3. CONSIDERATION OF REASONABLE ALTERNATIVES

3.1 Introduction

3.1.1 Overview

Article 5(1)(d) of Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification) as amended by Directive 2014/52/EU (the EIA Directive) requires that the Environmental Impact Assessment Report (EIAR) prepared by the developer contains *"a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment"*.

Article 5(1)(f) of the EIA Directive requires that the EIAR contains *"any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected"*.

Article IV of the EIA Directive states that the information provided in an EIAR should include a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer which are relevant to the proposed project and its specific characteristics and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.

This section of the EIAR contains a description of the reasonable alternatives that were studied by the developer, which are relevant to the proposed development and its specific characteristics, in terms of site location, size and scale, other land-use options for the site as well as site layout, grid connection routes and transport route options to the site. This section also outlines the design considerations in relation to the proposed wind farm, including the associated substation, construction compounds and borrow pits. It provides an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.

The consideration of alternatives is an effective means of avoiding environmental impacts. As set out in the *'Draft Guidelines on The Information to be Contained in Environmental Impact Assessment Reports'* (Environmental Protection Agency (EPA), 2017), the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

Hierarchy

EIA is concerned with projects. The Environmental Protection Agency's draft guidelines (EPA, 2017) state that in some instances neither the applicant nor the competent authority can be realistically expected to examine options that have already been previously determined by a higher authority, such as a national plan or regional programme for infrastructure.

Non-environmental Factors

EIA is confined to the environmental effects that influence consideration of alternatives. However, other non-environmental factors may have equal or overriding importance to the developer of a project, for example project economics, land availability, engineering feasibility or planning policy.

Site-specific Issues

The EPA draft guidelines state that the consideration of alternatives also needs to be set within the parameters of the availability of the land, i.e. the site may be the only suitable land available to the developer, or the need for the project to accommodate demands or opportunities that are site-specific. Such considerations should be on the basis of alternatives within a site, for example design and layout.

3.1.2 Methodology

The European Commission document *'Guidance on the Preparation of the Environmental Impact Assessment Report'* (EU, 2017) outlines the requirements of the EIA Directive and states that in order to address the assessment of reasonable alternatives, the Developer needs to provide the following:

- A description of the reasonable alternatives studied; and
- An indication of the main reasons for selecting the chosen option with regards to their environmental impacts.

There is limited European and National guidance on what constitutes a 'reasonable alternative' however the EU Guidance Document (2017) states that reasonable alternatives *"must be relevant to the proposed project and its specific characteristics, and resources should only be spent assessing these alternatives"*.

The guidance also acknowledges that *"the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative"*.

The draft EPA guidelines (2017) state that *"It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account is deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required"*.

Consequently, taking consideration of the legislation and guidance requirements into account, this chapter of the EIAR addresses alternatives under the following main headings:

- 'Do Nothing' Alternative;
- Alternative Locations;
- Alternative Technologies;
- Alternative Turbine Numbers and Model
- Alternative Designs;
- Alternative Grid Connections
- Alternative Transport Routes and Site Access and,
- Alternative Mitigation Measures.

Each of these is addressed in the following sections. When considering a wind farm development, given the intrinsic link between layout and design, the two are considered together in this chapter.

While environmental considerations have been at the core of the decision-making process for all of the project processes and infrastructure components, it should be noted that the majority of alternative options considered under the headings listed above are unlikely to have had significantly, greater environmental effects than the chosen option.

3.2 'Do-Nothing' Alternative

Article IV, Part 3 of the EIA Directive states that the EIAR should include *"an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge"*. This is referred to as the *"do nothing"* alternative. The European Commission document *'Guidance on the Preparation of the Environmental Impact Assessment Report'* (EU, 2017) states that this should involve the assessment of *"an outline of what is likely to happen to the environment should the Project not be implemented – the so-called 'do-nothing' scenario."*

An alternative land-use option to the development of a renewable energy project at the proposed development site would be to leave the site as it is, with no changes made to the existing land-use practices. Commercial forestry operations would continue as the primary land-use at the site, with agriculture as the secondary use.

In implementing the 'Do-Nothing' alternative, however, the opportunity to capture a significant part of Ireland's renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment, development contributions, rates and investment in the local area would also be lost. Also, the proposed amenity walkways and associated carpark would not be constructed and therefore this recreational opportunity would be lost. On the basis of the positive environmental effects arising from the project, when compared to the do-nothing scenario, the do–nothing scenario was therefore not the chosen option.

The existing commercial forestry operations and can and will continue in conjunction with this proposed use of the site, as will the use of other areas of the site for agriculture.

A comparison of the potential environmental effects of the 'Do-Nothing' Alternative when compared against the chosen option of developing a renewable energy project at this site are presented in Table 3-1 below.

Table 3-1 Comparison of environmental effects when compared against the chosen option (developing the proposed wind farm at this site)

Environmental Consideration	Do-Nothing Alternative
Population & Human Health (incl. Shadow Flicker)	No increase in local employment and no long-term financial contributions towards the local community. No potential for shadow flicker to affect sensitive receptors.
Biodiversity & Ornithology	No habitat loss
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Will not provide the opportunity for an overall increase in air quality or reduction of greenhouse gasses.

Environmental Consideration	Do-Nothing Alternative
	Will not assist in achieving the renewable energy targets set out in the Climate Action Plan.
Noise & Vibration	No potential for noise impacts on nearby sensitive receptors
Landscape & Visual	No change to existing character and use of the site
Cultural Heritage & Archaeology	No potential for impacts on unrecorded, subsurface archaeology
Material Assets	Neutral

3.3 Alternative Locations

3.3.1 Strategic Site Selection

The cost of building each megawatt of electricity-generating capacity in a wind farm is in the region of €1.5 million. It is therefore critical that the most suitable site for the proposed development was chosen. Sites selected for the development of a wind farm must be suitable for consideration under a number of key criteria, as follows:

- Planning Policy context;
- Low population density;
- Consistent wind speeds;
- Low potential for impact on designated sites; and
- Reasonable access to the national electricity grid.

The site selection process for the proposed development has been fully informed by national, regional and local policy at a macro level (see Chapter 2: Background to the Proposed Development), as well as site-specific factors that influence the turbine layout and project design on site at a micro level (see Section 3.6 below).

The key policy, planning and environmental considerations for the selection of a potential wind farm site included:

- Site location relative to both Waterford County Council and Cork County Council's Wind Energy Strategy classification of areas considered suitable for wind farm development;
- Low population density
- Protection of visual amenity.
- Located outside areas designated for protection of ecological species and habitats;
- Access to the national electricity grid possible within a viable distance;
- Sufficient area of unconstrained land that could potentially accommodate wind farm development and turbine spacing requirements;

The site was identified for potential development following a detailed desktop screening appraisal, firstly at national level and subsequently at regional and county level of all available sites which met the above criteria as set out in national and local policy with regard to the proposed siting of wind energy developments. Following this screening exercise, the top ranking sites were selected to progress with further detailed site-specific screening appraisals to determine initial feasibility for a planning application and this process of further review and refinement resulted in the Lyrenacarriga project being selected by the applicant as the optimal site in Waterford and Cork to progress to the next stage of feasibility assessment and early development work.

These criteria are explained further below in so far as they influenced the site identification exercise undertaken in respect of the ultimate selection of the Lyrenacarriga Wind Farm proposal. From an early stage in the design process, it was also considered optimal to seek a site capable of accommodating a large number of turbines within reasonable proximity to each other. This would limit the geographical spread of the turbines, consolidate supporting infrastructure and also reduce the number of clusters of turbines that may be required. The development of multiple, separate wind farm sites spread throughout a wider area would require supporting infrastructure (i.e. roads and cabling etc.) to run from each wind farm site to the connecting substation thereby increasing the amount of infrastructure required for development and increasing the potential for environmental impacts to occur. Therefore, the provision of a centralised location would concentrate the necessary infrastructure into a single geographic area.

While the outcome of the site selection process identified the optimal location for a wind farm development of the nature proposed, it does not preclude other sites being brought forward for consideration in the future.

3.3.1.1 Planning Policy

Section 2.4.4 in Chapter 2 of this EIAR sets out in detail the planning policies of Waterford County Council and Cork County Council with regard to wind energy development. As detailed in that section of this EIAR and as shown in Figure 2-1, the section of the proposed development site located in Co. Waterford is in an area classed by Waterford County Council as a **'Preferred Area'** for wind farm development. The section of the proposed development site located in Co. Cork is in an area classed by Cork County Council as **'Open to Consideration'** for wind farm development.

The proposed site location was therefore deemed suitable for the proposed wind farm from a planning policy perspective.

3.3.1.2 Population Density

The applicants sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity, the study area emerged as suitable to accommodate the proposed development. The population density of the Study Area, as described in Chapter5: Population and Human Health of this EIAR, is 19.4 persons per square kilometre. This is significantly lower than the average national population density of 68.1 persons per square kilometre.

3.3.1.3 Wind Speeds

The Irish Wind Atlas produced by Sustainable Energy Ireland shows average wind speeds for the country. With the upland nature of the landscape, the Wind Atlas shows that wind speeds on the proposed development site range from 7.5 to 8.75 metres per second. Such wind speeds indicated that this site is viable for commercial wind energy development. On-site monitoring of the wind resource verified that with a sufficient turbine height and blade diameter, the wind resource of the site is commercially viable.

3.3.1.4 Designated Sites

The proposed development site is not located within any area designated for ecological protection.

The closest Natura 2000 site, i.e. Special Area of Conservation (SAC) or Special Protection Area (SPA), is the Blackwater River (Cork/Waterford) SAC, the boundary of which is located within 10 metres of the north-eastern boundary of the proposed wind farm site, at its nearest point (at a tributary of the Blackwater). The nearest SPA is Blackwater Estuary SPA, the boundary of which is located approximately 3.5 kilometres southeast of the site, at its nearest point.

The closest national designated site, i.e. Natural Heritage Area (NHA) or proposed NHA (pNHA), is the Blackwater River and Estuary pNHA, which is located approximately 2.1 kilometres southeast of the site, at its nearest point.

3.3.1.5 Access to the National Grid

The proposed development site is traversed by an existing 110 kV overhead line. From the perspective of access to the National Grid, the proposed site was therefore deemed highly suitable for development of a wind farm. Details regarding potential alternative grid connection options considered are presented in Section 3.7 below.

3.3.2 Results of the Site Identification Exercise

The purpose of the site selection exercise was to identify an area that would be capable of accommodating a wind farm while minimising the potential for any adverse impacts on the environment, including population and in terms of visual impact. In order to satisfy this requirement, a significant landholding that would yield a sufficient viable area for the siting of each element of the proposed development was required.

From the high-level review of the key criteria set out above, the proposed development site emerged as the preferred location for the provision of a wind farm of the scale proposed. The proposed site is designated as a 'Preferred Area' and 'Open to Consideration' within the functional areas of Waterford and Cork County Council respectively, for the provision of wind farm development. This site does not overlap with any environmental designations, is located in an area with a relatively low population density and has appropriate annual wind speeds. The site of the proposed development is located within existing commercial forestry, which allows the proposal to take advantage of existing access roads. This existing road network when combined with access to the 110 kV network highlighted the suitability of the site, as it can make sustainable use of these established items of infrastructure.

Once the subject area emerged as the optimum location for the provision of a wind farm, the applicants approached landowners in order to assemble the site. Arising from the site assembly discussions a proposed site boundary was identified and brought forward as being potentially capable of accommodating a cohesive viable area of sufficient size to cater for the proposed development.

Further analysis of the site and potential locations of clusters of turbines was subsequently carried out, as described in Section 3.3.3 below.

3.3.3 Preliminary Landscape and Visual Constraints Study

A Landscape and Visual Constraints Study was carried out at the preliminary stage of the project by Macroworks on behalf of the applicant (March 2017). The study examined the landscape and visual constraints of potential clusters of turbines at five discrete locations, with a view to accommodating a large-scale wind farm in this area. Prior to this, two additional locations were ruled out of the set of potential clusters, as they were deemed too small to accommodate a cluster of turbines.

