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30 YEARS

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED CROAGHAUN WIND FARM, CO. CARLOW

VOLUME 2 – MAIN EIAR

CHAPTER 2 – SITE SELECTION AND ALTERNATIVES

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2. SITE SELECTION AND ALTERNATIVES

2.1 Introduction

The following chapter sets out the need for the development with respect to climate change, national policy and national renewable energy targets. Following the establishment of the need for the development, the chapter details the reasonable alternatives 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 comparisons of the environmental effects. It describes the site screening process, alternative design philosophies considered, alternative site layouts, the do-nothing alternative and alternative processes, amongst other things.

2.2 Need for the Development

The proposed development of the Croaghaun Wind Farm is necessary to produce renewable energy for the Irish national grid in order to transition Ireland to a low carbon economy. The proposed wind farm has an estimated capacity of up to approximately 38.5MW. The project will play a significant role in providing renewable electricity in the Republic of Ireland, accounting for approximately 1% of the current installed wind energy capacity (IWEA, 2020).

At a strategic level, the need for the Project is supported by International, European, and National environmental and energy commitments and policies. In Chapter 4 of this EIAR, a detailed analysis of these commitments and policies are outlined. The Irish Government published the Climate Action Plan in June 2019 (DoCCAE, 2019) which sets actions to ensure Ireland's 2030 renewable energy targets can be achieved. This is in the context of substantial and continuing failure by Ireland in meeting climate targets to date, specifically in relation to the 2020 end of year renewable energy targets. According to the latest figures provided by the Sustainable Energy Authority of Ireland, the nation will not meet its 2020 renewable energy targets (SEAI, 2020). Furthermore, according to a 2019 report by Climate Action Network Europe (CAN), Ireland is:

> *"Way off track with its greenhouse gas emission reductions in sectors such as transport, buildings, waste and agriculture (non-ETS) both for 2020 and 2030"*

The Climate Action Plan (2019) recognises that Ireland must make a significant increase in the current levels of renewable energy production in the country. A press release accompanying the Climate Action Plan (CAP), titled 'Giving Ireland a Sustainable Future' (DoCCAE, 2019a) states that:

> *"We should be radically reducing our reliance on carbon; Ireland's greenhouse gas emissions have been rising rapidly. We are currently 85% dependent on fossil fuels. We have a short window of opportunity to reverse this trend and secure a better, healthier, more resilient future for the country…This plan identifies how Ireland will achieve its 2030 targets for carbon emissions and puts us on a trajectory to achieve net zero carbon emissions by 2050."*

2.2.1 Climate Change

The scientific community and governments across the world are in agreement that the global climate is changing.

This is due to human activities which have significantly contributed to natural climate change through our emissions of greenhouse gases. This interference is resulting in increased air and ocean temperatures, drought, melting ice and snow, rising sea levels, increased rainfall, flooding and other influences (EPA, 2020).

The current Taoiseach Michéal Martin on the launch of the Climate Action Bill (2020) remarked that:

> *"The impact of our actions on the planet is undeniable. The science is undisputed. Climate change is happening. And we must act." (Government of Ireland, 2020)*

In this regard, the Government of Ireland enacted the Climate Action Plan (CAP) in June 2019 and more recently, the Climate Action and Low Carbon Development (Amendment) Bill (2020). The CAP sets out actions to cut emissions and make Ireland a zero-carbon economy by 2050. The Climate Action and Low Carbon Development Bill (2020) will drive implementation of a suite of policies to help Ireland to achieve a 7% average yearly reduction in overall greenhouse gas emissions over the next decade.

It is estimated that the capacity of approximately 38.5MW of electricity from the proposed Croaghaun Wind Farm will result in the displacement of approximately 53,118 tonnes of CO_2 per annum, as detailed in Chapter 6: Air and Climate.

This is in line with the targets of the CAP which:

> "identifies how Ireland will achieve its 2030 targets for carbon emissions, and puts us on a trajectory to achieve net zero carbon emissions by 2050" (DoCCAE, 2019a)

Greenhouse gases and other emissions from fossil fuels give rise to global warming, acid rain and air pollution. Fossil fuels still dominate Ireland's electricity production. The proposed Croaghaun Wind Farm will provide renewable energy to the national grid with minimal impact on the environment, offsetting the need for burning of fossil fuels. This is necessary to meet the challenges of future climate change.

The Department of Communications, Climate Action and Environment stated that:

> "climate disruption is already having diverse and wide-ranging impacts on Ireland's environment, society, economic and natural resources. The Climate Action Plan clearly identifies the nature and scale of the challenge." (DoCCAE, 2019)

The proposed Croaghaun Wind Farm will assist in mitigating the effects of climate breakdown and will support and maintain onshore wind capacity. The CAP seeks a total installation of 8.2 GW of onshore wind capacity by 2030. The Croaghaun Wind Farm has the potential to contribute to approximately 0.5% of this 2030 target.

2.2.2 EU Renewable Energy Targets and National Policy

As further detailed in Chapter 4 of this EIAR, Ireland has adopted binding agreements to reduce dependency on fossil fuels and increase energy production from sustainable sources, creating a requirement for the nation to transition to a low carbon economy.

This is supported by the latest Programme for Government (2020) 'Our Shared Future' which presents strong climate governance in rapidly reducing climate change in order to protect and improve public health and quality of life. The government are committed to rapid decarbonisation of the energy sector with an aim of providing the necessary actions to deliver national renewable electricity targets.

The 2030 Climate and Energy Framework (European Commission, 2014) adopted by the EU sets out a framework for the long-term perspective beyond 2020 targets. The 2030 Climate and Energy Framework sets out three key targets for the year 2030:

- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share of renewable energy
- At least 32.5% improvement in energy efficiency.

Further to this the European Commission in 2016 published its 2030 emissions targets break down for each Member State. While the overall EU target is a reduction of 40% on 1990 greenhouse gas emissions by 2030, every Member State negotiates an individual target. Ireland will have to reduce its emissions by 30% relative to its 2005 emissions.

The 2050 "Roadmap for a competitive low-carbon Europe" (European Commission, 2011) suggests that by 2050, the EU should cut greenhouse gas emissions to 80% below 1990 levels. This would require 40% emissions cuts by 2030 and 60% by 2040. This is in line with EU leaders' commitment to reducing emissions by 80-95% by 2050. Ireland is likely to face equivalent mandatory targets from the EU.

Ireland has adapted these targets into the Climate Action Plan (2019) which includes a target to increase electricity generated from renewable sources to 70% by 2030. This will require more than doubling Ireland's production of electricity from renewable sources, which stood at 33.2% in 2018 (SEAI, 2020). The 2030 target sets out the pathway to the goal of net zero greenhouse gas emissions by 2050.

To achieve 70% renewable energy production by 2030, substantial new development will be required The CAP sets out targets as follows which rely heavily on wind energy technology:

- Reduce CO2 eq. emissions from the sector by 50–55% relative to 2030 NDP projections;
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation;
- Increase electricity generated from renewable sources to 70%, indicatively comprised of:
    - at least 3.5 GW of offshore renewable energy
    - up to 1.5 GW of grid-scale solar energy
    - up to 8.2 GW total of increased onshore wind capacity

The binding EU targets have been transposed into Irish National Policy in the 2019 Climate Action Plan which focuses a large amount of future electricity production on the wind energy sector.

This demonstrates the significance of wind energy in the Irish energy context and highlights the need for the proposed Croaghaun Wind Farm in reaching both EU and national renewable energy targets.

2.2.3 Energy Security

Ireland is one of the most energy import-dependent countries in the European Union, importing 67% of its fuel in 2018 at an estimated cost of €5 billion (SEAI, 2020a). The largest share of energy imports in 2018 was oil, accounted for 73% of total energy imports, natural gas 17%, coal 8.2% and renewables 1.4%.

Price volatility of fossil fuels may increase as carbon prices escalate in the future. The cost of carbon credits is included in all electricity trade, and the price of electricity generated by coal is particularly vulnerable due to the high carbon emissions per unit of electricity generated. Coal still generates a significant amount of Ireland's electricity with 7% of electricity produced by coal in 2018 (SEAI, 2020) down from 18.3% in 2017 (SEAI, 2018). However, the previous programme for government called for a review of options to replace coal with low carbon alternatives within a decade as reflected in the CAP (2019).

The Energy White Paper, Ireland's Transition to a Low Carbon Energy Future 2015-2030 (DoCENR, 2015) sets out a framework to guide policy and actions that the government intends to take in the energy sector. The paper notes that "There will be substantial increases in the cost of carbon in the short and medium term, through the EU Emissions Trading Scheme". The proposed Croaghaun Wind Farm aims to reduce dependence on imported fossil fuels and add to financial autonomy and energy stability in Ireland, further emphasising the need for the proposed development.

Furthermore, the EU have rewritten the energy policy framework in the Clean Energy for all Europeans Package (2019). Member states must meet new commitments to improve energy efficiency and the take-up of renewables in their energy mix by 2030. For example, the new rules on the electricity market, which have been adopted, will make it easier for renewable energy to be integrated into the grid, encourage more inter-connections and cross-border trade, and ensure that the market provides reliable signals for future investment. This EU policy framework encourages energy security for all EU member states, emphasising a need for renewable energy and a move away from fossil fuels.

2.2.4 Competitiveness of Wind Energy and Economic Benefits of the Croaghaun Wind Farm

In addition to helping Ireland avoid significant fines and reducing Ireland's environmentally damaging emissions, the Croaghaun Wind Farm will also contribute positively to the national and regional economy.

SEAI, in its report Renewable Energy in Ireland (SEAI, 2020), indicated that in 2018 wind energy:

- Generated 28% of all electricity;
- Avoided 3.1 million tonnes of CO^2 emissions.
- Displaced 1.3 million tonnes of fossil fuel use
- Avoided approximately €432 million in fossil fuel imports (SEAI, 2019);

Additionally, a report published by Barringa in January 2019 states that:

> *"Our analysis indicates that the deployment of 4.1 GW of wind generation capacity in Ireland between 2000 and 2020 will result in a total net cost to consumers, over 20 years, of €0.1bn (€63 million to be exact), which equates to a cost of less than €1 per person per year."* (Baringa, 2019).

Notwithstanding the above financial costs and benefits, the Barringa report outlines that wind generation in Ireland avoids:

> *"33 million tonnes of power sector CO2 emissions. The total carbon emissions from electricity generation in 2017 was 11.7 Mt, so a saving of 33 Mt is equivalent to almost 3 years of total carbon emissions in the electricity sector today. 137 TWh of fossil fuel consumption at a saving of €2.7bn. In comparison, Ireland consumed 44 TWh (3814 ktoe) of fossil fuels for electricity generation in 2017, so a saving of 137 TWh is equivalent to 3 years of current fossil fuel consumption for electricity generation."*

In conclusion, the need for the Croaghaun Wind Farm development is a result of the need for action to fight against climate change by reducing consumption of fossil fuels. Ireland has accepted this need in entering into binding renewable energy targets with the European Union with an overall aim to become carbon neutral by 2050. The government has indicated that wind energy will play a key role in providing renewable electricity to the national grid. This will comprise of an increase of 8.2GW of onshore wind capacity by 2030 (DoCCAE, 2019). The Croaghaun Wind Farm has potential to contribute to approximately 0.5% of this 2030 target by providing up to 38.5MW of renewable electricity. The increase in domestic renewable energy as a result of the Croaghaun Wind Farm will also assist Ireland in improving resilience in energy security.

2.3 Alternatives Considered

This section of the EIAR sets out the reasonable alternatives considered throughout the development process. The requirement in relation to alternatives in the EIA process is set out in Directive 2011/92/EU, amended by Directive 2014/52/EU, in Article 5 (1)(d), which states that an EIAR should include:

> "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 Environmental Impact Assessment Report (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."

