2 Design Iteration and Proposed Development

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2 Design Iteration and Proposed Development

2.1 Executive Summary

2.1.1 This chapter provides a description of the site selection process and design iterations that were undertaken prior to arriving at the final design of the Proposed Development.

2.1.2 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 negative impacts have been avoided or minimised as far as reasonably possible.

2.1.3 This chapter draws on issues considered in more detail in the relevant technical chapters (Chapters 5 to 15). This chapter does not pre-empt the conclusions of the later chapters, but rather explains how potential environmental effects have informed the design of the Proposed Development.

2.1.4 The final design of the Proposed Development is then described along with a summary of the associated infrastructure.

2.1.5 A description of the likely activities to occur during the construction, operation and decommissioning phases is also provided.

2.2 Design Iteration

Introduction

2.2.1 This section explores the site selection and explains how the final design of the Proposed Development has evolved.

Site Selection

2.2.2 As an extension to the Applicant's Bhlaraidh Wind Farm (the 'Operational Development'), the Site is well known to the Applicant and they are well aware of the many attributes that make the Proposed Development an excellent wind farm site. Since the adjacent Operational Development (planning reference: 12/02556/S36) was developed in 2017, the Scottish Government has declared a climate emergency and the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 has been passed. The Scottish Government's Energy Strategy (2017) recognises that onshore wind offers the lowest cost renewable technology and is a vital component of the renewables industry in Scotland. This legislation backs the need to consider potential renewable energy developments, including extensions to existing onshore wind farms such as the Operational Development, where these can be sensitively sited.

2.2.3 As part of a portfolio of development across the country, the Applicant looked at their operational sites and identified the land adjacent to the Operational Development to be worth assessing for its potential for development. Initial feasibility studies were undertaken which identified that favourable attributes of the Site include the following:

- can positively contribute towards 2045 net zero emissions target, the climate emergency and the resultant urgent need for more renewable energy development;
- knowledge from the Operational Development survey work suggested no or limited ornithological or ecological impacts would be expected;
- a location with no aviation and radar constraints;
- no forestry or replanting requirements;
- no identified cultural heritage assets (scheduled monuments, battlefields or designed gardens and landscapes) on the Site;

- the Site sits within a single landscape character area, Rocky Moorland Plateau, which is suitable for development;
- the Site is outwith the Highland Council Special Landscape Area – Loch Ness and Duntelchaig;
- an excellent and proven wind resource;
- sufficient grid capacity within the vicinity;
- the presence of the extensive network of existing access roads associated with the Operational Development and the Livishie hydroelectric power scheme. Therefore, reducing the requirements for new track;
- the presence of existing infrastructure which would be reused, including former hydroelectric scheme borrow pits and, construction compounds of the Operational Development, reducing the requirement for new infrastructure;
- opportunity to concentrate wind farms in a landscape that has already accommodated wind turbines and has the capacity to accommodate further development;
- can provide socio-economic benefits to the local area;
- a location that is well separated from residential receptors;
- the infrastructure footprint would be located outwith nationally and internationally important cultural heritage, ornithological and landscape designations (and Wild Land); and
- the relative ease of delivery of turbine components.

Overview of Design Strategy

2.2.4 The EIA Regulations require the EIA to provide "*a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects".*

2.2.5 Site selection, detailed in Section 2.2.2 above considered the suitability of the location relative to alternative locations. Technology, size and scale has largely been influenced by the Proposed Development being an extension to an operational wind farm with a location suited to wind farm development, and the likely turbine models projected to be available in the wind energy market at tender.

2.2.6 The following sections provide detail on the alternative project design iterations which have been considered through the design evolution and how the final design has been reached.

Design Principles

2.2.7 The following principles were adopted during the design iterations made by the Applicant to ensure that the final design of the Proposed Development was the most suitable for the Site:

- maintain a suitable separation distance from residential properties to minimise potential noise, flicker, air quality and visual amenity impacts;
- avoid designated and protected sites, as far as practicable;
- maintain appropriate buffers to ornithological interests;
- sensitively site to avoid or minimise setting effects on heritage assets;
- avoid or minimise impacts on sensitive identified ecological habitats and species;

- where practicable avoid deep peat, areas of elevated peat slide risk, and high quality and active peatland;
- minimise the number of watercourse crossings and buffer surface watercourses shown on OS 1:50,000 scale mapping to 50m where practicable;
- avoid siting of turbines on areas of the Site identified to be visually sensitive from key views, including the elevated ridge of Carn Tarsuinn and the south eastern corner of the Site;
- maximise wind yield and maintain adequate spacing between turbines;
- ensure the Proposed Development is feasible from an engineering perspective, including taking into consideration ground conditions and topography to minimise earthworks;
- utilise existing tracks and infrastructure, where practical, in order to reduce the footprint of the Proposed Development;
- ensure that the Proposed Development is compatible with the Operational Development and other cumulative developments; and
- avoid skyline effects, backgrounding, and inconsistent turbine spacing, such as relatively large gaps, outliers or excessive overlapping turbines to minimise visual confusion and ensure a balance / compact array from key views.

2.2.8 Table 2.1 summarises scoping responses received from consultees with respect to the design of the initial scoping layout (Figure 2.1) and details how these have been factored into the design process.

Table 2.1 - EIA Scoping Opinion Comments on Design

Consultee	Scoping Comment	Page No.	Response
Highlands & Islands Airports Limited (HIAL)	The turbines could possibly affect the performance of electronic aeronautical systems for the airport and is potentially line of sight from our radar.	A52	Turbines positioned outwith line of sight of radar.
ScotWays	In the context of paths and rights of way, ScotWays highlight guidance on setback distance from turbines to public highways.	A63	Turbines positioned a significant distance from path HI71.
SEPA	Existing infrastructure should be re-used or upgraded where possible. Cabling should be laid in ground already disturbed, e.g. verges.	A23	This has been a key design consideration throughout the design process. This has been applied where practical. However, there are a couple of instances where indicative cross-country cable routes are proposed. Further details are provided in paragraph 2.3.43.

