Chapter 3: Site Description and Design Evolution



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Chapter 3: Site Description and Design Evolution

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3 Site Description and Design Evolution

3.1 Introduction

- 3.1.1 This chapter outlines the process undertaken in selecting the Site as a potential location for a wind farm. It provides a description of the Site and surrounding area and discusses the design evolution process that was undertaken to arrive at the final design described in **Chapter 4: Description of the Proposed Development** and shown on **Figure 4.1**.
- 3.1.2 The principles of the EIA process, that site selection and project design should be an iterative constraint-led process, have been followed in the preparation of the design of the Proposed Development. This has ensured that potential adverse impacts have been avoided or minimised as far as reasonably possible throughout the design process.
- 3.1.3 This chapter explains how potential environmental effects have informed the design of the Proposed Development without pre-empting the conclusions of the technical assessments set out in **Chapters 5** to 11.

3.2 Site Selection and Consideration of Alternatives

- 3.2.1 Regulation 5 (2) (d) and Paragraph 2 of Schedule 4 of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations 2017) requires that an EIA report should provide: "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." (Scottish Government, 2017).
- 3.2.2 The Applicant's approach to site selection is outlined below in relation to alternative sites considered. The 'do nothing' alternative is also explained. The main alternatives considered for the site include design, turbine specification, location, size and scale. This chapter explores these options and explains how the final design of the Proposed Development has evolved.

'Do Nothing' Alternative

3.2.3 If the Proposed Development is not constructed, the land would continue to be used for commercial forestry and open moorland. This would have no beneficial impact with regards to the production of renewable energy, offsetting of greenhouse gas emissions or contribution to Scotland's renewable energy and net zero targets. One possible environmental benefit to the 'do nothing' alternative would be that the felling required for the construction of the Proposed Development would maintain its role in carbon sequestration, helping to mitigate climate change by absorbing carbon dioxide (CO₂) from the atmosphere, albeit within the context of ongoing forestry management and periodic felling/harvesting. However, as set out in the outline Nature Enhancement Management Plan (NEMP) (**Technical Appendix 7.5**) proposed biodiversity restoration and enhancement measures include ditch blocking to improve carbon rich soils, riparian planting, pond creation and increasing nesting and roosting opportunities. Given the renewable energy and biodiversity restoration and enhancement associated with the Proposed Development, the 'do nothing' alternative is not considered to be the best environmental option for the Site.

Site Selection

- 3.2.4 When taking into consideration known environmental constraints, it is estimated that less than 10% of Scotland is suitable for wind farm development. Statkraft UK Limited undertakes detailed feasibility studies of all sites identified as potentially suitable for onshore wind farm development. The feasibility assessments takes into consideration:
 - the proximity of residential receptors;
 - the wind resource;
 - the presence, proximity and connectivity of internationally, nationally and locally designated sites (for landscape, archaeology, ecology, water and geology);
 - the potential for protected species and/or habitats (including deep peat);
 - turbine delivery routes;
 - the location of other wind farm developments in the area; and
 - the national and local planning policy status for the area.
- 3.2.5 Statkraft UK Limited only progresses 2% of sites on which they do an initial feasibility assessment to the development stage.



- 3.2.6 The Site of the Proposed Development is centred on NGR 272887, 597709 and located approximately 6.2 km north of Moniaive and 14.8 km east of Carsphairn as shown on **Figure 1.1**, in the administrative jurisdiction of Dumfries and Galloway Council (DGC).
- 3.2.7 The initial feasibility assessment identified that the Proposed Development Site:
 - has a very good wind resource (determined by initial desk based studies and wind monitoring on site);
 - is not covered by any planning allocations or policies which would preclude wind energy development;
 - is not covered by any internationally or nationally designated sites for ecology, landscape or geology;
 - is compatible with the existing commercial forestry use;
 - can be developed whilst maintaining a distance of 1 km between the turbines and the closest residential properties;
 - · has suitable ground conditions with limited areas of deep peat;
 - · has a suitable access point using a route previously used for turbine deliveries; and
 - has an existing network of tracks across the Site which would help minimise the length of new track required by utilising and upgrading existing forestry tracks to service the Proposed Development where possible.

