2. DESCRIPTION OF DEVELOPMENT

2.1 Introduction

2.1.1 This chapter provides a description of the proposed varied development for the purposes of identifying and assessing likely significant effects. Information is provided on:

- the physical characteristics of the whole proposed development, including construction, operation and decommissioning;
- land use requirements during the construction and operational phases;
- the main characteristics of the operation of the proposed development, including the nature and quantity of energy, material and natural resources used; and
- an estimate by type and quantity of expected residues and emissions produced during the construction and operation phases.

2.1.2 This chapter is supported by the technical appendices described in Table 2.1.

Table 2.1: Technical Appendices Supporting Chapter 2

Title	Description
Technical Appendix 2.1: Project Description Details	Schedule providing details of land-use (as required by the 2017 EIA Regulations), and turbine coordinates. For the avoidance of doubt, there is no change proposed in the land use area or turbine coordinates from the consented Viking Wind Farm.
Technical Appendix 2.2: Site-specific Environmental Management Plan	Reproduced from the ES Addendum (Appendix 14.6). It is noted that, in accordance with Condition 22 of the consent, an updated site specific Environmental Management Plan will be prepared for the agreement of the Planning Authority, taking account of good practice guidance and legislation published since the ES Addendum was prepared.
Technical Appendix 2.3: Peat Slide Risk Assessment	Reproduced from the ES (Appendix 14.1). No changes are proposed to the site layout, and as such the Peat Slide Risk Assessment prepared for the ES is considered to remain valid. It is noted that condition 10 and 22 of the consent requires further detail on peat slide risk and mitigation to be produced prior to construction commencing. It is noted that the original assessment made reference to peat slide risk in the Collafirth and Delting quadrants which do not form part of the consented Viking Wind Farm or the proposed varied development.
Technical Appendix 2.4: Peat Management Plan	An updated peat management plan, replacing the ES Addendum Appendix 14.4 has been prepared based on an improved baseline understanding of the peat extent and depth. It is noted that condition 10 and 22 of the consent requires further detail on peat management and excavated material management to be produced prior to construction commencing.
Technical Appendix 2.5: Borrow Pit Assessment	Reproduced from the ES (Appendix 14.2). No changes are proposed to the site layout from the consented Viking Wind Farm, and as such the Borrow Pit Assessment prepared for the ES is considered to remain valid. It is noted that condition 2 and 10 of the consent requires further detailed information on the restoration proposals for borrow pits to be submitted to the planning authority for approval prior to construction commencing. It is noted that the original borrow pit assessment made reference to borrow pits in

Table 2.1: Technical Appendices Supporting Chapter 2	
Title	**Description**
	the Collafirth and Delting quadrants which do not form part of the consented Viking Wind Farm or the proposed varied development.
Technical Appendix 2.6: Carbon Calculator	Carbon calculator prepared for both the consented Viking Wind Farm and the proposed varied development using the Carbon calculator tool v1.5.0[1] (October 2018).
Technical Appendix 2.7: Watercourse Crossing Details	Reproduced from the ES (Appendix 14.3). No changes are proposed to the site layout of the consented Viking Wind Farm, and as such the stream crossing assessment prepared for the ES is considered to remain valid. It is noted that the original assessment made reference crossings in the Collafirth and Delting quadrants which do not form part of the consented Viking Wind Farm or the proposed varied development.

2.1.3 Figures 1.2, 2.1 – 2.8 are referenced in the text, where relevant.

2.1.4 The proposed varied development would comprise 103 turbines along with associated infrastructure and ancillary development, as illustrated by the site layout shown on Figure 1.2 and as described in greater detail in the remainder of this Chapter and supporting Technical Appendices. The proposed wind generating station together with the associated infrastructure and ancillary development comprise the development for which deemed planning permission is sought under a section 57(2) direction under the 1997 Act. The proposed varied development would include the following key components:

- not more than 103 turbines each with a maximum tip height of 155 metres (m) and rotor diameter of 120m, and associated crane pads;
- all site tracks and foundations;
- seven permanent anemometry masts for monitoring wind farm (free standing lattice masts up to 96.5 m tall);
- substation at Moo Field and associated control buildings and compounds and a central sub-station/control building and workshop adjacent to the proposed Scottish Hydro Electric Transmission plc converter station in the Kergord valley;
- up to 10 borrow pits for the excavation of rock;
- temporary turbine component laydown areas;
- underground power cables;
- watercourse crossings; and
- temporary construction compound areas providing site offices, welfare facilities and storage for plant and materials and satellite construction compounds; and concrete batching plants.

