ScottishPower Renewables

Hare Hill Windfarm

Repowering and Extension

Environmental Impact Assessment Report

Volume 1

Chapter 4: Site Selection and Design Evolution

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Abbreviations

Abbreviation	Description
EIA	Environmental Impact Assessment
ha	Hectares
km	kilometres
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest

4. Site Selection and Design Evolution

4.1. Introduction

1. The purpose of this chapter is to identify the steps and alternatives that have been considered in the site selection and design evolution process of the proposed Development. This process included the initial site selection, the identification of various constraints and site-specific factors, consideration of candidate turbines most likely to be available and viable at the time of construction. Throughout the evolution process the consideration of stakeholder feedback and the identification of key design criteria has been essential in producing the final revision. The proposed Development is considered to strike the best balance between minimising environmental impacts, maximising the capacity for renewable electricity generation whilst making a significant contribution to net zero targets.

2. The principles of an EIA require that site selection and project design should be iterative and constraints-led process, to ensure that potential negative environmental impacts, as a result of the proposed Development, are avoided or minimised where reasonably possible. Schedule 4, paragraph 2 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations), requires the consideration of reasonable alternatives in terms of development design, technology, location and the size and scale of the proposed Development. Regulation 5(2)(d) of the EIA Regulations requires that an EIA report should include: "*a description of the reasonable alternatives studied by the developer, which are relevant to the development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment*". The alternatives considered were those relevant to the proposed Development and its specific characteristics. Further considerations included an indication of the main reasons for the option chosen, taking into account the effects of the proposed Development on the environment.

3. This Chapter draws on issues considered in more detail in the relevant technical Chapters (**Chapters 6 to 14**). However, it does not pre-empt the conclusions of the later Chapters. Instead, it explains how potential environmental effects, which have emerged early in the EIA process and through the studies by the EIA team, have informed the iterative design of the proposed Development.

4. This Chapter of the EIA Report is supported by the following figures provided in Volume 2a: EIA Report Figures:

    - **Figure 4.1 - Environmental Designations**
    - **Figure 4.2a-d - Design Iterations**
    - **Figure 4.3a - On-Site Constraints**

- Figure 4.3b - On-Site Constraints – Ecology
- Figure 4.3c - On-Site Constraints – Hydrology
- Figure 4.3d - On-Site Constraints - Peat Depth
- Figure 4.3e - On-Site Constraints – Noise
- Figure 4.3f - On-Site Constraints - Aviation

5. The final design for the proposed Development is described in **Chapter 5: Development Description** and is shown on **Figure 5.1.**

4.2. Site Context

4.2.1. Site Description

6. The Site comprises an area of circa 1319.92 hectares (ha), and the boundary to the Site Location is shown in a wider context on **Figure 1.1**

7. The proposed Development is located approximately 1.5 kilometres (km) south_east of the village of New Cumnock and 4.5 km west of Kirkconnel (**Figure 1.1**.) The application boundary (**Figure 1.2)** is across both the East Ayrshire and Dumfries and Galloway administrative areas.

8. Regarding the physical attributes of the Site, there are a number of burns and small watercourses across the Site. The Site is made up of undulating hills of upland heath and moorland with areas of commercial forestry. The Site lies north east of the Afton Reservoir and Blackcraig Hill, south east of New Cumnock and west of Kirkconnel.

9. The current operational site containing Hare Hill (HH) and Hare Hill Extension (HHE), known as 'Hare Hill Windfarm' has a total of 55 turbines. HH has 20 turbines with an output of 13.2 MW. It has been operational since 1999 and is one of Scotland's oldest windfarms. HHE comprises 35 turbines with an output of 30 MW. HHE has been operational since 2017. The HH turbines are situated towards the northern area of the operational windfarm with HHE turbines extending towards the south east. The proposed Development will incorporate both of these areas and extend further to the south east.

10. Access to the proposed Development is from the A76 east of New Cumnock, initially via the existing access track before turning south, adjacent to a block of commercial forestry, which leads to the first of the HH turbines. The access track then turns south east and continues in this direction connecting with the three spurs of the HHE turbines and the wider site. The existing track through the commercial forestry block will not be utilised for abnormal loads but for standard construction traffic, access for HHE, and by emergency vehicles.

11. There are no areas within the application boundary designated for their natural or heritage interests such as SAC, SPA and designated heritage assets. There is one SSSI which is also a Geological Conservation Review Site. Proposed infrastructure has been positioned at a similar distance to the current operational windfarm from this feature.

