Chapter 4: Development Description

Contents

4. Development Description

4.1 Introduction

4.1.1 This chapter describes the components of the Proposed Development for which planning permission is being sought and which has been assessed through the EIA process. It includes details about the construction and operation of the Proposed Development.

4.1.2 The chapter is supported by the following figures and appendices which are referenced throughout the text:

- **EIA Report Volume 3a: Figures**
  - **Figure 4.1: Site Layout;**
  - **Figure 4.2: Typical Wind Turbine;**
  - **Figure 4.3: Typical Turbine Foundation;**
  - **Figure 4.4: Typical Crane Hardstanding;**
  - **Figure 4.5: Typical Cable Trench;**
  - **Figure 4.6: Indicative Control Building, Substation and BESS Compound Layout;**
  - **Figure 4.7: Indicative Control Building and BESS Elevations;**
  - **Figure 4.8: Indicative New Site Junction;**
  - **Figure 4.9: Existing Track Widening;**
  - **Figure 4.10: Typical Cut Track Details;**
  - **Figure 4.11a: Typical Watercourse Crossing Methods;**
  - **Figure 4.11b: Typical Green Burn Watercourse Crossing;**
  - **Figure 4.12: Typical Construction Compound;** and
  - **Figure 4.13: Indicative Borow Pit Search Area.**
- **EIA Report Volume 4: Technical Appendices**
  - **Technical Appendix 4.1: Larbrax Access Forestry Report;**
  - **Technical Appendix 4.2: Aviation Risk Assessment;** and
  - **Technical Appendix 4.3: Shadow Flicker Assessment.**

4.2 Overview of the Proposed Development

4.2.1 The main components of the Proposed Development comprise:

- Up to four wind turbines each with a maximum tip height of up to 149.9 m;
- Foundations supporting each wind turbine;
- Associated crane hardstandings at each turbine location;
- Approximately 3 km of onsite access tracks (comprising 2 km of new tracks and 1 km of upgraded tracks);
- Up to eight watercourse crossings (comprising four new and four upgraded) and associated infrastructure;
- A network of underground cables to connect the turbines to the onsite substation;
- A control building and substation;
- A Battery Energy Storage System (BESS);
- A new Site access junction on the B738; and
- Habitat management and enhancement proposals.

4.2.2 In addition to the above components associated with the operation of the Proposed Development, construction of the Proposed Development will also require the following components/works:

- One temporary construction compound comprising site offices, car parking and laydown/storage areas;
- One temporary borrow pit (for the extraction of stone);
- Temporary clearance/laydown areas at each turbine location; and
- Removal of 0.28 hectares (ha) of trees/vegetation to facilitate access into the Site.

4.2.3 **Figure 4.1:** shows the layout of the Proposed Development including the key components noted above. **Table 4.1** provides the grid coordinates of the proposed wind turbine locations.

Table 4.1: Wind Turbine Details

Turbine No	Easting (X)	Northing (Y)	Maximum Blade Tip Height
1	196965	561416	149.9
2	196748	561849	149.9
3	196251	562184	149.9
4	196222	562692	149.9

4.2.4 A comparison of the Proposed Development components with the Consented Larbrax Wind Farm components is provided in **Table 3.1** of **Chapter 3: Site Selection and Design Strategy**.

4.3 The Proposed Development Components

Wind Turbines

4.3.1 Planning permission is being sought for the installation and operation of up to four three-bladed, horizontal axis turbines with maximum blade tip heights as presented in **Table 4.1**. For assessment purposes, and unless otherwise stated, the Nordex N133 (4.8 Megawatt) (MW) turbine has been chosen as a representative candidate turbine based on specifications available in the marketplace with maximum blade tip heights as per **Table 4.1**), giving a total output capacity of 19.2 MW, based on the candidate, exclusive of any battery storage. Based on this candidate model, hub heights will be up to 83.4 m and the rotor diameter will be 133 m (66.5 m length blades). It should be noted that the final chosen turbine may have larger or smaller blade lengths and higher or lower hub heights depending on the technology available at the time of construction, however, the maximum blade tip height proposed for each turbine will be fixed by a planning condition on the planning permission such that the maximum blade tip height will not exceed 149.9 m. Likewise, the overall capacity rating of turbines could change and be greater than the current candidate turbine, however, any more advanced and powerful turbine chosen will again need to comply with the maximum blade tip height parameters allowed by the planning permission.

4.3.2 A diagram of a typical 149.9 m maximum blade tip height turbine is shown on **Figure 4.2**. Turbine blades will be made from glass fibre/carbon spar with glass fibre airfoil shells. The turbine towers will be of tapering tubular steel construction, likely to be finished in a light grey semi-matt colour. The colour and finish of the wind turbine blades, nacelles and towers are expected to be the subject of a condition of consent.

4.3.3 As the turbine tip heights will be lower than 150 m, there is no requirement for visible aviation warning lights to be installed on the hubs in accordance with Article 222 of the Air Navigation Order 2016. Infra-red (non-visible) obstruction lights may, however, be installed in the interest of low flying aircraft as required by the Ministry of Defence (MoD) should they be required.

Turbine Foundations, Crane Hardstandings and Laydown Areas

4.3.4 The turbines will be installed on foundations comprising both stone and steel-reinforced concrete. These typically measure up to approximately 25 m diameter (area of approximately 491 m² with a concrete depth of approximately 3.5 m as shown on **Figure 4.3**). Each turbine foundation will require up to approximately 1,700 m³ of concrete. The

detailed design, sizing and specification for each foundation will depend on the final turbine selected and the ground conditions encountered at each turbine location, which will be confirmed by detailed site investigation post-consent, in the pre-construction period.

4.3.5 Adjacent to each turbine, an area of permanent hardstanding measuring approximately 2,819 m^2 will be constructed for use as a crane pad. The exact geometry and position of the crane pads will depend on the turbine supplier's specifications, the crane selected for erection and the findings of detailed ground investigations prior to construction. Additional temporary hardstanding areas will be constructed for the secondary crane, boom erection and storage of turbine components, and these will measure approximately 1,117 m^2.

