Drumlins Park Wind Farm

Chapter 2: Assessment of Project Alternatives

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Contents

2.1 Introduction

The presentation and consideration of the various project alternatives investigated is an important requirement of the EIAR process and the single most effective means of avoiding likely significant impacts on the environment. The purpose of this chapter is to document the assessment of the range of alternatives considered in the design process and the main reasons for selecting the development, as proposed.

2.2 Requirements of the EIA Directive

EIA Directive 2014/52/EU requires that an EIAR 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 EIAR to present transparent and objective evidence on the range of reasonable alternatives which were examined, analysed and evaluated as part of the iterative environmental impact assessment and project design decision-making processes, and which led to the adoption and selection of the final proposed development.

The *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports – Draft August 2017* state that it is generally sufficient to provide a broad description of each main alternative, identifying the key issues associated with it, and to demonstrate how environmental considerations were taken into account. A detailed assessment (or 'mini-EIA') of each alternative is not required.

2.3 Alternatives Considered

Alternatives may be identified at many levels and stages during the evolution of a project, from strategic site 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 in the evolution of a project are considered to represent the greatest potential for avoidance of likely significant effects on the environment. The reasonable alternatives considered in undertaking this EIAR were therefore as follows:

- 'Do Nothing' alternative;
- Alternative locations;
- Alternative technologies;
- Alternative design and layouts;
- Alternative grid connections; and,
- Alternative haul routes.

Each of these alternatives was considered relevant to the proposed development 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 development, as proposed.

2.4 Assessment of Alternatives

2.4.1 'Do-Nothing' Alternative

Current national Government policy in respect of energy production and the reduction of greenhouse gas emissions, such as the National Renewable Energy Action Plan 2010; the Government Strategy for Renewable Energy 2012-2020; the

White Paper on Energy Policy – Ireland's Transition to a Low Carbon Energy Future 2015-2030'; the National Mitigation Plan 2017; and the Climate Action Plan 2019, are all collectively supportive of the increased generation of renewable electricity to rapidly reverse climate breakdown and the transition of energy production away from fossil fuels.

The scale, urgency and primacy of transitioning to low-carbon, renewable energy sources is universally acknowledged at national, European and international levels, including the landmark 2015 Paris Agreement. In 2015, the Climate Change & Low Carbon Development Act was enacted to legally mandate and drive this transition. Ireland, however, continues to lag significantly behind in reducing greenhouse gas emissions and the Environmental Protection Agency (EPA) projects that Ireland's total greenhouse emissions will increase by 1% by 2020 and 6% by 2030, as opposed to targets of -20% and -30% respectively[1].

Energy production and consumption currently accounts for approximately 19% of Ireland's greenhouse gas emissions, 90% of which is dependent on fossil fuels. The Government has a legally mandated EU target to achieve 40% of electricity generated from renewable sources by 2020. The Government has also set a further ambitious target to achieve 70% of electricity achieved from renewable sources by 2030.

The Sustainable Energy Authority of Ireland (SEAI) estimates that Ireland will fall short of its mandatory European target for an overall renewable energy share by 2020[2]. The share of renewable electricity (RES-E) in 2019 was 30.1% as opposed to a national target of 40% by 2020. According to research by the Institute for International and European Affairs (IIEA), it has been estimated that up to €610m of Exchequer funds could be required to pay for failure to meet emissions and renewable targets in 2020 and as much as an additional €5.5 billion to 2030[3]. At the same time, with the continued decarbonisation of society, projected economic growth and electrification of transport, demand for electricity is projected to continue to increase rapidly[4].

Government policy recognises that onshore wind energy, as a proven and cost effective technology in the context of Ireland's abundant wind resource, will continue to be the major contributor to Ireland's renewable electricity generation to 2030. Onshore wind now accounts for 25.2% (normalised) of electricity generated in Ireland making it the second largest source of electricity generation after natural gas and it is envisaged that it will provide the largest source of renewable energy over the short-to-medium term. The Climate Action Plan 2019 provides that up to 8.2 gigawatts of increased onshore wind capacity will be required to meet these demanding targets. A separate system for connecting renewable energy projects to the national grid has been established under the auspices of the Commission for the Regulation of Utilities' (CRU) Electricity Connection Policy (ECP). A prerequisite for achieving a grid connection offer from the CRU is firstly securing planning permission for renewable energy generating infrastructure

The Government's Wind Energy Development Guidelines for Planning Authorities 2006 and subsequent updated *'Preferred Draft Approach'*, published in 2017, establishes a land-use planning framework whereby planning authorities can

[1] https://www.epa.ie/climate/emissionsinventoriesandprojections/nationalemissionsprojections/

[2] https://www.seai.ie/publications/National-Energy-Projections-to-2030.pdf

[3] IIEA, Joseph Curtin, How much of Ireland's "fiscal space" will climate inaction consume?, 2016

[4] https://www.seai.ie/publications/Irelands_Energy_Projections.pdf

proactively support the development of wind energy projects at appropriate locations. In accordance with these land-use policies, the Monaghan County Development Plan 2019-2025 is also strongly supportive of wind energy development at suitable locations within County Monaghan.

In the 'Do Nothing' alternative, the subject site would remain in pastoral agricultural use and the *status quo* in terms of the local environment would persist, as gradually evolving managed drumlin farmland, interspersed with one-off housing and farms. In recent years, County Monaghan has experienced a significant increase in the number of poultry rearing units being developed**.** It is also possible that in the 'Do-Nothing' scenario, there may be further development of such units in the local area. It is also possible that, over time, some land could be afforested.

The quantum of renewable energy produced in County Monaghan would also remain unchanged in the 'Do-Nothing' scenario. Therefore, due to the central importance of onshore wind energy in the transition to a low carbon economy in all national policies and the absolute imperative to transition to renewable energy sources, as outlined above, the 'Do Nothing' alternative was not considered a viable option.

Within County Monaghan, there are currently 2 no. operational wind farms with 27 megawatts (MW) of installed capacity. These developments are the Mullananalt Wind Farm comprising 5 no. wind turbines and the Old Mill Wind Farm comprising 6 no. wind turbines. The developments are located c. 18km and c. 20km respectively west of the proposed development. The Mountain Waters Wind Farm and Coolberrin Wind Farm, both of which are permitted but not yet constructed, are located c. 23km north of the proposed development site and amount to a further 29 MW of permitted capacity. This brings the total operational and planned wind energy capacity in County Monaghan to 56 MW.

Given the total national installed capacity of c. 3,700 MW and the scale of the ambitious national targets envisaged, it was concluded that there is significant potential within County Monaghan to deliver further wind energy generation capacity. The 'Do-Nothing' option would result in a failure to capitalise on and exploit the significant renewable wind energy resource available, resulting in the lost opportunity to contribute to meeting national targets for the production of renewable electricity and the resultant abatement of greenhouse gases.

2.4.2 Alternative Technologies

As discussed above, 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. A potential alternative technology to achieve the objectives of the project could be the development of a solar energy project. Photovoltaic solar is the only other terrestrial technological process reasonably available to meet the objectives of the project. However, solar energy requires a significantly larger land-take and would result in substantial changes to existing agricultural practices.

In contrast, a wind energy project will not result in any substantive alteration to current land uses and agricultural activities can co-exist and continue with only minor disturbance during the construction phase. For example, a 5 MW wind turbine (and ancillary structures) is estimated to require a land-take of c. 1 hectares (2.5 acres) while a solar development with an output of 5 MW would require an area of c. 10 hectares (25 acres). Evidently, a wind energy development would result in a substantially reduced level of disturbance to existing agricultural activities and

resulting loss of land from agricultural production; while a solar development would require a greater alteration to existing agricultural practices.