Consultee	Scoping Comment	Page No.	Response
	Welcome the fact a 50m buffer will be included around all water features. The EIAR should demonstrate how the deepest areas of peat have been avoided.		A 50m buffer has been maintained except where watercourse crossings are required, and a small number of other exceptions detailed in Chapter 9 (Hydrology and Hydrogeology). Detailed peat probing surveys were undertaken (refer to Chapter 10 (Geology and Soils) and Figure 10.2) and avoidance of deep peat and blanket bog habitat where possible has been a key design principle.
NatureScot	A key design principle should be design coherence with the existing wind farm. Note that present scale and size is not compatible. Advise that this visibility from the circular walk around Loch Affric should be designed out.	A31	This has been taken forward as a key design principle, considering the scale, size and location of proposed turbines in relation to existing turbines, landform and other landscape features. The turbine layout has been amended such that there is no longer visibility from the core path circular walk (refer to Chapter 8 (Landscape and Visual) and Figure 8.6.3).
The Highland Council (THC)	Development should be designed to avoid crossing watercourses and to bridge these where this cannot be avoided.	A8	The number of watercourse crossings has been minimised as far as reasonably possible.

Proposed Development Design Iterations

2.2.9 Following the selection of the Site location the Applicant has undertaken multiple design iterations of all aspects of the Proposed Development including the turbine and infrastructure layout. Table 2.2 details the principal design iterations that have been undertaken as the Applicant has sought to achieve a viable design that maximises the renewable electricity generation from the Site, whilst minimising the environmental effects. These design iterations have been made in line with the design principles set out in paragraph 2.2.7.

Table 2.2 - Design Iterations

Design Iteration	Figure	No. Turbines	Date	Description
A	2.1	20	July 2019	Layout A was produced prior to the completion of the suite of environmental surveys and was based on an initial high-level review of LVIA constraints. These reviews took account of consultation feedback on a 41 turbine layout presented at a Pre-Application Meeting in May 2019, as well as various other factors including: - Known site constraints from a high-level review including watercourses and waterbodies; - Comments made on Operational Development application; - Vertical and horizontal extent in the landscape and visual fit with Operational Development; - Range of suitable tip heights; and - Visibility from key locations. A 20 turbine layout was generated as a result. This is the layout that the Scoping Report was based on.
B	2.2	20	December 2019	All environmental survey work carried out over the summer of 2019, plus engineering constraints, led to the creation of a "No-Build" layer. This took into account a 50m buffer around identified watercourses and waterbodies, unsuitable topography, wind turbulence and the elevated ridge of Carn Tarsuin. As a result, two turbines proposed in the north-west section of the Site were removed primarily due to access and topographical constraints and potential landscape issues, with all proposed turbines now located to the east of the Operational Development. The Applicant utilised wind resource assessment software to optimise a 20 turbine layout within the remaining area available, respecting the “No-Build” layer generated through the environmental and engineering surveys.
C	2.3	20	December 2019	An engineering review of buildability and civil engineering suitability of turbine locations to produce a track alignment was undertaken by the Applicant. Movement of T1, T2, T5, T9, T15, T17 and T18 to reflect more buildable locations for turbine, hardstanding and/or track alignment.

Design Iteration	Figure	No. Turbines	Date	Description
D	2.4	18	February 2020	LVIA review leads to an additional area in the south-east of the Site being added to the “No-Build” layer, in particular to reduce potential effects on landscape viewpoints 3 (Meall Fuar-mhonaidh) and 5 (Suidhe). This also avoids potential impacts on a black grouse lekking zone to the south-east. T19 and T20 are removed from this area and the remaining area of the Site is "re-optimised" utilising the wind resource assessment software, which effectively leads to 18 new turbine locations, albeit with some in very close proximity to previous layout. T3 and T5 are also relocated to avoid impacts on blanket bog habitat.
E	2.5	18	April 2020	Design Workshop with the EIA project team and members of the Applicant’s project team to review and refine Layout D to ensure environmental and engineering constraints are considered fully and any preferable minor movement of proposed turbines is made to minimise impacts further. Initial track alignment based on preliminary survey data. Key layout changes include the following: - T1 moved to avoid ornithological constraint to the south; - T2, T6 and T10 moved to avoid visual clustering in key views; - Tracks to T3 and T12 realigned to avoid watercourse buffers; - Access track from the Operational Development to T7 is realigned to avoid higher quality, active blanket bog to the south; - An alternative access track to T15 proposed to avoid watercourse crossings and to reduce impacts on blanket bog habitat; - T18 and associated track realigned to avoid deep peat to the west; and - Indicative substation location sited to avoid areas of deep peat. Potential movement of T9 to the east and T11 to the west is restricted by identified ecological and ornithological constraints.

