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Introduction

2.1 This Chapter outlines the process undertaken in selecting the site as a potential and suitable location for a wind farm, provides a description of the site and surrounding area, and discusses the design evolution process.

2.2 The principles of the EIA process; that site selection and project design should be an iterative constraint-led process, have been followed as part of the proposed development. This has ensured that potential adverse impacts on the environment, as a result of the proposed development, have been avoided or minimised as far as reasonably possible through the design process.

2.3 This Chapter draws on issues considered in more detail in the relevant technical chapters (**Chapters 7 to 15**). This Chapter does not pre-empt the conclusions of the latter chapters but explains how potential environmental effects have informed the design of the proposed development.

2.4 The design for the proposed development is described in **Chapter 3: Description of Development** and is shown on **Figure 3.1**. This Chapter is supported by the Design and Access Statement (DAS) which is submitted separate from the EIA Report in support of the application.

Site Selection and Consideration of Alternatives

2.5 National Planning Framework 4 (NPF4) was adopted by the Scottish Government on 13 February 2023 and sets out the overarching spatial strategy for Scotland to 2045. The foundations for the spatial strategy as a whole are the global climate emergency and the nature crisis. NPF4 supports a large and rapid increase in electricity generation from renewable sources to meet Scotland's net zero emissions targets. It identifies that onshore wind energy development proposals will be supported in principle except for where located in National Parks and National Scenic Areas.

2.6 As noted in **Chapter 4: Renewable Energy and Planning Policy**, NPF4 states that within the Central Region (where the site would lie) work needs to be done to *"create more inclusive, greener and sustainable places that will stand the test of time"* and identifies renewable energy generation as one of the tools that will be needed to achieve this goal.

2.7 Regulation 5(2)(d) and Schedule 4, paragraph 2 of the EIA Regulations requires that an EIA report should include: *"a description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

2.8 The main alternatives including design, turbine specification, location, size and scale have been considered for the site. This Chapter explores these options and explains how the final design of the proposed development has evolved. As the purpose of the proposed development is to provide low carbon renewable energy and meet renewables / decarbonisation targets, a 'no scheme' alternative has not been considered further.

Site selection

2.9 A number of factors were considered when selecting the site for wind farm development including:

- the site is not located in a National Park or National Scenic Area (and therefore NPF4 is supportive of the location for renewable energy in principle);
- initial desk-based studies and wind monitoring on site suggest that there is a very good wind resource, and the site is available for wind energy development;
- there is a considerable distance to settlements and residential properties (no inhabited residential properties within 2.5km of the proposed turbines) thereby minimising potential adverse effects on residential amenity, and noise related issues;
- good existing access options from the public road network (A9 then C468/ Sheriffmuir road);
- the site does not support any international or national ecological or landscape designations;
- the site is located in central Scotland and has a viable route to the national grid network (anticipated to be via Braco west substation); and
- the site is located in an area of the Ochil Hills which is adjacent to the operational Burnfoot and Rhodders wind farm cluster. As such the proposed development would add turbines to an area which already hosts onshore wind infrastructure.

Technology, Size and Scale

2.10 In order to ensure the maximum energy yield from the site (for project viability and to aid progress towards renewable energy targets), wind turbines up to 180m to tip height were considered.

2.11 During the period leading up to a consent and ultimately the construction of the proposed development, it is expected that the design and manufacture of commercial wind turbines will evolve and result in a wider choice of turbines than is currently available. The ability to maximise the potential yield from the site through turbine choice at the point of procurement is important for the financial feasibility of the scheme in a time of increasing financial uncertainty. Without the ability to optimise the project in such circumstances, it may adversely affect the viability of the proposed development.

2.12 The availability of smaller turbines across Europe continues to reduce due to lack of demand as manufacturers are recognising that the world market is shifting to larger, more efficient machines and are focussing their development work on larger turbines which are more efficient than their smaller predecessors and secure the highest yield.

2.13 Therefore, it is clear that larger turbines (tip heights and rotor diameters) need to be considered in order to ensure a scheme's viability and constructability. In addition to viability and constructability, fewer numbers of larger turbines can also result in less associated infrastructure, such as new access tracks, turbine foundations and crane pads, and in turn potentially result in less environmental impact. As a result of this, turbines with tip heights of up to 180m were considered as part of initial feasibility studies. These turbines would be comparatively larger than the cumulative wind farm context within the vicinity of the site (the turbines which comprise the Burnfoot and Rhodders cluster range from 102m – 135m in tip height).

2.14 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 in order to understand what size of turbine may be appropriate. The purpose of a wind farm development is to harness the wind to generate electricity and from a yield perspective only, the optimum design would locate wind farms in areas exposed to the highest wind

speeds, with turbines placed in the most exposed locations. However, this may not account for the potential environmental effects of a wind farm. The design of a wind farm must therefore balance environmental effects and energy yield. In addition to these factors, the technical limitations of constructing a wind farm must also be considered at the design stage.

2.15 The design process is iterative and develops in tandem with environmental surveying to identify environmental sensitivities which are considered and taken into account within the design process. As environmental effects and sensitivities have been identified, the layout of the proposed development has undergone a series of modifications to avoid or reduce potential environmental effects through careful design. This process has resulted in the layout of the proposed development presented in this EIA Report. This layout represents the optimum fit within the technical and environmental parameters of the site and its surroundings.

2.16 In addition to the wind turbine selection and design, the other elements of the proposed development which have been designed to minimise environmental effects include: the access tracks, proposed borrow pits, crane hardstandings, temporary construction compounds, and the substation compound. The effects of these have been minimised through, careful environmental surveying, design, siting, routeing and construction methods.