Technology, Size and Scale

- 3.2.8 Onshore wind continues to be the lowest cost form of renewable energy however there is limited UK Government financial support for onshore wind. The ability to maximise the potential yield from the Site through turbine choice at the point of procurement is important for maximising yield and for the financial feasibility of the Proposed Development. Without the ability to optimise the Proposed Development in such a way, it may adversely affect the viability of the Proposed Development.
- 3.2.9 The supply of smaller turbines (e.g. below 150 m) across Europe is already reducing due to lack of demand as manufacturers are recognising that the world market is shifting to larger machines and are focussing their development work on increasing capacity and efficiency of the turbine technology to secure the highest yield.
- 3.2.10 During the period leading up to any consent and ultimately construction of the Proposed Development, it is expected that the design and manufacture of commercial turbines will evolve and result in a wider choice of turbines than is currently available.
- 3.2.11 It is clear, therefore, that larger turbines (tip heights and rotor diameters) need to be considered to ensure a scheme's viability and constructability. To gain the maximum energy yield from the Site, turbines up to 230 m to tip height were initially considered.
- 3.2.12 Despite the continuing move towards larger turbines on the grounds of economic viability and available technology, it is also important to consider the site and its surroundings to understand what size of the turbine may be appropriate. Careful consideration was given to the Site context and its surroundings when considering the appropriate turbine size for the Proposed Development. These included:
 - the proximity of nearby residential receptors, potential residential visual amenity, shadow flicker and noise issues;
 - proximity to landscape and cultural heritage designations;
 - sensitivity of receptors to visible aviation lighting;
 - the ability to transport turbine components to the site;
 - the scale of the local topography and surrounding hills and landscapes;
 - the landscape character type; and
 - the sensitivity of the landscape to tall turbines.
- 3.2.13 Taking the above points together and considering them alongside the objective of maximising energy yield from the Proposed Development, it was concluded that the Site could accommodate turbines up to 200 m to tip height. Turbines over 200 m were considered more likely to have an increased impact on residential amenity (both visual impact and noise).



3.3 Site Location and Description

- 3.3.1 The Site is located approximately 6.2 km north of Moniaive and 14.8 km east of Carsphairn within Dumfries and Galloway. There are several dispersed dwellings extending along the length of Shinnel Glen and up to the Site boundary. The nearest larger settlement is Sanquhar, approximately 12 km north/north-east. The A702 passes within approximately 7 km of the Site to the south-east between Thornhill and St John's Town of Dalry; the A76 runs along Nithsdale, approximately 12 km to the south-east of the Site.
- 3.3.2 The main Site where the turbines are located comprises a single block of commercial forestry under one private ownership, while the access track passes through land owned by a second private landowner and land owned by Forestry Land Scotland (FLS). The majority of the Site is within the Southern Uplands with Forest Landscape Character Type (LCT), and comprises two narrow ridges, extending out from Colt Hill. The north-eastern fringes of the Site are within the Upland Glens LCT, which are characterised by deep valleys and upland farming. The central valley within the Site consists of steep wooded slopes, with more level ground generally being found on the two ridges towards the Site's perimeter as well as the lower ground in the vicinity of Appin Burn, which flows through the centre of the Site from approximately north-west to south-east.
- 3.3.3 There are a number of landscape, ecological geological or archaeological designations within 10 km of the Site boundary:
 - Thornhill Uplands Regional Scenic Area (RSA) (located within the eastern extent of the Site boundary, although no infrastructure is proposed within the RSA) and Galloway Hills RSA (approximately 2 km to the west).
 - East Ayrshire Uplands and Moorlands Sensitive Landscape Character Area (4.9 km to the north).
 - The Southern Upland Way (SUW) runs approximately 1 km to the west of the main Site and will be crossed by the access track.
 - Upper Nithsdale Woods Special Area of Conservation (SAC) (5.03 km to the east) and Tynron Juniper Wood SAC (8.15 km to the south-east).
 - Stenhouse Wood Site of Special Scientific Interest (SSSI) (5.03 km to the south-east), Chanlockfoot SSSI (5.03 km to the east) and Tynron Juniper Wood SSSI (8.15 km to the south-east).
 - 20 Scheduled Monuments (the closest 1.8 km from the Site).
 - 124 Listed buildings (seven category A, 84 category B and 46 category C)
 - Drumlanrig Castle Garden and Designed Landscape (GDL) (7.5 km to the east) and Maxwelton (Glencairn Castle) GDL (9.3 km to the south-east).
 - Moniaive Conservation Area (CA) (5.5 km to the south-east) and Tynron CA (6.2 km to the southeast).
- 3.3.4 There are a number of operational wind farms within 45 km of the Site as illustrated on **Figure 5.7b**. The closest are Wether Hill and Whiteside Hill. In addition, there are a number of schemes which are consented or which are currently awaiting determination. These are also shown on **Figure 5.7b**.

