



Cush Wind Farm

# Environmental Impact Assessment Report

## Chapter 2: Assessment of Project Alternatives

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## 2.1 Introduction

The presentation and consideration of the various reasonable project alternatives investigated is an important requirement of the EIA process and the single most effective means of avoiding likely significant effects on the environment. As described in **Chapter 1**, the EIA process is highly iterative involving a constant interchange between project designers and competent experts, with designers continually adjusting the design in response to identified environmental constraints, and vice versa, including with the embedding of mitigation measures in the emerging project design. The purpose of this chapter is to record the key outcomes of this process and to document the assessment of the range of alternatives considered.

The EIA Directive requires that an EIA must include:-

*'A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of environmental effects'.*

This provision requires an EIA to present transparent and objective evidence on the range of reasonable alternatives which were examined, analysed and evaluated, and which led to the adoption and selection of the final project as described in **Chapter 3**. The *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2022) state that it is generally sufficient to provide a broad description of each of the main alternatives considered, identifying the key issues associated with each of them, and to demonstrate how environmental constraints were taken into account. A detailed assessment (or 'mini-EIA') of each alternative is not required.

## 2.2 Alternatives Considered

The consideration of alternatives is a dynamic process and alternatives may be identified at many levels and stages during the evolution of a project, from strategic site location selection through to site layouts, design, technologies and on to mitigation and any monitoring measures. Alternatives that are available for consideration at the earlier stages of a project, particularly at the feasibility and scoping stages, are considered to represent the greatest opportunity for the avoidance of likely significant effects on the environment. As environmental issues emerged during the EIA/project design process, alternative designs were also considered, and additional mitigation options considered towards the end of the process.

The reasonable alternatives considered in undertaking this EIA were as follows:-

- 'Do-Nothing';
- Alternative locations;
- Alternative technologies;
- Alternative design and layouts;
- Alternative grid connections;
- Alternative haul routes; and
- Alternative forestry replant lands.

Each of these alternatives were considered relevant to the project and its specific characteristics and are discussed in further detail below, including an assessment and

comparison of likely significant environmental effects and indicating the main reasons for choosing the project, as proposed.

## 2.3 Assessment of Alternatives

### 2.3.1 'Do-Nothing' Alternative

Current national Government policy in respect of energy production and the reduction of greenhouse gas emissions are all collectively very strongly supportive of the rapid, increased generation of renewable electricity, including wind energy, to reverse climate breakdown and the transition of energy production away from fossil fuels.

The Climate & Low Carbon Development (Amendment) Bill 2021 provides for one of the most ambitious decarbonisation pathways anywhere in the world. To achieve a 51% reduction in greenhouse gas emissions by 2030, the statutory Climate Action Plan 2023 commits to a renewable energy generation target of at least 80% by 2030. It is acknowledged that onshore wind will continue to play a vital role in achieving this target, particularly over the next five years, with a target of 6 gigawatts (GW) by 2025 and 9GW by 2030.

The Government's *Wind Energy Development Guidelines for Planning Authorities 2006* (DoEHLG, 2006) and subsequent updated *Draft Revised Wind Energy Development Guidelines 2019* (DoHPLG, 2019) establishes a land-use planning framework whereby planning authorities can proactively support the development of wind energy projects at appropriate locations. In accordance with these land-use policies, the *Offaly County Development Plan 2021-2027*, and accompanying Strategic Environmental Assessment (SEA), is generally highly supportive of wind energy development at designated locations within the county.

In the 'Do-Nothing' alternative, the status quo in terms of the local environment of the project site would remain unchanged with gradually evolving managed farmland, maturing commercial forestry (including woodland) and cutover bog. It is also likely that in the 'Do-Nothing' scenario, there would be some further commercial afforestation and small-scale domestic cutover peat extraction<sup>1</sup>.

The quantum of renewable energy produced in this part of County Offaly would also remain unchanged. Therefore, due to the critical importance of onshore wind energy in the transition to a low carbon economy in national, regional and local policies, and the recognised imperative of generating electricity from renewable sources, as outlined above, the 'Do-Nothing' alternative was not considered a reasonable alternative.

It was considered that there is potential within County Offaly to deliver further wind energy generation capacity. At present, according to the *Offaly County Development Plan 2021-2027*, the total installed wind energy capacity is c. 98.5MW<sup>2</sup>. This figure does not include wind farm developments within the county which have been commissioned since the publication of the *Offaly County Development Plan 2021-2027*<sup>3</sup>, which, when included, brings the total installed capacity up to c.

<sup>1</sup> In this EIA, 'cutover' bog refers to small areas of peatlands that have been domestically cut for peat extraction and which generally have greater and often more variable depths of peat remaining. 'Cutaway' bog, on the other hand, refers to large areas of peatlands that were industrially cut in the past, often leaving little (up to 50cm) or no peat layer remaining.

<sup>2</sup> This includes Leabeg Wind Farm, Meenwaun Wind Farm and Mount Lucas Wind Farm.

<sup>3</sup> Since the publication of the *Offaly County Development Plan 2021-2027*, two other wind farm developments in

195.7MW. This amounts to just 4.5% of the 4,332.5MW installed capacity in the Republic of Ireland<sup>4</sup>.

The *Offaly County Development Plan 2021-2027* separately notes that a further c. 237.8MW of wind energy development has been permitted within the county, including at the Cloncreen Wind Farm<sup>5</sup>, Derrinlough Wind Farm<sup>6</sup>, Yellow River Wind Farm<sup>7</sup>, and Moanvane Wind Farm<sup>8</sup>. It is noted that, whilst the Cloncreen project has now been commissioned, the Cushaling<sup>9</sup> Wind Farm has also been consented which brings the actual figure for total consented capacity across County Offaly to c. 301MW.

Accordingly, given the very strong policy imperative for the generation of renewable energy at appropriate locations and the clear requirement for additional renewable energy generation to reduce greenhouse gas emissions, it was concluded that the 'Do-Nothing' alternative was not an appropriate option.