2.1.5 Technical Appendix 2.1: Project Description Details provides the proposed turbine coordinates (British National Grid (BNG)) and both temporary and permanent land use requirements for the proposed varied development. The turbine coordinates and land use requirements are unchanged from the consented Viking Wind Farm. The locations of the proposed turbines and other infrastructure would be subject to 'micrositing' to take account of more detailed topographical and geotechnical surveys which would precede the start of construction works. Turbine positions and track routes may be amended by up to 50 m with the approval of (or at the request of) an Environmental Clerk of Works, with input from the site archaeologists, ecologists, and any other relevant specialists supervising construction activities, or by up to 100 m with the approval Shetland Islands Council (SIC), in consultation with appropriate consultees, such as Scottish Natural

[1] URL: https://informatics.sepa.org.uk/CarbonCalculator/index.jsp (accessed 24.10.2018)

Heritage (SNH), Scottish Environment Protection Agency (SEPA) or Historic Environment Scotland (HES). The Site-specific Environmental Management Plan (SEMP) would include detailed guidance on the application of the proposed micrositing tolerance (as required by condition 22 of the consent). An outline SEMP is included in Technical Appendix 2.2 (reproduced from the ES Addendum).

2.2 Site Access

2.2.1 The proposed Site Access remains unchanged from the consented Viking Wind Farm. The site would be accessed at locations described on Table 2.2 and further detailed in Chapter 10: Access, Traffic & Transport. The detail of new junction designs would be agreed with Shetland Islands Council (SIC) Roads Service and is likely to include the formation of a bell mouth to accommodate abnormal indivisible loads (AILs), opening up sight lines where necessary, and laying tarmac at the junction and for an appropriate length along the access track.

Table 2.2: Access Points and Purpose

Quadrant	Location	Purpose/Comment
Kergord	A970 Hamarigrind Scord (Access Point 4)	AIL and non-AIL access. Would be a staggered junction.
	B9075 Setter House (Access Point 6)	AIL and non-AIL access.
	B9075 Lamba Scord	AIL and non-AIL access.
	A971 Scord of Sound	AIL and non-AIL access. Construction traffic using this access would approach and depart via the A971 past Tingwall, and, would therefore not use the B9075 through Weisdale.
Nesting	A970 East of Hamarigrind Scord (Access Point 4)	AIL and non-AIL access. Would be a staggered junction.
	A970 East of Sand Water (Access Point 8)	AIL and non-AIL access.

2.2.2 Turbine towers, blades and nacelles are likely to be transported via trailers with self-steering rear axles (refer to Plate 2.1). The tower sections and other turbine components would be stored either at a designated laydown area or at each turbine hardstanding until turbine erection commences.

Plate 2.1: Typical Haulage Vehicle for Turbine Delivery

2.2.3 There are two principal options for the delivery of turbine components, either or both of which may be used:

- Sullom Voe/Sella Ness; or
- Greenhead/Dales Voe.

2.2.4 Very few modifications to the public roads are likely to be required because of the generally high standard of Shetland roads. Where modifications are required these are not considered likely to give rise to significant environmental effects. Further details on the access route, abnormal load transportation proposals and the potential for traffic-related construction stage effects are provided in Chapter 10: Access, Traffic and Transport.

2.2.5 A separate planning application is currently under consideration by SIC in relation to the proposed upgrade of Kergord access track between the B9075 road and the upper Kergord converter station (SIC planning application reference: 2016/226/PPF). In addition, an EIA screening request has been submitted in relation to the provision of a new section of road to replace a section of the existing B9075 (Sand Water Road). A planning application for this road improvement would be submitted upon the receipt of an EIA screening opinion from SIC. Neither of these proposals form part of the description of development and are being progressed via separate consenting routes.

