Chapter 3: Site Selection and Design Strategy

Chapter 3
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Introduction

3.1 This chapter provides details of the approach that has been taken to design Loch Liath Wind Farm (the 'Proposed Development'). Details of how and why the turbine layout and associated infrastructure have been modified during the iterative Environmental Impact Assessment (EIA) process are provided to explain how the Proposed Development described in **Chapter 4: Project Description** was designed. This chapter also outlines the Site selection process that was undertaken by Loch Liath Wind Farm Ltd ('the Applicant') in identifying the Site as a suitable location for a wind farm. The chapter therefore considers the 'reasonable alternatives' which were considered by the Applicant in designing the Proposed Development, as required in The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (hereafter referred to as 'the Regulations') , including why the application layout was chosen, taking account of environmental effects[1].

3.2 The key design changes are illustrated on **Figure 3.1a-3.1f**, and specific examples of changes made to the design are also illustrated on images within the text below. It should be noted that the information presented within this chapter is intended to provide illustrative examples of the changes made to the Proposed Development through the extensive design work undertaken and is not an exhaustive list. It provides a 'snapshot' of the design work undertaken and the numerous modifications made to the layout in light of the constraints onsite which were identified as the EIA progressed, and which were discussed by the relevant members of the team at a number of design workshops throughout the EIA process.

3.3 The chapter should also be read with reference to the **Design and Access Statement** which is provided in support of the application for the Proposed Development.

Site Selection and Design Strategy

Site Characteristics

3.4 The Site has a number of key characteristics which the Applicant considers make it suitable for a wind farm, including:

- The Site has an excellent wind resource and is available for wind energy development;
- The Site is not covered by an international or national designations for landscape or nature conservation[2];
- There is no forestry within the Site and no felling is required;
- Knowledge of the Site's conditions show that there are no key environmental constraints that would preclude development, or which cannot be avoided through design;
- The size of the Site allows for opportunities to explore and provide habitat management and enhancement, particularly for degraded peatland habitats thus also providing carbon sequestration benefits. Further details are set out in **Appendix 8.5: Outline Restoration and Enhancement Plan (OREP)**;
- The closest turbines are located approximately 5 kilometres (km) from the nearest residential receptors thereby avoiding unacceptable noise and residential visual amenity effects;
- The closest settlement to the Site is Invermoriston, which is approximately 7km south of the closest turbine (there is, however no visibility of the Proposed Development from Invermoriston; the closest settlement with visibility of the Proposed Development is Balnain, at a distance of approximately 8.5km to the north and north-east of the closest turbine;
- The immediate surrounding landscape is, in part, defined by the existence of the operational Bhlaraidh Wind Farm to the south-west, and the consented Bhlaraidh Wind Farm Extension to the south;
- There are no planning policies which, in principle, preclude wind energy development on the Site;
- There is a feasible grid connection available, as advised by the network operator SSEN. The grid connection will be the subject of a separate application by SSEN; and
- The Site is accessible for construction traffic and turbine deliveries, and benefits from use of an existing access which serves the operation Bhlaraidh Wind Farm, and which will also be used for construction of the consented Bhlaraidh Wind Farm Extension. This has the benefit of substantially reducing the extent of new infrastructure required for the Proposed Development.

Planning Policy Context

3.5 National Planning Framework 4 (NPF4) was approved by the Scottish Parliament on 11th January 2023, and was adopted and published on 13th February 2023. However, the Site selection exercise was undertaken under the planning policy in force at the time (i.e. Scottish Planning Policy (SPP) (June 2014)) which provided support for wind development in principle, and encouraged local authorities to guide development towards appropriate locations within their boundaries. Paragraph 161 of SPP highlighted the requirement for planning authorities to define a *"spatial framework identifying those areas that are likely to be most appropriate for onshore wind farms"* based on the following criteria (set out in SPP Table 1, Page 39):

- Group 1: Areas where wind farms will not be acceptable.
  - National Parks and National Scenic Areas.
- Group 2: Areas of significant protection.
  - Recognising the need for significant protection, in these areas wind farms may be appropriate in some circumstances. Further consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation.
  - Group 2 areas include World Heritage Sites; Natura 2000 and Ramsar sites; Sites of Special Scientific Interest; National Nature Reserves; Sites identified in the Inventory of Gardens and Designed Landscapes; Sites identified in the Inventory of Historic Battlefields; areas of wild land as shown on the 2014 Scottish Natural Heritage (SNH) map of wild land areas; carbon rich soils, deep peat and priority peatland habitat; and an area not exceeding 2km around cities, towns and villages identified on the local development plan.
- Group 3: Areas with potential for wind farm development.
  - Beyond groups 1 and 2, wind farms are likely to be acceptable, subject to detailed consideration against identified policy criteria.

3.6 SNH's (now NatureScot) Guidance 'Siting and Designing Wind Farms in the Landscape' (2017)[3] states that *"Developers and those involved in wind farm design should also refer to the Spatial Frameworks being developed by planning authorities in response to Scottish Planning Policy (SPP). When considering an individual application, the adopted development plan, relevant supplementary guidance, wind energy capacity studies and SPP provide the framework within which the application should be considered"*.

3.7 The Highland Council (THC)'s Onshore Wind Energy Supplementary Guidance was adopted in November 2016. This sets out the Council's spatial framework for onshore wind development in accordance with the requirements of SPP. As indicated within the Supplementary Guidance, the Spatial Framework contains information on the requirements for safeguarding areas concerning onshore wind energy development. The Proposed Development Site is a combination of Group 2, requiring significant protection due

[1] As required by Regulation 5. (2) (d), the EIA Report must include *"a description of the reasonable alternatives studied by the developer, which are relevant to the development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment"*. Also set out in Part 2 of Schedule 4 of the Regulations.

[2] The access is located through an area of Ancient Woodland Inventory (AWI), however this is an existing access which has been used for construction and operation of the existing Bhlaraidh Wind Farm (and which will be used for the consented Bhlaraidh Wind Farm Extension). As no works are required in this location, and no felling required, there will be no direct or indirect effect on the AWI designation.

[3] Scottish Natural Heritage (2017) Siting and Designing Windfarms in the Landscape (Version 3a)

to the presence of carbon-rich soils and priority peatland habitat and Group 3 which describes land that has potential for wind farm development as noted above.

3.8 In line with the identification of the Site as a Group 2 area under the now superseded SPP, the presence of peat and peatland habitat has formed a key consideration in the design process as detailed further below. However, it is considered that by avoiding deeper peat areas through the design, by application of embedded mitigation and good practice during construction, and by implementation of the measures detailed in the OREP (**Appendix 8.5**), significant effects on peat can be largely overcome (see **Chapter 7: Geology, Hydrology, Hydrogeology and Peat**).

3.9 It should also be noted that Policy 5 c) ii) of NPF4 explicitly supports renewable energy on peatland, carbon rich soils and priority peatland habitat for *"The generation of energy from renewable sources that optimises the contribution of the area to greenhouse gas emissions reductions targets"*. The Policy goes on to set out the requirements of assessments for development on peatland, all of which have been undertaken for the Proposed Development (i.e. identifying the baseline depth, habitat condition, quality and stability of carbon rich soils; identifying the likely effects of the Proposed Development on peatland, including soil disturbance; and identifying the effects on climate emissions and loss of carbon). These aspects are considered within **Chapter 7** and **Chapter 14: Other Issues**.

3.10 It should be noted that, in relation to NPF4, the Site is not located within either a National Park or National Scenic Area, which are the only areas where NPF4 states explicitly that proposals for wind farms will not be supported (Policy 11). Further details in relation to the planning policy context associated with the Proposed Development are set out in **Chapter 5: Statutory and Policy Framework**. Compliance with planning policy is discussed in the Planning Statement which accompanies the application for consent.

The Design Strategy

3.11 The design strategy sets out the overall approach to the progression of the design of the Proposed Development. It describes the starting point of the Proposed Development's design, and subsequent alterations to the layout that were made in response to environmental constraints, particularly landscape and visual, peat and hydrological, ecological, ornithological, wind yield and ground condition considerations, as information emerged through the EIA process.

3.12 The design strategy for the Proposed Development aimed to provide a balance between achieving the maximum energy yield possible from the Site and creating a layout which relates to the landform and scale of the Site and surrounding area, and has a positive relationship with the adjacent operational Bhlaraidh and consented Bhlaraidh Extension Wind Farms.

3.13 The starting point for the design was to maximise the potential output from the Site, which was then subsequently informed by landscape and visual considerations, therefore considering landform, scale, land use (including cumulative wind farm context) and key visual receptors. These factors will influence how the Proposed Development will be perceived by people within the surrounding area, and to what extent the landscape is capable of accommodating the Proposed Development (including in comparison with the adjacent operational and consented wind farms). The design strategy also comprised a number of design objectives which are set out below. The design of the Proposed Development has aimed to meet the guidance contained within NatureScot's Siting and Designing Wind Farms in the Landscape[3], as far as possible.