2.17 There were multiple elements of the site and its surroundings that were looked at when considering the size of wind turbine that may be appropriate, these included:

- landscape designations;
- the proximity to key cultural heritage assets;
- local bird populations and species type (and how wind turbine size and configuration might affect these);
- the ability to get wind turbine components to site;
- views from the surrounding hill summits within the Ochils;
- the landscape character of the site and its context, informed by the NatureScot landscape character types (LCTs) (as defined in NatureScot's siting and design guidance, 2017[1]);
- the scale of turbines within the adjacent operational Burnfoot and Rhodders wind farm cluster;
- the availability of a viable grid connection; and
- the sensitivity of the landscape to tall turbines, including the potential need for aviation lighting.

2.18 A 10-turbine, 180m to tip height wind farm layout was presented to Clackmannanshire Council in May 2022 as part of the Pre-Application Advice request. A Pre-Application Advice email was received from Clackmannanshire Council on 19 July 2022, with further advice received on 10 August 2022. The Pre Application Advice received was from Clackmannanshire Council, Perth & Kinross Council, Stirling Council, and a number of other key consultees. The advice was wide ranging, however with regards to the size of the wind turbines proposed (180m to tip height), several landscape and visual concerns

[1] SNH (2017) Siting and Designing Wind Farms in the Landscape, Version 3a

were flagged, such as effects on landscape character, views of the Ochils escarpment from the south, and views of the turbines from popular hill summits within the Ochils. Further to this, the visibility of the proposed turbines from a number of cultural heritage assets such as Alloa Tower and Clackmannan Tower, Stirling Castle, and Ardoch Roman military complex, was also raised. The Pre-Application Advice did not comment on the acceptability of a wind farm of this scale or at this location, instead it highlighted key areas of potential concern that require consideration during the EIA and iterative design process.

2.19 Taking the above inputs (from paragraph 2.17) and considering them alongside the desire to generate the maximum energy yield from the site, and also considering the Pre-Application Advice received, it was concluded that the site could accommodate wind turbines up to 149.9m to tip height. Turbines over 149.9m would have given rise to a requirement for aviation lighting (increasing visibility of the turbines, particularly at night time), and result in increased visual impact on views from the south, looking towards the Ochils escarpment.

Site Location and Description

2.20 The site, centred on NGR NN 87737 02889, is located in the Ochil hills, across the administrative boundaries of both Clackmannanshire and Perth & Kinross Councils. The site, which measures approximately 1,474ha, is predominantly used for sheep grazing, forestry, and water abstraction. The Ochils in general are used by hill walkers and other recreation uses such as running, and cycling.

2.21 Access to the site is proposed to be taken from the A9, traveling south west along the C468/Sheriffmuir road, and then turning off, at Carim Lodge, onto a purpose built site access track.

2.22 Wind turbine components would be delivered to the site via the port of Rosyth, travelling north on the M90 until reaching the Broxden roundabout near Perth. At the Broxden roundabout the turbine components would travel south west on the A9 until turning off onto the C468/Sheriffmuir road, using an existing exit, between Blackford and Longfauld. The turbine components would then continue on this road south west until reaching the existing access track adjacent to the Carim Lodge residential property which has been utilised for forestry activities. From here a new access track would take the turbine components southwards into the Ochil hills.

2.23 The site is characterised by sloping expanses of moorland at typical elevations of between 142m-677m Above Ordnance Datum (AOD). There are several hills within the site boundary, with the highest summit being Ben Buck at 679m AOD. The area in which the wind turbines are proposed is located on the upland plateau, between 450m – 555m AOD, benefitting from the high wind speeds which are present at this high altitude whilst avoiding the higher peaks of the surrounding hills. The site is intersected by a number of small tributaries several of which flow to the Allan Water and the River Devon (via the Upper Glendevon Reservoir).

2.24 The majority of the proposed development is shown by the British Geological Survey (BGS) to be underlain by several units of the Ochil Volcanic Formation, predominately comprising basaltic andesites and conglomerates. The northern part of the site (south of the A9) is shown to be underlain by Sheriffmuir Sandstone Member (sandstones). The BGS indicates that the majority of the site is underlain by superficial peat deposits, which are present on the high ground locally. Glacial till is recorded widely and at lower elevations, with alluvium adjacent to larger watercourses. The southern extent of the site, proposed access route and hill tops locally, including Ben Buck, are shown to be absent of any superficial deposit.

2.25 The superficial deposits and igneous bedrock beneath the site are unlikely to contain much groundwater. The igneous bedrock has been classified by the BGS as a low productivity aquifer whereby small amounts of groundwater may be present within the near surface weathered zone or secondary fractures. The sandstone bedrock has been classified as a moderately productive aquifer which may locally yield moderate amounts of groundwater. Shallow groundwater is likely to be present in the alluvium adjacent to watercourses.

2.26 There are no statutory environmental designations within the site boundary.

2.27 The southern part of the site is located within the Ochils Special Landscape Area (SLA) designation (the Clackmannanshire Local Development Plan (2015) uses the previous terminology of Special Landscape Area (SLA), rather than the newer Local Landscape Area terminology). The northern part of the site is located within the Ochil Hills Local Landscape Area (LLA) which is a local landscape designation within the Perth and Kinross local authority area.

2.28 There is a candidate Local Nature Conservation Site (Alva Moss) located within the site boundary. The Alva Moss candidate Local Nature Conservation Site (LNCS) was put forward in 2021. Consultation with The Scottish Wildlife Trust, NatureScot and Clackmannanshire Council has not indicated that Alva Moss has been adopted as a full LNCS.

2.29 There is one Core Path (BLFD/118) that falls within the site, across a section of the C468 / Sheriffmuir road included within the site boundary.

Surrounding Area

2.30 The immediate surrounding area is rural in nature, with no occupied residential properties located within approximately 2.5km of the proposed turbines. There are several settlements in the wider surrounding area. To the north of the site, in Perth & Kinross, are the settlements of Blackford (approximately 600m from the application boundary at its closest point, 5.3km from the nearest proposed turbine) and Greenloaning (approximately 2.9km from the application boundary at its closest point, 5.7km from the nearest proposed turbine). To the south of the site, in Clackmannanshire, are the towns of Alva (approximately 2.9km from the application boundary at its closest point, 3.2km from the nearest proposed turbine), Menstrie (approximately 3.1km from the application boundary at its closest point, 4.5km from the nearest proposed turbine) and Tillicoultry (approximately 3.8km from the application boundary at its closest point, 4.5km from the nearest proposed turbine).

