

2 SITE SELECTION AND DESIGN

2.1 INTRODUCTION

1. This Chapter of the Environmental Impact Assessment Report (EIA Report) contains a description of the land within the site boundary (the Site), the consideration of alternatives and site selection process, and the design process and scheme evolution that led to the final design of Heathland Wind Farm (the Development).
2. The Electricity Works (Environmental Impact Assessment) (Scotland)¹ Regulations 2017 state in Schedule 4 paragraph 2 that an EIA report must include:
'A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.'
3. This Chapter explains why the Site has been selected and summarises the layout options that were considered by the Applicant during the evolution of the Development.
4. This Chapter of the EIA Report is supported by the following figures provided in Volume 2a EIA Report Figures:
 - Figure 2.1: Ecological Designations;
 - Figure 2.2: Layout Evolution; and
 - Figure 2.3: Optimised Layouts.

2.2 SITE DESCRIPTION

2.2.1 Location

5. The Site, which covers an area of 831 hectares (ha), is located approximately 1.5 kilometres (km) northeast of the village of Forth in South Lanarkshire, centred on National Grid Reference (NGR) 296917, 657090, as shown on Figure 1.1. It lies within the administrative boundaries of South Lanarkshire Council (SLC) and West Lothian Council (WLC) ('the Councils').
6. The topography of the Site and the immediate vicinity is generally gently sloping with relatively low lying, but exposed hills. The elevation ranges from approximately 290 metres (m) Above Ordnance Datum (AOD) in the south-west part of the Site to approximately 362 m AOD at the north-east part of the Site, encompassing several low lying hills, for example Worm Law (343 m AOD). The hills are dissected by several small watercourses, including Wormlaw Burn, Mouse Water, Mosshat Burn and Longford Burn.
7. Access to the site is currently afforded from the A706 public road that abuts the Site's western boundary, and the aforementioned forestry tracks. There are no public roads within the Site.
8. There are several settlements surrounding the Site, including:
 - Wilstontown, located 1.9 km south of the nearest turbine;
 - Forth, located 2.6 km southwest of the nearest turbine;
 - Breich, located 1.9 km north of the nearest turbine;
 - Woolfords, located 2.3 km east of the nearest turbine;
 - Auchengray, located 3.3 km southeast of the nearest turbine;

¹ Scottish Government (2017) Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Available at: http://www.legislation.gov.uk/ssi/2017/101/pdfs/ssi_20170101_en.pdf (Accessed 03/09/2020)

- Fauldhouse, located 3.3 km northwest of the nearest turbine; and
 - West Calder, located 5.4 km northeast of the nearest turbine.
9. There are no farmsteads or other built infrastructure within the Site boundary. The closest village is Wilsons town, located 0.8 km to the south-west of the Site boundary. The closest property is Mountainblaw Farm which stands alone approximately 200 m south of the Site's southern boundary on Tashieburn Road, and located 1.25 km from the nearest turbine (T4).
10. There is one Core Path within the Site, which is split into three smaller named sections (CL/3166/1, CL/3167/1, and CL/3165/1), that follows an existing forestry track, as shown on Figure 16.2. The Path is located approximately 220 m west of the nearest turbine (T2) at the closest point.

2.2.2 Land Use

11. Active felling operations are taking place throughout the Site, which comprises predominantly of commercial coniferous plantation at varying degrees of maturity, including substantial areas of clear felling. This is owned and managed by Forestry and Land Scotland (FLS).
12. There are a number of existing forestry tracks used for the commercial woodland harvesting. The Site is currently accessible on foot to the public for walking and recreation, though there are health and safety restrictions in place during periods of harvesting and other forestry operations which means the network of paths and tracks is not always fully accessible to the public. Additionally, there are currently two active quarries on Site, located at NGR 297030, 656421 and NRG 297411, 657449 which are utilised periodically by FLS to obtain rock, and are otherwise not in use. Public access is not permitted within the quarries at any time.