### 2.3.2 Alternative Technologies

Wind energy is recognised in government policy as a proven and cost-effective renewable energy generation technology in the context of Ireland's abundant wind resource. The only other onshore technology reasonably available that could possibly meet the objectives of the project would be the development of a ground-mounted solar energy project. As discussed above, the Climate Action Plan 2023 recognises that onshore wind will continue to play a vital role in decarbonising Irish electricity generation with a target of at least 6GW by 2025. Solar, on the other hand, is recognised as a rapidly emerging technology with a corresponding target of 'up to' 5GW by 2025.

Solar energy production, however, requires a significantly larger direct land take and would result in substantial changes to existing land uses and agricultural practices. In contrast, a wind energy project will not result in any substantive alteration to current land uses, and agricultural and other activities can co-exist and continue with only minor, temporary disturbance during the construction phase. For example, a 7.2MW wind turbine (and ancillary infrastructure) is estimated to require a direct land take of c. 1 hectare (2.5 acres) while a solar development with an output of 7.2MW would require a footprint area of c. 12 hectares (29 acres). As such, the comparable land take for a solar energy project (of an equivalent installed capacity) required to meet the objectives of the project would have a direct footprint of c. 96 hectares thus substantially altering existing land uses and practices.

A wind energy development would also result in a substantially reduced potential likelihood of significant impacts on habitats due to land use changes; including for example, the loss of woodland; in comparison to a similarly scaled solar development.

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County Offaly (Offaly County Council Planning Register References 14/188 [An Bord Pleanála Reference PL19.244053] and 19/404, and An Bord Pleanála Reference PL19.PA0047) known as Cloghan Wind Farm and Cloncreen Wind Farm's, respectively, with a combined output of 97.2MW, have been commissioned.

<sup>4</sup> Installed Capacity in the Republic of Ireland as of May 2022 (Source: Wind Energy Ireland – <https://windenergyireland.com/about-wind/the-basics/facts-stats>)

<sup>5</sup> Now Commissioned and operational, see (2) above.

<sup>6</sup> An Bord Pleanála Reference PL19.306706.

<sup>7</sup> An Bord Pleanála Reference PL19.PA0032.

<sup>8</sup> Offaly County Council Planning Register Reference 17/335 (An Bord Pleanála Reference ABP-301619-18)

<sup>9</sup> Offaly County Council Planning Register Reference 19/606 (An Bord Pleanála Reference ABP-306924-20), and Kildare County Council Planning Register Reference 19/1323 (An Bord Pleanála Reference ABP-306748-20)

Moreover, in the context of this particular geographical location, a solar energy project would not generate renewable electricity in a similarly efficient manner as a wind energy development. Average wind speeds of approximately 7.3m/s at 114m (adjusted) have been recorded at the project site which makes this location highly viable for wind energy production. The *Renewable Electricity Support Scheme (RESS) High Level Design*, published by the Government, considers that onshore wind has a generating capacity of 31% while solar has a capacity factor of 11%; thus illustrating the substantially greater efficiencies offered by onshore wind energy developments compared to solar energy developments.

Wind energy production in Ireland is very effective due to the large available wind resource and mature cost-effective technologies and, on this basis of the above, other technologies were considered inferior and not considered a reasonable alternative to achieve the objectives of the project at this location.

### 2.3.3 Alternative Locations

Strategic site selection to avoid intrinsic environmental sensitivity is the principal mitigation option for onshore wind energy projects. Some locations have more inherent environmental sensitivities than others and an assessment of alternative locations can therefore avoid such locations in favour of locations which have fewer constraints and more capacity to sustainably assimilate a wind energy project. Where a mapped wind energy strategy has been prepared and adopted by the relevant planning authority, this will have been subject to a higher tier SEA that takes account of strategic environmental opportunities and constraints in the designation of specific locations as suitable or unsuitable for wind energy generation.

The *Offaly County Development Plan 2021-2027* includes a Wind Energy Strategy designates 'Areas Open for Consideration For Wind Energy Development' and 'Areas Not Deemed Suitable for Wind Energy Development' (Map No. 10 – Wind Energy Strategy Designations). To avoid duplication of assessments, this prior assessment of strategic alternatives was also considered in this EIAR in the assessment of possible alternative locations.

There is a well-established and widely used methodology for the selection of wind energy development locations used by developers and which generally accord with the criteria set out in the *Wind Energy Development Guidelines for Planning Authorities 2006*. The methodology is based on a screening process and applying key sieve analysis criteria (not listed in order of importance), as follows:-

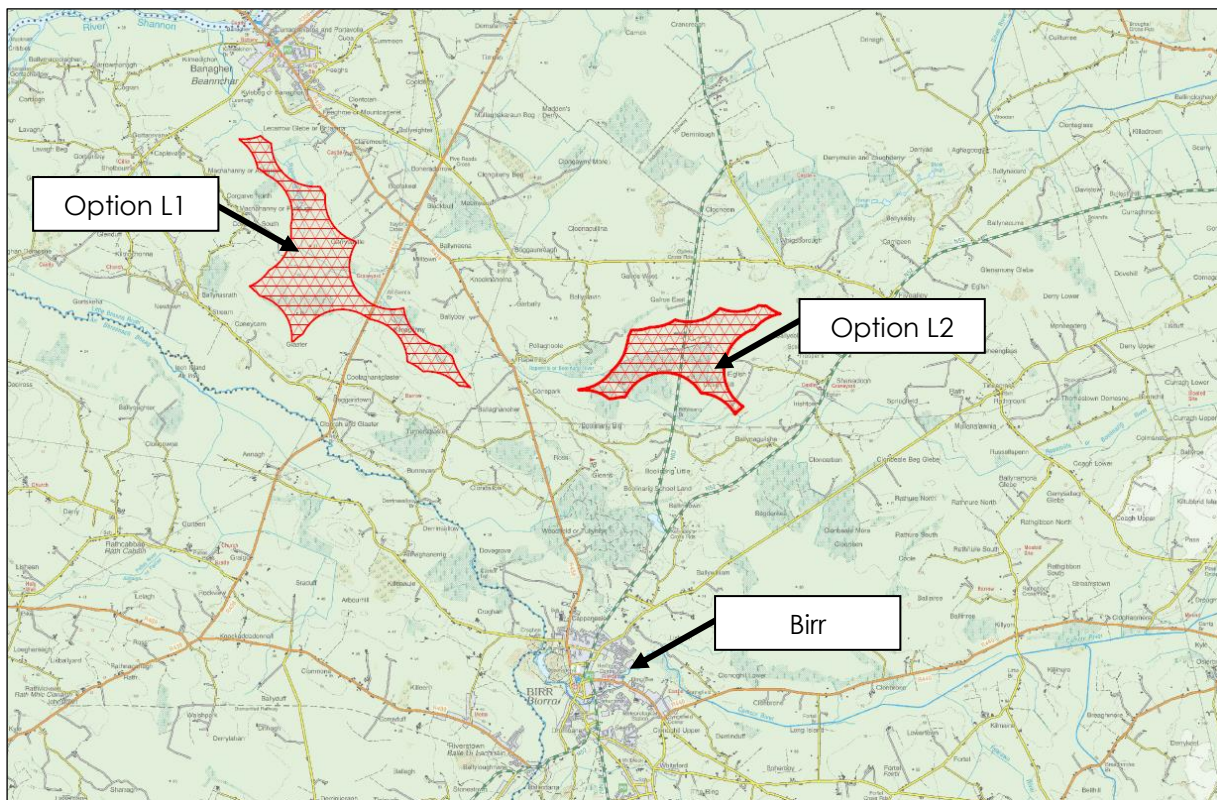
- Available wind resource;
- Land use context;
- Electricity grid availability and capacity;
- Residential amenity and community;
- Environmental constraints (including natural and archaeological heritage);
- Landscape and visual capacity;
- Accessibility;
- Energy and land-use planning policies; and,
- Other Factors.