3.14 During each design iteration, careful consideration was given to minimising effects on environmental features, whilst maximising renewable energy generation potential of the Site and maintaining the objectives of the design strategy.

The Site and Surrounding Area

3.15 The Site occupies an upland area to the west of the Great Glen and Loch Ness, with Glen Urquhart to the north and Glen Moriston to the south. The area where the turbines are proposed comprises undulating upland moorland plateaux with rocky outcrops and upland lochans. There are numerous steep-sided rocky hills in the surrounding area, including Meall Fuar-mhonaidh, the summit of which is approximately 7km east of the closest turbine of the Proposed Development (699m Above Ordnance Datum (AOD)), a popular hill with local walkers, from which views of the Great Glen are afforded to the north-east, east and south-east. Mixed woodland and coniferous forestry are found adjacent to the northern and south-eastern boundaries of the Site and extend onto the glen sides.

3.16 Key transportation routes located near the Site include:

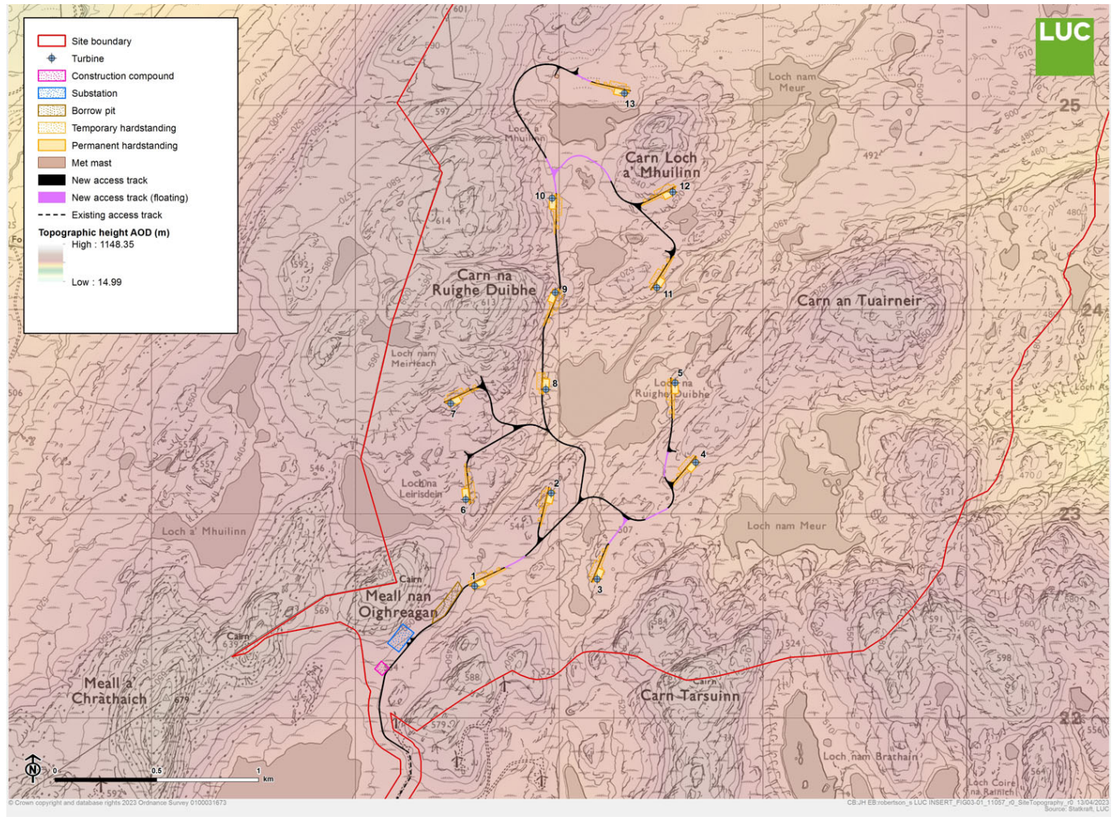
- The A831 passing through Glen Urquhart which is over 5km to the north of the closest turbine;
- The A887 to the south, from where the access to the Site will be taken;
- The A82 running alongside the western shore of Loch Ness within the Great Glen approximately 6.1km to the east of the nearest turbine; and
- The B862, which follows the eastern shore of Loch Ness approximately 10.9km to the east of the closest turbine.

3.17 Settlements nearby are generally located within the glens and adjacent to key communications corridors, with the closest settlements to the Site, as noted above, comprising Invermoriston (approximately 7km to the south of the closest turbine), Balnain (approximately 8.5km to the north of the closest turbine) and Drumnadrochit (approximately 13km north-east of the closest turbine). A number of small clusters of residential properties are found scattered along the glens to the north, east, south and north-west.

3.18 As noted above, a number of wet, peat depressions and deep peat and priority peatland habitat are present within the Site. The NatureScot Carbon and Peatland mapping indicates the majority of the Proposed Development lies mostly in Class 1 and Class 5 peat with some Class 2 peat in the extreme west, east and south and some mineral soils in the southern area. The NatureScot Carbon and Peatland map is shown on **Figure 7.3** and the topography of the Site is shown on **Image 3.1**.

3.19 There are a number of hydrological features within the Site. The northern and the western parts of the Site drain northwards via several watercourses including Allt Seanabhaile and Loch Meiklie to the River Enrick which discharges to Loch Ness at Drumnadrochit. The east and central part of the Site drains via numerous watercourses to the River Coiltie which also discharges to Loch Ness at Drumnadrochit. Some minor areas in the south-east of the Site drain south to Allt Saigh which discharges to Loch Ness at Alltsigh. Loch Ness lies to the east of the Site within the Great Glen and receives all Site waters and drains north to the River Ness and enters the North Sea at Inverness.

Image 3.1: Site Topography



The 'Do-Nothing' Scenario

3.20 The 'do-nothing' scenario can be considered as the existing conditions, taking account of only clearly foreseeable changes over the lifespan of the Proposed Development. Effects have been assessed relative to this baseline. It is accepted that the baseline conditions will gradually alter through time as a result of climate change which has the potential to alter the landscape and species of flora and fauna which are currently found within and around the Site. If the Proposed Development does not proceed, it is reasonable to assume that the management of the Site will continue as present, i.e. largely an area of upland moorland used for grazing and occasional recreational shooting.

Objectives of the Design Strategy

3.21 The objectives of the design strategy were to develop a layout:

- Which maximises the potential energy yield of the Site whilst ensuring a cohesive and sensitive layout which will be legible from key views in the surrounding area where there is visibility of the turbines;
- Which would minimise potential effects on Glen Urquhart and sensitive visual receptors located in the Glen;
- Which when seen alongside the operational Bhlaraidh turbines minimises the spread of turbines across the horizon from key viewpoints, in particular Meall Fuar-mhonaidh and the B862 Suidhe scenic viewpoint;
- Which minimises the horizontal extent and prominence of turbines in views from the Glen Affric NSA;
- Which reflects the established pattern of wind farm development in the Study Area, and the immediately adjacent Bhlaraidh Wind Farm and consented Bhlaraidh Wind Farm Extension, as well as being coherent in its own right;
- Which includes access tracks that utilise existing roads and tracks wherever possible, and which have been designed in such a way that they avoid steep terrain, and maximise screening through existing landform and vegetation to minimise visibility of these components; and
- Which fulfils the above objectives whilst respecting other environmental and technical constraints including ecological, ornithological; hydrological and ground conditions (including peat) related constraints identified during the EIA process.

3.22 During the design process, computer modelling was used as a tool to aid design. In particular, Zone of Theoretical Visibility (ZTV) models were generated and used to aid understanding of potential visual effects, including cumulative visual effects of the Proposed Development with other wind farms within the surrounding area. Wireframes were generated to illustrate views from key locations around the Site and to illustrate the cumulative effects with other nearby wind farm developments. Wireframes were also generated alongside photomontage visualisations to illustrate changes to views. Photomontages involved overlaying computer-generated perspectives of the Proposed Development over the photographs of the existing situation to illustrate how the views will change against the current baseline.

3.23 The main components of the Proposed Development considered in the initial design iterations were the turbines. The location of other infrastructure components was largely dictated by the positioning of the turbines, and designed around onsite environmental constraints. Later iterations to the turbine layout, following detailed engineering review, involved further alterations to turbine and infrastructure locations, which were reviewed against all constraints. For example, opportunities were taken to re-position turbine hardstandings and access tracks away from areas where detailed peat probing has identified deeper peat deposits, to reduce the likelihood of peat disturbance onsite.