2.3 Operational Phase Components

Wind Turbines

Turbine Specification

2.3.1 The proposed development would consist of 103 three bladed horizontal axis wind turbines. Based on the candidate turbine (Siemens SWT 4.3MW 120) the proposed turbines would not exceed the installed capacity of the consented Viking Wind Farm (up to 457.2 MW). Nevertheless, the overall rating could change should new turbines be available on the market at the time of construction procurement. The maximum turbine parameters selected for the purposes of this EIA is a turbine with a maximum ground to tip height of 155 m. Typical turbine details, including the indicative hub height and maximum rotor diameter are illustrated in Figure 2.1.

2.3.2 The turbine would generate electricity from wind speeds between approximately 3 metres per second (ms^{-1}) to 25 ms^{-1} with variable rotor speed and pitch regulation on the blades to control power output and maximise efficiency. The rotor would be mounted upwind of the tower, and all rotors would turn in the same direction. The rotational speeds would range from approximately 4 revolutions per minute (rpm) up to a maximum of approximately 18 rpm.

2.3.3 Above ground, each turbine would comprise:

- a tubular steel tower with door and internal access systems;
- a nacelle housing generator, gearbox, hydraulic and electrical control systems, and externally mounted anemometry instruments; and
- a rotor comprising a central hub and three blades.

2.3.4 Wind turbines are available in a variety of colours, the most common being white, off white or light grey. The finish is normally semi-matt. The colour of the turbines would be agreed in consultation with SIC.

2.3.5 A transformer would be required for each turbine. For the purposes of this assessment it has been assumed that the transformers would be located adjacent to each turbine. These are typically 6.25 m^2 in plan area and 3 m in height and would be sited within the standard hardstanding areas adjacent to the turbine. Depending on the turbine selected for the site, the transformer may be contained within the turbine towers.

Turbine Installation

Foundations

2.3.6 The wind turbines would typically be erected on steel re-enforced concrete foundations. The foundations would be situated under the turbine locations shown on Figure 1.2. Detailed foundation design would be completed following detailed geotechnical evaluation at each turbine location and final selection of a turbine model at the pre-construction stage. For the purposes of the EIA it is assumed that these would be of gravity-based design. Figure 2.2 provides an illustration of a typical turbine foundation. Plate 2.2 provides a photograph of a typical foundation construction.

2.3.7 Construction of the turbine foundations would generally require the excavation of subsoil and rock to a specified formation level, usually around 4 m below existing ground level. The formation would be levelled off prior to the in-situ casting of a steel-reinforced concrete foundation. Foundations are likely to be circular with a diameter of approximately 25 m. The depth of the excavation would depend on the depth to bedrock, with the sides 'battered' back to ensure that they remain stable during construction. Each foundation would require approximately 700 m^3 of concrete and 70 tonnes of steel reinforcement.

2.3.8 The foundation inserts would then be cast into a central concrete up-stand section, to which the turbine tower would later be bolted. The excavated area would be back-filled with compacted layers of graded material from the original excavation and capped with peat or soil. Locally around the turbines the finished surface would be capped with crushed aggregate to allow for safe personnel access around the base of the turbine.

Plate 2.2: Construction of Turbine Foundations

Crane Hardstanding

2.3.9 During the erection of the turbines, crane hardstanding areas would be required at each turbine base, as shown on Figure 2.3. Different turbine manufacturers require varying sizes of hardstanding. Typically, these consist of one main area of up to 2,500 m^2 adjacent to the turbine position where the main turbine erection crane and assist crane would be located. There would be a requirement to use cranes on occasion during the operational phase of the proposed development, so the main crane hardstanding (1,400 m^2) would be retained. The final size, design and layout of the crane hardstandings would be determined by the turbine supplier according to their preferred erection method, with micrositing to be exercised under the supervision of an

Environmental Clerk of Works. In addition to the main hardstanding areas, other areas, totalling up to 500 m^2 per turbine would be formed and used during the assembly of the main crane boom (hardstand for assist crane), assembly of the rotor as well as a trestle area for turbine blades and an area for tower storage as shown in Figure 2.2. The proposed approach complies with current good practice guidance (Scottish Renewables *et al.,* 2015) which recommends crane hardstanding areas are left uncovered for the lifetime of the proposed development.