This section has particular regard to the environmental considerations which influenced the selection of alternatives and details the evolution of the development through alternatives considered, indicating the main reasons for selecting the chosen option taking into account the effects of the project on the environment.

The alternatives considered have been described in line with the draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2017). The draft Guidelines 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 in deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required."

Furthermore, the draft Guidelines note the following with regard to high level plans and strategies which may influence or pre-determine decisions in the development process:

> "Higher level alternatives may already have been addressed during the strategic environmental assessment of relevant strategies or plans. Assessment at that level is likely to have taken account of environmental considerations associated… Thus, these prior assessments of strategic alternatives may be taken into account and referred to in the EIAR."

The section also details non-environmental factors of the development process where they are relevant to the evolution of the proposed project.

2.3.1 Do-Nothing Alternative

As set out in section 2.2.2, Ireland has binding targets set by the EU. Ireland is obliged to ensure that 16% of the total energy consumed in heating, electricity and transport is generated from renewable resources by 2020 and reduce its emissions by 30% by 2030, relative to its 2005 emissions, with an overall objective of carbon neutrality by 2050. This is in order to help reduce the nation's CO2 emissions and to promote the use of indigenous renewable sources of energy. These targets have been incorporated into national policy in the Climate Action Plan (2019) which aims to:

- Reduce CO2 eq. emissions from the sector by 50–55% relative to 2030 NDP projections;
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation; and
- Increase electricity generated from renewable sources to 70%
    - Indicatively comprising up to 8.2 GW total of onshore wind capacity.

Furthermore, the Climate Action and Low Carbon Development (Amendment) Bill (2020) will drive implementation of a suite of policies to help Ireland to achieve a 7% average yearly reduction in overall greenhouse gas emissions over the next decade.

Under the "Do-Nothing" scenario, the Croaghaun Wind Farm project would not go ahead, the development of wind turbines is not pursued, and the site remains in use as commercial forestry. In the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Carlow's wind energy resource would be lost at this site.

The nation's ability to produce sustainable energy and reduce greenhouse gas emissions to meet EU targets and National targets, as set out above, would be stifled. This may result in the nation incurring significant financial penalties from the EU if targets are not achieved.

The proposed development has the potential to prevent approximately 53,118 tonnes of CO2 emissions per annum, or up to 1,859,130 tonnes of C02 over the 35-year expected lifespan of the project. This would otherwise be released to the atmosphere through the burning of fossil fuels in the "Do-Nothing" scenario.

This may result in continued global warming and impact upon the intention to "pursue efforts" to limit warming as agreed to in the Paris Agreement (2015). This will result in continued negative impacts to air quality and climate.

According to EirGrid Group's All-island Generation Capacity Statement 2019 – 2028 (Eirgrid, 2019), the growth in energy demand for the next ten years on the Island of Ireland will be between 18% and 41%. In the 'Do-nothing' scenario, importation of fossil fuels to maintain growing energy supply will continue and Ireland's energy security will remain vulnerable. A "Do-nothing" scenario would contribute to strain on existing energy infrastructure and may impact on economic growth if energy demand cannot be met.

Under the "Do-Nothing" scenario, the socio-economic benefits associated with the proposed development will be lost. These benefits include up to 62 no. jobs during the construction phase of the project, and up to 15 long term jobs once operational. Furthermore, under the "Do-Nothing" scenario the local community will not benefit economically from the community benefit fund associated with the project which could be used to improve physical and social infrastructure in the area.

In the "Do-Nothing" scenario, the potential environmental impacts of the proposed development as set out throughout this EIAR will not occur. Table 2-1 sets out the potential impacts of the 'do-nothing scenario' compared to the residual impacts associated with the Croaghaun Wind Farm Project in relation to the various environmental topics covered in the individual chapters of this EIAR. Refer to each respective chapter for full details of residual impacts.

Table 2-1: Comparison of Potential Residual Environmental Effects - Project vs. 'Do-nothing'

Environmental Consideration	Residual Impact of the Proposed Project	'Do-noting' Alternative
Air & Climate	Slight to moderate temporary localised residual impacts arising from fugitive dust emissions. Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels.	Fossil fuel power stations will be the primary alternative to provide the required quantities of electricity resulting in greenhouse gas and other air pollutant emissions.
Noise & Vibration	Significant to slight temporary noise impacts associated with construction activities. Long-term slight to moderate impact on nearby dwellings as a result of the operational phase.	Neutral
Biodiversity	Slight to imperceptible negative impact on certain species and habitat.	Neutral
Ornithology	Slight imperceptible reversible impact on bird species.	Neutral

Environmental Consideration	Residual Impact of the Proposed Project	'Do-noting' Alternative
Land, Soils, Geology	Imperceptible residual impact following implementation of mitigation measures.	Neutral
Hydrology & Water Quality	Imperceptible and non-significant impacts following implementation of mitigation measures.	Neutral
Population & Human Health	Positive health gain due to provision of additional recreation facilities. Positive economic benefit to local area due to job creation and community benefit fund.	No economic benefit for the local area due to no provision of community benefit fund.
Material Assets	Positive impact by offsetting use of fossil fuel. Positive impact due to provision of electricity infrastructure.	No offset to fossil fuel use. No provision of additional electricity infrastructure in the local area.
Traffic & Transport	Slight temporary impact due to construction and decommissioning activities.	Neutral
Archaeology & Cultural Heritage	No residual impacts envisaged that cannot be reversed following decommissioning.	Neutral
Landscape & Visual	Slight to substantial-moderate visual impact, subject to viewshed as assessed in Chapter 15, with magnitude of impacts reducing with greater distance from the proposed project.	Neutral
Telecoms & Aviation	No Residual Impact	Neutral

2.3.2 Strategic Site Screening

Coillte continuously examines the lands under its stewardship for candidate sites for wind energy development.

In 2014, Coillte's Renewable Energy Development Team undertook a detailed screening process, through Geographical Information Spatial software (GIS), using a number of criteria and stages to assess the potential of a large number of possible sites, on lands within its stewardship (c. 441,000 hectares), suitable to accommodate a wind energy development. The GIS database drew upon a wide array of key spatial datasets such as forestry data, ordnance survey land data, house location data, transport, existing wind energy and grid infrastructure 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 this screening process

Phase 1 - Initial Screening

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

- Committed Lands for other developments
- Millennium Sites (This is a Coillte environmental designation – these sites were planted and managed for provision of a tree for every household in the country as part of the Millennium tree planting project)
- Life Site (This is a Coillte environmental designation – these former forested sites were cleared and are managed for biodiversity)
- Wild Nephin Properties (This is a Coillte designation. Since 2014 these properties have been incorporated into National parks)
- Farm Partnerships and Leased Lands
- National Parks
- Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA)

Coillte also reviewed the relevant local authority's County Development Plan (CDP) and/or Renewable Energy Strategy (RES) provisions and did not proceed with further analysis where the policy context was not supportive of wind farm development. In this regard, areas were not brought forward for further analysis if they were not identified as being at least "open for consideration" for wind farm development.

Lands where the average wind speed at 80 metres above ground level is less than 7 m/s and, therefore, potentially not suitable for a commercially viable wind energy development were also discounted at this stage. In addition, sites with a contiguous area of less than 300 hectares were discounted.

Phase 2 – Grid Constraints

The electricity transmission system is the backbone of the nation's power system, efficiently delivering large amounts of power from where it is generated to where it is needed. 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.

Phase 3 – Screening

The next stage of screening out lands from further analysis was due to the presence of the following:

- Sensitive Amenity or Scenic Areas designation in CDPs (at the time of the screening process)
- Tourist areas/sites/trails
- Lands utilised for other wind farm developments
- Telecommunications masts and links

- Sensitive habitat/species of bird
- Land Ownership title Issues,
- Relatively high residential density in vicinity
- Unfavourable slopes and ground conditions

This stage of screening was generally applied using Coillte's in-house expertise and local knowledge, and was subsequently validated externally in terms of the engineering considerations and the likelihood of obtaining a successful grant of planning permission based on industry trends in 2014.

Results of the Screening Process

Sites that emerged from the 2014 site selection process, outlined above, for which Coillte are in the process of preparing separate planning applications are:

- Croagh, County Leitrim
- Carrownagowan, County Clare
- Glenard, County Donegal
- Bottlehill, County Cork
- Castlebanny, County Kilkenny

Coillte intend to bring forward all of these landholdings for wind energy development as all were considered by Coillte to be viable sites for a wind energy project. 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 option with regard to their environmental impacts will be provided in the EIAR accompanying the applications for same.

In 2017 Coillte once again examined the lands under its stewardship for candidate sites for wind energy development using the same site selection process as described above but this time reducing the required contiguous site area from 300ha to 50ha. The proposed site emerged from this process and the process described in Section 2.3.3 below. Other sites which also emerged and for which Coillte are in the process of preparing separate planning applications are:

- Croaghaun (proposed site)
- Lissinagroagh
- Inchamore
- Ballinagree

Similar to the sites which emerged in 2014; the sites which emerged in 2017 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 option with regards to their environmental impacts will be provided in the EIAR accompanying the applications for same.

The alternative to this 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. In addition, a site with an average wind speed less than 7m/s (at 80m above ground level) and/or not located within practical proximity of existing grid infrastructure and may not be economically viable.

As stated above, Coillte conducted two reviews of its land in recent years in which it examined candidate sites for wind energy development. However, as also stated above Coillte continuously assesses at its lands for wind opportunities and other sites can emerge periodically.

2.3.3 Suitability of Candidate Site

The Croaghaun site was further examined in the context of the following elements which are considered decisive in determining viability for a wind farm project:

- Planning Policy
- Designated Sites
- Population Density
- Wind Speed and Grid.

2.3.3.1 County Development Plan Policies and Designations

The Department of Housing, Planning and Local Government's Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (2018) and the Environmental Protection Agency document 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (Draft, EPA, 2017) state that it is important to acknowledge the existence of difficulties and limitations when considering alternatives.

The Draft Guidelines state:

> "Alternatives may be identified at many levels and stages during the evolution of a project, from project concepts and site locations, through site layouts, technologies or operational plans and on to mitigation and monitoring measures. The alternatives that are typically available for consideration at the earlier stages in the evolution of a project generally represent the greatest potential for avoidance of adverse effects."

Section 3.4 of the Draft Guidelines is concerned with the Consideration of Alternatives, which states that:

> "Higher level alternative may already have been addressed during the strategic environmental assessment of strategies or plans. Assessment at that level is likely to have taken account of environmental considerations associated for example with the cumulative impact of the area zoned for industry on a sensitive landscape. Note also that plan-level/higher-level assessments may have set out project level objective or other mitigation that the project and its EIAR should be cognisant of. So, at EIA level this prior assessment of strategic alternatives informs the EIAR".

Development Plans and Regional Plans provide a strategic framework and policy context for all planning decisions. The Planning and Development Act 2000, as amended (Government of Ireland, 2000-2019) reinforces the role of the Development Plan as the primary strategic statement on land-use planning at city, town and county levels, and provides a clear defined context for the formulation and content of planning applications. Sites which Coillte identified for potential wind energy developments were screened against policy designations as listed below. Sites were discounted unless they were identified as being at least "open for consideration" for wind farm development.

Key policies of the Carlow County Development Plan 2015-2021 (Carlow County Council, 2015) which were identified include the following.:

- Wind Energy Policy
- Wind Energy Development Zonings;
- Sensitive Landscape Designations; and
- Cultural Heritage Sites.