4.2.2. Surrounding Area

12. The proposed Development lies to the north east of the Afton reservoir and Blackcraig Hill, south east of New Cumnock and west of Kirkconnel. The proposed Development is made up of undulating hills of upland heath and moorland with areas of commercial forestry with a number of burns and small watercourses also running across the Site.

13. The operational HH and HHE Windfarms (55 turbines) are both within the application boundary. There are several windfarms within the surrounding area as shown in Figure 4.3.

14. The closest environmental designations within 10 km of the Site are shown on Figure 4.1 and summarised in Table 4.1 and Table 4.2 below.

Table 4.1 Summary of Ecological and Geological Designated Sites within 10 km of the Site.

Type of Designated Site	Name	Distance from Site
Site of Special Scientific Interest	Fountainhead SSSI Muirkirk Uplands Northern Lowther Uplands	Partially within site boundary 3.08 km 3.24 km
Special Protection Area	Muirkirk and North	3.8 km
Geological Conservation Review site	The Knipe Polehote and Polneul Burns SSSI North Lowther Uplands SSSI/SPA Lagrae Burn Muirkirk Uplands SSSI/SPA	Partially within site boundary <1 km 2.5 km 3 km 3 km
Ancient Woodland Inventory site	97 Individuals parcels	Closest is within site boundary

Table 4.2 Summary of Cultural Heritage and Landscape Designated Sites within 10 km of the Site.

Type of Designated Site	Name	Distance from Site
Gardens and Designed Landscapes	Crawick Multiverse	10km north east
Scheduled Monuments	Five within 10 km, of which the nearest is St Connals Church and Graveyard	5 km north east
Conservation areas	Sanquhar	10 km east
Properties in Care of Scottish Ministers	NA	NA
Listed buildings	Nine within 10 km	Closest of which is Kirkconnel Parish Church and Graveyard 5.8 km east
Regional Scenic Areas	NA	NA

4.3. Site Selection

15. The Applicant uses a range of criteria to select sites for the development of renewable energy projects. As part of the growth plans for the development of renewable energy projects, the Applicant is continually assessing sites including those with operational windfarms currently on them and considering them for repowering, such as the proposed Development. This pipeline of potential sites, which is commercially sensitive, are not considered to be alternative sites to this proposed Development. Alternative sites therefore are not considered any further in the EIA Report.

16. However, in general when selecting appropriate sites, the criteria used by the Applicant to develop commercially viable projects include the following:

- suitable wind conditions for the installation of wind turbines;
- availability of nearby grid connection with available capacity to accept new renewable energy generation;
- favourable topography and access to enable the construction of projects;
- planning policies which support the development of renewable energy;
- avoidance of significant environmental constraints (in particular, the factors highlighted in Regulation 4(2) and 'sensitive areas' identified in Schedule 2 of the EIA Regulations) where possible onsite and/or immediately surrounding, including protected sites for conservation and heritage, protected species and their habitats and deep peatlands;
- avoidance of the most sensitive landscapes; and
- areas that are sparsely populated to protect the residential amenity of residential areas and households.

17. A review of the site selection requirements for the Site found the following:

- initial desk-based assessments onsite suggest that there is likely to be a good wind resource and the Site is available for a renewable energy development;
- the site itself has open and expansive characteristics considered appropriate for wind turbine development with proven record of previous development;
- Construction of a commercial scale renewable energy development is proven feasible within the context of the topography of the Site;
- there are no planning policies which, in principle, preclude wind energy or renewable energy development;
- the Site has reasonably good access from the public road network for construction traffic and wind turbine deliveries via an existing network of forestry haul access road for construction traffic and wind turbine deliveries, particularly for longer blades which allows consideration of larger turbines to make the best use of the expected wind resource;

- there are no national or international nature designations within the area identified for development; and
- the distances from the nearest residential properties are such that undue noise or visual impacts on visual amenity can be avoided.

4.4. Technology, Size and Scale

18. As a basis of the design of the proposed Development, it was considered that it would comprise of three-bladed horizontal axis turbines. A battery energy storage system was initially explored but not considered suitable for this application.

4.4.1. Wind Turbines

19. Onshore wind continues to be one of the cheapest forms of renewable energy and the Site has primarily been selected for its potential to generate energy from wind turbines. Allied to a significant and proven wind resource availability in the Dumfries and Galloway and East Ayrshire regions, the repower development potential is further reinforced by the success of both HH and HHE Windfarms. Additional to this, the challenge is to meet the Scottish Governments target within a context of limited Government support mechanisms for onshore wind.