Site Design Principles and Constraints

3.24 As part of the design strategy, a number of environmental characteristics have been identified as key environmental considerations during the EIA process and have led to the evolution of the application design layout. This has been informed by site surveys, consultation and the experience and professional judgement of the Applicant and the EIA team. The key constraints identified from an early stage included:

- Key landscape and visual considerations as noted above in relation to the overall design strategy;
- Hydrology, including distance to watercourses (maintaining a 50 metres (m) buffer where possible);
- Peat (avoiding deeper (>1m, and ideally >0.5m) peat where possible);
- Ornithology, including maintaining a 'corridor' for red throated divers flying between breeding and feeding lochs. The turbine layout has also been informed by the results of Golden Eagle Topographical (GET) modelling for golden eagle which nest nearby;
- Ecology, including avoidance of deeper areas of peat which generally correlate with more sensitive habitats, and subsequently avoiding particular features of interest as identified through survey;
- Cultural Heritage, including considering intervisibility with key assets in terms of their setting;
- Noise, including the presence of two bothies located within the wider landholding within which the Site is located, and which previously were located within the Site which has since been reduced. From an early stage a 1km buffer was applied to these bothies and they are no longer within the Site; and
- Engineering and construction considerations, including seeking to reduce the need for significant cut and fill works where possible.

3.25 Once the Site was established as a potential location for a wind farm, it was identified at an early stage as having a number of topographical and environmental sensitivities which had to be balanced to develop a layout that is environmentally sensitive, suitable from a construction perspective, and which remains economically viable. Some of the key constraints and considerations which fed into the design process are detailed below, including an explanation of where some compromises had to be made to design a viable scheme. It should be noted that this information is simply intended to provide some illustrative examples of the changes made to the Proposed Development through the extensive design work undertaken and is not an exhaustive list and, as noted above, is intended to provide a 'snapshot' of the detailed design work undertaken throughout the EIA process.

Landscape and Visual Amenity

3.26 As noted above, the landscape and visual effects formed a key element of the design process. A key theme of the design workshops was to minimise potentially significant landscape and visual effects of the Proposed Development and consultation was undertaken with both The Highland Council (THC) and NatureScot as the design of the project evolved. In particular, this has resulted in the removal of turbines in the most northerly part of the Site to minimise visibility from Glen Urquhart, setting turbines back from the western boundary of the Site to minimise the prominence of turbines in views from Glen Affric, and care has been taken to minimise the horizontal spread of turbines when seen from Meall Fuar-mhonaidh and the B862 Suidhe scenic viewpoint.

3.27 To illustrate the changes that were made to the design of the Proposed Development and how this relates to potential effects on landscape and visual amenity, comparative wireframes are provided at the end of this chapter for three of the key layouts detailed below (Layout 1 (Scoping, 26 turbines), Layout 4 (layout presented to NatureScot and THC in November 2021, 17 turbines) and Layout 6 (Design Freeze, 13 turbines) (**Images 3.7a-c** to **3.11a-c**).

3.28 The wireframes demonstrate how the design has evolved and sought to minimise effects on views from Glen Urquhart, reduce the spread of turbines when seen from key viewpoints including Meall Fuar-mhonaidh and the B862 Suidhe scenic viewpoint, and reduce the spread and prominence of turbines in views from Glen Affric and are presented from the following five key viewpoints (VPs) which are assessed in detail in **Chapter 6: Landscape and Visual Amenity**[4]:

- VP1: Affric Kintail Way near Braefield;
- VP2: Meall Fuar-mhonaidh;
- VP3: Balbeg;
- VP5: Coire Loch Trail, Glen Affric; and
- VP8: B862 Suidhe Viewpoint.

[4] In addition to the wireframes provided in support of this chapter, wireframes and photomontages for the application layout of the Proposed Development are also provided for each of these viewpoints in **Chapter 6**.

Peat

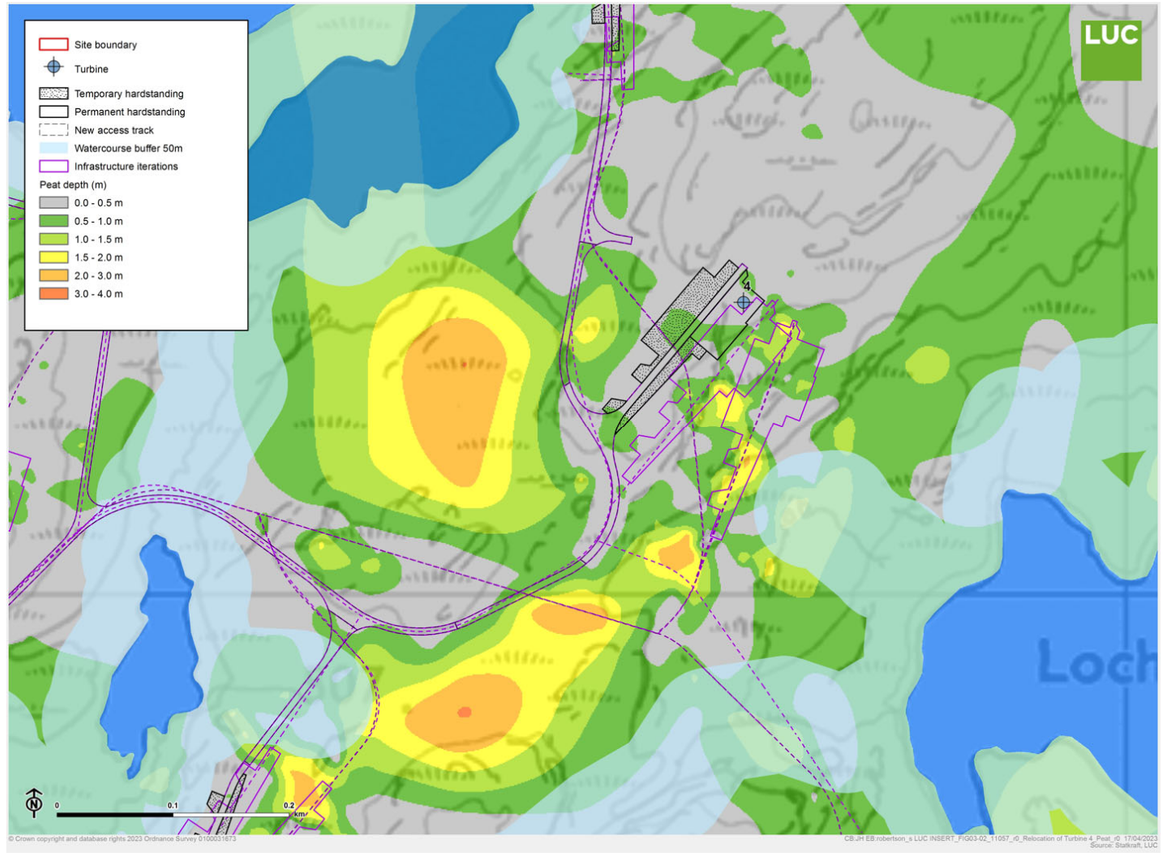
3.29 Phase 1 and Phase 2 Peat surveys were undertaken across the Site and at the infrastructure locations in line with good practice guidance[5]. Areas of deep peat (greater than 1m deep, and where possible greater than 0.5m) were avoided for siting turbines and associated infrastructure where feasible, although this has not been possible at all infrastructure locations due to the variability in peat depths and the need to consider other constraints. **Figure 7.9** in **Chapter 7** shows the design freeze layout overlaid on the peat depth data that was collected across the Site.

3.30 Extensive design work was undertaken to optimise the layout for peat, including dropping turbines, realigning tracks, flipping hardstandings, reducing the extent of hardstanding area and, following further site surveys, micrositing turbines and infrastructure to avoid small bog pools of hydrological and ecological interest.

3.31 **Image 3.2** below shows T4 overlaid on the peat data, illustrating how the design has changed to minimise effects on peat following detailed Phase 2 peat probing surveys illustrating where the hardstanding has been rearranged over several design iterations. The final design freeze layout is outlined in black, with previous iterations shown in purple. Another example is provided in **Image 3.3** below which shows how T3 has been designed to respond to the peat data that emerged through the surveys. This also illustrates how changes were made at the same location to benefit the water environment by removing infrastructure from the 50m watercourse buffer to the west.

3.32 In addition to undertaking peat probing, the peat surveys sought to identify areas of eroded and hagged peat located close to the infrastructure which will benefit from reprofiling and where excavated peat can be reused to seek to improve these areas, and provide an environmental benefit and enhancement as part of the Proposed Development. Further details are set out in the OREP which is provided as **Appendix 8.5**. This identifies measures to benefit peat and habitats as well as ornithology and other ecological protected species.

