Energy

3 Project Description

3.1 Introduction

3.1.1 The Consented Development described in this chapter is the result of the comprehensive EIA process presented in Chapters 6 to 21 of the EIAR. Details of the design iterations and mitigation that have led to the final design are considered in Chapter 5, the individual technical chapters that follow and the separately reported Design and Access Statement (DAS) submitted with the Application. A summary of mitigation measures and residual effects presented in Chapter 22.

3.2 Overview

3.2.1 The Consented Development application was for the construction and operation of a *"wind energy development including all ancillary development"* comprising the construction, 25 year operation and subsequent decommissioning of up to 17 turbines with a maximum height to blade tip of 145m and an installed capacity of over 50MW.

3.2.2 This chapter includes details of the wind turbines and all associated infrastructure including access tracks, temporary works, temporary site compound, anemometry mast, telecommunications mast, hardstanding areas, onsite electricity substation, borrow pits, underground cabling required to connect the turbines to the onsite electricity substation and ecological mitigation and enhancement measures for the Consented Development.

3.2.3 The access to the Site will be from the B9081 via a new access junction situated to the west of Hamnavoe as shown in Figure 18.2. A detailed construction programme and method statement would be developed by the contractor appointed to design and construct the Consented Development however an indicative programme has been prepared to inform the EIA to predict effects from a temporal perspective (See Section 3.19).

3.2.4 Once operational, the Consented Development would have a total installed capacity greater than 50MW. Considering a 3.4MW candidate turbine which is considered to be representative of what may be installed on the Site in the future, the wind farm would be capable of generating net electricity up to 239GWh each year. This is equivalent to the amount used annually by approximately 60,000 average Scottish households and could avoid 108,350 tonnes of CO_2 equivalent emissions per year.

3.2.5 Figure 3.1 shows the Consented Development overlaid on Ordnance Survey mapping and Figure 3.2 illustrates the Consented Development overlaid on an aerial photograph. In summary, the Consented Development shown on Figures 3.1 and 3.2 comprises the following key elements:

- up to 17 turbines with a maximum height to blade tip of 145m; including foundations and transformers (internal or external);
- approximately 11.1km of access tracks of average width 4.5m and verges plus drainage;
- five major and one minor mapped watercourse crossings;
- hardstanding areas for construction and maintenance of turbines;
- electrical substation and control building;
- underground cabling connecting turbines to the substation and control building;

- one anemometry mast of up to 90m tall;
- four borrow pits to provide aggregates for the construction of the wind farm;
- a telecommunications tower of up to 20m tall; and
- a scheme of ecological mitigation and enhancement.
- improved signage along an existing track from Hamars of Houlland highlighting existing heritage assets along the route.

3.2.6 The following temporary elements would also be required during the construction phase of the Consented Development:

- temporary site compound for construction and storage;
- site office;
- temporary removal of road signage along the B9076, A968 and B9081.

3.2.7 For the decommissioning phase, the temporary elements described in paragraph 3.2.6 may be temporarily re-instated.

3.2.8 The following sections describe the design elements of the Consented Development. Where appropriate, approximate dimensions have been provided to assist in the assessment of the significance of effects, the methodology of which is set out in the relevant chapters.

3.3 Wind turbines

Layout

3.3.1 The Project layout has evolved throughout the EIA process and has been guided by the physical and environmental constraints associated with the Site, the technical assessments and consultations with statutory bodies and the local community. A summary of the design evolution process is presented in Chapter 5 and the coordinates of the proposed turbine locations are provided in Table 3.1 (also refer Figure 3.1)

Table 3.1: Turbine locations

Turbine	*Easting*	*Northing*
1	450453.7	1183369.1
2	450654.4	1183105.0
3	451093.7	1183089.3
4	450670.3	1182757.1
5	451343.2	1182860.5
6	450909.8	1182524.9

Table 3.1: Turbine locations

Turbine	Easting	Northing
7	451627.1	1182659.2
8	451079.4	1182242.6
9	451997.9	1182487.6
10	451678.5	1182109.2
11	451223.2	1181970.0
12	452187.5	1182282.5
13	452007.6	1181932.8
14	451468.8	1181731.9
15	452111.3	1181525.2
16	451609.6	1181432.8
17	452357.6	1181254.1

3.3.2 Each turbine location has been reviewed to ensure that the locations (including a zone for micro-siting) are appropriate for access and amenable for suitable foundation design. The final position of the turbine and hardstanding would be directed by the results of Ground Investigations (GI) undertaken prior to construction and further design optimisation. The GI would provide the data for foundation design for each turbine as well as confirm the design of the crane pads. On this basis, the exact requirements for micro-siting would be determined. These aspects are considered together with outline engineering details required for construction. Appendix 2.1 provides photographs of the Study Area. A micro-siting allowance of 50m has been considered for wind turbines, except where it would overlap sensitive receptor buffers and land not in control of the Applicant, to provide controlled flexibility during the construction process (Section 3.18.1 and Figure 3.21).