3.4 Design Concept and Approach

Constraints Led

- 3.4.1 In EIA, constraint identification should continue throughout the design process to take cognisance of new information revealing additional limitations or required changes to the development. This allows the findings of technical and environmental studies to inform the design of a development and achieve a 'best fit' within the environment of a development site.
- 3.4.2 This approach has been adopted in respect of the Proposed Development. Where potentially significant effects have been identified, efforts have been made to avoid these by evolving the design. This is referred to within the EIA Report as 'embedded mitigation'. Information on embedded mitigation is explained further within each technical chapter of the EIA Report, as appropriate. Embedded mitigation includes, but is not limited to:
 - considering the size and scale of the Proposed Development appropriate to the location;
 - use of existing tracks within the Site and upgrading these to minimise groundworks;
 - design of access tracks to minimise cut and fill, reducing landscape and visual effects as well as costs;
 - sensitive siting of the proposed infrastructure incorporating appropriate buffer distances from environmental receptors (including nearby residential properties) to avoid or reduce effects;



- considering the appearance, finish and colour of turbines and the control buildings taking account of the now NatureScot (NS) (formerly Scottish Natural Heritage (SNH)) guidance 'Siting and Designing Wind Farms in the Landscape', Version 3a (SNH, 2017);
- inclusion and design of borrow pits to minimise the amount of the material required to be imported to the Site; and
- potential for up to 100 m micrositing of infrastructure during construction, avoiding known environmental constraints, to ensure the best possible location is chosen based on site investigations.

Landscape and Visual

- 3.4.3 Throughout the design process, a key driver has been the consideration of potential effects on landscape and visual receptors and how the Proposed Development would relate to the existing landscape character and the visual amenity from nearby recreational receptors and residential properties. In particular, due attention was given to the scale and number of turbines proposed and how these relate to the scale of the landscape and the existing and evolving cumulative wind farm context. Night-time effects associated with aviation safety lighting have also been a consideration in the design process.
- 3.4.4 The potential landscape and visual effects of the Proposed Development have been considered extensively from key receptors. This includes views for recreational receptors at the series of 'Striding Arch' Andy Goldsworthy sculptures¹. Views from the Shinnel Water Valley, the Southern Upland Way, key hill tops and communities have also been considered. The resulting analysis has been key to the design evolution process and in particular to the layout design of proposed turbines and the location of infrastructure on the Site.
- 3.4.5 'Siting and Designing Wind Farms in the Landscape', Version 3a states that: "In a wind farm, turbines can be arranged in many different layouts. The layout should relate to the specific characteristics of the landscape this means that the most suitable layout for every development will be different. For a small wind farm, this might comprise a single row of wind turbines along a ridge; while, for a larger development, a grid of wind turbines is often taken as a starting point, with turbines spaced at minimum technical separation distances." (SNH, 2017).
- 3.4.6 The layout and design of the Proposed Development evolved as part of an iterative design process. An iterative design approach works in tandem with the EIA process and facilitates a receptive design process aimed at reducing the potential landscape and visual effects of the Proposed Development whilst taking into account other constraints and maximising yield.
- 3.4.7 It is considered that the design respects the form of the underlying landscape and its scale by creating a grouping that appears as a single line along the ridge around the head of the Appin Burn Valley/ or an informal group in most views from the surrounding areas. The layout uses a single size of turbine across the Site for simplicity and to help reduce potentially adverse visual effects. The evolving cumulative context, and noting the nearby consent for Sanquhar 2 Wind Farm, has also been an important consideration. The approval of a reduced lighting scheme, with visible lighting on four out of the proposed nine turbines, has also been sought from the Civil Aviation Authority (CAA).