Design Iteration	Figure	No. Turbines	Date	Description
				This layout informed detailed survey requirements in summer 2020, including watercourse crossings, peat probing and peatland assessment.
F	2.6	18	September 2020	Refinement of the red line boundary following landownership review leads to relocation of Turbines 6 and 17. The location of the substation, borrow pit search areas, compounds and batching plant were refined following geology and detailed peat surveys. This also included the realignment of sections of access track to avoid areas of deeper peat and blanket bog habitat, notably on the track to T5 and to T6.
G	1.3	18	December & January 2020	Further Design Workshop with all environmental consultants and a civil engineering review led to some minor amendments to track and hardstanding alignments, a minor adjustment to the location of Turbine 15 and a resizing of one of the borrow pit search areas. The civil engineering review included detailed 3D modelling of the proposed layout. This was undertaken to provide a more accurate model for the assessment and refinement of vertical alignment, earthworks balance, aggregate requirements, and calculation of peat excavation volumes. The changes made following the design workshop and engineering review were primarily to avoid pockets of deep peat and to simplify watercourse crossings, whilst considering all design principles noted in paragraph 2.2.7. The substation footprint was also adjusted to ensure a realistic worst-case is considered in the EIA. Track alignment has endeavoured to follow the most direct route possible while taking into account identified environmental constraints. Where the most direct route has not been taken (i.e. track to T13 and track to T14), all other alternative routes were investigated and discounted due to significant topographical constraints precluding alternative approaches. The outcome of the final design workshop and further refinements resulted in: - A minor adjustment to the location of T15 to avoid deep peat.

Design Iteration	Figure	No. Turbines	Date	Description
				- Localised adjustments to track alignments and hardstanding orientations (e.g. T6 and T4) to avoid impacts on areas of deep peat, high quality and active blanket bog, and networks of bog channels, as identified in the hydrology survey and peatland condition assessment. - Minor adjustments to, and a resizing of one of the borrow pit search areas. - Minor track realignments to avoid watercourse crossings (e.g. at T4 approach and north of T7). The resulting layout is considered to be the best viable option with respect to environmental constraints and civil engineering feasibility. Layout G is the final layout which is described in Section 2.3 and shown in Figure 1.3, and for which the Applicant is applying for consent.

Do Nothing Scenario

2.2.10 Should the Proposed Development as described in Section 2.3 not be consented (the "do-nothing scenario"), it is anticipated that the Proposed Development site will not alter from the current baseline described below and in Chapters 5-15.

2.2.11 Habitats on the Site would continue to be impacted and shaped by weather and animal erosion. The main land use practices (upland grazing for sheep, deer stalking and the Operational Development) are expected to continue unchanged under the do nothing scenario and as such, grazing pressure on habitats from sheep and deer will likely remain the same.

2.2.12 By not developing the site, the opportunity to generate approximately 233,191MWh per annum of renewable energy, enough to power the equivalent of approximately 65,174 average UK households[1], and contribute to UK and Scottish Government's net zero targets, would not be realised.

Summary

2.2.13 The final layout has been informed by a robust design and EIA process, that considered physical constraints, potential environmental, landscape and visual impacts and their effects. The information used to inform the design iteration process included consultation responses received, baseline data and the impact assessment undertaken.

2.2.14 The Proposed Development layout is considered to represent the most appropriate design, taking into account potential environmental impacts and physical constraints, while maximising the renewable energy generating capability of the Site.

2.3 Proposed Development

Introduction

2.3.1 In line with Regulation 5(2)(a) of The EIA Regulations, this section provides a description of the development comprising information on the Site, design, size and other relevant features of the development.

Site Status & Context

2.3.2 The Proposed Development Site ('the Site') (Figure 1.1) is located adjacent to the Operational Development and will extend the Operational Development onto the adjoining land to the east (hereafter referred to as the 'Turbine Development Area') (refer to Figure 1.2). The British National Grid (BNG) reference for the centre point of the Turbine Development Area is 239512, 820991.

2.3.3 The Site is located west of Loch Ness and the Great Glen, on an area of high rocky plateau. This open, undulating moorland features several rocky outcrops, small hills, many lochs, lochans, watercourses, areas of bog, tracks, hydroelectric infrastructure and turbines of the Operational Development.

2.3.4 Outwith the Site there are several distinctive summits, including Meall Fuar-mhonaidh which slopes steeply down to the Great Glen. To the west, this plateau transitions to a rugged, exposed landscape of large mountains, while to the north and south, there are the wooded glens of Glen Urquhart and Glen Moriston, and to the north, the farmed broad Strathglass valley.

2.3.5 The low lying areas of the glens and river valleys contain the majority of settlement and transport infrastructure. There is very little settlement in higher level areas and land use tends to be limited to grazing (sheep and deer) and country pursuits (e.g. shooting and fishing). Man-made features in

[1] This has been calculated by multiplying the indicative installed capacity (100MW) by the number of hours in a year (8,760) by BEIS's long term average load factor for onshore wind (26.62%), then dividing this by the UK average domestic household consumption (3.578MWh).

the area include transmission towers (particularly those of the Beauly-Denny overhead line) and wind turbines.

2.3.6 The closest private dwelling is approximately 2.4km from the nearest proposed turbine.

Land Use

2.3.7 The Site (refer to Figure 1.1) covers an area of approximately 1,107 hectares and is predominantly moorland owned by Glenmoriston Estate.

2.3.8 The current land use of the Site is largely highland estate management practices including grazing (sheep and deer) and country pursuits (e.g. shooting and fishing). There is also existing renewable energy infrastructure within the Site including the Operational Development and the Livishie hydroelectric power scheme.

2.3.9 The anticipated land take of the Proposed Development has been assessed within Chapter 5 (Ecology) which details the temporary and permanent impacts on habitats. Temporary working areas will be reinstated as soon as practicably possible following completion of construction works.

2.3.10 The current activities of the estate, the Operational Development and the Livishie hydroelectric power scheme are not anticipated to be significantly impacted by the Proposed Development and will continue through the construction and operational phases. There will be continuous liaison with the landowner and the respective operators regarding timing of works.