2.31 The south eastern extent of the site lies within the River Devon surface water catchment. The north western extent is located within the Allan Water surface water catchment. The eastern extent of the site is located within a sub catchment of the River Devon (named ‘source to Gairney Burn confluences’) which has been designated as a Drinking Water Protected Area (DWPA). The DWPA designation is linked to the Glendevon Reservoirs which are maintained by Scottish Water for public water supply.

2.32 The operational Burnfoot Hill (13 turbines up to 102m tip height), Burnfoot East (3 turbines up to 135m tip height), Burnfoot North (2 turbines up to 102m tip height), and Rhodders (6 turbines up to 102m tip height) wind farms are located immediately to the east of the site (closest turbines within 1km of the proposed turbines). In addition to these, the following operational and consented wind farms are within 10km of the proposed turbines:

- Green Knowes Wind Farm – 18 turbines (93m to tip height), Operational, located approximately 6.6km to the north east;

- Strathallan Wind Farm – 9 turbines (93m to tip height), Consented (phase 1 i.e. four turbines, is operational, with phase 2 i.e. the remaining five turbines to follow), located approximately 7.9km to the north west.

2.33 The closest national landscape designations in proximity of the proposed development are:

- River Earn National Scenic Area (NSA) – approximately 20km north west of the nearest turbine;
- Loch Lomond and the Trossachs National Park (LLTNP) - approximately 23km west of the nearest turbine;
- Ben More – Ben Ledi Wild Land Area (WLA)[2] – approximately 30km west of the nearest turbine; and
- The Trossachs NSA – approximately 30km west of the nearest turbine.

2.34 The closest (within 5km) ecological designations in proximity of the site are:

- Carsebreck and Rhynd Lochs Site of Special Scientific Interest (SSSI) – approximately 900m north of the site boundary, which consists of three shallow reservoirs of open water and the large, raised bog of Shelforkie Moss;
- South Tayside Goose Roosts Ramsar – approximately 900m north of the site boundary (5.7km north of the nearest proposed turbine), designated for its wetlands;
- South Tayside Goose Roosts Special Protection Area (SPA) – approximately 900m north of the site boundary (5.7km north of the nearest proposed turbine), designated for the lochs providing roost sites for internationally important numbers of wintering geese and for nationally important numbers of nesting ducks.
- Shelforkie Moss Special Area of Conservation (SAC) – approximately 1.6km north west of the site boundary, designated for bog-moss Sphagnum magellanicum and S. cuspidatum pools;
- Quoigs Meadow SSSI – approximately 2.1km west of the site boundary, designated for biological features;
- Craig Leith and Myreton Hill SSSI – approximately 1.8km south east of the site boundary, which is known to support a breeding colony of northern brown argus (Aricia Artaxerxes) butterfly;
- Bog Wood and Meadow SSSI – approximately 3.3km north east of the site boundary, designated for biological features;
- Gleneagles Mire SSSI – approximately 3.5km north of the site boundary, designated for biological features;
- Mill Glen SSSI – approximately 3.37km south east of the site boundary, designated for a mixture of biological (non-avian ecology) and geological features; and
- Dollar Glen SSSI – approximately 3.6km east of the site boundary, designated for a mixture of biological (non-avian ecology) and geological features.

2.35 The closest (within 5km) cultural heritage designations in proximity of the site are:

[2] Wild Land Areas (WLA) are technically not designated but their importance is recognised in NPF4.

- East Biggs hut circles Scheduled Monument SM7586 – approximately 970m south of the site boundary at its closest point;
- Banheath Farmstead and Scheduled Monument SM7595 – approximately 1.18 km north of the site boundary at its closest point;
- Sherriff Muir, Whitestone Range Scheduled Monument SM10929 – approximately 1.7km west of the site boundary;
- Sherrif Muir Registered Battlefield BTL17 – approximately 2.2km west of the site boundary;
- Gleneagles Hotel and Golf Courses Garden and Designed Landscape GDL00360 – approximately 2.5km north east of the site;
- Braco Garden and Designed Landscape GDL00067 – approximately 4.4km north west of the site; and
- University of Stirling (Airthrey Castle) Garden and Designed Landscape GDL00010 – approximately 5.5km south west of the site.

Design Concept and Approach

Constraints Led

2.36 In EIA, constraint identification should continue throughout the design process in order to take cognisance of new, more detailed surveys revealing additional constraints to 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 the proposed development site.

2.37 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 of the proposed development. This is referred to within this EIA Report as mitigation embedded in the proposed development layout and design, or simply ‘embedded mitigation’ (avoiding the potential for impacts to arise through proposed development design). Information on embedded mitigation is explained further within each technical chapter of this EIA Report as appropriate. Several design principles have also been incorporated into the proposed development as standard practice.

2.38 ‘Embedded mitigation’ includes, but is not limited to:

- considering the size and scale of the proposed development appropriate to the location;
- design of the tracks to minimise cut and fill, reducing ecological effects, 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;
- inclusion and design of borrow pits to minimise the amount of the material required to be imported to site; and
- potential for up to 50m micrositing of infrastructure during construction to ensure the best possible location is chosen based on site investigations.

Landscape and Visual

2.39 Throughout the design evolution of the proposed development layout, a key driver has been the consideration of potential landscape and visual effects and how the proposed development would relate to the existing landscape character of the site and its visibility from the surrounding area. In particular, due attention was given to the scale, individual location and number of turbines proposed. The landscape and visual effects potentially caused by the proposed development have been considered extensively from key receptors. The resulting analysis has been an important input into the design evolution process of the proposed development and in particular to the layout design of proposed turbines and location of infrastructure on the site.

