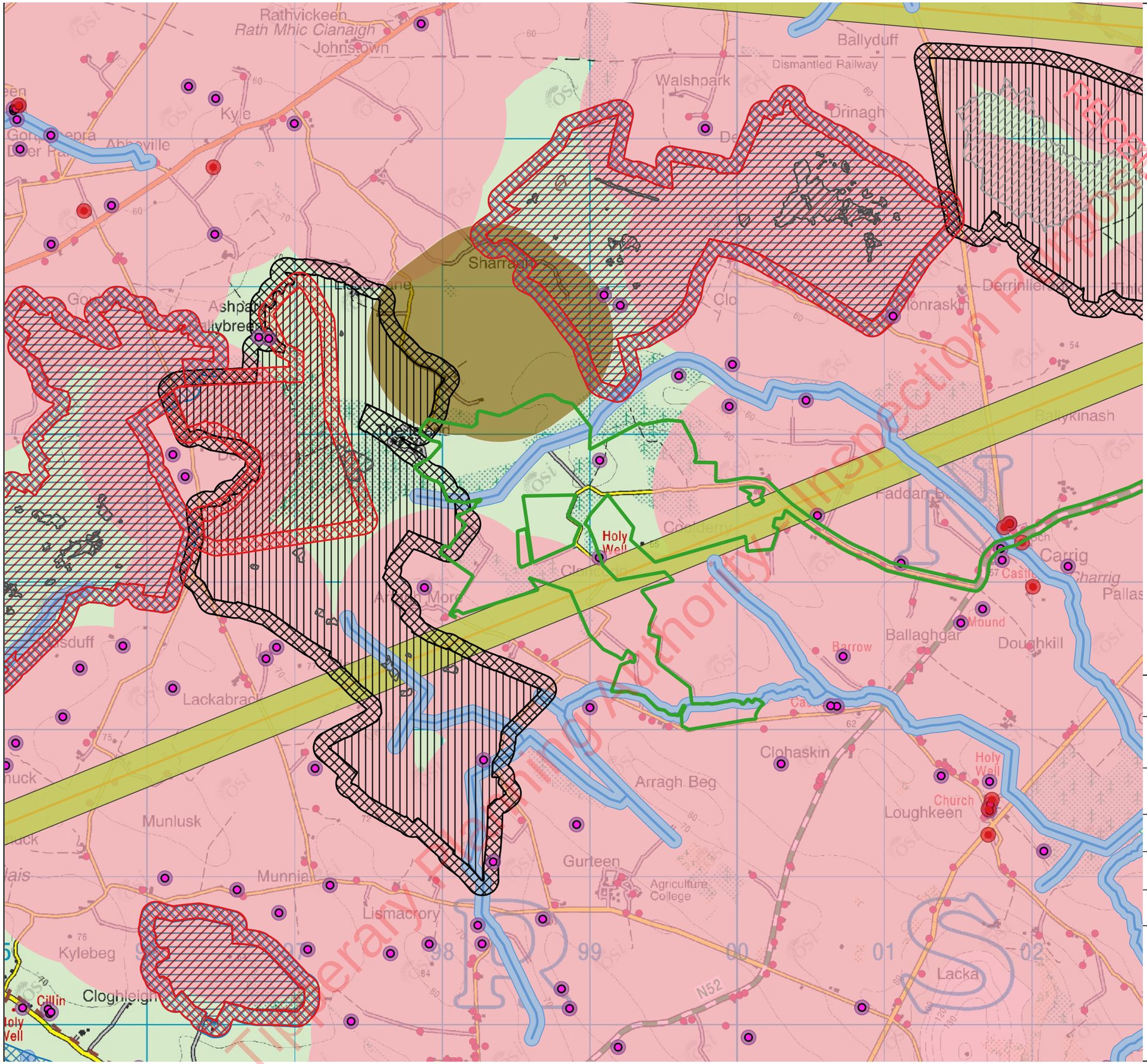
The inclusion of the constraints on a map of the study area allows for a viable area to be identified. An initial turbine layout is then developed to take account of all the constraints mentioned above and their associated buffer zones and the separation distance required between the turbines. Following the mapping of all known constraints, detailed site investigations were carried out by the project team. The ecological assessment of the Proposed Development 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. 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 Proposed Development 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 Proposed Development 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 Proposed Development 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 Proposed Development 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 Proposed Development 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 Proposed Development 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 7-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 Proposed Development went through 6 separate iterations. All 6 turbine layout iterations have not been included, but Figure 3-3 to Figure 3-7 below gives an indication of how the design of the turbine layout evolved during the design process.




## Map Legend

- EIAR Site Boundary

**Hydrology**

- Watercourses
- 75m Watercourse Buffer

**Sensitive Receptors**

- Sensitive Receptors
- 740m Sensitive Receptors Setback

**Ecology**

- 600m Biodiversity Buffer

**Designated Areas**

- Natural Heritage Area (NHA)
- 200m NHA Buffer
- Proposed Natural Heritage Area (pNHA)
- 200m pNHA Buffer
- Special Area of Conservation (SAC)
- 200m SAC Buffer

**Heritage**

- National Inventory of Architectural Heritage (NIAH) Sites
- 50m NIAH Sites Buffer
- National Monuments
- 50m National Monuments Buffer

**Telecommunications**

- Imagine Link
- 131m Imagine Link Buffer

**Land Holdings**

- 81m Landowner Setback



Drawing Title

# Constraints and Facilitators

Project Title

Carrig Renewables Wind Farm Development

| Drawn By | Checked By |
|---|---|
| JF | EM |
| Project No. | Drawing No. |
| 211016 | Fig. 3-1 |
| Scale | Date |
| 1:25,000 | 2023-09-20 |

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### 3.2.6.2.1 Proposed Layout Iteration No. 1

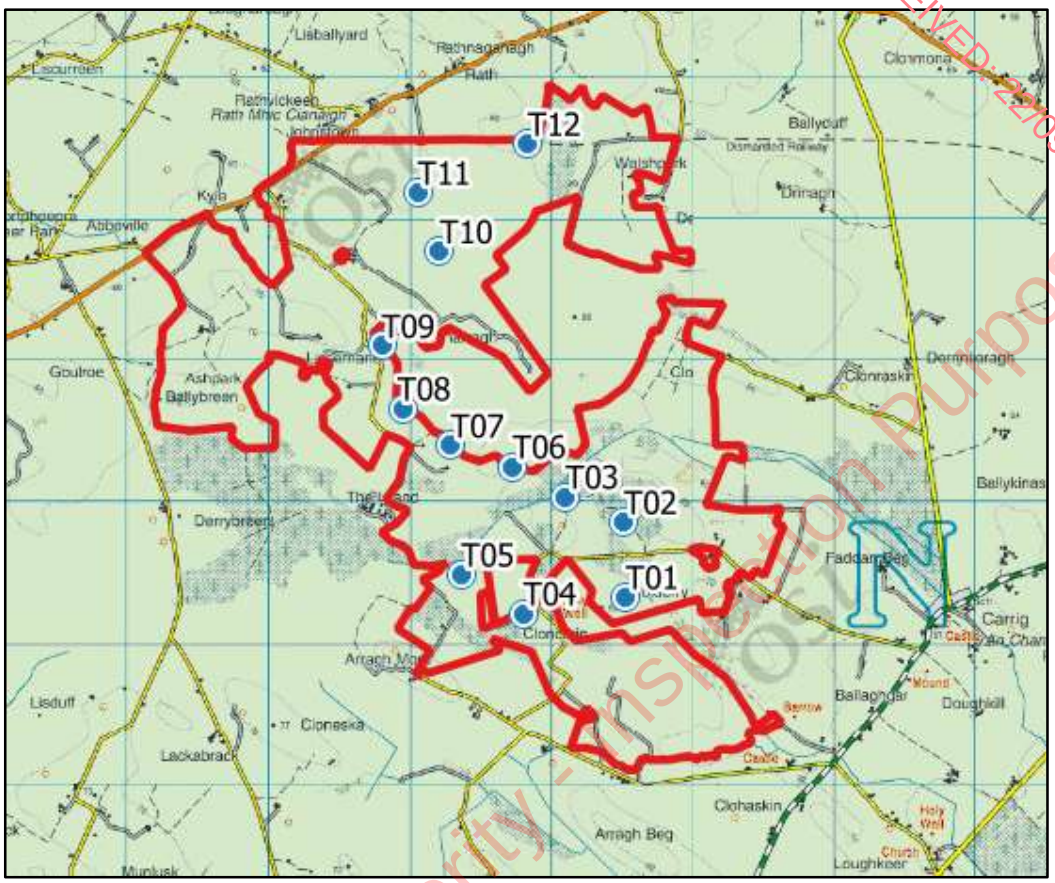


*Figure 3-2 Proposed Layout Iteration No. 1*

Iteration No. 1 which is presented in Figure 3-2 is the initial turbine layout which was based on a preliminary constraints mapping exercise and identification of a viable area for turbine siting. The initial desk-top constraints study identified a significant viable area within the overall study area. The site was considered potentially suitable for up to 12 no. turbines.