4.3.6 The hardstanding areas will be levelled using cut and fill operations and surfaced in crushed stone to provide a durable surface. These hardstanding areas are used during the erection process as a platform for the cranes to lift the turbine components into position. The hardstanding provides safe access for maintenance and repairs and will therefore remain in place for the operation of the Proposed Development. An indicative crane hardstanding arrangement with temporary laydown areas is shown in **Figure 4.4**.

4.3.7 Construction of turbine bases, hardstandings and temporary laydown/storage areas will require the excavation of surface organic and soft surface material through to a depth of approximately 4 m. This excavated material will be used to partially backfill the excavation and provide material for landscaping and surfacing reinstatement. As such, this material will be stored near to the excavation until required. The underlying rock will be levelled to provide a workable platform for the assembly of reinforcing bars and formwork used to contain the poured concrete.

4.3.8 During construction, dewatering could be required to keep the construction area dry (for example, if rainwater gets into construction areas). Suitable filtration systems will be employed to ensure that silt laden water will not contaminate surface watercourses, and that extracted water will be returned to the surrounding area with a limited effect on local hydrology.

Onsite Cables and Turbine Transformers

4.3.9 An electrical transformer will be required for each turbine and will most likely be located within the turbine tower or within the turbine nacelle (hub). Should the transformers be externally located, these will be positioned adjacent to each turbine within a metal ventilated cabin typically measuring 4 m x 2.5 m x 3 m. The transformers will be either oil-filled with a bunded footing to remove any risks of spillage or a solid cast resin type which is effectively non-polluting. The transformers will increase the electrical voltage to 33 kilovolts (kV) and will be connected to the control building within the onsite substation compound via underground high voltage cables as described below.

4.3.10 Power, earthing, communication and control circuits will be required to link each wind turbine to the 33kV/132kV switching station within the substation compound. These cables will be buried in trenches and located adjacent to the proposed/existing access tracks, where practicable. Typical cable trench details are shown in **Figure 4.5**.

4.3.11 The 33kV cabling connecting each wind turbine to the switching station will be single core and consequently each circuit will comprise three individual power cables laid in a trefoil arrangement and surrounded by sand backfill. Detailed construction and trenching specifications will depend on ground conditions encountered. Typically, cables will be laid in a trench 1.5 m deep and 1.5 m wide. To minimise ground disturbance cables will be routed along the side of the access tracks. Cables will be laid within a sand or granular bedding to prevent damage to the cables from sharp stones. Trenches will be backfilled with excavated material and the surface redressed to allow natural revegetation.

Grid Connection, Control Building and Substation

4.3.12 The Proposed Development will be connected to the national electricity network (the 'grid'). At this stage it is anticipated that the connection to the grid will be via overhead cables to the existing 33kV substation in Stranraer located approximately 9 km east of the Site. The grid connection will be subject to a separate application for consent by SP Energy Networks (SPEN) to the Scottish Ministers, as the grid operator for the South of Scotland, under Section 37 of the Electricity Act 1989. At this stage, the route options for the grid connection and the timing of the S37 application are not yet known. As a result, potential environmental effects associated with the grid connection are not considered within this EIA Report.

4.3.13 A compound measuring approximately 30 m x 50 m containing a 33kV substation and control building is proposed within the Site north-east of T1 as shown on **Figure 4.1**. The substation compound will be constructed as per SPEN's requirements and will contain all the electrical equipment required for connecting the Proposed

Development to the electricity distribution network. Within the substation compound there will also be an auxiliary transformer and auto-start standby diesel generator with close coupled fuel storage tank. The indicative arrangements for the substation compound are presented on **Figure 4.6**.

4.3.14 The control building will measure approximately 30 m x 10 m x 5 m (**Figure 4.7**) and will accommodate 33kV switchgear, metering equipment, electrical control panels and communications equipment, welfare, central computer systems and spare parts/maintenance consumables associated with the operation and maintenance of the wind turbines. The fuel will be stored in accordance with Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended). Rainwater will be collected from the roof of the building via a gutter and inlet pipe to fill a header tank. Waste will be held in a closed system and removed by a licensed contractor at regular intervals. The building will be constructed in keeping with the local built environment. The buildings will be constructed in keeping with the local built environment.

Battery Energy Storage System (BESS)

4.3.15 It is proposed that a Battery Energy Storage System (BESS) with a capacity of approximately 10 MW in total will be constructed within the substation compound to enable co-location of energy storage with the proposed wind turbines. It is anticipated that the preferred choice will be Li-ion batteries, contained within secure steel shipping-like containers, of which approximately 10 will be used. Each BESS container will have dimensions of approximately 7 m x 1.6 m x 2.5 m. The arrangement of the indicative Battery Energy Storage System (BESS) is shown on **Figure 4.6**. The energy stored in the batteries will be transferred to 33kV transformers within the battery storage compound then onto the 33kV substation via underground electrical cable for exporting to the electricity grid in times of demand.

Access from the Public Road Network

4.3.16 It is anticipated that turbine components will be delivered to the King George V Docks in Glasgow. Abnormal Indivisible Load (AIL) vehicles will then transport the components to the Site via the M8, M74, A74(M) and A6/M6 (exiting at Junction 42) then back north on the M6 (existing at Junction 22 at Gretna Green). Vehicles will then travel west via the A75 using Commerce Road to by-pass Stranraer, then south/south-west along the A77 towards Portpatrick. At the junction with the B738 before Portpatrick, vehicles will travel north to the Site entrance. The abnormal loads route is shown on **Figure 11.4**. It is intended that a blade lift adapter vehicle will be used where necessary along the transport route. This vehicle can raise a turbine blade up to 45 degrees while being transported, which allows it to navigate tight corners without the need for substantial road widening or the removal of street furniture. A Route Survey Report, detailing the proposed route and where temporary works may be required to transport the turbine components, is provided in **Technical Appendix 11.1 Annex B**. It is anticipated that the majority of the general construction vehicles (HGVs) and staff vehicles will originate from the north and east, and will use the A75, A77, A751 and B738. A new tarmac access junction will be required to enter the Site from the B738. The access junction design is shown on **Figure 4.8**. The detailed junction design will be a planning condition and will be agreed with Dumfries and Galloway Council (DGC) to ensure the safe access and egress of traffic from the Site during construction and operation.

