3 Proposed Development

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3 Proposed Development

3.1 Executive Summary

3.1.1 The Proposed Development comprises ten turbines of up to a maximum 149.9 m height from the ground to blade tip when vertical. Several ancillary elements are also proposed, including a temporary construction compound; permanent hardstandings adjacent to the turbines for maintenance and decommissioning cranes; site entrance and access tracks; on-site access tracks between turbines, including passing bays and corners; underground cabling between turbines; excavations/borrow pit workings to provide materials for access roads and turbine foundation; an on-site substation; and a maintenance building with welfare facility. Access to the site will be directly from the Craigmarloch Road.

3.1.2 It is anticipated that the construction phase of the Proposed Development would be completed over a period of approximately 14 months.

3.1.3 The Applicant is applying for consent for 30 years of operation of the Proposed Development. Upon expiry of this consent, the Proposed Development will be decommissioning in-line with guidance and legislation current at the time. The environmental effects of decommissioning are no greater than the construction effects but experienced over a much shorter time period, approximately 12 months.

3.2 Introduction

3.2.1 This chapter provides a description of the site and its geographical context and presents a description of the Proposed Development.

3.2.2 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (Scottish Government, 2017) require that the EIA Report must include "*a description of the location of the development; and a description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases"* Schedule 4(1(a) and (b)).

3.3 Site Status and Context

Site Description

3.3.1 The Proposed Development site is located east of Skelmorlie, in North Ayrshire. It comprises of the western extent of Ferret of Keith Moor, the upper part of Skelmorlie Glen. The central grid reference for the site is BNG (221492, 666156) and it occupies an area of approximately 328 hectares (ha). The site location and boundary are shown in Figure 1.1.

3.3.2 The site comprises largely of open upland. Skelmorlie Glen Site of Special Scientific Interest (SSSI), which carries Skelmorlie Water, splits the site from west to east and is designated for upland mixed ash woodland (refer to Chapter 7 for further details). Skelmorlie Water also bisects the site, entering the Proposed Development boundary at its north-eastern extent and exiting at its south-western extent.

3.3.3 There are a number of minor watercourse and drainages ditches which cross the site and flow into Skelmorlie Water and Outerwards Reservoir including Rigghill Burn, Fank Burn and numerous un-named watercourses (refer to Chapter 10 within this EIA Report for further details).

3.3.4 There is one residential property located within the turbine development area, Fardens, which will be uninhabited for the lifetime of the Proposed Development.

3.3.5 The site is within the Clyde Muirshiel Regional Park. On the site's eastern boundary is Renfrewshire Heights Special Protection Area (SPA) and SSSI which is designated for hen harriers (*Circus cyaneus*) (refer to Chapter 6 for further details).

3.3.6 To the west of the site is the Firth of Clyde, leading to the Irish Sea, and the Isle of Bute The coastline has been heavily industrialised in the past and contains a number of coastal communities including Greenock and Largs, approximately 9.6 km to the north and 4.7 km to the south.

3.3.7 The village of Skelmorlie is to the west of the Site. Weymss Bay merges with Skelmorlie to the north, and it is to here that the train line from Glasgow terminates. Weymss Bay also contains the port for the ferry between Rothesay on the Isle of Bute and the mainland.

3.3.8 The A76 follows the coast connecting Skelmorlie to Greenock and Largs. A minor, un-classified road, Brisbane Glen Road, traverses to the south-east of the site boundary, passing to the east of Outerwards Reservoir.

3.4 Description of the Proposed Development

3.4.1 The Proposed Development comprises ten stand-alone, three bladed horizontal axis turbines of up to a maximum height of 149.9 m from ground to blade tip when vertical. The overall capacity of the Proposed Development will be approximately 42 MW[1]. A number of ancillary development components are also proposed, including a temporary construction compound, permanent hardstandings adjacent to the wind turbines for installation and maintenance cranes, temporary laydown areas adjacent to the wind turbines, external transformers, internal access tracks, borrow pit, underground cables between turbines, an on-site substation compound and a permanent meteorological monitoring mast. The Proposed Development site layout is shown in Figure 1.2.