A solar energy project, particularly at this northerly latitude, would also not yield an equivalently efficient generating capacity and, therefore, would be significantly less viable in obtaining a grid connection offer from the CRU. On this basis, no other technological process it is considered a viable alternative for a renewable energy development project on the subject site.

2.4.3 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 avoid such locations in favour of locations which have fewer constraints and more capacity to sustainably assimilate the project.

There is a well-established and widely used methodology for the selection of wind energy development locations used by developers. 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 assessing alternative locations, particular cognisance was taken of the policies and objectives of the Monaghan County Development Plan 2019-2025 and Cavan County Development Plan 2014-2020, including the Strategic Environmental Assessment (SEA) prepared for each plan in accordance with Directive 2001/42/EC. SEA is a form of environmental assessment decided upon at a higher administrative level, and adopted by the Planning Authority.

Neither County Development Plan (CDP) includes a specific Wind Energy Strategy which identifies suitable or unsuitable locations for the development of wind energy projects as recommended in the Wind Energy Development Guidelines for Planning Authorities 2006. Accordingly, no assessment of alternative locations for wind energy developments has previously been undertaken in higher level planning strategies and environmental assessments.

Accordingly, an assessment of all reasonable alternatives relevant to the project and its specific characteristics was undertaken as part of this EIAR process and based on the abovementioned criteria together with the general criteria included in the Wind Energy Guidelines for Planning Authorities 2006, the 'Preferred Draft Approach' to the review of the Wind Energy Development Guidelines 2017 and the SEAI'S Methodology for Local Authority Renewable Energy Strategies 2013. Given the proximity of the region to the international border with Northern Ireland, particular regard was given to potential transboundary issues.

On the basis of this analysis, three locations were identified as potentially suitable for the development of a wind energy project in the general vicinity of:

- **Option L1:** Newbliss in County Monaghan;
- **Option L2:** Ballyhaise in County Cavan; and,
- **Option L3:** Knockatallan in County Monaghan.

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

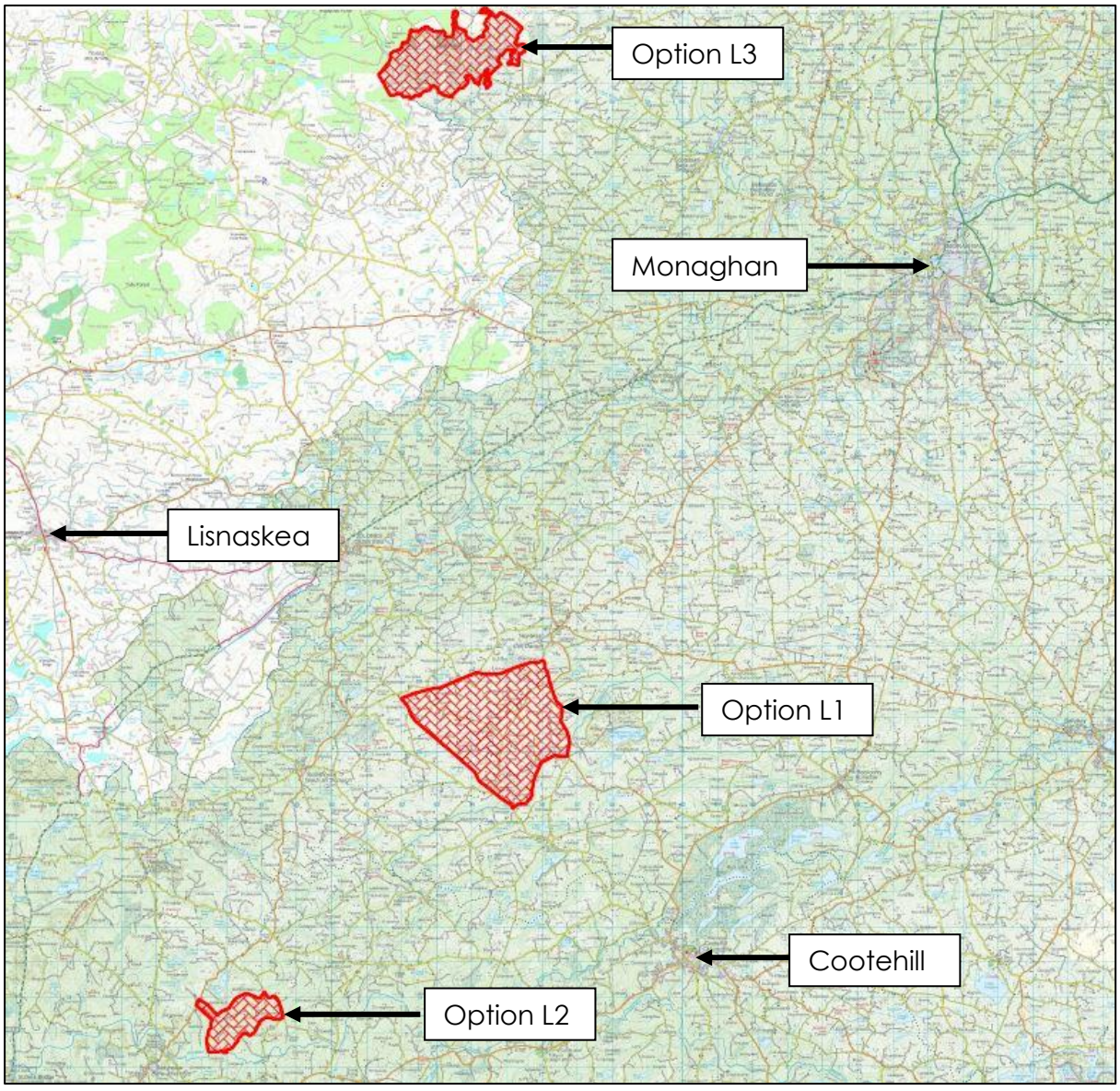

Figure 2.1: Alternative Locations

Table 2.1 below provides an overview of the assessment of environmental constraints and opportunities associated with each alternative location and provides a recommendation on the preferred location based on each environmental factor. In undertaking this assessment, the criteria provided in Schedule 7 of the Planning & Development Regulations 2001 (as amended) together with the general environmental factors included in Article 3(1) of the EIA Directive were used as a framework for analysis.