Image 3.2: Relocation of Turbine 4 Infrastructure for Peat Depth



[5] Scottish Government, Scottish Natural Heritage and SEPA (2017) Peatland Survey. Guidance on Developments on Peatland [pdf]. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2018/12/peatland-survey-guidance/documents/peatland-survey-guidance-2017/peatland-survey-guidance-2017/govscot%3Adocument/Guidance%2Bon%2Bdevelopments%2Bon%2Bpeatland%2B-%2Bpeatland%2Bsurvey%2B-%2B2017.pdf

Image 3.3: Relocation of Turbine 3 Infrastructure for Peat Depth and Watercourse Buffers

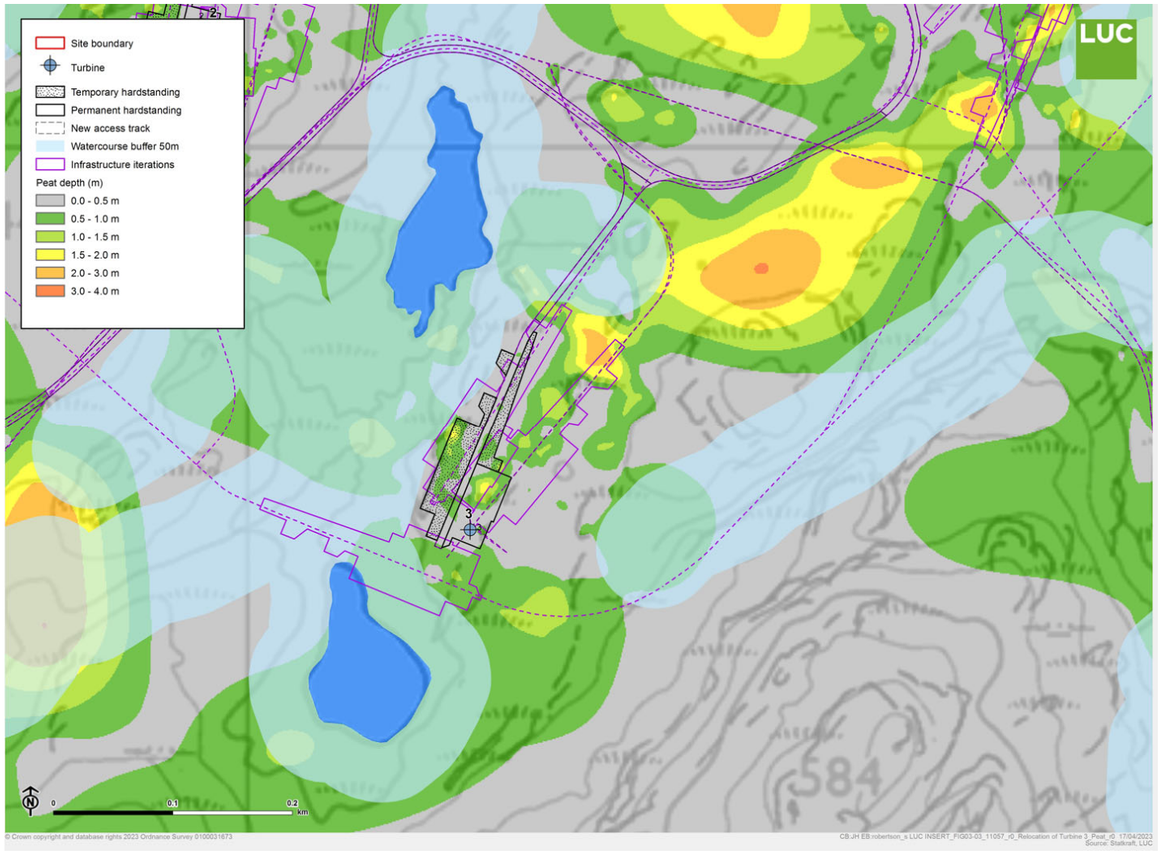


Image 3.4: Layout of Hardstanding at T8 Compared with Typical Hardstanding Layout at T7

Hydrology

3.33 All watercourses were mapped and 50m buffers applied to those shown on 1:50,000 and 1:25,000 OS mapping and design of the Proposed Development has sought to avoid encroaching into these where possible, with the exception of watercourse crossings (details of which are provided in **Appendix 7.5: Watercourse Crossing Inventory**). At T8, to avoid encroaching into a tributary of Loch na Ruighe Duibhe, the extent of the temporary hardstanding has been reduced as illustrated on **Image 3.4** below, with T7 also shown to provide a comparison with a 'standard' hardstanding.

3.34 There are a small number of locations where it has not been possible to maintain the 50m buffer for all infrastructure due to the presence of other constraints on the Site; these locations are detailed in **Chapter 7**. Whilst no significant effects are identified on hydrology during construction or operation of the Proposed Development, good practice mitigation is proposed to protect the watercourses as detailed further in **Chapter 7**.

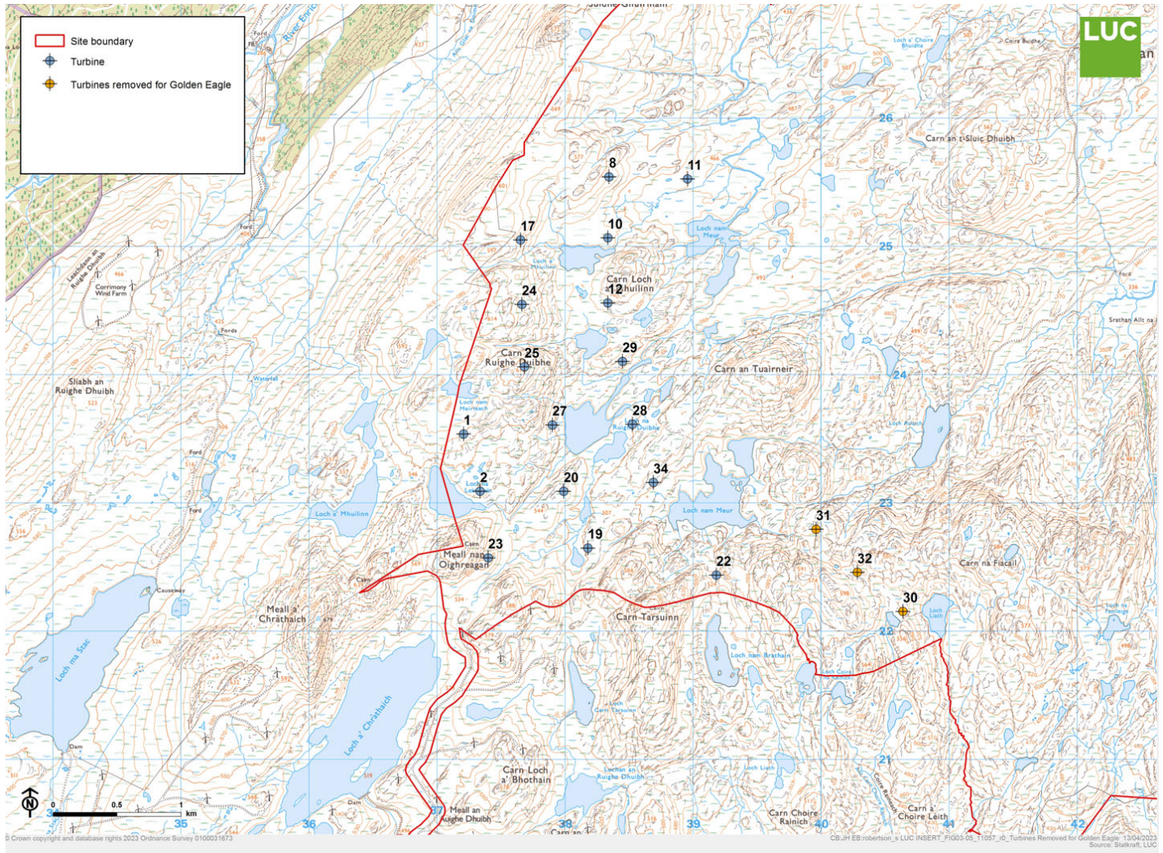
Ornithology

3.35 Ornithological surveys were undertaken between September 2019 and August 2021 including flight activity surveys, upland breeding bird surveys, breeding raptor surveys, breeding diver and Slavonian grebe surveys and black grouse surveys. As a result of early findings from these surveys, changes were made to the layout to allow a 'corridor' to be maintained for red throated divers flying between breeding and feeding lochs, and based on the findings of initial GET modelling, several turbines were dropped and the layout was refined for golden eagle, which are also known to nest nearby. This included the removal of three turbines from Layout 3 which formed a 'string' at the east of the Site as described further below and as illustrated on **Image 3.5**.

3.36 Whilst identified as being present in the ornithology survey area, no changes were needed to the layout to avoid black grouse leks or their associated protection buffers, and potential effects on Slavonian grebe were scoped out of detailed assessment as agreed with NatureScot in June 2021 (and subsequently confirmed with the Royal Society for the Protection of Birds (RSPB)).

3.37 Full details of the bird surveys and findings are provided in **Chapter 9: Ornithology**, with confidential information on breeding bird locations provided to NatureScot, RSPB and the Energy Consents Unit (ECU) only. The OREP includes measures to benefit ornithology, including provision of diver rafts and planting of woodland, and a detailed proposal has been prepared for golden eagle monitoring as set out in **Appendix 9.5: Regional Eagle Conservation Management Plan**.

Image 3.5: Turbines Removed for Golden Eagle



Ecology

3.38 Habitat and protected species surveys were undertaken which found extensive heathland and blanket bog habitats throughout the survey area. The most notable protected species recorded was water vole, evidence of which was recorded associated with watercourses and lochans throughout. In addition, there was a single sighting of a badger within the Site, and a camera trap recorded otter on one occasion and pine marten on two occasions; however these were incidental sightings outside the Ecological Study Area (ESA) and, as detailed further in **Chapter 8: Ecology**, no protected sites (e.g. holts, dens or setts) were recorded.