3.4.2 Whilst the location of the infrastructure described below has been determined through an iterative environmental based design process, there is the potential for these exact locations to be further optimised through micro-siting allowances prior to construction. In this regard, there will be a micro-siting allowance of up to 50 m in all directions in respect of each turbine and its associated infrastructure in order to address any potential difficulties which may arise in the event that preconstruction surveys identify unsuitable ground conditions or environmental constraints that could be avoided.

3.4.3 The assessments within this EIA report have included the considerations of this 50 m micro-siting and it does not alter the conclusions formed as to worst case effects.

Turbines and Turbine Foundation

3.4.4 The Proposed Development will comprise of approximately ten stand-alone, three bladed horizontal axis, wind turbines with a maximum height to blade tip of 149.9 m (refer to Figure 3.1).

3.4.5 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 are listed in Table 3.1.

Table 3.1 - Wind Turbine Coordinates

Turbine No.	Proposed Grid Reference (BNG)	
	Easting	Northing
T1	221671	665428
T2	221439	665676
T3	221155	665845
T4	221649	666092
T5	221976	665836

[1] 42 MW is target capacity. Actual installed capacity may be greater or less dependent on turbine model selection but will not be greater than 50 MW.

Turbine No.	Proposed Grid Reference (BNG)	
	Easting	Northing
T6	222203	666149
T7	221532	666537
T8	222099	666778
T9	221830	667020
T10	221343	666823

3.4.6 Each of the turbines comprises of the following components:

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

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

3.4.8 An elevation drawing of a typical turbine is illustrated in Figure 3.1. 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 is subject to an on-going 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.

3.4.9 As per Civil Aviation Authority guidance, turbines over 150 m tip height require aviation lighting on both the tower and on the hub (refer to Chapter 13 for further details). Therefore, aviation lighting is not anticipated.

3.4.10 A transformer will be sited either within the base of each tower or externally sited a few metres from the turbine tower. For the purpose of the EIA it has been assumed that the transformers would be external and have the approximate dimensions of 6 m long by 3 m wide by 2.5 m high.

3.4.11 The turbine foundations are anticipated to be an inverted "T" in section consisting of a reinforced central concrete pedestal approximately 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 approximate dimensions of the reinforced concrete slab are approximately 12-15 m in diameter and approximately 4 m deep. An illustration of a typical turbine foundation is provided in Figure 3.2. The actual foundation design will be specific to the site conditions as verified during detailed site investigations undertaken before construction commences. In the unlikely 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.

Crane Hardstanding

3.4.12 To enable the construction of the turbines, a crane hardstanding area and turning circle at each turbine location will be required to accommodate assembly cranes and construction vehicles. This will comprise a crushed stone hardstanding area measuring, approximately 2,500 m2, with a typical

thickness of approximately 600 mm, but subject to the specifications required by the selected crane operator and following detailed ground investigations prior to construction. The crane hardstandings will remain in place during the lifetime of the Proposed Development to facilitate maintenance works.

3.4.13 In addition to the permanent crane hardstanding, a temporary turbine laydown area and a turning circle will be constructed adjacent to each turbine. This will consist of crushed stone hardstanding approximately 300 mm in depth covering an area of approximately 1,500 m2 per turbine. This will be removed and completely reinstated following construction.

3.4.14 The crane hardstandings are illustrated as part of the site layout on Figure 1.2.

Access to the Proposed Development Site

3.4.15 The site will be accessed from Craigmarloch Road. Vehicles would access Craigmarloch Road from Routenburn Road and the A78 at Largs.

3.4.16 The new junction on to Craigmarloch Road will comply with Scottish National Roads Development Guidelines (SCOTS guidelines). The junction would be surfaced and constructed so that the junction bellmouth would be to adoptable standards (within the current limits of adoption). The remaining tracks within the site would be private.