2.2.3 Designations

13. There are no ecological designations within the Site; however, there are a number of located within 10 km of the Development, as shown on Figure 2.1. These include:
- Cobbinshaw Reservoir SSSI 2.7 km east of the nearest turbine location (T13);
 - Skolie Burn SSSI 3.4 km north of the nearest turbine location (T9);
 - Cobbinshaw Moss SSSI 3.8 km east of the nearest turbine location (T13);
 - Braehead Moss SAC and SSSI 4.3 km south of the nearest turbine location (T2);
 - Hermand Birchwood SSSI 6.3 km northeast of the nearest turbine location (T13);
 - Carstairs Kames SSSI 7.2 km south of the nearest turbine location (T4);
 - Easter Inch Moss and Seafield Law Local Nature Reserve (LNR) 7.5 km north of the nearest turbine location (T9);
 - Carnwarth Moss SSSI 7.5 km south of the nearest turbine location (T4);
 - North Shotts Moss Special Area of Conservation (SAC), 8.5 km northwest of the nearest turbine location (T1);
 - Hassockrigg and North Shotts Mosses SSSI, 8.5 km northwest of the nearest turbine location (T1);
 - Cranley Moss SAC and SSSI 8.7 km southwest of the nearest turbine location (T2);
 - Kingshill LNR 9 km west of the nearest turbine location (T1);
 - Tailend Moss SSSI 9 km north of the nearest turbine location (T9);
 - Craigengar SAC and SSSI 9.6 km southeast of the nearest turbine location (T13); and
 - Linhouse Valley SSSI 9.7 km northeast of the nearest turbine location (T13).
14. The West Lothian Special Landscape Area (SLA) is located approximately 300 m northwest of the Site at the nearest point and 450 m from the nearest turbine (T1), and

the Pentlands SLA is located 5 km west of the Site and 5.3 km from the nearest turbine (T14). SLAs are classed as local landscape designations.

15. The Site lies within the main river catchments of the River Clyde and River Almond. The River Almond has a SEPA overall condition status of 'moderate' and the River Clyde has a status of 'poor', in line with the Water Framework Directive (WFD) (2000/60/EC)² water quality objectives.
16. There are 34 Scheduled Monuments within a 10 km radius of the Site boundary; the nearest is Wilsontown Ironworks (SM2654) which is partly located within the Site boundary at the south, 1.1 km from the nearest turbine and outwith the area of the Site to be developed. There are 109 Listed Buildings of Category A, B and C within 10 km of the Site; the nearest is Category C Cleuch House (LB709), which is located 2.5 km south of the nearest turbine (T2).
17. The above designations are discussed as necessary within the relevant technical chapters.

2.3 SITE SELECTION

18. The selection of an appropriate site which has the potential to support a commercial wind farm development is a complex and lengthy process. It involves examining and balancing a number of environmental, technical, planning and economic issues. Only when it has been determined that a site is not subject to major known environmental, technical, planning or economic constraints is the decision made to invest further resources in developing the proposal and conducting an EIA.

2.3.1 Extant Consent

19. There is an extant consent on the site for 17 wind turbines (132 m to tip) and associated infrastructure. The Section 36 consent and deemed planning permission for Heathland Wind Farm was granted by Scottish Ministers on 26th October 2018, under reference number EC00003124 (the Consented Wind Farm).

2.3.2 The Site

20. In accordance with the EIA Regulations the design alternatives need to be studied with key reasoning, taking into account the potential environmental effects. The Site was selected as a suitable site for wind farm development by the Applicant because it met the following criteria:
 - Existing consent at the Site for the Consented Wind Farm demonstrates an established planning principle for an onshore wind farm in this location;
 - A sufficiently high annual mean wind speed across the Site;
 - Viable grid connection in close proximity to the Site;
 - Suitable road access, subject to the construction of a new access point;
 - Sufficiently limited theoretical visibility of wind turbines from populated areas and transport routes, and the potential for the Development design to respond to the adjacent cumulative context;
 - The Site is sufficiently distant from the nearest residential properties to ensure compliance with ETSU-R-97 noise limits, as well as to avoid or reduce the potential for adverse effects on residential visual amenity and shadow flicker effects; and
 - The Site itself does not support any international or national ecological, landscape or cultural heritage designations, with the exception of Wilsontown Ironworks Scheduled Monument, which is located well outwith the development area and over 1 km from the nearest turbine (T2).