Location	Option L1	Option L2	Option L3	Emerging

Factor				Preferred Option
Population & Human Health	Low density of dwellings in vicinity of identified location. Approximately 2km to nearest settlement.	Low density of dwellings in vicinity of identified location. Approximately 1km to nearest settlement.	Little or no dwellings in vicinity of identified location. Approximately 2km to nearest settlement..	Option L3
Biodiversity	Identified location is generally not sensitive, with no Natura 2000 sites within 5km.	Identified site is generally not sensitive, Lough Oughter and Associated Loughs SAC within 3km and the adjacent Annalee River provides a hydrological connection and potential pathway for effects.	Identified site is heavily afforested and is located within Slieve Beagh SPA.	Option L1
Land & Soil	No sensitive land uses with some localised evidence of peat.	No sensitive land uses with some localised evidence of peat.	No sensitive land uses with extensive areas of peat.	Option L1 or Option L2
Water	Some lower order watercourses located within identified location. No major rivers in proximity.	Annalee River in immediate proximity to the identified location.	River Finn, River Blackwater (Monaghan) and Colebrooke River are in close proximity, each of which ultimately discharge to a European site designated for nature conservation .	Option L1
Air & Climate	No constraints identified. Development would result in a positive overall impact.	No constraints identified. Development would result in a positive overall impact.	No constraints identified. Development would result in a positive overall impact.	Option L1 or Option L2 or Option L3
Landscape	No protected landscape designations or designated scenic views in the immediate vicinity.	Identified site in close proximity to Ballyhasie Amenity Park.	Identified site is in close proximity to a number of designated scenic views and the Blackwater River Valley Secondary Scenic Area	Option L1
Cultural Heritage	Low number of heritage features identified in the vicinity of the location.	Low number of heritage features identified in the vicinity of the location.	No heritage features identified in the vicinity of the location.	Option L3
Noise & Vibration	Due to limited number of receptors (dwellings) in the vicinity, potential impacts assessed as low.	Despite limited number of dwellings, due to the reduced setback distance to dwellings (c.1km), potential impacts assessed as higher.	Due to limited number of receptors (dwellings) in the vicinity, potential impacts assessed as low.	Option L1 or Option L3
Shadow Flicker	Due to limited number of receptors (dwellings) in the vicinity, potential impacts assessed as low.	Despite limited number of dwellings, due to the reduced setback distance to dwellings (c.1km), potential impacts assessed as higher.	Due to limited number of receptors (dwellings) in the vicinity, potential impacts assessed as low.	Option L1 or Option L3
Material Assets (Transport & Access; Telecommunications)	No significant impacts likely on transport. Site can be accessed via public road (national & regional routes) without the requirement for large scale extensive upgrade works. No significant impacts on telecommunications.	No significant impacts likely on transport. Access to the site would require substantial upgrades to public roads. Existing telecommunication masts in immediate vicinity of identified location.	No significant impacts likely on transport. Local roads accessing the site would require upgrading to accommodate large loads. Existing telecommunication masts in immediate vicinity of identified location.	Option L1

Table 2.1: Environmental Assessment of Alternative Locations

Based on this analysis, it was determined that Option L1, located near Newbliss, County Monaghan, was the emerging preferred location from an environmental constraints and opportunities perspective for the following reasons:-

- The land use context is benign, generally consisting of rolling drumlin pastoral farmland with access to a suitable land bank;
- The location has a generally low population density, with a low number of residential properties and appropriate available setback distances available to dwellings. The 'Preferred Draft Approach' to the review of the Wind Energy Development Guidelines (2017) proposes 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 500 metres;
- The absence of sensitive nature habitats and the absence of any European sites (Natura 2000) or other nature conservation designations on, or in the immediate vicinity, of the location. The nearest Special Area of Conservation (SAC) is the Kilroosky Lough Cluster SAC (Site Code: 001786) located c. 6km to the north. The nearest Special Protection Area (SPA) is the Upper Lough Erne SPA (Site Code: UK9020071) located c. 7km to the west. Kilroosky Lough Cluster SAC has no direct hydrological pathway connectivity to the location nor is the location underlain by any sensitive geology;
- There are a low number of recorded historical monuments within the location and in its immediate vicinity;
- The location is not the subject of any specific protective landscape designations under the provisions of the Monaghan County Development Plan 2019-2025;
- The location is well served by the national road network, with the R189 located immediately to the east. A network of local roads traverse the general area and could be utilised during the construction and operational phases of development. Road upgrades to accommodate the delivery of turbine components would be necessary; however, these would not be significant or extensive;
- National and local energy policies are supportive of the further development of wind energy within County Monaghan and there are no land-use planning policies which restrict development at this location; and
- The absence of any constraints in respect of aviation, telecommunications or existing infrastructure.

In addition, and beyond the environmental appraisal undertaken above, Option L1 is considered to have an average wind speed of approximately 7.5m/s at c. 100m height which is sufficient to ensure the viability of a wind energy development. Option L1 is also in relative proximity to a number of 38kV electrical substations which could accommodate electricity generated by a wind farm, while an existing 110kV overhead line passes through Option L1 which provides a further potential point of connection to the national grid.

On this assessment basis, it was decided to undertake further analysis of Option L1 while discontinuing with a further analysis of Options L2 and L3 as reasonable alternatives.

2.4.4 Alternative Design & Layouts

Following the identification of Option L1 as the 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 proposed development could be arranged such that there would be no likely significant effects on the environment.

The objective was to adopt the combination of design and layout options that

presents the best balance between avoidance of likely significant environmental impacts and achievement of the objectives of the project. The process involved an ongoing dialogue between technical designers and competent environmental experts throughout the design process, with the designers adjusting the design in response to assessment by the specialists. Feedback from the Scoping process, including public and stakeholder consultation discussed in **Chapter 1,** also informed this process.

The assessment of alternative designs and layout involved a series of repeated steps, each involving design and re-design, to try to get the best fit with a wide range of environmental factors and formed an intrinsic part in arriving at the final design and layout of the proposed development. The alternative layouts considered were highly dependent on the specific turbine technology to be installed, with larger turbines requiring increased intra-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;
- Setback from recorded archaeological sites; 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 intrinsically linked the precise layout of the wind turbines and the volume of ancillary infrastructure increases proportionally with the number of turbines proposed. The routing of access tracks is highly flexible, is closely linked to the siting of wind turbines and can be altered to reflect any changes to turbine locations or identified environmental constraints. Through the iterative turbine design and layout process outlined above, including site constraint mapping, the most appropriate access track routes were identified for each alternative considered, taking into account the presence of existing agricultural tracks and field boundaries, and, insofar as possible, to reduce the overall project footprint.

Consideration was firstly given to the size and height of the turbines to be developed, including a project comprising of a larger number of small-to-medium sized turbines with an overall tip height of c. 100m. Given the relatively low numbers of dwellings within the vicinity of Option L1, it was considered possible to achieve appropriate dwelling setback distances to dwellings and 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 103 MW. This wind energy complex has a large spatial extent and covers an area of c.1,133 hectares.

Having assessed that availability of land with Option L1, it was considered that the location could accommodate up to 20 no. wind turbines of up to 100m in height with an electrical output of c. 30MW. However, a project with a smaller number (8-10 no.) of larger turbines of up to 180m in height could, on the other hand, generate up to 45MW with a much smaller spatial extent (c.149 hectares). Installing larger turbines on a smaller site would result in significantly reduced likely impacts on the

environment, particularly in respect of likely landscape, noise and shadow flicker impacts, and significantly more efficient renewable energy production.

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

- **Option D1:** 10 no. turbines with a maximum tip height of up to 170m (37 MW);
- **Option D2:** 8 no. turbines with a maximum tip height of up to 180m (44 MW).