2.40 In order to address any potential landscape and visual effects, good practice guidance such as NatureScot's 2017 Siting and Designing Wind Farms in the Landscape (Version 3a) has been taken into consideration. The guidance helps to guide wind farms towards those landscapes best able to accommodate them and advises on how wind farms can be designed to best relate to their setting, and the setting of other wind farms and minimise landscape and visual impacts. This includes the following design aspirations:

- to select a turbine model which responds to the scale and key characteristics of the landscape in terms of tip height and proportion of blade length to tower height e.g. large scale turbines are best suited to more extensive, upland areas, and set back from the more sensitive upland fringes;
- relate the layout of the wind farm to the key characteristics of the landscape, e.g. a simple visual image that relates to the relatively simple upland landscape of the Ochils;
- to design a visually balanced and coherent group of turbines which is compatible with and to be seen as part of the operational wind farm group located <1km to the east of the proposed development comprising Rhodders, Burnfoot Hill, Burnfoot Hill North and Burnfoot Hill East; and
- aim to create a visually balanced, simple and cohesive layout when seen from key viewpoints, particularly from Braco, avoiding uneven visual densities, overlapping turbines, partial screening behind a skyline and outlying single turbines or groups of turbines, where possible.

2.41 NatureScot's 2017 Siting and Designing Wind Farms in the Landscape guidance (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."

2.42 Landscape and visual design objectives for the site included the following:

- to design a layout that reduces visibility of turbines and avoids turbines appearing too numerous and too dominant above the Ochils escarpment in views from the low-lying carseland to the south, whereby the Ochil Hills forms a prominent backdrop to this lower lying landscape;
- avoid turbines breaking the skyline in views north from the summit of Ben Cleuch;

- avoid turbines appearing too numerous and too dominant from the summit of Dumyat (which is one of the most popular hill summits in the Ochils and which currently has no visibility of the operational wind turbines within the Ochils); and
- to design a layout that reduces visibility and seeks to ensure that the proposed turbines do not appear excessive in size and scale compared to the nearby operational wind turbines within the Ochils, particularly in views from the north e.g. Braco; and minimise views from key cultural heritage assets e.g. Stirling Castle, Bannockburn Memorial, Alloa Tower, and the Ardoch Roman military complex.

2.43 The layout and design of the proposed development was considered as part of an iterative design process. An iterative design approach works in tandem with the EIA process and allows a receptive design process aimed at reducing the potential landscape and visual effects of the proposed development whilst taking into account other site constraints and commercial requirements. Several layouts were considered during the design process, with the layout evolving to respond to landscape and visual constraints such as views from settlements to the north and south, views from hill summits within the Ochils and also views from various nearby cultural heritage assets.

2.44 It is considered that the proposed design respects the form of the underlying landscape and its scale. The final layout has been optimised with regards to landscape and visual amenity as far as possible, on balance with other environmental constraints, technical constraints and commercial viability. The agreed representative viewpoints for the Landscape and Visual Impact Assessment (see **Chapter 7** for further information) represent key views experienced by receptors within the 40km LVIA study area. The modelling of the proposed development in views from these locations was used to inform the iterative refinement of the turbine layout.

2.45 Where possible, proposed excavation for access tracks and other infrastructure has been minimised. The location of the substation compound and temporary construction compounds have also been given consideration in relation to reducing potential landscape and visual effects. These have been located in lower lying areas or where natural screening occurs via landform, helping to reduce their potential prominence.

Efficiency Modelling

2.46 Throughout the constraints led design process, wind and yield analysis was undertaken to ensure changes made to layouts did not adversely affect the output and efficiency of the proposed development. The average prevailing wind direction experienced at the site is from the south west and as such, the turbine separation distances are larger at this orientation.

Stakeholder Consultation

2.47 Public consultation events were undertaken in June 2023 and November 2023 which allowed members of the local community to comment on the design proposals. Feedback from both rounds of consultation events were incorporated into the design evolution process where possible. Further details of the public consultation process can be found in the Pre-Application Consultation (PAC) Report accompanying this application.

2.48 Statutory consultees were invited to become involved in and input to the design process for the proposed development via the EIA Scoping process (see **Chapter 6: Scoping and Consultation** for more detail), Gatecheck process and subsequent consultation.

Constraints and Identification Mapping

2.49 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, which is further informed by environmental and technical constraints.

2.50 The designations in the area surrounding the site were identified as the first part of the constraints mapping process. These are shown on **Figure 2.1**. The known environmental and technical constraints within the site were also identified as part of this early stage constraints mapping. 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 altered appropriately. The key constraints which were taken into account during the design process included:

- topography and ground conditions (including peat);
- identified landscape and visual sensitivities;
- presence of birds, protected habitats and species;
- presence of watercourses, private water supplies and related infrastructure, and the Highland Spring water catchment area and zones of influence;
- presence of cultural heritage features;
- aviation and radar constraints;
- recreation resource (such as Core Paths);
- forestry; and
- fixed communications links.

2.51 In addition to the above, consideration was given to the candidate Alva Moss Local Nature Conservation Site, despite its current ‘candidate’ status.

2.52 The identification of constraints continued throughout the design evolution process as more detailed surveys refined the development envelope.

2.53 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.

Engineering

Topography and Ground Conditions

2.54 The steeper areas of the site (greater than 14% slope gradient) have been avoided for the siting of wind turbines and other wind farm infrastructure as far as possible. This is to facilitate the safe and efficient construction of the wind farm. Initial infrastructure design has confirmed that using an appropriate and proportional amount cut and fill should allow wind turbines, crane pads, tracks and other ancillary infrastructure to be constructed on gradients in line with standard practice.

2.55 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 peat slide risk.