² The Water Framework Directive (2000/60/EC) [Online] Available at: http://ec.europa.eu/environment/water/water-framework/index_en.html (Accessed: 01/04/2020)

2.4 SITE DESIGN

21. The design of a wind energy development is driven by the key objective of positioning turbines so that they capture the maximum energy possible within a suitable area determined by environmental and technical constraints.
22. The key constraints to onshore wind farm site design which need to be taken into account during the design process include:
 - Visibility from sensitive receptors, including nearby properties, settlements and landscape designations;
 - Presence of sensitive habitats and protected species;
 - Presence of sensitive ornithological species;
 - Presence of watercourses, private water supplies and related infrastructure;
 - Presence of cultural heritage features;
 - Proximity to noise sensitive receptors;
 - Presence of peat;
 - Ground conditions and topography; and
 - Key recreational and tourist routes.
23. The studies undertaken for the Development indicate that the key considerations specific to the Site, discussed in more detail in Section 2.4.1, are:
 - Cumulative landscape and visual effects taking consideration of the adjacent Tormywheel and Longhill Burn schemes;
 - Visibility to key visual receptors including nearby properties and settlements, such as Breich, Fauldhouse and Longridge to the north, Woolfords to the east, and Forth to the south-west;
 - Operational noise effects on nearby residential properties;
 - Potential for indirect effects on Wilsontown Ironworks and other Scheduled Monuments;
 - Areas of deeper peat across the Site;
 - Areas of previous mining activity across the Site;
 - Hydrological receptors on site; and
 - Forestry coupes.
24. These constraints were identified through desk study, site survey and analysis including consideration of the responses received from consultees during the early stages of the EIA process, predominantly at scoping.
25. The principles of the design strategy were to maximise the number of turbines and wind energy capture, whilst minimising significant adverse environmental effects. Therefore, some of these constraints were given a 'hard' constraint value in design that was not breached and others were assigned a 'soft' constraint value that could be impinged with sufficient justification that effects were still acceptable. This led to a comprehensive process of constraints mapping. This EIA Report and its conclusions constitute the outcome of the application of the design principles adopted for the Development.
26. Embedded mitigation was used to minimise any predicted environmental effects, and where applicable to a specific technical assessment, such mitigation is detailed in the relevant chapter within this EIA Report. This was particularly relevant to the avoidance of direct effects e.g. on known protected species. By employing an iterative design process, undertaken in conjunction with the EIA process, a number of potential effects were avoided completely.

2.4.1 Site Specific Environmental Constraints

27. The specific environmental factors considered in the design of the Development are set out below, with their influence on the design discussed.

24.1.1 Landscape and Visual

28. Chartered landscape architects with experience in wind farm design have worked closely with the project team to achieve a scale and a design that minimises the potential landscape and visual effects while maintaining economic viability and balancing other environmental constraints. The landscape and visual effects have been a focus of discussions with the Council following the scoping process and a number of additional viewpoint requests have been included in the LVIA. This includes a night time assessment viewpoint in Longridge to help understand the visual effects associated with visible aviation lighting. Several design workshops were undertaken which sought to minimise and reduce potentially significant landscape and visual effects and avoid 'overbearing' effects with regard to residential visual amenity.
29. A number of key design viewpoints, including from nearby settlements such as Forth, Breich, Woolfords and Longridge were used through the design process. The design process also considered the Development's relationship with adjacent operational wind farms and adjacent cumulative wind farms which are not currently part of the baseline. Whilst visibility from these receptors has not been eliminated, the design has sought to create a scheme which reduces the prominence of turbines whilst establishing a coherent and balanced layout which responds to the adjacent cumulative context.
30. The key landscape and visual design objectives for the proposed Heathland Wind Farm are:
 - Design a scheme which responds to the adjacent cumulative context including the operational Tormywheel (15 turbines at 111 m to tip) and the application stage Longhill Burn (application for 5 turbines at 200 m to tip height but noting the consent for 180 m to tip turbines). The proposed turbines are contained on the upland plateau between Tormywheel and Longhill Burn;
 - Avoid 'overbearing' effects on residential visual amenity for properties in closest proximity, largely to the north, south and west of the site through careful consideration of turbine size, distance and nature of views from properties;
 - To create a coherent and balanced layout in views from sensitive visual receptors including settlements in closest proximity such as Breich, Fauldhouse and Longridge to the north; Woolfords to the east; and Forth to the south-west; and
 - To create a coherent and balanced layout which respond to the cumulative context in longer distance recreational views from the Pentlands.
31. The effects and landscape and visual amenity are fully assessed in **Chapter 6 – Landscape and Visual Amenity**.