Specification

3.3.3 The proposed turbines would be of the traditional three bladed, horizontal axis design with a maximum blade tip height of 145m, as detailed in the Scoping Opinion Request. A number of turbines currently available are being considered for the Consented Development with slight differences in hub height and rotor diameter, none exceeding a maximum height to blade tip of 145m. The precise make and model of wind turbine would only be chosen should planning permission be granted and would follow a competitive tender process. As it is entirely possible that currently available turbines may be superseded or discontinued, allowance is included within the general specification ‘envelope’ to allow for new-to-market turbines to be included within the EIA parameters.

3.3.4 Where required and in order to evaluate potential environmental impacts a candidate turbine, the Senvion 3.4M with a 104m rotor diameter has been used. This turbine is considered typical of the type of turbine that may be installed in terms of dimensions, visual envelope and noise characteristics. This turbine is illustrated in Figure 3.3.

3.3.5 The wind turbines would have conical, tubular steel towers, a nacelle containing the gearbox, generator and associated equipment, and a hub and rotor assembly consisting of three glass fibre-reinforced polyester or glass reinforced epoxy blades.

3.3.6 The final external colour finish of the turbines would be determined in consultation with the Shetland Islands Council should planning permission be granted, but for the purposes of this assessment, it has been assumed that they would be semi matt grey or off white grey, similar to the majority of onshore wind turbines deployed in the UK. The manufacturer logos will not be displayed on the turbines and only information pertaining to Health and Safety will be displayed on the turbines.

Rotor speed

3.3.7 The proposed turbines would be variable speed to minimise voltage frequency fluctuations, reduce strain on the gearboxes, blades and towers, and to reduce noise at lower wind speeds. It is anticipated that rotational speeds would range from around 10 revolutions per minute (rpm) to 22 rpm depending on the wind speed.

3.4 Turbine foundations

3.4.1 Turbine foundations would be dependent upon site-specific ground conditions at the turbine locations and the make and model of turbine selected. However, based on known conditions, it is anticipated that standard construction techniques would be suitable for all locations. Subject to ground investigations, it is proposed that mass concrete gravity pads are likely to be used. Each turbine foundation would comprise of a steel reinforced mass concrete base of approximately 18-22m diameter and approximately 2.0-2.5m deep (depending on the ground conditions) with a reinforced concrete central column to which the turbine tower will be attached. The foundation would be at a depth of approximately 3m to allow for suitable back fill and cover of the foundation. A typical mass concrete gravity wind turbine foundation design is shown in Figure 3.4 (see also Photograph 1, Appendix 3.5).

3.5 Hardstanding areas

3.5.1 Hardstanding areas will be constructed for the main and assist cranes (crane pads) and assembling of the turbine's rotor. These would be up to 1,600m^2 in area and would be adjacent to each turbine location. The precise locations and dimensions of the hardstanding areas may vary due to topography, ground conditions and potential micro-siting of the turbines. However, they would always be within the Application Boundary, as identified on Figure 3.1. It is estimated that the crane pads will require 24,000m^3 of material and the changes in location and dimensions of hardstanding areas would have negligible impact on the volumes of material imported to the Site. A typical hardstanding area is shown in Figure 3.5.

3.6 Transformers

3.6.1 A transformer would be required for each turbine to increase the voltage of the electricity generated from 690V to 33,000V prior to transmission to the wind farm substation. The transformers would be located within the turbine towers at ground level or within an enclosed cabin of approximately 10m^2 and a maximum height of 3m high adjacent to the turbine depending on the preference of the turbine manufacturer. Outline elevations of the transformer cabins are provided in Figure 3.3.

3.7 Temporary site compound

3.7.1 The construction period for development of the wind farm would be approximately 18 to 24 months (see Section 3.19). Any fuel stored in the temporary compound would be contained within a bunded area capable of storing 110% of the fuel volume. Refuelling would take place in a designated area with separate drainage and oil interception, including full drainage cut off, within the site compound if necessary. The site compound will also comprise welfare arrangements such as a canteen, toilets, etc.

3.8 Substation and control building

3.8.1 The substation and control building would house electrical switchgear, fault protection and metering equipment, and the Supervisory Control and Data Acquisition (SCADA) equipment required to allow remote monitoring of the wind farm. The location of the proposed substation is shown in Figure 3.1. A typical layout for the substation is shown in Figure 3.6.

3.8.2 The substation / control building compound would also accommodate any associated electrical infrastructure and external parking. The final specification of the electrical equipment would be determined following detailed discussion with the Distribution Network Operator (DNO), Scottish and Southern Energy (SSE). The compound will have a footprint of approximately 38m × 40m and will consist of a boundary fence (Figure 3.6) and one transformer/switchgear and control building with a total floor area of approximately 550m^2 and up to 11m in height. Both the boundary fence and control building would be constructed and finished using materials to be approved by SSE and SIC (Refer to Photograph 2, Appendix 3.5).