4.3.17 During operation the Site entrance will be gated to prevent any unauthorised vehicle access.

Onsite Access Tracks

4.3.18 There are a number of access tracks onsite which are currently used for farming purposes. As shown on **Figure 4.1**, approximately 1 km of existing track will be upgraded, and 2 km of new track will be built as part of the Proposed Development. All tracks will facilitate access to the turbines and other infrastructure.

4.3.19 As discussed in **Chapter 3: Site Selection and Design Strategy**, a key design principle for Site infrastructure was to minimise track construction and therefore land take through the use of existing track in order to minimise the impact on current farming practices. As a result, 33% of all track required is already existing. All tracks (including upgraded existing tracks) will have a running surface of 6 m which is sufficient for HGV vehicles and farm vehicles to pass one another. Dedicated passing places shall only be required where absolutely necessary. **Figures 4.9**-**4.10** provide indicative details of how upgraded and new tracks will be constructed.

Watercourse Crossings

4.3.20 The number of watercourse crossings has been minimised and eight are proposed, four of which are existing and four of which are new. An inspection of the existing watercourse crossings has been undertaken and it is anticipated

that all of the existing watercourse crossings will need to be replaced or improved to facilitate construction and operation of the Proposed Development. These existing watercourse crossings will either be re-used, extended or replaced as determined later in the design process depending on specific engineering requirements and opportunities for habitat improvement. The necessary authorisation will be obtained from SEPA in accordance with the Water Environment (Controlled Activities) Regulations 2011 (as amended) prior to undertaking works in the water environment. Further details are provided in **Technical Appendix 9.1: Watercourse Crossing Report**, and the watercourse crossing method proposed (bottomless arched culverts) are shown in **Figure 4.11a**. In addition, a flood risk assessment (FRA) has been undertaken given the need to cross the Green Burn (watercourse crossing NC4) and its associated flood plain. The purpose of the FRA has been to understand the likelihood of the construction of NC4 on existing and future flood predictions, particularly for the B738, and how the crossing will need to be designed to safely manage flood risk. The findings of the FRA can be found in **Technical Appendix 9.4**, and the proposed design of crossing NC4 is shown on **Figure 4.11b**.

Temporary Construction Compound

4.3.21 A temporary construction compound measuring approximately 30 m x 50 m is proposed, as shown in **Figure 4.1**. This will be used by the Balance of Plant (BoP) Contractor and turbine supplier to store materials, to provide appropriate welfare facilities, staff offices (likely to be in the form of portacabins) and parking for staff. An indicative layout of the construction compound is shown in **Figure 4.12**.

Borrow Pit

4.3.22 To minimise the volume of stone brought onto the Site for construction of the Proposed Development, and any associated environmental effects, it is proposed that stone will be sourced from an onsite borrow pit located east of T2 for new or upgraded tracks and hardstanding construction. A borrow pit search area, measuring approximately 6,400 m^2, is estimated to have a yield of approximately 36,500 m^3, although this will be subject to pre-construction geotechnical investigation.

4.3.23 It is estimated that approximately 10,887 m^3 of stone aggregate will be required for construction of the Proposed Development (including permanent access tracks, structural fill beneath turbine foundations and crane hardstandings), with the borrow pit search area having the estimated theoretical capacity to provide more than 100 % of this requirement.

4.3.24 An indicative plan and cross-section of the proposed borrow pit is shown in **Figure 4.13**.

Tree and Vegetation Management

4.3.25 There is no commercial forestry present within the Site, although there is 9.3 ha of scattered conifer trees present which acts as shelterbelts. None of the coniferous trees within the Site will be affected by the Proposed Development, however, to facilitate access into the Site, there will be a need to remove approximately 0.28 ha of broadleaf trees and vegetation, the majority of which comprises dense and often impenetrable rhododendron which lines the edge of the B738. The 0.28 ha of tree/vegetation removal is shown on **Figure 4.1**, with further details provided in **Technical Appendix 4.1: Forestry.** The removal of this vegetation for the access junction will form part of wider biodiversity enhancement measures aimed at enhancing broadleaf trees and associated tree diversity in the eastern part of the Site, as detailed in **Technical Appendix 7.5: Outline Biodiversity Enhancement Management Plan**. Any trees removed as part of this felling will be replaced via compensatory planting in compliance with the Scottish Government's Control of Woodland Removal Policy (CoWRP).

Micrositing

4.3.26 It is proposed that the turbines and other infrastructure will be subject to a 100 m micrositing allowance which will be applied should adverse ground conditions be encountered during pre-construction ground investigations, or when more optimal ground conditions are available. Movement of infrastructure will, however, be dependent on other onsite constraints and subject to advice from an Environmental Clerk of Works (EnvCoW). This allowance will ensure that the final position of the turbines and associated infrastructure are not varied to such a degree as to cause a notable change in the predicted environmental effects outlined in the EIA Report. Beyond this distance, any relocation of components will require either written approval from DGC in consultation with statutory consultees or will be treated as a formal variation to the application. Where relevant, the specialist chapters detail individual

proposed directional restrictions on the overall micrositing allowance to ensure that environmental effects no greater than those identified within this EIA Report occur during construction.