20. The manufacture and supply of smaller wind turbines across Europe is already reducing the availability of turbine models commensurate with the models already onsite. This reduced availability is due to a lack of demand as manufacturers recognise the world market is shifting to larger wind turbine generators. As a consequence, the production and development of turbine manufacturing is now focussing on larger turbines to secure higher yield. The tendency is to install wind turbines at higher tip heights (e.g. 150 m and above to blade tip). Therefore, it is highly unlikely that a range of small turbines would be available at competitive prices by the time the proposed Development is ready to be constructed, if consented.

21. Developments with larger turbines now need to be considered if onshore wind development is to continue to contribute to both the UK and Scottish Government's renewable energy targets, particularly the recent announcement of net zero CO_2 emissions by 2045.

22. At the Scoping phase of the design consultation process, all turbines were set to a tip height of 250 m. During this process it was determined that a reduction in tip heights would represent the best balance between larger turbines and design in the landscape. The final design comprises seven turbines at 150 m, nine turbines at 180 m and seven turbines at 200 m to tip.

4.5. Layout and Design Constraints

23. The proposed Development, which is described in detail in **Chapter 5: Development Description**, is the result of the previously described design evolution process. This Section describes in more detail how this layout and design has been determined and outlines the environmental and technical constraints which have been considered.

4.5.1. Legislation and Guidance

24. The full range of predicted impacts have been considered throughout this EIA Report. A review of legislation and planning policy has been provided in **Chapter 2: Legal and Policy Context** and an assessment of such material is provided in the accompanying Planning Statement. A review was undertaken of design guidance documents and other standard texts on renewable energy development such as NPF4 Policy 11 Energy, the NatureScot (then Scottish National Heritage (SNH)) guidance on 'Siting and Designing Wind Farms in the Landscape' (Version 3a August 2017). These are considered further in **Chapter 6: Landscape and Visual Impact Assessment.**

4.5.2. Key Constraints

25. The key constraints which were considered during the design process include:

- identified landscape and visual constraints;
- presence of ornithology, protected habitats and species;
- presence of cultural heritage features;
- location of residential properties – proximity to noise sensitive receptors;
- ground conditions (including peat);
- access feasibility;
- presence of power lines and telecommunications links;
- area topography, including gradients, exposure, watercourses and land use; and
- compatibility with aviation interests.

26. The constraints analysis was undertaken using Geographical Information Systems (GIS). A project-specific workspace based on QGIS Online was developed specifically for the proposed Development. This allowed base-mapping to be overlaid with spatial data, such as environmental constraints and protected sites, and project-specific data to provide the project team with a means of interrogating environmental and project details in a single place at technical meetings and design workshops. Onsite constraints can be seen in further detail in **Figures 4.3a to 4.3f.**

27. A description of how the various environmental and technical disciplines have contributed to the design through detailed assessment is described below. Information in respect of the survey work undertaken is provided in the technical chapters of this EIA Report (**Chapters 6 to 15**).

4.5.3. Wind Analysis

28. Wind analysis and efficiency modelling has been carried out by the Applicant from project inception and throughout the design evolution process of the wind turbines to identify the parts of the Site likely to produce the highest yields, with an optimal layout and to ensure the commercial viability of the scheme.

29. For turbines to work as effectively as possible within any designed layout, they must be suitably spaced relative to the predominant wind direction. If the turbines are too close together, the wake effects from the wind turbines located on the upwind edge of the array will create turbulent air for the next row and so on through the array, reducing overall energy output. Additionally, turbulent air increases the strain placed on the turbine components, which could lead to a shortened lifespan of the individual turbines. Conversely, if wind turbines are spaced too far apart the opportunity to optimise the wind generation capacity is missed and, thereby, electricity generation from a site is reduced.

30. There is no industry standard for spacing, only manufacturer recommendations, design engineering experience and rules of thumb. Six times rotor diameter on the predominant wind direction against four times rotor diameter cross wind (6D x 4D) is a common starting point. This is understood to provide a reasonable compromise between turbine proximity and site capacity without unduly compromising turbine operation. The proposed Development may, however, employ turbines which are not yet on the market. Therefore, a more flexible methodology utilising wind yield modelling was used to find the right balance of turbine efficiency and productivity over a wide variety of potential rotor diameters.