Description of the Proposed Development

2.3.11 The Proposed Development comprises a generating station consisting of a wind farm with up to 18 wind turbine generators of up to a maximum height of 180m from ground to blade tip when vertical, supported by ancillary development. The installed capacity of the Operational Development is 108 MW and the total installed capacity of the Proposed Development alone, whilst dependent on the rated power of the turbine model procured, is anticipated to be in excess of 100MW. Therefore, the combined capacity of the Operational Development and the Proposed Development is anticipated to be in excess of 208MW.

2.3.12 The Proposed Development will be supported by a number of ancillary elements, including the following:

- crane hardstandings;
- access tracks;
- drainage;
- watercourse crossings;
- on-site substation;
- underground cabling;
- a LiDAR.
- two construction compounds;
- a batching plant; and
- borrow pits (eight search areas).

2.3.13 The Proposed Development site layout is shown in Figure 1.3, with the wider site layout shown on Figure 1.2.

2.3.14 The Proposed Development benefits significantly from the presence of the extensive network of existing access roads associated with the Operational Development and the Livishie hydroelectric power scheme, along with other existing infrastructure associated with the Operational

Development. Utilising this existing infrastructure has helped to reduce the footprint of the Proposed Development.

2.3.15 Whilst the location of the infrastructure described below has been determined through an iterative and robust environmental assessment taking into account physical constraints, potential environmental, landscape and visual impacts and their effects, there is the potential for these exact locations to be altered through micrositing allowances prior to construction. A micrositing allowance of up to 50m in all directions is being sought in respect of each turbine and its associated infrastructure in order to address any potential difficulties which may arise if preconstruction surveys identify unsuitable ground conditions or environmental constraints that need to be avoided. A larger micrositing allowance may be required to ensure optimum routing of any cross-country cable routes; it is proposed that the wording of any future condition provides the opportunity to agree any alterations to the proposed cross country cable locations beyond the 50m micrositing in order to optimise their routes following detailed design with respect to this specific piece of infrastructure.

Turbines and Turbine Foundation

2.3.16 As noted in paragraph 2.3.11 above, the Proposed Development will comprise up to 18 wind turbines with a maximum 180m height from ground to blade tip, when vertical.

2.3.17 The proposed locations of the turbines have been defined in order to enable the EIA to describe fully the Proposed Development for which permission is being sought. The British National Grid (BNG) coordinates denoting where each of the turbines are proposed to be located, along with their approximate height above ordnance datum (AOD) are listed in Table 2.3.

Table 2.3 - Wind Turbine Coordinates (BNG)

Turbine	Easting	Northing	AOD (m)
T01	238385	821688	518
T02	238364	821034	515
T03	238925	821693	533
T04	239380	821326	498
T05	239523	822070	534
T06	238277	822170	527
T07	238704	820694	499
T08	238771	820273	507
T09	239348	820077	462
T10	239501	820920	475
T11	238876	821220	532
T12	239955	821460	515
T13	240789	821549	528

Turbine	Easting	Northing	AOD (m)
T14	240252	820478	451
T15	239933	820784	490
T16	239852	820120	441
T17	240372	821198	492
T18	240876	821077	497

2.3.18 Each of the turbines comprises the following components:

- blades;
- tower;
- nacelle; and
- hub.

2.3.19 Each turbine will consist of a tapered tubular steel tower and a nacelle containing the gearbox or direct drive, generator and associated equipment, to which are attached a hub and rotor assembly including three blades. A transformer will be sited within the base of each tower. At the base, the turbine will be approximately 5m in diameter.

2.3.20 It is proposed that the Proposed Development will be fitted with infra-red lighting fitted on perimeter turbines, and will have no visible aviation lighting, the details of which has been approved by Civil Aviation Authority. Further details of the proposed lighting scheme are provided in Chapter 15 (Aviation and Radar) and Appendix 15.1 (Proposal for Alternative Lighting Scheme).

2.3.21 An elevation drawing of a typical turbine is illustrated in Figure 2.7. The turbines will be of a typical modern, three-blade, horizontal axis design in semi-matt white or light grey with no external advertising or lettering except for statutory notices. The specific turbine manufacturer and model has not yet been selected as this will be subject to a tendering exercise and will be confirmed post consent. Therefore, for the purposes of the EIA likely turbine dimensions and operational attributes have been established as a maximum development scenario.

2.3.22 The turbine foundations are anticipated to be an inverted 'T' in section consisting of a reinforced central concrete pedestal with a reinforced concrete slab. The tower is proposed to be attached to the foundations via an anchor cage which is then tension anchored to the tower. Until detailed ground investigations have been undertaken the exact size and depth of foundations required cannot be determined. Therefore, for the purposes of this EIA Report, the following approximate dimensions have been used:

- reinforced concrete slab approximately 25m in diameter; and
- depth of the foundations approximately 3m.

2.3.23 An illustration of a typical turbine foundation is provided in Figure 2.8. The actual foundation design will be specific to the site conditions as verified during detailed site investigations undertaken before construction commences. In the event that ground conditions are unsuitable for the standard foundation design described above, a piled foundation design may be required, involving the installation of a series of concrete piles per turbine, with each pile being bored or driven until the underlying bedrock is reached. The foundation design at each turbine will depend on the local ground conditions and may result in more than one design being utilised across the Site.

Crane Hardstandings

2.3.24 To enable the construction of the turbines, a permanent crane hardstanding area will be required to accommodate assembly cranes and construction vehicles. This will comprise a crushed stone hardstanding area measuring, approximately 1,875m^2 per turbine, with a typical thickness of approximately 750mm, but subject to the specifications required by the selected crane operator and following detailed ground investigations prior to construction. The permanent crane hardstandings will remain in place during the lifetime of the Proposed Development to facilitate maintenance works.

2.3.25 In addition to the permanent crane hardstanding, a temporary hardstanding area will be constructed adjacent to each turbine. This will consist of crushed stone hardstanding approximately 800mm in depth covering an area of 1,921m^2 per turbine. Following turbine erection, these temporary hardstanding areas will be reinstated.