4.4 Land Take

4.4.1 **Table 4.2** provides a summary of the anticipated approximate temporary and permanent land take for the components of the Proposed Development for which planning permission is being sought, and as shown on **Figure 4.1**. A comparison of the permanent land take with the Consented Larbrax Wind Farm is provided in **Table 3.1** of **Chapter 3.**

Table 4.2: Proposed Development Areas of Temporary and Permanent Land Take (Approximate)

Project Elements	Temporary Land take (m²)	Permanent Land Take (m²)	Track Extents (km)
Turbine foundations, Crane Pads, Clearance Areas and Laydown Areas	1,117	11,276	
Borrow Pits	BP1 - 6,400		
Substation Compound/Battery Storage		1,500	
Construction Compound (including concrete batching plant, parking and staff welfare facilities)	1,500		
Onsite Access Tracks (New)		15,512	2
Onsite Access Tracks (Existing Upgraded)		6,262	1
Total Land Take	9,017	34,550	
Total Land Take as % of Site Area	0.2%	1%	
Total Access Track Extent			3

4.5 Construction Details

4.5.1 It is estimated that it will take approximately 12 months to construct the Proposed Development. Where possible, construction activities will be carried out concurrently to reduce the overall length of the construction programme. Phasing of the construction process may result in civil engineering works progressing in some areas of the Site whilst turbines are being erected elsewhere. To minimise disruption to land use, Site restoration will be undertaken as early as possible. Works will comprise of the following principal activities:

- Mobilisation and enabling works (tree/vegetation removal, B738 junction construction, working borrow pit, and establishing construction compound);
- Upgrading/creation of Site access tracks, watercourse crossings, turning heads and junctions;
- Construction of turbine foundations at each turbine location;
- Construction of crane hardstandings and laydown/storage at each turbine location;
- Excavation of trenches and laying of electrical cables;

- Construction of substation, control building and BESS;
- Delivery and erection of wind turbines;
- Testing and commissioning of Site equipment including turbines, control building, substation and BESS; and
- Site restoration and implementation of the Biodiversity Enhancement and Management Plan (BREP) proposals.

Temporary Construction Compound

4.5.2 The construction compound will be formed by stripping organic and soft surface material and laying geotextile and crushed rock to create a firm regular surface. Any oil storage areas will be appropriately bunded to ensure secondary containment is provided in line with the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended). Perimeter drainage will intercept rainfall and then channel water to temporary filtration and dispersion structures, utilising where possible the natural contours of the landscape. The stripped surface material will be stockpiled nearby for reinstatement. Site offices (likely to be temporary portacabin style buildings) will be transported to the Site via typical curtain trailer HGVs.

Working of Borrow Pit

4.5.3 Excavation of material from the borrow pit will be carried out using standard quarrying techniques, which may include blasting and mechanical excavation. However, all blasting work will be undertaken by a specialist contractor who will assume responsibility for blast design and implementation. The extent of blasting requirement cannot be determined until intrusive site investigation tests are completed.

Concrete Batching

4.5.4 Concrete batching is proposed to be undertaken onsite within the construction compound and suitable pollution prevention measures will be put in place, which will be developed in conjunction with the ECoW and incorporated into the Construction Environmental Management Plan (CEMP).

Construction of New Public Road Junction

4.5.5 The access junction will be formed by removing all vegetation/trees (0.28 ha) and laying crushed rock. The junction footprint will then be surfaced with a tarmac finish to ensure a smooth running surface with appropriate drainage. The tarmac surface will help to minimise deposits of dirt and dust onto the B738 by construction vehicles. The access junction design will be agreed with DGC and will be fully compliant with the Design Manual for Roads and Bridges (DMRB). The junction will allow for safe access and egress to the Site by securing the visibility splays required by the DMRB.

4.5.6 Appropriate traffic management measures will be put in place on the B738 to avoid conflict with general traffic, subject to agreement with DGC. Typical measures will include HGV/AIL load turning and crossing signs and/ or banksmen and warning signs. A temporary reduced speed limit may also be enforced in the vicinity of the Site access point. These measures will be implemented through the Construction Traffic Management Plan (CTMP), a draft of which is provided at **Technical Appendix 11.1**.

Construction and Upgrading of Tracks

4.5.7 A cut track design is proposed and will be achieved by excavating through to a suitable foundation. During construction, vegetation, topsoil and subsoil will be placed temporarily to the sides of the tracks. A layer of stone will be compacted on top of the base formation to a thickness of around 150-250 millimetres (mm) dependent upon ground conditions. The total track depth will depend on the strength of the base formation and upon the gradient of the slope being traversed but will typically be up to 500 mm thick which will be supplied from material won from onsite borrow pits or imported. Where existing track is upgraded, the current track width will be widened to 6 m and, where possible, reinforced to ensure a suitable load bearing surface. Where constraints exist, such a watercourses, upgrading/widening to the existing track will be undertaken on the side furthest from the watercourse. The condition of all existing tracks used will be carefully maintained throughout construction. Drainage ditches of up to approximately 1m wide will be constructed alongside the access tracks. Surplus soil will be placed and dressed alongside the track to blend in with the surrounding landscape, and finally topsoil will be placed on the track shoulders and seeded to promote revegetation. Indicative track details are shown in **Figures 4.9**-**4.10**.

Construction of Turbine Foundations, Crane Hardstandings and Laydown Areas

4.5.8 Construction of turbine bases, hardstandings and laydown/storage areas will require the excavation of surface organic and soft surface material through to underlying rock. This excavated material may be used to partially backfill the excavation and provide material for landscaping and surfacing reinstatement. It will be stored near to the excavation until required. The underlying rock will be levelled to provide a workable platform for the assembly of reinforcing bars and formwork used to contain the poured concrete.

4.5.9 During construction, dewatering may be required to keep the construction area dry (for example, if rainwater gets into construction areas). Suitable filtration systems will be employed to ensure that silt laden water does not contaminate surface watercourses and that extracted water is returned to the surrounding area with a limited effect on local hydrology.

