3 ALTERNATIVES CONSIDERED

This chapter has been reviewed and updated where necessary considering any subsequent modifications, updates and additional information acquired for the Further information Request issued by Louth County Council (LCC) on the 6th February 2025 (Reference No: 2460766). It is noted that for ease of reference all changes from the original chapter are shown in orange. Where text has been removed it is shown as ~~strikethrough~~.

Following a review of the proposed development based on the Request for Further Information, it has been determined that site entrance 4 is not required for the construction, operation and decommissioning of the proposed development, as all works can be accommodated via the proposed site entrances 1-3. Therefore, it is proposed that entrance 4 will not be taken forward as part of the proposed development, and the initially proposed use of entrance 4 will instead be accommodated at entrance 2. The authors of all EIAR chapters have reviewed the revision, and no implications for the environmental effects and selection of the final layout presented in this chapter have been identified.

3.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIAR) provides 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. Alternatives were assessed taking commercial, construction, operational, decommissioning and key environmental constraints into consideration.

This chapter of the EIAR is supported by Figures in **Volume III** and the following Appendix documents provided in **Volume IV**:

- **Appendix 3.1** Alternative Grid Route and Turbine Delivery Route options
- **Appendix 3.2** Grid Route Feasibility Report
- **Appendix 3.3** Tech Note UGC Route from Drybridge to R-132- Technical Note 3

3.2 STATEMENT OF AUTHORITY

Jennings O'Donovan & Partners Ltd. (JOD) have extensive experience in all aspects of wind farm development, from design and planning stages through to construction. JOD have been active as engineering consultants in the wind energy market in Ireland since 1998 and have completed numerous wind farm projects, varying from single wind turbine installations to large-scale, multi-turbine developments with a total of over 2,000 MW generation capacity.

This section has been prepared by Mr. Ryan Mitchell of JOD. Mr. Mitchell has a Bachelors' Degree in Animal Conservation and Biodiversity, has a strong proven background in ecology and civil engineering project management with 7 years' of experience working in the sector. He is experienced in report writing, EIAR chapter writing and project management working on EIA Reports (EIAR) for wind farm developments in Ireland.

The chapter has been reviewed by Mr. David Kiely of JOD. Mr. Kiely has 42 years' experience in the civil engineering and environmental sector. He has obtained a bachelor's degree in civil engineering and a Master's in Environmental Protection, has overseen the construction of over 60 wind farms and has carried out numerous soils and geology assessments for EIARs. He has been responsible for the overall preparation of in excess of 60 EIARs.

This Chapter was reviewed and updated considering any subsequent modifications, updates and additional information acquired for the Further information Request issued by Louth County Council (LCC) on the 6th February 2025 (Reference No: 2460766) by Mr. Ryan Mitchell an Environmental Scientist at JOD.

3.3 METHODOLOGY

3.3.1 Requirements for Alternatives Assessment

Annex IV of the EIA Directive as amended (Information Referred to in Article 5(1) (Information for the Environmental Impact Assessment Report) elaborates as follows*:*

"2. 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".

The '*Guidelines on the information to be contained in Environmental Impact Assessment reports'* (EPA 2022) published by the Environmental Protection Agency (EPA) in May (2022) states 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".*

The EPA guidance documents on EIAR preparation[1], stipulates the following:

[1] EPA. (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports.

"The presentation and consideration of the various alternatives investigated by the applicant is an important requirement of the EIA process."

The alternatives can include*:*

- *"alternative locations*
- *alternative layouts*
- *alternative designs*
- *alternative processes*
- *alternative mitigation measures"*

The objective is for the Developer to present 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 Noted. of the project on the environment.

In an effective EIA process, different types of alternatives may be considered at several key stages during the process. As environmental issues emerge during the preparation of the EIAR, alternative designs may need to be considered early in the process or alternative mitigation options may need to be considered towards the end of the process. These various levels of alternatives are set out in chapter.

In accordance with the requirements of the legislation and guidance, this chapter addresses alternatives under the following headings:

- 'Do Nothing' Option
- Strategic Site Selection
- Alternative Wind Farm Design and Layout
- Alternative Turbine Numbers and Specifications
- Alternative Grid Connection
- Alternative Renewable Energy Technologies
- Alternative Turbine Haul Route
- Alternative Mitigation Measures

When considering a wind farm development, given the intrinsic link between layout and design, the two will be considered together in this chapter.

3.3.2 Approach to Alternatives

The Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (European Union, 2017) states that reasonable

alternatives *"must be relevant to the proposed project and its specific characteristics, and resources should only be spent on assessing these alternatives"* and that *"the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative"*.

3.4 'DO-NOTHING' ALTERNATIVE

The EPA 2022 guidance states "T*he 'do-nothing' alternative is a general description of the evolution of the key environmental factors of the site and environs if the proposed project did not proceed. It is similar to but typically less detailed than the 'likely future receiving environment' description discussed in section 3.6 Describing the Baseline*."

"EU guidance (EU, 2017) states that this should involve the assessment of "an outline of what is likely to happen to the environment should the Project not be implemented – the so-called 'do-nothing' scenario'."

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 as detailed in **Chapter: 4 Planning Policy**. The binding EU targets have been transposed into Irish National Policy in the 2024 Climate Action Plan which commits to a target 9 GW of onshore wind by 2030. This demonstrates the significance of wind energy in the Irish energy context and highlights the need for the proposed Kellystown Wind Farm in reaching both EU and national renewable energy targets.

Ireland is obliged under the Renewable Energy Directive EU/2023/2413 amended to ensure that 42.5% of the total energy consumed in heating, electricity and transport is generated from renewable resources by 2030. This is in order to help reduce the nation's CO_2 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 (2024) which aims to:

- Reduce CO_2 eq. emissions from the electricity sector by 62-81%.
- Deliver an early and complete phase-out of coal and peat fired electricity generation. (Note although peat-fired electricity generation has ceased in Ireland, coal and oil fired plants are still operational. Tarbert Power Station (620 MW) was scheduled to close by 2023, and Moneypoint Power Station (915 MW) was scheduled to close by 2025. These closures have been delayed arising from concerns about security of electricity supply.

This delay means that more carbon emissions will arise. It highlights the urgency of constructing this and other wind farms).

- Increase electricity generated from renewable sources to 80%, including:
  - 9GW of onshore wind energy.

Furthermore, the Climate Action and Low Carbon Development Act 2015 as amended by the Climate Action and Low Carbon Development (Amendment) Act 2021) will act to reduce 51% emissions over a ten-year period to 2030, in line with the programme for Government which commits to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieving net zero emissions by 2050.

Under a 'Do Nothing' alternative, the Project will not be constructed. The land upon which Project will occur would remain unchanged. The main land use of the Site would remain as commercial forestry and agriculture. Consequently, the environmental impacts, identified in the EIAR, positive and negative, would not occur. However, in the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Louth's wind energy resource would be lost at this Site.

The Project's contribution to EU and National renewable energy and greenhouse gas reduction targets would be lost. This may result in the nation incurring significant financial penalties from the EU if targets are not achieved.

The Development has the potential to prevent approximately between 33,554 and 42,384 tonnes of CO_2 emissions per annum, or between 1,174,390 tonnes and 1,483,440 tonnes of CO_2 emissions will be displaced over the proposed 35 year lifetime of the wind farm, see **Chapter 18: Air and Climate** for details on the Carbon Calculator method. This would otherwise be released to the atmosphere through the burning of fossil fuels in the "Do-Nothing" scenario. The Project's contribution to reducing CO_2 emissions would be lost, thereby reducing Ireland's contribution to the Paris Agreement 2015 targets. This will result in continued negative impacts to air quality and climate.

According to EirGrid Group's All-island Generation Capacity Statement 2021 – 2030 (EirGrid, 2021), the growth in energy demand for the next ten years on the Island of Ireland will be between 18% and 43%. 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 production

and may impact on economic growth if energy demand cannot be met. The delays in closing Tarbert and Moneypoint means we continue to rely on imported fossil-fuels with unpredictable pricing, a vulnerable supply chain and higher carbon emissions.

Under the "Do-Nothing" scenario, the socio-economic benefits associated with the Project will be lost. These benefits include between 41 to 54 No. jobs during the construction phase of the project, and between 2 – 3 long-term jobs once operational including Habitat management Plan monitoring. 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 within the vicinity of the Project.

The potential environmental effects of the 'Do-Nothing' Alternative when compared against the chosen option of developing a renewable energy project at this Site are presented in **Table 3.1**. Refer to each respective chapter for full details of residual impacts.

Table 3.1: Environmental effects of 'Do-Nothing' compared with a wind farm development

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Population & Human Health	The assessment has not identified any likely significant effects from the Proposed Development on population and human health. This includes all aspects of the construction, operation and decommissioning of the Proposed Development (Wind Farm Site, TDR and GCR) on the receiving environment in terms of Population and Human Health, namely, economic activity, employment, land use, tourism and human health. Long-term positive economic benefit to local area due to job creation and Community Benefit fund. Further details can be found in Chapter 5: Human Health and Population - Section 5.5.	No increase in local employment and no financial gains for the local economy or community via the community benefit fund.
Terrestrial Ecology	The strict mitigation measures which will be enforced to maintain water quality within on-site drains and local watercourses during the Construction, Operational and Decommissioning phases of the Proposed Development will ensure that there will be no	The ecology of the Site would be expected to remain similar as at present though any increase in grazing pressure could be detrimental to the quality of the Annex 1 Habitat Drumshallon lough cNHA habitat within the site.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
	significant residual effects on water quality or aquatic habitats and species, including otter. As potential effects on European designated sites as a result of the Proposed Development would arise from contaminants carried within watercourses, it follows that there will be no likely significant effects on identified designated sites (European and National) with hydrological connectivity with the Proposed Development site. Further details can be found in Chapter 6: Terestrial Ecology - Section 6.7	
Aquatic Ecology	The project may result in the degradation of water quality in aquatic habitats within and downstream of the Site, however the likelihood of emissions to water occurring is significantly reduced due the proposed mitigation measures. Residual effects on fish and fish habitat are not predicted to be Significant. Further details can be found in Chapter 9: Aquatic Ecology (**Error! Reference source not found.** - **Error! Reference source not found.**).	If the development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'Do-Nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices.
Bats	During construction there will be no direct effects in the form of removal of bat roosting features. Through avoidance during the design stage, there will be no removal of features determined to have a likelihood of roosting bats such as those in the mature treeline. With the implementation of mitigation measures and embedded mitigation including bat buffers there will be no residual significant effect due to collision and barotrauma for common and soprano pipistrelles, *Myotis* sp., and brown long-eared bat at a local scale during the operational phase. With the implementation of mitigation measures there will be no residual significant effect during the decommissioning phase	Without the proposed wind farm development proceeding, it is expected that the present main land uses on Site, namely livestock grazing, Silage and forestry, will continue. It is possible that further afforestation would occur on the Site in the future.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
	Further details can be found in Chapter 7: Bats - Section 7.7.	
Ornithology	Slight negative (imperceptible/not significant) impact on birds namely Black-headed gull, Common gull, Herring gull, Peregrine, Snipe, Lesser black-backed gull and Kestrel through Disturbance/displacement and habitat loss during construction and Disturbance/displacement, collision risk and barrier effects. Further details can be found in Chapter 8: Ornithology - Table 8.23: Summary of effects.	Without the proposed wind farm development proceeding, it is expected that the present main land uses on Site, namely livestock grazing, Silage and forestry, will continue. It is possible that further afforestation would occur on the Site in the future.
Soils & Geology	The residual impacts on the soils and geology environment as a function of the Development is that there will be a change in ground conditions at the Site with natural materials such as subsoil and bedrock being replaced by concrete, subgrade and surfacing materials. This is a localised, negative, moderate significance at a local scale. Further details can be found in Chapter 10: Soils and Geology – Section 10.6.	Should the proposed development not proceed, the existing land-use practices will continue with associated modification of the existing environment, including the underlying soils and geology, through agriculture and commercial forestry.
Hydrology & Hydrogeology	Non-significant impacts following implementation of mitigation measures. Further details can be found in Chapter 11: Hydrology – section Table 11.20.	Should the proposed development not proceed, the existing land-use practice of commercial afforestation and agricultural activities will continue with associated gradual alteration of the existing environment and associated pressures on surface water and groundwater quality.
Air & Climate	During construction and decommissioning stages there will be a slight negative impact locally to the air quality due to dust emissions. However, a Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels and the net displacement of between 33,554 and 42,384 of CO_2 per annum. Further details can be found in Chapter 18: Air and Climate – section 18.4.8.	There will be no improvement in air quality or a reduction of greenhouse gas emissions. By the Development not proceeding it will not assist in achieving the renewable energy targets set out in the Climate Action Plan. As a result, fossil fuel power stations will be the alternative to provide the required quantities of electricity resulting in greenhouse gas and other air pollutant emissions.
Noise & Vibration	Non-significant to slight temporary noise and vibration impacts associated with construction activities. Temporary slight negative impact along the grid route at certain dwellings during construction. The operational noise	There will be no change in noise and vibration emissions.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
	impacts are imperceptible. Further details can be found in Chapter 13: Noise – section 13.5.3 -13.5.5.	
Landscape & Visual	The scale of the proposed development will be well assimilated within its landscape context without undue conflicts of scale with underlying landform and land use patterns. Key views will have 'Slight' and 'Slight-imperceptible' likely visual impact significance. It is not considered that the Proposed Development will generate significant visual impacts. Further details can be found in Chapter 7: Landscape and Visual section 12.6.3.	In this instance, the existing forestry plantations contained within the Site would continue to be planted and felled in rotation in the do-nothing scenario. As this aligns with the current scenario, no additional landscape or visual impacts are likely to occur.
Material Assets	**Agriculture** slight negative and temporary for the duration of the construction and negligible for the operational lifespan of the Project. For decommissioning phase, the residual effect will be slight negative and temporary for the duration of the phase. Further details can be found in Chapter 14: Material Assets – section 14.5.6. **Forestry** A permanent slight negative impact on the existing forestry land use during the construction, a permanent slight negative during the operation phase and permanent slight negative during the decommissioning phase of the Project. Further details can be found in Chapter 14: Material Assets – section 14.6.5. **Telecommunication** The impact on telecommunications during the construction and decommissioning phase of the Project due to electromagnetic emissions from the Proposed Development is likely to have an imperceptible effect. Turbines will have impact on telecommunications during the	No provision of additional renewable electricity generation infrastructure in the local area. This will result in no potential impact on Agriculture, Forestry, Telecommunication, Electricity Networks, Quarry and Utilities.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
	operational phase **not-significant negative and long-term** in duration. Further details can be found in Chapter 14: Material Assets – section 14.7.10. **Electricity Networks** The residual impact on electricity during construction is likely to have a slight brief negative effect. The residual impact on electricity during the operational phase is likely to moderate positive and long-term. As the electrical transmission infrastructure will remain in place, the residual impact on electricity network during the decommissioning phase is likely to be slight positive and long-term. Further details can be found in Chapter 14: Material Assets – section 14.8.5. **Quarry** The residual impact on quarry resources during construction is likely to have a short-term slight negative effect. The residual impact on quarry resources during the operational phase is likely to long-term imperceptible negative. Further details can be found in Chapter 14: Material Assets – section 14.10.7. **Utilities** The residual impact on waste facilities is likely to have a short-term not significant negative effect during construction, a long-term imperceptible effect during the operational phase and short-term not significant effect during the decommissioning phase. Further details can be found in Chapter 14: Material Assets – section 14.11.8.	
Cultural Heritage	The Project will result in a range of long-term, indirect negative impacts on the wider setting of archaeological and architectural heritage receptors within and beyond the environs of the Site.	There will be no potential for Cultural Heritage impacts.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
	These indirect operational stage impacts range from Not Significant to Very Significant in terms of significance of effect. Further details can be found in Chapter 15: Cultural Heritage - **Error! Reference source not found.**.	
Traffic and Transportation	Moderate localised short-term impact due to construction and decommissioning activities. Further details can be found in Chapter 16: Traffic and Transport – section 16.6.	There will be no change to the existing traffic and transport context
Shadow Flicker	No residual impacts as the proposed development is committing to zero shadow flicker. Further details can be found in Chapter 17: Shadow Flicker – section 17.2.9.5.	There will be no change as the proposed development is committing to zero shadow flicker
Major Accidents	The risk of a major accident and/or disaster arsing during the construction, operation or decommissioning phases of the Proposed Development is considered 'low'. Further details can be found in Chapter 19: Major Accidents – section 19.4.3: Summary of effects.	There will be no change as it is expected that the present main land uses on Site, namely livestock grazing, Silage and forestry, will continue. It is possible that further afforestation would occur on the Site in the future.