3.4.17 The access junction would have the first 2 m surfaced in a bituminous macadam and appropriate junction markings and reflective junction markers would be provided at the access bell-mouth. The throat of the junction would be widened to a minimum of 5.5 m to ensure that opposing vehicles can pass in safety.

3.4.18 Visibility splays of 160 m in both directions with a set-back distance of 4.5 m from the centre of the junction would be provided.

3.4.19 A Transport Assessment (refer to Chapter 11 and Appendix 11.1) 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 11 (Traffic and Transport) includes a review of the proposed route, construction traffic impacts, and an abnormal load route review.

3.4.20 Prior to construction, appropriate highway safety measures will be agreed with North Ayrshire Council (NAC), with necessary signage or traffic control measures implemented throughout the construction phase on the agreed basis.

On-Site Access Tracks

3.4.21 The access tracks within the site boundary will be approximately 5 m wide. It is anticipated that approximately 6.5 km of new access tracks constructed.

3.4.22 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 layers of Type 1 or similar material.

3.4.23 The proposed layout of access tracks within the site is shown on Figure 1.2 and illustration of a typical access track is provided in Figure 3.3.

Drainage

3.4.24 An outline drainage strategy is presented in Appendix 3.1. This provides details on the management of surface waters and of foul water across the site, with detailed information for drainage related to tracks and crane hardstandings.

3.4.25 A detailed drainage design will be undertaken and provided to SEPA and NAC prior to construction. Illustration of typical drainage design is provided in Figure 3.4.

Watercourse Crossings

3.4.26 A number of watercourses, both natural and artificial, will be crossed by the proposed access tracks within the site. The crossings maybe simple concrete pipe culverts or arch culverts depending on the watercourse.

3.4.27 Pipe culverts will be twin wall uPVC or pre-cast concrete pipes with cast in-situ headwalls (if required). The arch culverts will have cast in-situ strip footings with precast concrete or galvanised steel arch segments and will be designed in accordance with SEPA Good Practice Guidance (2010). The headwalls, if required, will be precast concrete.

3.4.28 A total of 25 new watercourse crossings will be constructed on site. Figures 10.7 shows the location of all the watercourse crossings while Appendix 10.3 provides details of each watercourse at the location of the crossing. The design of each crossing will be determined at detailed design, following ground investigations and it is proposed that the final solution and detailed design for all water crossings will be addressed through an appropriately worded condition in order to ensure that the works comply with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (also known as the Controlled Activities Regulations (CAR)). Where necessary CAR licences for work affecting watercourses will be applied for post-consent, prior to construction commencing once final design has been reached.

3.4.29 Illustration of a typical watercourse crossings, pipe and arch culverts, are provided in Figures 3.5a and b. The Proposed Development infrastructure cross a number of watercourse within the Proposed Development site boundary.

Grid Connection

3.4.30 The electrical power produced by the individual turbines will be fed to an onsite substation within the site via underground cables. The proposed location for the onsite substation is shown in Figure 1.2, which is located in the north of the site. Connection of the Proposed Development to the grid will be subject to a separate planning application.

3.4.31 Onsite cables installed by the Applicant within the site will be laid in trenches, typically up to a maximum of 0.5 m deep and 1 m wide. The trenches will also carry earthing and communication cables for the operation of the Proposed Development. Cabling will be located mainly adjacent to the access tracks. The cables will be laid on a sand bed and the trenches backfilled using suitably graded material.

3.4.32 The onsite substation compound will measure approximately 75 m by 35 m and will accommodate all the equipment necessary for automatic remote control and monitoring of the Proposed Development, in addition to the electrical switchgear, fault protection and metering equipment required to connect the Proposed Development to the electricity transmission network, and a hardstanding area for vehicle parking constructed from crushed stone to a depth of approximately 600 mm. The substation building will measure approximately 25 m by 15 m with an approximate height of 7.6 m, subject to the final detailed design of the substation. Indicative elevation drawings of the onsite substation are provided in Figure 3.6. It will be constructed and finished in accordance with details to be approved by NAC through an appropriately worded condition.