4.5.10 The area around the turbine will be backfilled with selected excavated material.

4.5.11 Indicative turbine foundations and hardstandings are shown in **Figures 4.3-4.4**.

Installation of Cabling

4.5.12 The cabling connecting each turbine to the substation will be laid in a trefoil arrangement as shown in **Figure 4.5**. Detailed construction and trenching specifications will depend on ground conditions encountered. To minimise ground disturbance, cables will be routed along the side of the access tracks where practicable. Cables will be laid within a sand or granular bedding to prevent damage to the cables from sharp stones. Trenches will be backfilled with excavated material and the surface redressed. If sand bedding is used, clay bunds will be placed at intervals within the bedding to prevent unnatural flows of ground water.

Construction of Control Building, Substation and BESS

4.5.13 The foundations of the onsite substation, subject to investigation before construction, will typically consist of concrete strips at a depth of 600 mm below ground level. The strip foundations will be 500 mm wide and will have a centrally placed layer of mesh reinforcement.

4.5.14 The floor of the control building and BESS will be a ground bearing slab and will incorporate ducts and trenches for the laying of cables.

4.5.15 Substation transformers and battery storage units will be transported to site via low-loader vehicles.

4.5.16 An anticipated 2.5 m high steel palisade security fence will be installed around the perimeter of the compound, and CCTV will be installed at suitable locations throughout.

4.5.17 It is proposed that the external hardstanding of the compound will be constructed from site-won, processed and placed rock, with a close bound granular capping to act as a running surface to delivery and support staff vehicles etc. The hardstanding will be graded to provide drainage falls. This finish provides a free-draining granular running surface or pavement media, through which rainwater will gradually permeate through and/or be conveyed to the edge of the hardstanding, where it will be intercepted by a cut off ditch/linear soakaway that will convey any remaining flows to a soakaway.

Erection of Turbines

4.5.18 The erection process for each turbine will take approximately six days, although this will depend on weather conditions as generally turbines are erected in wind speeds not exceeding 8 to 10 m/s for health and safety reasons. Cranes will be used for the off-loading of turbine components from the abnormal load vehicles and to assist in the assembly. A ‘crawler’ or mobile wheeled crane of larger capacity, working in tandem with the main crane, will be used to erect the turbines. The turbine erection contractor will specify the type of cranes used during the installation process. The cranes will be positioned on the hardstanding area adjacent to each turbine. As only four turbines are proposed, it is anticipated that only one main crane and one crawler crane will be required for the Proposed Development.

Construction Lighting

4.5.19 Depending on the time of year and the stage of the construction programme, temporary lighting may be required at the temporary compound and substation/control building compound during working hours. It is not proposed that the lighting will be left on outside working hours unless time critical lifting or concrete pours are required.

Construction Material and Deliveries

4.5.20 The wind turbines will all be delivered to Site in component form and will consist of tower sections, blades, hub, gear assembly and nacelle. This will result in approximately 50 abnormal load deliveries.

4.5.21 Approximately 11,845 m³ of stone aggregate will be required for the construction of the access tracks, crane hardstandings, construction compound surface etc. It is possible that 100% of stone required could be sourced from the onsite borrow pit although this is dependent on further detailed investigation. Taking a conservative approach, however, **Chapter 11** has assumed that up to 50% of stone will be imported to the Site resulting in approximately 1,303 HGV deliveries.

4.5.22 It is estimated that approximately 5,966 m³ of concrete will be required for the substation, control building and BESS compound and turbine foundations. **Chapter 11** has assumed that concrete will be batched onsite using cement powder, water and sand imports which will generate approximately 278 HGV deliveries.

4.5.23 Steel reinforcement for the turbine foundations and for other components of the Proposed Development (estimated to be 315 tonnes) will generate 22 HGV deliveries. Sand (for cable trenches) and cabling deliveries will comprise up to 79 HGV deliveries. This will include the delivery of optical cable. 10.8 km of cable will be imported to the Site on 500 m drums. Up to three HGVs will be required to deliver the cables.

4.5.24 Materials will be sourced and transported to the Site from local suppliers, where possible.

Construction Programme

4.5.25 Construction of the Proposed Development is estimated to last approximately 12 months. An indicative programme for the construction activities noted above is shown in **Table 4.3** below.

Table 4.3: Construction Programme

Construction Task	Construction Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Mobilisation & Enabling Works (tree/vegetation removal, construction of new site junction, working borrow pit and preparation of construction compound)												
Access Tracks												
Wind Turbine Foundations												
Crane Hardstandings												
Cabling and Electrical Works												
Substation, control building and BESS												
Wind Turbine Erection												
Commissioning and Restoration												

Working Hours

4.5.26 In general, working hours for construction will be from 07.00 to 19.00 Monday to Friday and 07.00 to 13.00 on Saturday, and this will be a planning condition to the planning permission. No working is proposed on Sundays and public holidays. In the event that work outside of these hours is required, this will be agreed with DGC.

4.5.27 Exceptions to the proposed working hours will be made for foundation pours and turbine erection. Concrete pouring for an individual turbine foundation must take place continuously and so activity will only cease when the pour has been completed. Turbine erection can only occur during periods of low wind speeds and so to minimise the construction programme, lifting operations may need to be scheduled outwith the above hours. In addition, it could be necessary to complete a particular lifting operation to ensure the structure is left in a safe condition.

Construction Personnel

4.5.28 It is estimated that during the peak construction works, approximately 20 staff members will be working on the Site, undertaking various activities, including civil engineering, turbine installation and electrical works.

4.5.29 Where feasible and subject to procurement rules, local contractors or sub-contractors will be invited to tender. Prior to construction the Applicant will hold a meeting in the local area to introduce and discuss any aspects of the Proposed Development to local contractors.