As set out in section 4.6 of this EIAR, the Carlow County Development Plan 2015 – 2021 (CDP) encourages the facilitation of the development of 'green' industries, including industries relating to renewable energy. The CDP states that wind is the most advanced form of renewable energy in Ireland with the highest penetration on the Irish energy grid. The CDP states that County Carlow has the potential to absorb additional wind energy developments and make a contribution to national (renewable energy) targets.

The Wind Energy Strategy for the county sets out environmentally sensitive areas along with areas throughout the county with capacity for wind energy development in relation to wind speed, proximity to dwellings, substrate conditions, and access to the national grid. The site encompasses an area 'Open to Consideration' for wind energy development as set out in the Wind Energy Strategy. Refer to Section 4.6.2 of Chapter 4 for more details.

The CDP states that site suitability is an important factor in determining the suitability of wind farms (turbines), having regard to possible adverse impacts associated with for example, residential amenities, landscape, including views or prospects, wildlife, habitats, designated sites, protected structures or bird migration paths, public rights of way and compatibility with adjoining land uses. The Croaghaun Wind Farm site is considered suitable for wind energy development, the capacity for the proposed development at this location in terms of these environmental considerations, is detailed throughout this EIAR.

The proposed wind farm is situated in the 'Blackstairs and Mount Leinster Uplands' principal landscape character area which is further subdivided into 'generic landscape types', of which, the proposed wind farm is situated in the 'Uplands', which is designated as 'Level 5 – Most' sensitivity rating, the highest rating within the current landscape character assessment. This high sensitivity rating relates to the scenic, naturalistic and touristic values of the Blackstairs Mountains landscape. The site boarders the 'farmed lowlands' landscape character area, therefore the site possesses transitionary characteristics of both landscape types. As such, it is considered that the sensitivity of the immediate site surrounds is less sensitive than those areas of the landscape further south of Croaghaun Hill in the vicinity of Mount Leinster. Furthermore, the CDP designates this area as open to consideration for wind farm development.

No significant cultural heritage resources were identified at the site, as further detailed in Chapter 14: Archaeological, Architectural and Cultural Heritage.

2.3.3.2 *Designated Sites*

It is preferable that wind energy development is not located in an area designated as a Special Area of Conservation (SAC), Special Protected Area (SPA) or Natural Heritage Area (NHA). The Croaghaun Wind Farm site is not located within an SAC, SPA or NHA, therefore no direct impacts are predicted on designated sites as a result of the proposed development. However, the subject site was found to be in proximity to the Blackstairs Mountains SAC and hydrologically connected to the Slaney River SAC and the River Barrow and River Nore SAC. With respect to the conservation objectives for these Natura 2000 sites, it is considered that a wind energy project could be developed at the subject site without causing negative impacts to the designated sites through provision of mitigation measures to prevent hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses. Mitigation measures are set out in Chapter 8: Biodiversity and Chapter 10: Hydrology & Water Quality. A Natura Impact Statement has been prepared for the proposed development which concludes beyond reasonable scientific doubt that the integrity of the Slaney River Valley SAC and/or River Barrow and River Nore SAC will not be adversely affected.

2.3.3.3 *Population Density*

Areas with low housing density are preferable for wind energy development so as to minimise potential disturbance to residential amenity which may be caused as a result of construction activities, visual impacts, shadow flicker and noise. As discussed in Section 11.3 of this EIAR, the population density of the subject site was found to be below the state average and below the County Carlow average, as detailed in Table 2-2 below. The low population density and a lack of dwellings in proximity to the site provides greater capacity for wind energy development at the Croaghaun Site, allowing for a greater number of turbines to be constructed while maintaining appropriate setback distances from dwellings as set out in the Wind Energy Development Guidelines.

Table 2-2: Population Density

Area	Population Density (Persons per square kilometre) CSO 2016
State	67.8
Carlow County	63.5
Wind Farm Area	31.4
TDR Area	92
Grid Route Area	37.6

2.3.3.4 *Other Considerations*

Wind speed was assessed at the site in order to determine if wind energy development would be feasible. Wind speed analysis is available from the Sustainable Energy Authority of Ireland (SEAI). Wind speed at the subject site is above average due its elevation. Average wind speeds at a height of 100 meters range from 5 and 8 meters per second according to SEAI data. This indicates viable values for wind energy development at this location, considering values over 8 meters per second are generally required. The wind resource at the Croaghaun Wind Farm site is illustrated in Figure 2-1.

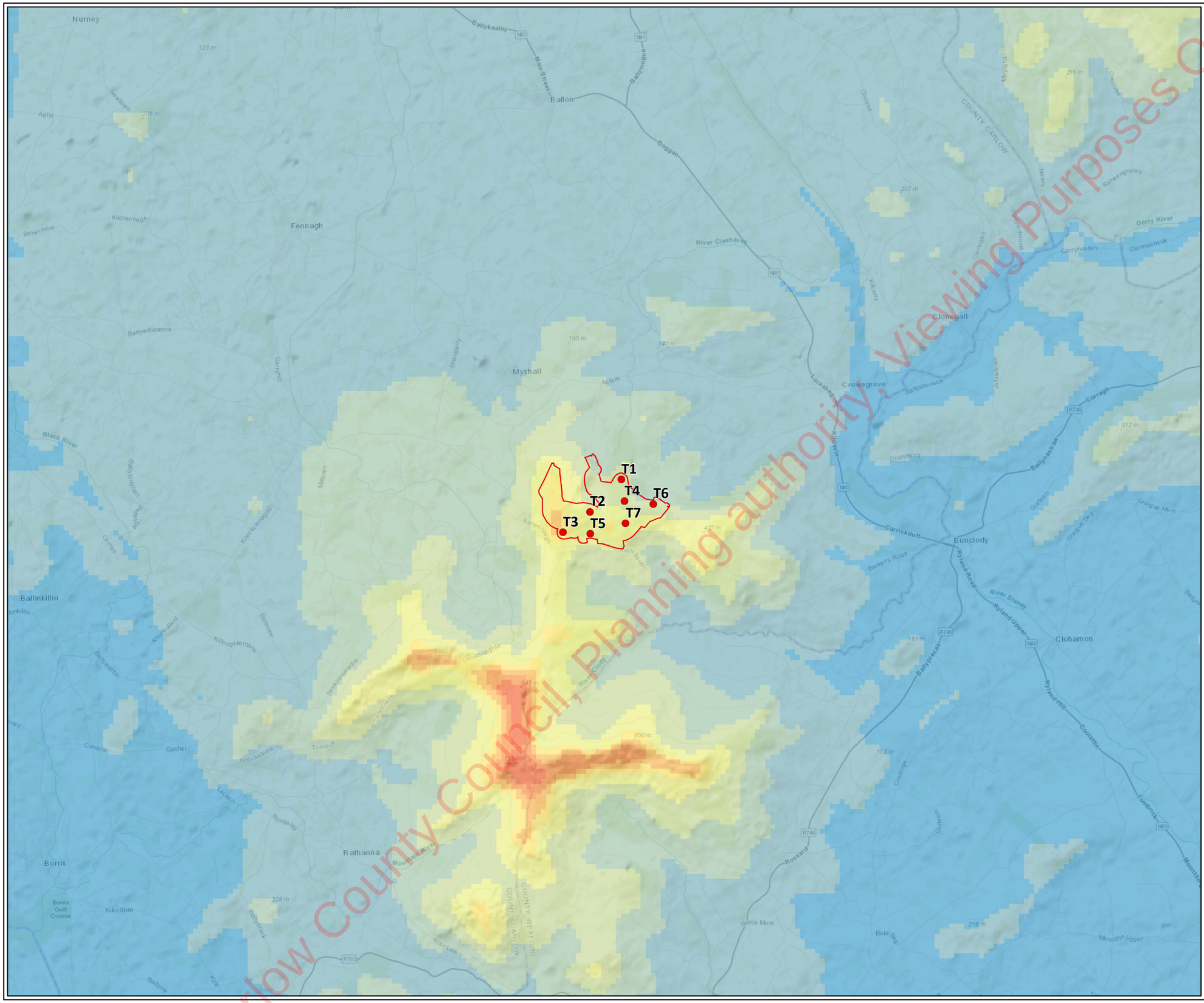
The subject site is in proximity to 2 no. primary transport routes, the N80 national primary route located to the east of the site at Bunclody and the M11 motorway located approximately 21km to the south east at Enniscorthy. Local roads leading from these primary routes to the site are of good quality and capacity and will require little upgrade to facilitate construction traffic and turbine deliveries.

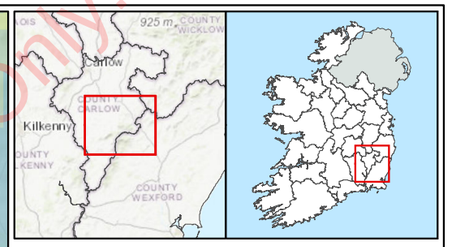
Grid constraints were also considered during the strategic site selection process as detailed in the strategic screening exercise. The Croaghaun site was found to be in proximity to two 110-220kV nodes on the national transmission system, the Kellistown 110-220kV substation and the Lodgewood 110-220kV substation. Capacity at both substations was examined, and potential routes were identified and assessed in order to determine a viable connection from the proposed Croaghaun Wind Farm Site to the national grid. This is further addressed in section 2.3.5.4.

In summary a strategic screening exercise was undertaken. This resulted in a short list of viable sites as detailed in section 2.3.2.1. Further detailed considerations including planning policy, proximity to designated sites, population density, wind resource and grid connection capacity were examined for the Croaghaun site indicating that a wind energy development is viable.

While the outcome of the site screening process has identified the site of the current proposal as a suitable location for a wind farm development of the nature proposed, it does not preclude other sites within the Coillte portfolio being brought forward for further consideration in the future. Coillte continuously examines the lands under its stewardship for further candidate sites for wind energy development.

Path: R:\Map Production\2019\P1913\Workspace\EIAR\P1913_GIS_Fig2-1_WindSpeed_A3.mxd





- Proposed Turbine Layout
- Proposed Development Boundary

Wind Speed 100m (m/s)

- 4.5 - 6.6
- 6.7 - 7.5
- 7.6 - 8.2
- 8.3 - 9
- 9.1 - 9.7
- 9.8 - 10.2
- 10.3 - 10.6
- 10.7 - 11.2
- 11.3 - 12.4
- 12.5 - 16.9

N W E S

0 2.5 5 10 Kilometers

TITLE:	Wind Speed		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	2.1		
CLIENT:	Coillte		
SCALE:	1:75000	**REVISION:**	0
DATE:	03/12/2020	**PAGE SIZE:**	A3

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2.3.4 Alternative processes – Renewable Energy Technologies

Coillte considered a range of alternative renewable technologies in order to identify the most economically viable and environmentally favourable for installation at the Croaghaun landholding. Bearing in mind, Coillte's lands consist of forested areas, this limited the choice of technologies, making off-shore wind and tidal/wave energy technologies unsuitable.

Solar PV was considered as a reasonable alternative source of renewable electricity which could contribute towards national policy and objectives in provision of clean renewable electricity.

Solar energy has quickly become one of the cheapest renewable electricity sources due to technological advancements in the past decade. Solar PV presents an opportunity to diversify Ireland's energy resources in an environmentally sustainable way.

However, when considering the general environment of the Croaghaun site, solar PV has potential to cause disproportionate environmental impacts due to the requirements of large areas of generally flat and unobstructed lands in order to produce significant amounts of electricity. This land requirement would result in large areas of tree felling, resulting in a loss of material assets of commercial forestry and could result in significant impact on water quality due to potential migration of silt to watercourse. This has potential to impact water quality and aquatic biodiversity.