3.39 Siting of turbines, including hardstanding, avoids the deeper areas of peat, which generally correlate with more sensitive habitats, and infrastructure has been moved to avoid bog pools of ecological and hydrological interest where possible. As upland water voles exist as metapopulations, with local colonisations and extinctions in response to unpredictable events (such as predation or storms), it is not possible to design the siting of infrastructure to minimise effects. However, as noted above, a 50m buffer has been maintained from all lochs, and watercourse crossings are limited wherever possible.

Cultural Heritage

3.40 Within the Site there are limited known assets of cultural heritage significance as confirmed by field survey. The survey confirmed the presence of three modern memorial cairns which commemorate the lives of John Ferguson, who died while fishing in Loch nam Meur, and Russel Cameron who died in 2002, while the third was erected in 1996 in remembrance of the 17th century battle of Carn Mharbh Dhaoine. These are outside the Site Boundary and will not be affected by the Proposed Development.

3.41 In terms of potential effects on setting, several designated assets were identified at an early stage of the design as having the potential to experience effects. However, design changes responding to this means that there will be less potential interaction between the Proposed Development the setting of these assets and a number of visualisations have been provided to accompany the assessment of effects on cultural heritage, which are included in **Appendix 10.1** of the EIA Report and which have been discussed and agreed with historic Environment Scotland (HES).

Engineering and Construction Considerations

3.42 The Site comprises varying topography with some areas of steep slopes. Therefore careful consideration has been given to the engineering constraints associated with the design, and the constructability of the Proposed Development. This has included designing infrastructure to reduce the need for significant cut and fill engineering works and, where possible, designing tracks to follow the contours of the Site. Several areas of 'floating' track have been identified to minimise the amount of peat excavation required, where peat depths are continuously over 0.5m. The location of the floating tracks is shown on **Figure 4.1**.

Site Infrastructure

Turbines

Turbine Scale

3.43 It is recognised by the Scottish Government that there is a pressing need to produce considerably more energy from renewable sources. As such, there is a need to plan for considerably larger scale wind energy development, as well as other forms of renewable energy. With the need to 'think big', comes the need to think where development of such a scale could be accommodated. In addition, the scale of the Proposed Development's turbines has been dictated partly by the size of turbines available to be obtained from manufacturers, who are producing larger turbines in line with advances in technology.

3.44 As noted above, consideration has also been given to the pattern of development and the scale of the other wind farms proposed in the wider area, including at the adjacent Bhlaraidh Wind Farm Extension, which has been consented at maximum blade tip height of 180m. In this way, the extent of the Proposed Development and the size of turbines has considered the overarching design objective of achieving a positive relationship with other nearby schemes.

Turbine Colour

3.45 SNH guidance[3] states *that "As a general rule for most rural areas of Scotland, a single colour of turbine is generally preferable ...a light grey colour generally achieves the best balance between minimising visibility and visual impacts when seen against the sky ... paint reflection should be minimised ... for multiple windfarm groups or windfarm extensions, the colour of turbines should generally be consistent"*. The turbines proposed for the Proposed Development are to be a non-reflective pale grey colour, to be consistent with adjacent schemes and as per industry standard.

Aviation Lighting

3.46 One of the key considerations form a landscape and visual amenity perspective was designing an appropriate aviation lighting scheme which both satisfies the requirements of aviation policy and reduces the visual effects of such lighting at nearby receptors. Further details on the requirements for aviation lighting are provided in **Chapter 14**, and details of the proposed lighting scheme for the Proposed Development are set out in **Appendix 14.2: Aviation Lighting and Mitigation Report**. In summary, six of the 13 wind turbines are proposed to have medium intensity (minimum of 2000cd) visible lighting mounted on the turbine hubs but no intermediate low intensity lights (32cd) on the turbine towers. Infrared lights (invisible to the naked eye) will be installed on all of the 13 turbines. This reduced lighting scheme has been agreed with the Civil Aviation Authority (CAA) and Ministry of Defence (MoD) through pre-application consultation. Further details on anticipated effects on landscape and visual amenity are set out in **Appendix 6.4: Wild Land Impact Aspect**.

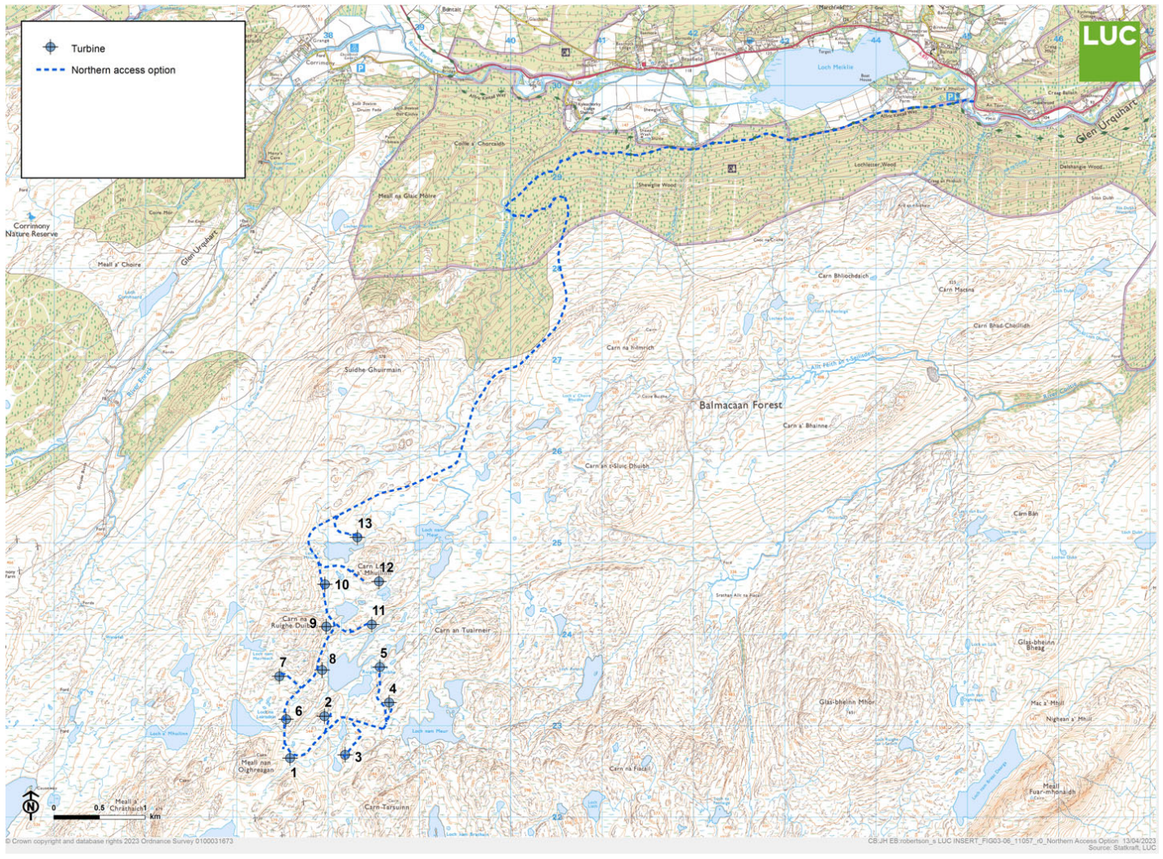
Ancillary Infrastructure

3.47 As noted above, the infrastructure required was designed and arranged in such a way as to avoid the identified onsite constraints. Numerous infrastructure layouts have been progressed as the scheme evolved, with some minor iterations to turbine locations being necessary to facilitate the optimum onsite infrastructure requirements and respond to civil engineering constraints,

such as topography. Access track routes in particular have been designed to minimise watercourse crossings and to avoid constrained areas within the Site, including steep slopes and deeper peat.

3.48 As noted above, a key benefit of the Proposed Development is that it will be accessed using existing access which serves the operational Bhlaraidh Wind Farm, and which will also be used for construction of the consented Bhlaraidh Wind Farm Extension. This has the benefit of substantially reducing the extent of new infrastructure required for the Proposed Development. An alternative access was also considered from the north, partially via the Affric Kintail Way as illustrated on **Image 3.6** below, however following a detailed review by the project team, including field surveys of both access options, the northern access option was dropped due to the increased potential for significant environmental effects when compared to use of the existing Bhlaraidh Wind Farm access from the south, largely as a result of the requirement to construction approximately 11km of additional new access track resulting in greater effects on habitats and peat. The northern access option was also located close to ornithological sensitivities, and partially followed the Affric Kintail Way long distance walking route. Together these considerations would result in greater effects during construction than use of the existing Bhlaraidh Wind Farm access track, which will require only minor surfacing upgrades to accommodate the delivery of the turbine components of the Proposed Development to the Site.