2.3.26 The hardstandings will need to be excavated into the hillside to ensure the provision of a flat operating surface for the cranes and storage of the turbine components. At these locations there will be a requirement to excavate out material to provide a level platform. These excavations will be kept to a minimum where possible and will be tied back into the existing ground with an anticipated slope gradient of 1 in 2. Where excavations are deeper the appropriate benching of material will be carried out to ensure stability at all times. This will be confirmed once rock sampling is carried out as part of the ground investigation works. Any yield from the excavation for hardstanding's will be recycled and used on site as fill material.

2.3.27 An illustration of a typical crane hardstanding is provided in Figure 2.9.

Access to the Proposed Development Site

2.3.28 It is proposed that all abnormal turbine loads will originate from Kyleakin/Kyle of Lochalsh and Inverness and access the Site via the A82/A87/A887.

2.3.29 A Transport Assessment (Chapter 12) has been prepared in support of the application for the Proposed Development and this provides greater detail on access routes to the Site for construction vehicles. Chapter 12 (Traffic and Transport) includes a review of the proposed route, construction traffic impacts and an abnormal load route review.

On-Site Access Tracks

2.3.30 There are existing on-site access tracks which service the Operational Development and an existing access track on the south of the Site which services the Livishie hydroelectric power scheme. Where possible these access tracks will be retained, re-used and where necessary upgraded. New access tracks will be required to connect the proposed turbines to the existing track network.

2.3.31 The on-site access tracks will generally be 5.5m wide, although will be wider on some bends and where passing places will be installed. It is anticipated that approximately 13.7km of existing tracks would be utilised, of which some sections may require to be upgraded, and approximately 10.1km of new access tracks constructed (refer to Figures 1.2 and 1.3). Intervisible passing places will be installed as required.

2.3.32 Construction of the access tracks will require stripping existing unsuitable material to a suitable bearing or the designed formation and placing a filter membrane and or geotextile reinforcement membrane (depending on site conditions) on the ground. Aggregate will then be layered, with the access track capped with a layer of Type 1 or similar material.

2.3.33 The proposed layout of access tracks within the Site is shown on Figure 1.3 and an illustration of a typical access track is provided in Figure 2.10**.**

Drainage

2.3.34 The detailed drainage design will largely be based on good practice and the following guidance:

- The Construction Industry Research and Information Association (CIRIA), 'Environmental Good Practice on Site 4th Edition (C741)' (2015);
- CIRIA, 'Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors (C532)' (2001);
- CIRIA, 'Control of Water Pollution from Construction Sites – Guide to Good Practice (SP156)' (2002);
- CIRIA, 'Control of Water Pollution from Linear Construction Projects – Technical Guidance (C648)' (2006);
- CIRIA, 'Culvert, screen and outfall manual (C786)' (2019);
- CIRIA, 'Site Handbook for the Construction of SuDS (C698)' (2007);
- CIRIA, 'The SuDS Manual (C753)' (2015); and
- SEPA flood mapping.

2.3.35 It will take into account activities during the construction and operational phases of the Proposed Development, including:

- access roads;
- turbine foundations; and
- hardstanding areas and buildings (including crane hardstandings, construction compound, substation compound, and associated infrastructure).

2.3.36 Drainage is discussed further in Chapter 9 (Hydrology and Hydrogeology) and the Construction Environmental Management Plan (refer to paragraph 2.3.80 to 2.3.84 below and Appendix 2.1). Illustrations of typical drainage design is provided in Appendix 2.1.

Watercourse Crossings

2.3.37 Watercourse crossings have been avoided in the design of the access track layout as far as possible, however there would be 8 new crossings of major watercourses (those identified on OS 1:50,000 mapping).

2.3.38 Approximately 28 minor watercourse crossings or discrete drainage channels have also been identified during site walkovers of the proposed new access track routes.

2.3.39 In addition, 30 existing minor watercourse crossings or discrete drainage channels have been identified along the existing hydro track. The majority of these will require to be upgraded to wind farm specification.

2.3.40 The locations of all identified watercourse crossings are shown on Figure 9.4 and further details of watercourse crossings and proposed crossing designs are provided in Chapter 9 (Hydrology and Hydrogeology) and Appendix 9.1.

2.3.41 It is anticipated that the final solution and detailed design of these crossings will be confirmed and agreed with SEPA prior to construction.

Electrical Connection

2.3.42 The electrical power produced by the individual turbines will be fed to an on-site substation via underground cables. The proposed location for the on-site substation is shown in Figure 1.3. Off-site connection of the Proposed Development to the grid will be subject to a separate consenting process.

2.3.43 On-site cables installed by the Applicant will be laid in trenches, typically up to a maximum of 1m deep and 6m wide. The trenches will also carry earthing and communication cables for the operation

of the Proposed Development. The cables will be laid on a sand bed and the trenches backfilled using suitably graded material.

2.3.44 Cabling will be located mainly adjacent to the access tracks, with the exception of approximately 700m of cross-country cable between T1 and T2 and approximately 450m of cross-country cables between T14 and T15 (indicative route shown on Figure 1.3).

2.3.45 The two cross-country cable routes are being proposed to reduce the environmental impact of longer cable routes being routed via the Operational Development's tracks to the Proposed Development's substation, and, to minimise the health and safety risks to construction and operations personnel, in accordance with the Construction (Design and Management) Regulations 2015, that trenching, installing and maintaining the Proposed Development's 33kV cables in the immediate vicinity of the Operational Development's 33kV cables would bring.