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

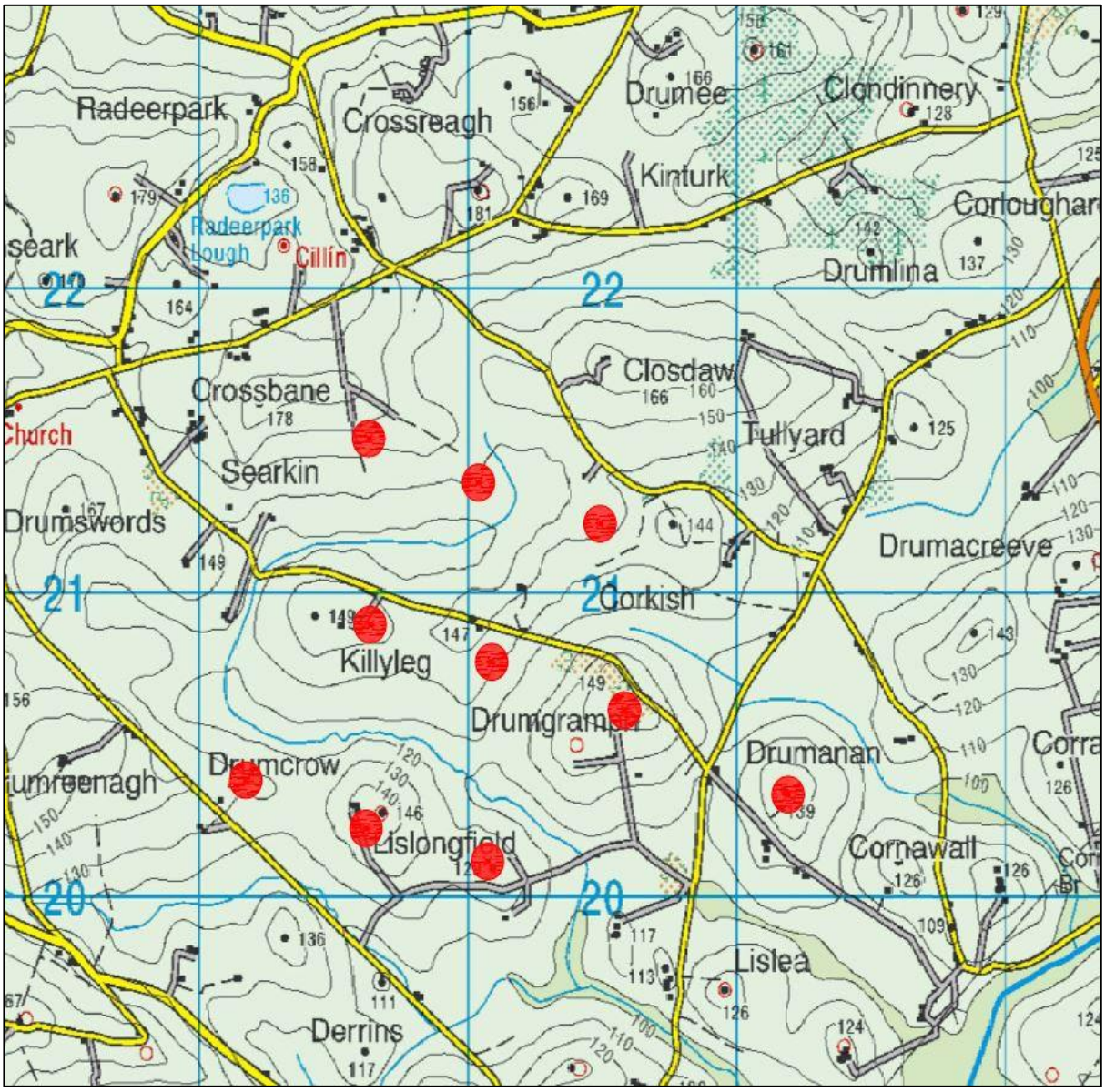

Figure 2.2: Option D1 Site Layout (10 Turbines, Maximum Height 170m, 37 MW)

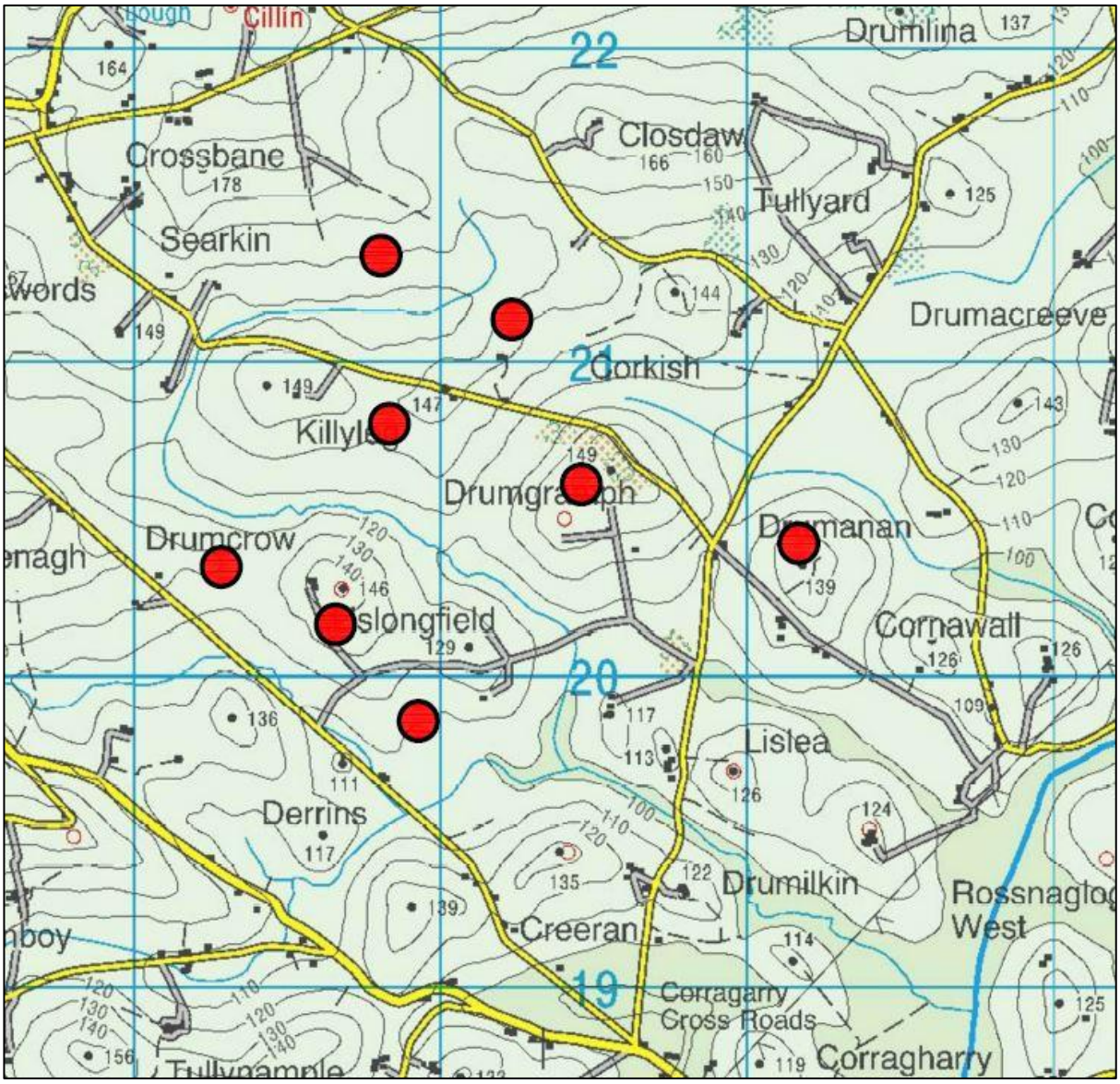

Figure 2.3: Option D2 Site Layout (8 Turbines, Maximum Height 180m, 44 MW)