24.1.2 Noise Sensitive Receptors

32. Residential properties located in the surrounding area of the Site were key drivers of the proposed layout. The key sensitivity considered for noise was the cumulative operational noise effects of the Development together with the other existing and consented wind turbines in the area, as well as the noise levels that the Development may generate in isolation.
33. Construction noise effects were a factor in the design of the Development infrastructure layout. Specifically, a potential borrow pit location to the south of the Site was omitted due to its proximity to Mountainblaw Farm to avoid potential significant construction noise effects.
34. Operational noise was a significant factor in the design of the turbine layout. Each layout iteration was modelled to determine its noise impact, and the effects on the energy output of the Development on any noise mitigation measures that may be required. Through this iterative process, the layout design was optimised to ensure that the Development could operate efficiently within appropriate noise limits.

35. A noise assessment is presented in **Chapter 13 – Noise**.

24.13 Archaeological Features

36. Minimising and avoiding direct effects, setting effects and cumulative effects on archaeological features were key drivers of the design process.
37. The Wilsontown Ironworks Scheduled Monument (SM2654) is located partly within the Site, to the south over 1 km from the nearest turbine (T2) and any potential for direct effects on this asset has been avoided. There are also several designations within the surrounding area which Historic Environment Scotland (HES) identified as likely to be sensitive to development, including;
- Woodmuir Farm, coke ovens and reservoir 600 m SSE of (SM 11227);
 - Tashieburn, horse engine platform 50 m NE of (SM 9700);
 - Haywood, deserted mining village (SM 9684);
 - Cleugh House, bell pits and inclined plane 130 m SSW of (SM 11234); and
 - West Harwood, burial mound 720 m SSE of (SM 11210).
38. There are no other designated heritage features within the Site, however there a number of non-designated assets which have been established through a desk based assessment (including data obtained from West of Scotland Archaeology Service, who act on behalf of the Council) and site walkover, primarily related to the mining history of the area.
39. The design has sought to avoid such features, both designated and undesignated, as well as consideration of indirect setting effects to designations in the wider area.
40. The effects on cultural heritage assets is fully assessed within **Chapter 7 –Archaeology and Cultural Heritage**.

24.14 Peat

41. Peat depth surveys were undertaken across the Site and data was used from the Consented Wind Farm application where available.
42. Whilst there are pockets of deep peat across the Site, noted in the north western area (2 m – 4 m depth), southern area (4 m – 6 m depth) and eastern area (>6 m depth), approximately 70% of the Site is underlain by shallow peat with a depth of < 1 m. Peat was a key design consideration and the design process sought where possible to avoid disturbance to deposits of deep peat. The turbines and associated infrastructure affecting deep peat are restricted to T3. This turbine is surrounded by deep peat and has been located in a position which will cause the least disturbance possible.
43. The effects of the Development on peat deposits are fully assessed within **Chapter 11 – Geology, Soils & Peat**.