3.5 STRATEGIC SITE SELECTION

3.5.1 Strategic Site Screening

The following section details the site selection process and outlines the rationale for selecting the Proposed Development site as the preferable location for the Proposed Kellystown Wind Farm.

As set out in **Section 1.3** of this EIAR the applicant, EDF Renewables Ireland Ltd., hereafter to referred to as EDF, is part of one of the world's largest electricity companies. The EDF team in Ireland has a wealth of experience in bringing complex development projects to fruition, across onshore and offshore wind, solar PV and battery storage technology, and is supported by more than 400 colleagues in the UK. The process of site screening and project selection is undertaken in- house by the development team, which comprises planners, engineers, environmental scientists, GIS specialists and project managers ensuring that a multi-disciplinary approach is undertaken during the process.

EDF recognises the complexities associated with the development of renewable energy sites and has developed a large GIS database of information that allows the company to identify and screen potential sites. Using the GIS database, the development team sought to identify lands within Ireland to bring forward for a renewable energy development. The GIS database drew upon a wide array of key spatial datasets including the following:

- Available wind resource;
- Access to grid infrastructure;
- Access to transport infrastructure;
- Environmental designations such as Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA);
- Prevailing planning policy;
- Proximity to residential dwellings;
- Proximity to existing renewable energy projects;
- Archaeological designations; and
- Landscape and visual designations.

In addition, the development team also had regard to European and national guidelines, regional and local development plans, wind energy guidelines, future wind farm planning applications and any relevant case law. When considering the type of renewable energy project to bring forward to development, the development team had regard to the Climate Action Plan 2024, which includes an ambitious target of deploying 9, 000 MW of onshore wind by 2030. According to recent figures published by Wind Energy Ireland, 4,767 MW of onshore wind capacity was available in September 2024, which equates to a 4,233 MW shortfall of onshore wind to be delivered by 2030. Delivering on these targets therefore requires an expansion of the supply of onshore wind generation assets to ensure that Ireland can deliver on the national decarbonisation targets. EDF Renewables is committed to helping the Irish Government to achieve its target of 9,000 MW of onshore wind by 2030 and has strategic plans to have 350-500MW of onshore wind projects operational by 2030. On that basis, the development team focused on selecting a site with the potential to accommodate a wind energy development, with the least likelihood of resulting in negative environmental effects in the long-term.

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

- Phase 1 – Screening

- Phase 2 – Proximity to National Grid

Phase 1 –Screening

This stage in the selection process sought to identify lands within Ireland, with the least likelihood of resulting in negative environmental effects in the long-term, and suitable for the development of the wind farm. On that basis, the following screening criteria was applied:

- Planning policy governing the site with specific regard to the local County Councils Wind Energy Strategy;
- Proximity to residential dwellings plus a setback distance from occupied dwellings of 4 x tip height from a turbine (i.e., 720m in this case)
- Access to existing transport corridors
- Proximity to110kV/220kV/400kV Electricity Transmission Corridors
- Proximity to watercourses/Waterbodies plus 50m buffer
- Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA)
- Existing wind farms developments and lands committed to permitted/proposed developments.
- Protection of sensitive landscapes and visual amenity
- Protection of cultural/archaeological heritage;

Sufficient areas of unconstrained land to accommodate a windfarm development.

Results of the Screening Process

The Proposed Kellystown Wind Farm site was identified for potential development following a detailed desktop screening appraisal, firstly at national level and then at regional and county level of all available sites which met the criteria referenced above. Following the screening exercise, the top-ranking sites were selected to progress with further detailed site-specific screening appraisals to determine initial feasibility for a planning application. The application of the above criteria to identify a site relevant to the project and its specific characteristics, resulted in the selection of a candidate site located in Co. Louth, 8.3km north of Drogheda, as a candidate site to be brought forward for more detailed analysis. The site is now known as the Proposed Kellystown Wind Farm.

The Proposed Kellystown Wind Farm sits in an area with suitable unconstrained land and a high available wind resource. The Proposed Wind Farm site is subject of two zoning designations, *"Open to Consideration"* and *"Preferred Areas"* for wind energy development according to Map 10.1: Areas suitable for Wind Development in the Louth County

Development Plan 2021-2027. This designation implies a recognition of the potential for wind energy development in the area, balanced against environmental, social, and economic considerations. The Proposed Kellystown Wind Farm does not contain areas designated a Special Area of Conservation (SAC), Special Protected Area (SPA) or Natural Heritage Area (NHA). The Proposed Wind Farm Site is located entirely within the 'Uplands of Collon and Monasterboice' Landscape Character Area, which is designated as having Regional Importance. This designation is considered to have a medium level of sensitivity and is therefore considered to have the capacity to absorb development without significantly changing its character. A Cultural Heritage desktop analysis was undertaken during the screening process, and it was considered that the Proposed Kellystown Wind Farm layout could be designed to avoid the locations of known and potential heritage receptors. The low population density allows for appropriate setback distance from residential dwellings. This set back distance minimises the potential disturbance to residential amenity which may be caused as a result of construction activities, as well as visual impacts, and noise during the operational phase.

A key consideration for the selection of the Proposed Windfarm Site was the access to existing transport corridors. The major transport corridor of the M1 passes to the west of the site (within 2km). The N2 passes the site in a general north/south direction c. 7.7km to the west. The N51 passes through the southwest quadrant of the study area near Drogheda, in a southwest to northeast direction c. 6.9km away. The N33 connects the M1 to the N2, and is approximately 8km to the northwest of the site. The Regional Roads R132 and R170 pass the site in north/south and west/east directions at distances of c. 1.4km and 2.5km respectively. The nearest road to the site boundary is the L2275 local road which passes the site to the east at a distance of approximately 800m. Other unnamed local roads service the site as part of the local road network in the surrounding area. The connectivity of the subject site with the existing regional and national road network was considered to have the potential to contribute to avoiding significant and further reaching construction activities associated with the introduction of new roads infrastructure. It is considered that this has the potential to reduce impact upon the land, soils and local biodiversity.

Other sites that also emerged from the screening process, for which EDF are in the process of preparing separate planning applications are located in Co. Clare and Co. Carlow.

EDF intend to bring forward all these sites for wind energy development as all were considered to be viable sites for a wind energy development. Each are projects in their own

right which will be subject to EIA. As such a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen options with regards to their environmental impacts will be provided in the EIAR accompanying the applications for the same.

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

Suitability of the Candidate Site

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

- Wind Speeds
- Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA)
- Available Set Back from Sensitive Receptors
- Residential Density
- Planning Policy
- Cumulative Developments, including Kilsaran Quarry

Wind Speeds

The Irish Wind Atlas produced by Sustainable Energy Authority of Ireland shows average wind speeds for the country. A suitable wind regime and consistent wind speeds are required for the development of a wind energy project. Wind speeds in the northeast of the country are typically between (6.4m/sec at 30m, 7.90m/sec at 75m, 8.4m/sec at 100m and 9.2m/sec at 150m/s). While the wind resource of Ireland's northeast is lower than that of coastal and elevated regions, it is still very good in comparison with many parts of Europe. On-site monitoring of the wind resource, which is ongoing, will further verify that with a sufficient turbine height and blade diameter, the wind resource of the site is commercially viable.

Designated Sites

The Proposed Development site is not within or adjacent any areas designated as a Special Area of Conservation (SAC), Special Protected Area (SPA) or Natural Heritage Area (NHA). The Project is not located within any area designated for ecological protection. The nearest Natura 2000 site, i.e., SPA or SAC to the Project are the Boyne Estuary SPA (ID: 004080), which is located approximately 7.7km southeast of the Proposed Development and the Clogher Head SAC (ID: 001459), which is located approximately 8Km west of the Proposed Development. There are no Natural Heritage Areas (NHAs) within a 15 km radius of the Proposed Wind Farm Site. The closest NHA is the Skerries Islands NHA (Site Code: 001218), which is located approximately 28km southeast. There is a Candidate Natural Heritage Area (cNHA) Drumshallon Lough located within the Site. The Drumshallon Lough wetland system comprises the highest value ecological feature within the Study Area. This was therefore considered as a key constraint and was carefully avoided when commencing the design stage of the Proposed Development.

Residential Density

The Applicant sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity, the study area has emerged as suitable to accommodate the Proposed Development. The surrounding area is largely rural with isolated residences and farmsteads and ribbon development throughout the area. The Site is located in the Electoral Divisions (EDs) of Mullary and Clogher (49.6km²). The population density of these EDS is;

- Clogher ED 68.8 persons per square kilometre
- Mullary ED 76.3 persons per square kilometre

The average population density across the whole of Ireland is 72 persons per square kilometre. Across County Louth the average population density per square kilometre is significantly higher than the national average at 169.6 persons per square kilometre Therefore, the EDs of Mullary and Clogher, where the Site and surrounds are located, have a relatively low population density in contrast to the County-wide population densities which are greater than 2 times that of the study area for the same period.

Regarding setback distances, SPPR2 of the Draft Revised Wind Energy Development Guidelines December (2019) mandates a minimum setback of 4 times the wind turbine's tip height, or at least 500 meters, from residential properties for visual amenity, with some flexibility for small-scale, on-site energy generation developments. Section 6.18.2 of the Guidelines states that an exception may be provided for a lower setback requirement from existing or permitted dwellings or other sensitive properties to new turbines where the

owner(s) and occupier(s) of the relevant property or properties are agreeable to same. It notes that the noise requirements of these Guidelines must be capable of being complied with in all cases. In such exceptional reduced setback situations, the relevant parties must provide written confirmation to the satisfaction of the planning authority that they have agreed to a reduced setback and have no objection to the proposed wind energy development.