Image 3.6: Northern Access Option



Modifications to Design

3.49 The development of the layout has evolved through a number of design iterations. The process has been summarised as six discrete layout iterations (as can been seen in **Figures 3.1a-f**), although a number of refinements have been made in between which have been subject to careful scrutiny by the project team at a number of design workshops, particularly in relation to engineering, hydrology and peat considerations.

3.50 The layouts presented are:

- Layout 1: 26 turbines up to 200m to blade tip (Scoping Layout) (**Figure 3.1a**);
- Layout 2: 22 turbines up to 200m to blade tip (**Figure 3.1b**);
- Layout 3: 20 turbines up to 200m to blade tip (**Figure 3.1c**);
- Layout 4: 17 turbines up to 200m to blade tip (this layout was presented to NatureScot and THC in November 2021) (**Figure 3.1d**);
- Layout 5: 14 turbines with a mixture of heights 180m/200m to blade tip (**Figure 3.1e**); and
- Layout 6: 13 turbines with a mixture of heights 180m/200m to blade tip (design freeze) (**Figure 3.1f**).

3.51 Wireframes for layouts 1 (Soping layout), layout 4 (17 turbines) and layout 6 (design freeze) are presented below in **Images 3.7a-c** to **3.11a-c** for the five key viewpoints detailed above (i.e. VP1: Affric Kintail Way near Braefield; VP2: Meall Fuar-mhonaidh; VP3: Balbeg; VP5: Coire Loch Trail, Glen Affric; and VP8: B862 Suidhe Viewpoint).

Layout 1: Scoping Layout

3.52 Layout 1, the Scoping layout for the Proposed Development, comprising 26 turbines at a maximum blade tip height of up to 200m, was developed by the Applicant. This was also presented to THC at the pre-application meeting which took place in February 2020. The layout was based largely on technical and operational efficiency criteria e.g. wind yield, but also took into account other known high-level constraints such as buffers on watercourses and included some initial input from the landscape team. This layout represented the 'maximum development scenario' considered to be possible at the Site.

3.53 This layout comprised 26 turbines at a maximum blade tip height of up to 200m, and was designed on the basis that the prevailing wind direction is 240 degree south-westerly.

3.54 Layout 1 (Scoping layout) is presented in **Figure 3.1a**. Illustrative wireframes of this layout are shown below.

Layout 2

3.55 Layout 2 consisted of 22 turbines at a maximum blade tip height of up to 200m and was based on initial feedback from ornithology surveys leading to the removal of four turbines (T13/T14/T18/T21) to ensure provision of a ‘corridor’ for red throated diver movement between lochans within the turbine area as noted above.

3.56 With the exception of two turbines (T5 and T12), the position of all other turbines was refined to take account of initial peat survey data (100m grid), to avoid steep slopes over 15 degrees, and to improve composition from key views. A larger rotor diameter was also assumed in terms of likely candidate turbine.

3.57 Layout 2 is presented in **Figure 3.1b**. Illustrative wireframes of this layout are shown below.

Layout 3

3.58 Layout 3 comprised 20 turbines at a maximum blade tip height of up to 200m and was informed by further data from the ornithology surveys and a detailed review of the layout by the landscape team which resulted in the removal of the most northern turbines from the layout and redesign to reduce visibility and prominence from Glen Urquhart, the Glen Affric National Scenic Area and the Central Highlands Wild Land Area. This layout also sought to address initial feedback received at the first public exhibition which took place between May and June 2021.

3.59 An initial infrastructure design was prepared for this layout, including access tracks, working areas and substation location.

3.60 Layout 3 is presented in **Figure 3.1c**. Illustrative wireframes of this layout are shown below.

Layout 4

3.61 As a result of initial GET modelling for golden eagle, three turbines were removed from the layout in the south-eastern corner of the layout resulting in a 17 turbine layout as described above and illustrated in **Image 3.5**. The 17 turbines were refined to improve

composition from key views (including Meall Fuar-mhonaidh) and was taken forward to further consultation with THC and NatureScot. The hardstanding at T8 was also reduced at this stage to avoid effects to a nearby watercourse, as described above.

3.62 At this stage, two possible options for access to the Site were under consideration, one from the south via the existing Bhlaraidh Wind Farm access (which is being taken forward to the final design) and an alternative from the north, partially via the Affric Kintail Way as described above. The northern access option is illustrated on **Image 3.6** above. This was ultimately discounted on account of the environmental benefits associated with using the existing Bhlaraidh Wind Farm access infrastructure compared with constructing the northern access route.

3.63 Layout 4 is presented in **Figure 3.1d**. Illustrative wireframes of this layout are shown below.

Layout 5

3.64 Following the feedback received from THC and NatureScot a further three turbines were removed from the north of the Site, leaving a 14 turbine scheme. At this stage, the maximum blade tip heights of three turbines was reduced to 180m to seek to reduce visibility and improve composition from key locations including from Glen Affric and to reduce the horizontal extent in the view from Meall Fuar-mhonaidh.

3.65 In addition numerous small changes were made to turbine locations and associated infrastructure to take account of ground conditions as informed by field work, including:

- Compound moved further south, parallel to access track;
- T17 moved to behind hill north of Carn Tarsuinn;
- T13 to be moved approximately 25m west to avoid bog pool;
- T16 adjusted to avoid bog pool;
- Junction to T11/14 moved approximately 30m west to avoid bog pool; and
- Edge of T9 hardstanding to be moved out of bog pool and turning head removed.

3.66 The layout also took account of feedback from Statkraft's wind resource and modelling team including updating the spacing to take account of a revised wind direction (225 degrees south-westerly).

3.67 Layout 5 is presented in **Figure 3.1e**. Illustrative wireframes of this layout are shown below.

Layout 6: Design Freeze

3.68 Following detailed review by the Applicant, and based on advice from the specialist EIA team in relation to constructability and the potential for effects, particularly on landscape and peat and hydrology, the most south-easterly turbine (T17) was removed from the layout, leaving a final design of 13 turbines. In addition, following advice from the hydrology team, and a review by the project engineer and the Applicant, the following design modifications were reviewed, some of which resulted in further minor modifications to the design as noted below:

- Turning head at T14 moved out of deepest peat;
- Track to the north of T10 was noted as being in wet bog and suggested to be moved west by the peat survey team. However, as the track is positioned within the hardstanding, any amendment to the track would require a tweak in the associated hardstanding such that it would ultimately impact on the deeper peat. In addition, the rotation of the hardstanding would mean that it wouldn't run parallel with the contours creating a larger footprint, as such, no changes were made in this location. Sections of the track north and south of T10 will be floated past the junction to T12 and T13 where located on areas of deep peat. Full details of the sections of track to be floated are shown on **Figure 4.1**
- Hardstanding at T12 flipped so the larger area is on lower terrain;
- The hydrology team proposed moving T11 slightly west however it has been situated in this location to minimise impact on peat therefore no changes were made; and
- T2 moved c.10m to east to avoid peat.
- At this stage a final decision was reached on use of the existing Bhlaraidh Wind Farm access, as detailed above.

3.69 Layout 6 (design freeze) is presented in **Figure 3.1f**. Illustrative wireframes of this layout are shown below.

Design Conclusion

3.70 The final layout takes into account the design aspirations outlined above. The Site is complex, with a number of competing technical and environmental constraints which have been considered in the iterative design process, and which have guided the positioning of both turbines and associated infrastructure. The inherent nature of wind turbines as tall, modern structures means that the form of the Proposed Development as a whole is important, and a clear design strategy is necessary. The overall aim of the design strategy was to create a wind farm with a cohesive design that relates to its landscape context (including other schemes) in line with appropriate published guidance, and balanced against the need to minimise potential effects on peat and ornithology in particular. The following key views were considered in the design, and illustrative wireframes from these locations are provided below (the Proposed Development is shown in grey, in the centre of each image):

- VP1: Affric Kintail Way near Braefield (**Images 3.7a-c**);
- VP2: Meall Fuar-mhonaidh (**Images 3.8a-c**);
- VP3: Balbeg (**Images 3.9a-c**);
- VP5: Coire Loch Trail, Glen Affric (**Images 3.10a-c**); and
- VP8: B862 Suidhe Viewpoint (**Images 3.11a-c**).

3.71 A number of iterations were considered throughout the design evolution, to develop a layout that fulfils the overarching objectives whilst maximising energy yield and respecting other technical and environmental constraints including ecological, ornithological, hydrological and ground conditions identified during the consultation and EIA process. The final design freeze layout has been presented to THC, NatureScot and Scottish Environment Protection Agency (SEPA) to explain the rationale for the final design and confirm how issues raised through the consultation process have been addressed. This included detailed follow up discussions with SEPA to clarify why it has not been possible to make further suggested changes to the layout due to competing constraints at the Site, as explained above.

3.72 Overall, the adverse effects of the Proposed Development have been minimised, with the residual significant adverse effects being limited to effects on landscape and visual amenity. The result of the design process is the final application layout, comprising up to 13 turbines not exceeding maximum blade tip heights between 180-200m, with associated ancillary infrastructure, both permanent and temporary, which has been carefully sited and designed to reflect economic, technical and environmental sensitivities.