24.15 Ecology

44. Both desk-based surveys and site visits were undertaken as part of the ecology baseline studies which were key to informing the final design of the site. Site surveys included the following:
- Extended Phase 1 habitat survey;
 - National Vegetation Classification (NVC) Survey;
 - Badger survey;
 - Otter survey;
 - Pine marten survey;
 - Red squirrel survey;
 - Wildcat survey;
 - Water vole survey;
 - Bat habitat suitability survey;
 - Bat activity survey;

- Fisheries habitat survey; and
 - Fish fauna survey.
45. The purpose of these surveys was to identify sensitive habitats and species within the site that should be avoided and subsequently ensure the Development could be designed sensitively to the ecological receptors located within and nearby the Site. These extensive surveys recorded few protected species or sensitive habitats.
- Risk to bats as a result of collisions with operational turbines has been minimised by the implementation of a 50 m separation distance between blade tips and high-value bat habitats, such as woodland, riparian habitats, and forest edges, in accordance with NatureScot published guidance.
46. The NVC survey identified habitats with the potential to be groundwater dependent communities, however they have been assessed from a hydrological perspective to be ombrotrophic, and therefore not groundwater dependent.
47. Given the relatively small area that these ecological sensitivities covered compared to the overall development area, the ecological constraints did not pose significant design limitations, and ensuring these areas were avoided through design with a suitable distance from development was a straightforward process.
48. Although protected species were recorded, including low levels of bat activity and the presence of badger and otter species in recent records, no notable ecological sensitivities that cannot be avoided or appropriately mitigated have been recorded.
49. Good practice has been adopted to avoid disturbance to protected species or direct effects on sensitive habitats. The final layout was informed by the aforementioned surveys, which ensured that the Development avoided the most sensitive habitats, predominantly areas of deep peat.
50. The effects on ecological receptors are fully assessed within **Chapter 8 – Ecology**.

24.1.6 Ornithology

51. Ornithology surveys were undertaken in 2018/2019 over the Site and appropriate buffer areas. During pre-scoping consultation, it was agreed with NatureScot (formerly SNH) that the ornithology baseline from the 2016 application could be used to inform the survey methodology in order to appropriately determine species present and patterns of distribution, to inform the impact assessment. NatureScot was consulted on the suitability of proposed surveys in November 2018, with updates in January and March 2019.
52. During the design process when Woodmuir Plantation (the northern part of the Site) was initially considered for development of turbines, NatureScot was consulted to confirm that the existing VP surveys undertaken appropriately covered the development area.
53. The surveys recorded flights from a number of target species, including pink footed goose, goshawk and curlew.
54. Ornithological features have been considered at all stages of the Development design, from initial feasibility to final layout. Standard good practice measures will also be implemented during construction (including felling, where this takes place prior to other construction works) to ensure compliance with relevant legislation protecting all breeding wild birds. This has helped to avoid or greatly reduce impacts on ornithological features.
55. The effects on ornithological features are fully assessed within **Chapter 9 – Ornithology**.

24.1.7 Traffic and Transport

56. The turbines would be delivered to the King George V Dock in Glasgow then via the M8, A899, A71, A704 and A706, and then be delivered to the Site from the west, using a new access point at NGR 294922, 656994, as shown on Figure 3.11.
57. Construction material would be transported via the A9. The effects on the traffic and transport are fully assessed within **Chapter 12 – Traffic and Transportation**.

24.1.8 Water Environment

58. During the EIA process desktop and site based surveys were carried out to inspect and identify all water features including private water supplies within the area with potential to be impacted by the Development.
59. The Site has several minor watercourses running through it which are tributaries of River Clyde and River Almond, namely Mouse Water and Wormlaw Burn and other small tributaries.
60. The aim of the design process was to achieve a layout that avoids effects on sensitive hydrological receptors including private water supplies. All turbines and infrastructure with the exception of access tracks and the edge of two crane hardstandings (T3 and T4) have been located a minimum of 50 m from any watercourse or waterbody.
61. The arrangement of access tracks has been designed to limit the number of watercourse crossings where possible or to re-use existing crossing points. The proposed layout will require potential upgrades to three existing watercourse crossings and two new watercourse crossings.
62. The wind farm design is considered to avoid effects upon private water supplies and mitigation measures will minimise the effects on private water supplies as a result of use and upgrades to the existing access tracks.
63. The effects on the hydrology environment are fully assessed within **Chapter 10 - Hydrology and Hydrogeology**.