4.5.4. Landscape Character and Visual Amenity

31. The wind turbine layout design is a vital part of the landscape and visibility effects of a windfarm. Its appearance considered on its own in the context of the surrounding landscape and cumulatively were important considerations. Landscape and visual input to the design was informed by NatureScot's Siting and Designing Wind Farms in the Landscape Version 3a (2017), experience and drawing on fieldwork observations. In addition to those general design principles, the following key landscape and visual sensitivities were identified and considered during the design process:

- Reduce the prominence of the proposed Development from nearby settlements and residents including the villages of New Cumnock and Kirkconnell;
- The use of differing turbine sizes were positioned so that the visual impact of the proposed Development works as one coherent project with no outlying turbines;
- The proposed Development was set back with topography to not become an overbearing feature in the landscape;
- Consider the impacts with nearby cumulative developments including operational Sandy Knowe, Sanquhar, as well as other proposals such as Euchanhead;
- Reduce the prominence of the proposed Development in views from key transport routes including the A76; and
- avoid significant impacts upon most valued landscape features on Site and seek enhancements where possible.

32. The final proposed Development layout has sought to achieve the following:

- reasonably consistent and balanced relationship when seen from the surrounding area, particularly when seen in views from the village of New Cumnock to the north west and Kirkconnell to the east;

- non-significant effects on visual amenity for nearby settlements, as well as most dispersed properties in proximity to the Site; and
- Where possible, proposed excavation for access tracks and other infrastructure has been minimised and the location of the substation and construction compound have been reviewed, and the selected option has been chosen in order to minimise visual effects.

33. The landscape and visual effects of the proposed Development are addressed in **Chapter 6: Landscape and Visual Impact Assessment**.

4.5.5. Ecology and Ornithology

34. Ecological surveys have been carried out across the Site since 2023, including a Phase 1 habitat survey, a National Vegetation Classification survey and protected species surveys (including bats, pine marten, badger, otter, water vole, red squirrel and fish). Carcass and fatality monitoring has also been carried out in 2024. Sensitive ecological features, including habitats present within the Site and species (with respective buffers) which use the Site, have been avoided as far as possible. The proposed Development avoids ecological features of greatest sensitivity, such as Annex 1 peatlands. In addition, the recommended habitat standoff distances from blade swept path to key habitat features have been incorporated into the design to reduce collision risk to bats.

35. Ornithology surveys have been carried out across the Site and surrounding area over a 24-month period between 2022-2024, including:

- vantage point watches;
- scarce breeding birds (for raptors, divers and any other species listed in Schedule 1 of the Wildlife and Countryside Act 1981); and
- winter walkovers for non-breeding birds.

36. Suitable buffers were considered during the design evolution process and areas have been specifically avoided to minimise the impact on sensitive species.

37. The ecology and ornithology effects of the proposed Development are addressed further in **Chapter 7: Ecology and Biodiversity**, and **Chapter 8: Ornithology**.

4.5.6. Hydrology and Hydrogeology

38. In accordance with good industry practice, a 50 m buffer zone has been applied around all watercourses on the Site for wind turbines. This reduces the risk of runoff, loose sediment and potential pollutants entering watercourses. However, in some cases the use of existing tracks, already within 50 m buffer zone of drainage ditches, have been identified as the best option for design. This compromise will minimise the need for new tracks. Watercourse crossings have been minimised as far as practicable; and where possible, existing crossings would be used. Existing crossings may be upgraded or replaced as appropriate.

39. Private Water Supplies (PWS) within 3 km of the proposed Development were considered. No PWS were identified as a major constraint to development, but it was noted that further

assessment post consent should take place for the nearest supplies identified through the EIA process.

40. Areas with potential to be Groundwater Dependent Terrestrial Ecosystems were also examined. A total of 76 habitats within the Site have the potential of moderate to high groundwater dependency. However, based on the underlying geology, hydrological context and topographical setting of the identified habitats, all habitats have been assessed as not truly groundwater dependant. These habitats are more likely to be almost entirely fed by precipitation and/or surface water or very near surface water runoff/infiltration.

41. The hydrology and hydrogeology effects of the proposed Development are addressed further in **Chapter 9: Hydrology, Hydrogeology, Geology and Soils**.

4.5.7. Peat Depth

42. The majority of the proposed Development is underlain by peat deposits as shown in **Figure 9.5**. These are mainly situated on the higher, flatter areas of topography, with no superficial deposits present on the steeper slopes. Glacial till deposits of Quaternary sand, gravel and clay (Diamicton) can also be seen within the application boundary, primarily following the line of incised channels and watercourses. In addition to these, alluvium, comprising of clay, silt, sand and gravel, associated with more recent fluvial deposition is present in riparian corridors of the main watercourses downstream of the Site. However, a small section is also present in the headwaters of Polstache Burm, a tributary of Kello Water, and within the headwaters of Kello Water itself.