3.9 Cable layout

3.9.1 Below ground cabling will be required to transmit electricity from the turbines to the onsite substation. Additional cabling will be required for earthing and for communication between the turbines, substation, control building and anemometry mast. The cables would be laid in underground trenches, typically around 1m deep and up to 2m wide, located within the verge, directly adjacent to access tracks to connect the turbines with the substation. Typical cable trench layouts are shown in Figure 3.7.

3.10 Grid connection

3.10.1 The wind farm would be connected to the Scottish Mainland via the Transmission network operated by National Grid (NGET). The grid connection is likely to be in the form of an underground cable which would leave the substation compound alongside the access track to the Site boundary where it would follow the B9081 via overhead cables to the Bay of Ulsta. Here a 4km subsea cable would be installed between the Bay of Ulsta and Mossbank on Mainland Shetland with the line then continuing overland to the proposed HVDC substation at Kergord. A subsea HVDC interconnector is proposed from Kergord to Caithness on the Scottish Mainland. The offsite grid connection will be subject to a separate application.

3.11 Anemometry mast

3.11.1 One permanent anemometry mast would be installed at the Site to provide ongoing monitoring of wind conditions during operation of the Consented Development. The anemometry mast would be sited so as to avoid the influence of wake effects from turbines as far as possible. The location of the anemometry mast is shown in Figure 3.1.

3.11.2 The anemometry mast would be of galvanised steel lattice tower construction and the height of the mast will be up to 90m in order to provide a good characterisation of the wind speeds at the turbine hub height (see Figure 3.8).

3.12 Telecommunications tower

3.12.1 In order to mitigate potential effects on the emergency services telecommunication network, operated by Airwaves, a telecommunications tower will be installed in the south east of the Site (Figure 3.1). This tower would be no more than 20m tall and will include a small single storey walk-in cabin with a footprint of approximately 4.0m × 2.5m, adjacent to the mast that will house a backup generator. The exact specification of the mast is the subject of ongoing consultation with Airwave Solutions Ltd but Figure 3.9 shows a typical design for the type of tower expected to be deployed (Chapter 20: Telecommunications). The telecommunications tower has also been referred to as the 'Radio Communications Tower' which have been used interchangeably throughout the EIAR, for clarity both refer to the same ancillary part of the Consented Development, shown on Figure 3.9.

3.13 Ecological enhancement and mitigation

3.13.1 As there are some species of importance present on or linked to the Site, it is proposed that habitats within the Application Boundary will be restored, enhanced and conserved. Conditions will be created on former and existing lochans in southern Yell to encourage breeding of red-throated divers in locations which are currently unsuitable. Breeding merlin habitat will also be enhanced in southern Yell to encourage the nesting and breeding of merlin. Refer to the Outline Habitat Management Plan (Appendix 10.4) for additional details.

3.14 Vehicular access to the Site

3.14.1 The wind turbine component deliveries, particularly blades, would be classified as Special Order movements. Special Order movements are abnormal load movements that require notification to and authorisation from the highway's authority (Transport Scotland) and police. Existing public highways would be used to transport the turbine components from the nearest suitable transport terminal to the Site. The turbine components will be transported by ship to the construction jetty at Sullom Voe. The Sullom Voe construction jetty (see Photograph 3a and 3b, Appendix 3.5) is listed as having a length of 100m and is approximately 20m wide and can accommodate vessels up to 120m in length. Discussions with the operator of the jetty have confirmed that the jetty has sufficient strength and width for crane access and may also be suitable for use by a geared ship without the need for additional mooring dolphins.

3.14.2 The turbine components will then follow the unclassified road to join the B9076 and then turn left onto A968 to Tofts Voe Pier. They will then be transported via the Tofts-Ulsta Ferry. From the Ulsta ferry terminal the route will continue on the A968 before turning right on to the B9081 from where the access track to the Site, as described in Chapter 18, will start. Figure 3.12 shows the two interceptions of the existing B9081 with the new access track. Site A is the principal access that will be used for most traffic and all abnormal loads (see Figure 3.12).

3.14.3 Works to accommodate and mitigate the impacts of construction traffic on Shetland Mainland and on the B9081 on Yell have been discussed with Shetland Islands Council through the scoping discussions and at subsequent periods with Peel. The works have been discussed in principle with no objections being raised, subject to the granting of technical approval through the appropriate road works licensing process.

3.14.4 The Council has expressed an interest in undertaking the required road design and implementation and Peel has confirmed that this would be acceptable subject to commercial considerations. Should this agreement be confirmed, the Council would undertake the design, permitting, construction and approvals necessary for the works required.

3.14.5 A route review has been undertaken involving a video survey and swept path assessment, which has confirmed that minor works would be required to enable the delivery vehicles to negotiate the turnings along the existing roads. The minor works would include some localised earthworks and temporary removal of signage (which can be replaced with demountable signs) and could be accommodated within the public highway without the need for third party land (see Chapter 18 and Appendix 18.1. Applications for Traffic Regulation Orders (TRO) will be submitted to the Shetland Islands Council prior to commencing the construction works.