1MW of Solar PV requires approximately 2 hectares of land. In order to produce the same amount of energy as the proposed Croaghaun Wind Farm (38.5MW), a solar farm would require in excess of 77 hectares of land (excluding taking account of capacity factors), resulting in the felling of in excess of 77 hectares of commercial forestry, 52.6 hectares greater than the felling required for the proposed Croaghaun Wind Farm. If capacity factors were considered the land required would increase significantly as wind farms typically have much higher capacity factors than solar farms in Ireland. The capacity[1] factor for a high wind speed site like Croaghaun is likely to be a minimum of 3 times that of a solar farm so to produce an equivalent volume of electricity, in excess of 200 hectares would be required. This would result in a significant loss of commercial forestry material assets in the area and would impact on biodiversity due to the earthworks required to remove the forested areas and the potential for silt to migrate to nearby streams.

Furthermore, the elevated nature of the site would result in visual impact inconsistent with the existing environment and potential for glint and glare.

For the reasons set out above, the proposal for a wind energy development at this site is considered to be the most efficient method of electricity production with the lesser potential for significant, adverse environmental effects.

A comparison of the potential environmental effects of the development of a solar PV array when compared against the chosen option of developing the proposed wind farm at the Croaghaun site are presented in Table 2-3.

[1] Capacity factor is a measure of how much energy is produced by a plant compared with its maximum output. It is measured as a percentage, generally by dividing the total energy produced during some period of time by the amount of energy the plant would have produced if it ran at full output during that time (NREL, 2013).

Table 2-3: Comparison of Potential Residual Environmental Effects Associated with Alternative Renewable Technologies

Environmental Consideration	Residual Impact of Project	Solar Energy
Air & Climate	Slight to moderate temporary localised residual impacts arising from fugitive dust emissions. Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels.	Moderate temporary negative impact due to felling of extensive area of forestry. Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels.
Noise & Vibration	Significant to slight temporary noise impacts associated with construction activities. Long-term slight to moderate impact on nearby dwellings as a result of the operational phase.	Temporary noise impact at nearby dwellings associated with construction activity.
Biodiversity	Slight to imperceptible negative impact on certain species and habitat.	Loss of habitat due to tree felling required. Potential impact to aquatic biodiversity due to migration of silt to watercourses.
Ornithology	Slight to imperceptible impact on birds.	Potential impact to habitat due to extensive tree felling and site clearance.
Land, Soils, Geology	Imperceptible residual impact following implementation of mitigation measures.	Potential impact to soils as a result of extensive tree felling.
Hydrology & Water Quality	Imperceptible and non-significant impacts following implementation of mitigation measures.	Potential migration of silt to watercourse as a result of extensive tree felling required to accommodate solar farm.
Human Beings	Positive health gain due to provision of additional recreation facilities. Positive economic benefit to local area due to job creation and community benefit fund.	Positive economic benefit to local area due to job creation and community benefit fund.
Material Assets	Positive impact by offsetting use of fossil fuel. Positive impact due to provision of electricity infrastructure.	Loss of significant area of commercial forestry due to land requirement of solar farm. Positive impact by offsetting use of fossil fuel. Positive impact due to provision of electricity infrastructure.
Traffic & Transport	Slight temporary impact due to construction and decommissioning activities.	Slight temporary impact due to construction and decommissioning activities.
Archaeology & Cultural Heritage	No residual impacts envisaged that cannot be reversed following decommissioning.	No residual impact envisaged.
Landscape & Visual	Slight to substantial-moderate visual impact, subject to viewshed.	Visual impact as a result of solar farm located on elevated lands, inconsistent with the existing environment at the Croaghaun site. Potential for glint and glare.
Telecoms & Aviation	No Residual Impact	No residual impact envisaged.

2.3.5 Alternative Layouts and Design

2.3.5.1 Design Philosophy - Mitigation by Design

Alternative layouts for the proposed wind farm were developed in an iterative design process which aimed to avoid environmental sensitivities, minimise potential environmental impacts both on and off site and to maximise the wind potential on site. The design has been carried out in accordance with industry guidelines and best practice, namely the Department of Environment, Heritage and Local Government's (DoEHLG) Wind Energy Development Guidelines (2006), The Department of Housing, Planning and Local Government's (DoHPLG), and the Irish Wind Energy Association Best Practice Guidelines (2012). The design process of the project has had regard to the Draft Revised Wind Energy Development Guidelines (2019). The layout and design was an iterative process which took account of such criteria as:

- Set back from houses;
- Set back from designated sites;
- Set back from other constraints such as watercourses, public roads and power lines;
- Suitable wind speeds;
- Landscape and visual sensitivity;
- Ecology;
- Ornithology;
- Soils and Geology;
- Hydrology;
- Noise; and
- Cultural Heritage.

Constraints and environmental sensitivities were first identified, and buffers applied in order to determine appropriate areas within the site to accommodate development. Consideration of the environmental sensitivities of the site included an analysis of the criteria listed above. This constraints exercise resulted in a developable area being defined. A comparison of environmental effects of following this design approach and not following it, i.e. applying mitigation by design versus a design which does not consider the various environmental factors of the receiving environment is presented in Table 2-4.

Table 2-4: Comparison of Potential Residual Environmental Effects - Mitigation by Design and Potential Impacts

Environmental Consideration	Mitigation by Design Utilised in the Croaghaun Wind Farm Project	Potential Impact if Mitigation by Design is not Included
Residential Amenity	Coillte set a minimum 750m set back from all inhabited dwellings, in line with the Wind Energy Development Guidelines. This was subsequently increased as the site has capacity for greater setback distances. The closest dwelling is located ca. 980 meters from the nearest turbine.	Potential for impact to residential amenity due to noise, vibration and dust during the construction stage. Further potential impact to residential amenity during operations due to visual impact and noise.

Environmental Consideration	Mitigation by Design Utilised in the Croaghaun Wind Farm Project	Potential Impact if Mitigation by Design is not Included
Flora and Fauna	Avoidance of designated sites and mitigation designed to avoid potential impacts on species and habitats.	Potential for impact on designated sites hydrologically connected to the subject site. Potential for habitat loss and disruption due to impacts on water quality.
Ornithology	Avoidance of designated sites. Any hedgerow trimming or removal to be completed outside of the bird breeding season.	Potential impact to avifauna associated with designated sites and other avifauna identified including Kingfisher and Merlin.
Soils & Geology	Avoid where possible areas of deep peat and steep gradient.	Potential impact on peat stability. Potential for landslide or subsidence.
Hydrology	Minimum 50m set back of infrastructure from rivers and streams where reasonably possible.	Potential impact to the existing hydrological regime. Potential for runoff to directly discharge to streams.
Water Quality	Minimum 50m set back from significant rivers and streams and appropriate mitigation designed to avoid siltation during construction.	Potential migration of silt or petrochemicals to watercourses. Potential impact on water quality and aquatic biodiversity.
Noise & Vibration	Ensure compliance with the relevant guideline limits for noise. A 980m setback between the turbines and nearby dwelling structures has been achieved which will assist in maintaining residential amenity at local dwellings. Further mitigation measures have been set out in Chapter 7 – Noise and Vibration.	Potential for impact to residential amenity at nearby dwellings due to noise nuisance.
Shadow Flicker	Shadow flicker detection systems to be installed in turbines to avoid shadow flicker at nearby dwellings, in line with the Draft Revised Wind Energy Development Guidelines (2019).	Potential impact on residential amenity due to shadow flicker at nearby dwellings.
Cultural Heritage	No direct impacts are expected.	No direct impacts are expected.
Material Assets	Commercial forestry impacted by the proposed development will be replanted at an alternative site. No significant impact expected.	Commercial forestry impacted by the proposed development will be replanted at an alternative site. No significant impact expected.
Landscape & Visual	Buffering of residential receptors in order to maintain setback distance. Consideration of sensitive visual receptors in the greater area including the Blackstrairs Mountains, the nine-stones viewing point and the nearby village of Myshall. Consideration of visual relationship with the adjacent Greenoge Wind Farm.	Potential negative visual impact on sensitive visual receptors and potential impact on residential amenity.

2.3.5.2 Design Philosophy - Alternative Scales and Density

Initially, following the establishment of the developable area of the Croaghaun Wind Farm Site, and as part of the design alternative process a number of different turbine heights were considered. The relationship between the turbine height and density (number of turbines) required to achieve a particular output was a key design consideration.

Several case studies and land surveys have highlighted that when given an option people tend to prefer a scenario of fewer larger turbines. One such study commissioned by Bord Fáilte (now Fáilte Ireland) in 2008 found that:

> "In terms of the size and composition of wind farms, tourists tended to prefer farms containing fewer turbines. If both produced the same amount of electricity, tourists also preferred wind farms containing a small group of large turbines (55%) to a large group of smaller turbines (18%)."

There is a balance to be struck between the visual and spatial dominance of turbines and the clutter and the frequency of turbines within a view as both of these effects contribute towards the magnitude of visual impact. This is illustrated in Figure 2-2, which compares a similar energy yield across three turbine heights within the same view. This is intended only as an illustrative diagram to show the balancing relationship between turbine height and density.

On the basis of these factors and through design stage analysis, consideration was given to the approach that the slightly increased sense of visual dominance imparted by taller turbines is preferable to the reduced level of permeability and increased visual clutter associated with a greater number of shorter turbines required to achieve the same output. Moreover, the perceived visual dominance of taller turbines is further offset by increased setback distances from residential receptors. In this regard, alternative turbine outputs were considered correlating to alternative turbine heights.

The consideration to provide fewer, larger turbines with greater power output is in line with industry trends. This option increases energy efficiency, improving the energy output to the national grid per turbine, thus reducing the cost of energy for the consumer. The use of less turbines also reduces the impact on the receiving environment with less land-take required to accommodate the wind farm and less associated construction works as detailed above. Recent permitted wind farm applications in Ireland tend towards larger/taller turbines (ie. the larger turbine tip heights that are available on the market in Ireland). Examples of recent consented wind farms which include larger/taller turbines are the Ardderroo Wind Farm, Co. Galway (ABP ref. PL07 .303086) which consists of 25 no. turbines at 178.5m tip height, the Coole Wind Farm, Co. Westmeath (ABP ref. PL25M.300686) which consists of 13 no. wind turbines of 175m tip height and Derryadd Windfarm, Co Longford (ABP ref. PL14 .303592) which consists of 24 turbines with tip height up to 185m.

This approach to design is examined further in the context of the alternative layouts considered for Croaghaun wind farm in the following section.