### 3.2.6.2.2 Proposed Layout Iteration No. 2

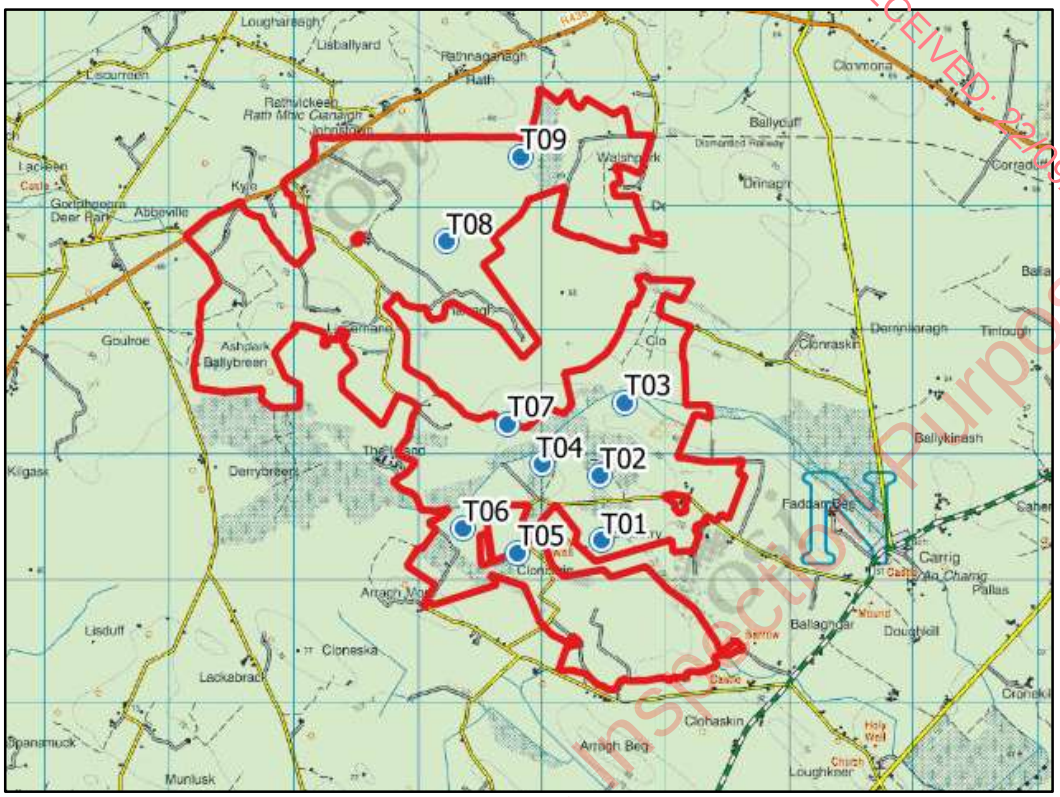


*Figure 3-3 Proposed Layout Iteration No. 2*

Iteration No. 2 which is presented in Figure 3-3. A merlin nest site and a whooper swan roost were identified during the ornithological surveys which were undertaken at the site. The project ornithologists requested that adequate setback distances be applied to these locations so as to reduce. The potential for adverse effects on these species. This led to a reduction of the viable area which in turn led to the removal of 3 no. turbines from the layout. The three turbines located within the centre of the site were removed from the project in order to reduce any potential impacts on migrating bird species between the northern and southern portions of the site.

### 3.2.6.2.3 Proposed Layout Iteration No. 3

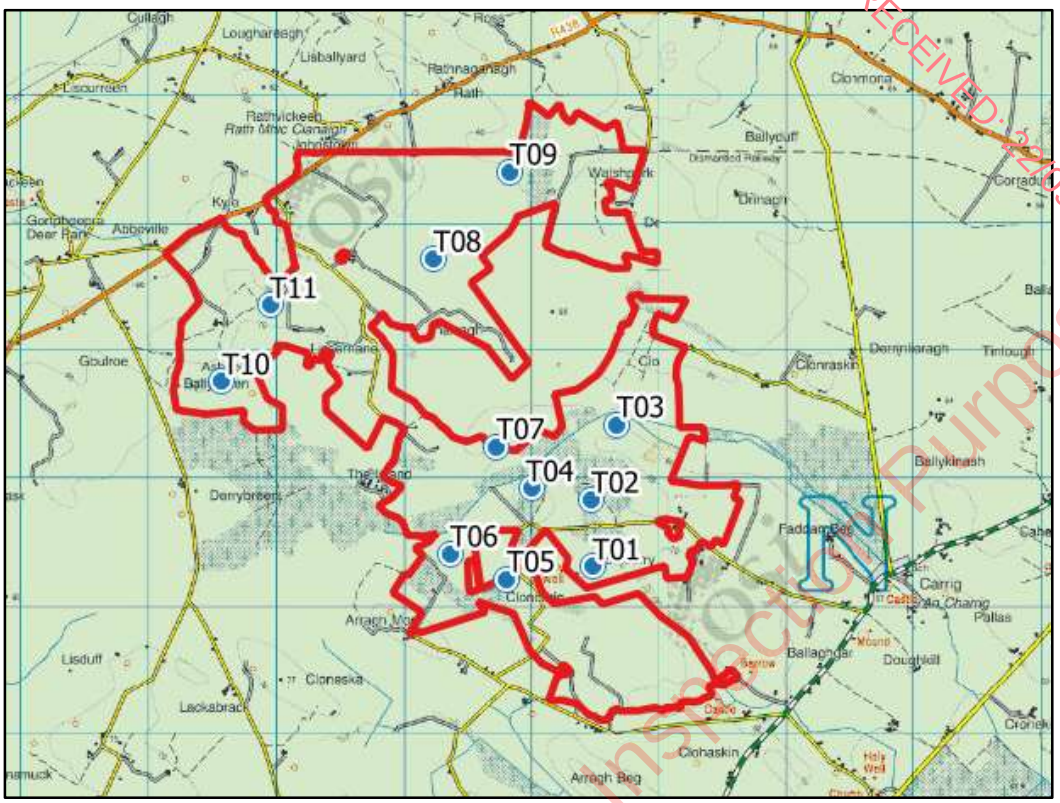


*Figure 3-4 Proposed Layout Iteration No. 3*

Iteration No. 3 which is presented in Figure 3-4. Initial site walkovers and surveys were carried out by the project team based on the second iteration of the turbine layout. Following continued discussions with landowners located within the site boundary, additional lands became available and this resulted in the additional 2 no. north-western turbines to the project. The addition of these turbines sought to further improve the economic viability of the project whilst having regard to the physical and environmental constraints previously identified.