3.14.6 Other HGVs transporting components during construction could approach the Site access travelling in both directions along the B9081. These include the delivery of cement, cabling, drainage materials and sand for cable bedding that would come from a range of different locations. HGVs delivering bulk aggregate would generally access the Site compound area through the Site access at Grid Reference HU48601 81189, (see Table 3.2 for the probable location of aggregate supplies). Sand, gravel and cement for the construction of access tracks, turbine foundations and other infrastructure will be imported from Shetland Mainland.

3.14.7 On the basis of HGVs required to complete the construction phase of the Consented Development, the number of vehicle movements required and the resultant distribution on the local road network has been determined and assessed in Chapter 18: Highways and Transportation. The traffic assessment indicates that total traffic movements are not predicted to increase by more than 10% on any routes on Mainland. On the A968 between Ulsta and its junction with the B9081 and on the B9081, total traffic flows are anticipated to increase by a maximum of 11% and 29% respectively.

3.14.8 Heavy Goods Vehicle (HGV) movements are anticipated to increase by less than 10% on the A970, A968 south of its junction with the B9076 and the B9076 itself. North of the junction of the A968 with the B9076, all roads considered are anticipated to experience uplifts in HGV traffic above 20% with the greatest impact of 63% anticipated on the B9081 between Ulsta and the site access junction.

3.14.9 Although the increase on the traffic volume on B9081 is high in percentage terms, this is partly due to the very low baseline levels of HGV traffic on the link. In real terms, the additional number of HGV movements per hour averages less than four within the peak month of construction activity.

Vehicular access within the Site

3.14.10 The site access point and layout of the access tracks is shown in Figure 3.1. This layout provides for delivery and construction access to each turbine location and is based on average geometry figures from a turbine manufacturers for similar turbines to those proposed for the Beaw Field Wind Farm. Therefore, all routes are indicative only and will be subject to a 50m micro-siting allowance except where known constraints will not allow it. This also gives flexibility to avoid any sensitive ecology that may be encountered during construction.

Access track design

3.14.11 Access tracks would be an average of 4.5m in width with approximately 1- 2m wide cable trenches cut into the verge of the track. Drainage ditches are likely to run along the side of tracks to manage surface water runoff from the track and surrounding area. Table 3.3 provides a description of the typical construction works required for the access tracks and the estimated volume of materials required. The road numbering is based on a main route with branches; when a new branch is required a separate access track is created, with track A001 being the main route. Tracks A001 to A009 are the main tracks to turbines. A010 and A011 are routes to Turbines 15 and 6 respectively. A012 and A013 are routes to the Anemometry mast and telecommunications tower respectively (Table 3.3 and Figure 3.1).

3.14.12 The aggregates required for construction of access tracks, substations, site compound area and turbine foundations will be sourced from up to four borrow pits identified within the Site (Figure 3.1). The details of the borrow pits are provided in Table 3.4

Table 3.3: Description of access roads within the Consented Development

Road	*Length (m)*	*Approximate Volumes of material (m^3)*
A001	4,360	37,200
A002	2,120	18,100
A003	730	6,200
A004	310	2,600
A005	310	3,400
A006	400	3,500
A007	110	900
A008	670	6,000
A009	230	2,100
A010	50	600
A011	100	900
A012	270	2,300
A013	790	6,700
Total	10,450	90,500

3.14.13 The track would be constructed by first stripping the topsoil to a depth of approximately 0.3 metres and then laying an appropriate depth of sand if required. A geotextile membrane would then be laid on top of the sand to reduce the impact on the soils. The track would then be constructed by laying and compacting approximately 0.7m of crushed aggregate. Wherever practical, geogrid reinforcement would also be used in order to reduce the thickness of aggregates needed. Typical access track construction is shown in Figure 3.10; however, final design details would be developed in advance of construction following a ground investigation. Following the ground investigation there is the potential that floating roads could be used for certain sections of the access track construction. This has been considered in more detail in Chapter 12: Soil and Peat. However, in order to assess the likely effect of the Consented Development, all access track design details are based on the method described above.

3.14.14 Existing haul roads / the restored tracks would be reshaped to take HGV transport as required, placing crushed aggregate to a depth to be determined by the ground investigation, up to an approximate maximum depth of 1m. Geogrid reinforcement may also be used over sections of the access route, which would reduce the thickness of aggregate required, depending on the final design.

3.14.15 The tracks would remain in place after construction of the Consented Development to provide access for maintenance, repairs and eventual decommissioning of the wind farm. Decommissioning of other tracks associated with the Development would be agreed with the landowners.

Turning areas

3.14.16 Hardstanding areas and junctions between access tracks would provide suitable turning areas however, where wind turbine locations are remote from such areas or junctions, additional turning heads are proposed to accommodate the turbine delivery vehicles (see Figure 3.1).