Landscape and Visual

2.56 No international or national landscape designations occur within the site. However, within the 40km LVIA[3] study area there are three national designations:

- River Earn NSA – approximately 20km north west of the nearest turbine;
- Loch Lomond and the Trossachs National Park - approximately 23km west of the nearest turbine; and
- The Trossachs NSA – approximately 30km west of the nearest turbine.

2.57 Given the distance between the proposed development and these national landscape designations, impacts would be limited and therefore not a key consideration during the design process.

2.58 The majority of the site is located within the Ochil Hills LLA within the Perth and Kinross local authority area. The southern part of the site is located within the Ochils SLA (the previous terminology for an LLA) which sits within the Clackmannanshire local authority area. There are a number of further locally designated landscapes within the 40km Study Area, the closest of these (within 15km are listed below):

- Western Ochils LLA – immediately adjacent to the west of the site boundary, and approximately 950m from the nearest proposed turbine;
- Forest SLA – approximately 6.1km south east of the nearest proposed turbine;
- Keir LLA – approximately 9.2km west of the nearest proposed turbine;
- Southern Hills LLA – approximately 13.3km south west of the nearest proposed turbine;
- Upper Strathearn LLA – approximately 13.5km north of the nearest proposed turbine; and
- Cleish Hills LLA – approximately 13.9km south east of the nearest proposed turbine.

2.59 With theoretical visibility and distance taken into account the following of the above locally designated landscapes were key considerations during the design process: Ochil Hills LLA, Ochils SLA and Western Ochils LLA.

2.60 The closest and only WLA within the LVIA study area is the Ben More – Ben Ledi WLA approximately 30km west of the nearest proposed turbine and as impacts would be limited it has not been a key consideration during the design process.

2.61 Landscape and visual effects are assessed within **Chapter 7: Landscape and Visual**.

Ecology and Ornithology

2.62 Ecological surveys, including a UK Habitat Classification (UKHab) survey, a National Vegetation Classification (NVC) Survey and protected species surveys, were carried out across the site during 2023, in order to identify broad areas of constraint to the proposed

[3] The study area for the LVIA was defined as a 40km radius from the outermost turbines of the proposed development in all directions, as recommended in current guidance (SNH (February 2017) Visual Representation of Wind Farms Guidance. Version 2.2) for turbines equal to or greater than 150m to blade tip, and in agreement with statutory consultees

development. Constraints mapping included the identification of sensitive ecological features, including habitats present within the site and species which use the site.

2.63 Areas with the potential to be Groundwater Dependent Terrestrial Ecosystems (GWDTEs) were found to be relatively limited in extent within the site. The design of the proposed development sought to minimise any effects on potential GWDTEs through taking account of NVC information, along with other site constraints, in layout iterations.

2.64 A distance of at least 50m between turbine blade tip and the nearest woodland has been established, as per current bat guidance (SNH, 2019). There is limited appropriate habitat for bat roosting or foraging within the site.

2.65 Ornithology surveys have been carried out across the site between 2021 to 2023, including vantage point watches, moorland breeding wader surveys, breeding raptor surveys and diver lochan surveys. The surveys recorded flights from a number of priority species including: Kestrel, Red Kite, and Golden Plover.

2.66 Standard best practice measures would be implemented during construction (including timing felling works outwith the breeding season) to ensure compliance with relevant legislation protecting all breeding wild birds.

2.67 Ecology effects are assessed within **Chapter 8: Ecology** and an assessment of ornithological receptors is presented in **Chapter 9: Ornithology**.

Geology and Soils

Peat Depth

2.68 As defined on NatureScot's Carbon and Peatland 2016 Map (SNH, 2016), the majority of the site is shown to be Class 1 Priority Peatland Habitat, with smaller areas of Class 2, Class 3, Class 4 and Class 5 also present. Site visits have confirmed the presence of peat, of variable condition and depth across the site, with deeper peat more likely to occur in the shallower areas of the upland plateau.

2.69 Peat probing was undertaken in May 2021, October 2023 and February 2024. A review of this data in conjunction with slope gradients allowed areas of deep peat (typically greater than 1.5m) to be avoided, where possible, at an early stage. The peat data is discussed in **Technical Appendix 10.1: Peat Landslide and Hazard Risk Assessment** and shown on **Figure 10.1.6** and **Figure 10.1.7**. Where possible, proposed turbines and ancillary infrastructure is located on areas of peat less than 1.5m deep.

2.70 Consultation with SEPA, regarding the avoidance of deeper peat, formed part of the iterative design process.

2.71 The majority of the deep peat (over 1.5m) is located in the southern half of the site (in Clackmannanshire). Although considerable effort was given to avoiding areas of deep peat with the proposed infrastructure, as a result of trying to avoid watercourses, excessive gradients, and optimise the efficiency of the site, there are instances where proposed infrastructure is located on peat in excess of 1.5m deep. In order to avoid the potential negative effects of locating proposed infrastructure on deep peat, the following mitigation has been applied:

- where onsite access tracks are proposed on areas with a peat depth of 0.5m (or more), for a distance of 30m (or greater) and with shallow topography the track will be floated; and

- where crane pads are located on areas of peat, the orientation of the crane pad has been designed so as to try and place the temporary and non intrusive sections of the crane pad over the deepest areas of peat. These temporary and non intrusive sections of the crane pad generally require clearance only, not any cut or fill, and as such would see the peat left undisturbed. The breakdown of the various parts of the proposed crane pad design are shown on **Figure 3.5a** and **3.5b**.

Peat Slide Risk

2.72 All turbine locations, access tracks, the substation compound, the temporary construction compound and borrow pits have been designed to avoid any areas which may be subject to peat slide risk. The ground condition constraints that were taken into account in the design of the proposed development were:

- identification of peat depths in excess of 1.5m – 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 14% – to minimise soil loss and potential instability; and
- avoidance, where possible, of areas where initial peat stability concern was identified – to avoid areas with possible instability issues.

2.73 Effects upon the peat and ground conditions of the site is contained within **Chapter 10: Hydrology, Hydrogeology and Geology**.