The current Wind Energy Development Guidelines (2006) do not specify exact separation distances between wind turbines and dwellings. Instead, the guidelines focus on a more comprehensive approach, considering various factors such as the size of the turbines, local topography, and the existing environment. Notably, they provide specific recommendations for mitigating certain impacts: shadow flicker at neighbouring dwellings should not exceed 30 hours per year or 30 minutes per day when within 500 meters of a turbine (Section 7.14). Additionally, the guidelines indicate that noise impacts are generally not significant if the nearest turbine is more than 500 meters away from any noise-sensitive property (Section 5.6).

The proposed development involves the installation of 5 no. wind turbines, each adhering to specific dimensions as detailed in the EIAR. These turbines are of the three-bladed, horizontal-axis type, with varying specifications: tip heights range from 179.5m to 180m, rotor diameters from 149m to 163m, and hub heights from 98m to 105m.

Considering the setback distances specified in the Draft Revised Wind Energy Development Guidelines from December 2019 (SPPR2), which mandate a setback distance for visual amenity purposes of four times the tip height of the relevant wind turbine with a mandatory minimum of 500 meters from any residential property, alongside the current Wind Energy Development Guidelines (2006) indicating that noise impacts are generally not significant if the nearest turbine is more than 500 meters away from any noise-sensitive property, the proposed development requires a minimum setback distance of 720m. This requirement is based on the tallest proposed turbine, which has a tip height of 180m.

As detailed in **Chapter 2: Description of the Proposed Development**, **Section 2.4.1** of the EIAR, the proposed layout was designed to achieve an optimal separation distance between the dwellings and the proposed turbines, providing a minimum separation distance of 720m between turbines and the nearest dwellings. In accordance with Section 6.18.2 of the Draft 2019 Guidelines, 4 no. properties are owned by landowners involved with the Project and have agreed to a reduced setback distance with the Applicant. It is worth noting

that the properties availing of the exception are all in excess of the mandatory minimum setback of 500 meters, with the closest dwelling located 552m from Turbine 05. The remaining 3 no. dwellings are setback in excess of 500m, with a setback of 563m, 686m and 689m from Turbine 02. Please refer to Figure 1.3. of the EIAR, which illustrates all sensitive receptors located within 2km of the proposed turbines.

In light of the foregoing, it is considered that the separation distances between the proposed turbines and residential dwellings complies with both the current Wind Energy Guidelines (2006) and the Draft Revised Wind Energy Development Guidelines 2019, ensuring that the project adheres to established standards for minimising impact on neighbouring properties regarding noise and visual impact.EDF are committed to ensuring that shadow flicker from the Proposed Development would not significantly impact the residential amenities of surrounding properties. As standard across all projects, EDF implement mitigation measures to cease operation of the turbines during periods of potential shadow flicker to ensure that no significant residual shadow flicker effects are experienced at any sensitive receptor within 10 rotor diameters of a turbine. In that regard, the Proposed Kellystown Wind Farm will comply with the recommended limits of 30 hours per year and 30 minutes per day detailed within the Wind Energy Development Guidelines (2006) and the zero shadow flicker policy as set out in the Draft Revised Wind Energy Development Guidelines (2019).

Having reviewed the settlement patterns in the vicinity of the Site, and in particular considering that adequate set back distances to existing dwellings could be achieved, the Proposed Site emerged as suitable to accommodate the proposal. The low population density surrounding the Proposed Site provides a sufficient area of unconstrained land to accommodate a windfarm development allowing for a greater number of turbines to be constructed while maintaining appropriate setback distances from dwellings as set out in the Draft 2019 Wind Energy Development Guidelines.

Planning Policy

As detailed in Chapter 4 of the EIAR, Planning Policy, there is a positive planning context for the Proposed Development as it supports national policy with regard to renewable energy provision and national renewable electricity targets. The Proposed Development is compliant with International, European and National policy on energy security, emissions reductions and renewable energy production. The Climate Action Plan 2024 sets out a detailed roadmap designed to increase the proportion of renewable electricity up to 80% by 2030, including a target of 9 Gigawatts of onshore wind energy by 2030. The proposed

pathway includes a more rapid build-out of renewable generation capacity, including wind power generation technologies. The proposed 5 no. wind turbines have an estimated maximum export capacity (MEC) of 28.5 – 36MW of renewable electricity through the indigenous wind resource at the Site, depending on the final turbine technology installed. It is considered that such development would contribute to achieving the Climate Action Plan's target of achieving 80% renewable electricity and reducing greenhouse gas emissions by 51% by 2030. The nature and export capacity of the proposed development accords with National Policy Objective 55 of the National Planning Framework (NPF), which seeks to promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050.

At a regional level, the Regional Spatial & Economic Strategy for the Eastern and Midland Regional Assembly supports the delivery of renewable energy stating that "The Strategy supports an increase in the amount of new renewable energy sources in the Region. This includes the use of wind energy – both onshore and offshore, biomass, and solar photovoltaics and solar thermal, both on buildings and at a larger scale on appropriate sites in accordance with National policy and the Regional Policy Objectives outlined in this Strategy". The nature of the proposed development is consistent with this objective.

At local level, the Louth County Development Plan 2021-2027 supports the development of Wind Energy projects in appropriate areas. The Louth County Development Plan supports the concept of generating renewable energy at 'local' level and the significant contribution that wind energy can make as a clean sustainable solution to energy requirements and its vital role in helping achieve national targets in relation to fossil fuel reductions and consequently greenhouse gas emissions with Objective S04 stating the following:

> "*Transition to a low carbon and climate resilient County supporting energy efficiency and reducing energy demand, through a combination of mitigation and adaption responses to climate change. This includes for increased usage of renewable energy through developing indigenous resources, supporting the transition to a low carbon economy by 2050, ensuring flood risk management. The Council will work with other bodies and organisations as appropriate, to identify and help protect critical infrastructure".*

The Proposed Development would therefore be integral to contributing to the transition to a low carbon and climate resilient County in accordance with the policy objectives set out in the Louth County Development Plan 2021-2027.

The Proposed Development is subject of two zoning designations, "Open to Consideration" and "Preferred Areas" for wind energy development according to Map 10.1: Areas suitable for Wind Development in the Louth County Development Plan 2021-2027. According to Objective IU 58, the placement of wind farms and related infrastructure in "Preferred Areas" as specified on Map 10.1 will be encouraged, and the Council will prohibit such development in designated "No-go Areas," and potentially consider, after appropriate assessment, installing wind energy infrastructure in areas marked as "Open for Consideration." The site's designation as 'Preferred Areas' and 'Open to Consideration' for wind farm developments underlines its suitability for this type of project. This designation implies a recognition of the potential for wind energy development in the area, balanced against environmental, social, and economic considerations.

In terms of landscape policy, the Proposed Wind Farm Site is located entirely within the 'Uplands of Collon and Monasterboice' Landscape Character Area, which is designated as having Regional Importance in the Louth County Development Plan 2021-2027. This designation is considered to have a medium level of sensitivity and is therefore considered to have the capacity to absorb development without significantly changing its character. There are three designated views and prospects within the wider vicinity of the site, Callystown to Clogherhead, Brownstown southwards over Areas of High Scenic Quality towards Drogheda, and Newtown Monasterboice towards Monasterboice Tower. Whilst these reflect the scenic opportunities presented in the wider area, it was noted that none of these views directly orientate towards the development, and two of the views orientate in the opposite direction from the site

To minimise visual intrusion, the development team applied the Wind Energy Development Guidelines (2006) guidance on wind farms, which includes siting and design criteria for a number of different landscape types. The subject site is located within a landscape setting that is consistent with the 'Hilly and Flat Farmland' landscape type according to the Wind Energy Development Guidelines. Therefore, the following criteria was applied when siting and designing the Proposed Kellystown Windfarm:

Location: the Proposed Development is located on a broad elevated plateau, which is preferred within the guidance, and is located at sufficient distance from surrounding

properties such that they do not visually dominate them. Their elevated location also ensure that they do not contribute to visual clutter.

Spatial Extent: The Proposed Wind Farm has a relatively small spatial extent that responds to the scale of this landscape.

Spacing: The turbines are well spaced, allowing a high degree of visual permeability between the turbines. Their regular spacing corresponds with the scale of the underlying field pattern.

Layout: The staggered linear layout adopted is advocated for this landscape type.

Height: The turbines are considered to be consistent with the scale of this relatively elevated plateau landscape and responds to the scale of the surrounding agricultural and commercial forestry context. Importantly, the turbines do not appear over scaled in relation to the topography of the receiving landscape, and are in no instances considered to dominate.

Cumulative effect: Whilst the landscape contains other wind energy developments, where visible cumulatively, these are at such distances that the wind turbines are not perceived to visually dominate.

Having regard to the above, it was considered that the nature and export capacity of the Proposed Kellystown Wind Farm was supported by national, regional and local policies and objectives regarding renewable wind energy. Regarding visual impact, it was considered that the proposed turbine structures, could be effectively integrated into the landscape character through adhering to the Wind Energy Development Guidelines (2006) guidance on siting and design.

Cumulative Developments: The location of proposed, permitted, and operational wind farm installations within a 20km radius of the Proposed Development were considered as part of the site selection process. There are a total of four wind farms within 20km radius of the Proposed Development these collectively have a total of 7 turbines. Dunmore Wind Farm has a total of 4 turbines built is two stages (Part 1 & Part 2), whereas Collon Wind Farm and Meade Potato Company are both comprised of one turbine. The nearest operational wind farm is Dunmore Wind Farm (Part 1) which is located 11.4km to the west of the Site. WuXi Biologics was recently granted planning permission in July 2024 for a single turbine located 19.5km North of the project. Given that the proposed wind farm will be one of four relatively small wind farm installations within the wider landscape, and would be viewed in isolation due to the distances, it was considered that the proposed wind farm would likely contribute to cumulative impacts in a minor way.

Kilsaran quarry, which operates adjacent to the Proposed Development was also considered as part of the site selection process. It was considered that the proximity of the turbines to this facility consolidates land use by facilitating compatible neighbouring industries to efficiently make use of the area. The proximity to the quarry will also reduce the construction phase impacts related to stone deliveries on the local road network. It is considered that the presence of the industrial scale quarry in proximity of the subject site creates a commercial context to the area and works towards assimilating the Proposed Wind Farm into the landscape.

An initial desktop study was carried out by WSP in of the relationship between quarry blasting and wind farms found that wind turbines were robust structures and could withstand high levels of vibrations. This was supported by a detailed Vibration and Air Overpressure Assessment (**Chapter 13: Noise & Vibration –– Appendix 13.4 Ground Vibration and Air Overpressure Blast Report**), which was undertaken to assess the impact of the quarry blasting on the Proposed Development. The assessment found there will be no impact from blasting at Kilsaran quarry on the Proposed Development.

Phase 2 – Proximity to National Grid

As part of the site selection process, it was necessary to integrate the areas identified in the above steps with information regarding accessibility to electricity transmission and distribution grids. Details of the electricity transmission and distribution network are provided in SEAI's Wind Atlas for Ireland. In addition, transmission network details are available on EirGrid's Smart Grid Dashboard. This process establishes, at a general level, areas which have electricity grid infrastructure, including in terms of distance to potential connection nodes and the grid capacity at the nodes, to accommodate the connection.

EDF commissioned TLI Group to prepare a Grid Connection Feasibility Report to identify potential grid connection options between the Proposed Kellystown Wind Farm site and Drybridge 110kV Substation. To support this study, a map series using publicly available GIS datasets to map the location of possible constraints within the study area was produced. A desktop analysis was carried out using the study area constraints map to identify potential grid routes between the Proposed Wind Farm site and Drybridge 110kV Substation. The feasibility assessment of the identified routes was then complemented with a high-level site survey. For the purpose of the Feasibility Study, only underground cable (UGC) grid connection options were assessed. This is in accordance with the Draft Wind Energy Guidelines 2019, which states that *"underground grid connections for wind energy projects*

are the most appropriate environmental and/or engineering solution, particularly in sensitive landscapes where the visual impacts need to be minimised".

The study demonstrated that Proposed Kellystown Wind Farm site was in proximity to the Drybridge 110kV Substation on the national transmission system, located c. 7.2km from the site entrance by public road. Capacity at the substation was examined, and potential routes were identified and assessed in order to determine a viable connection from the proposed Kellystown Wind Farm Site to the national grid. The study identified and assessed five potential route options from the wind farm site to the Drybridge 110kV Substation examining key technical and environmental constraints including:

- Challenging ground conditions;
- Existing infrastructure;
- Land use;
- Flood Risk;
- Watercourse crossings;
- Protected sites (SAC/NHA);
- Other known grid connection applications.

The preferred route identified in the study is the proposed grid connection route presented in the EIAR and included as part of the planning application for the Proposed Kellystown Wind Farm.