Drainage

3.14.17 The access tracks will be constructed with either a camber or cross fall to ensure drainage of the surface. Where the access tracks pass through areas of fill and are elevated above existing ground level, surface water generated on the road surface will drain to the side of the road and on to the existing ground, where it will either infiltrate in to the ground or enter one of the numerous drainage ditches that are naturally generated in the peat. If the area of fill is on a slope, a catchment trench will be provided on the upper slope side of the access track to collect flows and direct them to a culvert, ensuring no pooling of water along the track edge. Frequent culverts will be located on site at locations where naturally occurring drainage features within the peat have been created. The frequency of these culverts will vary along the length of the track depending on the localised drainage regime at each specific location. This will ensure that the existing surface water run off regime is maintained as much as possible and peat does not become artificially dried.

3.14.18 If the access track is in an area of cut, drainage channels will be located on either side of the access track, or on the up slope side only if the camber of the road falls towards it. These channels will fall longitudinally towards the extent of the cuttings where they will be directed in to the nearest naturally occurring drainage channel. This will ensure that all flows from both the access track surface and any flows which enter the cutting from the surrounding area, will be directed out of the cutting, ensuring no flooding to the track. In areas of large cutting, surface water channels may be located at the top of the cutting to capture flows prior to entering the cutting and direct them around the cut area. As cutting has a higher impact on the naturally occurring surface water regime, areas of cut have been minimised as much as possible.

3.14.19 The use of floating road was considered to minimise the impact on areas of peat. Floating roads can only be used in areas where the longitudinal and cross gradient of the land is 1 in 20 or less. There is approximately 954m of track which sits on land which has a grade of less than 1 in 20, and therefore floating roads will be used in these areas to minimise the impact on peat and its natural drainage. The exact length of floating road will be determined following a detailed survey of the track routes and a ground investigation carried out to determine the design.

Watercourse crossings

3.14.20 All of the wind turbines, the Site compound and other permanent and temporary structures except for the tracks will be sited at least 50m from the edge of any watercourse (see Chapter 15: Hydrology and Hydrogeology). The access track layout has been designed to minimise watercourse crossings however, five major watercourse crossings and one minor mapped watercourse crossings[a] are required as shown in Figure 3.13 and described in Appendix 3.1. The plan view and the cross-section of the watercourse crossings are provided as Figure 3.14 and Figure 3.15.

3.14.21 As well as the above mentioned watercourse crossings, it was noted that numerous un-mapped watercourses cross the proposed access route during the site walkover survey undertaken by a hydrologist. These are minor in size with small catchments and are mainly drain routes from the areas of peat. These water courses would be culverted using a 450mm diameter concrete pipe as a minimum to prevent and reduce the risk of blockage. Details of these water crossings and proposed culverts are provided in Appendix 3.1. All watercourse crossings would be constructed in line with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR).

3.15 Aggregate and construction materials

3.15.1 The resource estimation for the identified borrow pits indicates that there are sufficient quantities of aggregate available for construction of access tracks, turbine foundations and hardstanding areas/ crane pads (see Tables 3.3 and 3.4). The tables shown assume that some material excavated will be unsuitable for use as aggregate. A detailed ground investigation will be carried out prior to commencement of construction activities and for the purposes of this Application, it is assumed a large percentage of the material may be unsuitable for use as aggregate and therefore the borrow pits shown demonstrate the maximum quantities that may need to be extracted. Other raw materials such as sand, gravel and cement will be imported to the Site and stockpiled at the temporary construction compound.

3.16 Borrow pits

3.16.1 A total of ten potential borrow pit locations within the Application Boundary were considered and evaluated based on the possible constraints such as access, archaeological impact and landscape and visual impact (Refer Section 5.6.7-5.6.10). Based on the evaluation, up to four borrow pits have been identified for the Consented Development. The details of the borrow pits including working and restoration plans are provided in Figures 3.16-3.19.

[a] Any crossing on a watercourse shown on the 1: 250,000 scale OS map has been classified as a major crossing and crossings on any other watercourses have been classified as minor watercourse crossing.

Table 3.4 Identified Borrow Pits for the Consented Development

Borrow Pit	*Location*	*Size (m2)*	*Volume to be extracted (m3)*
BP 1	South of proposed access track	14,790	32,000
BP 2	South of Beaw Field	27,670	70,600
BP 3	South of Atli's Hill and between turbine 6 and 8.	23,410	62,600
BP 4	Adjacent to T10	17,930	57,300

3.17 Proposed permissive routes

3.17.1 Figure 3.20 highlights the existing recreational access routes that cross the site alongside the additional routes that are to be created and improved as part of the Consented Development. The access tracks used to construct the turbines will be retained for the duration of the wind farm's operational period, during which time they will be open for use by pedestrians and cyclists.

3.17.2 In addition to the retention of the construction access tracks, an existing 1.5km (0.9 mile) track that runs north-south between the Hamars of Houlland, and Evra Water will have improved way marking and interpretation installed. The area that this track passes through has a number of points of heritage interest which include plantiecrubs and cairn features (Chapter 9: Cultural heritage for further details). The new track will provide an improved opportunity for locals and visitors to view these parts of the landscape. The Consented Development seeks approval for only the provision of improved way marking and interpretation signage, no physical works to the surface or condition of the existing track are proposed.