43. Although outside of the Site, hummocky glacial deposits composed of rock debris, clayey till, sand and gravel can be seen within Euchan Water and Afton Water. Additionally, within the River Nith and Afton Water, various glacial fluvial deposits are present. These are deposited by meltwater streams and consist of coarse-grained sediments of sand and gravel with lenses of finer grained silt, clay or organic material. Smaller accumulations of alluvial fan deposits consisting of gravel, sand, silt and clay can also be seen in these main channels. These deposits are usually low, outspread relatively flat and gently sloping masses of loose rock material, shaped like a fan or segment of a cone, deposited by streams at the mouths of tributary valleys onto a plain or broad valley. Site visits have confirmed those areas within the proposed Development where the presence of peat and peatland habitats have been recorded (**Chapter 9**). Peat probing and habitat surveys were undertaken in 2024 and 2025 and show that the peat is of variable condition and depth across the Site, with deeper peat occurring in pockets across the Site (see **Figure 9.6**). Other areas of the Site are characterised by peaty soils and mineral soil. The peat probing data is discussed in **Chapter 9: Hydrology, Hydrogeology and Geology**.

44. A review of the peat depth data and habitat mapping, in conjunction with slope gradients, allowed areas of deep peat (typically greater than 1.5 m) and those areas of less modified peat to be avoided where possible through the evolution of the design. Where possible, proposed wind turbines and site infrastructure would be located in areas with no peat or with peat less than 1.0 m deep. Where access tracks cannot avoid areas of deep peat, floating tracks have been incorporated into the design. Further details of peatland habitat loss and habitat management proposals for restoring modified peatland habitat can be found in **Chapter 9: Hydrology, Hydrogeology, Geology and Geology.**

45. Figure 9.6 shows proposed site infrastructure along with peat depth information and aims to show that wind turbines and infrastructure have been carefully designed to avoid areas of deep peat.

46. The proposed Development has also been designed to avoid any areas which may be subject to peat slide risk. The ground condition constraints that were considered in the design of the proposed Development were:

- identification of peat depths in excess of 1.5 m - to minimise incursion, protect from physical damage, minimise excavation and transportation of peat, reduce potential for peat instability and minimise potential soil carbon loss;
- identification of slope angles greater than 5° - to minimise soil loss and potential instability; and
- avoidance of areas where initial peat stability concern was identified where possible – to avoid areas with possible instability issues and associated indirect effects on surface water.

4.5.8. Archaeology and Cultural Heritage

47. Archaeology and cultural heritage constraints were identified at an early stage of the design process, and hard and soft buffers were established around them based on their relative importance/sensitivity, so that they could be avoided during the design process.

48. The buffers and interpretation of heritage assets' importance/sensitivity were further assessed during the course of the design and EIA process. However, two heritage assets could be directly affected by construction works associated with the proposed Development, both of which are predicted to have an effect of minor significance.

49. Through the EIA scoping process and subsequently, the EIA team engaged with key heritage consultees such as Historic Environment Scotland to agree a basis for the assessment.

50. The archaeological and cultural heritage effects of the proposed Development are addressed further in Chapter 10 Archaeology and Cultural Heritage.

4.5.9. Noise Sensitive Receptors

51. For the purposes of early constraints mapping, avoidance buffers of 1 km were applied to inhabited residential properties in the vicinity of the Site. These buffers were refined further during the design process based on expert noise advice in order to reduce the risk of impacts on inhabited residential receptors.

52. An initial review of the baseline data surveyed for other windfarm schemes, and which are publicly available in the assessments for those schemes, suggests that existing baseline levels have been sufficiently defined for the purposes of an assessment of operational noise in accordance with ETSU-R-97 and best practice. Noise modelling was undertaken using this data for the proposed turbine layout at various stages of the design process, to predict the likely sound level which would result from the proposed Development at nearby residential properties.

53. The difference between measured background noise levels and predicted noise levels needs to be compliant with ETSU-R-97: 'The Assessment and Rating of Noise from Wind Farms' (Department for Trade and Industry (DTI), 1996) to avoid a significant impact. Applying design criteria in accordance with ETSU guidance ensures that no exceedances of acceptable noise levels would occur for the proposed Development.

54. The noise effects of the proposed Development are addressed further in **Chapter 13: Noise**.

4.5.10. Forestry

55. There are areas of commercial forestry within the Site, predominantly found near the entrance and access road. The existing forestry management plans for felling and planting across the Site have been considered in the design of the proposed Development. No felling is proposed to facilitate the proposed Development. Further information on forestry can be found in **Chapter 14**

4.5.11. Telecommunications

56. Consultation was undertaken with the relevant telecommunication link operators to inform the telecommunications links within the vicinity of the Site and to advise their position with respect to the proposed Development.