3.5.2 Summary

From the review of the criteria set out above, which is heavily weighted towards minimising any potential negative environmental impacts, the Proposed Development site was identified as a suitable location for the provision of a wind farm development.

The site's designation as 'Preferred Areas' and 'Open to Consideration' for wind farm developments underlines its suitability for this type of project. This designation implies a recognition of the potential for wind energy development in the area, balanced against environmental, social, and economic considerations. The low population density of the Proposed Site and surrounding area provides a sufficient area of unconstrained land to accommodate a windfarm development allowing for a greater number of turbines to be constructed while maintaining appropriate setback distances from dwellings as set out in the Draft 2019 Wind Energy Development Guidelines. This set back distance minimises the potential disturbance to residential amenity which may be caused as a result of construction activities, as well as visual impacts, and noise during the operational phase.

The Proposed Development site is located on agricultural land, which allows the site to utilise existing access roads (which will be upgraded) and highlights the suitability of the Proposed Development site as it can make sustainable use of these established items of infrastructure potentially reducing the impact upon the land, soils and local biodiversity.
The Proposed Development site is not within or adjacent any areas designated as a Special Area of Conservation (SAC), Special Protected Area (SPA) or Natural Heritage Area (NHA). The proximity of the turbines to Kilsaran quarry consolidates land use by facilitating compatible neighbouring industries to efficiently make use of the area. The wind farm also has reasonable access to the National Electricity Grid which is located a viable distance from the Proposed Kellystown Wind Farm site.

Once the current candidate site emerged as a suitable location, the Applicant approached the landowners in order to assemble the site for the Proposed Development. Arising from the site assembly discussions and environmental considerations the current site layout was identified and brought forward as being capable of accommodating a cohesive viable area of sufficient size to cater for the Proposed Development.

3.6 WIND FARM DESIGN AND LAYOUT

The design of the Proposed Development has been informed by the designers, Developers, engineers, landowners, environmental, hydrological and geotechnical, archaeological specialists, telecommunication specialists, and traffic consultants. The aim is to reduce potential for environmental effects while designing a project capable of being constructed and viable and maximising wind resource. Throughout the preparation of the EIAR, the layout of the Proposed Development has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities and as detailed in **Section 1.10** of **Chapter 1: Introduction**.

3.6.1 Constraints Led Approach

The design and layout of the Proposed Development follows the recommendations and industry guidelines set out in the 'Wind Energy Development Guidelines' (Department of the Environment, Heritage and Local Government, 2006), 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012) and is compliant with the Draft Revised Wind Energy Development Guidelines, December 2019. However the noise

recommendations were not followed because they are not considered to be best practice, see **Chapter 13:** Noise and vibration for further details. The layout and design were an iterative process which followed the constraints-led design approach.

The constraints-led design approach consists of the identification of environmental sensitivities within the Site by the design team with a view to identifying suitable areas in which wind turbines may be located. The resulting area is known as the 'Developable Area' (**Figure 3.1**). The initial turbine layout (**Figure 3.2**) was then developed to take account of the initial desktop constraints identified such as 4 times tip height separation distance from residential properties, Natura 2000 sites (including Drumshallon Lough cNHA), hydrological constraints, archaeological features and their associated buffer zones and the separation distance required between the turbines. The design was further refined using a robust constraints identification process.

The constraints identification process developed and included the gathering of information through detailed desk-based assessments, field surveys and consultation. Sensitive receptors were mapped and the design constraints were applied. Setback buffers were placed around different types of constraints to clearly identify the areas within which no development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented in the Department of the Environment, Heritage and Local Government Wind Energy Guidelines (DoEHLG, 2006) and other relevant Best Practice standards, which are identified in each chapter of this EIAR. The proposed setbacks also comply with the Draft Wind Energy Development Guidelines 2019 requirements.

The constraints map for the Site, as shown in **Figure 3.3** encompasses the following constraints and associated buffers:

- Four time tip height (720m) separation distance from residential properties to comply with the 2019 Draft Revised Wind Energy Development Guidelines
- Operator specific buffer from existing Telecommunication Link (Fresnel Zone)
- 10m Buffer for any excavations from High Pressure Gas line[2]
- 2 x the turbine mast height from the nearest edge of a transmission pipeline[3]
- 10m to 50m buffer of Watercourses

[2] Code of Practice for Working in the Vicinity of the Transmission Network, Gas Networks Ireland, Procedure No: AO/PR/127 Rev 3 Date: May 2021 p20.
[3] Code of Practice for Working in the Vicinity of the Transmission Network, Gas Networks Ireland, Procedure No: AO/PR/127 Rev 3 Date: May 2021 p20.

- 200m Roost Bat Buffer
- 20m buffer from Archaeological Sites
- Avoidance of designated (SPAs, SACs, NHAs) including candidate sites such as Drumshallon Lough cNHA.
- Existing access points and general accessibility of all areas of the Site due to existing road infrastructure
- Avoidance of environmental constraints identified from initial desk studies

This demonstrates the avoidance of significant impacts on the receiving environment through mitigation by design.

Following the mapping of all known constraints, detailed site investigations were carried out by the project team. The ecological assessments of the Site encompassed habitat mapping and extensive surveying of birds and other fauna. These assessments, as described in **Chapter 6: Biodiversity**, **Chapter 7: Bat Ecology**, **Chapter 8: Ornithology** and **Chapter 9: Aquatic Ecology** optimised the decision on the siting of turbines as explained in Section 3.6.2.

Similarly, the hydrological and geotechnical investigations of the Site informed the proposed locations for turbines, roads and other components of the Development, such as the substation and the construction compound. This included peat depth and peat stability analysis (**Chapter 10: Soils and Geology**) and the identification of watercourses, groundwater constraints, flood risk and wells (**Chapter 11: Hydrology and Hydrogeology**). Where specific areas were deemed as being unsuitable (e.g., unstable peat giving high risk for slippage) for the siting of turbines or roads, etc., alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the proposed wind farm has also been informed by wind data which has been collected from an on-site Lidar and the results of noise assessments as they became available.

3.6.2 Turbine Layout

The final proposed turbine layout of the Development shown in **Figure 3.6** takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on the results of all site investigations and feedback from consultations that have been carried out during the EIAR process.

The final selection of turbine number and layout has had regard to wind-take by siting the turbines to achieve optimal performance (three times the rotor diameter (3d) in the crosswind direction and seven times the rotor diameter (7d) in the prevailing downwind direction). Potential noise emissions considerations were also incorporated into turbine layout by ensuring no turbines are constructed in a location that would lead to unacceptable noise impacts on nearby receptors. Potential shadow flicker impacts were also considered and by selecting suitable candidate turbines with built in shadow shut down measures where the turbine operating control system detects when sunlight is strong enough to cast a shadow on a property or properties, and automatically shuts down for a period until the conditions resulting in the shadow impact have passed.

The EIAR and wind farm design process was an iterative process. As information regarding the Site was compiled and assessed, the number of turbines and the proposed layouts were revised and amended to take account of the physical constraints of the Site. The requirement for buffer zones and other areas in which no turbines could be located was also compiled and assessed. Findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts.

The development of the final Proposed Wind Farm layout has resulted following feedback from the various studies and assessments carried out as well as ongoing negotiations and discussions with landowners and the local community. The specific locations of the various turbines were reviewed during the optimisation of the Site layout. This was achieved by strictly adhering to the Developable Area for the location of the turbines and avoiding known constraints for the site infrastructure.

First Layout

In 2023 a constraints study was undertaken for the Site using all criteria outlined in 3.6.1. The redline boundary was reduced from that used in the preliminary design as a number of private landholders did not want to proceed with long-term lease agreements. The study identified a viable area within the overall study area suitable for seven turbines. In line with the 2006 Wind Energy Guidelines a separation distance between the turbines of three times the rotor diameter (3d) in the crosswind direction and seven times the rotor diameter (7d) in the prevailing downwind direction was applied to ensure optimal performance.

The first layout (7 Turbines) in shown in **Figure 3.3**.

Second Layout

Following the design of the first layout and a review of the viable lands the number of turbines was increased from 7 No. to 8 No. Maximum separation distance between the turbines was incorporated to reduce the ellipses overlapping onsite in the prevailing downwind direction was applied to ensure optimal performance. The second layout is shown in **Figure 3.4**. takes account of all site constraints arising from the site investigation results collated during the EIAR (e.g., ecology, ornithology, hydrology, telecommunications etc.) and design constraints (e.g., setback distances from houses and third-party lands/infrastructure and distances between turbines on-site etc.). As stated above this layout also takes account of the results of all detailed site investigations and baseline assessments that have been carried out during the EIAR process.

Third Layout

The third layout as presented in **Figure 3.5** the number of turbines was reduced to a five-turbine layout. Turbine 2 was removed from the project this was due to the turbine being isolated and due to limited freehold land available to connect the site. Turbine 5 and Turbine 6 were also removed from the project this was due to serval factors such as a telecommunications link Vodafone (freznal zone) transversing the site. The ground surface water levels were not optimal for T06 and would require extensive excavation works and require floating foundation design. In addition, high numbers of bats were noted at the location of T06 during the summer months and there was the potential to negatively impact the local bat populations. Due to the proximity of the turbines to each other, the ellipses were overlapping and would potentially cause turbulence and damage other turbines over a period of time. The removal of the three turbines allowed more space between the turbines and reduced any significant ellipse overlap. The red-line boundary was reduced to encompass only the area of the Site that was now confirmed as viable for development see **Figure 3.1**. The area within the red-line boundary reduced from 481 ha to 84ha.

Fourth and Final Layout

Following continued detailed analysis of the onsite constraints, further minor amendments were made to the layout to ensure the site is being proposed in the most environmentally responsible way. T02 was moved to reduce any over sail on the minor stream north of the turbine. This would minimise the potential impact on bats in this location. T05 was moved further south in order to be at a separation distance of 200m from known bat roosts situated in the tree line to the north of turbine.

A comparison of the potential environmental effects of the three wind turbine layouts when compared against the final layout are presented in **Table 3.2**.

Table 3.2: Environmental effects from first and second layout iteration compared to the final layout

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health.	No material environmental difference for population or human health.	No material environmental difference for population or human health.	No material environmental difference for population or human health.
Biodiversity	**Overall assessment**	**Overall assessment**	**Overall assessment**	**Overall assessment**
	Increases the potential negative impact on Bat populations from collisions in the surrounding vicinity of the wind farm.	Increases the potential negative impact on Bat populations from collisions in the surrounding vicinity of the wind farm.	Reduces potential impact on potential Bat Collisions with the reduction of turbines and T06 in particular.	T02 was moved to reduce any over sail on the minor stream north of the turbine. This would minimise the potential impact on bats in this location. T05 was moved further south in order to be at a separation distance of 200m from known bat roosts situated in the tree line to the north of turbine
	Turbine 01	**Turbine 01**	**Turbine 01**	**Turbine 01**
	No biodiversity concerns	No biodiversity concerns	No biodiversity concerns	No biodiversity concerns
	Turbine 02	**Turbine 02**	**Turbine 02 (Formally T08)**	**Turbine 02 (Formally T08)**
	No biodiversity concerns	No biodiversity concerns	Original T02 location removed from the project. Formerly T08 - The assessment for D.11 for Leisler's bat for spring and summer returned a score of 6 (medium). Soprano and common pipistrelles had a	Original T02 location removed from the project. Formerly T08- The assessment for D.11 for Leisler's bat for spring and summer returned a score of 6 (medium). Soprano and common pipistrelles had a score of 2 in all seasons, indicating a low collision risk.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
			score of 2 in all seasons, indicating a low collision risk. Turbine oversailing a stream bat collision risk is predicted – Medium Risk.	Turbine moved south 50m away from stream to reduce oversail and potential impact on bats.
	Turbine 03	**Turbine 03**	**Turbine 03**	**Turbine 03**
	T03 Important habitat at national level near the turbine hardstand and turbine location. The hydrology of the wetland requires high level evaluation to assess whether there will be interference with wetland and how it is fed. The wetland is high quality Annex 1 habitat	T03 Important habitat at national level near the turbine hardstand and turbine location. The hydrology of the wetland requires high level evaluation to assess whether there will be interference with wetland and how it is fed. The wetland is high quality Annex 1 habitat	Site investigations were carried out further details can be found in **Chapter 12: Geology** and no impact is predicted on the Annex 1 wetland habitat. No potential impact to the cNHA Drumshallon Lough habitat matrix.	Site investigations were carried out further details can be found in **Chapter 12: Geology** and no impact is predicted on the Annex 1 wetland habitat. No potential impact to the cNHA Drumshallon Lough habitat matrix. Hardstand orientated to reduce impact on scrub.
	Turbine 04	**Turbine 04**	**Turbine 04**	**Turbine 04**
	No biodiversity concerns	No biodiversity concerns	No biodiversity concerns	No biodiversity concerns