3.18 Micro-siting

3.18.1 During the detailed engineering design, micro-siting of turbines and access tracks will be carried out. A micro-siting allowance of 50m has been considered for wind turbines, except where it would overlap sensitive receptor buffers and land not in control of the Applicant, to provide controlled flexibility during the construction process. The access tracks will also be subject to a 50m micro-siting allowance except where known constraints do not allow to provide flexibility to avoid any sensitive ecology that may be encountered during construction. The extents of this micro-siting allowance are shown in Figure 3.21A and 3.21B.

3.19 Construction and outline programme

Working hours

3.19.1 The construction period for the Consented Development would be approximately 24 months and includes a programme to reinstate the working areas (Refer Section 3.19.17). With the exception of abnormal load deliveries (see Chapter 19) and turbine erection, hours of operations for construction would be anticipated to be between 07:00-19:00 Monday to Friday and 07:00-13:00 Saturday, unless otherwise agreed with Shetland Islands Council.

3.19.2 Erection of turbines is very weather dependent with low wind speed conditions being essential. It is therefore possible that such conditions may only persist in the evenings. The construction activity for erecting the turbines would not be an inherently noisy activity. The Construction Environment Management Plan ('CEMP', an outline of which is contained within Appendix 3.6) will detail the approach and application of environmental management and mitigation for the construction of the Consented Development to ensure that adverse effects from the construction phase, on the environment and the local communities, are minimised.

Employment

3.19.3 The Consented Development will give rise to direct and indirect, full time and temporary employment opportunities which are considered in detail in Chapter 6: Socio-Economic, Tourism and Recreation Assessment.

Construction

3.19.4 Construction would consist of the following principal operations, listed sequentially, where possible. The Consented Development would be phased to enable activities to take place concurrently, including:

- establishment of borrow pit BP1;
- construction of access track between borrow pit BP1 and BP2;
- establishment of borrow pit BP2;
- establishment of a temporary compound on existing prepared area;
- establishment of borrow pits BP3 and BP4;
- construction of new access tracks and water course crossings;
- construction of wind turbine foundations;
- construction of hardstanding areas;
- construction of control building and installation of electrical equipment;
- laying and connection of onsite cabling;
- connection to the distribution network;
- temporary dismantling of highways signage;
- assembling of wind turbines towers;
- assembling of rotor blades and coupling into the hub;
- commissioning of site equipment;
- commissioning of wind turbines;
- reinstatement of the areas used during construction, in accordance with the approved restoration and aftercare management plans, to include amendments associated with the Consented Development; and
- implementation of ecological mitigation and enhancement
- Waymarking for public access added to construction access tracks and existing track between Hamars of Houlland and the Site access track.

3.19.5 A range of materials would be required for construction of the Consented Development and would be sourced locally, and general fill will be sourced on Site from overburden, where possible.

Hardstanding areas

3.19.6 The hardstanding areas required for crane pads and turbine laydown would be formed by excavating peat to a suitable bearing strata and filling with a sub base and surface wearing course of aggregate to form an adequate load bearing surface; construction methods and details are anticipated to be the same as the adjacent access tracks. The surface aggregate would be sourced from the borrow pits identified within the Application Boundary (Table 3.5) or recovered from suitable materials gained from excavation of foundations and access track construction.

Foundations

3.19.7 It is anticipated that mass concrete gravity foundations are likely to be used for the turbine bases. This is subject to a full ground investigation which would determine the suitability of the rock. The gravity bases would be constructed by excavating peat and rock down to the level of suitable bearing strata (usually approximately 3m depth), pouring a blinding layer of concrete to seal the surface and provide a working platform, erecting the formwork and reinforcement, and pouring the foundation concrete. The base of the foundation is likely to be at a depth of approximately 3m, with the base itself ranging from 1.5 to 2m in depth. The base, following the full curing period, will then be backfilled to provide cover. The excavated peat would also be reinstated and surplus peat, would be used to restore any degraded areas in the vicinity. If the peat is not suitable for reuse, it would be disposed of in accordance with Scottish Renewables and SEPA 2012 Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste.

Wind turbines

3.19.8 The turbine components would be delivered to the Site and if necessary, stored in the temporary site compound or within the hardstanding areas until weather conditions permit their erection (see Photograph 5, Appendix 3.5). The base turbine tower sections would be attached to the central column of the foundations, followed by the upper turbine tower sections being lifted into place. The nacelle would then be lifted into place on the top section of the tower. Blades may be lifted up and fitted individually to the rotor hub or fitted to the rotor hub on the ground and then lifted onto the nacelle (see Photograph 6, Appendix 3.5).