In the first instance, a strategic search area was identified north of Birr, County Offaly as there are currently few other existing, permitted or proposed wind farms in this

general area<sup>10</sup>. On the basis of this assessment, 2 no. possible locations were identified as potentially suitable for the development of a wind energy project in this general area, as follows:-

- **Option L1:** Milltown, Garrycastle, Ballynagrah, Glaster, Kilnaglinny, Coolaghansglaster, Ballaghanohar, Ballyboy, Macnahanny or Furlough, Macnahanny or Ashgrove, Lecarrow Glebe or Britannia, County Offaly; and,
- **Option L2:** Cush, Galros West, Boolinarig Big, and Eglis, Co. Offaly.

Both of these options were consequently selected for further detailed technical and environmental assessment, as detailed below. The alternative locations are illustrated below at **Figure 2.1** and reproduced at **Annex 2.1**.



**Figure 2.1: Alternative Locations**

**Table 2.1** below provides an overview of a comparative assessment of environmental constraints and opportunities associated with both alternative locations and the emerging preferred location based on each environmental factor. In undertaking this assessment, the criteria provided in Schedule 7 of the Planning Regulations together with the general environmental factors included in Article 3(1) of the EIA Directive were used as a framework for analysis.

<sup>10</sup> Other permitted and operational wind farms in this general area include Meenwaun Wind Farm (4 no. turbines), Cloghan Wind Farm (9 no. turbines) and the permitted (and under construction) Derrinlough Wind Farm (21 no. turbines).

Location Factor	Option L1	Option L2	Emerging Preferred Option
Population & Human Health	Low density of dwellings in vicinity of identified location; however, notable levels of residences along local routes which makes appropriate separation distances to dwellings challenging. Approximately 4km to the nearest urban settlement (Birr).	Low density of dwellings in vicinity of identified location with substantial separation distances to wind turbines achievable. Approximately 4km to the nearest urban settlement (Birr).	Option L2
Biodiversity	Comprises a mix of land cover including significant areas of intact peat. This location includes a SPA (All Saints Bog SPA), a SAC (All Saints Bog and Esker SAC) and a pNHA (All Saints Bog and Esker). There are a number of other Natura 2000 sites within 10km, including the Dovegrove Callows SPA, River Little Brosna Callows SPA, Middle Shannon Callows SPA, Redwood Bog SAC, Middle Shannon Callows SAC and Ballyduff/Clonfinane Bog SAC. There is also a possible direct hydrological connection to the All Saints Bog and Esker SAC as well as a connection to the River Shannon Callows SAC via the Rapemills River.	Comprises agricultural pasture, cutover bog, commercial forestry (including woodland). This location does not include any sites designated for nature conservation; however there are a number of Natura 2000 sites within 10km including; the Dovegrove Callows SPA, River Little Brosna Callows SPA, Middle Shannon Callows SPA, Redwood Bog SAC, Middle Shannon Callows SAC and Ballyduff/Clonfinane Bog SAC. The Rapemills River provides a direct hydrological connection and potential pathway for effects.	Option L2
Land & Soil	Predominately underlain by intact/cutaway bog, limestone till and marl. Landcover includes intact peat (heather/scrub), pockets of forestry/woodland and agricultural pasture.	Predominately underlain by peaty soils including limestone till, limestone sands and gravels. Landcover includes cutover and cutaway bog, commercial forestry/woodland, scrub and agricultural pasture.	Option L1 or L2
Water	The Rapemills River bisects the location running from east to west and is within the Lower Shannon Catchment Area. As identified above, the location includes the All Saints Bog SPA and All Saints Bog and Esker SAC. There is a direct hydrological connection to a further five Natura 2000 sites including; Middle Shannon Callows SPA, River Little Brosna Callows SPA, Lough Derg (Shannon) SPA, River Shannon Callows SAC, and Lough Derg, North-east Shore SAC.	The Rapemills river flows through the location westward where it drains to River Shannon. There is a direct hydrological connection to seven Natura 2000 sites including the Middle Shannon Callows SPA, River Little Brosna Callows SPA, All Saints Bog SPA, Lough Derg (Shannon) SPA, All Saints Bog and Esker SAC, River Shannon Callows SAC, and Lough Derg, North-east Shore SAC. It is through the River Shannon and its tributaries that the	Option L2