24.1.9 Public Rights of Way

64. A desk-based study of local socio-economics, recreation and tourism receptors was undertaken at an early stage to establish the socio-economics of the local area and gain a full understanding of the recreation and tourism receptors within the wider area.
65. A SLC Core Path is located within the Site, to the west, linking the Tormywheel Wind Farm in the north with the settlement of Wilsontown to the south, where it connects to the wider Core Path network. A setback distance of the tip height plus 10 % has been applied in line with best practice.
66. The effects on the socio-economic, recreation & tourism resources are fully assessed within **Chapter 16 – Socio-Economics, Recreation & Tourism**. Additionally, **Chapter 6 – Landscape and Visual Amenity** also assesses the visual impact of the Development on key receptors which relate to tourism and recreational assets.

2.4.2 Site Specific Technical Constraints

24.2.1 Wind Resource

67. A key element to the design process is the wind resource of the Site; the availability of wind resource is affected by various issues such as wind speed, the prevailing wind direction, and local topography. The wind resource was modelled across the Site which fed into the design process to ensure wind yield production could be maximised throughout the Site.

24.2.2 Turbine Spacing

68. The spacing of the turbines is a key consideration in wind farm layout design; turbines need to be arranged a minimum distance apart such that turbulence from a specific turbine does not unduly affect the operation of a turbine which is downwind. The spacing for turbines needs to be larger in the prevailing wind direction and will vary from site to site and between different turbine models. The spacing is directly proportional to the size of the wind turbine rotor, whereby the larger the rotor the larger the spacing between turbines, and the fewer turbines that may be accommodated within a specific area.
69. The spacing chosen for the Development has been selected based on modelling assumptions and is designed to maximise the energy yield from the Development whilst keeping fatigue loads, caused by turbulence, within the turbine manufacturer's design tolerances.

24.2.3 Topography and Ground Conditions

70. The suitability of ground conditions was considered during the design of the Development, which principally considered areas of steep slope, peat and historic mining.
71. Where gradients of greater than 14% were identified, these areas are considered unsuitable for wind turbines and also restrictive to access track and hardstanding construction. Fortunately, areas of steep slopes are minimal throughout the Site and so did not constrain design.
72. The presence of peat has been assessed both from an environmental and technical perspective. Peat greater than 1.0 m was localised, generally found in topographically low lying, flat areas in the western sector of the Site and at the very eastern boundary. These areas have been avoided where possible and infrastructure affecting deep peat is limited to that associated with T3.
73. The Site is extensively underlain by historical mine workings, both from opencast extraction and from underground extraction. A number of surface features have also been identified including shafts, adits and remnants of opencast workings. Opencast working is known to have taken place over large areas in the northern, central and south-western sectors of the site. Where possible, risk has been reduced by locating turbines and Site infrastructure in areas less affected by historic mining activities, however seven proposed turbines remain in areas at high risk of ground instability. A thorough ground investigation will be undertaken post consent to inform any necessary mitigation through micro-siting or design solutions. This is fully assessed within **Chapter 11 – Geology, Soils & Peat**.

2.5 DESIGN EVOLUTION

74. The Development as presented in the EIA Report has been the subject of a number of iterations and refinements which seek to mitigate by design predicted adverse effects as far as reasonably practicable. The resultant proposal balances the environmental and technical constraints, whilst producing an economically viable project. Design changes made as a consequence of the key constraints are considered to be mitigation which is 'embedded' in the design.
75. During the design process, two areas for extension of the original site boundary were considered, 'Woolfords' to the east of the Site and 'Woodmuir Plantation' to the north. Woolfords, was removed from consideration for Development infrastructure prior to the scoping stage, whereas Woodmuir Plantation was adopted after scoping. As the Woodmuir Plantation area had been covered by ornithology viewpoint surveys undertaken for the Site previously, no further ornithology surveys were undertaken. Additional ecology surveys were undertaken in April 2020 in which no sensitivities were

identified. The inclusion of Woodmuir Plantation was highlighted within the gatecheck report issued in early September 2020 by the ECU to stakeholders.