The process undertaken for the Landscape and Visual Constraints Study was to identify through the generation of Zone of Theoretical Visibility (ZTV) maps, the extent of visibility of a potential wind farm as a whole and also on a cluster by cluster basis. The locations of the five potential clusters of turbine initially identified are presented below in Figure 3-1.

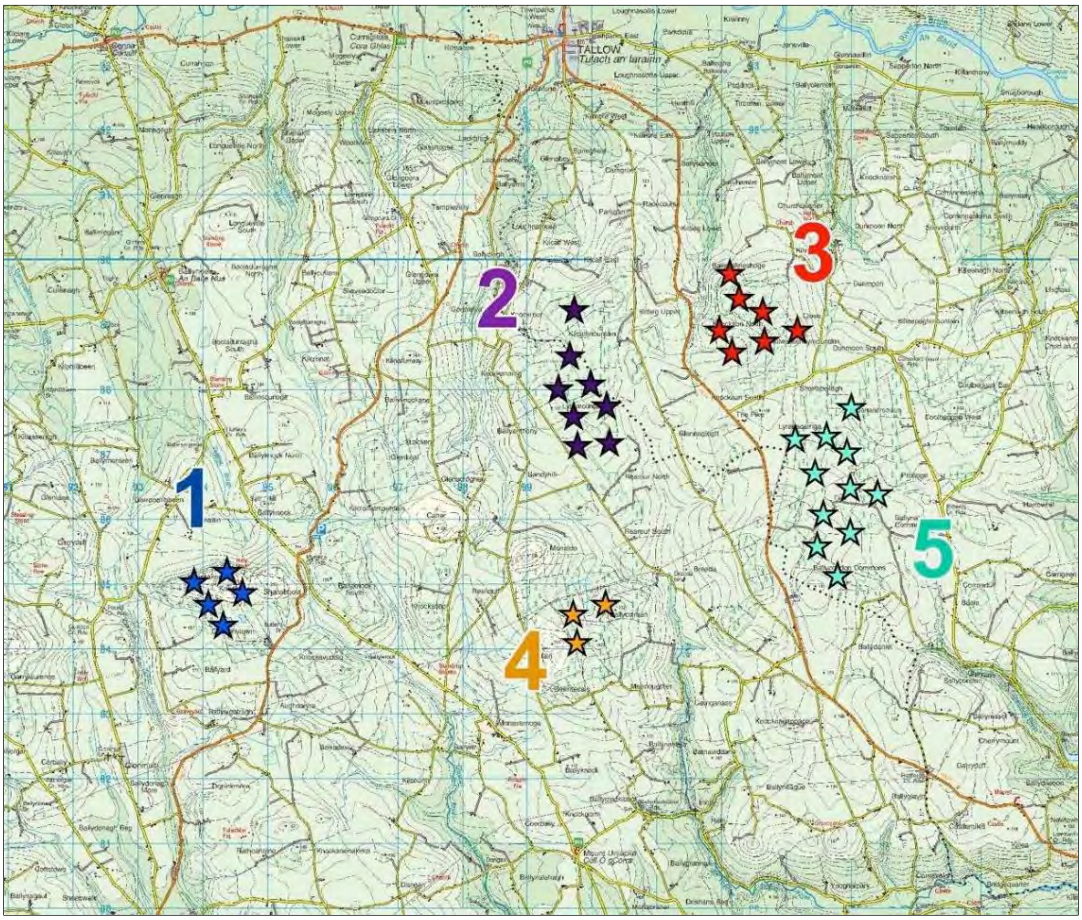


Figure 3-1 Initial Potential Turbine Clusters 1 to 5

The findings from the initial Landscape and Visual Constraints study indicated that turbine Cluster Location 1 (as per Figure 3-1 above) was by far the most discrete from the other locations from a landscape and visual perspective. The study also found that Cluster Locations 2 to 5 formed a more consolidated group and were more likely to be visible in conjunction with each other. This largely avoids the visual ambiguity associated with sprawling clusters of turbines where it can be unclear if they form a singular and cohesive development. Turbine Cluster Location 1 was therefore omitted at an early stage from the proposed wind farm layout. On further analysis, it was also decided to omit Cluster Location 4 from consideration, in order to reduce the spatial extent of the potential wind farm. Further details on this are provided in Section 3.6.2 below.

A further landscape constraints study was undertaken by Macroworks in April 2017. This study focused on Cluster Locations 2, 3 and 5 (as per Figure 3-1 above) only, with a view to accommodating a wind farm at these locations. The progression from the original constraints study was from the theoretical understanding of where the scheme may be visible from, to an understanding of how the various clusters would actually appear from important receptor locations, both singularly and collectively. The findings from the study indicated that the three potential turbine Cluster Locations were contained in areas of broad landform and land-use patterns and with relatively sparse rural populations. The study also found that the landscape in this area is a modified (anthropogenic) landscape; there is relatively low level of built development and the predominant farming / forestry land uses are of low intensity. In conclusion, the study found that overall, there did not appear to be significant landscape and visual constraints associated with the three potential turbine cluster locations.

Clusters 2, 3 and 5 were located closer to each other, thereby allowing the spatial extent of the proposed wind farm to be considerably reduced, and ensuring works could remain in one general location. The initial proposed development layout was therefore progressed for assessment based on three potential clusters of turbines, which was later subsequently further reduced to two clusters, details of which are provided in Section 3.6.2 below.

Table 3-2 presents a comparison of the environmental effects of the larger number of turbine clusters originally considered and provides the main reason for selecting the then chosen option of three clusters over the reasonable alternatives having regard to the environmental effects of each.

Table 3-2 Comparison of environmental effects when compared against the chosen option (progressing three clusters of turbines for further assessment)

Environmental Consideration	Alternative Site Options	
	Development of Proposed Turbines in 5 No. Clusters	Development of Proposed Turbines in 4 No. Clusters
Population & Human Health (incl. Shadow Flicker)	Significantly increased potential for impacts on residential amenity due to noise, shadow flicker or visual impact, arising from larger spatial extent of wind farm	Moderately increased potential for impacts on residential amenity due to noise, shadow flicker or visual impact, arising from larger spatial extent of wind farm
Biodiversity & Ornithology	Additional habitat loss and tree felling when compared to fewer clusters. Greater potential collision risk for birds due to the presence of more turbines	Additional habitat loss and tree felling when compared to fewer clusters Greater potential collision risk for birds due to the presence of more turbines
Land, Soils & Geology	Larger footprint and increased volumes of soil to be excavated	Larger footprint and increased volumes of soil to be excavated
Geotechnical	Larger footprint and increased potential for slope stability risk	Larger footprint and increased potential for slope stability risk
Water	Additional tree felling when compared to fewer clusters, with increased potential for run-off	Additional tree felling when compared to fewer clusters, with increased potential for run-off
Air & Climate	Potential for increased number of turbines; greater contribution to renewable energy targets and greenhouse gas reductions	Potential for increased number of turbines; greater contribution to renewable energy targets and greenhouse gas reductions
Noise & Vibration	Increased potential for noise impacts on nearby sensitive receptors	Increased potential for noise impacts on nearby sensitive receptors
Landscape & Visual	Spatial extent of wind farm significantly increased	Spatial extent of wind farm moderately increased
Cultural Heritage & Archaeology	Increased potential for impacts on unrecorded, subsurface archaeology	Increased potential for impacts on unrecorded, subsurface archaeology
Material Assets	Significantly increased potential for impacts on local road network due to larger spatial extent of the wind farm	Increased potential for impacts on local road network due to larger spatial extent of the wind farm

3.4 Alternative Renewable Energy Technologies

The proposed wind farm will be located on a site where forestry and agriculture will continue to be carried out around the footprint of the wind farm. Alternative sources of renewable energy considered for the site included solar energy.

Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). To achieve the same electricity output, as is expected from the proposed wind energy development (up to 85 MW), from solar energy would require a significantly larger development footprint. In this instance, the proposed wind energy development requires 45.6 hectares of commercial forestry to be permanently felled. A solar PV array of the scale necessary to provide the same electricity output would require the permanent felling of a significantly larger area of commercial forestry. In addition, a solar development would have a relatively higher potential environmental effect on Hydrology and Hydrogeology, Traffic and Transport (construction phase) and Biodiversity and Birds (habitat loss, glint and glare) at the site.

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

Table 3-3 Comparison of environmental effects when compared against the chosen option (wind turbines)

Environmental Consideration	Solar PV Array (with up to 85 MW Output)
Population & Human Health (incl. Shadow Flicker)	Relatively lower long-term financial contributions towards the local community (i.e. community benefit fund) on a per MWh basis. No potential for shadow flicker to affect sensitive receptors. Potential for glint and glare impacts on local road users
Biodiversity & Ornithology	Larger development footprint would result in greater potential habitat loss. Larger development footprint would result in additional felling of forestry. Potential for glint and glare impacts on birds.
Land, Soils & Geology	Larger development footprint would result in greater volume of spoil to be excavated.
Geotechnical	Shallower excavations involved in solar PV array developments would decrease the potential for slope stability risk.
Water	A solar PV array development would require a significantly larger area of forestry to be felled therefore increasing the potential for silt-laden runoff to enter receiving watercourses.
Air & Climate	Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.
Noise & Vibration	No potential for noise impacts on nearby sensitive receptors.

Environmental Consideration	Solar PV Array (with up to 85 MW Output)
Landscape & Visual	Potentially less visible from surrounding area due to screening by forestry and topography.
Cultural Heritage & Archaeology	Neutral
Material Assets	Potential for greater traffic volumes during construction phase due to the number of solar panels required to achieve the same output.

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

3.5 Alternative Turbine Numbers and Model

The proposed wind turbines will each have a potential power output in the 3.5 to 5.0 MW . It is proposed to install 17 turbines at the site which could achieve in the range of 60 to 85 MW total output. Theoretically, such a wind farm could also be achieved on the proposed site by using smaller turbines (for example 2.3 MW turbine models). However, this would necessitate the installation of 35 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make efficient or economically viable use of the wind resource available having regard to the nature of the site.

A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the site, with a larger amount of supporting infrastructure being required (i.e. roads etc) and increasing the potential for environmental impacts to occur. The final proposed number of turbines takes account of all site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the site.

The 17-turbine layout selected for the site has the smallest development footprint of the other alternatives considered, while still achieving the optimum output at a more economical level than would be achievable using different turbines. The other alternatives considered included a 24-turbine layout and 18 turbine layout which are discussed in further detail in Section 3.6.2 below.

The turbine model to be installed on the site will be the subject of a competitive tendering process. The maximum height of the turbines that will be selected for construction on the site will not exceed 150 metres when measured from ground level to blade tip. For the purposes of this EIAR, a range of turbines within this size envelope has been assessed (i.e. the "worst case" within acceptable limits for the defined range of rotor blade length and hub height combinations) for the impact assessments; visual impact, shadow flicker impact, noise impact etc.). The EIAR therefore provides a robust assessment of the turbines that could be considered within the overall development description. The use of alternative smaller turbines at this site would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the site and would potentially require a larger development footprint. This alternative would potentially lead to additional environmental effects. A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing fewer, larger wind turbines is presented in Table 3-4.

Table 3-4 Comparison of environmental effects when compared against the chosen option (larger wind turbines)

Environmental Consideration	Larger number of smaller turbines
Population & Human Health (incl. Shadow Flicker)	Greater potential for shadow flicker impacts on nearby sensitive receptors due to the increased number of turbines.
Biodiversity & Ornithology	Larger development footprint would result in greater potential habitat loss. Greater potential collision risk for birds due to the presence of more turbines
Land, Soils & Geology	Larger development footprint would result in greater volume of spoil to be excavated and stored.
Geotechnical	Neutral
Water	Larger development footprint, therefore, increasing the potential for silt-laden runoff to enter receiving watercourses.
Air & Climate	Increased potential for vehicle emissions and dust emissions due to an increased volume of construction material and turbine component deliveries to the site.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors.
Landscape & Visual	A larger number of turbines could have a greater visual impact.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.

3.6 Alternative Designs

The design of the proposed development has been an informed and collaborative process from the outset, involving the designers, developers, engineers, landowners, environmental, ecological, hydrological, geotechnical, and archaeological specialists and traffic consultants. The aim was to reduce the potential for environmental effects while designing a project capable of being constructed and viable.