2.3.46 The Proposed Development's cables cannot be joined onto the Operational Development cables, either within the Operational Development's cable trench, or within one of the Operational Development's turbines as the Operational Development's cables, turbine switchgear and substation are not electrically rated or physically capable of accommodating the additional electrical power, incoming cables or high voltage electrical equipment from the Proposed Development. Therefore, going via the Operational Development would require the excavation of substantial new cables trenches adjacent to the Operational Development's cables and a greater corridor of temporary ground disturbance due to the necessary physical separation between the Operational Development's cables and the Proposed Development's cables. It is likely that this wider corridor would require a temporary track to be constructed adjacent to the new cable trenches to assist cable laying due to the distance to the trench from the existing track being in excess of what a long-reach excavator could accommodate. The cross-country route options proposed are the shortest distance, and result in approximately 23,400m^2 less temporary land disturbance and 7.8km less overall cable length, therefore the proposed routes are considered to be the option with the lesser environmental impact and health and safety risk.

2.3.47 The proposed cross country cabling routes were selected based on optimising electrical cabling arrays, reducing cable lengths, and hence ground disturbance, and avoiding watercourse crossings. A further detailed design review will be undertaken post consent following detailed ground investigations to confirm suitable cabling installation methods. The method of cable installation for the proposed cross-country cable routes will be determined based on detailed ground truthing by the cable installation contractor (e.g. to confirm access and identify suitable plant and machinery which may be required) and a detailed review of ground investigation data (e.g. thermal resistivity values to determine if cables can be direct buried or if ducts are required). The installation method selected will be dependent on electrical and civil engineering properties along the route as well as topography and soil depth. Based on the available peat probing data, the peat depth along the proposed cross country cable routes is likely to be variable but mainly shallow (<1m) and therefore a combination of: direct ploughing; ducting and / or direct burial will be required. The preference will always be towards ploughing as this presents the least impact in terms of ground disturbance, however reinstatement measures following other open cut methods will ensure that habitats are restored as soon as possible following completion of cable installation.

2.3.48 The on-site substation compound footprint will measure approximately 150m by 130m and will accommodate all the equipment necessary for automatic remote control and monitoring of the Proposed Development, in addition to the electrical switchgear, reactive compensation equipment, fault protection and metering equipment required to connect the Proposed Development to the electricity network, and a hardstanding area for vehicle parking constructed from crushed stone to a depth of approximately 750mm. The substation buildings will measure approximately 55m by 25m and 25m by 15m with an approximate height of 12m. Details of the final design of all components of the substation are proposed to be secured through an appropriately worded condition. Indicative elevation drawings of the on-site substation are provided in Figure 2.11. An indicative layout plan of the internal make-up of the substation compound is provided in Figure 2.12.

LiDAR

2.3.49 A permanent on-site LiDAR will be required to monitor wind speeds for the operational life of the Proposed Development. It is expected that the LiDAR will be of a height no greater than 2.5m and will be situated on a reinforced concrete foundation of approximately 4m by 3m. An indicative drawing of the LiDAR is provided in Figure 2.13.

2.3.50 The final location and height of the LiDAR will be determined prior to construction of the Proposed Development. It is proposed that these details and specifications will be addressed through an appropriately worded condition.

Temporary Construction Compounds

2.3.51 Two secure, temporary construction compounds will be required during the construction period. The location of the compounds is shown in Figure 1.3.

2.3.52 The primary compound will house temporary portable cabin structures to be used as the main site office and welfare facilities, including toilets, clothes drying and kitchen, and provision for sealed waste storage and removal. This area will also be used for parking for vehicles, containerised storage for tools and small parts, and oil and fuel storage.

2.3.53 The primary construction compound will be located at the Site entrance in the same location that was used for the Operational Development. This includes the permanent eastern section (6,206m^2) which, following the construction of the Operational Development, was subject to a separate planning application (planning ref 18/03690/FUL) and was retained by Glenmoriston Estate as a parking and forestry laydown area. It is proposed to reuse this area for construction of the Proposed Development, after which this will return to utilisation by Glenmoriston Estate. The construction compound will also include the western section (c.6,471m^2) that was previously reinstated following construction of the Operational Development. The western section can utilise the aggregate platform that remains beneath the reinstated layer. The western section will be temporary and will be removed and the land restored following completion of the construction phase. An indicative plan drawing of the primary construction compound is provided in Figure 2.14.

2.3.54 The satellite compound will provide additional storage areas for materials, tools/stores as well as welfare facilities and a potential laydown area.

2.3.55 The satellite compound will be located where the batching plant had been positioned for the Operational Development. This will be a temporary compound measuring approximately 7,814 m^2. It will be removed, and the land restored following completion of the construction phase. Locating the satellite compound on the site of the former batching plant allows for the platform that remains beneath the reinstated layer to be utilised.

2.3.56 The EIA has considered the maximum dimensions of the construction compounds, however the full areas may not be required. The detailed size, layout and engineering properties of the construction compounds will be confirmed prior to the start of construction, after the turbine supplier and model have been confirmed.

Batching Plant Search Area

2.3.57 A concrete batching plant will be located within the Site. The concrete batching plant will comprise aggregate and cement hoppers, water bowsers / tank, a mixer and a control cubicle. Aggregates and sand would be stockpiled and contained adjacent to the plant.

2.3.58 A batching plant search area has been identified with an area of 10,250m^2 within which it is proposed that the actual batching plant will be located, however, it is likely only a portion of the area identified will be required. The detailed size and layout of the batching plant will be confirmed by the appointed contractor and will be microsited within the search area to allow consideration of local topography, hydrology, peat depth and surface water drainage requirements.