Access Tracks

Access Track Specification

2.3.10 No changes are proposed to the site access track network or track specifications from the consented Viking Wind Farm. Tracks are required to enable the turbine components and construction materials to be transported to their locations, and to enable ongoing access for subsequent maintenance visits. There are main 'access' tracks to the site, and there would be a series of 'site' tracks accessing each turbine and the borrow pits, anemometry masts, control rooms and substations (Figure 1.2). There would be three standards of track, all of which would remain in place for the lifetime of the proposed development:

- single width construction tracks, with a running surface approximately 6 m wide;
- double width construction tracks along main arterial routes with a running surface approximately 9 m wide, to minimise congestion; and
- operational tracks, built to a lower specification, and with a 3.5 m running surface, to provide short cuts for lighter operational vehicles.

2.3.11 Some access tracks follow the routes of existing hill tracks. These would be utilised as far as is practical, following appropriate upgrading to a standard required for wind turbine construction and maintenance access. Figure 2.4 provides an illustration of typical track construction specifications.

Access Track Construction

2.3.12 The proposed access tracks total approximately 71.06 kilometres (km) in length. The access track layout is shown on Figure 1.2. The layout shown in Figure 1.2 includes 44.94 km of excavated track (9 m wide) and 26.12 km of floating track (6 m wide).

2.3.13 Depending on local ground conditions, access tracks would be constructed using either a 'floating track' or a 'cut track' design. Generally, a 'floating track' design would be utilised on the site in areas where peat depth is greater than 1 m^2. This would incorporate geotextile material laid onto the surface to suit the road width, which would greatly increase the resistance to prevent the tracks settling into the ground. A layer of approximately 700 mm of crushed stone would then be laid on the geotextile to form the track, which produces a steep stone batter with the edges of the track raised above the surface. This style of track is typically used in peaty areas across Scotland including other wind farm developments as well as public roads.

2.3.14 In areas of shallow or no peat (0-1m), a 'cut track' design would be utilised for which the topsoil and peat would be stripped to expose a suitable foundation horizon on which to build the track. The track would then be constructed by laying and compacting crushed rock (obtained from suitable on-site borrow pits) to the required level. Given the variable and undulating topography across the site, it is likely that earthworks (cuttings and embankments) would be required to achieve the required gradients for tracks and crane hardstandings. Cutting slopes would be designed to reflect the existing landscape and topography and would likely range from gradients of 1:1 to 1:2. The upper soil/peat horizon, together with any vegetation, would be placed to one side during construction and used to dress around the tracks, drainage features and hardstandings during reinstatement.

[2] Exceptions may be made according to engineering limitations

2.3.15 All tracks would be designed to incorporate passing places and turning heads. It is anticipated that passing places would be required approximately every 500 m, with typical dimensions as shown in Figure 2.4. Turning heads would be incorporated along the access tracks to avoid long reverse driving for loaded transports, for example, where they may be required to turn around prior to delivery of the load.

2.3.16 The access track layout has been designed taking into account a range of environmental and technical constraints. This included a requirement to maintain appropriate gradients for construction and turbine delivery vehicles and avoid watercourses and deeper peat where possible.

2.3.17 Proposed site access track routes have been designed to minimise watercourse crossings. Watercourse crossings would be designed to maintain the hydrological characteristics of the watercourses as well as allowing the free passage of mammals, and aquatic species (where relevant). An appropriate crossing type for each of the proposed watercourse crossings required for the development was specified as part of Appendix 14.3 of the 2009 Viking Wind Farm Environmental Statement (reproduced as part of this EIA Report in Technical Appendix 2.7: Watercourse Crossing Details). No changes are proposed to the specified watercourse crossing types as part of this EIA Report; however, it is noted that Technical Appendix 2.7 makes reference to crossings in the Collafirth and Delting quadrants, which are not part of the consented Viking Wind Farm or the proposed varied development. The final detailed design of the crossings, including gaining any necessary authorisation for the crossings under The Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended), referred to henceforth as the CAR, would be completed by the appointed contractor during the post-consent/pre-construction phase of development. It is noted that the site would require a Construction Site License under the CAR, which would include the agreement of pollution prevention plan for controlling the quantity and quality of surface water discharge from the site during construction.

2.3.18 All new constructed tracks would be constructed to good practice working methods [3,4,5,6,7,8]. Where necessary, the access tracks would be constructed incorporating sufficient sub-track cross drainage to ensure that hydraulic continuity in ground water sensitive habitats would be maintained at pre-development levels without concentrating the discharges into a narrow channel. This would be achieved by using a porous granular rock fill blanket and perforated pipes, wrapped in geotextile placed below the track construction.