Table 2.2 provides an overview of the environmental constraints and opportunities associated with each identified option and provides a recommendation of the emerging preferred option based on each environmental factor. Again, in undertaking this assessment, the criteria provided in Schedule 7 of the Planning & Development Regulations 2001 (as amended) 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 (10 Turbines/170m)	Option D2 (8 Turbines/180m)	Emerging Preferred Option
Population & Human Health	Low number of dwellings in vicinity of turbines. Layout is expansive and appropriate setback distances may be difficult to achieve.	Consolidated project when compared to Option D1. Setback distances more easily achievable thus further reducing likelihood for any likely significant	Option D2

		impacts.	
Biodiversity	No likely significant impacts identified.	No likely significant impacts identified.	Option D2
Land & Soil	No likely significant impacts identified. Some access tracks may be located within mapped areas of localised peat.	No likely significant impacts identified. Some access tracks may be located within mapped areas of localised peat. This option would require a lesser volume of excavations thus further reducing likelihood for any likely significant impacts.	Option D2
Water	No likely significant impacts identified. Some infrastructure located in close proximity to watercourses.	No likely significant impacts identified. Some infrastructure located in close proximity to watercourses.	Option D1 or Option D2
Air & Climate	No constraints identified. Development would result in a likely positive overall environmental impact.	No constraints identified. Development would result in a likely positive overall environmental impact.	Option D1 or Option D2
Landscape	No protected landscape designations or designated scenic views in immediate vicinity.	No protected landscape designations or designated scenic views in immediate vicinity. Visual impact likely to be less than Option D1 due to reduced number of turbines.	Option D2
Cultural Heritage	3 no. turbines in close proximity to heritage features. Potential for visual impacts on other heritage features in wider area.	3 no. turbines in close proximity to heritage features; however the separation distances are greater than those of Option D1 thus reducing potential for direct effects. Potential for visual impacts on other heritage features in wider area. The reduced number of turbines likely to reduce any likelihood of significant impacts.	Option D2
Noise & Vibration	No likely significant impacts identified.	No likely significant impacts identified. Increased separation to dwellings likely to further reduce any likelihood of significant impacts.	Option D2
Shadow Flicker	No likely significant impacts identified.	No likely significant impacts identified. Increased separation to dwellings likely to further reduce any likelihood of significant impacts.	Option D2
Material Assets (Transport & Access; Telecommunications)	No likely significant impacts identified on transport. Site can be accessed via public road (national & regional routes) but will require construction of a substantial length of internal access tracks. During the public consultation process, concerns were raised regarding the potential for impacts on broadband and television signal but no likely significant impacts on telecommunications have been identified by any service provider.	No likely significant constraints identified on transport. Site can be accessed via public road (national & regional routes) but will require construction of a substantial length of internal access tracks. No likely significant impacts on telecommunications identified. During the public consultation process, concerns were raised regarding the potential for impacts on broadband and television signal but no likely significant impacts on telecommunications have been identified by any service provider. The reduced number of turbines will serve to reduce the potential for adverse effects.	Option D2

Table 2.2: Environmental Assessment of Alternative Site Designs and Layouts

Based on this appraisal, it was concluded that Option D2 (8 no. turbines) was the emerging preferred project design and layout for the following reasons:-

- Setback distances from dwellings can be maximised through a consolidated project of 8 no. turbines as opposed to a more spatially extensive project, reducing the likelihood of significant noise and/or shadow flicker impacts on residential amenity. Based on this layout, a total of 123 no. dwellings are located within 1.8km (10-times overall tip height), with no third party dwellings within 500m of a proposed wind turbine.
- A similar level of renewable electricity can be generated from a reduced

number of larger turbines while reducing the likelihood for significant environmental impact particularly in respect of Biodiversity, Land & Soil, and Water;
- A reduced number of turbines will minimise any likelihood of significant air quality impacts (i.e. temporary dust impacts etc,) which may arise during the construction phase due to the reduced requirement for materials to be brought to site. The erection of a smaller quantity of larger turbines also provides for a greater volume of electricity generated by the project, resulting in greater air quality benefits;
- A reduced number of turbines significantly reduces the footprint of the project and its spatial extent and, consequently, the likelihood of any significant visual impacts. The generous intra-turbine spacing also reduces the potential for visual clutter;
- The limited spatial extent of the project and regular spacing between turbines (in response to field patterns) accords with Section 6.9.2 of the Wind Energy Development Guidelines for Planning Authorities for 'Hilly and Flat Farmland' landscape character types;
- Option D2 provides for greater avoidance of features of cultural heritage significance. 3 no. wind turbines are located in close proximity to heritage features in both alternative layouts; however, the separation distance between turbines and features is increased in Option D2; and
- A consolidated project of 8 no. turbines will require fewer materials (e.g. aggregates, concrete, steel) to be imported to the site. Therefore, fewer vehicular movements will be required during the construction phase reducing the likelihood for any significant impacts on the local road network.

Subsequent to the conclusion that Option D2 was the emerging preferred project design and layout, 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 180m were considered, include the following:

- General Electric GE 5.5-158;
- General Electric GE 5.3-158;
- General Electric GE 4.8-158;
- General Electric GE 4.0-130;
- Vestas V150-5.6;
- Enercon E-138 EP3; and,
- Siemens Gamesa SG 5.8-155.

Each of these turbine models were deemed to be generally suitable for installation at the subject site and, subject to planning permission being granted, could be considered in the competitive tender process prior to the commencement of development. However, based on the analysis undertaken, the General Electric GE 5.5-158 and the General Electric GE 4.0-130 are presently considered to be particularly suitable for the site and have been selected as candidate turbines for assessment in the EIAR (see **Chapter 3** for further details). Notwithstanding this, all wind turbine models which can be provided within the overall 180m tip height envelope could potentially be installed and the selection of a specific turbine model will not result in any material deviation in the significance of environmental effects assessed in this EIAR.

2.4.5 Alternative Grid Connections

The method of connection to the national electricity grid is an integral element of the project which falls to be considered in the EIAR for the proposed development as an off-site project.

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. It cannot, therefore, be determined with complete certainty as to the precise mode of connection to the national grid. Options will remain open until such time as a grid connection offer is received which shall be at the discretion of Eirgrid/ESB Networks. It is therefore necessary to include an assessment of the likely significant impacts on the environment of reasonable alternative grid connection methods.

Following a detailed technical analysis, including an assessment of the existing grid network and grid capacity in the region, and consultation with Eirgrid/ESB Networks, it is anticipated that the proposed development will connect to the national grid by way of one of the following three options:-

- **Option G1:** Construction of a 38kV substation on the proposed development site and installation of a 38kV part overhead electricity line (OHL) and part underground electricity line (UGL) to the existing Clones 38kV substation on the national grid, which lies approximately 5km to the northwest;
- **Option G2:** Construction of a 38kV substation on the proposed development site and installation of a 38kV OHL to the existing Shankill 110kV substation on the national grid, which is located approximately 16km to the southwest; and
- **Option G3:** Construction of a 110kV substation approximately 500m to the south of the nearest turbine and connection to the existing Lisdrum to Shankill 110kV overhead line by way of approximately 500m of UGL and the erection of 2 no. strain towers.

Other substations on the national grid, such as the existing Errigal 38kV substation in Cootehill and the Lisdrum 110kV substation, east of Monaghan town, were not considered to be reasonable alternatives to connect the proposed development to the national grid due to the lack of available capacity.