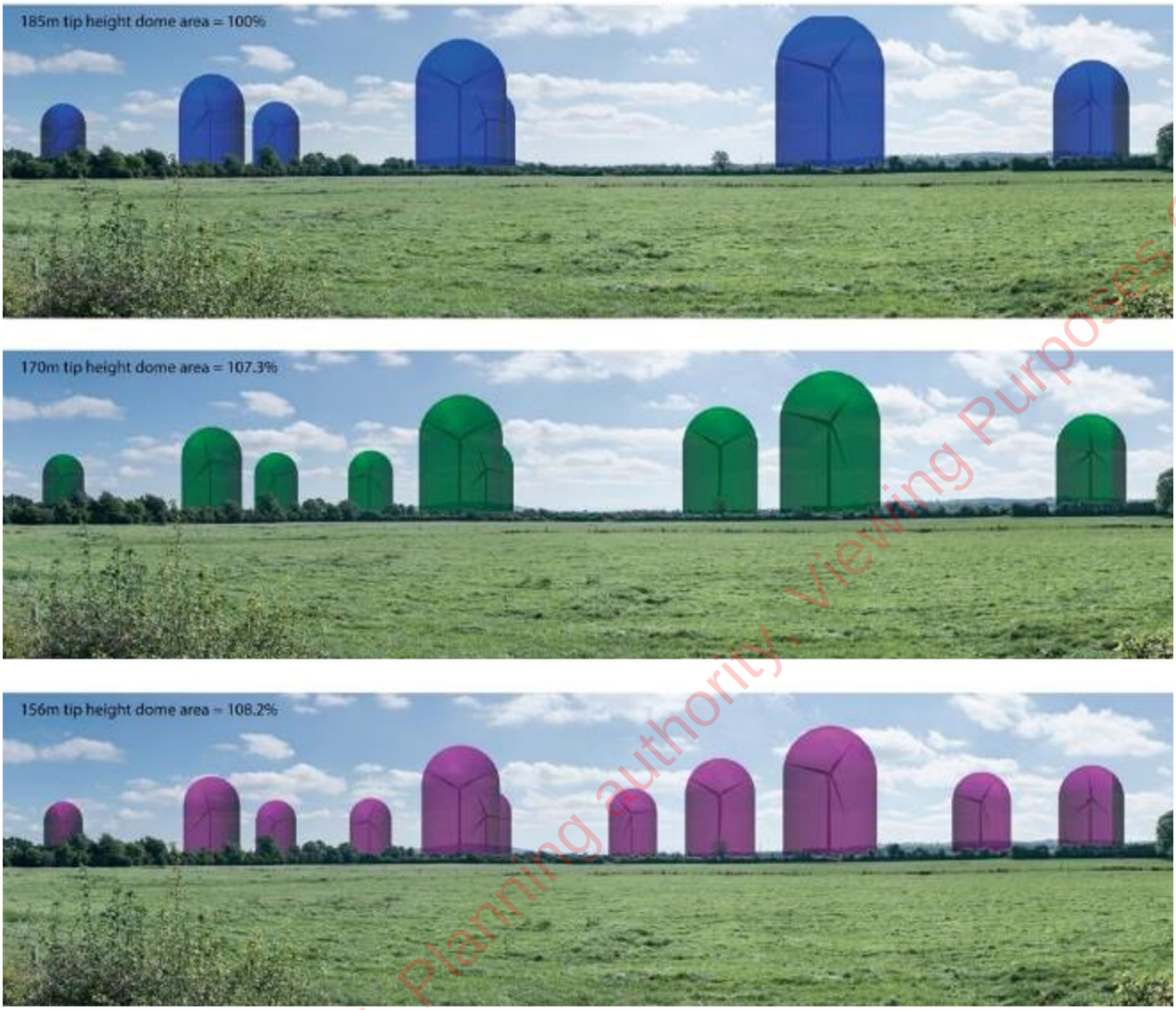

Figure 2-2: Turbine Height versus Density Relationship (Same Power Output for each Example)

2.3.5.3 Wind Farm Design Iterations

The design of the proposed Croaghaun Wind Farm was an iterative process which considered a range of alternative designs throughout the evolution of the project. The design iterations were influenced by potential environmental effects identified throughout the environmental assessment, leading to the evolution of the developable area of the project and the establishment of the final design as proposed. 4 no. design iterations were considered with various scales and densities. These are detailed in Table 2-5.

An initial design within the developable area of the wind farm site consisted of 9 no. wind turbines. This represented the maximum volume developable at the site and was considered with respect to environmental impacts. The turbine height considered for this initial layout was 150m tip height with 130m rotor diameter. From the outset, this turbine layout was considered to have a significant visual impact on the nearby village of Myshall. As detailed in Chapter 15: Landscape and Visual, reverse ZTV maps were prepared from Myshall, as the settlement and its associated heritage value were noted as potential constraints to the proposed project at an early stage.

The initial reverse ZTV map for the potential view of the 9 no. turbine layout from Myshall is illustrated in figure 2-3. It is clear from this figure that turbines in proximity to the town at the north west of the site were more visible, whereas the turbines located to the south east of the site were mostly not visible when viewed from Myshall.

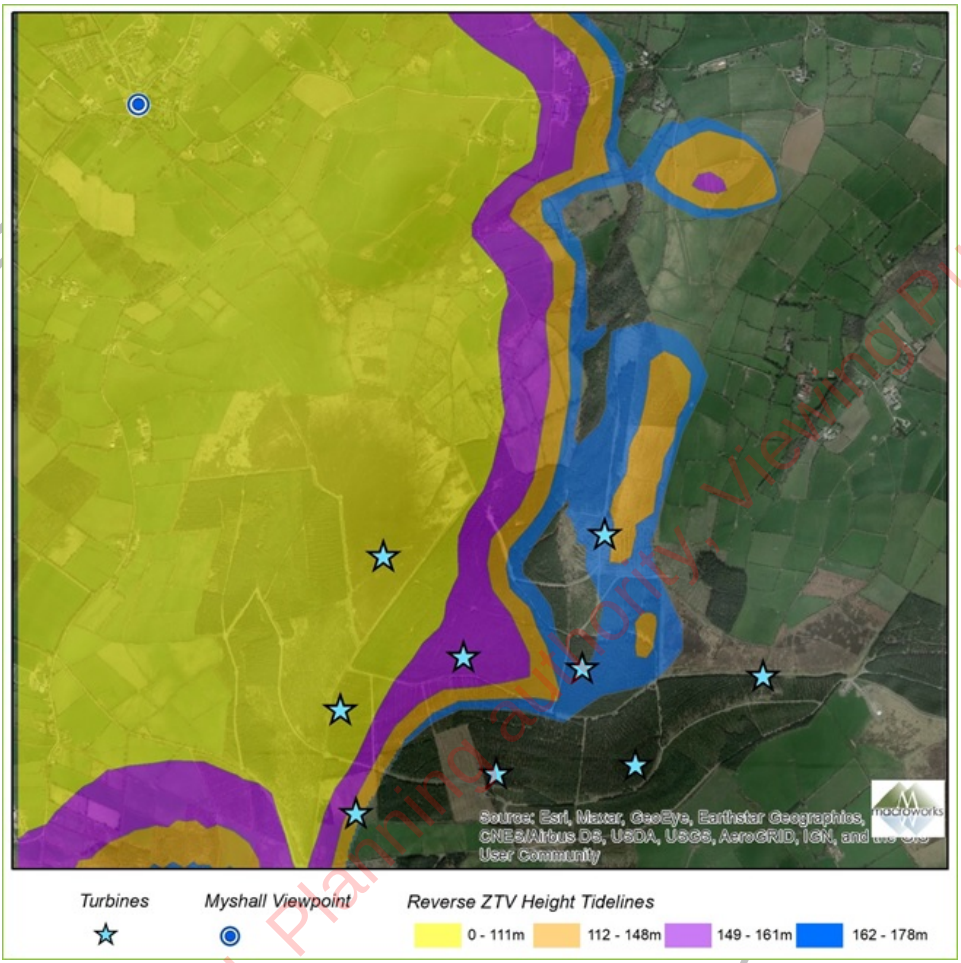

Figure 2-3: Reverse ZTV Map of 9 no. Turbine Layout Viewed from Myshall

Following this initial assessment, and considering the scale and density as detailed in the previous section, it was chosen to remove turbines at the western section of the site and examine the use of fewer, taller, turbines in the remainder of the site. Subsequently, 2 no. alternative design options were considered for the proposed wind farm, Option 1 and Option 2. Both options proposed to screen the turbines insofar as possible from Myshall and to reduce the potential for visual impacts when viewed from the west. This resulted in the layout of the wind farm shifting further east, away from the most elevated sections of Croaghaun Hill, and removal of the two most north westerly turbines which were located in this area. As a consequence of this, theoretical visibility of the proposed turbines within the central areas of Myshall resulted in only partial views of blade tips of up to two turbines and the visual presence of the overall scheme was therefore found to be reduced from the nearest settlement.

Option 1, as illustrated in Figure 2-4, includes 7 no. wind turbines at a height of 170m and a rotor diameter of 140m. This option includes taller turbines (20m taller than the initial design) focused on the eastern section of the site. The internal road layout utilises existing forestry tracks with short spurs of new tracks required to access turbines.

Option 2, as illustrated in Figure 2-5, utilises the same approximate developable area as Option 1, however, includes fewer, taller turbines. This layout includes 6 no. turbines of 185m in height and 150m rotor diameter. This results in slightly greater space between the turbines to allow for the larger rotor diameter, and slightly less impact on habitat due to less turbines and slightly less requirement for access tracks. This option would be visible from a greater distance due to the taller tip height of the turbines. Furthermore, due to having less turbines than the preceding options, Option 2 would produce the least power.

The two options were assessed by the EIA team to determine which option would be brought forward for further consideration. The alternative options were assessed against on-site constraints and scored with respect to potential impact on environmental sensitivities.

The assessment found that Option 1 and Option 2 did not present any significant environmental impacts and it was decided to take the merits of both options forward for further consideration. It was considered that a 7 turbine proposal compared with a 6 turbine proposal would provide significant additional capacity to the wind farm development, providing greater opportunity to produce renewable electricity at the site and produce a greater long-term positive impact on air quality and climate in comparison to Option 2. However, it was also considered in proposing the 7 no. turbine layout that a slightly lower tip height should be assessed to that considered in Option 1.

This proposed project layout is illustrated in Figure 2-6. This layout is a hybrid of Option 1 and Option 2 and was further developed through detailed environmental impact assessment, site investigation and wind analysis of the site. The turbine dimensions for the proposed project include a tip height of 178m and a rotor diameter of 138m reflecting a compromise between option 1 and 2. The complex wind conditions on the site was also a factor in considering the turbine type, a slightly higher hub height was required to raise the blades above the complex wind conditions. As a result, the proposed turbines are marginally more visible from the surrounding area in comparison to Option 1. The access tracks were re-aligned to avoid potential impact on sensitive habitats at the north east of the site as detailed in 2.3.5.7

A comparison of potential environmental impacts of the wind farm site design iteration options and the chosen option for the proposed Croaghaun Wind Farm project is detailed in Table 2-6. The proposed option was developed to present the least potential environmental impact through the project philosophy of mitigation by design.

Table 2-5: Alternative Wind Farm Design Options

Layout No.	No. of Wind Turbines	Tip Height	Rotor Diameter	Total Approx Power Output
Initial Design	9	150	130	43.2 MW
Option 1	7	170	140	38.7 MW
Option 2	6	185	150	33.6 MW
Proposed Project	7	178	138	38.7 MW

Table 2-6: Comparison of Potential Residual Environmental Effects of the Wind Farm Design Iterations

Environmental Consideration	Initial Design (9 Turbines, 150m tip)	Option 1 (7 Turbines, 170m tip)	Option 2 (6 Turbines, 185m tip)	Proposed Project (7 Turbines, 178m tip)
Air & Climate	Greatest potential for long-term positive impact to air quality & climate due to greater electricity export capacity associated with more turbines.	Long-term positive impact to air quality & climate due to provision of renewable electricity	Least potential for long-term positive impact to air quality & climate due to less electricity export capacity associated with less turbines.	Long-term positive impact to air quality & climate due to provision of renewable electricity.
Noise & Vibration	Potential slight to moderate impact on dwellings in close proximity to the site due to operational noise.	Potential slight to moderate impact on dwellings in close proximity to the site due to operational noise.	Potential slight to moderate impact on dwellings in close proximity to the site due to operational noise.	Slight to moderate impact on dwellings in close proximity to the site due to operational noise.
Biodiversity	Slight negative impact on certain species and habitat due to greater habitat loss as a result of larger landtake compared to other options.	Slight to imperceptible negative impact on certain species and habitat.	Slight to imperceptible negative impact on certain species and habitat. Least habitat disruption due to less turbines and less access tracks.	Slight to imperceptible negative impact on certain species and habitat.
Ornithology	Slight to imperceptible impact on birds with greater potential for collision risk due to greater number of turbines.	Slight to imperceptible impact on birds.	Slight to imperceptible impact on birds.	Slight to imperceptible impact on birds.
Land, Soils, Geology	Slightly higher impact due to greater number of turbines resulting in more ground works and soil disturbance due to felling.	Imperceptible residual impact expected following implementation of mitigation measures.	Imperceptible residual impact expected. Least amount of ground works required.	Imperceptible residual impact following implementation of mitigation measures.
Hydrology & Water Quality	Imperceptible and non-significant impacts expected. Slightly higher potential for silt to migrate to nearby streams due to more ground	Imperceptible and non-significant impacts expected following implementation of mitigation measures.	Imperceptible and non-significant impacts expected following implementation of mitigation measures.	Imperceptible and non-significant impacts following implementation of mitigation measures.