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	Turbine 05	**Turbine 05**	**Turbine 05 (Formally T07)**	**Turbine 05 (Formally T07)**
	No biodiversity concerns	No biodiversity concerns	T07 – location becomes T05 due to removal of 3 turbines. No biodiversity concerns	T07 – location becomes T05 due to removal of 3 turbines. No biodiversity concerns
	Turbine 06	**Turbine 06**	**Turbine 06**	**Turbine 06**
	Highest level of bat activity this was recorded at this location predominantly leislers bat activity. This species has one of the highest collision risk. This species is less reliant on features for feeding and commuting.	Highest level of bat activity this was recorded at this location predominantly leislers bat activity. This species has one of the highest collision risk. This species is less reliant on features for feeding and commuting.	Removed from project due to high Bat activity	T05 was moved further south in order to be at a separation distance of 200m from known bat roosts situated in the tree line to the north of turbine.
	Turbine 07	**Turbine 07**	**Turbine 07**	**Turbine 07**
	No biodiversity concerns	No biodiversity concerns	See Turbine 05	See Turbine 05
	Turbine 08	**Turbine 08**	**Turbine 08**	**Turbine 08**
	T08 not incorporated into the design at this stage.	Unknown impact on Bats due to the turbine being a new addition to the project.	See Turbine 02	See Turbine 02

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
Ornithology	No significant environmental constraints	There is Increased potential negative impact on Bird populations in surrounding vicinity of the wind farm from collision strike from the Blades in surrounding vicinity of the wind farm. This is because there are more turbines in the project increasing the likelihood of Bird Strike and displacement to occur.	Reduces the potential negative impact on Bird populations in surrounding vicinity of the wind farm from collision strike from the Blades in surrounding vicinity of the wind farm. This is because there are less turbines in the project reducing the likelihood of Bird Strike and displacement	No significant environmental constraints
Soils & Geology	**Overall assessment**	**Overall assessment**	**Overall assessment**	**Overall assessment**
	Overall, no significant environmental impacts.	Slight increase in the volume of spoil to be managed due to the addition of T08. Overall, no significant impacts.	Slight decrease in the volume of spoil to be managed due to a reduction in development footprint. Overall, no significant environmental impacts.	No significant environmental impacts.
	Turbine 01	**Turbine 01**	**Turbine 01**	**Turbine 01**
	No Geological concerns	No Geological concerns	No Geological concerns	No Geological concerns

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	Turbine 02	**Turbine 02**	**Turbine 02 (Formally T08)**	**Turbine 02 (Formally T08)**
	No Geological concerns	No Geological concerns	Original T02 location removed from the project. No geological concerns at this turbine	Original T02 location removed from the project. No geological concerns at this turbine
	Turbine 03	**Turbine 03**	**Turbine 03**	**Turbine 03**
	T03 Important habitat at national level near the turbine hardstand and turbine location. The hydrology of the wetland requires high level evaluation to assess whether there will be interference with wetland and how it is fed. The wetland is high quality Annex 1 habitat	T03 Important habitat at national level near the turbine hardstand and turbine location. The hydrology of the wetland requires high level evaluation to assess whether there will be interference with wetland and how it is fed. The wetland is high quality Annex 1 habitat	Site investigations were carried out further details can be found in **Chapter 12: Geology** and no impact is predicted on the Annex 1 wetland habitat. No potential impact to the cNHA Drumshallon Lough habitat matrix.	Site investigations were carried out further details can be found in **Chapter 12: Geology** and no impact is predicted on the Annex 1 wetland habitat. No potential impact to the cNHA Drumshallon Lough habitat matrix. Hardstand orientated to reduce impact on scrub.
	Turbine 04	**Turbine 04**	**Turbine 04**	**Turbine 04**
	Located on a fault line however in Ireland this is generally accepted as not of a concern. This is due to the very low levels of seismic activity in Ireland.	Located on a fault line however in Ireland this is generally accepted as not of a concern. This is due to the very low levels of	Located on a fault line however in Ireland this is generally accepted as not of a concern. This is due to the very low levels of seismic activity in Ireland.	Located on a fault line however in Ireland this is generally accepted as not of a concern. This is due to the very low levels of seismic activity in Ireland.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
		seismic activity in Ireland.		
	Turbine 05	**Turbine 05**	**Turbine 05 (Formally T07)**	**Turbine 05 (Formally T07)**
	No geological concerns	Excavations in this area has the potential to impact the hydrology to the Annex 1 habitat located at Drumshallon Lough.	Old T05 removed from project. T07 – location becomes T05 due to removal of 3 turbines. No geological concerns at this location	Old T05 removed from project. T07 – location becomes T05 due to removal of 3 turbines. No geological concerns At this location
	Turbine 06	**Turbine 06**	**Turbine 06**	**Turbine 06**
	Geology in this area is complex. This turbine foundation will be required to be piled into the bedrock. Significant drainage will need to be implemented in this location. Concerns raised regarding the hydrology of this area.	Geology in this area is complex. This turbine foundation will be required to be piled into the bedrock. Significant drainage will need to be implemented in this location. Concerns raised regarding the hydrology of this area.	Removed from project due to challenging geological conditions.	Removed from project due to challenging geological conditions.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	Turbine 07	**Turbine 07**	**Turbine 07**	**Turbine 07**
	No geological concerns	No geological concerns	See Turbine 05	See Turbine 05
	Turbine 08	**Turbine 08**	**Turbine 08**	**Turbine 08**
	T08 not incorporated into the design at this stage.	No geological concerns	See Turbine 02	See Turbine 02
Hydrology & Hydrogeology	No significant environmental impacts.	T06 Concerns raised regarding the hydrology of this area. This is due to the turbine foundation required to be piled into the bedrock. Significant drainage will need to be implemented in this location. An increase in the volume of peat and spoil to be managed on site would increase the potential for runoff. Overall, no significant environmental impacts.	The hydrology and hydrogeology impacts remain the same as the second layout. Overall, no significant environmental impacts.	No significant environmental impacts.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
Air & Climate	Overall, a long-term, significant, positive impact on Climate.	Slight decrease in the carbon payback time. Overall, a long-term, significant, positive impact on Climate.	The carbon payback time remains the same as the second layout. A long-term, significant, positive impact on Climate.	Slight increase in the carbon payback time. Overall, a long-term, significant, positive impact on Climate.
Noise and vibration	**Overall assessment**	**Overall assessment**	**Overall assessment**	**Overall assessment**
	No significant noise and vibrations anticipated on residential receptors or vibration impact on turbine hard stands from the adjacent blasting quarry.	No significant noise and vibrations anticipated on residential receptors or vibration impact on turbine hard stands from the adjacent blasting quarry.	No significant noise and vibrations anticipated on residential receptors or vibration impact on turbine hard stands from the adjacent blasting quarry.	No significant noise and vibrations anticipated on residential receptors or vibration impact on turbine hard stands from the adjacent blasting quarry.
	Turbine 01	**Turbine 01**	**Turbine 01**	**Turbine 01**
	Location c.150m from the quarry boundary - no impacts are predicted.	Location c.184m from the quarry boundary - no impacts are predicted.	Location c.184m from the quarry boundary - no impacts are predicted.	Location c.184m from the quarry boundary - no impacts are predicted.
	Turbine 02	**Turbine 02**	**Turbine 02 (Formally T08)**	**Turbine 02 (Formally T08)**
	Location c.150m from the quarry boundary -	Removed from layout.	Location c.170m from the quarry boundary - no impacts are predicted.	Location c.132m from the quarry boundary - no impacts are predicted.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	no impacts are predicted.			
	Turbine 03	**Turbine 03**	**Turbine 03**	**Turbine 03**
	Location c.18m from the quarry boundary. This location was not evaluated.	Location c.90m from the quarry boundary - no impacts are predicted.	Location c.164m from the quarry boundary - no impacts are predicted.	Location c.164m from the quarry boundary - no impacts are predicted.
	Turbine 04	**Turbine 04**	**Turbine 04**	**Turbine 04**
	Location c.340m from the quarry boundary - no impacts are predicted.	Location c.340m from the quarry boundary - no impacts are predicted.	Location c.519m from the quarry boundary - no impacts are predicted.	Location c.519m from the quarry boundary - no impacts are predicted.
	Turbine 05	**Turbine 05**	**Turbine 05 (Formally T07)**	**Turbine 05 (Formally T07)**
	Location c.753m from the quarry boundary - no impacts are predicted.	Location c.753m from the quarry boundary - no impacts are predicted.	Location c.753m from the quarry boundary - no impacts are predicted.	Location c.863m from the quarry boundary - no impacts are predicted.
	Turbine 06	**Turbine 06**	**Turbine 06**	**Turbine 06**
	Location c.753m from the quarry boundary -	Location c.753m from the quarry boundary - no	Removed from project due to Fresnel zone and other environmental factors	Removed from project due to Fresnel zone and other environmental factors

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	no impacts are predicted.	impacts are predicted.		
	Turbine 07	**Turbine 07**	**Turbine 07**	**Turbine 07**
	Location c.1100m from the quarry boundary - no impacts are predicted.	Location c.950m from the quarry boundary - no impacts are predicted.	See Turbine 05	See Turbine 05
	Turbine 08	**Turbine 08**	**Turbine 08**	**Turbine 08**
	T08 not incorporated into the design at this stage.	Location c.203m from the quarry boundary - no impacts are predicted.	See Turbine 02	See Turbine 02
Material Assets	**Overall assessment**	**Overall assessment**	**Overall assessment**	**Overall assessment**
	High Pressure Gas Main transverses the site and identified as a constraint. It has been sufficiently avoided from site infrastructure. No significant environmental impacts. Turbines T05 & T06 situated in a Vodaphone Fresnel	High Pressure Gas Main transverses the site and identified as a constraint. It has been sufficiently avoided from site infrastructure. Turbines T05 & T06 situated in a Vodaphone Fresnel	High Pressure Gas Main transverses the site and identified as a constraint. It has been sufficiently avoided from site infrastructure. Turbines T05 & T06 removed from the project, no significant environmental impacts anticipated on telecoms.	High Pressure Gas Main transverses the site and identified as a constraint. It has been sufficiently avoided from site infrastructure. Turbines T05 & T06 removed from the project, no significant environmental impacts anticipated on telecoms.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	zone which traverses the Site.	zone which traverses the Site.		
	Turbine 01	**Turbine 01**	**Turbine 01**	**Turbine 01**
	Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.	Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.	Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.	Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.
	Turbine 02	**Turbine 02**	**Turbine 02 (Formally T08)**	**Turbine 02 (Formally T08)**
	No Material Asset concerns	No Material Asset concerns	No Material Asset concerns	No Material Asset concerns
	Turbine 03	**Turbine 03**	**Turbine 03**	**Turbine 03**
	No Material Asset concerns	No Material Asset concerns	No Material Asset concerns	No Material Asset concerns
	Turbine 04	**Turbine 04**	**Turbine 04**	**Turbine 04**
	No Material Asset concerns	No Material Asset concerns	No Material Asset concerns	No Material Asset concerns
	Turbine 05	**Turbine 05**	**Turbine 05 (Formally T07)**	**Turbine 05 (Formally T07)**
	Situated in a Vodaphone Fresnel	situated in a Vodaphone Fresnel	Old T05 removed from project.	Old T05 removed from project.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	zone which traverses the Site.	zone which traverses the Site.	T07 – location becomes T05 due to removal of 3 turbines. Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.	T07 – location becomes T05 due to removal of 3 turbines. Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.
	Turbine 06	**Turbine 06**	**Turbine 06**	**Turbine 06**
	Situated in a Vodaphone Fresnel zone which traverses the Site.	situated in a Vodaphone Fresnel zone which traverses the Site.	Removed from project due to Fresnel zone and other environmental factors	Removed from project due to Fresnel zone and other environmental factors
	Turbine 07	**Turbine 07**	**Turbine 07**	**Turbine 07**
	Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.	Located in Commercial forestry the forestry removal has been assessed there will be no significant impact.	See Turbine 5	See Turbine 5
	Turbine 08	**Turbine 08**	**Turbine 08**	**Turbine 08**
	T08 not incorporated into the design at this stage.	No Material Asset concerns	See Turbine 2	See Turbine 2
Landscape & Visual	**Overall assessment**	**Overall assessment**	**Overall assessment**	**Overall assessment**