2.4.5.1 Option G1: 38kV On-site Substation and OHL/UGL to Clones 38kV substation

This option would comprise the construction of a 38kV on-site substation consisting of a single-storey control building and an external electrical equipment compound located in the townland of Crossbane. The control building and compound houses equipment such as grid transformers, circuit breakers, earth fault meters, metering equipment, computers and servers, designed and constructed to comply with ESB Networks' specifications.

Following an assessment of the intervening landscape between Clones and the proposed wind farm site, to assess environmental, infrastructural and technical constraints, it was determined that a 5km OHL route across private agricultural lands and including minor sections of UGL at either end of the route would be the optimum configuration as illustrated in **Figure 2.3** below (reproduced at **Annex 2.3**).

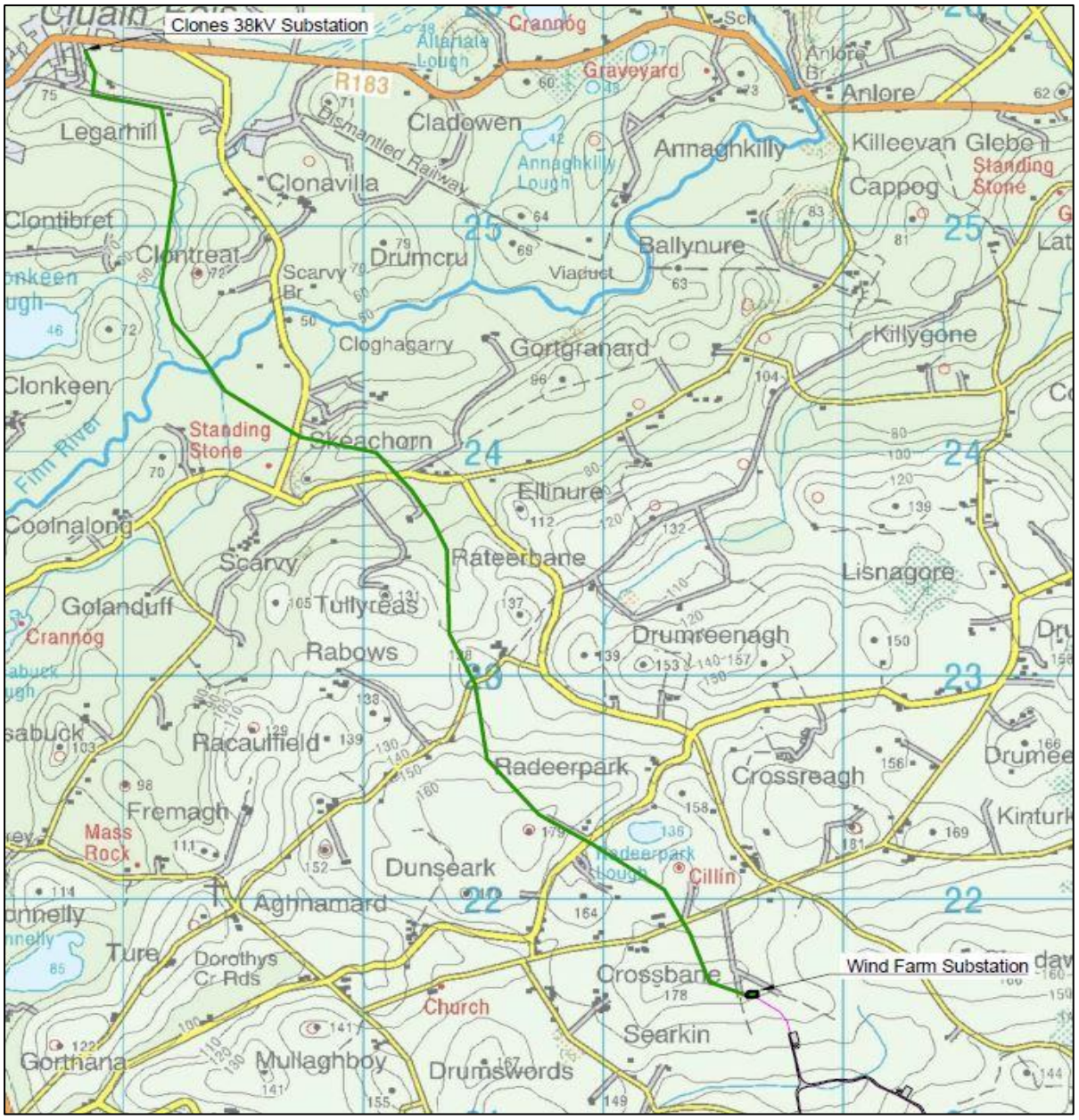

Figure 2.3: Option G1 – OHL/UGL Grid Connection to Clones 38kV substation

2.4.5.2 Option G2: 38kV On-site Substation and OHL to Shankill 110kV substation

Similar to Option G1, this option would comprise the construction of a 38kV on-site substation comprising a single-storey control building and an external electrical equipment compound, but this time located in the townland of Lislongfield. The substation would be connected to the Shankill 110kV substation by way of a 16km OHL as illustrated in **Figure 2.4** below (and reproduced at **Annex 2.3**).