### 3.2.6.2.4 Proposed Layout Iteration No. 4

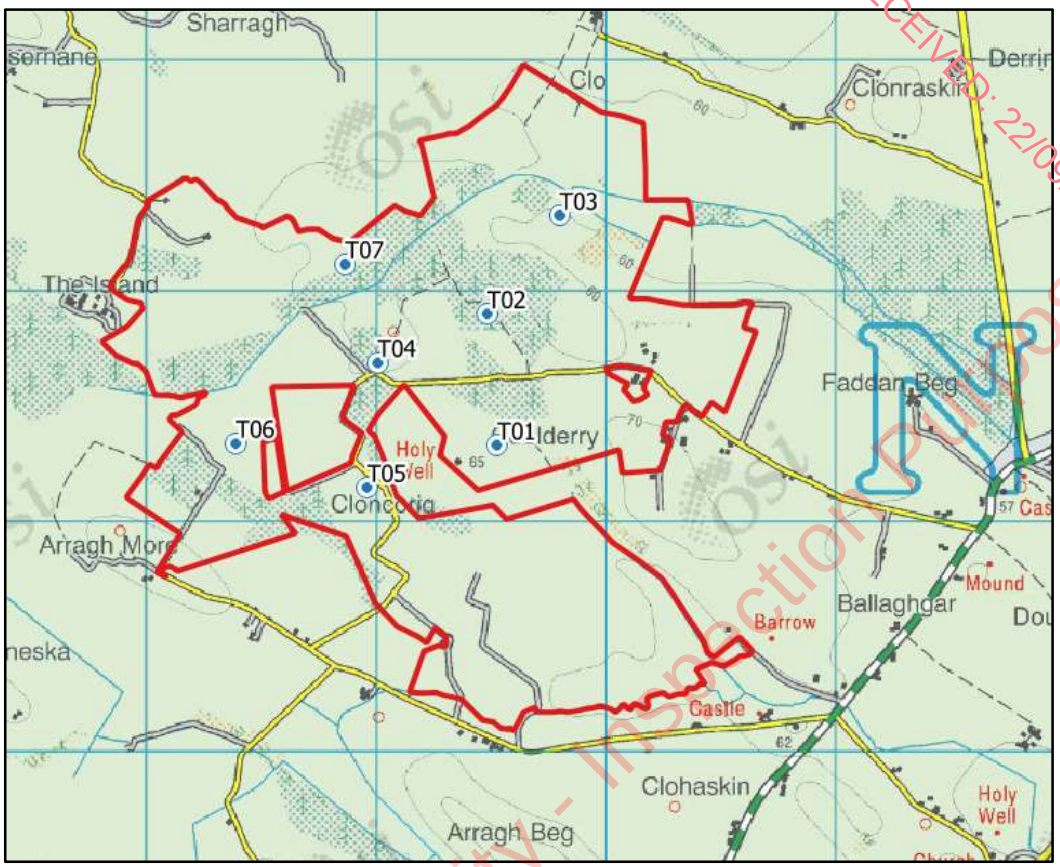


*Figure 3-5 Proposed Layout Iteration No. 4*

Iteration No. 4 as presented in Figure 3-5. The fourth iteration of the turbine layout saw the removal of turbines from the northern portion of the site boundary due to the results of continued dialogue with landowners and the biodiversity constraints which had previously been identified as part of the ecological/ornithological survey work. Another reason for the removal of the northern turbines was to create a single coherent cluster of turbines in the southern portion of the site, following the landscape and visual appraisal of the third iteration.

The fourth iteration of the turbine saw the turbine infrastructure located solely in the southern half of the site layout - and therefore the removal of any infrastructure from the townland of Sharragh in the northern portion resulting in the change of the project name to Carrig Wind Farm Development.

### 3.2.6.2.5 *Proposed Layout Iteration no.5*

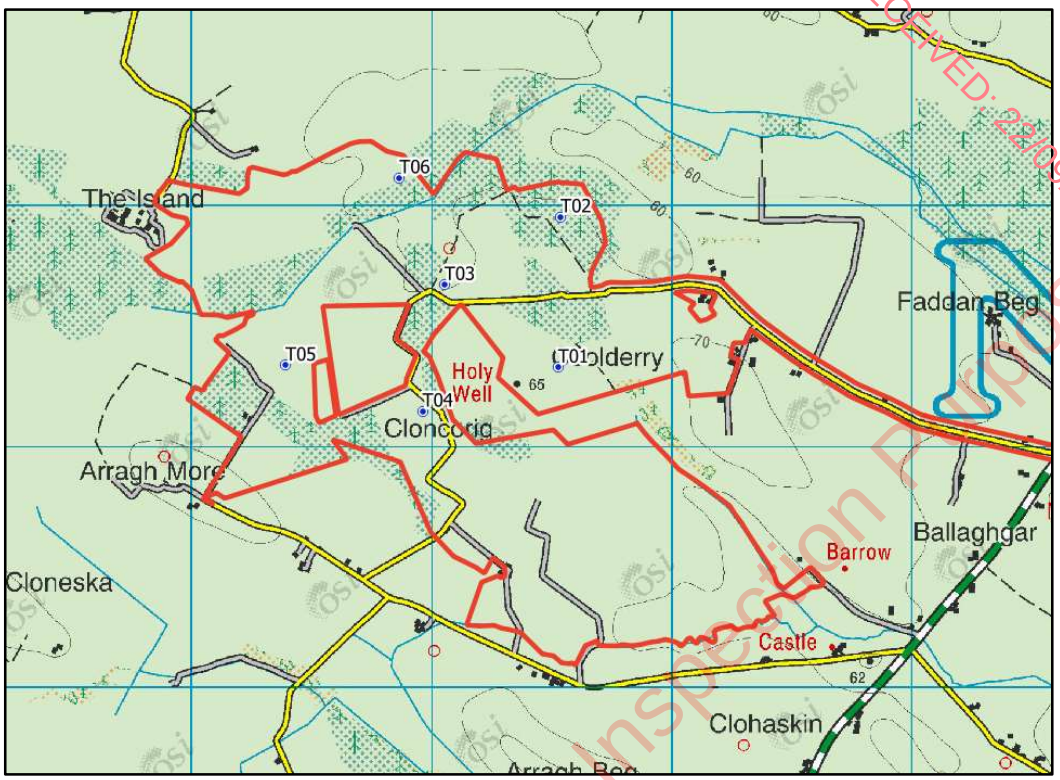


*Figure 3-6 Proposed Layout Iteration no. 5*

Iteration no.5 is shown in Figure 3-6 above. The fifth turbine layout was considered optimal as the preceding turbine layouts had the potential for greater environmental effects. Detailed and rigorous site investigations, surveys and modelling continued but any further refinement of the layout at this stage was expected to be minimal. This turbine layout sees the removal of one turbine (T03) from the previous iteration layout as a result of continued dialogue with landowners. This layout also included a potential grid connection route to Dallow into the site boundary.