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	7 Wind Turbines was assessed overall, there are no significant landscape and visual impacts.	The visual impact is slightly increased with the additional turbine. However, overall, there are no significant landscape and visual impacts.	Slightly less visual impact. No significant landscape and visual impacts.	Slightly less visual impact. No significant landscape and visual impacts.
Cultural Heritage	**Overall assessment**	**Overall assessment**	**Overall assessment**	**Overall assessment**
	Potential impact due to the presence of an archaeological sites on site. A Larger development footprint will increase the potential for impacts on unrecorded, subsurface archaeology.	Potential impact due to the presence of an archaeological sites on site. A Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Potential impact due to the presence of an archaeological sites on site. A Smaller development footprint would reduce the potential for impacts on unrecorded, subsurface archaeology.	Potential impact due to the presence of an archaeological sites on site. A Smaller development footprint would reduce the potential for impacts on unrecorded, subsurface archaeology.
	Turbine 01	**Turbine 01**	**Turbine 01**	**Turbine 01**
	Access roads requires design input to sufficiently avoid in compliance with a buffer on the archaeological features.	Road designed to sufficiently avoid archaeological features onsite.	Road design remained static to avoid archaeological features onsite.	Road design remained static to avoid archaeological features onsite.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	Turbine 02	**Turbine 02**	**Turbine 02 (Formally T08)**	**Turbine 02 (Formally T08)**
	Burial site located in the surrounding area however this has been evaluated as low risk.	Burial site located in the surrounding area however this has been evaluated as low risk.	No archaeological concerns.	No archaeological concerns.
	Turbine 03	**Turbine 03**	**Turbine 03**	**Turbine 03**
	Close proximity to 3 standing stones	Close proximity to 3 standing stones Design altered to reduce impact on the standing stones. It is recommended to use the existing track way for access to the turbine.	Turbine access tracks sufficiently avoid the 3 Standing stones however will be impacted from a settings perspective.	Turbine access tracks sufficiently avoid the 3 Standing stones however will be impacted from a settings perspective.
	Turbine 04	**Turbine 04**	**Turbine 04**	**Turbine 04**
	No direct impacts predicted. Only potential subsurface remains to be encountered during excavation., Excavation works will	No direct impacts predicted. Only potential subsurface remains to be encountered during excavation., Excavation works will	No direct impacts predicted. Only potential subsurface remains to be encountered during excavation., Excavation works will be monitored by an	No direct impacts predicted. Only potential subsurface remains to be encountered during excavation., Excavation works will be monitored by an Archaeologist this is standard practice.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	be monitored by an Archaeologist this is standard practice.	be monitored by an Archaeologist this is standard practice.	Archaeologist this is standard practice.	
	Turbine 05	**Turbine 05**	**Turbine 05 (Formally T07)**	**Turbine 05 (Formally T07)**
	Unrecorded archaeological features to the west of the townland boundary. Turbine location is not directly impacting features archaeological potential high for subsurface remains with the soil. There is a marked 'old drain' along old townland boundary on first edition maps.	Unrecorded archaeological features to the west of the townland boundary. Turbine location is not directly impacting features archaeological potential high for subsurface remains with the soil. There is a marked 'old drain' along old townland boundary on first edition maps.	Old T05 removed from project. T07 – location becomes T05 due to removal of 3 turbines. No archaeological concern	Old T05 removed from project. T07 – location becomes T05 due to removal of 3 turbines. No archaeological concerns
	Turbine 06	**Turbine 06**	**Turbine 06**	**Turbine 06**
	The surrounding landscape from piperstown house might be impacted. No	The surrounding landscape from piperstown house might be impacted.	Removed from project.	Removed from project.

Criteria	First Layout (7 wind turbines)	Second Layout (8 wind turbines)	Third Layout (5 wind turbines)	Fourth and Final Layout (5 wind turbines).
	other archaeological concerns.	No other archaeological concerns.		
	Turbine 07	**Turbine 07**	**Turbine 07**	**Turbine 07**
	The surrounding landscape from piperstown house might be impacted.	The surrounding landscape from piperstown house might be impacted.	See Turbine 05	See Turbine 05
	Turbine 08	**Turbine 08**	**Turbine 08**	**Turbine 08**
	T08 not incorporated into the design at this stage.	Rockby Hall visitor attraction might be impacted. This is a 18th Century house; this house has national importance status.	See Turbine 02	See Turbine 02

3.6.3 Internal Site Access Road Layout

Roads must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was deemed necessary during the initial design of the Development that existing roads would be utilised where possible to minimise the potential for impacts which arise from the construction of new roads.

As the overall site layout was finalised, the most suitable routes between each component of the Proposed Development were identified, taking into account the existing roads and the physical constraints of the Site. Locations were identified where upgrading of the existing road would be required. This primarily included where sections of new roads would need to be constructed, in order to ensure suitable access to and linkages between the various project elements, and efficient movement around the Site.

An alternative option normally would be to utilise the existing road network within the Site would be to construct a new road network, having no regard to existing roads. However, this approach was not applicable for this development due to the lack of pre-existing road network onsite. The site infrastructure has been assessed in all chapters no significant direct impact is anticipated to any sensitive receptors.

3.6.4 Location of Ancillary Structures

The alternatives considered are discussed for the following ancillary infrastructure required for the Development. A temporary construction compound (a single compound versus two smaller compounds), electricity substation (location) and borrow pit (using local quarries versus an onsite borrow pit).

3.6.4.1 Construction Compound

The use of a single temporary construction compound as opposed to three smaller compounds located in different areas of the Site was considered and generally will result in less disturbances to the Site and a reduced visual impact during construction. However, due to the design of wind farm two is more appropriate to reduce impact on the local road networks, carbon emissions and dust pollution from unnecessary travel between the sites. The third small separate compound has been allocated adjacent to the substation in the south east of the site. A comparison of the potential environmental effects of constructing a single, large construction compound when compared against constructing three smaller compounds is presented in **Table 3.3.**

Table 3.3: Comparison of environmental effects from constructing three smaller construction compounds compared to one large construction compound

Criteria	One Temporary Compound	Three Temporary Compounds
Population & Human Health	Potential for increased noise impacts on nearby sensitive receptors.	the same overall level of traffic but lower on specific routes as the traffic will use different parts of the road network.
Biodiversity	Less impact to the Site ecology by constructing three construction compounds in different areas of the Site as the footprint of three smaller construction compounds is larger than one large compound. However, this is dependent on the location of the temporary compound.	Potential for a greater impact to the Site ecology by constructing three construction compounds in different areas of the Site as the footprint of two smaller construction compounds is larger than one large compound.
Ornithology	The site ornithological fauna is likely to be less impacted by one temporary storage compound as the noise and disturbance will be concentrated in one area.	Potential for a greater impact to the Site ornithological fauna by constructing two construction compounds in different areas of the Site could result in habitat destruction and disturbance.
Soils & Geology	A slight smaller development footprint will result in lower volumes of spoil to be excavated and stored. Lower volume of stone required from quarries in the vicinity for road construction.	Larger development footprint will result in greater volumes of spoil to be excavated and stored. Larger volume of stone required from quarries in the vicinity for road construction.
Hydrology & Hydrogeology	The use of one temporary construction compounds site has the potential to reduce the risk to watercourses due to it being confined to one location.	The use of multiple construction compounds sites has the potential to increase the risk to watercourses due to the additional generation of spoil in multiple areas. However, these locations have been assessed and there will be no significant impact to the surrounding hydrology.
Air & Climate	Potential for an increase in vehicular emissions/dust due to an increase in distance travelled of construction traffic. However, these will not be significant.	Potential for reduction in vehicular emissions/dust due to reduction distance travelled of construction traffic. However, these will not be significant.
Noise	Potential for increased noise impacts on nearby sensitive receptors however no significant difference predicted.	Potential for increased noise impacts on nearby sensitive receptors however no significant difference predicted.
Material Assets	No significant difference	No significant difference

Criteria	One Temporary Compound	Three Temporary Compounds
Landscape & Visual	Potential for visual and landscape impacts due to the construction of one construction compounds in different parts of the Site. However, this will not be significant.	Potential for visual and landscape impacts due to the construction of three construction compounds in different parts of the Site. However, this will not be significant.
Cultural Heritage	A single large temporary footprint would increase the potential for impacts on unrecorded, subsurface archaeology in the immediate vicinity.	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology in different locations onsite.
Traffic and Transport	One compound is less efficient movement and management of material across the Site with multiple compounds. This would increase traffic movements on the existing road infrastructure on the Gallstown road during construction.	Multiple compounds is more efficient movement and management of material across the Site with multiple compounds on the site as the development is separated into three separate sites. This would reduce traffic movements on the existing road infrastructure on the Gallstown road during construction.
Major Accidents	A single compound onsite would have a slight negative impact as it may take longer to report an accident on site.	Multiple compounds onsite would have a slight positive impact as accidents can be reported quicker on site and in closer proximity to personnel.

3.6.4.2 Onsite Substation incorporating Control Building and Battery Energy Storage System

The north and south of the Site were assessed for locating the Onsite Substation and BESS However having regard to the Site constraints, the grid connection to Drybridge 110 kV substation and the EirGrid requirement to maintain 3.5 times the turbine fall over distance, the south of the Site was selected for location of the Onsite Substation including Control Building and BESS.

Table 3.4: Comparison of environmental effects from constructing an onsite substation in the South to one in the North of the Site

Criteria	North	South
Population & Human Health (incl. Shadow Flicker)	Impact on sensitive receptors is similar due to housing density.	Impact on sensitive receptors is similar due to housing density.
Biodiversity	Potential for habitat removal impacts on at both locations. However limited sensitive habitats onsite resulting in similar impact.	Potential for habitat removal impacts on at both locations. However limited sensitive habitats onsite resulting in similar impact.
Ornithology	Limited potential for impacts to ornithology at either location.	Limited potential for impacts to ornithology at either location.
Soils & Geology	The volume of spoil removed for both sites will be the same.	The volume of spoil removed for both sites will be the same.
Hydrology & Hydrogeology	The potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support the same for both sites.	The potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support the same for both sites.
Air & Climate	The potential dust emissions and exhaust emissions the same for both locations.	The potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support the same for both sites.
Noise	The potential for noise impacts will be the same for both locations.	The potential for noise impacts will be the same for both locations.
Material Assets	The land-take will be the same for both locations, no impacts on existing infrastructure predicted such as telecoms and Gas line.	The land-take will be the same for both locations, no impacts on existing infrastructure predicted such as telecoms and Gas line.
Landscape & Visual	The visual impact of the onsite substation will be the same for both locations.	The visual impact of the onsite substation will be the same for both locations.
Cultural Heritage	The potential for impacts on unrecorded, subsurface archaeology is the same for both locations.	The potential for impacts on unrecorded, subsurface archaeology is the same for both locations.
Traffic and Transport	The volume of traffic associated with the construction of the onsite substation will be the same for both locations.	The volume of traffic associated with the construction of the onsite substation will be the same for both locations.

3.6.4.3 *Borrow pit vs quarry.*

There will be approximately 43,870m^3 of rock required during the construction phase. All the fill material required for the construction of access roads and turbine bases will be obtained from locally licensed quarries. Due to the close proximity of the adjacent quarry, it is envisioned that material would be sourced from here. The use of an existing quarry represents an efficient use of the existing facilities within the county.

A comparison of the potential environmental effects of using an onsite borrow pit in comparison to using an offsite quarry is presented in **Table 3.5**.

Table 3.5: Environmental effects from utilising local quarries compared to the on-site borrow pit

Criteria	Existing Quarry	Borrow Pit
Population & Human Health (incl. Shadow Flicker)	Potential for increased noise, vehicular and dust emissions from transporting material from offsite quarry locations to the site which could have adverse health effects. Increased HGV disturbance will lead to increased environmental nuisance. Positive impact from an employment and local economic perspective utilising local businesses.	A possible reduction from noise onsite due to less excavation works being carried out onsite and limited or no use of rock breaking equipment.
Terrestrial Ecology	The proposed wind farm development has a smaller footprint without a borrow pit. Therefore, less habitat will be impacted by the development.	Negative impact the proposed wind farm development has a larger footprint with a borrow pit. This may also cause more disturbance to wildlife during the construction period.
Aquatic Ecology	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support from the borrow pit and the quarry.	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support from the borrow pit and the quarry.
Ornithology	no negative impact on habitats and less disturbance on the wind farm site.	Slight Negative- habitat removal and greater disturbance on the wind farm site.
Soils & Geology	Slight negative - Effect on local quarry resource.	Slight negative - Effect on existing geology on site.
Hydrology & Hydrogeology	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they

Criteria	Existing Quarry	Borrow Pit
	support from the borrow pit and the quarry.	support from the borrow pit and the quarry.
Air & Climate	Slight negative - dust emissions and vehicle emissions associated with off-site vehicle movements.	Potential increase in dust emissions and vehicle emissions associated with on-site rock breaking equipment and more traffic movements onsite.
Noise	Whilst there would be less noise generated from the Site as a result of using an offsite source, there will be an increase in noise emissions from the transport of material from offsite quarry locations on public roads. This will impact on dwellings and facilities situated along these roads.	Negative impact from noise during construction onsite from larger construction footprint and the need for rock breaking equipment and heavy plant machinery.
Material Assets	Slight negative - Effect on local quarry resource.	Constraints on site reducing locality such as Gas line and land use.
Landscape & Visual	no potential landscape and visual impact with no borrow pit on site.	A slight negative - visual impact with a borrow pit on site.
Cultural Heritage	A smaller footprint reduces The potential for impacts on unrecorded, subsurface archaeology.	Slight Negative - The potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	Additional HGV trips required for importation of fill however due to the proximity of the quarry this has limited impact on the surrounding roads.	A reduction in road traffic off site however will increase movement on the internal road infrastructure.
Major Accidents	Safer to use an existing quarry than to extract rock and suitable material onsite,	More hazardous to use a borrow pit onsite.