Illustrative Wireframes from VP1: Affric Kintail Way near Braefield

Image 3.7a: Layout 1: Scoping Layout (26 turbines of up to 200m to blade tip)

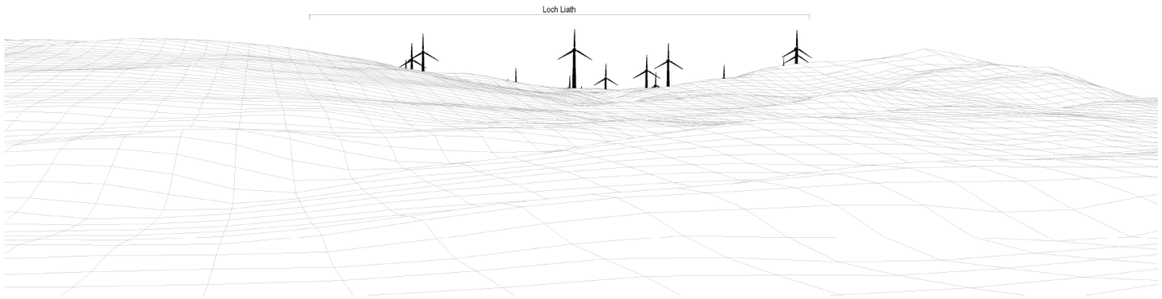


Image 3.7b: Layout 4 (17 turbines up to 200m to blade tip)

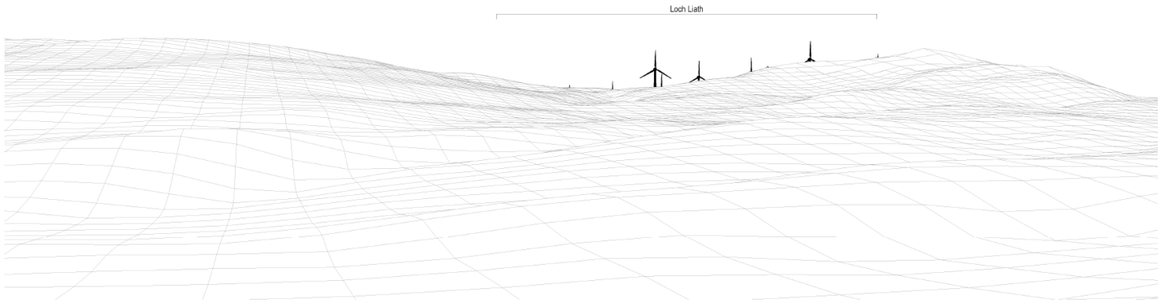
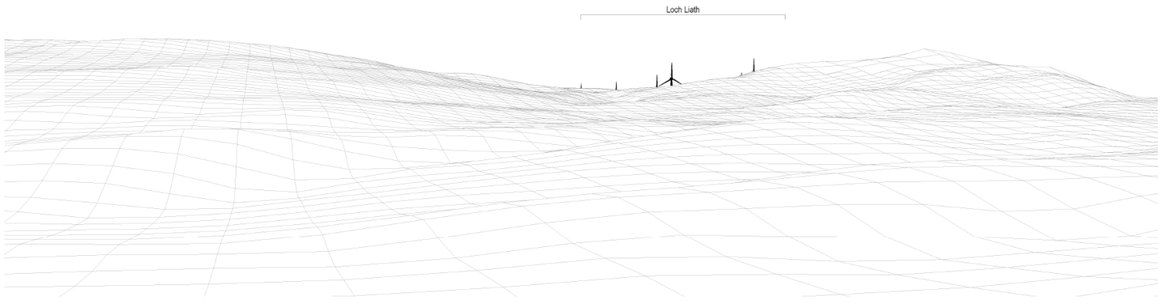


Image 3.7c: Layout 6: Design Freeze (13 turbines with a mixture of heights 180m/200m to blade tip)



Illustrative Wireframes from VP2: Meall Fuar-mhonaidh

Image 3.8a: Layout 1: Scoping Layout (26 turbines of up to 200m to blade tip)

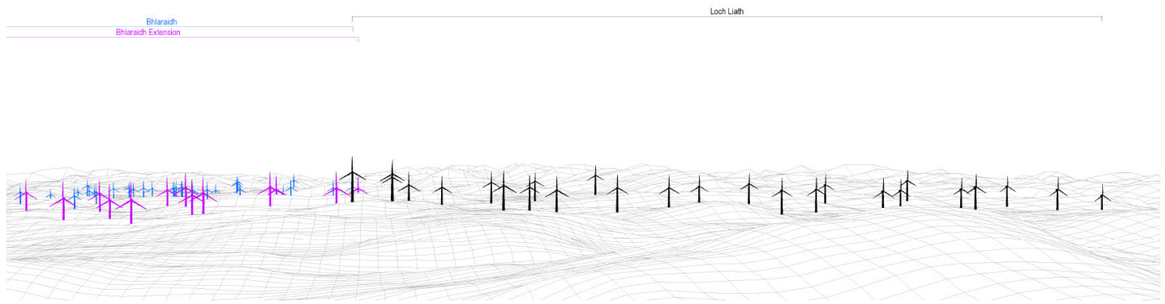


Image 3.8b: Layout 4 (17 turbines up to 200m to blade tip)

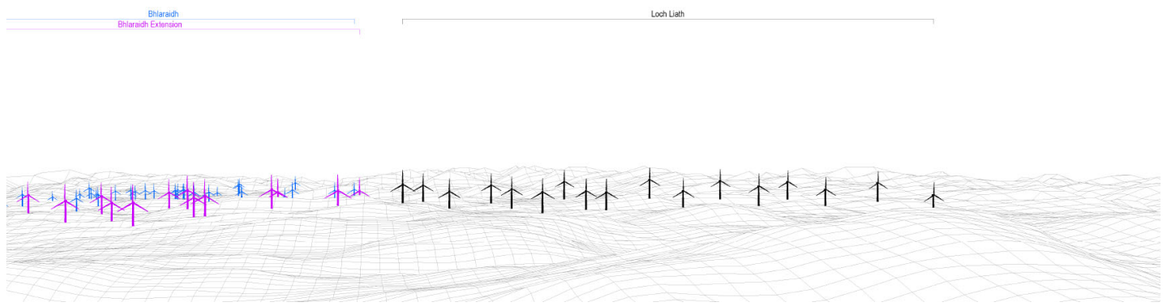
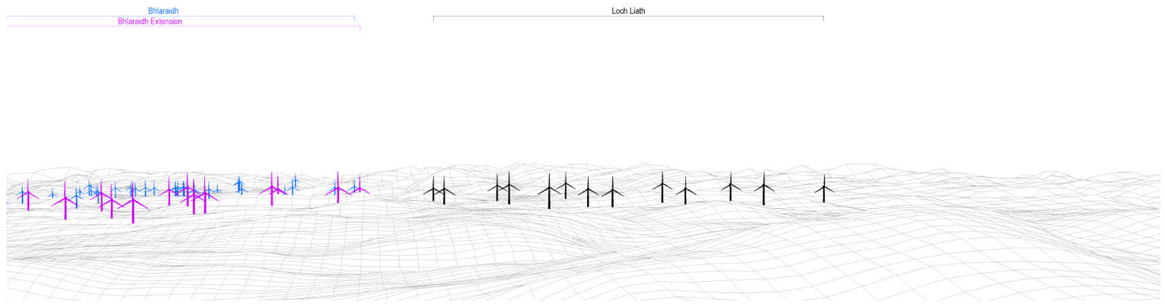


Image 3.8c: Layout 6: Design Freeze (13 turbines with a mixture of heights 180m/200m to blade tip)



Illustrative Wireframes from VP3: Balbeg

Image 3.9a: Layout 1: Scoping Layout (26 turbines of up to 200m to blade tip)

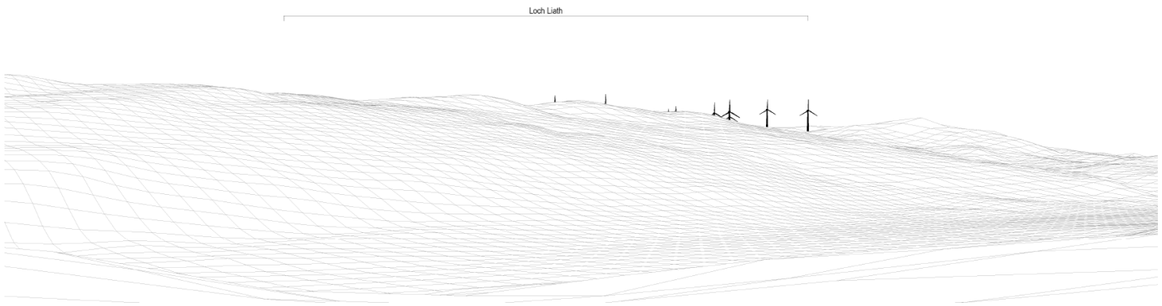


Image 3.9b: Layout 4 (17 turbines up to 200m to blade tip)