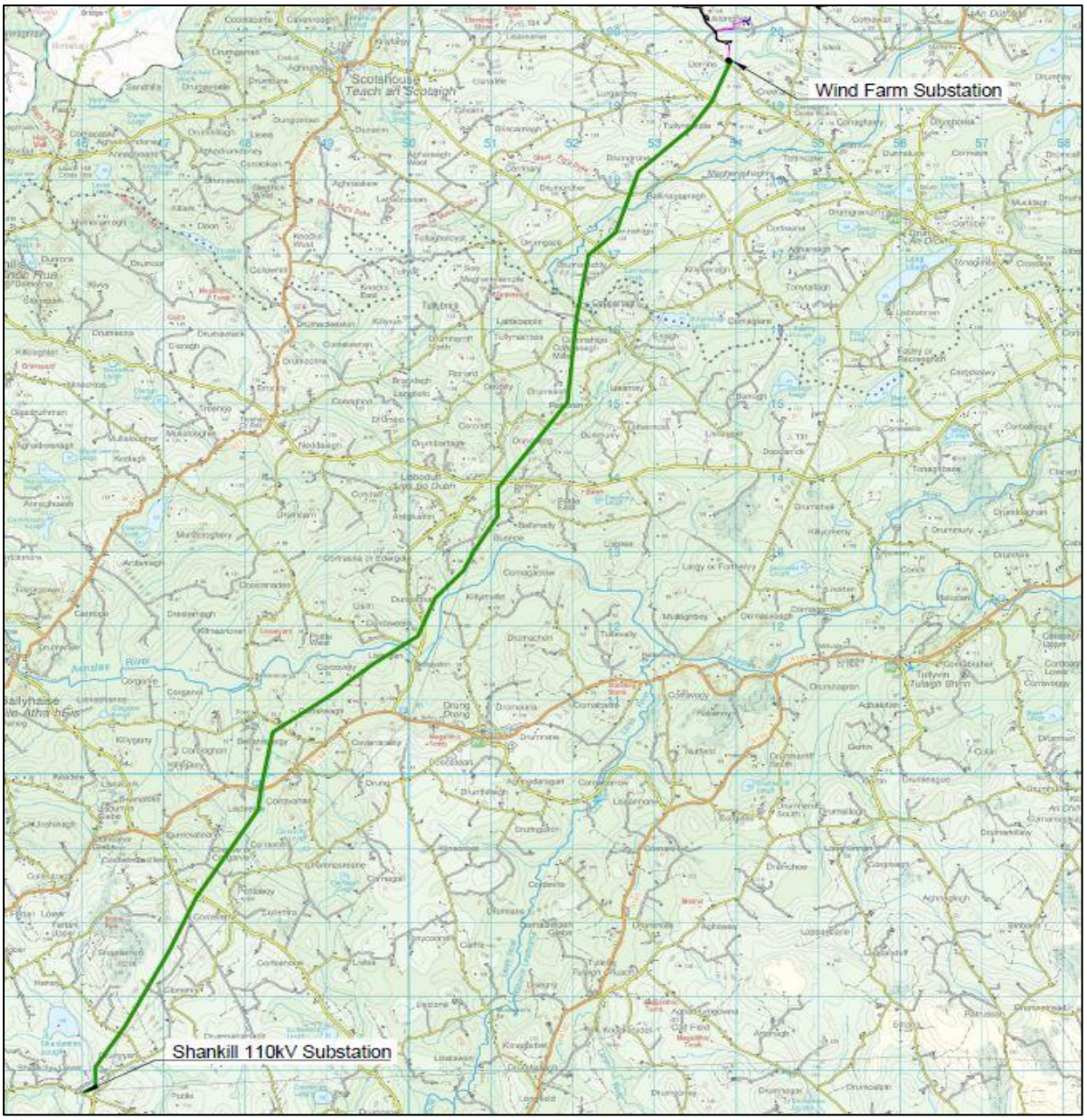

Figure 2.4: Option G2 – OHL Grid Connection to Shankill 110kV substation

2.4.5.3 Option G3: New 110kV 'Loop In/Loop Out' Substation

A connection to the existing Lisdrum to Shankill 110kV overhead line is also a feasible method for connecting to the national grid. This method of connection would require the construction of a new 110kV loop-in/loop-out substation adjacent to (or as close as possible to) the existing 110kV OHL which would be connected to the proposed development by way of low voltage cabling located predominately within the carriageway of local public roads. An indicative location map of this option is provided at **Figure 2.5** below and reproduced at **Annex 2.3**.

Figure 2.5: Option G3 – New 110kV substation

2.4.5.4 Assessment of Alternative Grid Connection Options

Following an assessment to determine the potential for environmental impacts, it is concluded that none of the 3 no. identified options are likely to result in significant effects on environmental receptors. Each option, whichever is instructed to be constructed by ESB Networks/Eirgrid, comprises infrastructure with in commonplace in the Irish landscape and each can be constructed and operated without resulting in any significant environmental effects.

2.4.6 Alternative Haul Routes

2.4.6.1 Turbine Components

A number of potential haul route alternatives to transport large wind turbine components to the proposed development site were assessed to ascertain their suitability to accommodate oversized heavy goods vehicles and abnormal loads. These routes included:-

- **Option H1:** M50, M3, N3, R188 and R189 (via Virginia, Cavan town by-pass and Cootehill). This option was discounted due to constraints in the town of Cootehill; namely, a 90° junction and the absence of sufficient horizontal clearance for oversized HGVs to undertake this manoeuvre;

- **Option H2:** M50, M3, N3, R212 (via Virginia, Cavan town by-pass and Ballyhaise). This option was discounted due to a narrow bridge to the northeast of Ballyhaise;
- **Option H3:** M50, M1, N33, N2, R180, R183 and R189 (via Carrickmacross, Ballybay and Newbliss). This route was discounted due to the presence of a 90° junction in Ballybay and the absence of sufficient horizontal clearance for oversized HGVs to undertake this manoeuvre;
- **Option H4:** M50, M1, N33, N2, R135, North Road (via Monaghan Town contra-flow), R162, R188, R183 and R189. This route was not considered to be a suitable due to turning/horizontal clearance constraints at the R135/North Road junction; and,
- **Option H5:** M50, M1, N33, N2, R937, N54, R162, R188, R183 and R189 (via Monaghan Town). This option would include reversing manoeuvres to allow HGVs to navigate the N54/R189 junction west of Monaghan town and would require temporary and permanent upgrade works at a number of locations along the R188, R183 and R189. The upgrade permanent works would predominately involve increasing the running width of the road carriageways, through the removal of existing roadside banks/high verges to allow abnormal loads navigate bends, while temporary works would be limited to the short-term removal of street furniture.

Each of the identified alternative turbine component haul routes are identified at **Figure 2.6** below (reproduced at **Annex 2.4**)