Throughout the preparation of the EIAR, the layout of the proposed development has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout that is the subject of this application for planning permission. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory consultees, the local community and local authorities, as detailed in Section 2.6 of Chapter 2.

3.6.1 Constraints and Facilitators Mapping

The design and layout of the proposed wind energy development follows the recommendations and guidelines set out in the *'Wind Energy Development Guidelines for Planning Authorities'* (Department of the Environment, Heritage and Local Government (DoEHLG), 2006) and the *'Best Practice Guidelines for the Irish Wind Energy Industry'* (Irish Wind Energy Association, 2008).

The '*Wind Energy Development Guidelines'* (DoEHLG, 2006) are currently the subject of a targeted review. The proposed changes to the assessment of impacts associated with onshore wind energy developments are outlined in the document *'Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review'* (2013), the '*Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach'* (June 2017), and the '*Draft Revised Wind Energy Development Guidelines, December'* (2019). Further details on these documents are provided in Section 2.4.5 in Chapter 2 of this EIAR.

Constraints are restrictions that inform the design of a project by highlighting onsite sensitivities and providing appropriate setback buffers. The constraints mapping process involves the placing of buffers around different types of constraints so as to identify clearly the areas within which no development works will take place. The size of the buffer zone for each constraint mapped on the proposed development site was assigned using guidance presented in the documents listed above, as applicable.

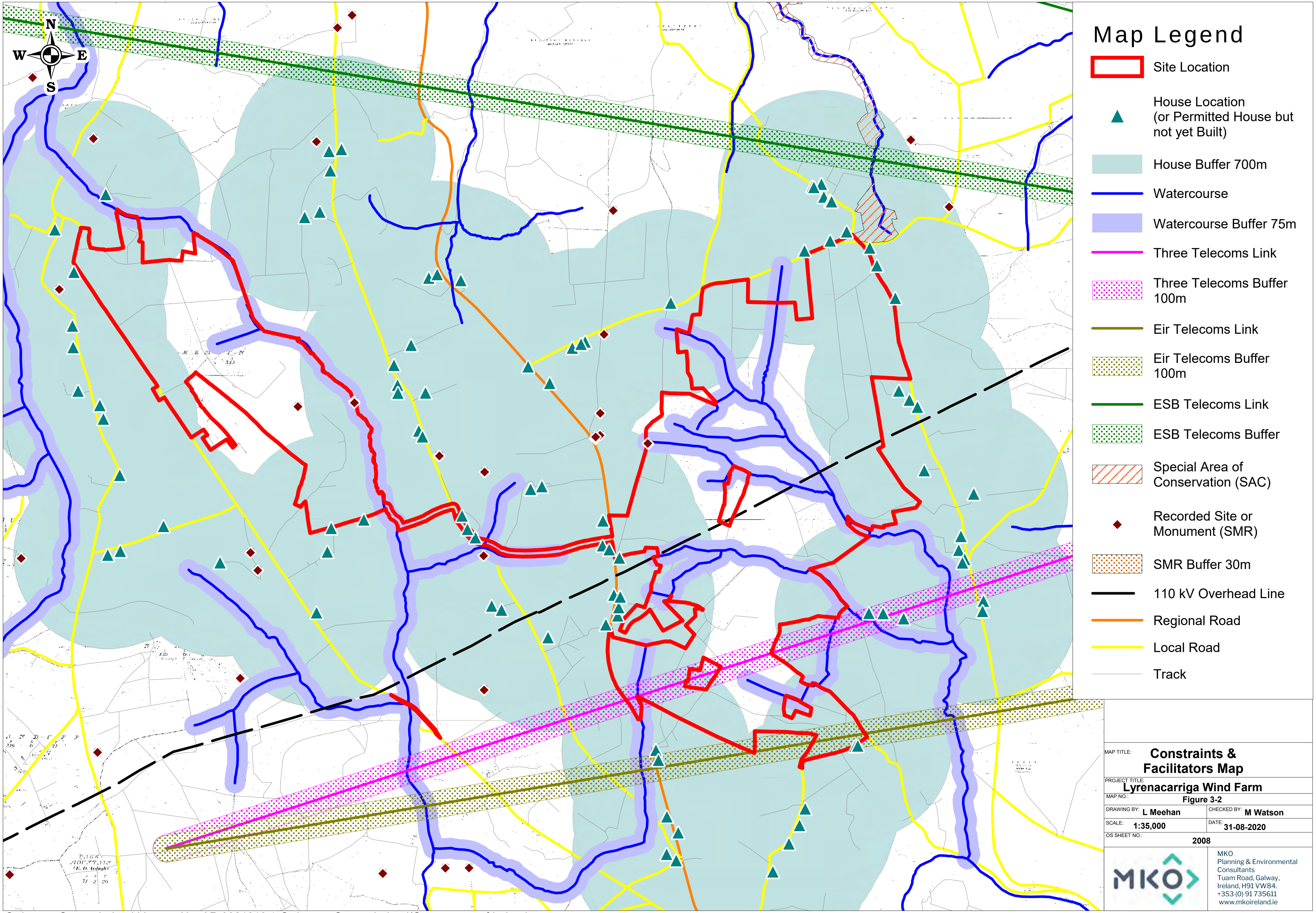
Facilitators are factors that give an advantage to a proposed design layout, such as existing road infrastructure within a site. Mapping the constraints and facilitators for a wind farm project identifies a viable area within which wind turbines could be accommodated. Once the viable area is established, the siting requirements of the wind turbines in terms of separation distances etc. are considered and a preliminary layout can be developed for the site.

The constraints and facilitators map for the site of the proposed development, as shown in Figure 3-2, was produced following a desk study of all site constraints. Figure 3-2 encompasses the following constraints and associated buffers:

- Residential dwellings plus a minimum 700 metre setback (exceeding the requirement for a 4 x tip height separation distance from all houses as proposed with the *'targeted review of the Wind Energy Development Guidelines 2006'*);
- Watercourses plus 75-metre buffer;
- Telecommunication Links plus operator-specific buffer; and
- Archaeological Sites or Monuments, 50-metre buffer, plus 'Zone of Notification' as required by the National Monuments Service (ROI).

Facilitators at the site build on the existing advantages and include the following:

- Size of available lands for development;
- Separation distance from un-associated landowners;
- Existing access and general accessibility of all areas of the site due to existing road infrastructure;
- Existing grid infrastructure; and
- Good wind resource.


N
S
E
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Map Legend
Site Location
House Location (or Permitted House but not yet Built)
House Buffer 700m
Watercourse
Watercourse Buffer 75m
Three Telecoms Link
Three Telecoms Buffer 100m
Eir Telecoms Link
Eir Telecoms Buffer 100m
ESB Telecoms Link
ESB Telecoms Buffer
Special Area of Conservation (SAC)
Recorded Site or Monument (SMR)
SMR Buffer 30m
110 kV Overhead Line
Regional Road
Local Road
Track
MAP TITLE: Constraints & Facilitators Map
PROJECT TITLE: Lyrenacarriga Wind Farm
MAP NO.: Figure 3-2
DRAWING BY: L Meehan
CHECKED BY: M Watson
SCALE: 1:35,000
DATE: 31-08-2020
OS SHEET NO.: 2008
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The inclusion of the constraints on a map of the study area allowed for a viable area to be identified. A preliminary wind farm layout was then developed to take account of the constraints mentioned above and their associated buffer zones, and the separation distance required between turbines and other infrastructure.

Following the mapping of the facilitators and all known constraints and the emergence of a preliminary wind farm layout, detailed site investigations and assessments were carried out by the project team. During site investigations, where specific areas were deemed as being unsuitable for the siting of turbines or associated infrastructure, alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The proposed turbine layout was also informed by wind data and the results of noise and shadow flicker modelling as they became available.

The previous alternative turbine layouts assessed during the design process, which led to the evolution of the final proposed layout from the initial preliminary design, are described in Section 3.6.2 below.

3.6.2 Turbine Layout

The development of the final proposed wind farm layout has resulted following feedback from the various studies and assessments carried out, as well as ongoing negotiations and discussions with landowners and the local community, as described above. As information regarding the site was compiled and assessed, the number of turbines and the proposed wind farm layout were revised and amended to take account of these findings. The EIAR and wind farm design process was therefore an iterative process, where findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts. Where changes were made to the proposed turbine layout during the design process, these updates were circulated to the project team on ongoing basis and assessed to ensure they would not give rise to adverse environmental impacts.

The initial constraints study identified a significant viable area within the site, in which turbines could potentially be located. From here, the proposed turbine layout went through 11 separate iterations during optimisation of the site design. A description of the alternative turbine layouts is presented below. A comparison of the potential environmental effects of the previous alternative layouts versus the final proposed layout is presented in Table 3-5 at the end of this section.

3.6.2.1 Proposed Layout Iteration No. 1

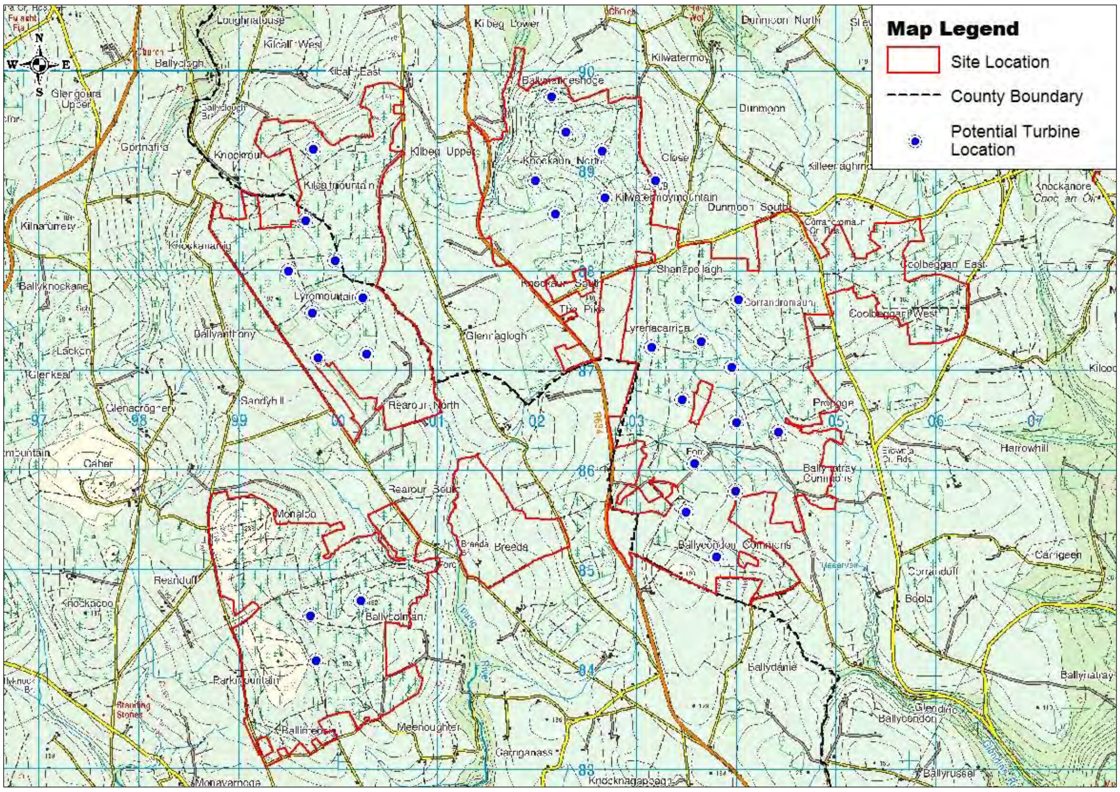


Figure 3-3 Proposed Layout Iteration No. 1

The proposed turbine layout Iteration No. 1 comprised 29 No. turbines located in four clusters, as shown in Figure 3-3. This preliminary turbine layout was prepared based on the initial constraints mapping and modelling exercises, and the identification of a potential viable area, as described in Section 3.6.1 above.

Layout Iteration No. 1 formed the basis for the initial environmental site surveys which comprised soil probing, watercourse mapping, habitat characterisation and ground-truthing of constraints. Following further noise, shadow flicker and Zone of Theoretical Visibility (ZTV) modelling and a review of the overall spatial extent of the site, it was decided to omit the cluster of three turbines in the south-western section of the site from the proposed wind farm layout. This would reduce the spatial extent of the wind farm, and thereby reduce the potential for environmental effects over a larger area.