		location is directly connected to these Natura 2000 sites.	
Air Quality & Climate	No constraints identified. Wind energy development in this location would result in a positive overall impact.	No constraints identified. Wind energy development in this location would result in a positive overall impact.	Option L1 or L2
Landscape	Located within an 'Area of High Landscape Sensitivity' and an 'Area of Medium Landscape Sensitivity' per the Landscape Classification Map (Figure 4.22) of the <i>Offaly County Development Plan 2021-2027</i> . The Wind Energy Strategy designates this location as 'Not Deemed Suitable for Wind Energy Development'.	Located predominantly within an 'Area of Low Landscape Sensitivity' with a small area of the lands also within an 'Area of Medium Landscape Sensitivity' per the Landscape Classification Map (Figure 4.22) of the <i>Offaly County Development Plan 2021-2027</i> . The Wind Energy Strategy designates this area as an 'Area Open for Consideration for Wind Energy Development'.	Option L2
Cultural Heritage	10 no. cultural heritage features sited at this location, including a small cluster to the immediate north. However, low number of features in the vicinity generally.	5 no. cultural heritage features sited at this location, including to the northeast and southwest. However, low number of features in the vicinity.	Option L2
Noise & Vibration	Limited number of receptors (dwellings) in the vicinity, however, notable levels of residences along local routes which makes appropriate separation distances to dwellings challenging.	Due to the limited number of receptors (dwellings) in the vicinity and available separation distances, likely effects are assessed as low. It is, however, assessed that increased separation distances can be achieved at this location when compared to Option L1.	Option L2
Shadow Flicker	Limited number of receptors (dwellings) in the vicinity, however, notable levels of residences along local routes which makes appropriate separation distances to dwellings challenging.	Due to the limited number of receptors (dwellings) in the vicinity, and available separation distances, likely effects are assessed as low. It is, however, assessed that increased separation distances can be achieved at this location when compared to Option L1.	Option L2
Material Assets (Transport & Access; Aviation; and Telecommunications)	No likely significant transport constraints identified. Location can be accessed via national, regional and local roads. Some temporary upgrade works likely to be required. Existing telecommunication masts in wider vicinity of identified location but no likely significant telecommunications constraints identified.	No likely significant transport constraints identified. Location can be readily accessed via national roads with some minor temporary upgrade works likely to be required. N62 National Road bisects the site, thus enabling direct national road access during the construction phase, particularly for turbine component delivery. Existing telecommunication masts in wider vicinity of identified location but no	Option L2

		likely significant telecommunications constraints identified.	
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**Table 2.1: Environmental Assessment of Alternative Locations**

Based on this analysis, it was determined that, although both locations were generally suitable, Option L2 was the emerging preferred location from an environmental constraints and opportunities perspective for the following reasons:-

- The location has been designated as an 'Area Open for Consideration for Wind Energy Development' within the Wind Energy Strategy of the *Offaly County Development Plan 2021-2027* and is not the subject of any specific protective landscape designations being predominantly designated as having a low level of landscape sensitivity;
- The location has a generally low population density with the availability of a suitably large land bank with a low number of proximate residential dwellings. The *Draft Revised Wind Energy Development Guidelines 2019* propose a setback distance of 4-times overall tip height between a wind turbine and the nearest point of the curtilage of any residential property, subject to a mandatory minimum setback of 500m. These setback distances can be achieved at this location for all non-involved (third party) dwellings;
- The general absence of sensitive habitats and the absence of any European designated nature conservation sites (Natura 2000) or other national nature conservation designations on, or in the immediate vicinity, of the location.
- The land use context is benign, generally consisting of flat or gently undulating mix of cutover bog; commercial forestry and forestry (including woodland); and, farmland;
- The location is well served by the national road network, with the N62 national secondary route bisecting the site. Significant road upgrades to accommodate the delivery of turbine components would not therefore be necessary; and,
- The absence of any particular cultural heritage constraints.

Importantly, from a technical and commercial viability perspective, Option L2 has an estimated wind speed of approximately 7.3m/s at 114m height (adjusted; as derived from the existing meteorological mast installed at this location) which is sufficient to ensure the viability of a wind energy development at this location.

On the basis of this assessment, it was decided to undertake further analysis of Option L2 as the emerging preferred location and to discontinue further analysis of Option L1 as a reasonable alternative.

#### 2.3.4 Alternative Design & Layouts

Following the identification of Option L2 as the emerging preferred location, an iterative process was undertaken to determine the precise siting, design and layout of the wind turbines and associated infrastructure. A number of alternative layouts were evaluated to consider how different elements of the project could be arranged such that there would be no likely significant adverse effects on the environment.

The aim was to adopt the combination of design and layout options that presents the best balance between the avoidance of likely significant environmental effects and the achievement of the objectives of the project. Again, this process involved an ongoing dialogue between technical designers and environmental experts

throughout the design process, with the designers continuously adjusting and readjusting the design in response to these environmental assessments. Feedback from the scoping process, including public and stakeholder consultation discussed in **Chapter 1**, also informed this process.

The alternative layouts considered were highly dependent on the specific turbine technology to be installed, with larger turbines requiring increased inter-turbine spacing to minimise wake effects and maintain correct operational performance. A series of wind modelling analyses, using specialist software, examined a range of site layouts and turbine designs to establish turbine technology, including hub, rotor and overall height parameters. These iterations were particularly influenced by the following localised environmental considerations:-

- Visual impact;
- Inter-visibility/visual clutter;
- Flood risk;
- Setback to existing electricity lines and infrastructure; and
- Setback to existing/permitted residential dwellings.

The location of ancillary wind farm infrastructure; including crane hardstands, access tracks, site entrances and underground cabling; is also intrinsically linked to the precise layout of wind turbines. The routing of access tracks is more flexible and can be altered to reflect any changes to turbine locations or identified environmental constraints. Through the iterative turbine design and layout process described above, the most appropriate access track routes were identified for each alternative considered, taking into account the presence of existing agricultural tracks, ground conditions, forestry tracks, field boundaries to reduce the overall project footprint.

Consideration was firstly given to the size and height of the turbines to be installed, including the possibility of a project comprising of a larger number of small-to-medium sized turbines with an overall tip height of c. 105m. Given the relatively low numbers of dwellings within the local vicinity, it was considered possible to achieve appropriate setback distances and therefore to install a larger number of smaller turbines. A comparable example of such a development would be the Mountain Lodge/Bindoo/Edrans/Carrickallen wind farm complex in County Cavan where a total of 65 no. turbines are currently in operation generating a total output of 103MW. This wind farm complex has a large spatial extent and covers an area of c. 1,135 hectares (2,804 acres).