### 3.2.6.2.6 Final Iteration of the Proposed Layout

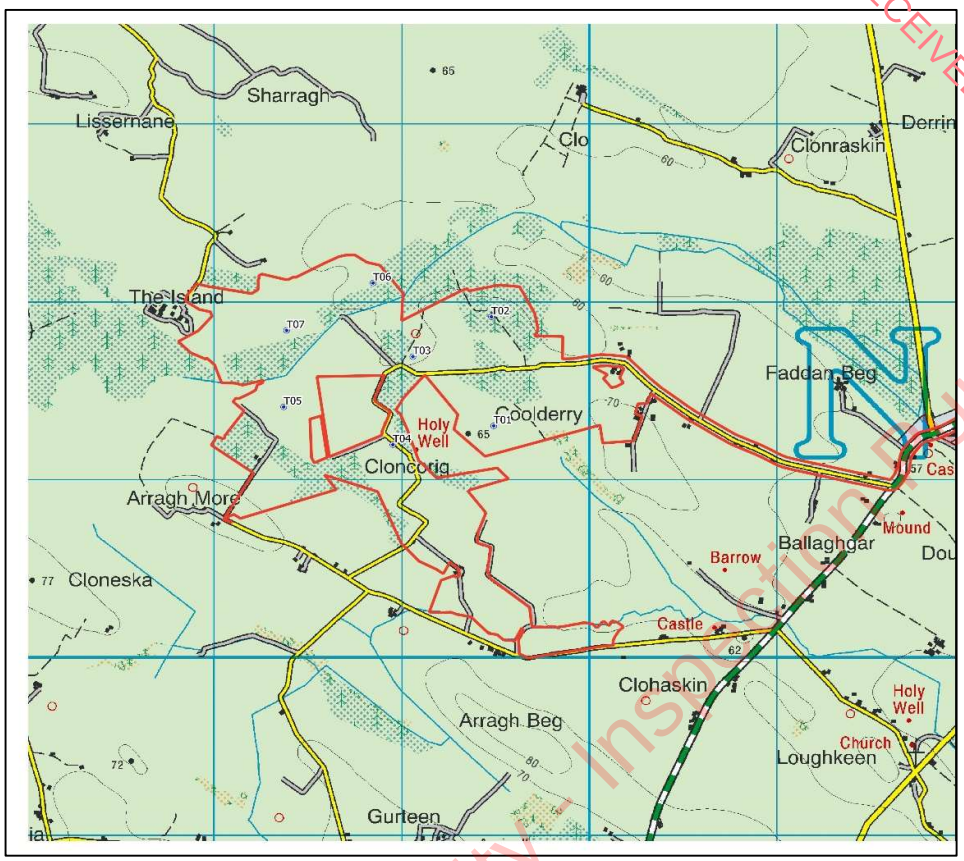


*Figure 3-7 Final iteration of the Proposed Layout*

The final Iteration of the layout, shown in Figure 3-7 above, involves the addtion of a seventh turbine to the project. Additional lands were made available to the project following continued negotiations with a landowner in the area. Ecological surveys, ground investigations and modelling continued following the addittion of the seventh turbine to ensure there was the least impact on the local environment as possible whilst ensuring optimum placement of turbines in the available lands in order to obtain maximum energy output. The final proposed turbine layout as presented in Figure 3-7 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 7. 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<br><br>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.<br><br>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.<br><br>As detailed in Chapter 7, the Collision Risk Assessment (CRA) indicated that the impact of the Proposed Development on birds corresponds to a **Low-Very Low** effect significance. |
| Land, Soils & Geology | Neutral | Smaller footprint would result in smaller volume of soils to be excavated and managed.<br><br>As detailed in the assessment in Chapter 8, no significant effects on soils and subsoils will occur. |
| Water | Larger footprint would result in a greater potential for silt-laden runoff to enter natural watercourses within and around the site. | Smaller footprint would result in a reduced potential for silt-laden runoff to enter natural watercourses.<br><br>As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur. |
| Air | Neutral | Neutral |
| Climate | A larger number of turbines could result in a greater amount of exhaust emissions from construction vehicles and plant and the transport of materials and workers to/from the site. | As detailed in the assessment in Chapter 11, over the proposed 35 year lifetime of the Proposed Development, 40,512 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation. |
| 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 |

| Environmental Consideration | Initial Turbine Layouts and all associated infrastructure | Chosen Option of the final 7. No Turbine Layout and all associated infrastructure |
|---|---|---|
| | | 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 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 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 Proposed Development 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 Proposed Development. 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 Proposed Development.

An alternative option to making maximum use of the existing road network within the Proposed Development 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 Proposed Development 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 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 Source of Crushed Stone for Construction

In order to facilitate the construction of the Proposed Development, all of the crushed stone, hardcore materials and ready-mix concrete that will be required during the construction phase will be sourced from local, appropriately authorised quarries. For the purposes of assessment within the EIAR, 1 no. quarry and ready-mix concrete batching plant (RMC) within 10km of the Proposed Development has been selected and is shown in Figure 4-23. The transport routes for general construction materials for the purposes of this assessment, is as per the access routes considered for the turbine plant traffic.

Deliveries of stone and ready-mix concrete for use in construction of the Proposed Development, are discussed in further detail in Chapter 15 of this EIAR. Site investigation works were carried out at the Proposed Development to determine if it would be feasible to extract rock from an onsite borrow pit 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 there was little to no potential to develop an onsite borrow pit.

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 Quarry)*

| 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.<br><br>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.<br><br>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.<br><br>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 increased extent 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. |

| Environmental Consideration | Obtaining all stone from onsite borrow pits | Chosen Option of obtaining all stone material offsite (Delivery of Materials from Nearby Quarries) |
|---|---|---|
| Land, Soils & Geology | Potential for increased impact on lands, soils and geology due to excavation of material at onsite borrow pits. | No borrow pit exaction therefore no potential for additional impacts on land, soils and geology due to the extraction activities. As detailed in the assessment in Chapter 8, no significant effects on bedrock, peat 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 project drainage design. As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur. |
| Air Quality | Potential for less vehicular exhaust emissions and dust emissions if all stone was sourced onsite compared to delivery of stone to the site. | Potential for increased vehicular exhaust emissions and dust emissions, along the construction haul route, due to increased traffic associated with delivery of material.<br><br>Potential for reduced dust emissions due to the absence of onsite excavation of borrow pits. |
| Climate | Potential for less vehicular exhaust emissions if all stone was sourced onsite compared to delivery of stone to the site | As detailed in the assessment in Chapter 11, no significant effects on climate will occur. Over the proposed 35-year lifetime of the Proposed Development, 40,512 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.<br><br>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.<br><br>Potential during construction phase of increased noise and vibration impacts on nearby sensitive receptors due to increased traffic movements.<br><br>Based on the assessment detailed in Chapter 12 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise |

| Environmental Consideration | Obtaining all stone from onsite borrow pits | Chosen Option of obtaining all stone material offsite (Delivery of Materials from Nearby Quarries) |
|---|---|---|
| | | levels from the Proposed Development, during the construction phase. |
| Cultural Heritage & Archaeology | Larger development footprint, therefore increasing potential for impacts on sub-surface archaeology | No borrow pit exaction onsite, therefore no potential for additional potential impacts on sub surface archaeology. As detailed in the assessment in Chapter 13, the significance of direct effects will be slight - significant and no significant effects will occur. There will be no significant direct or indirect impacts on Cultural Heritage. |
| Landscape & Visual | Neutral (as onsite borrow pits would be reinstated following use) | Neutral |
| Material Assets | Less potential for impact on public road network and users compared to delivery all stone to site which would give rise 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 15, 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

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) and the Draft Wind Energy Guidelines (DoHPLG, 2019) also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid.

The Megawatt (MW) output of the Proposed Development is such that it can connect to either 38kV substation or a 110kV substation using a step-up transformer. The substations that were considered for connecting the Proposed Development to the national grid were:

- Birr 38kV Electricity Substation
- Derrycarney 110kV Electricity Substation
- Dallow 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.

Grid Connection Route Option A, as presented in Figure 3-8, is an underground grid connection cabling route, connecting the proposed onsite electricity substation to the existing Birr 38kV substation. The Birr substation is located approximately 8.4km northeast of the proposed onsite substation. The grid connection cabling route runs entirely along a combination of local, regional and national secondary roads. The cabling route measures approximately 10.1km in length.
Grid Connection Route Option B, as presented in Figure 3-9, is an underground grid connection cabling route, connecting the proposed onsite electricity substation to the existing Derrycarney 110kV substation. The Derrycarney substation is located approximately 22.7km northeast of the proposed onsite substation. The grid connection cabling route runs entirely along a combination of local and regional roads. The cabling route measures approximately 29.5km in length.

Grid Connection Route Option C, as presented in Figure 3-10, is an underground grid connection cabling route, connecting the proposed onsite electricity substation to the existing Dallow 110kV substation. The Dallow substation is located approximately 10.4km northeast of the proposed onsite substation. The grid connection cabling route runs almost entirely, off-road, through agricultural land. The cabling route measures approximately 13.4km in length.

Grid Connection Route Option D, as presented in Figure 3-11, is an underground grid connection cabling route, also connecting the proposed onsite electricity substation to the existing Dallow 110kV substation. The grid connection cabling route runs entirely along a combination of local, regional and national secondary roads. This cabling route option also measures approximately 13.4km in length.

Grid Connection Route Option E, as presented in Figure 3-12, is an underground grid connection cabling route which connects the proposed onsite electricity substation to the existing Dallow 110kV substation. The grid connection cabling route runs entirely along a combination of local, regional and national secondary roads. This cabling route option differs to Option D in that it avoids the narrowest section of the N52 by proposing to locate the grid cable in the L9520 and L1071 local roads before rejoining the N52 in the townland of Ballyloughnane. Grid Connection Route Option E measures 13.7km in length.

Option A is located entirely within the public road corridor and is the shortest of the four options considered, however, the Birr 38kV substation does not currently have the connection capacity, nor it is likely to have in the future, that would allow the Proposed Development to export its maximum electricity output to the national grid. It was therefore not the chosen option for connection to the national grid.

Option B is the longest of the four options considered and, as it is located entirely within the public road corridor for its entire length, this option would have the greatest potential for significant impacts on road users. This option would also cause potential environmental nuisances (noise, dust etc.) for the greatest number of residential receptors. Finally, as a consequence of its length and the requirement for directional drilling at 8no. watercourse crossing locations, the construction costs associated with this option would be far greater than Options A, D or E. Therefore, Option B was not the chosen option for connection to the national grid.