76. The key iterations to reach the Development Layout are described below, and are shown in Figure 2.2 Layout Evolution which demonstrate how the layouts have evolved throughout the EIA process.
 - Consented Wind Farm;
 - Scoping Layout;
 - Woodmuir Extension; and
 - Application Layout.
77. Following the scoping stage and before the extension of the Site to the north, there was a process of optimisation for wind speed and for landscape which is illustrated on Figure 2.3 Optimised Layouts.

2.5.1 Consented Wind Farm – October 2018 – 17 turbines – Tip Height 132 m

78. In July 2013 a scoping request was submitted on behalf of Partnership for Renewables (PFR) for a wind farm development consisting of 20 (three-bladed) turbines, with a maximum tip height of 132 m. In response to matters raised by consultees regarding potential cumulative landscape and visual effects, a redesigned layout of 17 turbines was proposed and subsequently consented which omitted two turbines to the east and one turbine in the north of the Site, reducing the landscape and visual effects of the proposed wind farm. The Section 36 consent and deemed planning permission was granted by Scottish Ministers on 26th October 2018, under reference number EC00003124 (the Consented Wind Farm). At this time there was no consent in place for the adjacent Longhill Burn Wind Farm.
79. EDF purchased the Partnership for Renewables development portfolio in 2017, including Heathland Wind Farm.
80. An initial feasibility study was undertaken to develop a design which would present an increased generating capacity with higher yielding turbines. Commercial turbines are generally becoming larger with greatly improved generation outputs that can be achieved from an increased rotor size, alongside a significant reduction in electricity generation costs.
81. A preliminary layout, taking into account all known constraints within Heathland and Woolfords, was found to realistically be capable of supporting in the region of 15 turbines (13 within Heathland and 2 within Woolfords) with a tip height of up to 180 m.

2.5.2 Scoping Layout – December 2019 – 14 Turbines – Maximum tip height 180 m

82. In designing the layout in advance of scoping, turbines were positioned to avoid immediately known onsite constraints (such as 50 m watercourse buffers and peat presence). It also incorporated initial consideration of landscape and visual effects with a focus on designing a visually cohesive scheme within the context of the cumulative developments, including the application for Longhill Burn wind farm adjacent to the Site to the north-east for larger scale turbines (5 turbines now consented for 180 m to tip). Under this new cumulative context with Longhill Burn, which extends turbine development further north than the consented Heathland Wind Farm, the opportunity to maximise turbine development to the north was explored.
83. The Woolfords opportunity was no longer considered at scoping, due to greater perceived visual impacts at the Woolfords settlement. The Scoping layout design process, as set out within the Scoping Request, resulted in a reduction in number of turbines from 15 in the preliminary layout to 14 at a maximum tip height of 180 m, with the same red line boundary areas as that of the Consented Wind Farm.

84. The Development was scoped under the EIA Regulations in December 2019, and a Scoping Opinion was received from the Scottish Government on the 2nd March 2020 (Energy Consents Unit Reference: ECU00001986).

2.5.3 Optimisation Process – March to July 2020 –

85. Following Scoping and as further information was obtained from surveys and the EIA assessment process, a range of design options were explored, looking for the best balance for wind generation and minimisation of environmental effects. This included stress testing the layout with schemes ranging from 9 to 15 turbines, with environmental, technical and financial viability considered for each. The examples with the smallest number of turbines were not financially viable and did not appear in keeping with the existing cumulative developments as a result of the larger spacing between individual turbines. The most promising schemes ranged between 12 to 14 turbines and detailed analysis focussed on a series of layout options which were optimised for wind yield and landscape and visual. These layout series are shown on Figure 2.3 Optimised Layouts.
86. The wind-optimised layouts focussed on the implications of maximising spacing in the south-west to north-east direction to minimise the effects of turbulence on generation. Turbines were moved to areas of highest wind speeds interpolated from wind yield data, which included the central and the north-eastern parts of the Site. This resulted in layouts that maximised the east–west spread of the layouts.
87. Those layouts optimised for landscape and visual factors were focused on a more ‘contained’ grouping and a more coherent balanced design from the key design viewpoints. This resulted in turbines located further from the Site peripheries and also from individual residential receptors to the south and the settlement of Woolfords, to the east.
88. This process found that a 14 turbine layout was optimal from both wind yield and landscape and visual perspectives, allowing a tighter turbine spacing which reflected that of surrounding wind farms and still benefited from strong energy generation. The 14 turbine layout was then developed further, to balance with other on-site environmental considerations, such as hydrological features, peat and known mining, and with results of noise modelling for predicted levels at nearby receptors.
89. At this stage, the decision was taken to reduce the tip heights of three turbines (T1-T3 which are located to the western side of the layout) from 180 m to 150 m to further allow the Development to be perceived as one coherent grouping with the operational Tormywheel (15 turbines at 111 m to tip) to the immediate west of the Development.