3.6.2.2 Proposed Layout Iteration No. 2

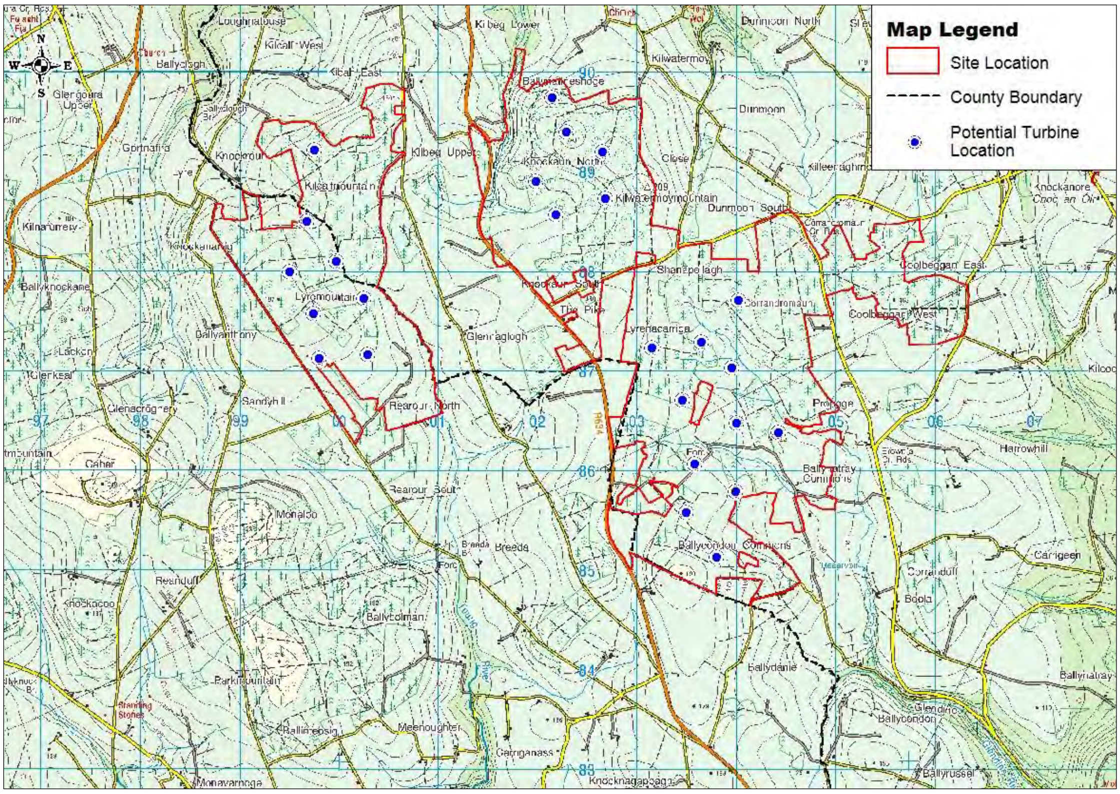


Figure 3-4 Proposed Layout Iteration No. 2

Turbine layout Iteration No. 2 comprised 25 No. turbines located in three clusters, as shown in Figure 3-4. The fourth cluster of turbines was dropped from the proposed development layout, as described above, in addition to one turbine from the north-eastern cluster.

Iteration No. 2 formed the basis for the detailed onsite surveys and investigations. This included geotechnical, ecological, hydrological and archaeological surveys. Following the site surveys and investigations a number of amendments were incorporated into the proposed turbine layout to take account of the findings, including:

- Adjusting turbine locations to move foundations and proposed access roads out of steeper gradient areas.
- Adjusting turbine locations to increase their separation distance from watercourses.

The recommendations from the detailed surveys were incorporated into the layout as indicated in Iteration No. 3 below. During site surveys, areas of potential Marsh Fritillary habitat were also identified for further survey during the appropriate survey season.

3.6.2.3 Proposed Layout Iteration No. 3

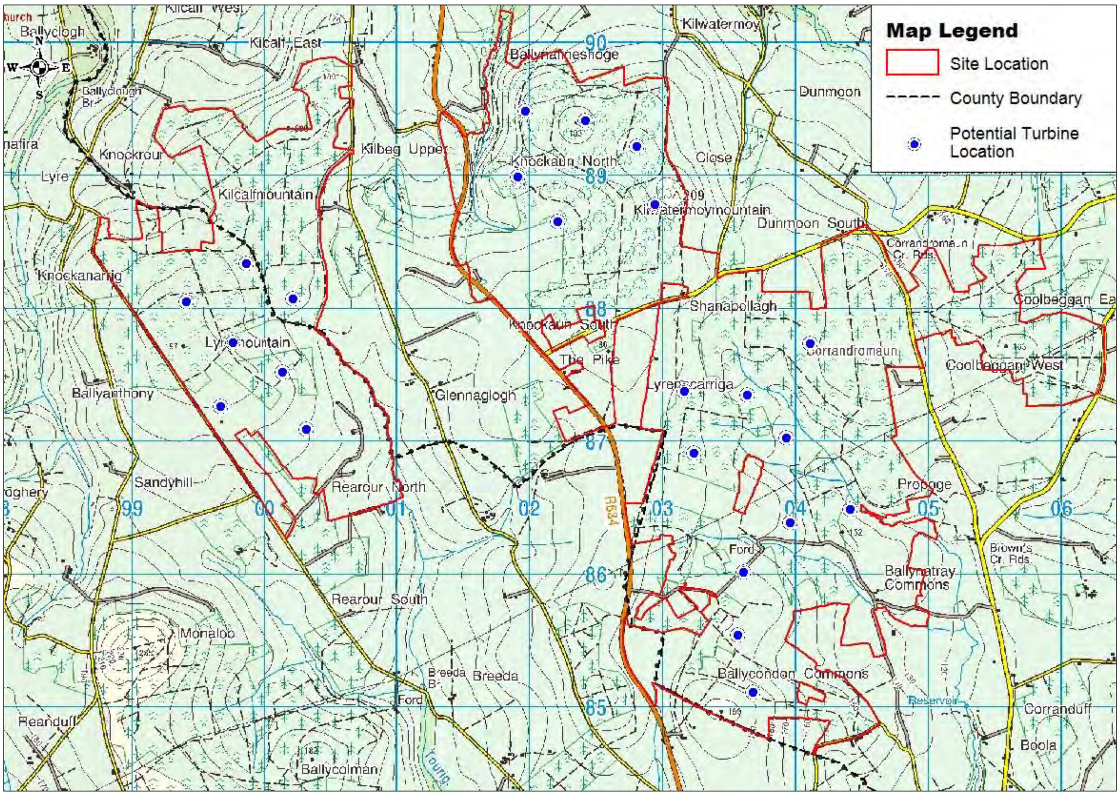


Figure 3-5 Proposed Layout Iteration No. 3

Turbine layout Iteration No. 3 comprised 23 No. turbines located in three clusters, as shown in Figure 3-5. This layout took account of the findings of the site surveys as described above. The most northerly turbine in the western cluster was omitted from the layout, in order to reduce the spatial extent of the proposed wind farm. A second turbine was also omitted from the south-eastern cluster in order to improve spacing between wind turbines in this area.

3.6.2.4 Proposed Layout Iteration No. 4

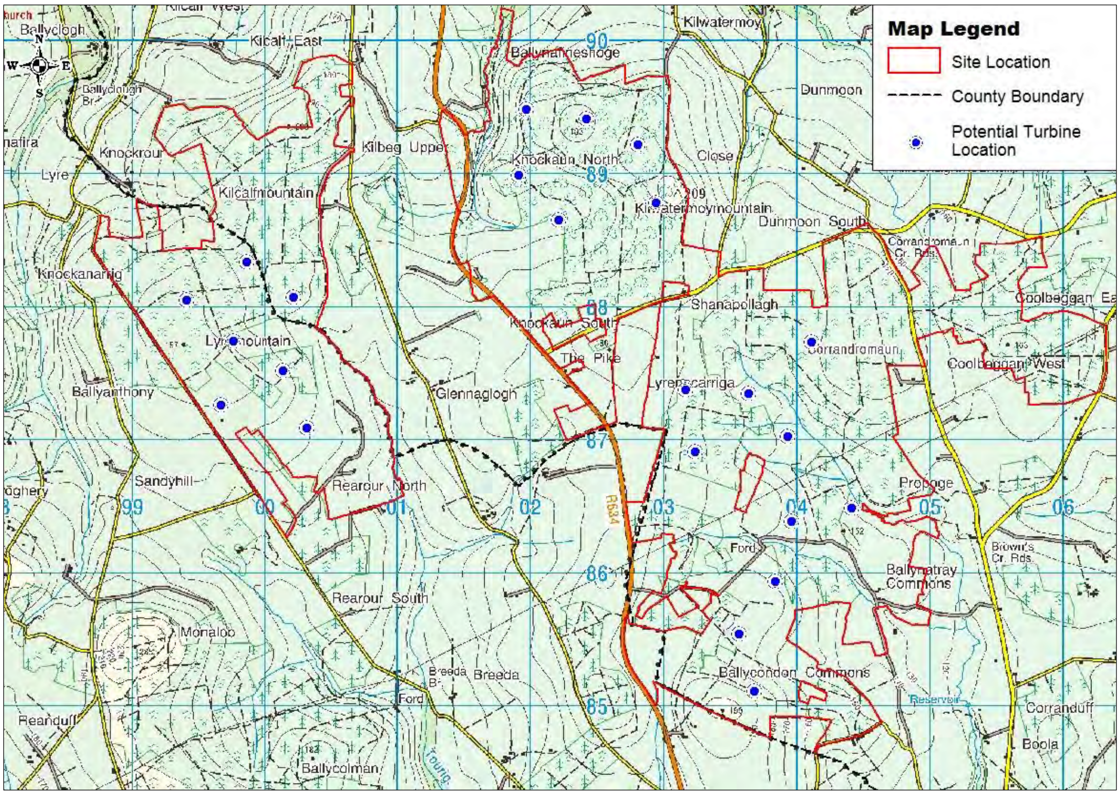


Figure 3-6 Proposed Layout Iteration No. 4

Turbine layout Iteration No. 4 comprised 23 No. turbines located in three clusters, as shown in Figure 3-6. This layout is the same as Iteration No. 3, with the exception of one turbine in the south-western cluster, which was moved approximately 240 metres in order to take advantage of the presence of an existing forestry road and thereby reduce the requirement for a new access track to be constructed.