Efficiency Modelling

3.4.8 Throughout the constraints-led design process, wind and yield analysis was undertaken to ensure changes made to layouts did not adversely affect the output of the Proposed Development.

3.5 Constraints and Opportunities Identification

- 3.5.1 The design of any wind farm is driven by the key objective of positioning turbines so that they capture the maximum energy possible within a suitable area while minimising the environmental effects.
- 3.5.2 The designations within the Site and surrounding area were identified as the first part of the constraints mapping process. These are shown on **Figure 3.1**. The known environmental and technical constraints within the Site were identified through this early-stage constraints mapping (**Figure 3.2**). It is important to note that the identification of a constraint does not necessarily result in the exclusion of that area from the potential development envelope; rather it means that careful thought and attention was paid to the constraint and the design evolved appropriately. The key constraints which were taken into account during the design process included:
 - topography and ground conditions (including peat);

¹ The Striding Arches are a series of non-designated sandstone arches built on the hilltops around Cairnhead, and form landmarks for users of local walking routes.



- environmental designations;
- identified landscape and visual constraints, including consideration of intervisibility between the Striding Arches;
- proximity to residential receptors (with regards to visual amenity, shadow flicker and noise);
- presence of protected species and habitats (including groundwater dependent terrestrial ecosystems (GWDTE));
- presence of watercourses, private water supplies (PWS) and related infrastructure;
- presence of cultural heritage features;
- aviation and radar constraints;
- recreational resources; and
- forestry.
- 3.5.3 The identification of constraints continued throughout the design evolution process as more detailed surveys refined the development envelope, as shown on **Figure 3.2**.
- 3.5.4 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 **Chapters 5 to 11**.

Topography and Slope Stability

- 3.5.5 The topography of the Site has meant that gradients greater than 15 degrees have been avoided for the siting of turbines.
- 3.5.6 Slope stability has been taken into consideration to understand whether infrastructure could be located within certain areas of the Site. Where slope stability was identified as an issue, these areas were deemed to be unsuitable for infrastructure and have therefore been avoided due to the potential for slope instability and engineering constraints.

Designated Landscapes and Visual Amenity

- 3.5.7 There are a number of landscape designations within the 45 km initial study area. These are mapped on **Figure 5.6a**. No turbines or infrastructure are proposed within national or locally designated landscapes. However, the eastern edge of the Site is within the locally designated Thornhill Uplands RSA. Effects on landscape designations have been considered through the design process. Wildland is recognised as a resource of national importance, although Wild Land Areas (WLAs) are not designated. There are two areas of Wild Land in the 45 km study area (refer to **Figure 5.6a**). Any effects on these would be indirect, and given the status to these areas through NPF4, unlikely to be a key consenting issue.
- 3.5.8 Potential landscape and visual effects have been considered throughout the design evolution process. Several turbine and infrastructure layouts were considered during the design process, with the layout evolving to respond to landscape and visual constraints such as views for recreational receptors at the series of 'Striding Arch' Andy Goldsworthy sculptures. Views from the Shinnel Water Valley, the Southern Upland Way, key hill tops and communities have also been considered. The potential for cumulative effects of the Proposed Development along with existing operational, under construction, consented and application stage wind farms in the study area have also been a landscape and visual consideration throughout the design evolution process.
- 3.5.9 The final layout has been optimised with regards to landscape and visual effects as far as possible using the agreed viewpoints for the Landscape and Visual Impact Assessment (see **Chapter 5** for further information).
- 3.5.10 Where possible, proposed excavations for new sections of access tracks and other infrastructure have been minimised. The location of the substation compound and temporary construction compound have been given particular consideration in relation to reducing potential landscape and visual effects. These have been located on lower ground within the eastern part of the Site where landforms and vegetation help to reduce the potential prominence of the structures.

Ecology and Ornithology

3.5.11 Ecology and ornithology surveys were undertaken across the Site between March 2022 and March 2025 to identify any broad areas of constraint to the Proposed Development. Constraints mapping included the identification of sensitive ecological features, including habitats present within the Site. Where relevant, buffers were placed around any sensitive features, (e.g. GWDTE) and the design of the Site was amended where possible. Protected species surveys were undertaken within the Site but no constraints to development were identified.