2.5.4 Woodmuir Extension – August 2020 – 14 Turbines – Maximum tip heights 180 m/150 m

90. Woodmuir Plantation forms part of the FLS landholding and abuts the Heathland Plantation to the North. It was not available for development during the progression of the initial Heathland scheme. Whilst the Woodmuir Plantation extends further North than the Heathland site boundary, a large proportion of the land lies to the West of the most Northerly point of Heathland, such that the wind farm could be extended into Woodmuir without increasing the Northerly spread of the proposed Heathland development.
91. The advantages of the extension to Woodmuir included greater space and the opportunity to extend the scheme to the north to allow greater consistency along the northern edge of turbines in the context of a larger turbine grouping which incorporates the adjacent Tormywheel and Longhill Burn wind farms. This also allowed the development of a 14 turbine layout which increased offset of turbines from individual residential receptors to the south (including Mountainblaw Farm), to help further minimise effects on residential visual amenity.

2.5.5 Application Layout – November 2020 – 14 Turbines – Maximum tip height 180/150 m

92. The Application Layout consists of 14 turbines, with three turbines (T1-T3) at a maximum tip height of 150 m and 11 turbines (T4-T14) at a maximum tip height of 180 m. The layout incorporates necessary rotor spacing requirements, based on a prevailing south-west wind (approximately 225 degrees), and the turbines positioned to minimise interaction with onsite constraints, including areas of deep peat (based on peat depth survey results) and watercourses. This included some minor refinements to a number of turbine positions, as more detailed site survey results became available. The layout takes account of key landscape and visual considerations, including views experienced from nearby key residential and recreational and viewpoints raised through scoping consultation. The reduction of tip heights of T1-T3 helps to provide a more visually coherent layout with respect to the cumulative context, in particular turbines at the operational Tormywheel Wind Farm, to the immediate west.
93. The layout incorporates infrastructure elements, which were not present on the scoping layout and other earlier iterations. This includes internal tracks, substation compound, temporary construction compound, anemometer mast and potential borrow pit locations. The Site contains an existing internal network of forestry tracks, and reusing these wherever possible has been a key design criteria.
94. Refinements in the final iteration included:
 - Refinement to positioning of southern and easternmost turbines, particularly T12 & T14, to improve visuals from south and potential for noise at nearby receptors (Mountainblaw);
 - Turbines in the north were located to ensure adequate spacing from consented Longhill Burn turbines to the north-east;
 - Final refinements in relation to peat, watercourses and on-site quarry; and
 - Minor refinements to turbine locations to help minimise overly engineered access track solutions, where appropriate.
95. The technical assessments within this EIA Report include an allowance for micro-siting of the application layout up to 100 m to ensure that the environmental and technical factors are balanced at the time of detailed design and construction.

2.6 SUMMARY

96. Various environmental, technical and economic factors were all considered throughout the iterative design process. These were informed through a variety of baseline surveys and consultation with a range of stakeholders.
97. The final design assessed in this EIA Report has been carefully developed taking these factors into account.
98. The final design is considered to meet the balance of increasing the renewable energy generation capacity of the Site whilst minimising the introduction of new environmental effects.