3.7 ALTERNATIVE DESIGN PHILOSOPHY AND SPECIFICATIONS

Consideration was given to an appropriate limited range of turbine dimensions that would allow suitable flexibility at procurement stage. This is necessary because of the rate of change in technology and the length of time required to progress a project from early planning stage to turbine purchase. Different models that are currently available may not be available in a number of years and models that are not available now are likely to become available. The Developer undertook a review of currently available technology and chose a range of dimensions that ensures the best chance of a competitive procurement process for the proposed limited range of dimensions.

The result was the proposed limited range of dimensions as set out below:

- A tip height range of 179.5m to 180m;
- A hub height range of 98m to 105m, and
- A rotor diameter range of 149m to 163m.

The range of dimensions are shown on **Figure 1.4**.

3.7.1 Turbine Type

This output may vary as a result of the final turbine type, power output modelling and turbine development over the period leading up to construction. For the purposes of this EIAR, a minimum rated output of 5.6 MW and a maximum rated output of 6.6 MW has been used to calculate the power output of the proposed wind farm, which will result in an estimated installed capacity of between 28.5 MW to 36 MW. A wind farm with the same potential power output could also be achieved on the Site by using smaller turbines (for example 3.5 MW machines). However, this would necessitate the installation of up to 11 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the Site. Taller wind turbines with larger rotor diameters allow wind turbines to sweep more area, capture more wind, and produce more electricity.

3.7.2 Number of Turbines

A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the Site, with a larger amount of supporting infrastructure being required (i.e., roads and hardstands etc) and increasing the potential for environmental impacts to occur.

The proposed number of turbines takes account of all site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the Site. The 5 No. turbine layout selected for the Site has the smallest development footprint of all alternative layouts that were considered, while still achieving the optimum output.

3.7.3 Height of Turbines

The turbine model to be installed on the Site will be the subject of a competitive tendering process. The model of the turbines that will be selected for construction on the Site will have

an overall ground to blade tip height ranging from 179.5m to 180m, a rotor diameter ranging from 149m to 163m and a hub height ranging from 98m to 105m. The turbine model finally selected onsite will be the same for all five turbines. The use of alternative smaller turbines at this Site would fail to make the most efficient use of the wind resource passing over the Site and a greater number of smaller turbines required to deliver the desired capacity which would impact the surroundings visually due to cluttering the landscape.

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The relationship between the turbine height and density (number of turbines) required to achieve a particular output was a key design consideration. From research carried out by Betakova *et al*. (2015) people have highlighted that when given an option, they tend to prefer a scenario of fewer larger turbines:

"People prefer reducing the number of turbines by replacing smaller turbines with larger ones even though larger ones might be visible from a larger number of residences"

One such study commissioned by 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%)."[4]

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 array 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.

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, with less associated construction works as detailed above. Recent permitted wind farm applications in Ireland tend towards larger/taller turbines (i.e., 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 Carrownagowan Wind

[4] https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf [Accessed 21/08/2024]

Farm, Co. Clare (ABP ref. PA03.308799) which consists of 19 No. wind turbines at 169m tip height, Castlebanny Wind Farm, Co. Kilkenny (ABP ref PA10.309306) which consist of 21 No. wind turbines at 185m tip height, Ardderroo Wind Farm, Co. Galway (ABP ref. PL07 .303086) which consists of 25 No. wind turbines at 178.5m tip height. Coole Wind Farm, Co. Westmeath (ABP ref. PL25M.300686) which consists of 13 No. wind turbines of 175m tip height, and Derrinlough Wind Farm (ABP ref. PA19.306706) which consists of 21 No. wind turbines of 185m tip height.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing a smaller number of larger wind turbines are presented in **Table 3.6**. For this analysis. a standard smaller turbine size of 125m tip height and 3MW output was utilised. A total of 12 turbines would be required to achieve the same capacity 36MW as the proposed development

Table 3.6: Environmental effects from a large number of smaller wind turbines compared to the Development

Criteria	large number (12) smaller turbines (125m tip height)	Smaller number (5) of larger turbines (180 tip height))
Population & Human Health	Greater potential for shadow flicker impact on nearby sensitive receptors with a larger number of turbines.	A reduced potential for shadow flicker impact on nearby sensitive receptors with a smaller number of turbines.
Biodiversity	Larger development footprint would result in greater habitat loss and negative effects on Bats with a larger number of turbines.	A smaller development footprint would result in less habitat loss and negative effects on Bats with a larger number of turbines.
Ornithology	The presence of more turbines would increase the potential effects on birds.	The presence less turbines would reduce the potential effects on birds.
Soils & Geology	Larger development footprint would result in greater volumes of spoil to be excavated.	Smaller development footprint would result in smaller volumes of spoil to be excavated.
Hydrology & Hydrogeology	The larger development footprint would increase the potential for silty runoff to enter receiving watercourses.	The smaller development footprint would decrease the potential for silty runoff to enter receiving watercourses.
Air & Climate	Neutral – Potential air and climate impacts would be similar during operation. A slight increase in	Neutral – Potential air and climate impacts would be similar during operation. A slight decrease in

Criteria	large number (12) smaller turbines (125m tip height)	Smaller number (5) of larger turbines (180 tip height))
	potential dust and vehicle pollution during the construction period.	potential dust and vehicle pollution during the construction period.
Noise	Potential for increased noise impacts on nearby sensitive receptors.	Potential for a reduction to noise impacts on nearby sensitive receptors.
Material Assets	Neutral – Potential material assets impacts would be similar.	Neutral – Potential material assets impacts would be similar.
Landscape & Visual	A larger number of smaller turbines would likely have a greater visual impact	A reduced number of larger turbines would likely result have less visual impact.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Smaller development footprint would decrease the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.	Traffic volumes during construction phase for a smaller development footprint would be reduced compared to a larger development.

3.8 ALTERNATIVE GRID CONNECTION

3.8.1 Grid Connection Technology and Routes

A key consideration in determining the Grid Connection technology for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line (OHL). While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. A comparison of the potential environmental effects of constructing overhead lines when compared against constructing underground lines is presented in **Table 3.7**.

Table 3.7: Environmental effects from overhead lines compared to underground lines

Criteria	Overhead Lines	Underground Cabling
Population & Human Health	Overhead lines impose a greater safety risk and greater risk of electricity supply interruption than underground cables. In addition, Overhead cables result in greater electromagnetic field emissions during operation.	Overhead lines impose a greater safety risk and greater risk of electricity supply interruption than underground cables. In addition, Overhead cables result in greater electromagnetic field emissions during operation.
Biodiversity	Overhead lines have less impact on habitats due to smaller construction footprint.	Where underground lines are unable to be placed in the road there is greater potential for impact to biodiversity as the footprint of cable trenches will be greater than that of wooden poles. In addition, higher potential for sediment/contaminated spoil release from cable trenches to contaminate water courses
Ornithology	Overhead lines have greater potential for a negative impact for over headline on as birds can fly into any supporting wires and structures resulting in injury and/or death.	A higher potential for sediment/contaminated spoil release from cable trenches to contaminate water courses. This poses a potential pollution risk to wetland habitats.
Soils & Geology	Over headlines have a smaller footprint than overhead line infrastructure and will have a smaller potential to impact soils and geology as the excavation volumes will be reduced.	Cable trenches have a larger footprint than overhead line and will have a greater potential to impact soils and geology as the excavation volumes will be greater.
Hydrology & Hydrogeology	There is greater potential for water impacts due to sediment release for cable trenches as there will be a greater volume of material excavation than with OHL poles.	There is greater potential for water impacts due to sediment release for cable trenches as there will be a greater volume of material excavation than with OHL poles.
Air & Climate	Slightly less dust emissions associated with OHL installation due to the smaller excavation footprint.	Higher carbon emissions for underground cables due to the removal of tarmac and re-installation of road surface, as well as the use of plastic ducting.
Noise	Overhead Lines during construction likely to be less impactful to sensitive receptors due to proximity to dwellings. However, Over Headlines have a greater impact during operational phase.	Higher potential for construction noise for trench installation during the construction and decommissioning phases due to proximity to sensitive receptors along the road. Operational noise impacts

Criteria	Overhead Lines	Underground Cabling
		reduced compared to from Over Headlines.
Material Assets	Overhead lines will still generate waste however not to the extent of underground grid connection and may impact land use i.e. restrict afforestation.	A significant amount of road surface material contaminated by bitumen needs to be disposed at a registered waste facility for underground cables.
Landscape & Visual	Potential for greater visual impact due to overground poles and cables.	Virtually no visual impact during operational phase when compared to overhead lines excluding the substations.
Cultural Heritage	Reduced potential for impacts on unrecorded, subsurface archaeology Potential for impacts on unrecorded, subsurface archaeology is greater for underground lines as they will be placed on land/off-road and will cover a greater surface area than overhead lines infrastructure.	Higher potential for impacts on unrecorded, subsurface archaeology is greater for underground lines as they will be placed on land/off-road and will cover a greater surface area than overhead lines infrastructure.
Traffic and Transport	Very limited impact on traffic and transport except where repairs are required over the public road infrastructure.	Repair of underground cables are more time consuming and therefore upgrades or repairs will have a greater impact on traffic and road safety management.

3.8.2 Grid Connection Routes

Potential grid connectivity and constraints were also considered during the strategic site selection process as detailed in the strategic screening exercise as discussed in **Section 3.5.2.1**. Drybridge 110kV GIS substation was selected because it had capacity available when compared to Navan 110kV limited capacity and because of its closer proximity to the Site (i.e., within 8km as the crow flies compared to 27km).

Five cabling route options from Kellystown to Drybridge were initially considered and assessed as part of a civil and structural due diligence to determine which route would be brought forward. These five routes, Route A, B, C, D & E are shown on **Figure 3.7**. The initial grid route assessment found a Route A was the most favourable as this is the shortest route and least potential impact on the environment. A comparison of the potential environmental effects of constructing all initial routes A, B, C, D & E are presented in **Table 3.8** further details can be found in **Appendix 3.2**: **Grid Route Feasibility Report**.

Table 3.8: Environmental effects of the initial grid route options A B, C, D and E outlined in the TLI Group feasibility report.

Criteria	Route A	Route B	Route C	Route D	Route E
Population & Human Health	Neutral as the temporary works would avoid Tullyallen village.	Slight negative as the temporary works would impact Tullyallen village.	Slight negative as the temporary works would impact Tullyallen village.	Slight negative as the temporary works would impact Tullyallen village.	Slight negative as the temporary works would impact Tullyallen village.
Terrestrial Ecology & Ornithology	Route A avoids directly travelling through any Natura 2000 sites. There are water crossings which are hydrologically connected to River Boyne and River Blackwater SPA.	Route B travels through pNHA King Wouldiam's Glen. There are water crossings which as hydrologically connected to River Boyne and River Blackwater SPA.	Route C travels through pNHA King Wouldiam's Glen. There are water crossings which as hydrologically connected to River Boyne and River Blackwater SPA.	Route D avoids directly travelling. There are water crossings which as hydrologically connected to River Boyne and River Blackwater SPA.	Route E travels through pNHA King Wouldiam's Glen. There are water crossings which as hydrologically connected to River Boyne and River Blackwater SPA.
Aquatic Ecology	3 No. HDD crossings required for bridges/culverts	4 No. HDD crossings required for bridges/culverts.	4 No. HDD crossings required for bridges/culverts.	3 No. HDD crossings required for bridges/culverts.	3 No. HDD crossings required for bridges/culverts.
Soils & Geology	The potential impacts associated with the Grid Connection Route in relation to soils and geology in general are considered slight.	The potential impacts associated with the Grid Connection Route in relation to soils and geology in general are considered slight.	The potential impacts associated with the Grid Connection Route in relation to soils and geology in general are considered slight.	The potential impacts associated with the Grid Connection Route in relation to soils and geology in general are considered slight.	The potential impacts associated with the Grid Connection Route in relation to soils and geology in general are considered slight.
Hydrology & Hydrogeology	Route A has five bridge crossings which would increase the potential for silty runoff and hydrocarbons to enter	Route B has six bridge crossings and therefore more potential for silty runoff and hydrocarbons to enter receiving watercourses.	Route C has four bridge crossings and therefore less potential for silty runoff and hydrocarbons to enter receiving watercourses.	Route D has four bridge crossings and therefore less potential for silty runoff and hydrocarbons to enter receiving watercourses. No identified flood risk areas	Route E has four bridge crossings and therefore less potential for silty runoff and hydrocarbons to enter receiving watercourses. National Indicative Fluvial