3.5.12 The design of the Proposed Development sought to minimise any effects on potential GWDTEs through taking account of habitat (National Vegetation Classification, NVC) information, along with other site constraints, in layout iterations. However, it has not been possible to avoid all impacts on GWDTE when taking into balance other constraints (e.g. noise, watercourses and peat) and therefore appropriate mitigation will be implemented to protect the GWDTE as described in **Chapter 6: Geology**, **Hydrology and Peat** which assesses residual effects on GWDTEs as being non-significant.

Peat

- 3.5.13 NatureScot records the Site as having a range of different peat classes with Class 1 found on Colt Hill and Blackcraig Hill, Class 2 on Mullwhanny hill and Class 3 on Lamgarroch, Mid Hill, Whether Hill, Green Hill and the lower slopes of Colt Hill. The remainder of the Site is Class 4 or 5 which are considered to be areas unlikely to be associated with peatland habitats, although the soils may remain carbon rich and contain areas of deep peat.
- 3.5.14 As part of establishing the baseline conditions at the Site, a comprehensive peat probing and condition assessment programme was completed between September 2022 and February 2025, the results of which are presented in full in the Peat survey Report in **Technical Appendix 6.2**. These surveys identified that there are no areas of Priority Peatland across the Site and only a few pockets of deeper peat. Through identification of these areas during several rounds of survey and feeding this data into the design process, it has been possible to avoid deeper areas of peat (>1 m) within the Site, thereby minimising the potential for adverse effects on peat.

Hydrology and Hydrogeology

- 3.5.15 A 50 m buffer zone has been applied around the primary watercourses within the Site. These buffers were used to ensure that turbines and infrastructure, other than tracks, were not located in close proximity to hydrological features in accordance with wind farm construction best practice guidelines (as noted in **Chapter 6**). This reduces the risk of run-off and water pollution into existing watercourses.
- 3.5.16 Although some of the existing tracks are less than 50 m from a watercourse, the use of the existing tracks was identified as the best design option as it minimised the need for new tracks.
- 3.5.17 Subject to detailed design, six new watercourse crossings have been proposed as part of the Proposed Development. In addition, 48 existing watercourse crossings will also be used which will require structural and general condition assessment to establish the extent of any upgrades required.
- 3.5.18 Data on PWS was obtained from DGC and supplemented with local questionnaires. Although there are PWS locally in the area, the Proposed Development infrastructure is not located within the PWS catchments.

Archaeology and Cultural Heritage

- 3.5.19 There are no Scheduled Monuments, Listed Buildings or GDLs within the Site boundary. There are 86 non-designated (or possible) assets within the Site boundary.
- 3.5.20 The consideration of the setting impacts to designated heritage assets outwith the Site boundary has been given due consideration throughout the design evolution process. **Chapter 9: Cultural Heritage** considers potential setting impacts on three Scheduled Monuments located within 5 km of the Site.

Noise

- 3.5.21 For the purposes of early constraints mapping, a buffer of 1 km was applied to residential properties in the vicinity of the Site.
- 3.5.22 Noise modelling was undertaken 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. 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 adverse effect. ETSU-R-97 is endorsed by national planning policy (and the Dumfries and Galloway Local Development Plan (LDP)) as the appropriate guidance document for the assessment of noise from turbines. Applying design criteria in accordance with ETSU guidance, therefore, ensures that no exceedances of acceptable noise levels would occur for the Proposed Development.
- 3.5.23 During design evolution, noise considerations formed an important design consideration to the positioning of turbines to ensure that the maximum distances possible were employed between residential properties and the proposed turbines.

Shadow Flicker

3.5.24 Shadow flicker is considered to potentially to be an issue for properties which are closer to a turbine than a distance of ten times the rotor diameter of the proposed turbines. Potential shadow flicker effects were a consideration during the constraints mapping process. Shadow Flicker is considered further in **Technical Appendix 2.3**.

Aviation

- 3.5.25 The potential aviation constraints on turbines at the Site were identified during the EIA process. These are as follows:
 - potential effect on Prestwick Airport;
 - potential effect on the NATS Lowther Hill radar; and
 - the requirement for aviation lighting.
- 3.5.26 The Applicant is in dialogue with NATS En Route and Prestwick Airport regarding a defined and suitable mitigation strategy. The Proposed Development will be fitted with aviation safety lighting in accordance with the reduced lighting scheme outlined in **Technical Appendix 4.6**. The reduced scheme, whereby only four out of the nine turbines (Turbine 1, Turbine 2, Turbine 5 and Turbine 9) would be visibly lit, has been approved by CAA and will ensure that lighting is minimised while meeting safety requirements.