2.3.19 The final detailed track designs would be determined by the appointed civil engineering contractor, in consultation with the project Environmental Clerk of Works, following pre-construction detailed topographical and geotechnical investigations.

Substations

2.3.20 The wind farm would be clustered into two main electrical sub-groups. The southern Nesting quadrant would be connected to a sub-station at Moo Field, about 3km north of Catfirth. It is envisaged that the South Nesting Sub-station at Moo Field would be connected to the convertor station by means of an underground 132 kV cable. All other turbines would be connected to a combined control building/substation location adjacent to the AC/DC convertor station in Kergord Valley. These substations were consented under the relevant section 36 consent granted by

[3] Forestry Commission (2011). Forests and Water. UK Forestry Standard Guidelines. Forestry Commission, Edinburgh. i–iv + 1– pp.
4 Forestry Commission (2014) Forest Commission Road Specification, April 2014, URL: http://www.forestry.gov.uk/forestry/infd-6emgrz (accessed 16.10.15)
5 Scottish Natural Heritage (2015) Good Practice During Wind Farm Construction, A joint publication by Scottish Renewables, SNH, SEPA, Forestry Commission Scotland and Historic Scotland, 3rd Edition.
6 CIRIA Publications 2006: Control of Water Pollution from Linear Construction Projects. Site Guide (C649);
7 Scottish Natural Heritage (2013) Constructed Tracks in the Scottish Uplands, 2nd Edition;
8 Forestry Commission Scotland and Scottish Natural Heritage (2010) Floating Roads on Peat.

decision letter from the Scottish Ministers dated 4 April 2012 and form part of the consented Viking Wind Farm.

2.3.21 The substations would provide isolators, circuit breakers, transformers, the Supervisory Control and Data Acquisition (SCADA) system, and, would form the interface point between the proposed development and the external electricity grid. An indicative substation compound plan is shown on Figure 2.5. The detailed design of the external equipment in the compound would not be confirmed until the final turbine is selected, and detailed design undertaken post consent.

Onsite Cabling

2.3.22 The turbines would be electrically connected to the control building by means of sets of three 33 kilovolt (kV) cables. The cables, along with control and telecoms cables, and earthing tape, would be laid underground in trenches. The trenches would be backfilled, possibly partially with sand brought onto the site. Alternatively, cables may be laid by means of a cable plough. In both cases, cables would be marked with buried safety warning tape, and reinstated. Cables would generally be laid adjacent to the site tracks, following the same principles for protecting peatland hydrology, as applies to the access track construction. Indicative details for cable trenches are illustrated in Figure 2.3.

Meteorological Masts

2.3.23 Seven permanent anemometry masts would be required for control purposes and to ensure the efficient operation of the proposed development. The proposed mast locations are marked on Figures 1.2 and the locations are included in Technical Appendix 2.1. The masts would be free standing lattice construction up to 96.5 m high (Figure 2.4).

2.4 Associated Developments

Grid Connection

2.4.1 The proposed development would be connected to the transmission system at the proposed AC/DC converter station shown in Figure 1.2. It is envisaged that the connection to the mainland transmission system would be by means of a sub-sea high voltage direct current (HVDC) cable (which does not form part of this application). National Grid Electricity Transmission Ltd (NGET) is responsible for managing access to the GB transmission system, and Scottish Hydro Electric Transmission plc is the Transmission License holder responsible for providing a grid connection.

2.5 Construction Phase Components

Principal Site Operations

2.5.1 Construction onsite would consist of the following principal operations:

- excavation of aggregates from on-site borrow pits for track, turbine base and hardstanding construction;
- construction of site tracks within the wind farm;
- construction of temporary hard standing and temporary office and welfare facilities;
- construction of turbine foundations;
- construction of permanent crane hardstandings;
- excavation of trenches and cable laying adjacent to the site tracks;
- connection of distribution and telecommunications cables;
- erection and commissioning of turbines;
- reinstatement of borrow pits and the temporary construction compound areas; and
- Construction of 33/132kv sub-stations.