4.6 Environmental Management and Construction Working Practices

Construction Environmental Management Plan (CEMP)

4.6.1 A CEMP will be prepared prior to the start of construction, detailing measures to avoid or mitigate potential effects associated with key construction activities. These will reflect and expand upon measures identified in this EIA Report, and will be agreed with DGC, SEPA, NatureScot and other stakeholders, as appropriate. The preparation and implementation of the CEMP will be planning condition.

4.6.2 The purpose of the CEMP will be to:

- Provide a mechanism to ensure that construction methods avoid, minimise and control potentially adverse significant environmental effects, as identified in the EIA Report.
- Ensure that good construction practices and all environmental legislation are adopted throughout the construction of the Proposed Development.
- Provide a framework for mitigating unexpected effects during construction.
- Provide assurance to third parties that agreed environmental performance criteria will be met.
- Establish procedures for ensuring compliance with environmental legislation and statutory consents.
- Detail the process for monitoring and auditing environmental performance.

4.6.3 The CEMP will be updated when necessary to account for changes or updates to legislation and good practice methods throughout the construction phase. The CEMP will also be amended to incorporate information obtained during detailed ground investigations which will be undertaken post consent and prior to construction activities. Compliance with the CEMP (including procedures, record keeping, monitoring and auditing) will be overseen by a suitably qualified and experienced EnvCoW.

4.6.4 The CEMP will contain the following documents, which the Principal Contractor and their sub-contractors will be required to adhere to throughout the construction process:

- A Pollution Prevention and Incident Plan (PPiP);
- Construction Method Statements (CMS);
- Site Waste Management Plan (SWMP);
- Construction Traffic Management Plan (CTMP) (following the principles set out in the draft CTMP presented in **Technical Appendix 11.1**);
- Access Management Plan (AMP);

- Species Protection Plan;
- Bird Disturbance Management Plan;
- Site Restoration Plan; and
- Decommissioning and Reinstatement Plan.

4.6.5 The CEMP will also contain the following information:

- The name, qualifications and CV of the nominated person(s) with the responsibility for all environmental matters, for approval.
- A completed register of contacts confirming the contact details for all key personnel for managing environmental issues, including the Applicant's representatives, the EnvCoW, Principal Contractor contacts and appropriate regulator contacts.
- The construction programme and detailed working method statements.
- A site-specific action plan, providing a register of environmental risks and outlining the requirement for accompanying site-specific mitigation, monitoring and reporting procedures.
- Audit and inspection procedures.

4.6.6 The Principal Contractor will be responsible for the continual development of the CEMP to take account of monitoring and audit results during the construction phase and changing environmental conditions and regulations.

4.6.7 The services of other specialist advisers will be retained as appropriate, to be called on as required to advise on specific environmental issues.

4.6.8 Performance against these documents will be monitored by the Applicant's Construction Project Manager and the EnvCoW throughout the construction period. They will ensure that the works carried out will be in accordance with the relevant legislation and best practice guidance documents.

Good Practice Construction Measures

4.6.9 Good practice measures will be employed as standard techniques during the construction and operation of the Proposed Development. Therefore, these are not considered to be mitigation as such, but an integral part of the design, construction and operation of the Proposed Development. This is considered a realistic scenario given the current regulatory context and accepted good practice across the industry.

4.6.10 During construction, there will be a suitably qualified environmental manager appointed with responsibilities including training, liaison with SEPA and ensuring applicable licences are held (for example CAR licences and abstraction licences). This role will have authority for halting works if necessary. Emergency procedures will be detailed and subsequently agreed with SEPA, including contact lists and the personnel responsible.

4.6.11 Good practice measures will include (but are not limited to) measures associated with:

- Pollution incidents;
- Erosion and sedimentation;
- Modification of surface water drainage patterns (including flooding);
- Modification of groundwater levels and flows;
- Compaction of soils; and
- Peat stability.

4.6.12 Further details on these measures, which are an inherent part of the Proposed Development, can be found in **Technical Appendix 2.1: Schedule of Mitigation, Good Practice, Enhancement and Monitoring** along with other good practice measures proposed for individual topics assessed in this EIA Report**.**

Site Reinstatement

General Approach

4.6.13 Following construction, all areas disturbed will be reinstated. This will form part of the contract obligation for the Principal Contractor and will involve the removal of any infrastructure and the re-vegetation of disturbed ground.

4.6.14 Details of the reinstatement works will form part of the CEMP.

4.6.15 The anticipated type and extent of reinstatement is outlined below. Where a re-turfing method is appropriate, such as along track verges, the surface layer of soil and vegetation will be stripped and stored separately from the lower soil layers and replaced as intact as possible once construction is complete. Local reinstatement will be carried out to retain the structure and composition of the original plant communities, as well as forming a stable area over reformed ground, thus reducing erosion by rain, run-off and wind. Bare soil areas will be allowed to re-vegetate naturally in combination with reseeding using a low-density seed mix which mirrors local vegetation to help bind the soil more quickly.

Site Tracks

4.6.16 Site tracks are required throughout the operational phase to permit access for maintenance and repair operations. They will also be necessary to allow access during the decommissioning stage.

4.6.17 Generally, the sloping verges of access tracks will be dressed with turf or seed bank material sourced from spoil from the Site. If suitable material is generated during the construction of the track, this material can be used to form a low-lying bund along the downhill side of the track, to be dressed as per the track verges.

Turbine Bases and Crane Hardstandings

4.6.18 Turbine foundations will be capped with soil material, which may form a raised mound above the existing ground level. These will be re-turfed with the removed material, but where vegetation is sparse or unlikely to regenerate, reseeding with an appropriate local seed mix may be undertaken as outlined above.

4.6.19 The condition of turfs will be monitored regularly during the first few months following reinstatement. If necessary, water will be imported to the Site to ensure the re-establishment of this vegetation.

4.6.20 Hard-standing areas at each turbine location will be retained for use during operation and decommissioning, however the edges will as far as possible be blended to the adjacent contours and natural vegetation allowed to re-establish.