Recreation

- 3.5.27 Consultation has been undertaken with Scotways who have confirmed that there are no rights of way within or close to the main Site boundary.
- 3.5.28 The DGC core path record identifies three core paths (Path IDs GLEN/51/3, GLEN/51/4 and GLEN/51/5) which all follow existing forestry access track that will also be used to access the Site. In addition, Core Path TYNR/51/10 follows the eastern edge of the Site boundary (but will be unaffected by the Proposed Development).
- 3.1.1 The Southern Upland Way (SUW) (Path ID UNNO/504/14) is located approximately 250 m from the main Site boundary at the nearest point, and will be crossed by the Proposed Development access route where the SUW crosses an existing forestry access track approximately 4 km from the main Site boundary. A further core path (Path ID GLEN/52/6) will be crossed by the Proposed Development access route approximately 3 km west of the main Site boundary. As the proposed access crosses and utilises some of the existing core paths, an Outline Access Management Plan (OAMP) has been prepared (see **Technical Appendix 4.5**).

Forestry

- 3.5.29 The Site includes large portions of commercial forestry which have been considered throughout the design evolution of the Proposed Development.
- 3.5.30 Use of existing tracks within the Site and containment of the Proposed Development to the west of the Site has reduced the area of felling. Approximately 62.52 ha of felling is proposed to accommodate the Proposed Development. The area of required felling and the requirement for compensatory planting are considered further in **Technical Appendix 4.2**.

Telecommunications

3.5.31 Consultation with Ofcom and fixed link operators did not identify any fixed telecommunication links which run through the Site and could potentially be affected by the Proposed Development.

3.6 Design Evolution

3.6.1 GIS constraints mapping was used to identify the areas within the Site which may be suitable for turbines and associated infrastructure. All known constraints gathered throughout the EIA process were used to inform the evolution of the location of the proposed turbines and associated infrastructure. During design optimisation, the locations of infrastructure and track design was refined to minimise the volume of earthworks and cut and fill required to construct the Proposed Development.

Turbine Layout Evolution

- 3.6.2 The design optimisation process was iterative, with each design involving a review of wireline visualisations from key landscape and visual receptors, consideration of setting impacts on cultural heritage assets, potential noise effects on residential properties, impacts to peat, hydrology, ecology and consideration of the energy generation seeking to maximise wind yield.
- 3.6.3 Turbine tip heights explored during the design process ranging from 200 m to 230 m, including the use of varied tip heights across the Site.
- 3.6.4 Four of the key design iterations for the Proposed Development are shown on **Figure 3.3** and detailed in **Table 3.1**.

Table 3.1 – Design Iterations

Layout	No. of Turbines	Description
A (Scoping Layout)	25	 Presented in the EIA Scoping Report in March 2022 and represented the 'maximum development scenario'.
		– Tip heights up to 230 m.
		 Layout A was largely based on technical and operational efficiency but also took into account initial desk-based observed constraints including ecologically important sites, sites of archaeological and/or cultural heritage importance, landscape designations and residential properties.
		 Refer to Figure 3.3.
В	17	 Following feedback through the EIA Scoping process, as well as information gained from undertaking surveys, the layout was reduced to 17 turbines (Layout B).
		 Layout B was presented during an initial round of public and online consultation in September 2022.
		 Layout B had turbines with two different tip heights, 200 m and 230 m to address impacts in relation to visual amenity.
		 Locations of turbines refined taking into consideration 50 m watercourse buffers, the initial peat probing survey data and avoidance of slopes over 15 degrees.
		- Refer to Figure 3.3.
С	9	 Removal of eight turbines from the layout following detailed noise modelling.
		 A range of turbine tip heights was considered and reviewed for both close and long distance views.
		 Consideration of four potential access routes into the Site from the north, as well as three possible access routes from the west.
		– Refer to Figure 3.3 .
D (Application Layout)	9	Following detailed review by the Applicant, and based on advice from the specialist EIA team in relation to constructability and the potential for impacts, the following design modifications were reviewed, some of which resulted in further minor modifications to design as noted below (refer to Figure 3.3):
		 Micrositing of T2 along with T3 and T4 to avoid stacking of turbines and intervisibility between the Striding Arches Sculptures (refer to Figure 3.4).
		 T1 moved to behind the crest of the hill at Lamgarroch to reduce direct views from the property at Shinnelhead.
		 T2 moved outwith the 100 m GWDTE buffers in the north-west of the Site, as well as outwith watercourse buffers (refer to Figure 3.5²).
		 T3 was moved 190 m west, while this placed it within the 100 m GWDTE buffer this was considered preferable to impacts on peat and steep terrain (refer to Figure 3.5).
		 T5 and T6 microsited onto flatter ground to avoid steep slopes and tracks realigned to avoid watercourse buffers.
		 T8 orientation has been adjusted to minimise impacts on peat and a watercourse buffer to the north (refer to Figure 3.5)