Hydrology and Hydrogeology

2.74 A 50m buffer zone has been applied around the primary watercourses which traverse the site, as well as the multiple small lochs / bodies of water within the site. These buffers were used to ensure that as much of the proposed wind farm infrastructure as possible, other than tracks, is not located in close proximity to hydrological features, in accordance with wind farm construction best practice guidelines (GPP 5, 2018). This reduces the risk of run off and water pollution into existing watercourses.

2.75 Watercourse crossings have been minimised as much as possible and existing culverts would be upgraded or replaced as required.

2.76 Data on private water supplies (PWS) was obtained from land owners and supplemented with data from a PWS survey conducted in November 2023.

2.77 Effects upon hydrology are assessed within **Chapter 10: Hydrology, Hydrogeology and Geology**.

Archaeology and Cultural Heritage

Cultural Heritage Features

2.78 There are no designated heritage assets of regional or national importance within the site. Within 10km of the proposed turbines there are 11 nationally important designated heritage assets that are being assessed (see **Chapter 11: Cultural Heritage and Archaeology**) following discussion with the relevant key consultees:

- East Biggs, hut circles, Scheduled Monument, SM7586;

- Ardoch, Roman Military Camp, Scheduled Monument, SM1601;
- Rhynd enclosed settlement, Scheduled Monument, SM7596;
- Orchill Fort, Scheduled Monument, SM3605;
- Shielhill Roman Signal Station, Scheduled Monument, SM3897;
- Shielhill Roman Signal Station, Scheduled Monument, SM3871;
- Grinnan Hillfort, Scheduled Monument, SM3088;
- Clackmannan Tower, Scheduled Monument, SM90073;
- Alloa Tower, Category A Listed Building, LB20959;
- Braco, Garden and Designated Landscape, GDL00067; and
- Sauchie Tower, tower and house, Scheduled Monument, SM629.

2.79 There are 16 non-designated heritage assets within the site.

2.80 There are approximately 47 non-designated heritage assets within 1km of the site.

2.81 The above cultural heritage assets have been considered during the design of the proposed development. This includes avoiding siting wind turbines and other infrastructure on cultural heritage features within the site where possible, and also designing the wind turbine layout with cognisance of views from cultural heritage assets located within 10km of the proposed development.

2.82 Effects upon archaeological and cultural heritage assets are assessed within **Chapter 11: Cultural Heritage and Archaeology**.

Noise

2.83 For the purposes of early constraints mapping, avoidance buffers of 1km for wind turbines, and 500m for the substation compound (including battery storage) were applied to residential properties in the vicinity of the site.

2.84 Following the early design iterations of the site layout, it became apparent that no turbines would be located within 2.5km of any habitable residential properties. As such operational noise from the proposed development was not a key consideration in the design of the proposed development.

2.85 Despite not being considered a key consideration in the design of the proposed development, operational noise from the proposed development has been considered further in **Chapter 14: Other Issues**.

Shadow Flicker

2.86 As with noise (discussed above) due to the distance between the proposed turbines and residential properties (in excess of 2.5km), it was considered at an early stage that shadow flicker was unlikely to result in any significant effects. Therefore, shadow flicker was not a key consideration in the design of the proposed development.

2.87 Despite not being considered a key consideration in the design of the proposed development, shadow flicker from the proposed turbines has been considered further in **Chapter 14: Other Issues**.

Aviation

2.88 Aviation, covering all relevant radar installations, all navigational aids, air-ground-air communications stations and low flying activities, were a key consideration in the design of the proposed development.

2.89 Early consultation was held between the applicant and NATS Safeguarding in relation to the proposed development and if there were any specific constraints around the height of turbines or their geographical spread within the site.

2.90 Further to direct consultation with NATS Safeguarding, other relevant consultees (BAA (Glasgow Airport), BAA Aerodrome Safeguarding (Edinburgh), Civil Aviation Authority, Defence Infrastructure Organisation, and Highlands and Islands Airport Ltd) have been consulted during the EIA process, particularly at EIA Scoping stage.

2.91 The design of the proposed development has considered turbine tip heights in combination with ground level (AOD), in order to ensure that there would be no negative effects on aviation assets. An Instrument Flight Procedure (IFP) Impact Assessment has been carried out on the proposed development to confirm that there would be no adverse impacts on the Instrument Flight Procedures of both Edinburgh and Glasgow Airports.

2.92 As the proposed turbines are under 150m to blade tip height, it is understood that visible aviation lighting should not be required.

2.93 Aviation is considered further in **Chapter 14: Other Issues**.

Socio-economics, Tourism, Recreation and Land Use

Recreation

2.94 There is one ‘core path’, within the site boundary, and several in the area surrounding the site boundary. There are also multiple well used walking and cycling routes (formal and informal) within the site and its surrounding area. There are a number of popular hill summits within the area surrounding the site, particularly Ben Cleuch and Dumyat.

2.95 These core paths, recreational routes and hill summits were all considered during the iterative design process for the proposed development. The proposed development avoids the need for any disruption to any core paths or walking routes, with the exception of temporary disruption to the core path, which crosses the site boundary, during construction. The layout of the proposed turbines has also sought to minimise views from the summits of popular hills within the Ochils where possible, with particular care being given to keeping the visibility of turbines from Dumyat to a minimum, and avoiding turbines breaching the skyline when viewed from the summit of Ben Cleuch.

2.96 A survey of the recreational usage of this part of the Ochils (covering an area approximately from Dumyat in the west to the upper Glendevon reservoir in the east) was undertaken from September to November 2023, in order to understand the pattern and volume of recreational usage in the Ochils since the 2006 survey carried out as part of the Burnfoot Wind Farm planning application. The survey carried out in 2023 also included canvasing members of the public using the Ochils on what their feelings were with regards to wind farms.

2.97 The proposed development also includes a commitment from the applicant to install a walking path/trail from the proposed access track at the south of the site, linking up to the existing path that comes up from Alva, alongside Glenwinnel Burn (see **Figure 13.4a-b**).