Option C is the only option of the four options considered that is not located within the public road corridor. It runs almost exclusively through agricultural land. Given that this is an off-road route, it would have the least potential for direct impacts on road users. However, it would require the construction of access tracks along the majority of its 13.4km length, including the construction of three new watercourse crossings. Therefore, this option would give rise to a much larger development footprint and, thus, the greatest potential for environmental impacts. In addition, this route passes through 31 no. individual landholdings along its length. Achieving option agreements with each of these individual landowners would be extremely costly and time consuming. Taking all of this into consideration, Option C was not the chosen option for connection to the national grid.

Option D and Option E are located within the public road corridor for their entire length. These options are longer than Option A but significantly shorter than Option C. Owing to the existing

connection capacity at Dallow substation compared to Birr substation, both Option D and Option E were preferred over Option A.

Given that Option D and Option E are far shorter route than Option B, they would have less of an impact on road users and residential receptors and the construction costs would also be significantly less. Therefore, Option D and Option E were preferred over Option B.

In contrast to Option C, Option D and Option E are located entirely within an existing infrastructure corridor and do not require the construction of any new access tracks or watercourse crossings. Because of this, its potential to give rise to environmental impacts would be significantly less. In addition, it would not require any landowner agreements and therefore bringing either Option D or Option E forward as the preferred option for connection to the national grid would be far less costly or time consuming.

Finally, during a meeting, held on the 4th of September 2023, engineers from Tipperary County Council's Roads and Transport Directorate expressed concerns regarding the laying of grid connection cables within the national road network. These concerns echoed those of Transport Infrastructure Ireland (TII) (refer to Section 2.6 of Chapter 2 of this EIAR). In order to address these concerns, efforts were made to minimise the length of the cable located within the road carriageway along the N52. The cable has been located within grass verges, hard shoulders or along footpaths, where possible. Option E was preferred over Option D as it further reduced the length of grid connection cabling on the N52 carriageway by utilising the L9520 and L1071 local roads, thereby avoiding the narrowest section of the N52 between the N52/L5041 junction and the N52/R489 junction.

Based on the environmental and land availability considerations outlined above and concerns raised by the Roads and Transport Directorate of Tipperary County Council and TII, Grid Connection Option E was the most favoured option of those considered.

A comparison of the potential environmental effects of Options A, B, C and D when compared against the chosen option (Option E) is presented in Table 3.6 below.

**Map Legend**

- Wind Farm Site
- Grid Connection Route Option A to Birr 38kV Substation
- Birr 38kV Substation





Drawing Title

Grid Conneciton Option A - Birr 38kV Substation

Project Title

Carrig Renewables Wind Farm Development

| Drawn By | Checked By |
|---|---|
| JF | EM |
| **Project No.** | **Drawing No.** |
| 211016 | Fig. 3-8 |
| **Scale** | **Date** |
| 1:40,000 | 2023-09-20 |

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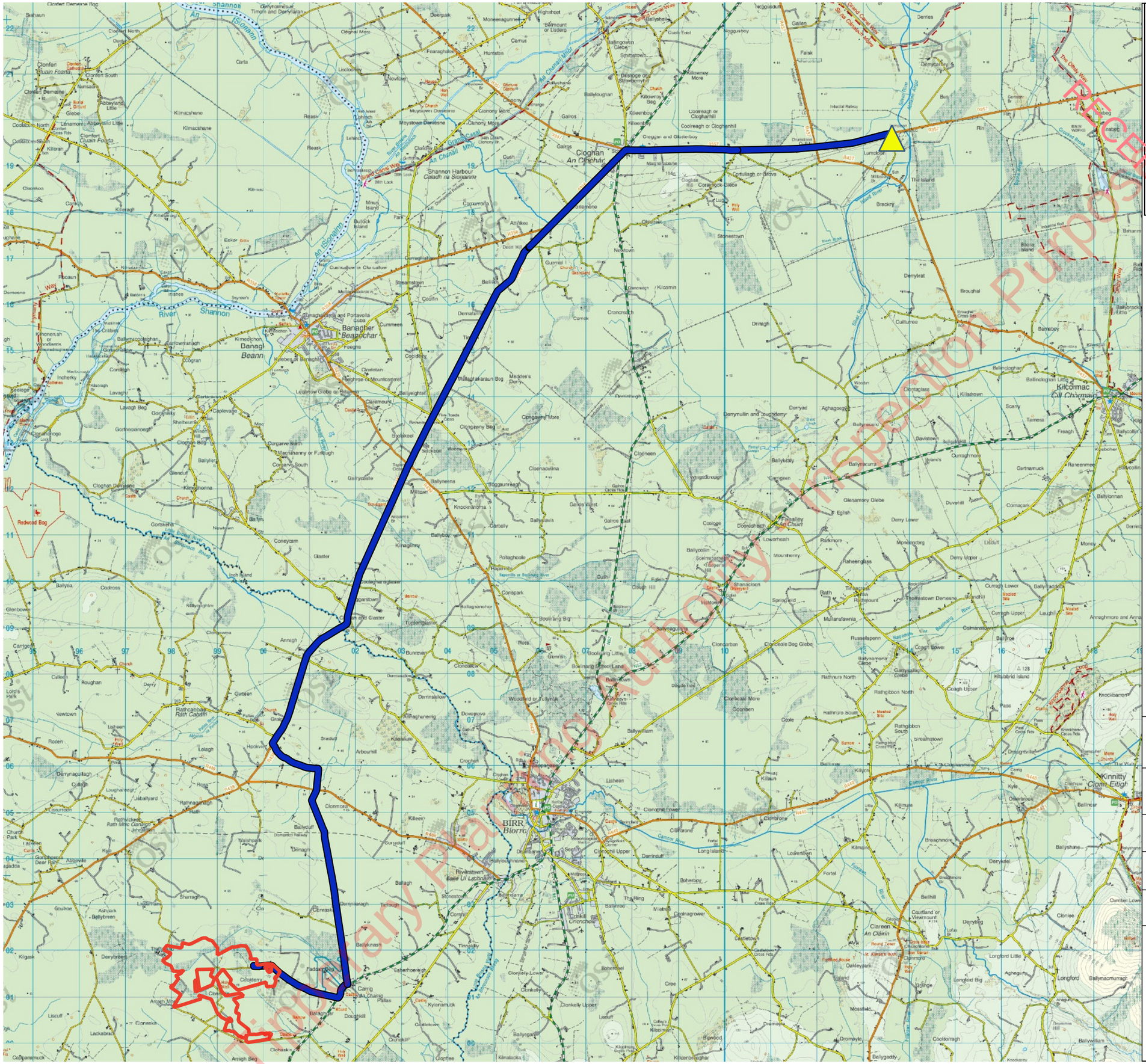


**Map Legend**

- Wind Farm Site
- Grid Conneciton Route Option B to Derrycarney 110kV Substation
- Derrycarney 110kV Substation