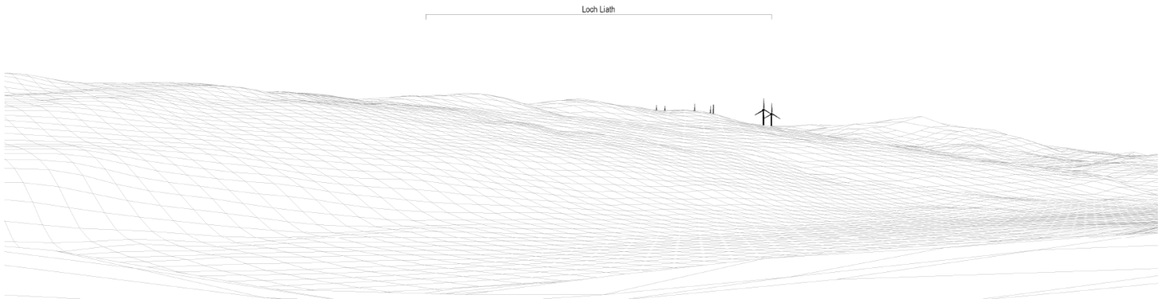
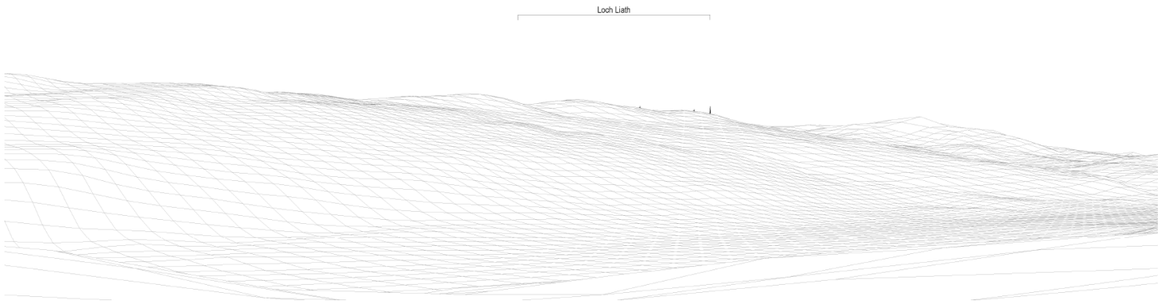


Image 3.9c: Layout 6: Design Freeze (13 turbines with a mixture of heights 180m/200m to blade tip)



Illustrative Wireframes from VP5: Coire Loch Trail, Glen Affric

Image 3.10a: Layout 1: Scoping Layout (26 turbines of up to 200m to blade tip)

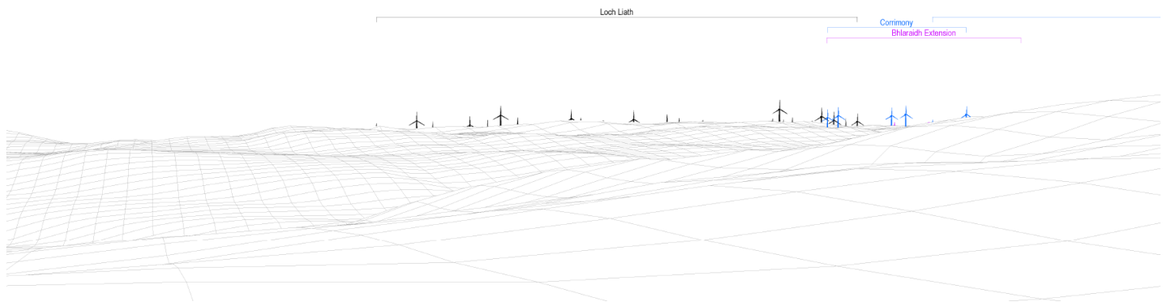


Image 3.10b: Layout 4 (17 turbines up to 200m to blade tip)

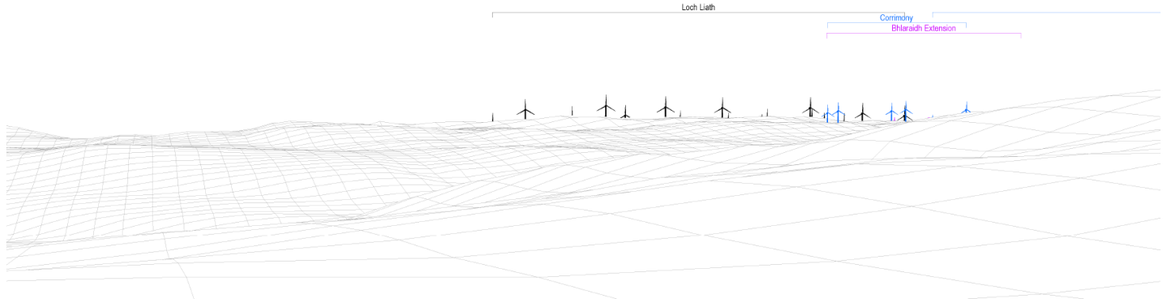
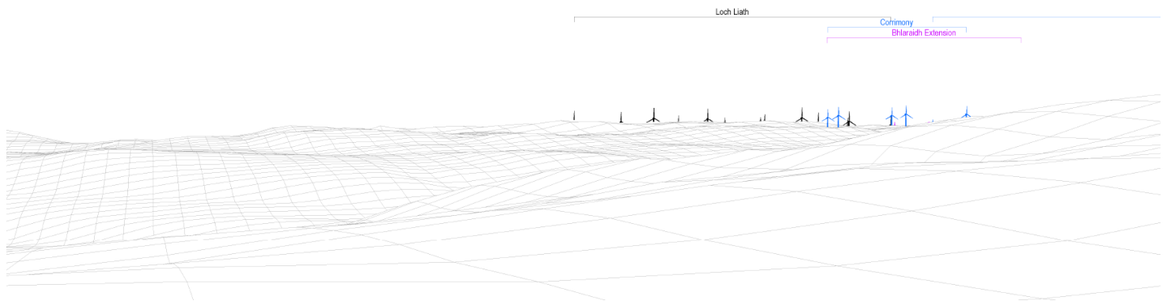


Image 3.10c: Layout 6: Design Freeze (13 turbines with a mixture of heights 180m/200m to blade tip)



Illustrative Wireframes from VP8: B862 Suidhe Viewpoint

Image 3.11a: Layout 1: Scoping Layout (26 turbines of up to 200m to blade tip)

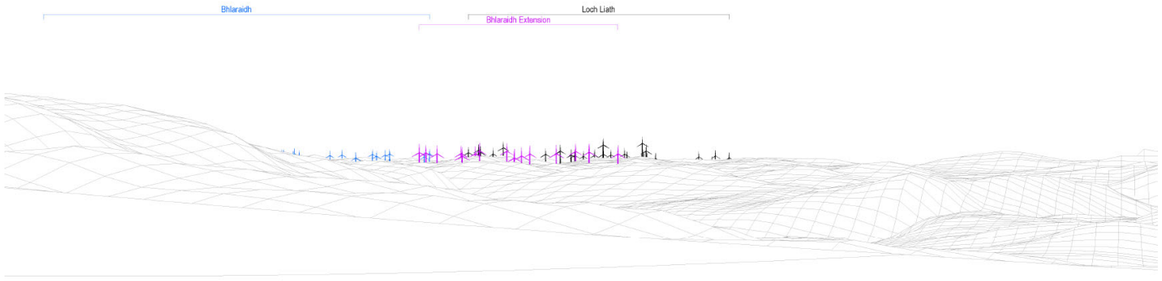


Image 3.11b: Layout 4 (17 turbines up to 200m to blade tip)

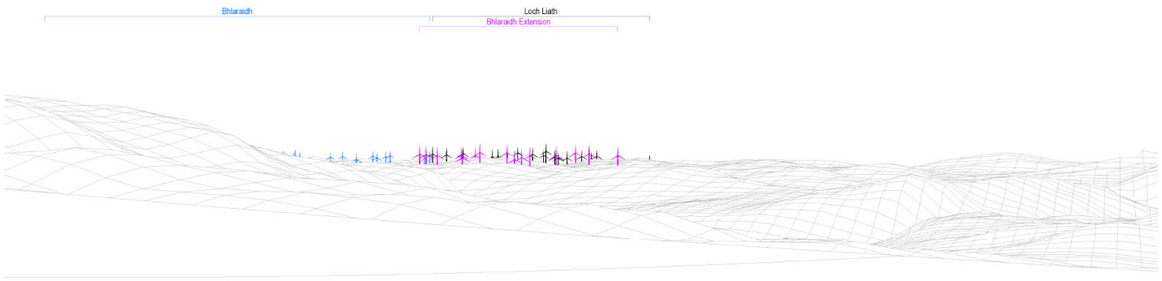


Image 3.11c: Layout 6: Design Freeze (13 turbines with a mixture of heights 180m/200m to blade tip)