Fuel transport and storage

3.19.9 The fuel will be brought in tankers to the temporary site compound and stored within a bunded container capable of storing 110% of the fuel volume. Refuelling would take place in a designated area with separate drainage and oil interception, including a cut off valve, within the site compound. A designated area will be provided for washing of vehicles and regular maintenance activities for the construction vehicles.

Drainage and dewatering

3.19.10 While any excavations are open, they would be subject to surface water ingress from runoff and direct rainfall. The excavations would be dewatered as required during construction and would pass through a small settlement lagoon to remove silts.

3.19.11 No water abstraction would be required during construction of the wind farm. Where pumping to dewatering excavation voids is required, the water would not be discharged directly to watercourses and would be subject to appropriate pollution prevention control first. All drainage and dewatering activities undertaken would be authorised by SEPA in accordance with licence requirements under the Water Environment (Controlled Activities) (Scotland) Regulations 2011.

Building materials

3.19.12 The construction of the wind turbines, substation, control building foundations and access tracks would require quantities of concrete and aggregates. Subject to a ground investigation, it is currently assumed that all aggregates will be sourced from the borrow pits outlined above (Table 3.5). The effects of transport of other construction material to the Site have been assessed in Chapter 19.

Table 3.5: Summary of building material quantities

Material	***Quantity (approximate)***	***Usage***
Cement	1000-2000m^3	To produce concrete for turbine bases, substation and control building, water crossings, general foundations, bedding material.
Sand	4000-6000m^3	Access tracks, hardstanding areas, construction compound, concrete, cable trenches, bedding material.
Aggregates	150,000 -200,000m^3	Access tracks, hardstanding areas, construction compound, concrete, backfill material, bedding and surround, fill material.
Timber	100 – 300 t	Fencing, concrete formwork
Geomembranes / Geotextile	10,000-20,000m^2	Access roads, earthworks slopes, building slabs
Geogrid	20,000-30,000m^2	Crane pads, access roads, blade set down areas
Brick / Block works	50-100t	Buildings
Steel / Steel Reinforcement	500-1000t	Water crossings, turbine bases
Bituminous materials	200m^3	Road access junctions

Concrete production

3.19.13 The concrete for the construction works will likely be produced at the temporary site compound. The aggregates will be brought to the site compound from the identified borrow pits, if determined to be suitable, in trucks of up to 25 tonnes capacity. Other materials such as cement and sand will be imported and stockpiled at the temporary site compound. A batching plant is likely to be provided at the site compound and concrete will be transported in truck mixers to the turbine locations.

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Vehicle movements during the construction period

3.19.14 The erection of the turbines would be undertaken by two cranes; the largest would be the main crane and would lift the major turbine components into position. The smaller of the cranes would assist by assembling the larger crane and moving materials on site. A typical turbine takes approximately 2-3 days to assemble from completion of the foundation if weather conditions permit. The proposed timing of the construction and the resulting number of vehicle journeys is shown in Table 3.6, which takes account of the construction programme of 24 months identified in Section 3.19.17.

Table 3.6: Traffic movements on the public highway

Activity	*Loads*	*Movements*	*Vehicle type*
Set up			Various - flat bed, fixed
Gravel for access tracks			12 wheeled tipper
Surface wearing course access tracks			12 wheeled tipper
Gravel for crane pad			8 wheeled tipper
Surface wearing course crane pads			12 wheeled tipper
Geogrid material			Flat bed - artic
Culvert material			Flat bed - artic
Sand for trenching			8 wheeled tipper
Electric and communications cabling			Flat bed - artic
Concrete for turbine and met mast foundations			Ready Mix
Substation and control building			8 to 12 wheeled tippers/flat bed
Formwork and reinforcing steel			Flat bed - artic
Mobile cranes			Flat bed - artic / abnormal loads
Turbine components and met mast			Abnormal loads
Removal of Plant, equipment & other materials			Various - flat bed, fixed
Total (construction programme)			
Note: Vehicle loads, and numbers have been rounded to the nearest whole HGV			

Welfare arrangements

3.19.15 Onsite welfare facilities will be provided for all site workers and visitors. Portable welfare will be provided for the road construction and cabling works.

Site reinstatement

3.19.16 Upon completion of construction of the Consented Development, reinstatement would be undertaken to remove and restore any temporary elements such as the temporary construction compound. These works would be agreed in advance with Shetland Islands Council.

Construction programme

3.19.17 The construction programme will be in the order of 18 to 24. In accordance with outline programme a worst case programme has been considered for the purposes of impact assessment and is presented below:

Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Construction of temporary site compound																		
Extraction of stones and aggregates from onsite borrow pits																		
Offsite batched concrete preparation																		
Construction of internal access roads																		
Laying of electrical transmission cables																		
Preparation of turbine foundations																		
Transportation of turbine components																		
Erection of turbines																		
Commissioning of wind turbines																		
De-mobilisation																		

OPERATION

Wind turbines

3.19.18 Wind turbine service and maintenance requirements differ between manufacturers; however, it is anticipated that the turbines will require biannual maintenance with major services occurring every twelve months and minor services occurring every six months. An initial service three months after commissioning may also be required. During servicing and maintenance, the turbine under inspection will be completely shut down.