Drawing Title

Grid Conneciton Route Option B - Derrycarney 110kV

Project Title

Carrig Renewables Wind Farm Development

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| JF | EM |
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| 211016 | Fig. 3-9 |
| Scale | Date |
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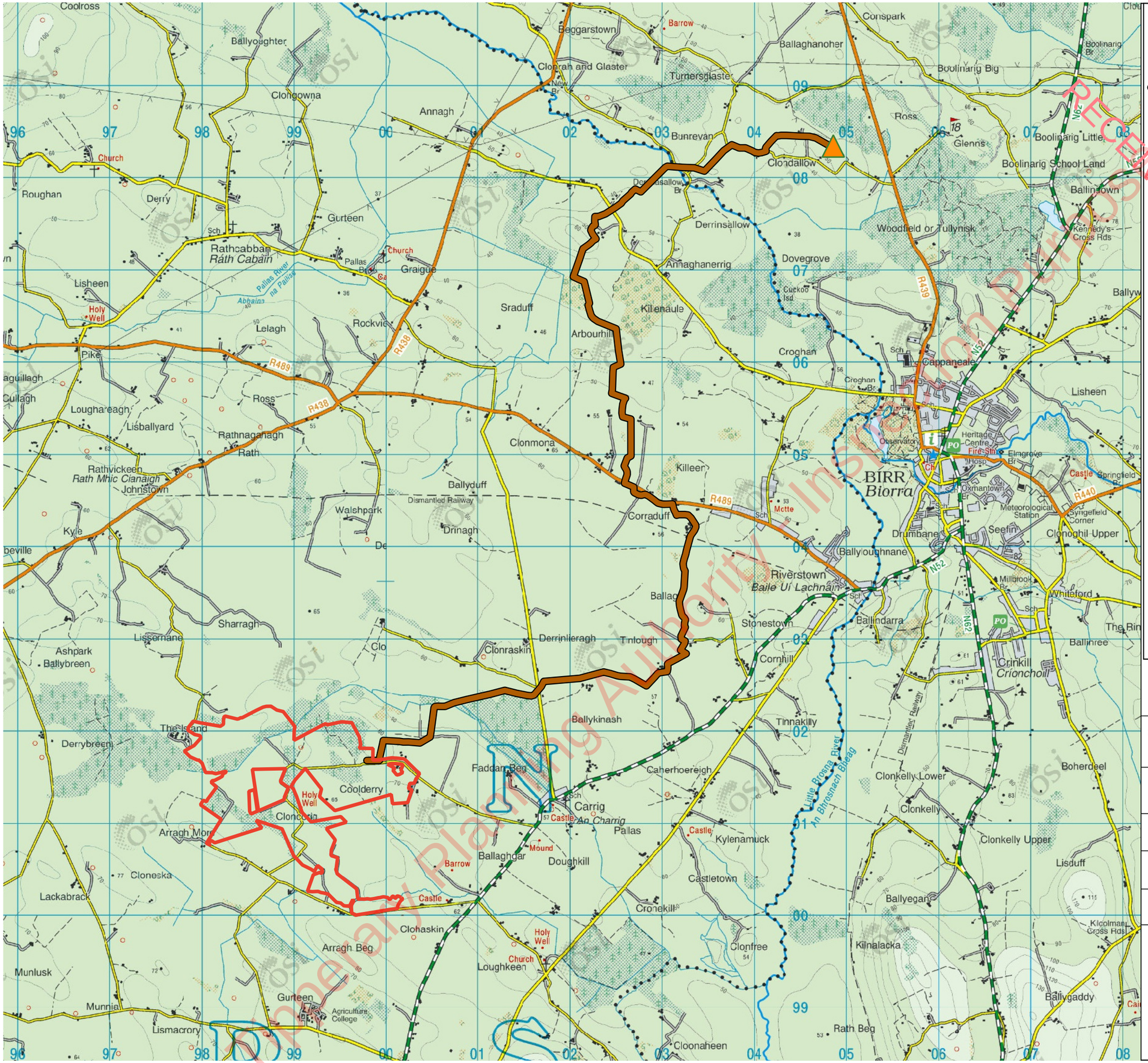


**Map Legend**

- Wind Farm Site
- Grid Connection Route Option C to Dallow 110kV Substation
- Dallow 110kV Substation



N



Drawing Title

Grid Connection Route Option C to Dallow 110kV Substation

Project Title

Carrig Renewables Wind Farm Development

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**Map Legend**

- Wind Farm Site
- Grid Connection Route Option D to Dallow 110kV Substation
- Dallow 110kV Substation





Drawing Title

Grid Connection Route Option D to Dallow 110kV

Project Title

Carrig Renewables Wind Farm Development

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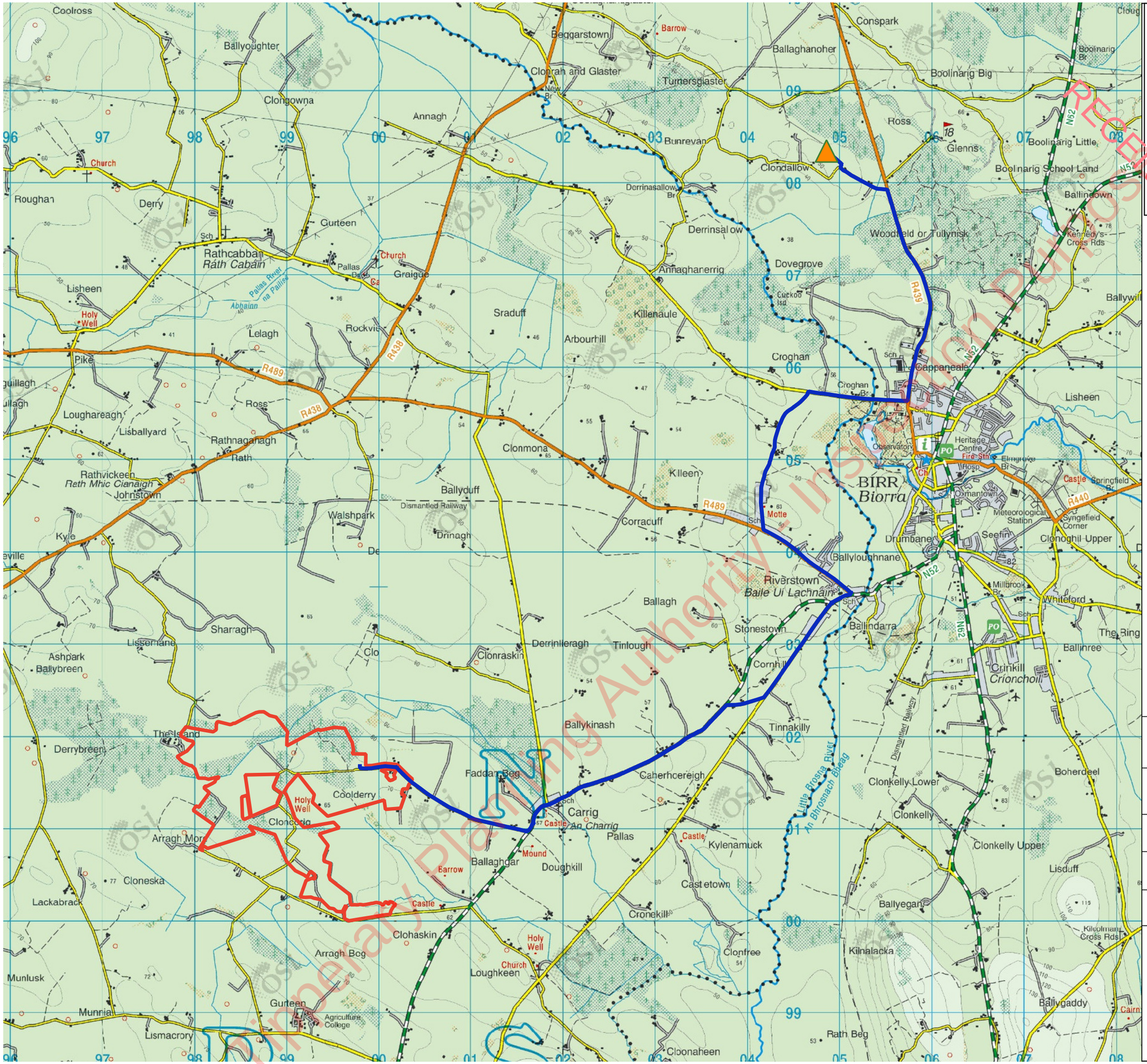




**Map Legend**

- Wind Farm Site
- Grid Connection Option E to Dallow 110kV Substation
- Dallow 110kV Substation