Having assessed the availability of land within Option L2, it was considered that the location could accommodate up to 15 no. wind turbines of up to 105m in height with an electrical output of c. 22MW. However, a project with a smaller number (7-11 no.) of larger turbines of up to 200m in height could, on the other hand, generate between approximately 50MW-80MW with a much smaller physical footprint and spatial extent. Installing larger turbines would also result in a considerably reduced likelihood of significant adverse environmental effects; particularly in respect of likely landscape, noise and shadow flicker impacts; and substantially more efficient renewable energy generation output.

The results of these analyses determined that, having regard to the proposed project objectives and its specific locational characteristics, two main project design options could be reasonably considered from a technical and environmental perspective, as follows:-

- **Option D1:** 12 no. turbines with a maximum tip height of up to 200m (c. 86MW); and,
- **Option D2:** 11 no. turbines with a maximum tip height of up to 200m (c. 79MW).

The layout of each option is provided at **Figure 2.2** and **Figure 2.3** below and reproduced at **Annex 2.2**.



**Figure 2.2: Option D1 Indicative Site Layout (12 no. Turbines)**



**Figure 2.3: Option D2 Site Layout (11 no. Turbines)**

**Table 2.2** provides an overview of the environmental constraints and opportunities associated with each of the two identified options and provides a recommendation of the emerging preferred alternative based on each environmental factor. Again, in undertaking this assessment, the criteria provided in Schedule 7 of the Planning Regulations together with the general environmental factors included in Article 3(1) of the EIA Directive were used as a framework for analysis.

Design & Layout			
Factor	Option D1	Option D2	Emerging Preferred Option
Population & Human Health	Low number of dwellings in vicinity of turbines; 6 no. dwellings within 4-times tip height of a wind turbine.	Low number of dwellings in vicinity of turbines; 2 no. dwellings within 4-times tip height of a wind turbine.	Option D2
Biodiversity	Removal of hedgerow, woodland and commercial forestry likely to be required. Turbine layout generally avoids watercourses; however access tracks will be required to cross watercourses at 4 no. locations. 1 no. turbine located within a 1-in-100 year flood zone <sup>11</sup> - see further consideration under 'Water', below. 3 no. turbines located on cutaway bog.	Extent of hedgerow and commercial forestry removal will be marginally reduced compared to Option D1. Turbine layout generally avoids watercourses; however access tracks will be required to cross watercourses at 4 no. locations. 1 no. turbine located within a 1-in-100 year flood zone. 3 no. turbines located on cutaway bog.	Option D1 or D2
Land & Soil	Lands predominantly underlain by peat and peaty subsoils, with lands to the east underlain by limestone till and lands to the south and southeast underlain by limestone sands and gravels. Lands to north include cutaway and cutover bog with forestry and mixed woodland prevalent throughout the central area. Lands to the east and southwest are in agricultural pasture.	Lands predominantly underlain by peat and peaty subsoils, with lands to the east underlain by limestone till and lands to the south and southeast underlain by limestone sands and gravels. Lands to north include cutaway and cutover bog with forestry and mixed woodland prevalent throughout the central area. Lands to the east and southwest are in agricultural pasture.	Option D1 or D2
Water	4 no. proposed crossings required over watercourses, this includes 3 no. proposed crossings and the upgrade of an existing crossing. Mapped 1-in-100 year flood zone identified on the western side of the site including the area within and around the western-most turbine. Full Flood Risk Assessment commissioned by the Developer indicates that the	4 no. proposed crossings required over watercourses, this includes 3 no. proposed crossings and the upgrade of an existing crossing. Mapped 1-in-100 year flood zone identified on the western side of the site including the area within and around the western-most turbine. Full Flood Risk Assessment commissioned by the Developer indicates that the	Option D2

<sup>11</sup> Note: Based on National Indicative Fluvial Mapping (Source: <https://www.floodinfo.ie/map/floodmaps>)

	proposed western-most turbine remains within the flood zone.	proposed western-most turbine is located outside of flood zone.	
Air & Climate	No likely significant adverse effects. Project would result in a likely positive overall environmental effect. Positive impact enhanced due to increased renewable energy generation.	No likely significant adverse effects. Project would result in a likely positive overall environmental impact.	Option D1 or D2
Landscape	No protected landscape designations or designated scenic views in immediate vicinity. Lands fully located within an 'Area Open for Consideration for Wind Energy Development' as identified within the <i>Offaly County Development Plan 2021-2027 – Wind Energy Strategy</i> . The larger footprint associated with Option D1 will marginally increase the spatial extent of the project and increase the likelihood of potential landscape and visual effects. A larger spatial extent will also marginally increase the potential likelihood for cumulative landscape and visual effects.	No protected landscape designations or designated scenic views in immediate vicinity. Lands fully located within an 'Area Open for Consideration for Wind Energy Development' as identified within the <i>Offaly County Development Plan 2021-2027 – Wind Energy Strategy</i> .	Option D1 or D2
Cultural Heritage	No significant likely effects identified.	No significant likely effects identified.	Option D1 or D2
Noise & Vibration	No significant likely effects identified due to the setback distances available to the nearest dwellings.	No significant likely effects identified due to the setback distances available to the nearest dwellings. Fewer dwellings located within 2km (10 x tip height) compared to Option D1.	Option D1 or D2
Shadow Flicker	No significant likely effects identified due to the setback distances available to the nearest dwellings.	No significant likely effects identified due to the setback distances available to the nearest dwellings. Fewer dwellings located within 2km (10 x tip height) compared to Option D1.	Option D1 or D2
Material Assets (Transport & Access; Telecommunications)	No likely significant effects on transport identified. Location can be readily accessed via national roads (construction phase) and local roads (operational phase), with some temporary upgrade works required. During consultation with service providers, a potential risk of interference with existing aerial	No likely significant effects on transport identified. Location can be readily accessed via national roads (construction phase) and local roads (operational phase), with some temporary upgrade works required. During consultation with service providers, a potential risk of interference with existing aerial telecommunication networks was identified. However, Option	Option D2

	telecommunication networks was identified. During consultation with Eirgrid, concerns were raised with the southern-most turbine being located within 3.5 x rotor diameter (distance) from an existing 400kV overhead electricity line (OHL) and the potential for interference with airflows.	D2 increases the separation distance and further consultation confirmed no significant effects anticipated. The alternative design associated with Option D2 removes the closest turbine to the 400kV OHL and removed potential risk to airflows. No significant effects anticipated.	
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**Table 2.2: Environmental Assessment of Alternative Site Designs and Layouts**

It should be noted that matters raised by members of the local community, through the community consultation process, were also an important factor in the consideration of alternative site design and layouts. In particular, a number of local residents raised concerns regarding visual impact, noise and shadow flicker. This local knowledge of the site, and the concerns raised, were central to the assessment of alternatives and enabled the project team to fully consider and assess alternatives which responded to the characteristics of the site and the feedback provided by third parties.