2.98 More detail is provided in **Chapter 13: Socio-economics, Tourism, Recreation and Land Use.**

Telecommunications

2.99 Initial assessment of potential telecommunications constraints, resulted in the finding of no operational fixed telecommunications links that passed through the site. Several key telecommunications providers were consulted at EIA Scoping stage in order to further understand if there were any potential telecommunications constraints, with none responding that there were.

2.100 Telecommunications have therefore not been considered a key constraint with regards to the design of the proposed development. More detail is provided in **Chapter 14: Other Issues**.

Design Evolution

Design Iterations

2.101 The initial potential development area within the site boundary was refined using constraints mapping. These constraints (comprised of various environmental, technical and landscape and visual constraints) were used to inform the evolution of the location of the proposed turbines and associated infrastructure. The design optimisation process was iterative, involving review of multiple layouts and related wirelines from key landscape and visual receptor locations in the study area, and adjustment to turbine locations to minimise potentially adverse landscape and visual impacts insofar as possible, whilst also taking into consideration energy generation (e.g. wake loss) and other environmental, technical and economic considerations.

2.102 Four of the key design iterations are shown on **Figure 2.2** and comprise the Pre-Application Layout (Layout A), the Scoping layout (Layout B), the Gatecheck Report Layout (Layout C), and the Design Freeze Layout (Layout D: the proposed development). These four iterations represent key stages of the layout evolution, however several further ‘interim’ layouts were considered throughout the refinement process.

2.103 The factors that were considered as part of the design evolution process to achieve the final layout are described in the following paragraphs.

Wind Turbines

Layout A (Pre-Application Layout): 10 Turbines at 180m tip height

2.104 A 10 turbine, 180m to tip height wind farm layout was presented to Clackmannanshire Council in May 2022 as part the Pre-Application Advice request. At this time, the site spanned a smaller extent than it now is, and the application boundary was fully within the Clackmannanshire Council area. Based on this smaller site size, 10 turbines at 180m to tip height were presented. This was to show what was then considered to be a ‘max scale’ (before the site increased in size) in terms of turbine numbers and blade tip heights and prompt Clackmannanshire Council and other consultees to offer advice on this. At this stage, only very limited design work or environmental assessment work had been conducted, as it was deemed appropriate to obtain input from the consultees, and establish the design rationale at this early stage.

2.105 Wirelines of this initial layout are shown on **Figure 2.3a**, **Figure 2.3b**, **Figure 2.3c**, and **Figure 2.3d**.

2.106 Following responses from Clackmannanshire Council and other consultees, as well as further environmental and landscape feasibility work, it was considered appropriate to reduce the turbine blade tip height from 180m to 149.9m, which would allow the avoidance of visible aviation lighting.

Layout B (Scoping Layout): 15 Turbines at 149.9m tip height

2.107 The Scoping layout was produced, taking into account the Pre-Application Advice feedback received, the environmental and landscape related assessment work which had been carried out up to that point, and also, following the expansion of the site application boundary to include an area of Blackford Farms within the Perth and Kinross Council area.

2.108 As detailed above, the Scoping layout (layout B) was based on a reduced tip height of 149.9m. At the same time however, due to the expansion of the site application boundary, five additional turbines were included in the layout (all five additional turbines were located on the Blackford Farms land within the Perth and Kinross Council area).

2.109 The Scoping layout comprised 15 turbines of up to 149.9m to blade tip height. Wirelines of this layout are shown on **Figure 2.4a**, **Figure 2.4b**, **Figure 2.4c**, and **Figure 2.4d**.

2.110 Following continued environmental and landscape and visual assessment work, as well as feedback from consultees, it was considered that this layout could be refined further in order to:

- Avoid deeper areas of peat (over 1.5m);
- Reduce the number of turbines and turbine hubs visible in views from the south. As well as reduce the amount of turbine stacking visible in views from the south;
- Reduce the amount of turbine stacking visible from views from the north, particularly around Braco; and
- Reduce the visibility of the proposed turbines from the summit of Dumyat.

Layout C (Gatecheck Report Layout): 14 Turbines at 149.9m tip height

2.111 The Gatecheck Report layout was produced, taking into account the Scoping responses received, the environmental and landscape related assessment work which was largely complete at that point, and feedback from the public received following public exhibitions and via the Ochils survey.

2.112 In order to address the points highlighted in paragraph 2.110 above, one of the 15 turbines from layout B was dropped, and the locations of the remaining 14 turbines amended. Some of the key turbine moves included pushing T2 further north in order to minimise visibility from the south, T10 moving east in order to reduce visibility from Dumyat, and the line of four turbines along the southside of Sauchanwood hill being altered in order to reduce stacking in views from the north (particularly around Braco).

2.113 The Gatecheck Report layout comprised 14 turbines of up to 149.9m to blade tip height. Wirelines of this layout are shown on **Figure 2.5a**, **Figure 2.5b**, **Figure 2.5c**, and **Figure 2.5d**.

2.114 Following the responses from consultees to the Gatecheck Report, the final environmental and landscape and visual assessment work undertaken, as well as further analysis on wake loss and yield, it was considered that this layout could be refined further in order to:

- Further avoid areas of deeper peat (over 1.5m); and
- Reduce wake loss and improve wind yield.

Layout D (Design Freeze – The Proposed Development)

2.115 The Design Freeze layout was produced, taking into account the Gatecheck Report responses, the final environmental and landscape and visual assessment work, and the further analysis on wake loss and yield.

2.116 In order to address the points highlighted in paragraph 2.114 above, one of the 14 turbines from layout C was dropped, and the location of the remaining 13 turbines optimised further. The turbine that was dropped was T10 (as numbered in layout C) which allowed for less wake loss from turbines and an improved wind yield. Other turbine locations were tweaked as well, as was the track layout, particularly the track that joins to T5 (or T2 as numbered in layout C).