3.19.19 Teams of two people utilising a 4×4 vehicle for transport will take on average two to three days to complete the servicing and maintenance of each turbine. Blade inspection will typically be undertaken every two to five years with an inspection time of two hours per blade, weather dependent (low wind, warm, dry conditions are preferable). Should blade replacement be required, further equipment, time and personnel will be involved.

3.19.20 Access track maintenance is dependent on the frequency and type of traffic movements along the tracks and the severity of weathering on the period. It is anticipated that the volume of traffic during operation will be low and as such maintenance will be required infrequently. Any maintenance required will normally be undertaken using imported material and during dry periods in the summer months, however maintenance can be carried out as required.

3.19.21 Table 3.7 details the potential service and maintenance activities that may be required during operation of the Consented Development.

Table 3.7: Potential worst case service and maintenance activities

Item	*Personnel*	*Equipment*	*Duration (days)*
Generator	2	50-120t crane, flatbed lorry	1
Gearbox	4	50-120t crane, flat bed lorry	6
Transformer	2	50-120t crane, flatbed lorry	1
Track maintenance	3	20t stone delivery lorry, grader/roller, excavator	Dependent track length
Snow clearance	1	Excavator	Weather dependent
Dismantling of turbines	8	600t crane, specialised articulated lorry	3, per turbine
Electrical/comms faults	6	LGV	Issue dependent

3.20 Design life and decommissioning

3.20.1 The Consented Development has an operational life of 25 years from commissioning. A variation is now being sought through the S36C application to extend this to 40 years. At the end of the planning consent period two options would be available:

- The turbines and buildings could be removed, and the Site restored to its previous state. The foundation upstands would be cut off 1m below the ground surface and the topsoil reinstated. Decommissioning of the access tracks associated with the Consented Development would be agreed with the landowners and where additional tracks are left in place to facilitate landowner access, these would be identified in the context of approved restoration plans.
- Permission could be sought to repower the Site with new turbines and infrastructure, however for the purposes of this EIA, it has been assumed that decommissioning will take place 40 years after commissioning. Should a repower be pursued a new planning application and EIA would be required.

3.20.2 The time required for decommissioning and restoration would be considerably less than that of construction with the magnitude of works required also being reduced. The laydown areas will be dismantled, and the disturbed ground would be restored. This would restore the ground profile to tie in with existing undisturbed ground levels to prevent the collection of surface water. The onsite tracks would be retained if required by the landowner. Reinstatement work would be undertaken at the earliest opportunity.

3.20.3 Reinstatement would be undertaken using the soil resources available. On completion of grading, the finished surface would be allowed to regenerate to a natural grass sward or would be reseeded to match the adjacent areas.

3.21 Sustainability

3.21.1 The Consented Development is inherently sustainable in its nature and once operational it would provide a net GHG (Greenhouse Gas) emissions saving throughout the lifetime of the project; this is discussed in Chapter 14.

3.21.2 The energy consumption and GHG emissions associated with the manufacturing of turbines would be offset within the first year of their operation. Considering the impacts on soil stability and long-term GHG emissions during construction and operation[1], it is predicted that the Consented Development would have a GHG emissions payback time of 1.1 years.

3.21.3 During the construction phase every effort would be made to reduce any adverse effects arising from the erection of the turbines. Surplus excavated materials would be retained on site. Where possible, this would include the use of recycled materials and local sourcing of materials. Transport movements would be kept to a minimum and site workers would be encouraged to lift share.

3.22 Summary

3.22.1 The Consented Development is for a wind farm of up to 17 turbines with a maximum height to blade tip of 145m and associated infrastructure. This would include construction of approximately 11.1km of internal access tracks, up to four borrow pits, hardstanding areas, a substation, underground cables, a control building, a telecommunications tower and an anemometry mast. Temporary infrastructure required during construction would include a temporary site compound. Further, habitats within the Application Boundary will be restored, enhanced and conserved to encourage breeding of red-throated divers and the nesting and breeding of merlin in locations which are currently unsuitable.

3.22.2 The design of the Consented Development takes into account constraints including the proximity of a number of designated areas and sensitive receptors including the Otterswick and Graveland Special

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Protection Area (SPA) and Otterswick Site of Special Scientific Interest (SSSI) SPA among others (see Figure 3.11 and Chapter 5).

3.22.3 Access to the Site will be from the B9081 via a new access junction situated to the west of Hamnavoe. The turbine components will be transported by ship to the Sullom Voe construction jetty from where they will follow the existing road network to the Tofts Voe Pie. The turbine components will then be transported on the Tofts-Ulsta ferry to the Ulsta ferry terminal. From there the route will continue on the A968 before turning right on to the B9081 from where the access track to the Site will start.

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1 The Scottish Government, 2011. Technical Note and Carbon Calculator Scottish Government. (Online) http://www.gov.scot/Resource/0044/00448589.xlsx {Accessed September 2015]