57. There are two telecom links within the proposed Development Boundary both of which are relevant to the current operational windfarms. The proposed Development layout avoids impacts to these identified Airwave telecommunications link through the Site.

58. The effects of telecommunications on the proposed Development are also addressed in **Chapter 14**.

4.5.12. Shadow Flicker

59. As stated for noise in Section 4.6.9 above, avoidance buffers of 1 km were applied to inhabited residential properties in the vicinity of the proposed Development. This also served to reduce the frequency and likelihood of shadow flicker effects being encountered by residents. Further information on shadow flicker effects can be found in **Chapter 14.**

4.6. Design Evolution

60. This section of the EIA Report addresses the consideration of alternatives and evolution of the design that the Applicant has gone though from inception to arriving at the proposed layout and scale of the proposed Development.

4.6.1. Consideration of Alternatives

61. According to the EIA Regulations, the EIA Report should include: "*a description of the reasonable alternatives studied by the developer, which are relevant to the development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.*"

62. With respect to the proposed Development the alternatives considered were as follows:

- different turbine and infrastructure layouts/locations within the Site; and

- different turbine heights/dimensions.
- The design and layout of the proposed Development was produced through consultation feedback and environmental constraints gathered through survey. There were four iterations of the design which focussed on the number of turbines, turbine heights, turbine positioning, the access track route and the Site boundary.

4.6.2. Design Evolution Approach

63. The turbine specifications and layout of the proposed Development went through a process of continuous design evolution throughout the EIA process as a better understanding of the environmental sensitives of the Site became known. This process is commonly referred to as an iterative design process. This process works alongside the EIA process, whereby the design process considers and facilitates incremental changes within the layout and design from continually developing and understanding the Site's environmental constraints. This iterative approach allows potential environmental constraints, as they are identified, to be avoided or minimised through design specifics. This approach is referred to within this EIA as mitigation 'embedded' into the proposed Development or 'embedded mitigation'. Further information on embedded mitigation is explained within each technical Chapter of this EIA Report (**Chapters 6-14**).

64. The iterative design process was performed under the guidance, requirements and considerations of the Applicant with specialist contribution from the consultant team involved. The design process was also guided by the findings of the baseline surveys, by recommendation of the specialist consultants and by issues raised by statutory and non-statutory consultees, as well as relevant planning policies.

65. The aim of the siting and design process was to arrive on a final design that would minimise environmental effects, is economically viable and be technically feasible, using the best available techniques, and engineering principles. The design optimised the specifics of the proposed Development for the generation of low carbon and low-cost electricity to contribute to national targets to decarbonise energy sources. As noted above, the design process included the selection of number and sizes of turbines, placement of turbines and other associated infrastructure. This took into account topographical, landscape and visual, cultural heritage, ecology, ornithology, hydrology and aviation constraints.

66. The locations of individual turbines were guided by the technical requirements of construction and operation, slope angles and the nature of the topography. Siting was also guided by the results of the EIA surveys and responses from the scoping exercise. Particular attention was given to the landscape and visual effects, residential amenity and the relationship between infrastructure and hydrology/peat resources across the site.

67. Wind resource and constraint modelling was also used as a tool to aid the development of the designed layout. Additionally, wirelines were generated to provide views from sensitive locations around the proposed Development, providing the opportunity to 'test' the design from the surrounding area.

68. A number of layouts were devised throughout the EIA process and following extensive investigation and consultation, an optimum layout was chosen. The evolution of the design is illustrated in **Figure 4.2a-d** which shows the evolution from the Scoping Layout (Design A) through to Design Freeze (Design D) as shown in **Figure 5.1: Proposed Site Layout**

69. As part of the approach numerous design principles and environmental measures have been implemented and incorporated into the proposed Development as standard practice, including the following:

- Minimising implications of the proposed Development splitting into two phases to accommodate differing lifespans of the current operational windfarms;
- Maximise site efficiency and low carbon electricity production;
- Provide a turbine with simple form, which reflects the scale of and relates to the landscape character of proposed Development and its surroundings;
- Avoid areas of constraints where practically feasible;
- Achieve a balanced composition of the turbines against the landscape and skyline from key viewpoint locations, avoiding complex and visually confusing layouts;
- Minimising impacts on peat;
- Minimising removal of plantation/tree cover to accommodate renewable energy infrastructure;
- Seeking opportunities within the Site to provide biodiversity enhancements;
- Consideration of re-using existing onsite infrastructure;
- Consideration of winning rock and aggregate from within the Site to minimise the amount of the material required to be imported to the Site; and
- Potential for up to 50 m micrositing of infrastructure during construction to ensure the best possible location is chosen based on detailed Site investigation.