Environmental Consideration	Initial Design (9 Turbines, 150m tip)	Option 1 (7 Turbines, 170m tip)	Option 2 (6 Turbines, 185m tip)	Proposed Project (7 Turbines, 178m tip)
	works and felling, however, mitigation would prevent this.			
Population & Human Health	Greater impact to residential amenity due to visually prominent turbines at the east of the site. Positive health gain due to provision of additional recreation facilities. Positive economic benefit to local area due to job creation and community benefit fund.	Positive health gain due to provision of additional recreation facilities. Positive economic benefit to local area due to job creation and community benefit fund.	Positive health gain due to provision of additional recreation facilities. Positive economic benefit to local area due to job creation and community benefit fund.	Positive health gain due to provision of additional recreation facilities. Positive economic benefit to local area due to job creation and community benefit fund.
Material Assets	Largest positive impact by offsetting use of fossil fuel due to greater electricity export capacity. No significant impact on commercial forestry resource expected due to replanting of forestry.	Positive impact by offsetting use of fossil fuel. No significant impact on commercial forestry resource expected due to replanting of forestry.	Positive impact by offsetting use of fossil fuel. No significant impact on commercial forestry resource expected due to replanting of forestry.	Positive impact by offsetting use of fossil fuel. No significant impact on commercial forestry resource expected due to replanting of forestry.
Traffic & Transport	Slight temporary impact due to construction and decommissioning activities.	Slight temporary impact due to construction and decommissioning activities.	Slight temporary impact due to construction and decommissioning activities.	Slight temporary impact due to construction and decommissioning activities.
Archaeology & Cultural Heritage	Potential impact to heritage value of the village of Myshall as a result of visual prominence of turbines at east of the site.	No residual impacts envisaged that cannot be reversed following decommissioning. No significant impact on the heritage value of Myshall.	No residual impacts envisaged that cannot be reversed following decommissioning. No significant impact on the heritage value of Myshall.	No residual impacts envisaged that cannot be reversed following decommissioning. No significant impact on the heritage value of Myshall.
Landscape & Visual	Significant visual impact on nearby settlement of Myshall due to	Slight to substantial-moderate visual impact, subject to viewshed, with magnitude of impacts reducing	Slight to substantial-moderate visual impact, subject to viewshed. Option would likely have the least visual impact due to less turbines,	Slight to substantial-moderate visual impact, subject to viewshed, with magnitude of impacts reducing

Environmental Consideration	Initial Design (9 Turbines, 150m tip)	Option 1 (7 Turbines, 170m tip)	Option 2 (6 Turbines, 185m tip)	Proposed Project (7 Turbines, 178m tip)
	prominent turbines located at the east of the site.	with greater distance from the proposed project.	however, would be the tallest of the options considered.	with greater distance from the proposed project.
Telecoms & Aviation	No residual impact expected.	No residual impact expected.	No residual impact expected.	No residual impact expected.

The design option chosen to take forward for the proposed project was chosen as it strikes a balance between energy production capacity and avoidance of environmental sensitivities. The chosen option provides for the greatest amount of energy production while avoiding potential significant impacts on the receiving environment. The initial turbine layout consisting of 9 no. turbines has the potential to produce the most energy, however, this option was seen to cause significant visual impact on the nearby settlement of Myshall with potential to impact on residential amenity and the heritage value of the settlement.

The evolution of the project resulted in less proposed turbines to avoid this visual impact. The environmental impacts associated with Option 1 and Option 2 were found to be similar with no significant impacts identified as a result of providing 7 no. turbines rather than 6 no. turbines. It was further considered that the provision of 7 no. turbines has potential to produce more energy with greater benefits to air quality and climate and the offsetting of use of fossil fuels. For this reason, Option 1 was chosen as the optimal option. This was then developed further into the final layout of the proposed development as a result of wind optimisation of the site and complete environmental impact assessment. The proposed wind farm layout is illustrated in Figure 2-6.

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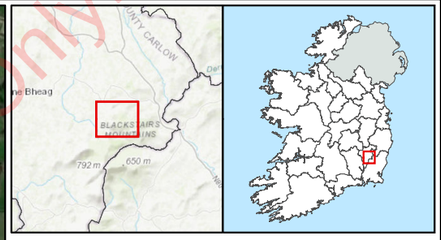

Proposed Turbine Layout

Study Area Boundary

Proposed Internal Access Tracks

Proposed Substation Compound

TITLE:	Design Option 1		
PROJECT:	Croaghaun Wind Farm		
FIGURE NO:	2.4		
CLIENT:	Coillte		
SCALE:	1:15000	**REVISION:**	0
DATE:	03/12/2020	**PAGE SIZE:**	A3

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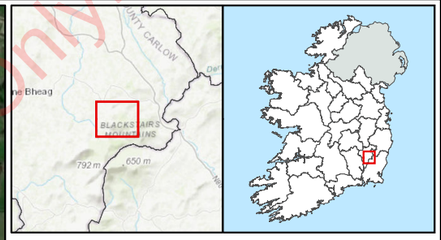

Proposed Turbine Layout

Study Area Boundary

Proposed Internal Access Tracks

Proposed Substation Compound

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Kilometers
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TITLE: Design Option 2			
PROJECT: Croaghaun Wind Farm			
FIGURE NO:	2.5		
CLIENT:	Coillte		
SCALE:	1:15000	**REVISION:**	0
DATE:	03/12/2020	**PAGE SIZE:**	A3

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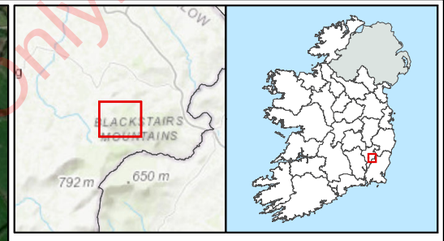

- Proposed Turbine Layout
- Proposed Development Boundary
- Existing 80m Met Mast
- Proposed Permanent 100m Met Mast
- Proposed Grid Connection Route
- Proposed Croaghaun Loop
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turning Heads and Passing Bays
- Proposed Turbine Hardstanding
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation Compound

N W E S

0 0.125 0.25 0.5 Kilometers

TITLE: Proposed Wind Farm Layout			
PROJECT: Croaghaun Wind Farm			
FIGURE NO:	2.6		
CLIENT:	Coillte		
SCALE:	1:10000	**REVISION:**	0
DATE:	03/12/2020	**PAGE SIZE:**	A3

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2.3.5.4 Grid Connection

When considering an appropriate substation to connect the proposed Croaghaun Wind Farm to the national grid, two substations were identified in proximity to the site on an existing 110kV-220kV line on the national transmission network. The two potential alternative grid options include the Kellistown 110kV-220kV substation, located approximately 14km to the north of the site and the Lodgewood 110kV-220kV substation, located approximately 18km to the south east of the site. The grid connection options are illustrated in figure 2-7. No viable 38kV connection options were identified in the area of the Croaghaun site.

The grid options were considered with regard to capacity and potential environmental impacts, which are compared in Table 2-7.

A preliminary viability study was carried out for an underground grid connection to the Lodgewood Substation to be buried in local roads and to be brought underneath the Slaney River Valley SAC by horizontal directional drilling. However, technical review and consultation indicated that capacity may not be available at the Lodgewood Substation and that the alternative Kellistown Substation will provide the appropriate capacity required. For this reason, further alternative routes and connection types to the Lodgewood Substation were not further considered. The preliminary environmental assessment of the connection to the Lodgewood Substation is included in Table 2-7 and compared to the alternative options brought forward.

The Kellistown Substation was chosen as the optimal route due to the capacity identified at the substation. Furthermore, the overall route length to the substation is shorter than the Lodgewood option and potential environmental impacts resulting from the proposed construction works, including potential impact on the Slaney River Valley SAC is reduced as the Kellistown route does not come in proximity to designated sites. Three options for the grid connection to the Kellistown Substation were assessed to determine the optimal option. These included an overhead line option, an underground cable option and a mixture of overhead and underground cabling. The potential environmental effects of each option are compared in Table 2-7.

The chosen grid route option included a variant which passed through the village of Myshall. This alternative variant route was considered as it provides a direct route by public road to the Kellistown Substation, however, it was discounted as it posed greater potential to impact on residential amenity and traffic and transport due to the construction works required in the town, which has a significantly higher population density to that of the alternative route chosen which avoids the town. The route variant is illustrated in Figure 2-7 and an environmental comparison of the route variant is included in Table 2-7.

The underground grid connection to Kellistown was ultimately chosen to bring forward for the proposed Croaghaun Wind Farm project as it has less potential visual impact and less potential impact on avifauna. Although the construction activities will take longer and will likely cause more noise, dust and traffic related impacts during construction, when compared to the overhead option. The underground option was found to have the least residual impact on the receiving environment once constructed and was therefore chosen as the optimal option. An underground solution is also in line with the latest recommendations in the Draft Wind Energy Development Guidelines (2019).

Table 2-7: Comparison of Potential Residual Environmental Effects - Grid Route Options

Environmental Consideration	Proposed Kellistown Underground Cable	Kellistown Underground Cable with Route Variant through Myshall	Kellistown Overhead Line	Kellistown Combination of Overhead & Underground	Lodgewood Underground Cable
Air & Climate	Potential for temporary light to moderate residual impacts arising from fugitive dust emissions during construction.	Potential for temporary light to moderate residual impacts arising from fugitive dust emissions during construction.	Potential for temporary non-significant impacts arising from fugitive dust emissions during construction due to minor excavations.	Potential for temporary light to moderate impacts arising from fugitive dust emissions during construction at certain residential receptors.	Potential for temporary light to moderate residual impacts arising from fugitive dust emissions during construction.
Noise & Vibration	Temporary significant noise impact at particular properties along the grid route due to construction works.	Temporary significant noise impact at particular properties along the grid route due to construction works. Heightened potential noise impact in town of Myshall due to higher population density.	Temporary moderate noise impact at particular properties along the grid route due to construction works.	Temporary significant noise impact at particular properties along the grid route due to construction works.	Higher density of dwellings along route may result in greater impact on residential amenity during construction works due to potential temporary noise, dust and traffic.
Biodiversity	Route is not in close proximity to any designated sites. No significant residual impacts are expected.	Route is not in close proximity to any designated sites. No significant residual impacts are expected.	Imperceptible impact.	Imperceptible impact.	Potential impact on the Slaney River Valley SAC. Potential for horizontal directional drilling to cross beneath the SAC, however, the option runs adjacent to the SAC for much of the route, increasing the potential for impact on the designated site.
Ornithology	No expected impact.	No expected impact.	Overhead line provides a potential collision risk for avi-fauna.	Overhead line provides a potential collision risk for avi-fauna.	No expected impact.