Drawing Title

Grid Conneciton Route Option E - Dallow 110kV

Project Title

Carrig Renewables Wind Farm Development

| Drawn By | Checked By |
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| JF | EM |
| **Project No.** | **Drawing No.** |
| 211016 | Fig. 3-12 |
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*Table 3-6 Comparison of environmental effects when compared against the chosen option (Option E – Dallow 110kV substation)*

| Environmental Consideration | Option A – Birr 38k V Substation | Option B – Derrycarney 110kV Substation | Option C – Dallow 110kV Substation | Option D – Dallow 110kV Substation |
|---|---|---|---|---|
| Population & Human Health | Neutral - Option A is in the public road network. There is no material environmental effect difference between both options considered. | Neutral - Option B is in the public road network. There is no material environmental effect difference between both options considered | Neutral - Option C is off the public road network. There is no material environmental effect difference between both options considered | Neutral - Option D is in the public road network. There is no material environmental effect difference between both options considered |
| Biodiversity (including Birds) | Potential for less impacts on sensitive ecological receptors as there is no designated sites along the grid cable route and less watercourses to cross than Option E. | Potential for greater impacts on sensitive ecological receptors as there is a greater cable route, a greater number of watercourse crossings and it passes through a greater number of designated sites, such as River Little Brosna Callows SPA and All Saints Bog SPA, than Option E. | Potential for greater impact on sensitive ecological receptors during the construction phase as Option C is located within River Little Brosna Callows SPA and All Saints Bog and Esker SAC, River Little Brosna Callows NHA, Kileen Bog NHA. Option C would involve the excavation of agricultural fields and habitats due to its off-road nature. | Potential for less impacts on sensitive ecological receptors as there is no designated sites along the grid cable route and less watercourses to cross than Option E. |

| Environmental Consideration | Option A – Birr 38kV Substation | Option B – Derrycarney 110kV Substation | Option C – Dallow 110kV Substation | Option D – Dallow 110kV Substation |
|---|---|---|---|---|
| Land, Soils & Geology | Neutral - There is no material environmental effect difference between both options considered. | Neutral - There is no material environmental effect difference between both options considered. | Option C would involve the excavation of the land and soil due to its off-road nature and therefore would have a greater impact than Option E. | Neutral - There is no material environmental effect difference between both options considered. |
| Water | Option A has 3 no. EPA mapped watercourse crossings and therefore less potential for impacts on water quality. | Option B has 11 no. EPA mapped Watercourse crossings and therefore greater potential for impacts on water quality. | Option C has 2 no. EPA mapped Watercourse crossings and therefore less potential for impacts on water quality. | Option D has 4 no. EPA mapped Watercourse crossings and 2 no. non-EPA mapped watercourse crossings and therefore less potential for impacts on water quality.<br><br>As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur. |
| Air | Given the maximum potential length of Option A is 10.1km and is approx. 3.6km shorter than Option E, there is potential for less dust emissions and vehicle emissions impacts associated with Option A when | Given the maximum potential length of Option B is 29.4km and is approx. 15.7km longer than that of Option E there is the potential for more dust emissions and vehicle emissions impacts associated with Option B when | Given the maximum potential length of Option C is 13.4km which is 0.3km shorter than Option E, there is less potential impact on dust emissions and vehicle emissions impacts associated with Option C.<br><br>. | Given the maximum potential length of Option D is 13.4km which is 0.3km shorter than Option E, there is less potential impact on dust emissions and vehicle emissions impacts associated with Option D.<br><br>. |

| Environmental Consideration | Option A – Birr 38kV Substation | Option B – Derrycarney 110kV Substation | Option C – Dallow 110kV Substation | Option D – Dallow 110kV Substation |
|---|---|---|---|---|
| | compared to the chosen Option E. | compared to the chosen Option E. | | |
| Climate | Given the maximum potential length of Option A is 10.1km and is approx. 3.6km shorter than Option E, there is potential for less dust emissions and vehicle emissions impacts associated with Option A when compared to the chosen Option E. | Given the maximum potential length of Option B is 29.4km and is approx. 15.7km longer than that of Option E there is the potential for more dust emissions and vehicle emissions impacts associated with Option B when compared to the chosen Option E. | Given the maximum potential length of Option C is 13.4km which is 0.3km shorter than Option E, there is less potential impact on dust emissions and vehicle emissions impacts associated with Option C. | Given the maximum potential length of Option D is 13.4km which is 0.3km shorter than Option E, there is less potential impact on dust emissions and vehicle emissions impacts associated with Option D. |
| Noise & Vibration | Given the maximum potential length of Option A is 10.1km and is approx. 3.6km shorter than Option E, there is potential for less noise impacts associated with Option A when compared to the chosen Option E. | Potential for greater noise impacts on nearby sensitive receptors during the construction phase. Given the maximum potential length of Option B is 15.7km longer than that of Option E there is the potential for less | Given the maximum potential length of Option C is 13.4km which is 0.3km shorter than Option E, there is less potential impact on noise impacts associated with Option C. | Given the maximum potential length of Option D is 13.4km which is 0.3km shorter than Option E, there is less potential impact on noise impacts associated with Option D. |

| Environmental Consideration | Option A – Birr 38kV Substation | Option B – Derrycarney 110kV Substation | Option C – Dallow 110kV Substation | Option D – Dallow 110kV Substation |
|---|---|---|---|---|
| | | noise impacts associated with Option B when compared to Option E. | | |
| Landscape & Visual | Neutral - There is no material landscape and visual effect differences between both options considered. | Neutral - There is no material landscape and visual effect differences between both options considered. | Neutral - There is no material landscape and visual effect differences between both options considered. | Neutral - There is no material landscape and visual effect differences between both options considered. |
| Cultural Heritage & Archaeology | Neutral | Neutral | Neutral | Neutral |
| Material Assets | Potential for less traffic volumes during construction phase due to Option A being 3.6km shorter when compared to Option E. | Potential for increased traffic volumes during construction phase of Option B given the greater length of cable when compared to Option E. | Potential for less traffic volumes during construction phase due to Option C being located off the public road network when compared to Option E. | Potential for less traffic volumes during construction phase due to Option D being 0.3km shorter when compared to Option E. |

### 3.2.9 Alternative Turbine Delivery 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 Proposed Development. With regard to the selection of a transport route to the Proposed Development, alternatives were considered in relation to turbine components, general construction-related traffic.

#### 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 Shannon Foynes due to its proximity from the port to the M7 motorway, in which the exit to the national and regional roads towards the Proposed Development is accessible.

#### 3.2.9.2 Turbine Delivery Route Option A

Turbine Delivery Option A involved the delivery of turbine components from Shannon Foynes Port in Co. Limerick to the Proposed Development site. The route involved the National road network (N69, N18, N52) the motorway network (M7) and the local road network (L5040). Option A involved the turbine delivery vehicle exiting the M7 at Junction 26 Nenagh and traveling northwards towards to the site. This option was screened out due to a vehicle turning constraint at the crossroads of N52 - N65 - L1092 in Borrisokane that was identified in an autotrack assessment. This constraint rendered Option A unviable.

#### 3.2.9.3 Turbine Delivery Option B

Turbine Delivery Option B, the chosen option for the Proposed Development, involves the delivery of turbine components from Shannon Foynes Port to the Proposed Development site, utilising the Motorway network (M7), National Road network (N52, N62, N18), the Regional road network (R435, R445) and the local road network. Option B involves the vehicle exiting the M7 at Junction 21 Borris in Ossory and proceeding along the described route (see Section 3.2.9.4 below) to the Proposed Development site. Option B was chosen due to a lesser number of pinchpoints, compared to Option A, along the delivery route that was identified by an autotrack assessment.

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.

Option B has been proven suitable for the transport of turbine components, and the transport analysis (as presented in Section 15.1 of this EIAR), shows that only minor accommodation works will be required to accommodate the proposed turbines.

All construction traffic will use designated haul routes only, as agreed with the local authority. 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.