Based on this appraisal, it was concluded that Option D2 should be progressed as the emerging preferred project design and layout. Evidently, Option D1 provides a marginally greater degree of renewable energy electricity generation over Option D2, however Option D1 includes a proposed turbine which is located within a modelled flood zone (westernmost turbine) and a proposed turbine within an area of concern for Eirgrid (southernmost turbine).

As discussed above, at **Section 2.1**, however, the EIAR process is also highly iterative and project design is continuously adjusted in response to an assessment of a range of commercial, technical and environmental considerations. On the basis of further commercial and technical assessments, the Developer elected to omit the 3 no. northernmost turbines. A revised Option D3 was therefore identified and selected as the preferred project design and layout at this time (see **Figure 2.4**). Evaluations are ongoing at the locations of the 3 no. omitted wind turbines to facilitate their potential development at a future date, which would be subject to a separate consenting process.



**Figure 2.4: Option D3 Site Layout (8 no. Turbines)**

Subsequent to the conclusion that Option D3 was the emerging preferred project design and layout at this time, a technical appraisal of available turbine technology was carried out to determine which turbine model was optimal for the site.

Turbine models, which could be provided within the overall tip height of 200m were considered, include the following:-

- Nordex N163-6.0;
- Vestas V172-7.2;
- Vestas V162-6.2;
- General Electric GE 5.8-158; and
- Siemens Gamesa SG 6.6-155.

Each of these turbine models were deemed to be generally suitable for use at the project site. However, based on a technical analysis undertaken, the Vestas V172-7.2 was considered to be the most suitable for the site and was ultimately selected as the preferred turbine model for the project (see **Chapter 3** for further details).

### 2.3.5 Alternative Grid Connections

The method of connection to the national electricity grid is also an integral element of the overall project which falls to be considered in the EIAR.

In Ireland, the point of connection to the national grid is determined by way of a separate and subsequent statutory process under the auspices of EirGrid/ESB Networks, as grid network operators. While it cannot be determined with complete certainty as to the precise method of connection, a detailed technical analysis was carried out by the Developer of the existing grid network and grid capacity in the region, alongside the predicted electrical output of Option D3, above.

Following this evaluation, a further technical evaluation was completed to identify suitable substations on the national electricity grid to which to connect and the most



suitable method of providing this connection. As a result of this analysis, 3 no. grid connection options were identified as being generally viable alternatives, as follows:-

- **Option G1:** Construction of a 110kV substation at the project site (wind farm) and installation of a 110kV underground electricity cable within the carriageways of local and regional public roads to the existing Dallow 110kV substation at Clondallow, Co. Offaly, which is located approximately 5.6km to the southwest;
- **Option G2:** Construction of a 110kV substation at the project site (wind farm) and installation of a 110kV underground electricity cable within the carriageways of local and regional public roads to the existing Shannonbridge 220/110kV substation at Shannonbridge, Co. Offaly, which is located approximately 25km to the northwest; and,
- **Option G3:** Construction of a 110kV substation at the project site (wind farm) and installation of a 110kV underground electricity cable within the carriageways of local, regional and national public roads to the existing Derrycarney 110kV substation at Lumcloon, Co. Offaly, which is located approximately 15km to the northeast.

Other options to provide a connection to the national grid were considered; including the provision of a new 110/220kV substation (**Option G4**) located on lands at Glaster, Co. Offaly approximately 5.6km west of the project site, as well as a potential connection via the permitted Derrinlough Wind Farm substation (**Option G5**) located on lands at Stonestown, Co. Offaly, approximately 15km from the project site. However, these were not considered to be reasonable alternatives due to an absence of clarity regarding available capacity and status of these substations.

The location of each of these grid connection options are illustrated at **Annex 2.3** and further evaluated at **Table 2.3** below.

Design & Layout		Option G1	Option G2	Option G3	Emerging Preferred Option
Factor					
Population & Human Health	Relatively low density of dwellings along the route of the underground electricity cable and in the vicinity of substation. Likelihood of temporary disruption to local residents and traffic during construction works.	Higher density of dwellings in the vicinity of the substation and along the route of underground electricity cable. The route would pass through the small settlement of Shannon Harbour. Longer connection route and increased likelihood of temporary disruption to local residents and traffic during construction works compared to Option G1.	Relatively low density of dwellings along the route of the underground electricity and in the vicinity of the substation. Longer connection route and Increased likelihood of temporary disruption to local residents and traffic during construction works compared to Option G1.		Option G1
Biodiversity	Identified route is generally not sensitive due to being	Identified route is generally not sensitive due to being	Identified route is generally not sensitive due to being		Option G1

	predominately located within carriageway of public roads. Where the route is located on private lands it is generally located within an existing laneway. Route does not involve the crossing of any mapped watercourses.	predominately located within carriageway of public roads; however, the route crosses the River Shannon Callows SAC and a number of lower order watercourses which discharge to the SAC.	predominately located within carriageway of public roads; however, the route crosses a number of lower order EPA mapped watercourses which discharge to the River Shannon Callows SAC.	
Land & Soil	No likely significant constraints identified.	No likely significant constraints identified.	No likely significant constraints identified.	Option G1, Option G2 or Option G3
Water	The route does not cross any mapped watercourses. The substation is not located in close proximity to any important surface water feature.	The route crosses a number (c. 11 no.) mapped watercourses, including the direct hydrological link to the River Shannon Callows SAC. The substation is not located in close proximity to any important surface water feature.	The route crosses a number (c. 2 no.) mapped watercourses, including an indirect hydrological link to the River Shannon Callows SAC. The substation is not located in close proximity to any important surface water feature.	Option G1
Air & Climate	No likely significant constraints identified. Project would result in a positive overall effect.	No likely significant constraints identified. Project would result in a positive overall effect.	No likely significant constraints identified. Project would result in a positive overall effect.	Option G1, Option G2 or Option G3
Landscape	Landscape effects from electricity cables largely imperceptible due to nature of underground connection and use of public roads. The route does, however, run within an area of High Landscape Sensitivity in the area around the L70151 local road. No designated scenic views in the immediate vicinity. Substation location is substantially screened from public view.	Landscape effects from electricity cables largely imperceptible due to nature of underground connection and use of public roads. The route does, however, run within an area of High Landscape Sensitivity in the area around Shannon Harbour. Electricity route also traverses designated scenic view V06 on the R356 regional road. Substation location is substantially	Landscape effects from electricity cables largely imperceptible due to nature of underground connection and use of public roads. The route does, however, run within an area of High Landscape Sensitivity in the area around the R437 regional road. No designated scenic views in the immediate vicinity. Substation location is substantially screened from public view.	Option G1 or Option G3