70. The substation area has been selected using a similar approach to the wind turbine layout by applying technical and environmental constraints to the Site. Due to the nature of this infrastructure, the principal criteria for the substation was the identification of an area of flat land that avoided the more sensitive habitats and areas of deep peat. The same is true for the construction and maintenance compounds. The construction and maintenance compounds were either directed towards the entrance of site or further into site to provide staging areas to serve some of the more distant turbines within the proposed Development.

71. As there is currently the operational HH and HHE windfarms within the proposed Development, to minimise the impact of new access tracks, existing tracks have been utilised where possible. This will minimise the volumes of cut and fill material which would reduce the amount of ground disturbance, volume of material required for construction, loss of habitat and reduction in landscape and visual effects, predominantly during construction phases.

72. Borrow pits were also considered to be required as a potential source of rock to be used in the construction of the tracks, hardstandings and foundations. The proposed borrow pit search areas are outlined in **Figure 5.1.** There may be opportunity to re-use the borrow pits from the previous HHE development, if material is still available. By utilising borrow pits on site and potentially re-using the historic borrow pits associated with previous phases of

windfarm development, the Applicant has reduced the environmental impact of the proposed Development, as fewer deliveries of materials to the Site will be required to accommodate the proposed Development infrastructure.

73. Where felling is required to accommodate the proposed Development infrastructure, this has been minimised by taking a 'keyholing' rather than 'clear-felling' approach. There is minimal forestry within the Site and the most significant interaction with existing tree coverage would be with the new access track and turbine 1. Reducing the amount of felling to accommodate the proposed Development would also minimise the production of waste materials and potential sources of pollution. The access track itself in certain locations would also act as the firebreak and therefore obviate the need to cutting firebreaks elsewhere.

4.6.3. Development of Preferred Layout

74. The Applicant has been investigating the potential for renewable energy development at the Site since 2021. The key points of this design evolution process are presented in the following section.

75. The proposed Development has gone through several iterations with four key design stages presented below. Layouts A to D are shown in **Figure 4.2a-d** and illustrate the four interim layouts and visually illustrates how the design and application boundary have evolved through the design stages of the EIA process. Layout D is shown in **Figure 5.1**. A summary of the evolving layouts and design and the reasons for the changes are presented in **Table 4.3** below.

Table 4.3 Description of Design Evolution Stages

Layout	Number of Turbines	Tip height (m)	Comments
Layout A: Scoping Layout	27	250	A feasibility study was undertaken in 2022 and was further revised leading into the scoping process. This layout formed the basis of the EIA Scoping Report submitted in March 2023.
Layout B: Design Workshop Layout	27	150-200	Due to aviation constraints the turbines within this design were highlighted for height reduction between the range of 150-200m. Informed by environment constraints data and wind turbine parameters instructed by the Applicant.
Layout C: Chilled Layout	25	150-200	A 25 turbine layout of up to 200 m to tip, responding to field data collated for the Site up to September 2024, scoping and public consultation responses, alongside further advanced onsite environmental surveys and visual analysis
Layout D: Frozen Layout	23	150-200	The final proposed Development layout derived of 23 turbines of up to 200 m to tip. This was informed by detailed multidisciplinary assessment and including locations of ancillary infrastructure. New access track and turbine infrastructure, avoiding commercial forestry block, was included as a suitable agreement was not achievable for abnormal loads/turbine delivery and turbine development.

4.6.3.1. Layout A: Scoping Layout

76. In 2022, a feasibility study was undertaken on behalf of the Applicant which concluded that the proposed Development had a potential to accommodate up to 27 turbines of a tip heights in the range of 175 m of up to 250 m.

77. Numerous iterations of the design were considered, consisting of a range of turbine heights. The layout at this point was considered optimal from all known constraints at the time of submitting the Scoping Report.

78. This design is shown in Figure 4.2a.

4.6.3.2. Layout B: Design Workshop Layout

79. Following EIA scoping, an initial constraints assessment and updated design was prepared, consideration of candidate turbine design parameters, energy yield, and a variety of environmental assessments undertaken from 2023 through the summer of 2024. The environmental assessments included but were not limited to:

- ornithological and bat surveys;
- ecological habitat surveys;
- phase 1 peat depth probing to assess the overall peat depth across the Site;
- telecommunications assets; and
- initial consideration of the impacts on the setting of cultural heritage assets in the vicinity of the Site.