Temporary Construction Compound and Borrow Pit

4.6.21 The temporary construction compound and borrow pit will be reinstated into the surrounding landscape and restored to their original condition.

Public and Private Water Supplies

4.6.22 Desk based study (consultation with DGC and issuing of questionnaires to nearby residences) was used to identify properties within 1 km of the Site who rely on a Private Water Supply (PWS) which could be potentially affected during construction works. This identified four PWS outwith the Site but within 1km, however none are considered to be hydrologically connected to the Proposed Development infrastructure, and no effects will occur. Consultation with SEPA identified that there are no licenced abstractions for public drinking water within 1 km of the Site. See **Chapter 9** and **Figure 9.1.**

Peat Slide Risk

4.6.23 A Peat Landslide Hazard and Risk Assessment (PLHRA) (**Technical Appendix 9.6**) has been undertaken and assesses the peat landslide risk associated with the Proposed Development. **Technical Appendix 9.6** describes the assessment methodology and results of the assessment under both natural conditions and in association with construction of the Proposed Development. The assessment also provides mitigation and control measures to reduce the identified risks prior to, during and after construction. The PLHRA have been informed by results from the Peat Survey Report (**Technical Appendix 9.2**).

Peat Management

4.6.24 An Outline Peat Management Plan (OPMP) (**Technical Appendix 9.5)** has been produced to provide indicative volumes for soil and peat extraction and outline good practice measures for the excavation, handling, re-use, and storage of soil and peat materials during construction of the Proposed Development.

4.6.25 **Technical Appendix 9.5** estimates that the volume of peat to be excavated will be 1,577 m^3 and will be re-used in full to reinstate a cutover area adjacent to the temporary construction compound. Due to the relatively thin soils present across much of the Site, the overall soil volume proposed to be excavated is 7,630 m^3. Excavated soils will either be reinstated within their original locations (temporary construction compound, blade laydowns and secondary hardstandings, borrow pit) or used to tie-in (or landscape) the surroundings of infrastructure by providing a vegetated top surface to areas of earthwork cut and fill. Overall, there will be no surplus of peat or soil materials following their re-use. These plans will be developed to update the CEMP with detailed post construction restoration plans. This will be reviewed and monitored along with the updated PMP and CEMP to ensure compliance with method statements.

Waste Management

4.6.26 As noted above, there will be no residual soil or peat materials generated following reinstatement works which will be classified as waste. Good practice waste management methods will be implemented during the construction phase. These will encourage the reduction, reuse and recycling of wastes. Mitigation measures will be put in place to further minimise the potential environmental effects associated with the storage and transportation of waste, with further details provided below:

4.6.27 Any materials that cannot be reused will be disposed of according to relevant waste management legislation which will serve to address a number of possible environmental effects.

4.6.28 All measures will be enforced through a Site Waste Management Plan (SWMP) as part of the CEMP.

Public Access Management

4.6.29 The Land Reform (Scotland) Act 2003 gives the public rights to non-motorised access to most land in Scotland. This allows the right to walk, cycle, ride a horse and camp within a site provided that the Scottish Outdoor Access Code is adhered to.

4.6.30 There are a number of core paths which provide access throughout the Site and which link with other paths and trails in the surrounding area, including the Rhins of Galloway Coastal Path. In addition, it is common for grouse shooting to take place within the Site as well as recreational walking.

4.6.31 Existing paths and access to the Site will only be restricted where it is absolutely necessary for health and safety purposes. Impacts on access will be kept to a minimum, and an Access Management Plan (AMP) will be produced as part of the CEMP. Measures which may be employed to facilitate continued safe access include (but are not limited to):

- Installation of safe route crossing points (including signage);
- Consideration of diversions;
- Agreement that path users would have right of way;
- Requirement for drivers to stop to allow horse riders to pass;
- Separation of plant and pedestrian mechanisms (for example including Heras fencing as a barrier);
- Information signage, leaflets etc advising on the development construction activity (plant, vehicles, and machinery) and the temporary changes to baseline access provision;
- Enforcement of speed limit on tracks for all construction vehicles/plant;
- Enforcement of speed limit advisory signage including on exit of the Site to remind drivers of local speed limits and potential interaction with pedestrians and cyclists;
- Use of hazard/flashing beacons on all construction vehicles when using access tracks; and
- Delivery of Toolbox Talks to all Site workers to ensure awareness of potential presence of path users.

4.6.32 If for any reason there are times when safe access is not possible, this will be communicated to the public through onsite and offsite public information including, for example, the project website and liaising with local community councils and groups.

Construction Traffic Management

4.6.33 In addition to staff transport movements, construction traffic will consist of Heavy Goods Vehicles (HGVs) and abnormal load deliveries.

4.6.34 **Technical Appendix 11.1** sets out the expected number of vehicle movements to and from the Site each month, taking into account forecasted vehicle numbers from construction activities and assuming a construction start year of 2028. The maximum traffic volumes associated with construction of the Proposed Development is predicted to occur in month seven of the construction programme. During this month, an average of 38 two-way HGV movements is predicted per day and it is estimated that there will be a further 20 two-way car and light van movements per day to transport construction workers to and from the Site. The wind turbines will all be delivered to the Site in component form and will require up to 50 Abnormal Indivisible Loads (AILs) per turbine (consisting of tower sections, blades, hub, gear assembly and nacelle) – see **Technical Appendix 11.1**. The anticipated transport route for abnormal loads and other imported materials is discussed above and shown in **Figure 11.4**.

4.6.35 In consultation with DGC, a detailed CTMP and Abnormal Load Management Plan will be prepared prior to the construction of the Proposed Development, should planning permission be granted. Further details are provided in **Chapter 11**.

4.7 Operational Management and Maintenance

4.7.1 The Proposed Development has been designed to have an operational life of up to 35 years. Once operational, the Site will not be permanently manned, and it is envisaged that the amount of traffic associated with the Proposed Development will be minimal. Traffic generated will comprise routine service and maintenance team visits, together with the occasional need for more extensive maintenance or repair (as discussed in **Chapter 11**). Wind turbine operations will be overseen by suitably qualified contractors.