		screened from public view.		
Cultural Heritage	The underground electricity cable route is located in close proximity (within 100m) to a cultural heritage feature but does not impinge on the footprint of any feature. The substation is not located in close proximity to any feature.	The underground electricity cable route is located in close proximity (within 100m) to a number of cultural heritage features (a greater number than Option G1) but does not impinge on the footprint of any feature. The substation is not located in close proximity to any feature.	The underground electricity cable route is located in close proximity (within 100m) to a number of cultural heritage features (a greater number than Option G1) but does not impinge on the footprint of any feature. The substation is not located in close proximity to any feature.	Option G1
Noise & Vibration	Construction activities would take place in the immediate vicinity of dwellings along the route of the underground electricity cable. Substation location is remote from dwellings and noise is unlikely to affect local residents.	Construction activities would take place in the immediate vicinity of a greater number of dwellings along the route in comparison to Option G1. Substation location is remote from dwellings and noise is unlikely to affect local residents.	Construction activities would take place in the immediate vicinity of a greater number of dwellings along the route in comparison to Option G1. Substation location is remote from dwellings and noise is unlikely to affect local residents.	Option G1
Shadow Flicker	Not applicable	Not applicable	Not applicable	Not applicable
Material Assets (Transport & Access; Telecommunications)	Short-term, temporary effects likely on transport and access during construction due to requirement for temporary road closures and diversions. No likelihood of significant effects on telecommunications.	Short-term, temporary effects likely on transport and access during construction due to requirement for temporary road closures and diversions. The longer route (compared with Option G1) increases the extent and duration of anticipated road closures. No likelihood of significant effects on telecommunications.	Short-term, temporary effects likely on transport and access during construction due to requirement for traffic management measures. The longer route (compared with Option G1) increases the extent and duration of anticipated traffic management measures, including on the national road (N62). No likelihood of significant effects	Option G1

			on telecommunication.	
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**Table 2.3: Environmental Assessment of Alternative Grid Connection Options**

As was the case with the assessment of alternative site designs and layouts above, the assessment of alternative grid connections was also cognisant of matters raised by members of the local community through the community consultation process. Local knowledge of the area, and concerns raised, were included in the above assessment and enabled the project team to fully consider and assess alternatives which responded to the characteristics of the site and the feedback provided by the local community.

Based on this appraisal, it was concluded that neither Option G1, G2 nor G3 were considered likely to give rise to significant adverse environmental effects. Option G1 is, however, considered to be preferential in environmental impact terms to Option G2 and G3 and was, therefore, selected as the preferred means of connecting the project (wind farm) to the national electricity grid network. The grid connection option will be subject to a separate future development consent process, including EIA. However, as also discussed above, it may be the case that EirGrid/ESB Networks ultimately direct the Developer to undertake an alternative mode of connection. In such an eventuality, a further development consent process, including EIA, will also be required.

**2.3.6 Alternative Haul Routes**

**2.3.6.1 Turbine Components**

It should be noted that there are a number of ports of entry for turbine components into Ireland and, therefore, an exact haul route cannot be confirmed until the completion of the turbine tendering process i.e. prior to construction. The turbine manufacturer will ultimately determine the port of entry and, subsequently, the chosen haul route. However, given the relative proximity of Option L2 to the N62/N52 (accessed from the M6); it can be confirmed that turbine components will travel along this route.

A number of ports may be used to import turbine components including Port of Galway, Dublin Port, Limerick-Shannon-Foynes Port, and the Port of Waterford. Turbine components travelling between any of the abovenamed ports and the M6/N52 junction will utilise national (including motorway) routes which are regularly used in the transportation of turbine components and will not require any particular modification works.

While each of the abovenamed ports have been assessed as feasible options; for the purposes of this EIAR, the Port of Galway has been selected (for assessment purposes only) as the most likely port of entry for turbine components. Therefore, a detailed haul route assessment, from the Port of Galway to the site of Option L2 was undertaken

and it was concluded that only minor, temporary modification works would be required to accommodate the delivery of wind turbine components. The necessary works are described in detail at **Chapter 3**.

#### 2.3.6.2 Construction Materials

The construction phase of the project will require materials, such as stone aggregates and concrete, to be imported to the project site from selected suppliers. It is unlikely that significant volumes of stone aggregates will be encountered during construction works and, thus, the majority of capping material for access tracks and crane hardstands will be sourced from local quarries. No concrete batching will be undertaken at the project site and all concrete will be imported from local suppliers.

A range of potential local suppliers have, therefore, been considered and the potential haul routes to the main site entrance are illustrated at **Annex 2.4**. Potential suppliers include:-

- Whytes Concrete, Mackney (Kelly), Co. Galway;
- McKeons Sand and Gravel – Culliaghbeg, Co. Roscommon;
- Banagher Concrete, Banagher, Co. Offaly;
- Smyths Sand and Gravel, Whigsborough, Fivealley, Co. Offaly;
- Smyths Sand and Gravel, Lelagh, Co. Tipperary;
- Loughnane Concrete, Ballynaguilsha, Birr, Co. Offaly; and,
- Carroll Quarries, Bohernaghty, Portlaoise, Co. Laois.