3.6.2.5 Proposed Layout Iteration No. 5

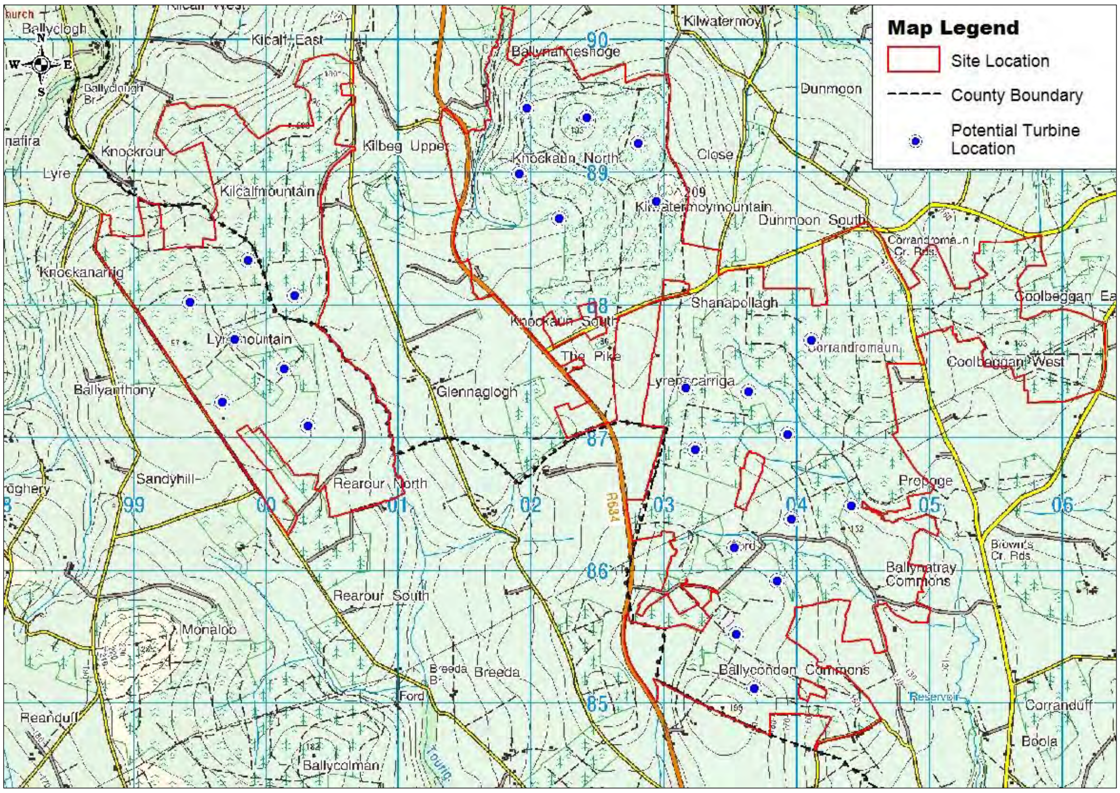


Figure 3-7 Proposed Layout Iteration No. 5

Turbine layout Iteration No. 5 comprised 24 No. turbines located in three clusters, as shown in Figure 3-7. This layout is the same as Iteration No. 4, with the exception of one additional turbine now added in the south-western cluster. Following the movement of a turbine location in this part of the site, as described above, further wind data analysis identified that an additional turbine could now be accommodated in this south-western cluster.

3.6.2.6 Proposed Layout Iteration No. 6

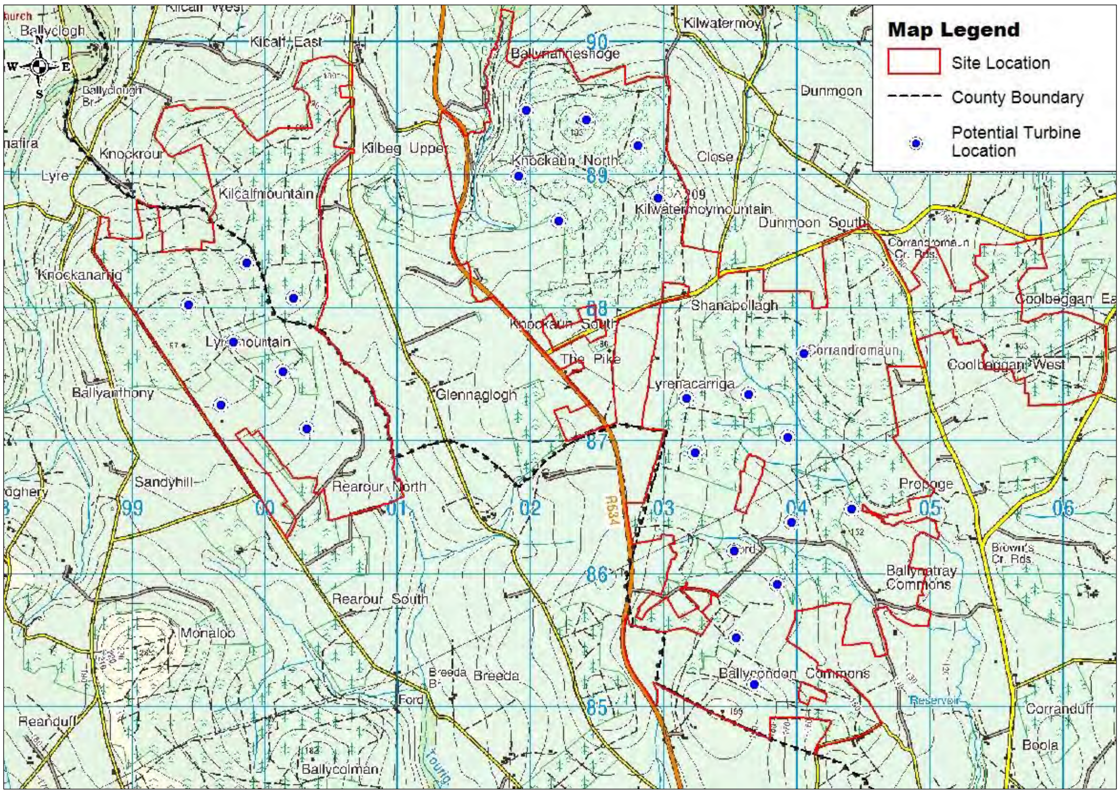


Figure 3-8 Proposed Layout Iteration No. 6

Turbine layout Iteration No. 6 comprised 24 No. turbines located in three clusters, as shown in Figure 3-8. This layout is the same as Iteration No. 5, with the following exceptions:

- Three turbines were moved distances of between 50 and 100 metres in order to increase their setback distance from the local road L2003 and houses located along this road.
- The most southerly proposed turbine was also moved approximately 50 metres northward in order to reduce the north-south spatial extent of the wind farm.

3.6.2.7 Proposed Layout Iteration No. 7

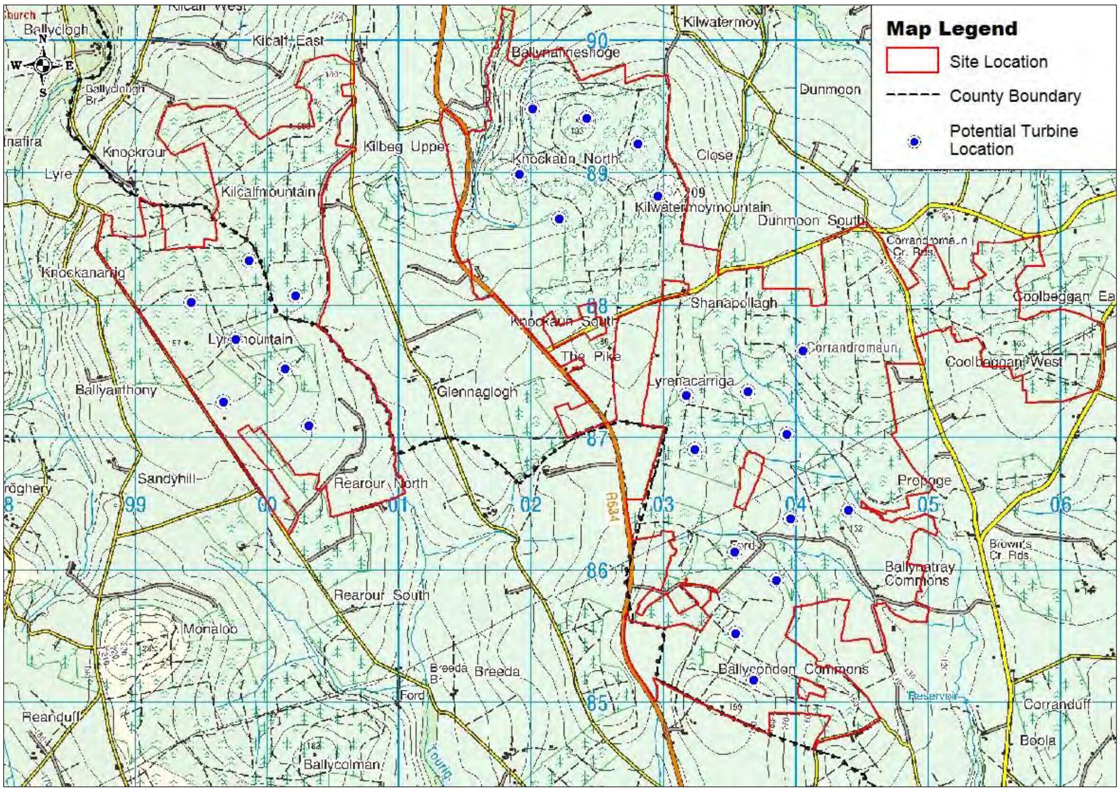


Figure 3-9 Proposed Layout Iteration No. 7

Turbine layout Iteration No. 7 comprised 24 No. turbines located in three clusters, as shown in Figure 3-9. This layout is the same as Iteration No. 6, with the following exceptions:

- The most northerly turbine was moved approximately 40 metres west following the geotechnical site assessment, in order to move it from a steeper gradient area.
- Two turbines in the south-eastern cluster were each moved approximately 40 metres following the hydrological site assessment, in order to increase their separation distance from watercourses.

3.6.2.8 Proposed Layout Iteration No. 8

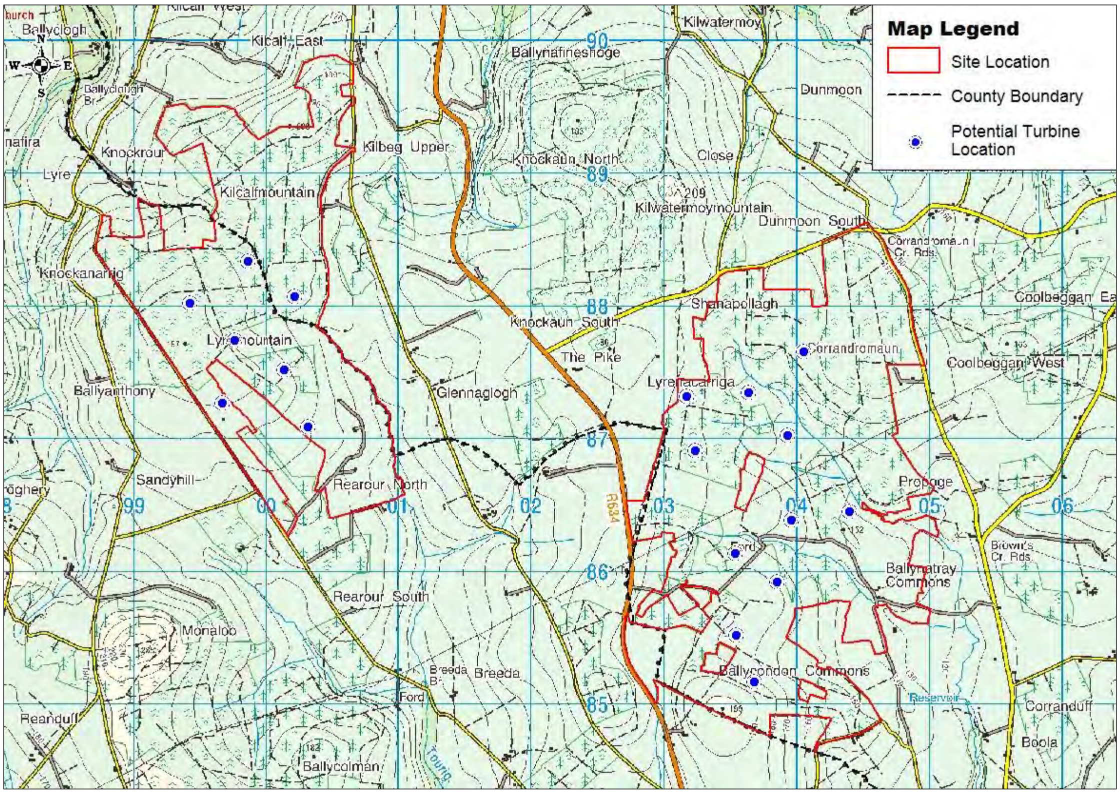


Figure 3-10 Proposed Layout Iteration No. 8

Turbine layout Iteration No. 8 comprised 18 No. turbines located in two clusters, as shown in Figure 3-10. This layout represents a significant update from the previous iteration and was derived following the decision to omit the north-eastern cluster of 6 No. turbines from the proposed development. This decision was made following engagement with local residents, and while it is considered that sufficient setback distances could be obtained and that visibility of turbines to the north and south of the L2003 local road would be limited due to the presence of screening and distance from turbines, the omission of the 6 no. turbines in the northern cluster significantly reduces the potential for cumulative residential amenity and visual impacts to residents along this road.