Borrow Pits

2.5.2 Borrow pits would be quarried to provide a source of stone necessary for the construction of access tracks and crane hardstanding areas. Proposed search areas for the borrow pits are shown on Figure 1.2. The use of on-site borrow pits is subject to post-consent ground investigations proving the presence of suitable stone. It is proposed that a method statement for the formation, management and restoration of the borrow pits be agreed with the Shetland Islands Council prior to opening the borrow pits, using current good practice.

2.5.3 The aims of such a method statement would be to ensure efficient safe working, prevention of pollution, and the meeting of hydrological, ecological, archaeological, noise and landscape environmental objectives and commitments. The following paragraphs describe the likely basic principles, which would be modified accordingly in the case of reopening of former borrow pit sites:

- a series of trial pits and test drills would be made to inform the design;
- pollution prevention measures such as silt traps would be established to protect any vulnerable watercourses;
- turves would be removed and temporarily stored;
- overburden would be removed and stored;
- a working face would be established;
- the borrow pit would be worked either by excavator, or by combination of excavator and drill and blast, depending upon the characteristics of the rock. Typically, blasting would occur a maximum of once per week;
- if necessary the rock would be graded and crushed in a mobile crusher plant; and
- upon completion, the borrow pit would be partially reinstated, involving reworking of faces to stabilise them, partial infilling with overburden material and re-landscaping with peat and turves to create a habitat to tie in with the surrounding habitat types as far as possible.

Construction Compounds and Laydown Areas

2.5.4 The site layout illustrated in Figure 1.2 includes for four construction compound areas. A typical layout for a satellite contractor's compound is illustrated in Figure 2.5. The site facilities compound area would include:

- temporary portable office accommodation;
- tool storage;
- toilet and welfare facilities;
- maintenance and refuelling facilities;
- laydown areas; and
- parking.

2.5.5 It is likely that most of the concrete would be batched on-site. The batching plants would comprise aggregate and cement hoppers, water bowsers and tanks, a mixer, and control cubicle. Aggregates would be stockpiled adjacent to the plant. The batching plant would be located adjacent to the site compounds.

Construction Programme

2.5.6 It is expected that many of the above operations would be carried out concurrently. This would minimise the overall length of the construction programme such that it is limited to approximately four years. This period is however dependent on timing of the granting of consent, availability of grid connection and discharge of relevant consent conditions, and, the weather and ground conditions experienced at the site.

2.5.7 Table 2.3 provides an indicative construction programme.

Table 2.3: Indicative Construction Programme

Activities	Quarter															
	1 (2020)	2	3	4	5 (2021)	6	7	8	9 (2022)	10	11	12	13 (2023)	14	15	16
Principal Contractor Mobilisation																
Borrow Pits																
HV Cable Installation																
Construct New Access Track																
Turbine Base/Hardstanding Construction																
33/132kv Substation Construction																
Operations Building Construction																
Wind Turbine Generator Installation																
Borrow Pit Restoration																
Site Restoration																

2.6 Construction Working Practices

Site Environmental Management Plan

2.6.1 An outline Site Environmental Management Plan (SEMP) has been provided in Technical Appendix 2.2 of this EIA Report (reproduced from the ES Addendum, Appendix 14.6). The SEMP provides outline information on the proposed working methods to be used during construction to avoid, reduce or control the potential associated adverse environmental effects. The SEMP would form part of the contract documents between the Applicant and the appointed construction contractor. It is noted that the outline SEMP provided in Technical Appendix 2.2 contains reference to out of date/superseded reference documents. These references will be fully updated to discharge the pre-commencement condition (condition 22), which requires that the updated SEMP is agreed with SIC, in consultation with the relevant statutory bodies prior to commencement of construction. The SEMP would also be updated to include any additional site-specific information obtained during subsequent pre-construction surveys as part of the detailed design stage.

Construction Working Hours

2.6.2 General construction activities would typically be limited to the working hours of 07:00 to 19:00 Monday to Friday, and 07:00 to 12:00 on Saturday. However, to ensure that optimal use is made of fair weather windows and daylight, or at critical periods within the programme, it may be necessary to work outwith these hours and on Sundays, however this would be limited (in accordance with the consented Viking Wind Farm planning condition, part 2, condition 11) to work that is not audible from any noise-sensitive property located outwith the site, unless otherwise approved by the planning authority. In particular it would be necessary to make use of low wind speed weather windows during turbine installation. During turbine erection, it is anticipated that work would progress 24 hours per day, and seven days per week using a shift working pattern.