- 3.6.5 Throughout the turbine design process the layout and visual amenity of the Proposed Development was considered, with the design being considered from viewpoints in a number of locations surrounding the Proposed Development. **Figures 5.11-5.30** present the visualisations from a number of viewpoints considered (see **Chapter 5: Landscape and Visual Amenity** for further details).
- 3.6.6 **Figures 3.6a-e** demonstrate comparative wirelines of Layouts A, B, C and D from the following viewpoints:
 - VP4 Shinnelhead;
 - VP6 Benbrack, Striding Arch;
 - VP7 Shinnel Water Valley near Craigencon;
 - VP9 Moniaive; and
 - VP14 Cairnsmore of Carsphairn.

² Figure 3.5 shows one of several interim infrastructure layouts that were refined throughout the EIA process to avoid environmental constraints prior to finalising the Proposed Development layout as is shown on **Figure 4.1**.

Other Site Infrastructure

Site Access

- 3.6.7 Multiple options were considered to access the main Site of the Proposed Development considering public and private roads from every direction.
- 3.6.8 The public road that directly connects to the Site is the U400N which heads north from Tynron to Appin. However, due to the narrow width of the road and the requirement to cross to bridges which are designated as Listed Buildings this road was not considered suitable to deliver turbines to the Site.
- 3.6.9 Similarly, the public road to the west of the Site (U394N between Monaive and Benbuie) and to the north of the Site (U405N from Druidhall to Polskeoch) were also investigated but deemed unsuitable due to their narrow nature or difficulty in accessing them with turbine components.
- 3.6.10 Access from the west via the C35s, which has previously been used in the construction of wind farms, was then investigated. This road is accessible for turbine delivery via the B729 and A713 using a blade lifter and an existing blade transfer area on the outskirts of Carsphairn.
- 3.6.11 Alternative routes to connect the C35s to the Site were explored (refer to **Figure 3.7**). The environmental impacts of each option consider with regards felling requirements, peat, hydrology, cultural heritage, ecology, ornithology and landscape and visual amenity. This identified that Option 4 was the least preferable due to the visual effects on the Southern Upland Way and Striding Arches and that it would cross Class 1 peat (as identified in NatureScot mapping). Options 2 and 3 required a very steep gradient to climb out of the Cairnhead valley and would require significant cut and fill. Option 1 while following a similar route as Options 2 and 3, avoided this requirement and was considered an improvement.
- 3.6.12 Another Option was then considered, Option 5, which while following Option 1 in the east looked to maximise the use of existing forestry access tracks in the west and thereby minimising the felling and new tracks required. This option was then taken forwards to final design.