3.6.2.9 Proposed Layout Iteration No. 9

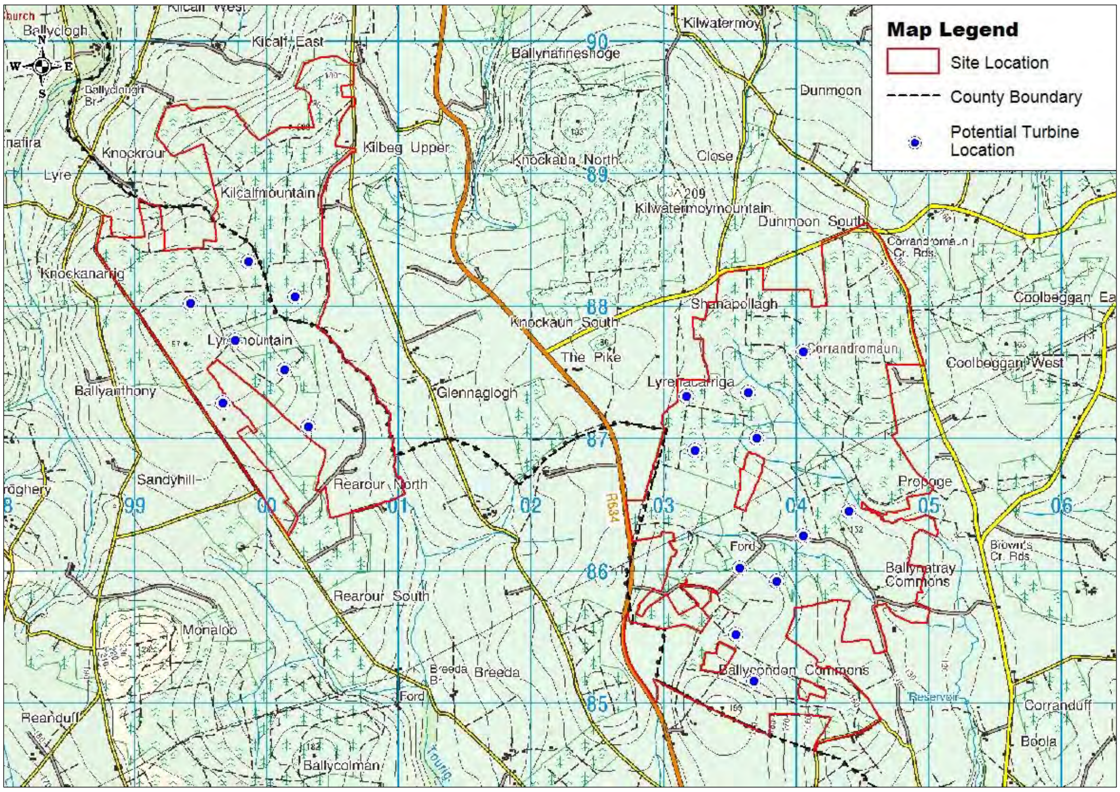


Figure 3-11 Proposed Layout Iteration No. 9

Turbine layout Iteration No. 9 comprised 18 No. turbines located in two clusters, as shown in Figure 3-11. This layout is the same as Iteration No. 8, with the following exception:

- The three turbines located nearest to the existing 110 kV overhead line, which traverses the site, were moved by distances ranging from 120 metres to 230 metres, in order to increase their separation distance from the line.

This update was made to the layout following pre-planning discussions with EirGrid.

3.6.2.10 Proposed Layout Iteration No. 10

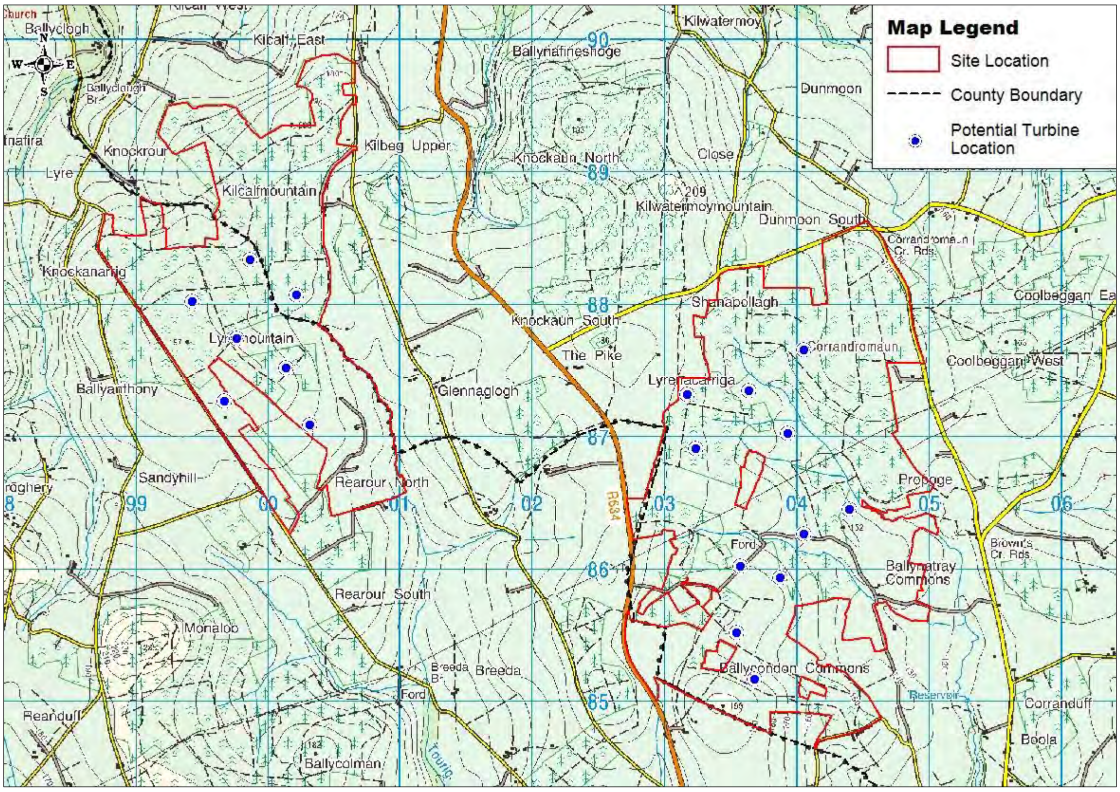


Figure 3-12 Proposed Layout Iteration No. 10

Turbine layout Iteration No. 10 comprised 18 No. turbines located in two clusters, as shown in Figure 3-11. This layout is the same as Iteration No. 9, with the following exceptions:

- One turbine in eastern cluster was moved approximately 230 metres to increase its separation distance from a watercourse, and to improve spacing between turbines (so as to optimise the wind resource).
- A second turbine in the eastern cluster was moved approximately 20 metres in order to improve its access from an existing forestry track.

3.6.2.11 Proposed Layout Iteration No. 11

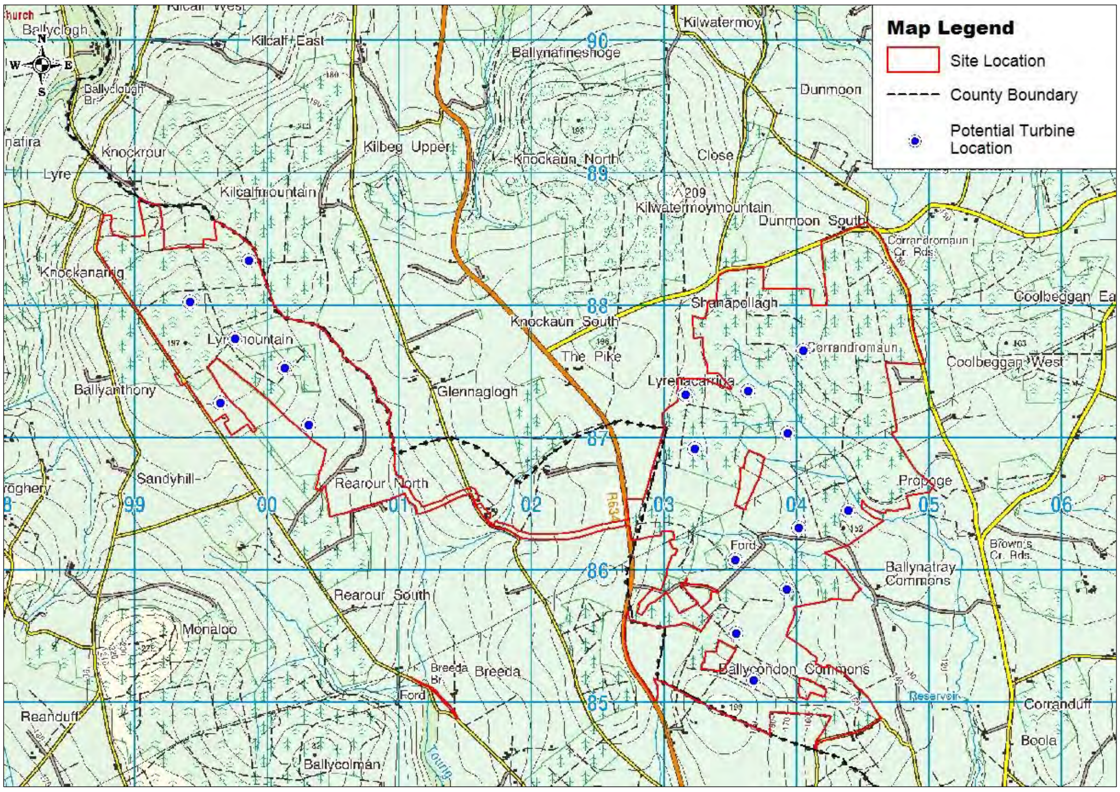


Figure 3-13 Proposed Layout Iteration No. 11

Iteration No. 11 as presented in Figure 3-13 represents the final proposed layout and comprises 17 No. turbines located in two clusters. This layout is the same as Iteration No. 10, with the following exceptions:

- One turbine has been omitted from the western cluster due to land availability.
- Three turbines were moved distances ranging from 60 metres to 100 metres in the eastern cluster to improve separation distances between them and allow for improved access.

The final proposed turbine layout as presented in Figure 3-13 takes account of all site constraints and investigations, impact assessments, design constraints (e.g. setback distances required from houses and third-party lands / infrastructure and distances required between turbines etc.) and feedback obtained during the extensive scoping and consultation exercises. This layout has been subject to detailed onsite assessment by the project team.

The final chosen turbine layout is considered the optimal layout given it has the least potential for environmental effects. A comparison of the potential environmental effects of the previous alternative layouts versus the final proposed layout is presented in Table 3-5 below.

Table 3-5 Comparison of environmental effects of alternatives when compared to final proposed layout

Environmental Consideration	Earlier Alternative Layouts
Population & Human Health (incl. Shadow Flicker)	› Earlier layouts comprising additional clusters of turbines had the potential to give rise to additional impacts on residential amenity, due to noise, dust or traffic impacts during the *construction* phase of the proposed development. › Earlier layouts comprising additional turbines or clusters of turbines had the potential to give rise to additional impacts on residential amenity, due to noise, shadow flicker or visual impact during the *operational* phase of the proposed development.
Biodiversity & Ornithology	› Larger development footprint would result in greater habitat loss. › Greater potential collision risk for birds due to the presence of more turbines or clusters of turbines. › Earlier layouts encompassed turbines located nearer to watercourses; turbines were moved in order to increase this separation distance and reduce the potential for any run-off to enter watercourses.
Land, Soils & Geology	› Larger development footprint would result in greater volumes of soil and subsoil to be excavated and removed to borrow pits for storage.
Geotechnical	› Larger development footprint would result in greater potential for slope stability risk. › Following site investigations, proposed turbine locations and associated access roads were moved in order to avoid steep areas.
Water	› Earlier layouts encompassed turbines located closer to watercourses; turbines were moved in order to increase this separation distance and reduce the potential for any run-off to enter watercourse.
Air & Climate	› Earlier layouts comprising additional turbines or clusters of turbines had the potential to make a greater contribution to renewable energy targets and greenhouse gas reductions
Noise & Vibration	› Earlier layouts comprising additional turbines or clusters of turbines had the potential to give rise to additional impacts on residential amenity, due to noise. › Turbines were moved in order to increase their separation distance from houses.
Landscape & Visual	› Earlier layouts comprising additional clusters of turbines had the potential to give rise to additional landscape and visual impacts.