The selection of construction material suppliers will be subject to a competitive tendering process prior to the commencement of development. Therefore, it is not currently possible to determine the precise material haul routes. While it is evaluated that there is no likelihood of significant adverse effects on either the road network or third party access as a result of the movement of construction related vehicles using any of the abovementioned haul routes; in order to reduce any minor effects yet further, the chosen suppliers will be instructed to utilise motorway, national and regional roads, and avoid local roads, insofar as is possible and practicable. The directions for all construction related vehicles will be set out in a Traffic Management Plan. Thus, while the indicative haul routes presented at **Annex 2.4** do not necessarily represent the most direct route to the project site, they are deemed to be the most appropriate to ensure the protection of the road network in the region.

#### 2.3.7 Alternative Forestry Replant Lands

While the majority of the infrastructure associated with Option D3 is located within agricultural lands, some infrastructure is located within commercially afforested lands and woodland (mixed). Therefore, it is proposed to permanently remove 23 hectares (ha) of forestry in order to accommodate the construction of turbine foundations, access tracks and other ancillary infrastructure associated with the project; and to facilitate the physical operation of the wind turbines (see **Chapter 3** & **Chapter 5** for further details).

All tree felling to be undertaken will be the subject of a Felling Licence application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017. In accordance with the Forest Service's published policy on granting felling licences for wind farm developments, areas of forestry which have been felled to accommodate wind turbines, turbine bases, access roads and any other wind farm related uses must be replaced by replanting at an alternative site. The alternative site can be located anywhere within the Republic of Ireland.

As part of this process, the Developer identified 2 no. landbanks; located within County Monaghan and County Cavan respectively; each of which extend to an area of c. 25ha, and are considered to be generally suitable for afforestation, as follows:-

- **Option RP1:** Lands within the townlands of Drumleek South, Drumagelvin, Lisdonny, and Moy, County Monaghan and located c. 2.5km east of the town of Castleblayney; and
- **Option RP2:** Lands within the townlands of Fartagh and Legland, County Cavan and located c. 8km northwest of the town of Bailieborough.

The location of each of these landbanks are illustrated at **Annex 2.5 (Volume II)** and further evaluated at **Table 2.4** below.

Design & Layout			
Factor	Option RP1	Option RP2	Emerging Preferred Option
Population & Human Health	Low density of dwellings in the vicinity generally comprising farmsteads. Potential for minor traffic disruption during planting operations.	Low density of dwellings in the vicinity generally comprising farmsteads; however, 5 no. dwellings immediately adjacent. Potential for minor traffic disruption during planting operations.	Option RP1
Biodiversity	Lands predominately comprise improved/semi-improved grassland; however, significant areas have become overgrown with gorse and scrub. Notwithstanding this, the site is not assessed to be of any particular ecological significance.	Lands largely comprise improved agricultural grassland bounded by mature hedgerows interspersed with trees. No particular ecological significance identified.	Option RP1 or RP2
Land & Soil	Lands are classed as having bedrock at or near the surface while localised areas of peat are also mapped.	Lands comprise sandstone and shale till and are not geologically complex.	Option RP1 or RP2
Water	There are no watercourses within or adjacent to the identified lands.	Madabawn Stream is located on the south and southeastern periphery of the lands.	Option RP1
Air & Climate	No likely significant constraints identified.	No likely significant constraints identified.	Option RP1 Or RP2
Landscape	A number of scenic viewpoints located to the southwest of the identified lands associated with Lough Muckno. Topography at this location is generally flat and forestry is unlikely to be particularly prominent in the landscape.	No scenic viewpoints located in or around the identified lands. Forestry at this location is unlikely to be particularly evident in the landscape.	Option RP1 or RP2
Cultural Heritage	A heritage feature is present within the lands; however, it is stated to be 'redundant'.	No heritage features present within the lands.	Option RP1 or RP2
Noise & Vibration	Significant levels of noise or vibration are unlikely to be generated by works	Significant levels of noise or vibration are unlikely to be generated by works	Option RP1

	associated with replanting activities.	associated with re-planting activities. 5 No. dwellings located immediately adjacent to identified lands.	
Shadow Flicker	Not applicable	Not applicable	Not applicable
Material Assets (Transport & Access; Telecommunications)	Short-term effects likely on transport & access during planting. No likelihood of significant effects on telecommunications.	Short-term effects likely on transport & access during planting. No likelihood of significant effects on telecommunications.	Option RP1 or RP2

**Table 2.4: Environmental Assessment of Alternative Forestry Replant Lands**

On the basis of the above, it is assessed that neither Option RP1 nor RP2 were considered likely to give rise to significant effects. Option RP1 is, however, considered to be preferential in environmental impact terms due to the increased separation from residential dwellings and watercourse(s). Option RP1 was, therefore, selected and assessed for replanting with further details provided at **Chapter 3**.

Whilst Option RP1 has been assessed as the preferred replant lands, it is important to note that an alternative parcel of land may also be selected in due course. Given, as described in **Chapter 3**, that the actual replacement lands will be subject to an environmental assessment and technical approval process as part of the normal course of the consenting process, it is assessed that the selection of alternate replacement lands will not affect the substantive conclusions of this EIAR.

## 2.4 Conclusion

This chapter has provided a description of the reasonable alternatives, which are relevant to the project and its specific characteristics which have been assessed, evaluated and analysed, and an indication of the main reasons for selecting the preferred option, including a comparison of environmental effects. The 'Do-Nothing' Alternative; Alternative Technologies; Alternative Locations; Alternative Design & Layouts; Alternative Grid Connections; Alternative Haul Routes; and Alternative Forestry Replant Lands have all been discussed and analysed.

The objective of this process was to avoid any likely significant adverse effects on the environment through the selection of a location for the project which avoided inherent environmental sensitivities, in favour of a location which had fewer constraints and greater capacity to sustainably assimilate the project. Once the preferred location was identified, a series of alternative designs and layouts were evaluated through a recursive, iterative design process, intended to resolve any likely significant environmental effects through an examination of localised constraints, including in the embedding of mitigation measures in the emerging preferred project design and in the design and routing of off-site/secondary developments, which allowed the project designers to make informed decisions based on these constraints.

The final project assessed in this EIAR has therefore adopted the combination of design and layout options that strike the best balance between the avoidance of any likely significant environmental effects and achievement of the objectives of the project.