80. As a result, the proposed layout was amended in June 2024. The main factor considered within this iteration was the constraint from an Instrument Flight Procedure of nearby airports. This removed turbines over a certain height across the site which led to the reduction in height ranges to 150-200 m to tip. Initially, potential locations for up to 27 turbines were identified. Through a process of collaboration and review, the design remained at 27 turbines but turbine moves were made as presented in **Figure 4.2b**.

4.6.3.3. Layout C: Chilled Layout

81. A further design session was held in September 2024 with turbine moves based on discussions with relevant consultees, feedback from public consultations, engagement with local community councils and the increase in environmental data provided by surveys.

82. One of the major changes within this iteration was the removal of turbines in the eastern area which significantly removed a large area of land and access routes to the east.

83. Landscape and visual impacts towards the northern ridge of the Site was also looked at in detail to remove the stacking of turbines and improve the visual impact of site from surrounding key viewpoints.

84. The outcome of the chilled design was a 25 turbine layout, with connecting new and upgraded access tracks. This is shown in **Figure 4.2c**.

4.6.3.4. Layout D: Frozen Layout

85. A frozen design was achieved in October 2025 following Phase 2 peat probing which focussed on the areas of infrastructure within the chilled design footprint. Further amendments were made to the design to avoid localised areas of deep peat, adjusting construction compound locations to reflect the proposed access track to the Site and confirmation of a roads design specification.

86. Following further fieldwork and collaboration, it was decided to remove a turbine ("T1" as shown in Layout C) from the design so that the proposed Development would appear as a more coherent whole in views towards the Site and to reduce landscape and visual impact to surrounding residential areas. An additional turbine ("T10" as shown in Layout C) was also removed from the layout due to cumulative noise constraints.

87. The turbines were renumbered at this stage to run sequentially from 1 to 15 for Phase 1 and 16 to 23 for Phase 2.

88. Additionally, , the proposed access track was re-designed and turbine infrastructure moved to avoid the forested area as a suitable access agreement for abnormal loads/delivery traffic and turbine development was not feasible.

89. To accommodate this new proposed access track, the positions of turbines "T1", "T2" and "T3" and their hardstands were adjusted. This frozen design and finalised turbine numbering are shown in **Figure 5.1** as well as in Layout D – Frozen Layout on **Figure 4.2d.**

4.7. Micrositing

90. In order to be able to address any localised environmental sensitivities, unexpected ground conditions or technical issues that are found during detailed intrusive site investigations and construction, it is proposed that agreement is sought for a 50 m micrositing allowance around all infrastructure. The technical assessments (presented in **Chapters 6 to 15**) have considered the potential for micrositing. During construction of the proposed Development, the need for any micrositing would be assessed and agreed with the onsite Environmental Clerk of Works.

References

Dumfries and Galloway Council: [2019] *Dumfries and Galloway Local Development Plan 2*. Available at: https://www.dumfriesandgalloway.gov.uk/sites/default/files/2024-07/Adopted_LDP2_OCTOBER_2019_web_version.pdf [accessed June 2025].

NatureScot [2016] *Carbon and Peatland 2016 map*. Available at: https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/soils/carbon-and-peatland-2016-map [accessed September 2024].

Scottish Government [2022] *Onshore Wind Policy Statement: Scottish Government: 2022*. Available at https://www.gov.scot/publications/onshore-wind-policy-statement-2022/ [accessed September 2024].

Scottish Government [2023, updated 2024]. *National Planning Framework 4*. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/02/national-planning-framework-4/documents/national-planning-framework-4-revised-draft/national-planning-framework-4-revised-draft/govscot%3Adocument/national-planning-framework-4.pdf [accessed September 2024].

SNH [2017*] Siting and Designing Wind Farms in the Landscape (Version 3a):* Available at: https://www.nature.scot/doc/siting-and-designing-wind-farms-landscape-version-3a [accessed September 2024].

UK GOV [2017] *The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.* Available at: https://www.legislation.gov.uk/ssi/2017/101/contents [accessed September 2024].

UK GOV [1996] *ETSU-R-97: The Assessment and Rating of Noise from Wind Farms: Department for Trade and Industry (DTI): 1996*. Available at: https://assets.publishing.service.gov.uk/media/5a798b42ed915d07d35b655a/ETSU_Full_copy__Searchable_.pdf [accessed September 2024].