Environmental Consideration	Earlier Alternative Layouts
Cultural Heritage & Archaeology	› Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	› Earlier layouts comprising additional clusters of turbines had an increased potential for impacts on local road network due to larger spatial extent of the wind farm. › Turbines were re-located so as to avoid existing infrastructure (110 kV overhead line) and telecommunications links.

3.6.3 Road Layout

Access tracks are required onsite in order to enable transport of infrastructure and construction materials within the proposed development. Such tracks must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was decided at an early stage during the design of the proposed development that maximum possible use would be made of existing onsite roadways and tracks where available to minimise the potential for impacts that would be associated with using new roads as an alternative.

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

An alternative option to making maximum use of the existing road network would be to construct an entirely new road network, having no regard to existing roads or tracks. This approach was not favoured, as it would create the potential for additional environmental effects to occur in relation to land, soils and geology (increased excavation and aggregate requirements), hydrology (increased number of new watercourse crossings) and biodiversity (increased habitat loss).

A comparison of the potential environmental effects of constructing an entirely new road network when compared against maximising the use of the existing road network is presented in Table 3-6 below.

Table 3-6 Comparison of environmental effects when compared against the chosen option (maximising use of the existing road network)

Environmental Consideration	New Road Network
Population & Human Health (incl. Shadow Flicker)	Potential for increased impacts on residential amenity due to increased disturbance during the construction stage.
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss.
Land, Soils & Geology	Larger development footprint would result in greater volumes of soil and sub-soil to be excavated and stored. Larger volume of stone required for road construction.
Geotechnical	Larger development footprint and increased potential for slope stability risk
Water	Larger development footprint and increased number of new watercourse crossings, therefore, increasing the potential for silt-laden runoff to enter receiving watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone. Potential for greater vehicular emissions due to and increased volume of construction traffic.

Environmental Consideration	New Road Network
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors during the construction of the new roads.
Landscape & Visual	Potential for greater visual and landscape impacts due to the construction of new roads.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.

3.6.4 Location of Ancillary Structures

The proposed development encompasses ancillary infrastructure required for the wind farm, including construction compounds, electricity substation and borrow pits. These features formed part of the project design from the outset, and were taken into consideration during the constraints mapping, site design and site assessment stages, as described in Sections 3.61 and 3.6.2 above.

3.6.4.1 Construction Compounds

The temporary construction compounds will be used for the storage of all construction materials and turbines. The proposed construction compounds are accessed off the existing road network that runs throughout the site. The use of two construction compounds as opposed to a single larger compound on site will result in shorter traffic movements and a reduction in vehicular movements throughout the site. The construction compounds are located strategically within each section of the site to facilitate the construction of the various infrastructure components.

A comparison of the potential environmental effects of constructing one larger compound when compared against the use of two compounds is presented in Table 3-7 below.

Table 3-7 Comparison of environmental effects when compared against the chosen option (multiple construction compounds)

Environmental Consideration	Single Larger Construction Compound
Population & Human Health (incl. Shadow Flicker)	Potential for increased impact on residential amenity due to increased vehicular and dust emissions from longer distance of traffic movements.
Biodiversity & Ornithology	Neutral
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site

Environmental Consideration	Single Larger Construction Compound
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to longer distance of traffic movements within the site.
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Less efficient construction practices due to longer movements of construction vehicles, plant and materials within the site.

3.6.4.2 Borrow Pits

Fill material required for the construction of access roads and turbine bases is proposed to be obtained primarily from three onsite borrow pits, located within the site of the proposed development. This approach entails an efficient use of existing on-site resources and eliminates the need to transport large volumes of construction materials along the local public road network to the site. The location for the proposed borrow pits were identified early in the site design, considering the site constraints, including topography, habitat type and surface water features. The proposed locations were then subject to onsite investigation, including ecological, geotechnical and hydrological assessment, in order to confirm their suitability.

An alternative to using onsite borrow pits was the option of sourcing all required stone and hardcore materials from a licensed quarry(ies) in the vicinity. The movement of such material would result in a significant increase in construction traffic and heavy loads and was therefore considered a less preferable option. A comparison of the potential environmental effects of obtaining all stone material offsite when compared to the chosen option of using onsite borrow pits is presented in Table 3-8 below.

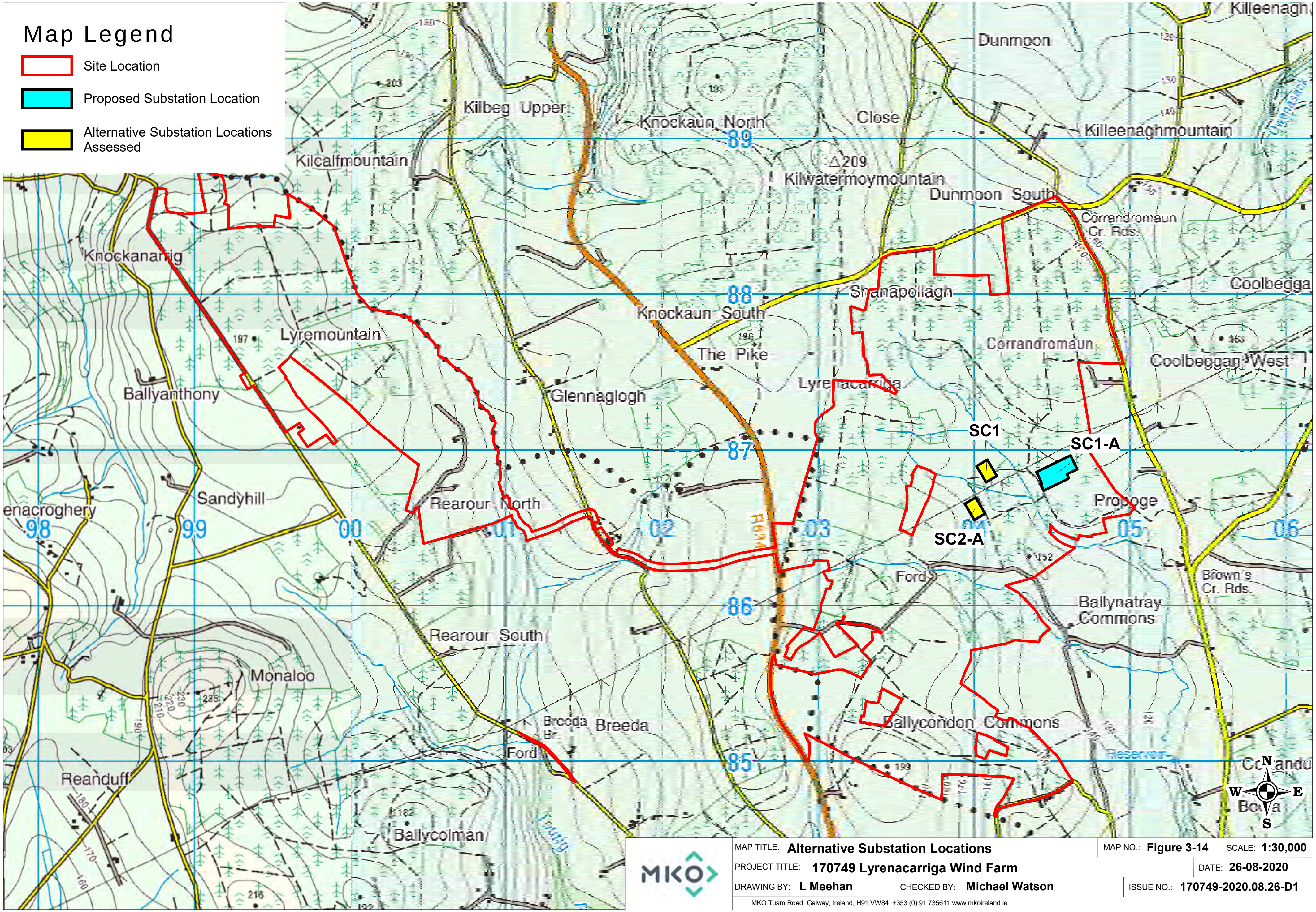
Table 3-8 Comparison of environmental effects when compared against the chosen option (use of onsite borrow pits)

Environmental Consideration	Obtaining all stone from off-site sources
Population & Human Health (incl. Shadow Flicker)	Potential for increased impact on residential amenity due to vehicular and dust emissions from additional traffic associated with movement of material on and off-site.
Biodiversity & Ornithology	Smaller development footprint, therefore reduced habitat loss and felling requirement
Land, Soils & Geology	No borrow pit excavation onsite, resulting in requirement to remove all other excavated material offsite for storage
Geotechnical	No borrow pit excavation onsite, resulting in requirement to remove all other excavated material offsite for storage
Water	No requirement for drainage from onsite borrow pits to be incorporated into project drainage design

Environmental Consideration	Obtaining all stone from off-site sources
Air & Climate	Potential for increased vehicular and dust emissions from additional traffic associated with movement of material on and off-site.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to additional traffic associated with movement of material on and off-site.
Landscape & Visual	Neutral (as onsite borrow pits will be reinstated following use)
Cultural Heritage & Archaeology	Smaller development footprint, therefore reduced potential for impacts on sub-surface archaeology
Material Assets	Less efficient construction practices and increased potential for impact on public road network due to additional traffic associated with movement of material on and off-site

3.6.4.3 Electricity Substation

At the initial stages of the project, three potential locations were identified within the viable area for the proposed onsite substation. Please refer to Figure 3-14 which show the locations of options SC1, SC1-A and SC2-A. The hydrological, geotechnical and ecological investigations of the site examined the proposed substation locations. Ease of access was taken into consideration. A summary of the findings from the investigations is presented below.


Map Legend
Site Location
Proposed Substation Location
Alternative Substation Locations Assessed
SC1
SC1-A
SC2-A
Knockanarrig
Lyremountain
Ballyanthony
Sandyhill
Kilcalfmountain
Kilbeg Upper
Knockaun North
Close
Dunmoon
Killeenaghmountain
Kilwatermoymountain
Dunmoon South
Corrandromaun Cr. Rds.
Coolbegga
Shanapollagh
Knockaun South
The Pike
Corrandromaun
Coolbeggan West
Lyrenacarriga
Glennaglogh
Rearour North
Propoge
Ford
Brown's Cr. Rds.
Ballynatray Commons
Rearour South
Monaloo
Breeda
Ballycondon Commons
Reanduff
Ballycolman
Reservoir
N
W
E
S
MAP TITLE: Alternative Substation Locations
MAP NO.: Figure 3-14
SCALE: 1:30,000
PROJECT TITLE: 170749 Lyrenacarriga Wind Farm
DATE: 26-08-2020
DRAWING BY: L Meehan
CHECKED BY: Michael Watson
ISSUE NO.: 170749-2020.08.26-D1
MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

Geotechnical Investigations

Given the ground conditions onsite comprise predominantly deep, well-drained mineral soil, with localised areas of shallow well-drained mineral soil, all three potential substation locations were found to be suitable from a constructability point of view.

Hydrology and Hydrogeological Investigation

From a hydrogeological perspective, the excavations for each of the substation locations will be relatively shallow and therefore no significant potential to impact on groundwater supplies will occur.

Each of the substation locations was also assessed in relation to its proximity to watercourses. As each substation location was outside the 75-metre watercourse buffer, all locations were considered suitable. However, location SC1 was located in the intervening area between two watercourses, thereby increasing its potential to give rise to run-off.

Ecological Assessment

The ecological multi-disciplinary walkover survey found that each of the substation locations contain habitats and species that are widespread and of low ecological significance and of local importance only.

Land Availability and Physical Constraints

In consideration of the distance required between proposed turbines and substation, and the area required for a 110 kV substation, it was deemed that location SC1-A was the optimum location for the substation. Furthermore, location SC1-A is the only of the three potential substation locations sited within an area of forestry, which will assist in screening it from view in the surrounding area.

Summary

A comparison of the potential environmental effects of the alternative substation locations when compared against the chosen location is presented in Table 3-9 below.