Criteria	Route A	Route B	Route C	Route D	Route E
	receiving watercourses. National Indicative Fluvial Mapping shows that the area surrounding the Drogheda Corporation Water Works Reservoir, has a flood zone associated with the respective rivers channels. All zones showing low to high probability of flooding.	No identified flood risk areas are traversed by this route according to the previously mentioned public databases.	National Indicative Fluvial Mapping shows that the area along the western side of the R168, adjacent to the Mattock river, has a flood zone associated with the respective river. All zones showing low to medium probability of flooding.	are traversed by this route according to the previously mentioned public databases	Mapping shows that the area along the western side of the R168, adjacent to the Mattock river, has a flood zone associated with the respective river. All zones showing low to medium probability of flooding.
Air & Climate	Route A would generate the least temporary dust and exhaust emissions from construction vehicles as this is the shortest route 11.75km overall length.	Route B would generate more temporary dust and exhaust emissions from construction vehicles compared to Route A as this route is longer 14.86km overall length.	Route C would generate most temporary dust and exhaust emissions from construction vehicles as this has the longest route 16.58km overall length.	Route D would generate more temporary dust and exhaust emissions from construction vehicles compared to Route A as this route is longer 13.92km overall length.	Route E would generate more temporary dust and exhaust emissions from construction vehicles compared to Route A as this route is longer 15.78km overall length.
Noise	Neutral - Temporary noise impacts during the construction phase.	Neutral - Temporary noise impacts during the construction phase.	Neutral - Temporary noise impacts during the construction phase.	Neutral - Temporary noise impacts during the construction phase.	Neutral - Temporary noise impacts during the construction phase.
Material Assets	Route A would generate the least road surface material contaminated by bitumen which is required to be disposed at a registered	Route B would generate more road surface material contaminated by bitumen which is required to be disposed at a registered waste facility, as	Route C would generate the most road surface material contaminated by bitumen which is required to be disposed at a registered waste facility, as	Route D would generate more road surface material contaminated by bitumen which is required to be disposed at a registered waste facility, as this route is longer	Route E would generate more road surface material contaminated by bitumen which is required to be disposed at a registered waste facility, as this route is longer

Criteria	Route A	Route B	Route C	Route D	Route E
	waste facility, as this is the shortest route 11.75km overall length.	this route is longer 14.86km overall length.	this has the longest route 16.58km overall length.	13.92km overall length.	15.78km overall length.
Landscape & Visual	Neutral – No visual impact.	Neutral – No visual impact.	Neutral – No visual impact.	Neutral – No visual impact.	Neutral – No visual impact.
Cultural Heritage	A Zone of notification of a listed monument is traversed, which would require consideration during planning and construction stages to prevent damage	A Zone of notification of a listed monument is traversed, which would require consideration during planning and construction stages to prevent damage	A Zone of notification of a listed monument is traversed, which would require consideration during planning and construction stages to prevent damage	This route would impact the road serving the Church of Our Lady of Assumption, Tullyallen. This church possesses a 6 No. of sites & monuments records and 1 No. site of architectural heritage, all contained within a ZoN. This zone encompasses the local road.	A Zone of notification of a listed monument is traversed, which would require consideration during planning and construction stages to prevent damage.
Traffic and Transport	Least impactful Route due to being the shortest length of Underground in the road network. There is potential for some temporary road closures will be necessary on narrow roads to facilitate the installation of cables.	A longer route would have more impact on road closures and traffic management requirements. In addition, an increase of removal of road surface material to a waste facility would increase traffic on roads.	A longer route would have more impact on road closures and traffic management requirements. In addition, an increase of removal of road surface material to a waste facility would increase traffic on roads.	A longer route would have more impact on road closures and traffic management requirements. In addition, an increase of removal of road surface material to a waste facility would increase traffic on roads.	A longer route would have more impact on road closures and traffic management requirements. In addition, an increase of removal of road surface material to a waste facility would increase traffic on roads.

During the pre-planning meeting with Louth County Council (Date:15th February 2024), a minor amendment to route A was outlined and highly recommended by the council due to the initial route options being limited because of utilities infrastructure in the road network.

The Project Team was advised by the roads engineering meeting with Louth County Council 29th February 2024 that a high density of existing and planned infrastructure, water, telecoms and power, are present in the Slane Road making Route Option A challenging, further details are outlined in **Appendix 1.2 Scoping Responses**. The proposed grid route as outlined in TLI Group Drawing reference 05949-DR-101 – 106.

In response to the request for Further information the items raised by Transport Infrastructure Ireland and to investigate this further, the Applicant engaged TLI Group to carry out a Ground Penetrating Radar (GPR) survey of the Slane Road. The results are included in Appendix 3.3 Tech Note UGC Route from Drybridge to R-132- Technical Note 3.

As can be seen in Plates 3.1 & 3.2 below the GPR survey results outlined the road is heavily populated with existing services including water, telecoms and two LV-MV cables. A detailed desktop analysis of each section of the route, utilising the GPR survey results, was carried out to determine if an additional 38kV cable could be accommodated while maintaining the clearance distances required between services. It was found that no space was available for an additional 38kV cable on the Slane Road.

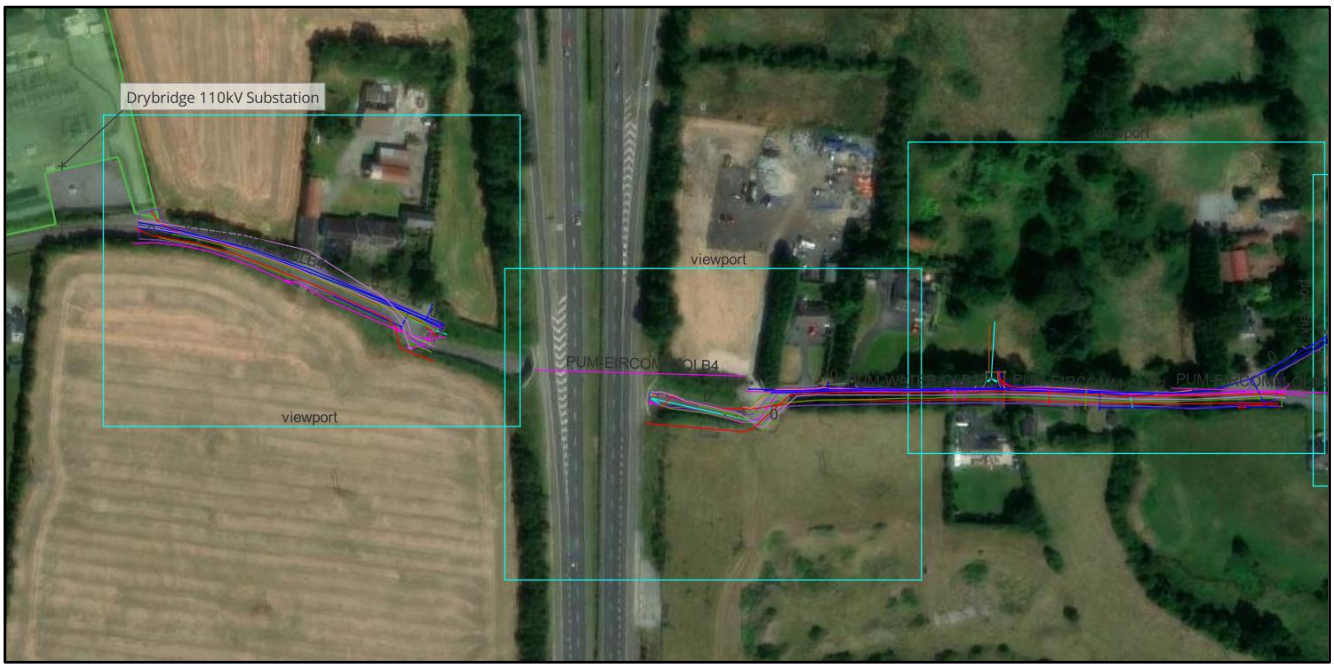

Plate 3.1 Examine the Results of the GPR Survey of Slane Road and implications for Route Option A.

The roads engineering meeting with Louth County Council 29th February 2024 advised to not utilise the Slane Road route because the high density of existing and planned infrastructure, water, telecoms and power utilities has been subsequently confirmed and there is currently no space for 38kV grid connection.

After a review, two minor alternatives of Feasibility Grid Route Option route A outlined in **Appendix 3.1a Kellystown Wind Farm Preliminary Delivery Route and Site Route Analysis** were assessed and outlined in **Appendix 3.1.** Route option 1 which is a minor amendment of route option A as described in **Chapter 2: Proposed Development** and presented in TLI Group Drawing reference 05949-DR-101 – 106 has been selected as the final grid connection route due to accessibility.

3.9 ALTERNATIVE RENEWABLE ENERGY TECHNOLOGIES

An alternative source of renewable energy considered for Site following its identification was solar energy. Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). The capacity factor of solar energy is significantly lower than that of onshore wind energy, requiring approximately three times the capacity of the Development (i.e. X (3) x Y (33 MW) = Z (99 MW)) to produce the same amount of energy. Solar farms require 1 hectare per MW, the land area required to generate the equivalent amount of MW would be in the region of 40 ha. This compares to a footprint of 7.2ha for the five proposed turbines. **Table 3.9** outlines the potential impact from the development of a solar photovoltaic array when compared to a wind farm energy development. The selected wind farm energy development is the most efficient method of energy production with the lesser potential for significant, adverse environmental effects.

Table 3.9: Environmental effects from a solar photovoltaic array compared to a wind farm development

Criteria	Solar Photovoltaic array	Wind Development
Population & Human Health (incl. Shadow Flicker)	Potential for glint and glare impacts on local road users and at dwellings.	No potential for shadow flicker to affect sensitive receptors.
Biodiversity	Larger development footprint (40a) would result in greater habitat loss.	A smaller development footprint (7.2ha) would result in less habitat loss

Criteria	Solar Photovoltaic array	Wind Development
Ornithology	Potential for mimicry of sensory cues i.e., glint and glare similar to water leading to bird fatalities caused by collision. This can be mitigated.	Slight Negative impact from potential collision with the turbines no Significant impact predicted.
Soils & Geology	Although Solar PV has a larger development footprint, the volume of spoil to be excavated is less than that required for a wind farm due to the shallow excavation works required during construction.	A larger volume of spoil to be excavated and managed.
Hydrology & Hydrogeology	A solar PV array development would require a larger development footprint therefore increasing the potential for silty laden runoff to enter receiving watercourses.	A smaller development footprint therefore decreasing the potential for silty laden runoff to enter receiving watercourses.
Air & Climate	Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.	A higher capacity factor of wind turbine technology would result in a quicker carbon payback period.
Noise	The potential noise impacts from a solar PV are less than that of a wind energy development due to the smaller scale construction and there is no noise associated with the solar panels.	Wind turbines produce more noise than solar panels however the substation and Battery Energy Storage system would be neutral at the same capacity.
Material Assets	The larger development footprint would have a greater impact on the land use (Forestry and Agriculture) of the Site.	The smaller development footprint would have a lesser impact on the land use (Forestry and Agriculture) of the Site.
Landscape & Visual	Potentially less visible from surrounding area due to screening from existing forestry and topography. More of a local low level visual impact due to the increased land take and slope of the land.	A greater impact from a visual perspective as wind turbines can be seen from a 20km radius.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Smaller development footprint would reduce the potential for impacts on unrecorded, subsurface archaeology.

Criteria	Solar Photovoltaic array	Wind Development
Traffic & Transport	Potential for greater traffic volumes during construction phase due to the number of solar panels required to achieve the same output. However, due to the smaller size of the solar panels there will be less work required along the TDR route to accommodate their delivery.	Lower number of traffic movements however larger components and more difficult to manage turbine delivery.

3.10 ALTERNATIVE TURBINE HAUL ROUTE

Alternative ports of entry and transport routes to the Site were considered, the latter in relation to turbine component delivery as well as general construction-related traffic.

3.10.1 Port of Entry

The alternatives considered for the port of entry of wind turbines into Ireland for the Development Belfast Port, Co Antrim (UK), Galway Port, Co. Galway and the Greenore Port, Co. Louth. All Ports offer a roll-on-roll-off procedure to facilitate import of wind turbines. Belfast was initially considered however was ruled out due to logistical difficulties following United Kingdom leaving the European Union. Galway Port was selected as the most appropriate port of entry for this Project because it could facilitate the delivery of the blade size required for the wind farm. Several of existing wind farms have successfully utilised this port.

3.10.2 Turbine Component Delivery to Site

The Final Turbine component delivery route selected following route from Galway Port via the R339, R865, N6, M6, M4, N4, M50, M1 and R169 and R132. This route has proven suitable for the transport of turbine components for other wind farm developments in the area. The transport analysis (as presented in **Chapter 16: Traffic and Transportation**) outlines only minor additional accommodation works will be required to accommodate the proposed turbines. Excluding one node at junction R132 / L6274 which requires landscaping and the construction of an access road.

There are two further alternative options which were assessed for turbine blade delivery outlined in **Appendix 3.1.**

3.11 ALTERNATIVE MITIGATION MEASURES

Mitigation by avoidance has been central to the Project's evolution. By avoiding the sensitive areas of the Site using the constraints led approach described in **Section 3.6.1** the potential for environmental effects is limited. As noted above, the site layout aims to avoid any environmentally sensitive areas through the application of site-specific constraints. Where loss of habitat occurs at the Site, this has been mitigated with the proposal of enhancement lands.

The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks and have been designed to break the pathway between the Site and any identified sensitive receptors.

3.12 CONCLUSION

A description of the reasonable alternatives in terms of wind farm design and layout, design philosophy and specifications, grid connection, renewable energy technologies, turbine haul route and mitigation measures, 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 has been provided.