2.3.59 The location of the batching plant search area is shown on Figure 1.3.

Borrow Pit Search Area

2.3.60 To minimise the volume of imported material brought onto the Site, and any associated environmental impact, borrow pits located within the Site will be used to source stone for infrastructure construction including access tracks and hardstanding. A borrow pit is an area where material has been excavated for use at another location. It is proposed that all aggregate requirements will be sourced from the proposed borrow pit search areas, therefore no imported aggregate is likely to be required, minimising transport requirements.

2.3.61 A Borrow Pit Assessment Report (BPAR) is provided in Appendix 10.1. Eight borrow pit search areas have been identified and it is proposed that the actual borrow pit(s) would be located within these search areas, however, only a portion of the search area would be required. The three extant hydro borrow pit search areas identified to the south of the Site are former borrow pits utilised for the construction of the Livishie hydroelectric scheme, which will be reopened for sourcing aggregate. Dependent on detailed site investigations, the BPAR identifies that it is likely only six of the eight borrow pit search areas will be required.

2.3.62 The locations of the search areas are shown on Figure 1.3.

2.3.63 Detailed site investigations prior to construction will be carried out to further confirm the rock type, rock characteristics and suitability, as well as potential volumes to be extracted from the search areas. The pollution control measures to be implemented during usage of the borrow pit(s) and its reinstatement are covered within the Construction Environmental Management Plan (CEMP).

2.3.64 The borrow pit(s) will require the use of plant to both win and crush the resulting rock to the required grading. It is anticipated that rock will be extracted by breakers and other relevant methods that may be required. Noise associated with stone extraction is discussed in Chapter 11 (Noise).

2.3.65 Environmental considerations have influenced the location of the borrow pit search areas to minimise the effect on ecology, hydrology, peat and landscape, and to allow successful reinstatement measures to be put in place as appropriate. Following construction and completion of borrow pit working, the borrow pits will be restored and reinstated to agreed profiles.

Construction

2.3.66 The estimated on-site construction period for the Proposed Development is approximately 18 months and includes a programme to reinstate all temporary working areas. Normal construction hours will be 07:00 to 19:00 Monday to Friday and 07:00 to 14:00 Saturdays. There shall be no construction traffic movements to or from the Site outwith these hours or on Sundays. In the event of work being required out with these hours, e.g. abnormal load deliveries, commissioning works or emergency mitigation works, the Planning Authority will be notified prior to these works taking place wherever possible. Operation of crushing equipment located within / next to borrow pits will generally be limited to 08:00 to 18:00 hours Monday to Friday and 08:00 to 13:00 on Saturdays, with no operation on Sundays. Any blasting on site shall only take place between the hours of 10:00 to 16:00 on Monday to Friday inclusive and 10:00 to 12:00 on Saturdays with no blasting taking place on a Sunday unless otherwise approved in advance in writing by the Planning Authority.

2.3.67 Table 2.5 below provides an indicative construction programme for the main items of work to be carried out, with work likely to be phased so that certain activities take place concurrently.

Table 2.4 - Indicative Construction Programme

Task	Month																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Establish Site Compound																		
Borrow Pit Operation Period																		
Reinstatement & Restoration																		
Access Track Construction																		
Turbine Base / Hardstandings																		
Concrete Deliveries																		
Cable Delivery & Installation																		
Turbine Delivery & Installation																		
Wind Farm Testing & Commissioning																		

2.3.68 The main materials likely to be required for the construction of the wind farm are described below:

- crushed stone;
- geotextile;
- ready mixed concrete;
- sand;
- steel reinforcement; and
- electrical cable.

2.3.69 For the purposes of the transport assessment, it has been assumed that concrete will be batched on-site within the identified concrete batching area.

2.3.70 Necessary excavations will be made, initially by stripping back the soil from the area to be excavated. This soil will typically be stored separately either in a mound adjacent to the excavation area for backfill, if required, or stored at a designated area on-site for further use or reinstatement of temporary works areas. The handling of soils will be undertaken in accordance with best practice techniques.

2.3.71 Should surface water run-off or groundwater enter the excavation during construction, appropriate pumping measures to divert the run-off will be taken to ensure the works are safely carried out and the excavation is sufficiently dry to allow concrete placement. Once the concrete is cast, the excavated material will be used for backfill and compacted to the required design density. Once this backfill is completed, the hardstanding areas will be constructed.

2.3.72 The proposed method for constructing the wind turbines is as follows. The turbines will be erected using a large mobile crane or crawler crane, positioned on the hardstanding adjacent to the turbine base. A smaller tail crane will be positioned adjacent to the delivery position of the turbine components. The two cranes will lift the tower sections and blades into their assembly positions, and the main crane will lift the tower sections, nacelle and blades into their operational positions.

2.3.73 As soon as practical, once installation is complete, the immediate construction area will be restored to as close to its original profile as possible, although the permanent crane hardstandings will be retained for future maintenance. The topsoil will be replaced and vegetation turves reused where available or reseeded where appropriate and as advised by an on-site Environmental Clerk of Works (ECoW). The ECoW will be on-site through construction and post-construction as required. Further details of their role will be provided in the CEMP.

Traffic and Transportation

2.3.74 A detailed Transport Assessment is provided within Chapter 12 (Traffic and Transport) of this EIA Report and the study area and proposed Abnormal Indivisible Loads (AIL) route are shown on Figures 12.1 and 12.2 respectively.

2.3.75 Construction traffic associated with the construction and maintenance of the Proposed Development falls into two main categories, namely AIL and Construction/Maintenance Loads. The abnormal loads are those that will require an escort, either by private contractor or by police escort. Construction/maintenance loads are those that do not require any special escort or permissions and are only influenced by normal traffic regulations.

2.3.76 The Applicant will develop and implement a Construction Traffic Management Plan (CTMP). The CTMP will detail the management of traffic to and from site, including abnormal loads and daily worker's commute. It shall also include mitigation for impacts to public transport, local private access and public foot paths. The Applicant shall amend and update the CTMP as required throughout the construction and decommissioning period.