Temporary Construction Compound

3.4.33 A principal construction compound for the site (in addition to the compound area for the on-site substation construction as noted above) will be required as a control centre for all site activities and to provide facilities for the day-to-day needs of the project and the workforce. The compound will be located to the south-east of the Proposed Development, centred on the coordinates BNG (220683, 665659), as shown on Figure 1.2. It will comprise an area of 1 ha, at 100 m by 100 m.

3.4.34 The compound area will house temporary portable cabin structures to be used as the main site office and welfare facilities, including toilets and washing facilities and waste storage. It will also be used for the storage and assembly of certain components, containerised storage for tools and small parts, and appropriately bunded oil and fuel storage. Adequate parking will be provided for cars and

light vehicles. Access into the main site will be controlled from this location, with appropriate signing in and out procedures.

3.4.35 On completion of construction works, all temporary structures will be removed, and the compound area will be restored to its previous state.

3.4.36 The detailed location, size 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.

Meteorological Mast

3.4.37 A permanent onsite meteorological monitoring mast will be required to monitor wind speeds for the operational life of the Proposed Development. It is expected that the mast will be of a height no greater than 100 m and will be situated on a reinforced concrete foundation of approximately 5 m by 5 m with guidewires extending to a distance of no greater than 50 from the base for stability (refer to Figure 3.7).

The final location and height of the meteorological mast will be determined in consultation with the confirmed wind turbine manufacturer prior to construction of the Proposed Development. It is proposed that these details and any requirements for aviation lighting will be addressed through an appropriately worded condition

Borrow Pit Search Areas

3.4.38 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 track construction. A borrow pit is an area where material has been excavated for use at another location.

3.4.39 One temporary borrow pit search area has been identified within the eastern extent of the Proposed Development boundary, centred on the coordinates BNG (222134, 666236) and approximately 0.013 ha in size. The location of the borrow pit is shown in Figure 1.2.

3.4.40 Detailed site investigations will be carried out prior to construction to confirm the rock type, rock characteristics and suitability, as well potential volumes to be extracted from the search area. The final borrow pit identified during the geotechnical evaluation will be defined within the Construction Environmental Management Plan (CEMP) (refer to Section 3.5 below). The pollution control measures to be implemented during usage of the borrow pit and its reinstatement will also be covered within the CEMP.

3.4.41 The borrow pit 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 8.

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

3.4.43 Further information is provided in Appendix 3.2.

3.5 Construction

3.5.1 The estimated on-site construction period for the Proposed Development is expected to take approximately 14 months and includes a programme to reinstate all temporary working areas. Normal construction hours will be between 07:00 and 19:00 Monday to Friday and 08:00 to 18:00 at weekends. These times have been chosen to minimise disturbance to local residents and if required to be restricted this will be agreed with NAC by an appropriately worded condition. Details of the construction programme will be provided to NAC in the CEMP prior to the commencement of construction.

3.5.2 Any construction out with these hours, due to construction time constraints (e.g. specific works are required to be undertaken within one session), weather windows and/or health and safety

requirements, will be in line with the noise limits as assessed in Chapter 8 (Noise) and advance warning of any works out with the normal working hours will be provided to NAC Environmental Health Officer and local residents.

3.5.3 The construction programme will consist of the following principal operations, listed sequentially wherever possible. The Proposed Development will likely be phased so that certain activities will take place concurrently:

- construction of the construction compound and establishment of a storage area for wind farm components and temporary site facilities;
- construction of access tracks, including construction of drainage, and excavation of cable trenches;
- construction of wind turbine foundations, crane pad hardstanding areas, met mast and substation;
- cable laying;
- erection of wind turbines;
- connection of on-site electrical power and signal cables;
- commissioning of the site equipment; and
- site reinstatement and restoration of temporary works areas.