Environmental Consideration	Proposed Kellistown Underground Cable	Kellistown Underground Cable with Route Variant through Myshall	Kellistown Overhead Line	Kellistown Combination of Overhead & Underground	Lodgewood Underground Cable
Land, Soils, Geology	Residual impacts are considered imperceptible.	Residual impacts are considered imperceptible.	Residual impacts are considered imperceptible.	Residual impacts are considered imperceptible.	Residual impacts are considered imperceptible.
Hydrology & Water Quality	Residual impacts are considered imperceptible and not significant	Residual impacts are considered imperceptible and not significant	Residual impacts are considered imperceptible.	Residual impacts are considered imperceptible and not significant.	Potential pre-mitigation impact on the Slaney River Valley SAC.
Population & Human Health	Temporary significant noise impact expected to occur at nearby dwellings during construction associated with excavation which may impact on residential amenity.	Temporary significant noise impact expected to occur at nearby dwellings during construction associated with excavation which may impact on residential amenity. Heightened impact on residential amenity in Myshall due to higher population density,	Temporary moderate noise impact expected to occur at nearby dwellings during construction which may impact on residential amenity. Visual presence of overhead line may impact on residential amenity at some dwellings. Route passes within 500m of approx. 241 dwellings.	Temporary significant noise impact expected to occur at nearby dwellings during construction associated with excavation which may impact on residential amenity.	Route passes within 500m of approx. 980 dwellings resulting in greater potential for impact on residential amenity during construction due to noise, dust and traffic impacts.
Material Assets	Much of the route can be installed in roadside verge resulting in less impact to road surfacing. Avoids N80 national route by horizontal directional drilling.	Much of the route can be installed in roadside verge resulting in less impact to road surfacing. Avoids N80 national route by horizontal directional drilling. Temporary impact on streets of Myshall and potential for disruption to services.	Requirement to cross the N80 national route may cause temporary impact on national road during construction.	Avoids N80 national route by horizontal directional drilling.	Majority of route to be installed in the public road due to presence of cobble walls.
Traffic & Transport	Avoids N80 national route by horizontal directional drilling. Temporary slight residual impact to traffic and	Avoids N80 national route by horizontal directional drilling. Temporary slight residual impact to traffic and	Temporary non-significant residual impact to traffic and transport during construction. Construction	Avoids N80 national route by horizontal directional drilling. Temporary slight residual impact to traffic and	Longer route results in slightly greater impact on traffic and transport due to a longer installation phase.

Environmental Consideration	Proposed Kellistown Underground Cable	Kellistown Underground Cable with Route Variant through Myshall	Kellistown Overhead Line	Kellistown Combination of Overhead & Underground	Lodgewood Underground Cable
	transport during construction.	transport during construction. Temporary moderate impact to traffic and transport in settlement of Myshall during construction.	period less in duration than the underground cable option. Potential temporary impact in N80 during construction.	transport during construction.	
Archaeology & Cultural Heritage	The grid connection works will not result in any residual impacts on cultural heritage resource.	The grid connection works will not result in any residual impacts on cultural heritage resource.	Greater potential for indirect impact on RMPs and NIAHs along the route due to visual intrusion of overhead line.	Potential for indirect impact on RMPs and NIAHs along the overhead line section of the route due to visual intrusion.	Potential impact to cobble walls lining the route.
Landscape & Visual	No expected impact.	No expected impact.	Visual impact associated with overhead line. Potential to impact on residential amenity and sensitive visual receptors.	Visual impact associated with overhead line section of the route. Potential to impact on residential amenity and sensitive visual receptors.	No expected impact.
Telecoms & Aviation	No expected impact	No expected impact	No expected impact.	No expected impact.	No expected impact
Substation Capacity	Acknowledgement of capacity at substation.	Acknowledgement of capacity at substation.	Acknowledgement of capacity at substation.	Acknowledgement of capacity at substation.	A number of existing and planned underground cables entering the Lodgewood Substation. Potential for thermal derating on any cables in proximity due to the existing cables, which may impact on carrying capacity of the proposed grid connection.

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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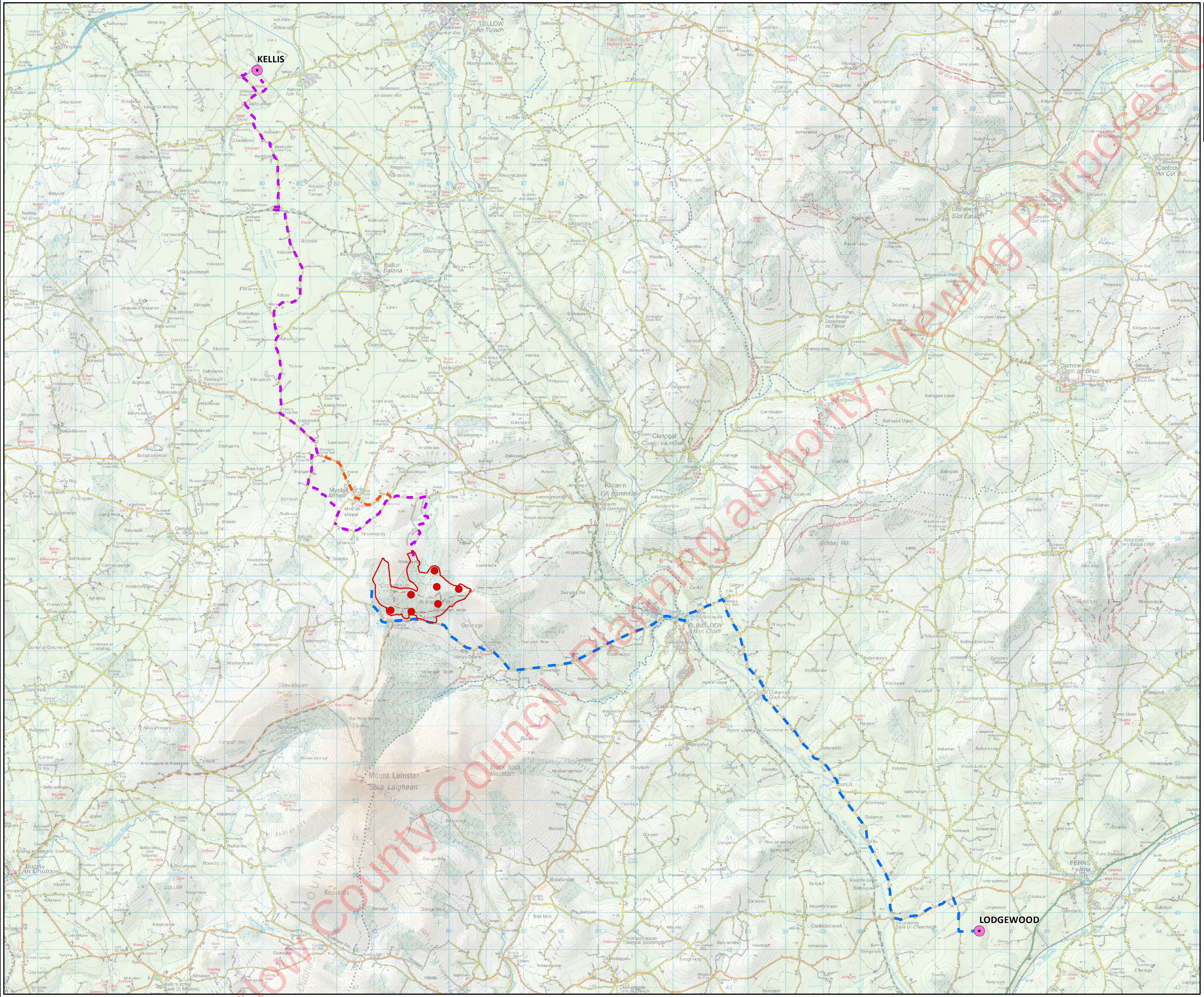

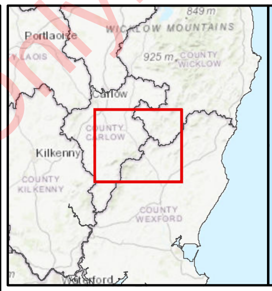

- Proposed Turbine Layout
- Proposed Development Boundary
- Substation
- Kellistown 220kV Substation Route
- Kellistown 220kV Substation Route Option B
- Lodgewood 220kV Substation Route

TITLE:	Grid Route Options
PROJECT:	Croaghaun Wind Farm
FIGURE NO:	2.7
CLIENT:	Coillte
SCALE:	1:100000
REVISION:	0
DATE:	03/12/2020
PAGE SIZE:	A3

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2.3.5.5 Offsite Substation

In order to complete the connection to the Kellistown Substation, a new substation building will be required adjacent the existing to allow for the voltage from the proposed wind farm grid connection to be 'stepped up' to 110kV. The works will comprise a substation compound which will be self-contained and positioned in a neighbouring field to that of the existing Kellistown substation. Two alternative locations have been considered for this new substation compound and have been assessed as part of this EIAR. These options are illustrated in Figure 2-8 below.

Both alternatives have similar environmental impacts in terms of visuals, land, hydrology and biodiversity, however, one option requires a greater amount of underground cable to be installed adjacent existing dwellings which may cause a greater temporary impact on residential amenity when compared to the alternative option. The final chosen design for the substation at Kellistown will be carried out by the network operator subject to upgrade requirements and the grid connection agreement, but will come within the parameters assessed in this EIAR. Both options are assessed in this EIAR.

Figure 2-8: Kellistown Substation Options

2.3.5.6 On-site Substation

When designing the on-site infrastructure for the proposed Croaghaun Wind Farm, it was considered important to find the optimal location. A substation location at the centre of the site was investigated due to its relatively flat topography and its proximity to each of the seven proposed turbines. This area is indicated in Figure 2-9.

The proposed substation and associated compound was later moved to the north of the site. This was in part due to the proximity to the grid route which exits the wind farm site at the north. This position is also secluded from the main walking trails at the wind farm site. The proposed substation position aims to avoid impact on recreation and amenity potential of the site for walking and hiking.

The alternative area considered as indicated in Figure 2-9 is proximate to walking trail areas and was therefore considered to potentially impact on the amenity value of the site. A comparison of potential residual environmental effects of the two options considered is provided in Table 2-8.

Figure 2-9: On-site Substation Alternative

Table 2-8: Comparison of Potential Residual Environmental Effects of On-site Substation Locations

Environmental Consideration	Proposed Substation Location	Alternative Area Considered for Substation
Air & Climate	Imperceptible impact during construction.	Imperceptible impact during construction.
Noise & Vibration	Slight and temporary impact during construction. Potential to produce noise during operation, however, not located adjacent to sensitive receptors.	Slight and temporary impact during construction. Potential to produce noise during operation which may affect adjacent recreation tracks.
Biodiversity	Imperceptible impact.	Imperceptible impact.
Ornithology	No potential impact envisaged.	No potential impact envisaged.
Land, Soils, Geology	No residual impact envisaged.	No residual impact envisaged.
Hydrology & Water Quality	No residual impact envisaged.	No residual impact envisaged.
Population & Human Health	Potential slight and temporary impact during construction due to noise.	Potential slight and temporary impact during construction due to noise. Potential impact to recreation use of the site due to presence of substation and compound located adjacent to walking tracks. Potential for noise from substation to impact on recreation activities.
Material Assets	Imperceptible impact to forestry resource as a result of felling.	Imperceptible impact to forestry resource as a result of felling.
Traffic & Transport	Imperceptible effect.	Imperceptible effect.
Archaeology & Cultural Heritage	No potential impacts envisaged.	No potential impacts envisaged.
Landscape & Visual	No potential impacts envisaged due to location in forested area.	No potential impacts envisaged due to location in forested area.
Telecoms & Aviation	No potential impact envisaged.	No potential impact envisaged.