2.3.77 The Applicant will ensure that the vehicles will be routed as agreed with the Highland Council (THC), Transport Scotland and Police Scotland, to minimise disruption and disturbance to local residents

and road users. Further details regarding transport and access can be found in Chapter 12 (Traffic and Transport) of this EIA Report.

Health & Safety

2.3.78 High standards of health and safety will be established and maintained. At all times, all activities will be undertaken in a manner compliant with SSE's strict health and safety policies and procedures, all of which align with applicable health and safety legislation and with relevant good practice as defined under applicable statutory approved codes of practice and guidance.

2.3.79 During the construction phase, the Construction (Design and Management) Regulations 2015 will apply. The Principal Contractor would be required to prepare a Construction Phase Health and Safety Plan and collate information during the works to enable the Health and Safety File to be completed.

Construction Environmental Management Plan (CEMP)

2.3.80 As part of the construction contract, the Applicant will produce, and adhere to, a CEMP. The CEMP shall be developed in accordance with the joint Scottish Renewables, SNH, SEPA, Forestry Commission Scotland and Historic Environment Scotland guidance on Good Practice During Windfarm Construction (2019).

2.3.81 The CEMP shall describe how the Applicant will ensure suitable management of, but not limited to, the following environmental issues during construction of the Proposed Development:

- noise and vibration;
- dust and air pollution;
- surface and ground water (including drainage controls and mitigation);
- ecology and ornithology (including protection of habitats and species);
- agriculture (including protection of livestock and land);
- cultural heritage;
- waste (construction and domestic);
- pollution incidence response (for both land and water); and
- site operations (including maintenance of the construction compound, working hours and safety of the public).

2.3.82 The Applicant shall provide the following for integration within the CEMP:

- details of the all the environmental mitigation which is described within this EIA Report (refer to Chapter 16 (Schedule of Environmental Commitments)) that is required during construction of the Proposed Development, and of how the Applicant will implement this mitigation and monitor its implementation and effectiveness;
- details of how the Applicant will abide by the local and national legislative requirements e.g. The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended);
- details of how the Applicant will implement and monitor construction best practice techniques e.g. the control of noise and dust;
- details of a Pollution Prevention Plan (PPP) which will be agreed with THC and SEPA to ensure that appropriate measures are put in place to protect watercourses and the surrounding environment; and

- details of a Waste Management Plan which will include opportunities to reduce and re-use waste on site, recycling of waste which cannot be reused and disposal of waste to landfill.

2.3.83 The Applicant shall consult with NatureScot, SEPA, and THC on the relevant aspects of the CEMP where required. The Applicant shall amend and update the CEMP as required throughout the construction and decommissioning period.

2.3.84 Specific requirements of the CEMP for each of the environmental topics assessed in the EIA are provided in the relevant EIA Report chapters and an outline CEMP is provided in Appendix 2.1.

Operation & Maintenance

2.3.85 During operation, only site maintenance vehicles and local utility company vehicles will normally be required on the site. Approximately three visits per week to the control building by maintenance personnel in four-wheel drive or conventional passenger vehicles will occur following the commissioning phase.

2.3.86 High standards of health and safety will be established and maintained at all times, and maintenance activities will also be controlled via the Applicant's Operational Safety Rules and Wind Turbine Safety Rules. Where construction works are being undertaken during the operational phase, the Construction (Design and Management) Regulations 2015 will apply.

2.3.87 In the event that a major turbine component requires replacement, vehicles delivering the components will use the new access tracks and crane pads, utilising the same route as delivery of components during construction.

Operation Environmental Management Plan (OEMP)

2.3.88 The Applicant will develop and implement an Operation Environmental Management Plan (OEMP) on commissioning of the Proposed Development. Similar to CEMP the OEMP will set out how the Applicant will manage and monitor environmental effects throughout operation. The OEMP will be developed in consultation with NatureScot, SEPA and THC where required and will include but not be limited to:

- details on the track, watercourse crossing and turbine maintenance;
- the control and monitoring of noise;
- the control and monitoring of surface and groundwater;
- a pollution prevention plan and a pollution incidence response plan;
- details of how the Applicant will abide by the local and national legislative requirements e.g. The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended); and
- a Habitat Management Plan and relevant protected species management plans (if required).

Decommissioning

2.3.89 This assessment assumes that the operational lifespan of the Proposed Development would be 50 years, after which it would be appropriately decommissioned. It is expected that decommissioning would take approximately 12 months. The environmental effects of decommissioning are considered to be no greater than construction effects but experienced over a much shorter time period.

2.3.90 In the event of decommissioning, vehicles would access the Site by the same routes used for delivery and construction.

2.3.91 Either the restored sections of the temporary construction compounds would be re-established or new construction compounds would be developed as agreed with Scottish Ministers and THC at the appropriate time, to temporarily store decommissioned plant and equipment. The nacelles

(including hubs) and blades would be removed using cranes situated on the crane pads as previously constructed. The towers would then be dismantled.

2.3.92 All components would be removed from the Site for disposal and/or recycling as appropriate and in accordance with regulations in place at that time.

2.3.93 It is likely that exposed parts of the concrete foundations would be ground down to below the surface and the remaining volume of the foundations would remain in situ. It is considered that leaving in situ will cause less environmental impact than that of complete removal.

2.3.94 Hardstandings will be removed and/or grassed over, however it is likely that the access junction and sections of access track may be left in situ to assist with recreational access. The CEMP will be updated prior to decommissioning by the Applicant to reflect current legislation and policy and will be agreed with THC, NatureScot and SEPA.

2.4 References

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