2.117 This layout incorporates necessary rotor spacing requirements, based on a prevailing south-westerly wind, and the turbines positioned to minimise interaction with onsite constraints, including areas of deep peat and watercourses.

2.118 The turbine numbering was also updated and rationalised for this layout.

2.119 The Design Freeze layout comprises 13 turbines of up to 149.9m to blade tip height. Wirelines of this layout are shown on **Figure 2.6a**, **Figure 2.6b**, **Figure 2.6c**, and **Figure 2.6d**.

Other Site Infrastructure

Site Access

2.120 Access to the site would be via the A9, turning onto the C468/Sheriffmuir road and then via new tracks up into the Ochils and to the turbine area.

2.121 The proposed abnormal load route required to transport turbine components to the site is shown on **Figure 12.3** and would be from the port of Rosyth, via the M90 to the Broxden roundabout near Perth. At the Broxden roundabout the turbine components would travel south west on the A9 before turning off onto the C468/Sheriffmuir road. The turbine components would then continue on this road south west until reaching the area around the Carim Lodge residential property. From here a new access track would take the turbine components southwards into the Ochil hills and onto the site.

2.122 In order to accommodate abnormal loads, it is proposed that theC468/Sheriffmuir road will be widened from the A9 Junction to the new proposed new track near Carim Lodge. A new section of road would also be created from the Sheriffmuir road junction with the A9, avoiding the sharp turn back in the road at present see **Figure 3.1b**.

Site Tracks

2.123 The proposed access tracks and upgraded / realigned roads have been designed to be as direct / short as possible, whilst attempting to avoid crossing watercourses, avoid deep peat and also taking slope into account to ensure viable for construction and use.

2.124 Access tracks have been designed to follow routes which, in the main, do not exceed gradients of 14%, or where they do, that follow the contours of the land as far as possible. This gradient is specified by a number of turbine manufacturers in their technical specifications to permit safe delivery of turbine components and associated parts. In addition to this, initial infrastructure design has confirmed that using an appropriate and proportional amount cut and fill should allow access tracks to be constructed on gradients in line with manufacturers specifications.

2.125 There are 10 sections of floating track across the site. Consideration was given to alternative routing options in order to avoid the need to propose floating track, however due to site topography (slope steepness), watercourses, and ecological habitats, it was considered that floating track would be most appropriate at these locations.

2.126 Careful consideration was given to how best to connect Turbines T5 and T11 with the other turbines on site. Turbines T5 and T11 sit on the other side of the Fin Glen (and Finglen Burn) to the other eleven turbines that comprise the proposed development. As can be seen in **Figure 2.7a-e** (particularly **Figure 2.7e**), the Fin Glen is very steep and wide at the section near to where most of the wind turbines are located, with only the initial section near Turbine T5 being relatively narrow and suitable for a relatively minor bridge crossing. Consideration was given to running a track along the southern part of the site, south of the Fin Glen, from Turbine T1 to T5, however this option would have resulted in a long section of track that passed through areas of deep peat and also required several watercourse crossings.

Borrow Pits

2.127 Up to two borrow pits would be required as a source of rock to be used in the construction of the tracks, hardstandings and foundations. On site borrow pits have been sought in order to reduce the need to transport large quantities of aggregate to the site.

2.128 Potential borrow pit locations that have been identified are at NGR NN 87682 01510 and NGR NN 87930 03306. Borrow pit locations have been selected to avoid areas of deep peat and high quality habitats, maintain a stand off distance of at least 50m to watercourses, and to try and minimise landscape and visual effects.

2.129 Further intrusive geotechnical investigations would be carried out to identify which of the borrow pits would yield the required quality of rock for each aspect of the infrastructure. It is not anticipated that any more than two borrow pits would be needed.

Temporary Construction Compounds

2.130 Three temporary construction compounds are proposed, one would be located at the north of the site (TCC1)at NGR NN 86202 06111, one in the west of the site (TCC2) at NGR NN 87060 01816 and the final in the centre of the site (TCC3) at NGR NN 87938 01818. These locations are considered appropriate as they:

- have appropriate topography;
- are located in areas of shallow peat and low peat slide risk; and
- avoid sensitive habitat areas.

Substation Compound

2.131 The proposed substation compound would be located to the north of the turbine area at NGR NN 86227 06321. The location is considered appropriate as it:

- has appropriate topography (slope);
- is located in an area of shallow peat and low peat slide risk;
- avoids sensitive habitat areas;
- is at a lower elevation than the proposed wind turbines and as such less visible to surrounding settlements and other key viewpoints; and
- is adjacent to the existing road.

2.132 The substation compound is located greater than topple distance from the proposed turbines. The internal site grid connection cables would be undergrounded within the site from each turbine to the control building, therefore avoiding visual impact. **Figure 2.8** shows a ZTV for the proposed substation compound (the equipment / buildings within the substation compound have varying heights, so for the purposes of the ZTV an indicative height of 5m has been used).

Micrositing

2.133 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 sought that the consent includes provision for a 50m micrositing allowance around wind turbine infrastructure. The technical assessments (presented in **Chapters 7** to **14**) have considered the potential for horizontal micrositing and it is considered that the proposed infrastructure could be microsited within 50m (except within watercourse buffers) without resulting in potential significant effects, except where notable deep peat is identified. During construction, the need for any micrositing would be assessed and agreed with the onsite Environmental Clerk of Works.

Conclusion

2.134 The design process has been an iterative one, so that constraints identified throughout the EIA and layout design process could be avoided, and potential impacts from the proposed development avoided or reduced. Various economic, technical, and environmental considerations were established by a combination of baseline surveys, assessment, and consultation with stakeholders.

2.135 The final layout of the proposed development is described in detail in **Chapter 3: Description of Development** and shown on **Figure 3.1**.

2.136 The assessment of potential impacts of the resulting layout is addressed in **Chapters 7** to **14** of the EIA Report.