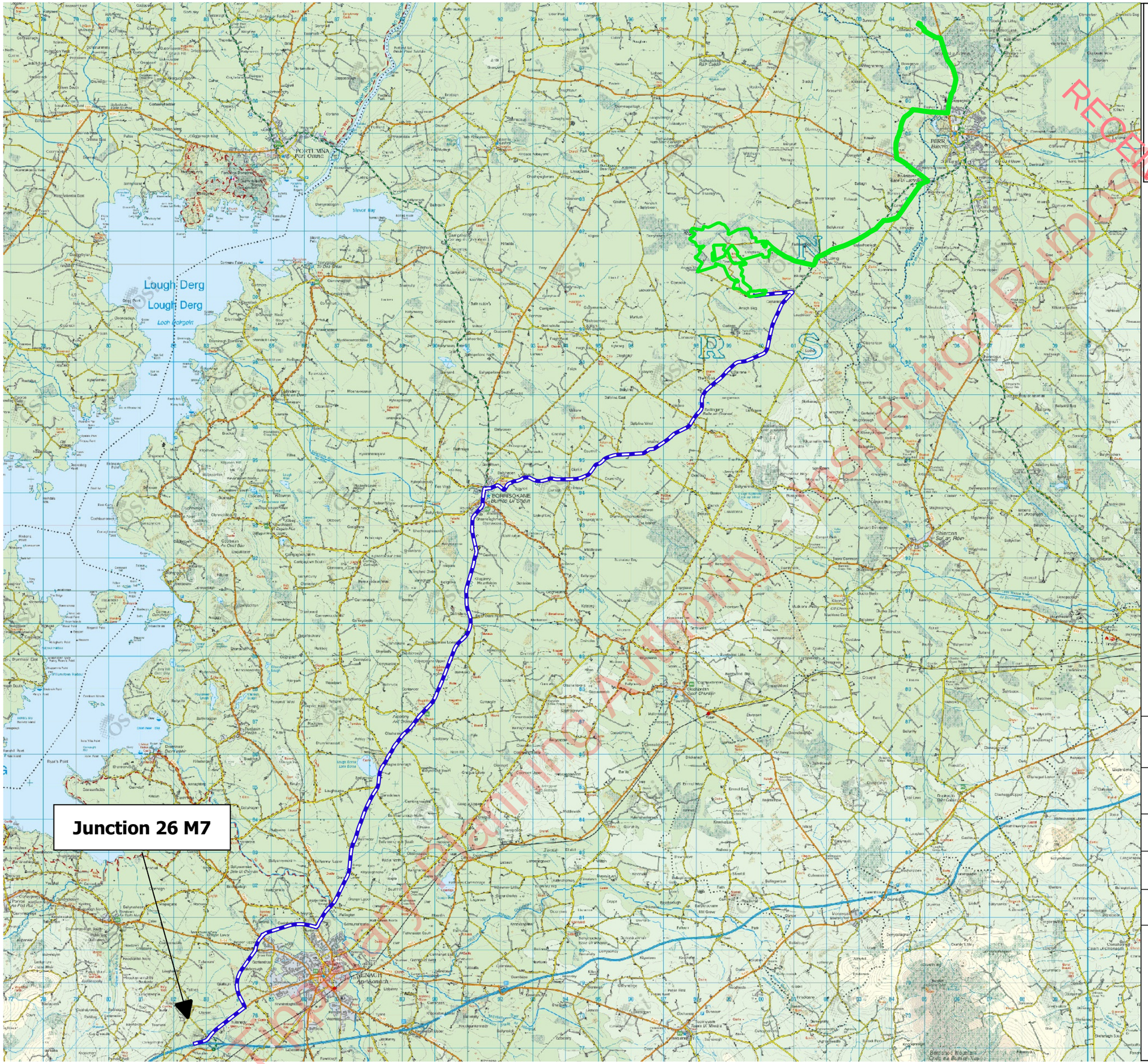
The delivery of turbine components including blades, tower sections and nacelles is a specialist operation owing to the oversized loads involved. As detailed in Section 15.1 of this EIAR, turbines blades will be delivered to site using a Super Wing Carrier. When considering turbines transport routes, alternative modes of transport were also considered. 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 Proposed Development.



*Table 3-7 - Comparison of environmental effects when compared against the chosen option (Option B)*

| Environmental Consideration | Option A |
|---|---|
| Population and Human Health | Greater potential for impacts on human health as more accommodation works would be required along the route, giving rise to more vehicular emissions, dust emissions, noise and traffic disruption. |
| Biodiversity (including Birds) | Neutral |
| Land, Soils and Geology | Neutral |
| Water | Neutral |
| Air Quality | Greater potential for impacts on air quality as more accommodation works would be required along the route giving rise to more vehicular and dust emissions. |
| Climate | Greater potential for impacts on climate as more accommodation works would be required along the route giving rise to more vehicular emissions. |
| Noise and Vibration | Greater potential for impacts in relation noise and vibration as more accommodation works would be required along the route giving rise to more noise emissions and potential vibration. |
| Landscape and Visual | Neutral |
| Cultural Heritage | Greater potential for impacts on unrecorded, sub-surface archaeology due to more accommodation works being required, and therefore excavations, along this route. |
| Material Assets | Greater potential for impacts in relation to traffic as more accommodation works required which could give rise to traffic disruption. |




**Map Legend**

- EIAR Site Boundary
- Turbine Delivery Option A



Drawing Title: Turbine Delivery Option A

Project Title: Carrig Renewables Wind Farm

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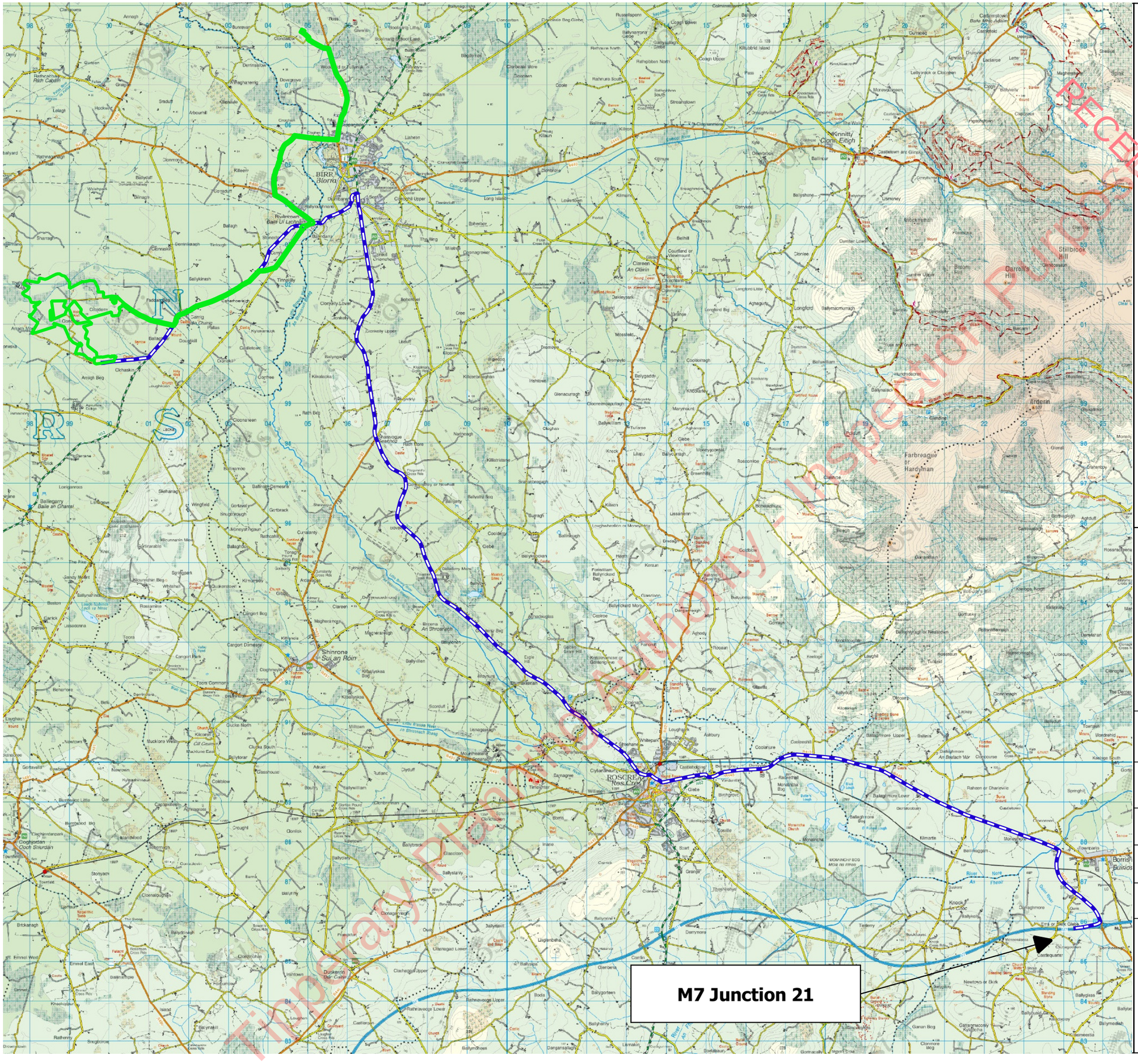


**Map Legend**

- EIAR Site Boundary
- Turbine Delivery Option B



Drawing Title

Turbine Delivery Option B

Project Title

Carrig Renewables Wind Farm Development

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|---|---|
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### 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 Proposed Development. Any forestry felled due to the construction of the Proposed Development 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.