3.5.4 The main materials likely to be required in part or total for the construction of the track, turbine and control building foundations, hardstanding areas and cable trenches are described below:

- crushed stone;
- precast concrete pipes or uPVC twin wall pipes for culverts
- geotextile;
- sand;
- steel reinforcement; and
- electrical cable.

3.5.5 It is proposed that all the concrete will be batched on-site at the construction compound.

3.5.6 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.

3.5.7 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.

3.5.8 As soon as practical, once installation is complete, the immediate construction area will be restored to its original profile, although the crane hardstanding's will be retained for future maintenance. The topsoil will be replaced and reseeded where appropriate and as advised by an onsite Environmental Clerk of Works (ECoW). The ECoW will be responsible for pre-construction surveys and will be onsite through construction and post-construction as required. Further details of their role will be provided in the CEMP.

Traffic and Transportation

3.5.9 A detailed Traffic and Transport Assessment is provided within Chapter 11 of this EIA Report.

3.5.10 Construction traffic associated with the construction and maintenance of the Proposed Development falls into two categories, namely Abnormal Indivisible Loads (AIL) and Construction/Maintenance Loads. Details of both types of vehicles are as follows:

- AILs:
  - wind turbine blade transporter;
  - nacelle/tower section transporter;
  - assembly crane; and
  - transformer transporter.
- Construction/Maintenance Loads:
  - 4-axle large tipper Heavy Goods Vehicle (HGV);
  - standard low loader; and
  - land rover/transit vans, general personnel transport.

3.5.1 Preferred access routes are detailed in Chapter 11.

3.5.2 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.

3.5.3 The Applicant will ensure that the vehicles will be routed as agreed with NAC and Transport Scotland, to minimise disruption and disturbance to local residents. Further details regarding transport and access can be found in Chapter 11 within this EIA Report.

Pollution Prevention & Health & Safety

3.5.4 Prior to commencement of construction activities, a pollution prevention strategy, contained within a CEMP, will be agreed with SEPA to ensure that appropriate measures are put in place to protect watercourses and the surrounding environment.

3.5.5 As with any development, during the construction stage there is the potential for threats to the quality of the water environment in waterbodies, watercourses and local ditches. These mostly arise from poor site practice so careful attention will be paid to the appropriate guidance and policies to reduce the potential for these to occur (refer to Chapter 10).

3.5.6 Any fuel or oil held on site will only be of an amount sufficient for the plant required. This will be stored in a bunded area, as noted above, and an oil interceptor will be installed to prevent pollution in the event of a spillage, in accordance with GPP2 – Above Ground Oil Storage (SEPA, 2017). There will be no long-term storage of lubricants or petrochemical products on-site.

3.5.7 High standards of health and safety will be established and maintained at all times. All activities will be undertaken in a manner compliant with applicable health and safety legislation and with relevant good practice, as defined under applicable statutory approved codes of practice and guidance.

3.5.8 Further details of site-specific pollution prevention and protection of watercourses during construction are presented in Chapter 10.

Construction Environmental Management Plan (CEMP)

3.5.9 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).

3.5.10 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 groundwater;
- 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).

3.5.11 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 17) 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 including The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (amended 2013) (Scottish Government, 2011);
- details of how the Applicant will implement and monitor construction best practice techniques;
- details of a Peat Management Plan, following the principles set out in the joint Scottish Renewables and SEPA guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste' (Scottish Renewables and SEPA, 2012) (an outline Peat Management Plan is provided in Appendix 10.1);
- 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; and
- details on how the Applicant will liaise with the public and local landowners and how they will respond to any queries and/or complaints.

3.5.12 The Applicant shall consult with SNH, SEPA, Historic Environment Scotland and NAC on the relevant aspects of the CEMP. The Applicant shall amend and update the CEMP as required throughout the construction and decommissioning period.

3.5.13 Specific requirements of the CEMP for each of the environmental topics assessed in the EIA are provided in the relevant EIA Report chapters.