Site Tracks and Hardstandings

- 3.6.13 As turbine layouts C and D progressed a number of different internal access track designs were considered. The key design principles for the internal access tracks were:
 - suitable gradient for the transportation of turbine components along the access tracks of more than 15°;
 - maximising use of the existing tracks;
 - to follow the existing ground topography as much as possible, minimising the necessity for cut and fill engineering works and associated visual effects;
 - to keep overall new track length to a minimum, reducing stone requirements and associated potential environmental effects;
 - to minimise watercourse crossings except where crossings are necessary (where required, water crossings will be 'mammal friendly', with banksides retained or mammal ledges installed to minimise potential effects on aquatic mammals);
 - to build health and safety aspects into track design from as early a stage as possible, including avoiding slopes which are too steep for access and creating clear definitions between turbine working areas and access tracks; and
 - avoiding deeper peat and GWDTEs.
- 3.6.14 As the turbine locations were micro-sited as described in **Table 3.1** above, the access tracks and hardstandings were also micro-sited, for example:
 - optimising the access track approaching T4 to remove a double watercourse crossing (refer to **Figure 3.5**);
 - re-designing the access track near T8 to avoid the buffer around a bog pool and therefore moving the hardstanding to accommodate this change while avoiding the majority of a pocket of deep peat; and
 - changing the orientation of the hardstanding of T3 to avoid pockets of deeper peat whilst aiming to minimise impacts on GWDTEs.

Borrow Pit Search Areas

3.6.15 Borrow pits are required as a source of rock to be used in the construction of the tracks and hardstandings. On-site borrow pit search areas have been identified based upon a review of geological mapping, aerial mapping and site reconnaissance by an engineer and geological specialist. Where

possible, the Proposed Development aimed to re-open existing borrow pits rather than creating new openings.

- 3.6.16 Borrow pits 2 and 3 (refer to **Figure 4.1**) are located in the location of existing borrow pits which are/have been used to extract aggregate for the existing access tracks on Site.
- 3.6.17 Several locations were considered for borrow pit 1 as shown on **Figure 3.8**, however these were discounted due to proximity to watercourses, proximity to utilities, or potential impacts to users of the Southern Upland Way. The final location for borrow pit 1, although slightly removed from the proposed access route for the Proposed Development, is also at the location of an existing borrow pit and was therefore considered to minimise environmental impacts.

Substation and Construction Compounds

- 3.6.18 The design of the substation aimed to achieve the following:
 - minimise cut and fill required to create a flat platform for construction;
 - · minimise impacts on forestry and peat;
 - situated outwith watercourses and watercourse buffers;
 - located a minimum of three turbine rotor diameters from the turbines; and
 - minimise visibility in the landscape.
- 3.6.19 A temporary construction compound is required adjacent to the substation so the identified location had to also be an area that could accommodate both.
- 3.6.20 The topography of the Site slopes steeply around the central Appin Burn and therefore there were few locations that achieved the above aims. The final location chosen on Markreach Hill situates the substation on a flat platform requiring limited cut and fill, and with space to accommodate the construction compounds for the substation as well as for the turbines. Three potential locations and orientations for the construction compounds were considered with the final locations determined following peat probing to minimise impacts on peat.

3.7 Micrositing

- 3.7.1 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, consent is sought for the provision of a 100 m micrositing allowance for the Proposed Development (refer to Standard Conditions).
- 3.7.2 The technical assessments in **Chapters 5-11** of the EIA Report have considered the potential for horizontal micrositing and it is considered that the Proposed Development could be microsited within 100 m within the Site boundary without resulting in potential significant effects greater than those detailed in this EIA Report. Micrositing will not be undertaken within any identified areas of constraint e.g., within watercourse buffers or where notable deep peat is identified. During construction, the need for any micrositing would be assessed and agreed with the on-site Environmental/Ecological Clerk of Works (ECoW) (definition of this role is contained in the outline Construction Environmental Management Plan (CEMP) (**Technical Appendix 4.1**).

3.8 Conclusion

- 3.8.1 The design process has been iterative responding to constraints identified throughout the EIA, public consultation and layout design process so that potential adverse impacts from the Proposed Development could be avoided or reduced where possible.
- 3.8.2 The final layout of the Proposed Development is described in detail in **Chapter 4: Description of the Proposed Development** and shown on **Figure 4.1**. The assessment of the potential effects of the final layout is addressed in **Chapters 5 to 11** of the EIA Report.

3.9 References

Department of Trade and Industry (1996) The Assessment and Rating of Noise from Wind Farms.

Scottish Natural Heritage (2017). Siting and Designing Windfarms in the Landscape Version 3a. <u>https://www.nature.scot/sites/default/files/2017-</u> <u>11/Siting%20and%20designing%20windfarms%20in%20the%20landscape%20-</u> <u>%20version%203a.pdf</u>.

The Scottish Government (2017). The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Available at: <u>https://www.legislation.gov.uk/ssi/2017/101/contents/made</u>.