Table 3-9 Comparison of environmental effects when compared against the chosen option (location SC1-A

Environmental Consideration	Alternative Substation Location: SC1	Alternative Substation Location: SC2-A
Population & Human Health (incl. Shadow Flicker)	Neutral	Neutral
Biodiversity & Ornithology	Located between two watercourses therefore increasing the potential for silt-laden run-off to enter a watercourse. Not located in forestry; therefore less felling would be required.	Not located in forestry; therefore less felling would be required.
Land, Soils & Geology	Neutral	Neutral
Geotechnical	Neutral	Neutral

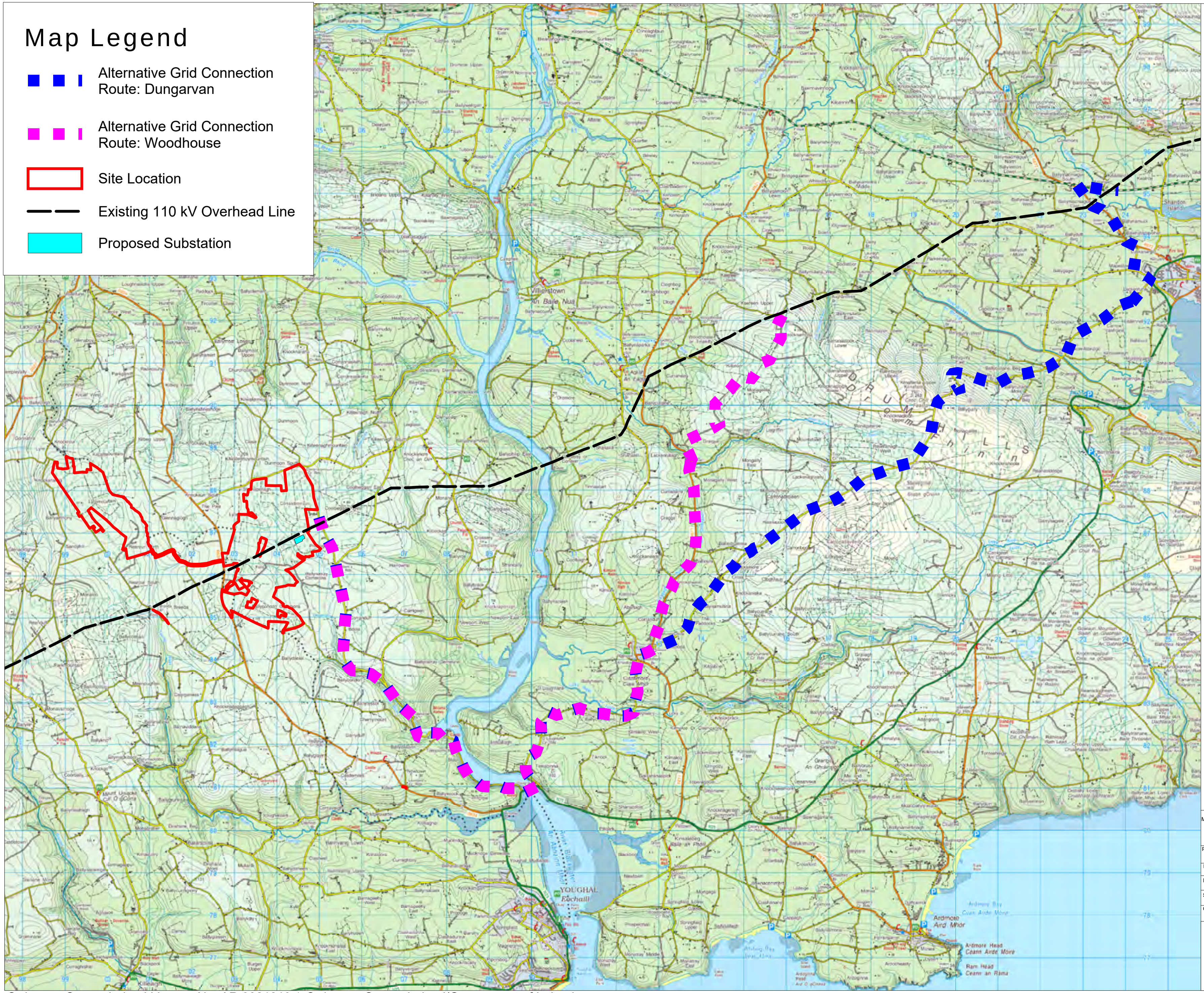
Environmental Consideration	Alternative Substation Location: SC1	Alternative Substation Location: SC2-A
Water	Located between two watercourses therefore increasing the potential for silt-laden run-off to enter a watercourse.	Located closer to a watercourse than selected location, which could increase the potential for silt-laden run-off to enter a watercourse.
Air & Climate	Neutral	Neutral
Noise & Vibration	Neutral	Neutral
Landscape & Visual	Not located in forestry; therefore potential for increased visibility from surrounding landscape	Not located in forestry; therefore potential for increased visibility from surrounding landscape
Cultural Heritage & Archaeology	Neutral	Neutral
Material Assets	Additional section of roadway would be required for upgrade to provide access, thereby slightly increasing the overall footprint of the proposed development. Located nearer to proposed turbines than selected location.	Located nearer to proposed turbines than selected location.

It should also be noted that while the operational lifespan of the proposed turbines is expected to be 30 years (following which they may be replaced or decommissioned) the electricity substation and associated infrastructure will become an ESB asset and will be a permanent feature of the proposal as it will be required to continue to form part of the electrical infrastructure of the area in the event of the remainder of the site being decommissioned.

3.7 Alternative Grid Connections

The output of the proposed wind farm is such that it requires to connect to a 110 kV substation. A high-level review of grid connection options was undertaken by Mullan Grid Consulting, which examined the viability of the grid connection with respect to technical and economic aspects. Further consideration was then given to the route options by the project team with regard to environmental aspects.

Three potential grid connection methods were identified and considered within the high-level review as set out below. The route options are shown on Figure 3-15.



MAP TITLE: **Alternative Grid Connection Routes**

PROJECT TITLE: **Lyrenacarriga Wind Farm**

MAP NO.: Figure 3-15

DRAWING BY: L Meehan

CHECKED BY: M Watson

SCALE: 1:120,000

DATE: 31-08-2020

OS SHEET NO.: 2008

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Connection Option 1 is a 110 kV loop-in connection to the existing Knockraha-Dungarvan- Cullenagh 110 kV network and is considered suitable for a wind farm with capacity such as that intended at the proposed wind farm. This connection method entails an onsite connection to the existing 110 kV overhead line that traverses the proposed development site.

Connection Option 2 is a dedicated 38 kV connection to the existing Dungarvan 110 kV substation. This substation is located approximately 36 kilometres from the proposed development site, via the public road network.

Connection Option 3 is a dedicated 38 kV underground cable connection to Woodhouse 110 kV substation. This substation is located approximately 25.7 kilometres from the proposed development site, via the public road network. From a technical point of view, Option 3 was considered suitable for a wind farm with a MEC of up to 50 MW only. The proposed wind farm will have an output in excess of 50 MW.

Grid connection Option 1 was considered the most viable option for connecting the proposed wind farm to the national grid. This connection method is considered the most suitable for the proposed wind farm due to the long distance associated with the two alternative options. A further assessment of the potential environmental effects of the alternative grid connection options compared against the chosen option of the onsite connection are presented in Table 3-10 below.

Table 3-10 Comparison of environmental effects when compared against the chosen option (Option 1: onsite grid connection)

Environmental Consideration	Grid Connection Option 2	Grid Connection Option 3
Population & Human Health (incl. Shadow Flicker)	Potential for increased disturbance to road users and occupants of dwellings located along roads, due to works associated with laying underground cabling in long sections of road	Potential for increased disturbance to road users and occupants of dwellings located along roads, due to works associated with laying underground cabling in long sections of road
Biodiversity & Ornithology	Potential for impacts on roadside habitats. Potential for impacts on watercourses at grid connection crossing points.	Potential for impacts on roadside habitats. Potential for impacts on watercourses at grid connection crossing points.
Land, Soils & Geology	Increased volume of spoil and tar to be excavated due to longer route	Increased volume of spoil and tar to be excavated due to longer route
Geotechnical	Neutral	Neutral
Water	Longer route would require more watercourse crossings which would increase the potential for silt-laden runoff and hydrocarbons to enter receiving watercourses.	Longer route would require more watercourse crossings which would increase the potential for silt-laden runoff and hydrocarbons to enter receiving watercourses.
Air & Climate	Potential for increased vehicular and dust emissions associated with grid connection works	Potential for increased vehicular and dust emissions associated with grid connection works

Environmental Consideration	Grid Connection Option 2	Grid Connection Option 3
Noise & Vibration	Potential for increased noise and vibration nuisances during construction phase on sensitive receptors (residential dwellings) located along the public road sections of the grid connection route	Potential for increased noise and vibration nuisances during construction phase on sensitive receptors (residential dwellings) located along the public road sections of the grid connection route
Landscape & Visual	Neutral	Neutral
Cultural Heritage & Archaeology	Potential for impacts on features of architectural heritage, for example bridges	Potential for impacts on features of architectural heritage, for example bridges
Material Assets	Potential for greater traffic volumes during construction phase due to grid connection works on public roads. Increased potential for impacts on existing underground services and utilities.	Potential for greater traffic volumes during construction phase due to grid connection works on public roads. Increased potential for impacts on existing underground services and utilities.

3.8 Alternative Transport Routes and Site Access

Wind turbine components (blades, nacelles and towers) are not manufactured in Ireland and therefore must be imported from overseas and transported over land to the site of a proposed development. With regard to the selection of a transport route to the proposed development site, alternatives were considered in relation to turbine components, general construction-related traffic, and site access locations. Turbines will be delivered to the site of the proposed development from Waterford via the N25 towards Youghal and from here onto the R634 Regional Road. This route makes optimum use of the National road network.

Three site entrances are proposed for the construction stage of the proposed development in order to transport turbine components, construction materials and equipment to the site. The locations of the access junctions are shown in Figure 4-23 in Chapter 4 of this EIAR and comprise the following:

- Access for turbine delivery traffic to the eastern cluster via an existing junction on the R634 Regional road (Access A);
- Access for turbine delivery and general construction traffic to the western cluster via an existing junction on the L7806 Local road (Access B), and
- Access for general construction traffic to the eastern cluster via an existing junction on the L2003 Local road (Access C).

An alternative option considered to the above was to use two access junctions only (one at each cluster). However, in order to avoid concentrating all traffic movements to and from the eastern cluster of turbines at one access location, it was considered more appropriate to make use of two access locations. Turbine components (i.e. abnormal sized loads) can be delivered to this part of the site via an existing access off the R634 Regional road, while non-turbine traffic (i.e. normal construction traffic) can turn right onto local road L2003 – without the requirement for any upgrade or widening works to this junction – and access the site from the existing forestry entrance. This update to the proposed layout was incorporated to the site design following engagement with near neighbours, and so as to avoid concentrating all construction traffic to one entrance.

Regarding access B above, there are two existing site entrances to the western cluster of turbines using forestry roads. Following engagement with near neighbours, the proposed access to the wind farm site was selected as the more southerly of the two existing entrances, so as to minimise disruption.

A comparison of the potential environmental effects of the alternative option when compared against the chosen location is presented in Table 3-11 below. A complete Traffic and Transportation Assessment (TTA) of the proposed delivery route and access junctions has been carried out by Alan Lipscombe Traffic and Transport Consultants. The results of the TTA are presented in Section 15.1 of this EIAR.

Table 3-11 Comparison of environmental effects when compared against the chosen option (use of three access junctions)

Environmental Consideration	Use of one access location to the eastern cluster
Population & Human Health (incl. Shadow Flicker)	Potential for increased disturbance to residents living close to the site access location, due to additional traffic movements to and from the site
Biodiversity & Ornithology	Neutral
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Neutral
Noise & Vibration	Potential for increased noise and associated disturbance to residents living close to the site access location, due to additional traffic movements to and from the site
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Potential for increased disturbance to road network users, due to additional traffic movements to and from one main access location

3.9 Conclusion

A description of the reasonable alternatives in terms of project design, technology, location, size and scale, which are relevant to the proposed wind farm and its specific characteristics, and an indication of the main reasons for selecting the chosen option with regard to each, including a comparison of the environmental effects, has been provided in the preceding sections. The consideration and assessment of alternatives has been carried out throughout the project design so as to avoid adverse environmental impacts.