Site Reinstatement

2.6.3 Reinstatement works are generally undertaken during construction (and immediate post-construction phase) and aim to address any areas of ground disturbance and changes to the landscape as part of the construction works. Reinstatement is undertaken as soon as possible following the construction works in each area, such as:

- Areas disturbed by turbine foundation excavation;
- Track batters;
- Laydown areas;
- Site compounds, substations; and
- Borrow pits.

2.7 Site Operation and Maintenance

Site Operations

2.7.1 The wind farm has been designed with an operational life of approximately 30 years. On a day-to-day basis the wind turbines would operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction. The proposed development would be connected to a remote-control room, as well as an on-site building, from where output and key alarms would be monitored.

2.7.2 Routine maintenance and servicing would be carried out on each turbine approximately twice a year, in addition to the initial service three months after commissioning. On average two people would take five days to service each turbine.

2.7.3 At regular periods, oil and components would require changing, increasing the service time per machine. Gearbox oil changes are required approximately every 20 months. Blade inspections are carried out as required (normally somewhere between every two and five years). Appropriate maintenance works would be carried out immediately following any unexpected events on site, such as failure of a generator or gearbox.

2.7.4 There would also be regular safety inspections, maintenance of the tracks, fencing, and other infrastructure.

Employment

2.7.5 It is anticipated that approximately 34 permanent full-time jobs would be created for staff directly employed to manage and operate the proposed development. Additional staff would be utilised on site on an ad hoc basis.

Track Maintenance

2.7.6 Frequency of track maintenance depends largely on the volume and nature of the traffic using the track, with weathering of the track surface also having an appreciable effect.

2.7.7 Heavy plant is particularly wearing, and ongoing track maintenance would be undertaken as necessary throughout the year. Safe access would be maintained all year round

2.8 Site Decommissioning

2.8.1 The decommissioning period for a wind farm of this size is estimated to be 18-24 months. Detailed decommissioning proposals would be established and agreed with relevant authorities prior to commencement of decommissioning activities, in accordance with relevant conditions.

2.8.2 Decommissioning would likely involve:

- dismantling and removing the turbines;
- breaking out the exposed upstand section of the turbine foundation to a depth at/below the ground level and re-instating with topsoil where appropriate;
- restoration of all hardstanding areas adjacent to turbines;
- removing access tracks (or leaving them in place, whichever is more appropriate for the landowner). If removed, they would be re-instated with top soil;
- disconnecting turbine interconnecting cables (left in place); and
- removing the substation, control building, control and electrical equipment and any protective fencing before the land would be reinstated.

2.8.3 The turbines would be dismantled and removed from the site in a manner similar to that of their erection. The turbines would be split into suitable sections, which would then be transported, from the site by HGVs. It is anticipated that the removal of the turbine components from site would not result in abnormal loads as were required for construction, as components would be reduced to such a size as to be manageable on standard HGVs.

2.8.4 It is not currently good practice to remove the concrete foundations from the site as this would result in more land damage than leaving them in situ. The exposed concrete plinth would be removed, and the entire foundation would be graded over with topsoil and replanted appropriately to minimise ground disturbance. This follows advice in the Scottish Government's web-based renewables advice (Scottish Government, 2014).

2.8.5 All buildings and equipment would be removed including removal of fencing and of building foundations. All material arising would be disposed of responsibly as described above.

2.8.6 Some of the access tracks could be left on-site to ensure the continued benefit of improved access by the landowner(s), or they could be reinstated.

2.8.7 It is anticipated that underground cabling would not be removed.

2.8.8 The above has been considered when predicting decommissioning effects in each of the technical assessments reported in this EIA Report when considering potential decommissioning effects.