3.6 Operation and Maintenance

3.6.1 Most of the operation of the Proposed Development will be automatic, with turbine operation managed by control and monitoring systems to control the rotational speed of each individual turbine and ensure its continued safe operation.

3.6.2 The lifetime of the Proposed Development is envisaged to be 30 years from final commissioning to commencement of decommissioning. Regular maintenance and servicing will be performed on each turbine. Additionally, there may be a need to conduct irregular, ad hoc maintenance in the event of breakdown.

3.6.3 Access tracks and crane hardstandings will be retained during the operational period to allow access for maintenance operations.

3.6.4 Health and safety will also be controlled as set out in the construction phase.

3.7 Decommissioning

3.7.1 At the end of the Proposed Development's operational lifespan of 30 years, it will be decommissioned, unless further consents are sought. It is expected that decommissioning will take approximately 12 months. The environmental effects of decommissioning are considered to be the same or less than those during construction, and over a shorter time period.

3.7.2 Prior to decommissioning, a Decommissioning Environmental Management Plan (DEMP) will be produced to reflect then current legislation and policy and will be agreed with the relevant statutory authorities.

3.7.3 During the decommissioning phase, vehicles will access the site by the same routes used for delivery and construction.

3.7.4 Either the restored temporary construction compound will be re-established, or a new construction compound developed as agreed with NAC at the appropriate time, to temporarily store decommissioned plant and equipment. The nacelles and blades will be removed using cranes situated on the retained crane hardstandings. The towers will then be dismantled.

3.7.5 All turbine components will be removed from the site for disposal and/or recycling as appropriate and in accordance with regulations in place at that time.

3.7.6 If required, exposed parts of the concrete foundations would be ground down to below sub-soil level, however, 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.

3.7.7 The land used for the turbine base areas, on-site access tracks, temporary compounds and crane pads would be returned to its previous use unless further consents were granted to retain or vary the use of these elements of the Proposed Development.

3.7.8 If, after the operational lifespan of the Proposed Development has expired, there is potential for repowering the Proposed Development, for example by installing new nacelles, blades or other components, this would be subject to a separate consenting process.

3.8 Climate and Carbon Balance

3.8.1 This section of the chapter details the calculations undertaken to establish the carbon dioxide (CO_2) emissions from the Proposed Development. In addition to generating electricity, the Scottish Government sees windfarms as an important mechanism for reducing the UK's CO_2 emissions. This section estimates the CO_2 emissions associated with the manufacture and construction of the Proposed Development as well as estimating the contribution the Proposed Development would make to reducing CO_2 emissions, to give an estimate of the whole life carbon balance of the Proposed Development. The carbon balance assessment uses the Scottish Government's web-based Carbon Calculator Tool (Scottish Government, 2019). The assessment is based on a detailed baseline description of the Proposed Development and its location. All calculations are based on site specific data, where available. Where site specific data is not available, approved national/regional information has been used.

3.8.2 The purpose of the Carbon Calculator Tool is to assess, in a comprehensive and consistent way, the carbon impact of windfarm developments. This is undertaken by comparing the carbon costs of windfarm developments with the carbon savings attributable to the windfarm.

3.8.3 Carbon emissions and savings are both ultimately part of a global 'pool' and therefore this assessment is not restricted solely to those emissions or savings that occur within the site boundary of the Proposed Development. Land-based emissions from peat and habitat losses are based on the site boundary but other activities, for example, emissions resulting from the extraction and production of steel, are likely to occur in other parts of the world but are still attributable to the Proposed Development.

3.8.4 To undertake the assessment of carbon balance the following parameters were considered, which encompass a full life cycle analysis of the Proposed Development. These parameters include:

- Emissions arising from the fabrication of the turbines and all the associated components;
- emissions arising from construction (including transportation of components; quarrying; building foundations, access tracks and hard standings; and commissioning);
- the indirect loss of CO_2 uptake (fixation) by plants originally on the surface of the site but eliminated by construction activity (including the destruction of active bog plants) and felling;
- emissions due to the indirect, long term liberation of CO_2 from carbon stored in peat due to drying and oxidation processed caused by construction; and
- loss of carbon due to drainage of the site and from forestry clearance.