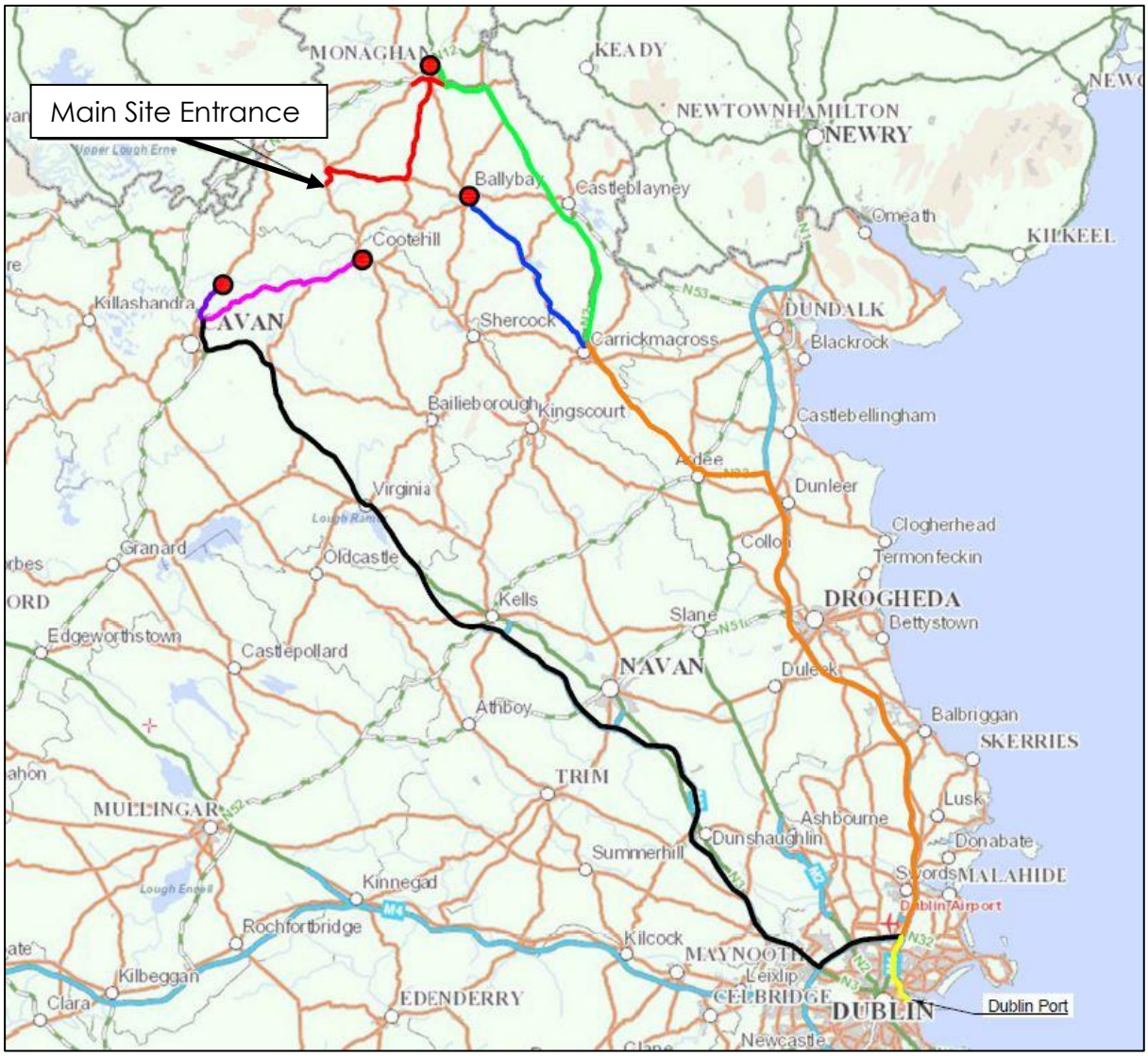

Figure 2.6: Alternative Turbine Component Haul Route Options

Local roads, from the R189 to the proposed wind turbine locations comprise numerous local-primary, local-secondary and local-tertiary roads which are generally unsuitable for large abnormal HGV loads. Accordingly, the upgrade of a number of local roads in the vicinity of the proposed development site was considered in order to provide suitable access. However, this option was discounted due to the extent of upgrade works that would be required and the likely significant local traffic disruption as a consequence of these works. Accordingly, for each of the abovementioned alternatives, the 'last mile' access will be by way of a dedicated proposed off-road arterial access track from the R189 across private agricultural lands and which will avoid the need for works to the majority of local public roads.

The proposed haul route for turbine components will only be finally determined following a competitive tendering process prior to the commencement of development. None of the options considered were evaluated as likely to have any significant impacts on the environment. Nevertheless, on the basis of the technical analysis undertaken, Option H5 was selected as the emerging preferred haul route option for turbine components. This option was evaluated as unlikely to have any significant impacts on local road traffic.

2.4.6.2 Construction Materials

The construction phase of the proposed development will require significant volumes of construction materials, such as aggregates and concrete. The proposed development will not include any on-site borrow pits or concrete batching. A range of potential local suppliers have therefore been considered and the potential haul routes to the main site entrance are illustrated in **Figure 2.7** and reproduced at **Annex 2.5**. Potential suppliers include:-

- Scotshouse Quarries, Scotshouse, Co. Monaghan;
- Sean Kelly Quarries, Cootehill, Co. Cavan;
- John Nulty Quarries, Castletara, Ballyhasie, Co. Cavan;
- Pitwood Quarries, Ballyhasie Co. Cavan;
- Wright's Concrete Products, Swans Cross, Co. Monaghan; and
- B.D. Flood, Lavey, Co. Cavan.

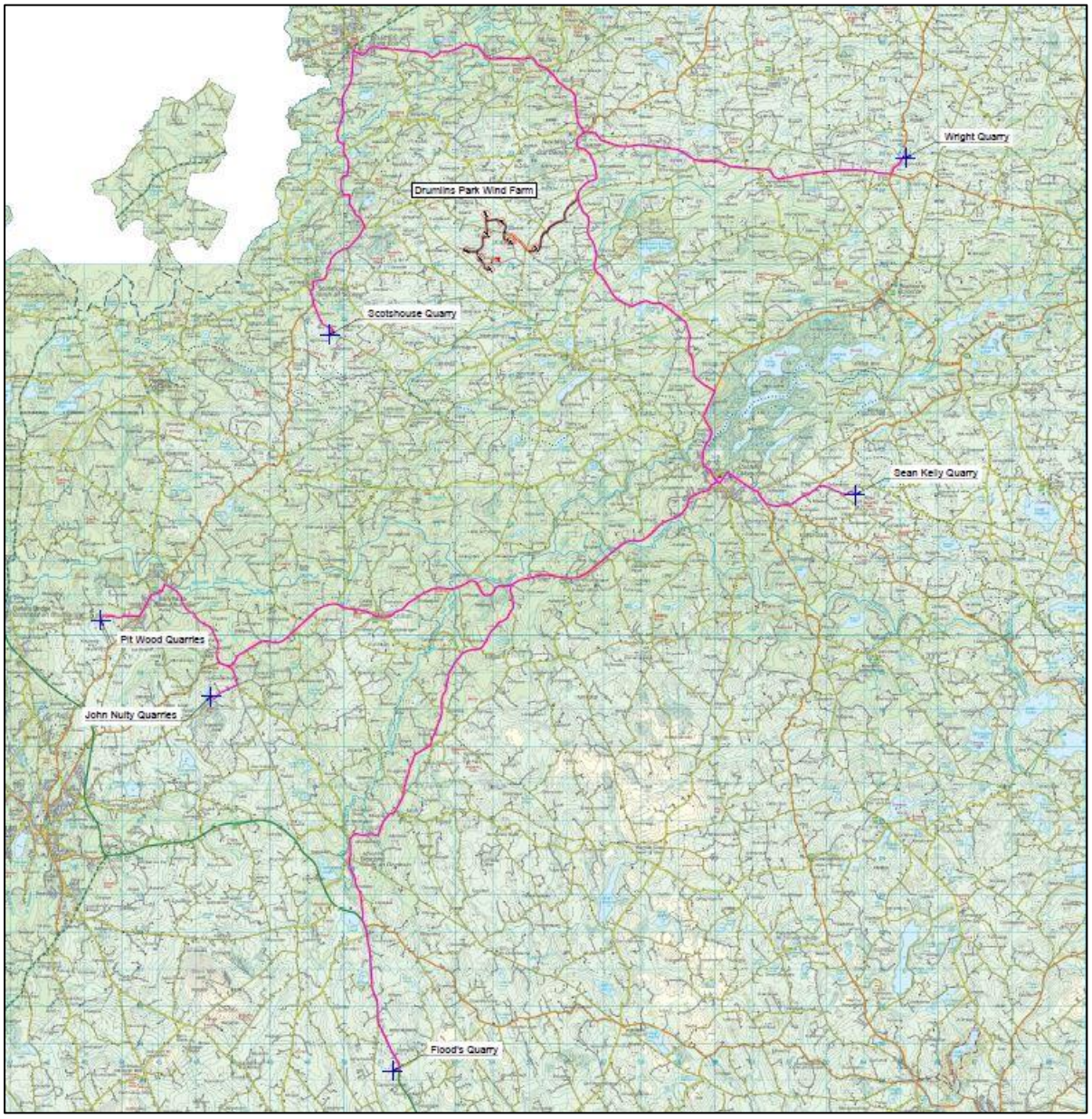

Figure 2.7: Alternative Construction Material Suppliers and Indicative Haul Routes

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. Given the extensive road network in counties Monaghan and Cavan, it is evaluated that there is no potential for significant effects on either the road network or third party access as a result of the proposed development. Nevertheless, and in an effort to reduce any minor effects yet further, the chosen suppliers will be instructed to utilise regional roads, and avoid local roads, insofar as is practicable.

2.5 Conclusion

This chapter has provided a description of the reasonable alternatives, which are relevant to the proposed 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; and Alternative Haul Routes for turbine components and construction materials have all been discussed and analysed.

The objective of this process was to avoid any likely significant impact on the environment through the selection of a location for the proposed development which avoided inherent environmental sensitivities, in favour of a location which had fewer constraints and greater capacity to sustainably assimilate the proposed development. 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 impacts through an examination of localised constraints, including 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 proposed development evaluated 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 impacts and achievement of the objectives of the project.