2.9 Residues and Emissions

Table 2.2: Residues and Emissions

Topic	Potential residue/ emission
Water	All surface water runoff from the proposed development would be captured by a SuDS to control the rate, volume and quality of discharge in to the water environment. All discharges would be subject to regulations in accordance with a pollution prevention plan to be approved under the CAR, and subject to a Construction Site License to be issued by SEPA. No significant residues or emissions have been identified.
Air	Due to the nature of the proposed development no significant point source or diffuse air emissions would be produced during its construction or operation. The proposed development would generate renewable electricity and would therefore displace CO2 emissions associated with electricity generation from non-renewable sources. The Scottish Government Carbon Calculator for Wind Farm on Peatlands was used to calculate a payback period for the consented Viking Wind Farm and the proposed varied development based on the full development lifecycle. The results of this assessment are contained in Technical Appendix 2.6: Carbon Calculator and indicate that the proposed varied development would have an expected payback period of 1.65 years compared to grid mix of electricity generation, while the consented Viking Wind Farm would have a payback of 1.72 years. The proposed varied development would save approximately 504,558.58 tonnes of carbon dioxide per year (compared to a typical grid mix of electricity supply) compared to 422,421.14 from the consented Viking Wind Farm. This equates to the proposed varied development supplying 475,099 homes with renewable electricity per year9 (compared to 397,757 for the consented Viking Wind Farm).
Noise and Vibration	The wind turbines would generate noise during operation, and the noise levels would vary according to the wind speed, within an agreed noise limit designed to protect residential amenity at nearby dwellings. Further details are presented in Chapter 6: Noise. There would be no vibration emissions associated with the proposed development.
Light	Construction compounds and working areas (during construction) may require lighting. The substation and control buildings are likely to be equipped with passive infra-red sensor-controlled security lighting. These would illuminate the sub-station compound area when activated. Any effect would be temporary and not expected to be significant during normal operation of the proposed development. The Air Navigation Order 2016 requires 'en-route obstacles' taller than 150 m to be provided with aviation lighting scheme. The Applicant would seek to agree suitable lighting scheme with the planning authority in consultation with the Scatsta Airport Operator and the Civil Aviation Authority (CAA). For the purposes of this EIA Report, it has been assumed that the lighting strategy would use medium intensity (2000 candela, cd), omni-directional red and steady lights, mounted on the nacelle, with lower intensity (32 cd) red lights fitted to the tower at half the height of the nacelle (assumed to be at 47.5m). This is likely to include radar activated lighting, which would reduce the times at which the lighting would be required substantially. It is noted that the hours of operation at Scatsta airport are 07:00 – 21:00 hours (Monday to Friday), and 08:00 – 18:00 hours (Saturday and Sunday, for 'catch up' purposes). The Applicant would seek a mitigation solution that would mean no lightings outside of these operational hours. 60 – 90 flights per week are typically scheduled from Scatsta. It is reasonable to assume 12 and 18 flights per day

[9] Based on a capacity factor of 46.3%.

Table 2.2: Residues and Emissions	
Topic	**Potential residue/ emission**
	(equating to between one flight every 47 mins to 70 minutes). In the winter months the airport is likely operate in low light and darkness for eight hours a day – (~ 6 to 10 flights). In the summer months low light operation would restricted to around one hour per day (~1 flight). Further detail on the assessment of light emissions is provided in Chapter 4: Landscape and Visual. Further details on the aviation impacts are provided in Chapter 7: Aviation and Telecommunications.
Soil pollution/ Waste	The power generation aspect of the proposed development would not produce any waste emissions or pollutants. However, the general operation and maintenance has the potential to produce a small amount of waste. This is likely to be restricted to waste associated with the control building from employees and visiting contractors and waste gearbox oils and lubricants. No soil pollution is anticipated. Peat excavated during construction would be managed in accordance with a Peat Management Plan (PMP). The Stage 1: PMP is provided in Technical Appendix 2.4.

2.10 Health and Safety and Related Issues

2.10.1 Health and safety would be initially addressed as part of the Pre-Construction Information Pack prepared by the CDM Coordinator for the project under the Construction (Design and Management) Regulations 2015. The contractor would be required to prepare a Construction Phase Health and Safety Plan and forward information to the CDM Co-ordinator during the works to enable the Health and Safety File to be completed.

2.10.2 Turbines are designed to be safe and are built to withstand extreme wind conditions. The turbines selected for the proposed development would have a proven record in terms of safety and reliability.

2.10.3 Day to day operational and maintenance activities would be coordinated via the Control Building.

2.10.4 In accordance with the Land Reform (Scotland) Act 2003 as amended, general public access rights are removed throughout the construction working area for health and safety reasons.

2.10.5 An Operations and Maintenance Manual for the design life of the wind farm would be prepared, which would cover all operational and decommissioning procedures.

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