3.8.5 Version 1.6.0 of the Carbon Calculator Tool is the current model and was used in this assessment. The online calculation tool (project reference H8PP-LQ12-QNXJ) allows a range of data to be input in order to address the expected, minimum and maximum values as a result of the Proposed Development. However, it should be noted that if several parameters are varied together, this can have the effect of 'cancelling out' a single parameter change. For this reason, the approach for this assessment has been to include 'maximum values' as those values which would result in the longest (maximum) payback period; and 'minimum values' as those values which would result in the shortest (minimum) payback period.

3.8.6 The input parameters for the Scottish Government online calculation tool are detailed in Appendix 3.3. The choice of methodology for calculating the emission factors uses the 'Site Specific Methodology' defined within the calculation tool.

3.8.7 The carbon calculations results are provided in Appendix 3.3 and can be viewed online (using the project reference code H8PP-LQ12-QNXJ. A summary of the anticipated carbon emissions and carbon payback period of the Proposed Development are provided in Table 3.2 below.

Table 3.2 – Anticipated Carbon Emissions

Results	Expected	Minimum	Maximum
Net emissions of carbon dioxide (t CO2 eq.)	61,150	59,233	62,890
Carbon Payback Period of Proposed Development Comparison			
Displacing coal-fired electricity generation (years)	0.7	0.6	0.8
Displacing grid-mix of electricity generation (years)	2.5	2.2	2.8
Displacing fossil fuel mix of electricity generation (years)	1.4	1.2	1.6

3.8.8 The calculations of total CO_2 emission savings and payback time for the Proposed Development indicates the overall payback period of a windfarm with 10 turbines with an average (expected) installed capacity in the region of 4.2 MW per turbine would be approximately 1.4 years, when compared to the fossil fuel mix (the existing energy mix within the UK) of electricity generation.

3.8.9 The potential savings in CO_2 emissions due to the Proposed Development replacing other electricity sources over the lifetime of the Proposed Development (assumed to be 30 years for the purposes of the carbon calculator) are approximately:

- 90,037 tonnes of CO_2 per year over coal-fired electricity (2.70 million tonnes assuming a 30 year lifetime for the purposes of the carbon calculator);
- 24,817 tonnes of CO_2 per year over grid-mix of electricity (0.74 million tonnes assuming a 30 year lifetime for the purposes of the carbon calculator); or

- 44,040 tonnes of CO_2 per year over a fossil fuel mix of electricity (1.32 million tonnes assuming a 30 year lifetime for the purpose of the calculator).

3.9 References

Scottish Government (2011). *The Water Environment (Controlled Activites) (Scotland) Regulations 2011.* Available at:
http://www.legislation.gov.uk/ssi/2011/209/contents/made

Scottish Government (2017). *The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.* Available at:
http://www.legislation.gov.uk/ssi/2017/102/contents/made

Scottish Government (2019). *Carbon Calculator Tool v1.6.0.* Available at:
https://informatics.sepa.org.uk/CarbonCalculator/index.jsp

Scottish Renewables & SEPA (2012). *Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.* Available at: https://www.macarthurgreen.com/files/00455955.pdf

Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science, & AEECoW (2019). *4th ed. Good Practice During Wind Farm Construction.* Available at:
https://www.nature.scot/sites/default/files/2019-05/Guidance%20-%20Good%20Practice%20during%20wind%20farm%20construction.pdf

SEPA (2017). *Above Ground Oil Storage Tanks: GPP 2*. Available at:
https://www.netregs.org.uk/media/1299/gpp-2-pdf.pdf

Williamsleatag (2019). *Design Manual for Roads and Bridges*. Available at:
http://www.standardsforhighways.co.uk/ha/standards/dmrb/

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