2.3.5.7 Access Tracks

Alternative alignments of access tracks were considered throughout the evolution of the project. The proposed development aimed to use as much existing access tracks as possible to avoid environmental impact associated with tree felling and ground works. Therefore, the existing internal forestry tracks were utilised where possible. The assessment of the receiving environment identified a sensitive habitat at the east of the site consisting of Dry Siliceous Heath, as described in Chapter 8: Biodiversity.

As a result, the initial design of the access tracks which passed through this habitat were removed from the design to avoid potential impacts on this area. The tracks removed from the design are illustrated in red in Figure 2-10 below. To avoid impact, the access track for T6 was realigned and reduced, the access track for T4 was re-orientated and the track connecting T1 to T6 was removed from the design. Furthermore, the track which runs along the edge of this sensitive habitat at its southern boundary was moved south by 30m to avoid impact on the habitat.

This will require a new track to be laid, which is necessary to gain access to T1, T2, T4 and T7, while avoiding impact on the sensitive habitat. An environmental comparison of potential residual effects of the two access track options is presented in Table 2-10.

The access tracks as proposed are illustrated in Figure 2-10.

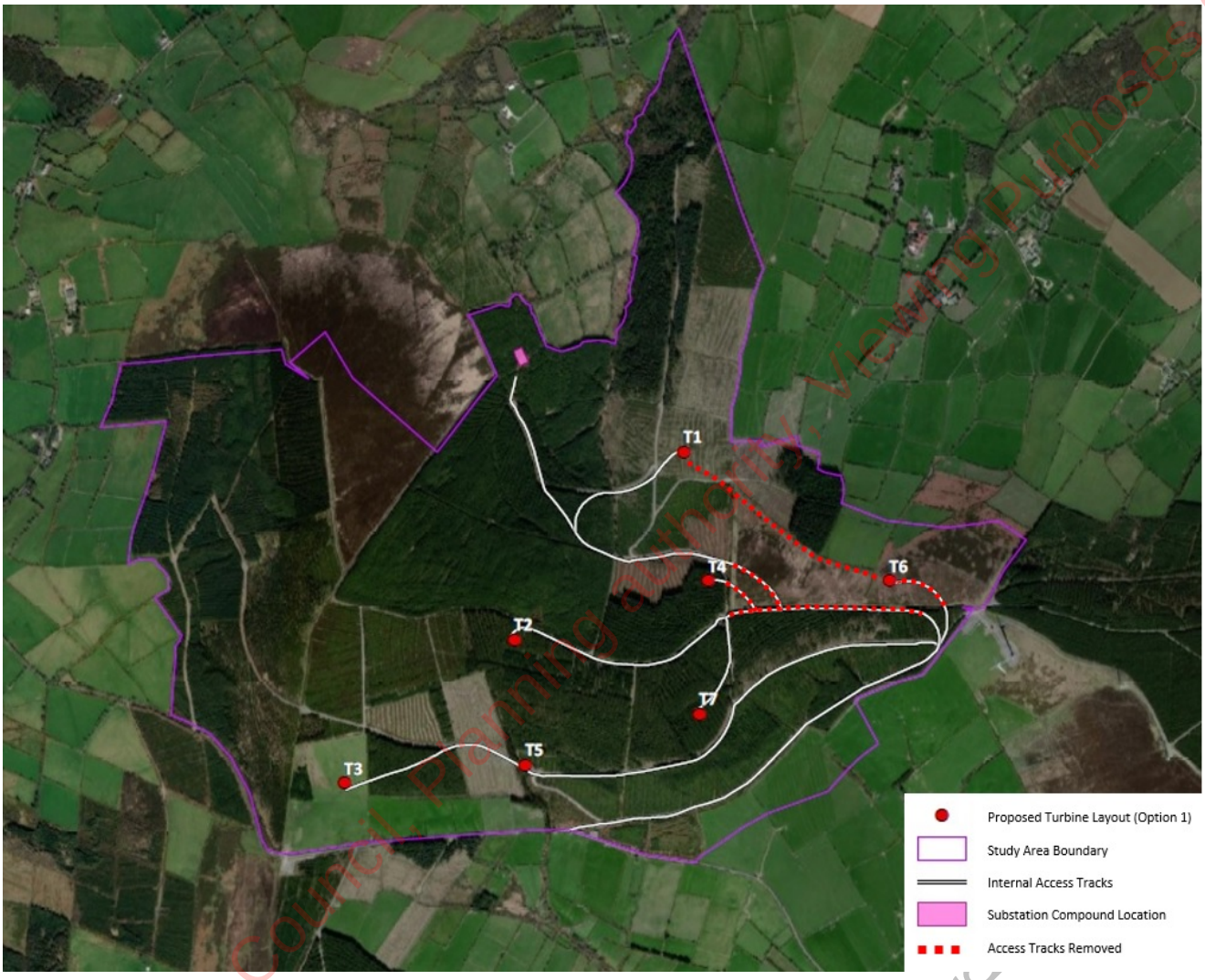

Figure 2-10: Alternative Access Tracks Considered

Table 2-9: Comparison of Potential Residual Environmental Effect of Alternative Access Tracks

Environmental Consideration	Proposed Access Track Layout	Alternative Access Track Layout
Air & Climate	Imperceptible impact during construction.	Imperceptible impact during construction.
Noise & Vibration	Slight and temporary impact during construction.	Slight and temporary impact during construction.
Biodiversity	Imperceptible impact. Existing tracks to be upgraded and small areas of felling required for new tracks.	Potential impact on sensitive Dry Siliceous Heath habitat due to requirement of new access tracks to traverse this area and an upgraded track to run along its southern boundary.
Ornithology	No potential impact envisaged.	No potential impact envisaged.
Land, Soils, Geology	No residual impact envisaged.	No residual impact envisaged.
Hydrology & Water Quality	No residual impact envisaged.	No residual impact envisaged.
Population & Human Health	No residual impact envisaged.	No residual impact envisaged.
Material Assets	Imperceptible impact to forestry resource as a result of felling.	Imperceptible impact.
Traffic & Transport	Imperceptible effect.	Imperceptible effect.
Archaeology & Cultural Heritage	No potential impacts envisaged.	No potential impacts envisaged.
Landscape & Visual	No potential impacts envisaged due to location in forested area.	Potential slight visual impact due to construction of new tracks at north east of the site where there is limited vegetation screening.
Telecoms & Aviation	No potential impact envisaged.	No potential impact envisaged.

2.3.5.8 35 Year Operational Life

Initially a 30-year operational life was considered for the proposed Croaghaun Wind Farm. This is largely in line with other permitted wind farm developments throughout the country. However, the lifespan of wind turbines allows for a 35-year operational life based on the emerging technological advancements in turbine manufacturing. Furthermore, it should be noted that section 7.2 of the Planning Guidelines 2006 states for the following:

> 'The inclusion of a condition which limits the life span of a wind energy development should be avoided, except in exceptional circumstances'

A 35-year operational period has also been considered when compared to a 30-year lifespan due to the long-term benefits to climate change and air quality.

As detailed in Chapter 6: Air & Climate, the proposed development will offset approximately 53,118 tonnes of CO2 emissions per annum. An additional 5-year operational period will therefore result in the offset of an approximate total of 265,590 tonnes of CO2.

A 35-year operational life will also have a positive impact on material assets by extending the offsetting of the use of fossil fuels for electricity production and increasing the amount of renewable electricity being supplied to the national grid, as required by EU renewable energy targets. This will also benefit Ireland's energy security for a longer period.

Potential negative impacts of a 35-year period of consent are consistent with a 30-year lifespan but extended in the short-term. These relate to residual short-term visual impact and short-term noise impacts on nearby residential receptors which are not considered significant. There are no impacts envisaged at the Grid Route (grid route and substation are to remain in place) or TDR during this period. It is therefore considered that a 35-year operational life will provide greater overall benefits, when compared to a 30-year operational life.

A comparison of the potential residual environmental impacts of the alternative project operational life considered is detailed in Table 2-10.

Table 2-10: Comparison of Potential Residual Environmental Impacts of Alternative Project Operation Life

Environmental Consideration	35-year Operation Life	30-year Operation Life
Air & Climate	Long-term positive impact on air quality and climate due to offset of CO2 emissions from fossil fuels. Additional 5-year offset to CO2.	Long-term positive impact on air quality and climate due to offset of CO2 emissions from fossil fuels.
Noise & Vibration	Long-term slight to moderate impact on nearby dwellings as a result of the operational noise. Short-term additional period of slight to moderate impact on these receptors.	Long-term slight to moderate impact on nearby dwellings as a result of the operational noise.
Biodiversity	Imperceptible and reversible impacts during operational phase.	Imperceptible and reversible impacts during operational phase.
Ornithology	Slight imperceptible reversible impact on bird species during operational phase.	Slight imperceptible reversible impact on bird species during operational phase.
Land, Soils, Geology	No residual impact envisaged.	No residual impact envisaged.
Hydrology & Water Quality	No residual impact envisaged.	No residual impact envisaged.
Population & Human Health	Positive health gain due to provision of additional recreation facilities. Long-term slight to moderate impact on nearby dwellings as a result of the operational noise. Short-term additional period of noise at nearby dwellings.	Positive health gain due to provision of additional recreation facilities. Long-term slight to moderate impact on nearby dwellings as a result of the operational noise
Material Assets	Long-term positive impact by offsetting use of fossil fuel. Greater offset due to additional period of operational phase.	Long-term positive impact by offsetting use of fossil fuel.

Environmental Consideration	35-year Operation Life	30-year Operation Life
Traffic & Transport	Imperceptible effect.	Imperceptible effect.
Archaeology & Cultural Heritage	No potential impacts envisaged.	No potential impacts envisaged.
Landscape & Visual	Slight to substantial-moderate visual impact, subject to viewshed as assessed in Chapter 15, with magnitude of impacts reducing with greater distance from the proposed project. Additional short-term visual impact as a result of extended operational life.	Slight to substantial-moderate visual impact, subject to viewshed as assessed in Chapter 15, with magnitude of impacts reducing with greater distance from the proposed project.
Telecoms & Aviation	No potential impact envisaged.	No potential impact envisaged.

2.4 Conclusion

This chapter of the EIAR has described the need for the development and the reasonable alternatives considered throughout the development process for the Croaghaun Wind Farm. The need for the development is established in Section 2.2 and it centres on providing renewable electricity to the Irish national grid, in line with European and national policy objectives, and the need to meet EU Renewable Energy targets and national targets as set out in the Climate Action Plan (2019).

A description of the reasonable alternatives in terms of project design philosophies, technology, size and scale for the development of the Croaghaun Wind Farm project is detailed in Section 2.3. This section sets out the evolution of the proposed development and the alternatives considered. The section details the strategic site screening process ie. the high-level considerations in finding a suitable site for a renewable energy project. The assessment of the suitability of the candidate site then considers the proposed site in terms of policy and other environmental constraints. Alternative renewable energy technologies were considered and a comparison of potential environmental effects of the alternatives was provided.

The alternative layouts of the proposed development were established through the project philosophy of mitigation by design. Alternative density and scales were considered the potential environmental impacts of various alternative turbine scales numbers were compared. The alternative grid connection options were examined, and the optimal option was chosen as a result of environmental assessment.

Alternatives were also considered for other individual elements of the project including the proposed on-site and off-site substations, the proposed access tracks and the proposed operational life of the project. These elements were arrived at through the avoidance of potential environmental impacts as detailed in the comparisons provided throughout section 2.3.

The final proposed layout of the Croaghaun Wind Farm as assessed throughout this EAIR is thought to be the optimal design which minimises impacts on the receiving environment, while providing significant renewable electricity to the national grid, in line with national energy and climate policy.

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