4.7.2 Routine maintenance and servicing is expected to take place approximately twice per year. Servicing will include the performance of tasks such as adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. Other visits to the Site will take place more frequently to ensure that the turbines, and Battery Energy Storage System (BESS) are operating at their maximum efficiency. In the event of any unexpected events onsite appropriate repair works will be carried out.

4.7.3 The vehicle used for most of these visits will likely be a four-wheel drive vehicle, although there could be an occasional need for an HGV or crane to access the Site for heavier maintenance and repairs. Ongoing track maintenance will generally be undertaken in the summer months when tracks will be dry. Safe access will be maintained all year round.

4.7.4 Site access tracks are required throughout the operational life of the Proposed Development to permit access for maintenance and repair operations. They will also be necessary to allow access during the decommissioning stage.

Aviation

4.7.5 The Aviation Risk Assessment (**Technical Appendix 4.2**) has been undertaken for the Proposed Development to determine its potential impact on aviation operations. The primary risk identified is the potential impact on Belfast City Airport Primary Surveillance Radar (PSR). The Proposed Development is not understood to be in a sensitive location with respect to Belfast City Airport air traffic services, and therefore it is predicted that the impacts can be operationally accommodated. The Proposed Development is located within an area of low priority for military low flying. Physical obstruction impacts to low flying will be mitigated by installing MoD accredited infra-red warning lights to each turbine nacelle.

Shadow Flicker

4.7.6 Under certain combinations of geographical position, time of day and year, wind speed and wind direction, the sun may pass behind the rotor and cast a shadow over neighbouring buildings' windows. When the blades rotate and the shadow passes a window, to a person within that room the shadow appears to flick on and off; this effect is known as shadow flicker.

4.7.7 A shadow flicker assessment (**Technical Appendix 4.3**) has been undertaken for six Shadow Flicker Assessment Locations (SFALs) which are all the residential dwellings within 1,330 m and 130 degrees either side of north of the proposed wind turbine locations. The purpose of the assessment is to quantify the level of occurrence that may happen under a maximum 'worst-case' scenario and a more realistic scenario, and where mitigation may be required.

4.7.8 The maximum theoretical occurrence of shadow flicker amounts to 47.9 hours per year and up to 0.71 hours per day, experienced at SFAL1 – Labrax Cottages, located approximately 1169 m to the south east of the nearest proposed wind turbine. This level of occurrence does not take into account weather conditions (i.e. when there is no sun or when there is partial cloud cover), local visual obstructions (such as trees, hedges or other structures), turbine orientation and turbine operation. In reality, the amount of time when shadow flicker occurs will be less than that predicted. Accordingly, an assessment has also been undertaken to estimate a more realistic shadow flicker occurrence taking into account typical sunshine hours for the region. A review of historical met data suggests that this typically occurs for 30% of all daylight hours. Considering this, the likely occurrence of shadow flicker at the most affected properties (Labrax Cottages) is predicted to be less than 14.37 hours per year.

4.7.9 No routine mitigation is proposed at this stage. If shadow flicker issues arise during operation, mitigation measures can be incorporated into the operation of the wind turbines to reduce the amount of shadow flicker experienced.

Telecommunications and Television

4.7.10 No issues were raised by telecommunications stakeholders who responded to consultation (BT, Vodafone, Atkins Global, MBNL, Arqiva, JRC, and 02. As such, no impacts on telecommunication links are likely.

4.7.11 Analogue television broadcast has now been phased out and replaced by digital television, which is less likely to be affected by atmospheric conditions that rendered analogue television unwatchable and does not suffer reflection effects or ghosted image generation. It is anticipated that an appropriate condition will be attached to the planning permission and will require the Applicant to provide mitigation in the event that effects on television reception occur as a consequence of the operation of the Proposed Development.

4.8 Residues and Emissions

4.8.1 Schedule 4 of the EIA Regulations require that the EIAR provides an estimate, by type and quantity, of expected residues and emissions (such as water, air and soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced) resulting from the construction and operation of the Proposed Development.

4.8.2 **Table 4.4** below provides a summary of the anticipated residues and emissions.

Table 4.4: Proposed Development Potential Residues and Emissions

Topic	Potential Residue/Emission
Water	**Construction** Hydrology receptors have been considered as part of the Site's design to avoid areas of higher sensitivity such as, deeper peat, watercourse crossings and GWDTEs. In addition, the Applicant is committed to the delivery of a Construction Environmental Management Plan (CEMP) which will ensure adherence to requirements in relation to the control and management of water quality and quantity from the Proposed Development (refer to **Technical Appendix 2.1**). Further information is presented in **Chapter 9.** **Operation** No significant pollution sources have been identified for the operation phase.
Air	**Construction** The construction phase will require the need for transport vehicles with associated emissions to the atmosphere. However, the quantity of emissions released from construction vehicle sources is expected to be low relative to the general background air emissions from road traffic. Therefore, no significant air emissions are anticipated.

Topic	Potential Residue/Emission
	Operation No significant air emissions are expected during operation. The construction of the Proposed Development and subsequent operation will include activities that either directly or indirectly result in CO_2 emissions. The Scottish Government Carbon Calculator was used to calculate the payback period for the Proposed Development based on the full development lifecycle. The assessment is provided in **Technical Appendix 12.1**. The carbon calculator indicates that the overall payback period will be around 0.7 years (approximately 8.5 months). This means that the Proposed Development is anticipated to take around 0.7 years to repay the carbon exchange to the atmosphere (the CO_2 debt) through construction of a wind farm; the Site will in effect be in a net gain situation following this time period and can then claim to contribute to national emission reduction objectives.
Noise and Vibration	**Construction** Noise will be emitted by equipment and vehicles used during construction of the Proposed Development although this will only be temporary during the construction phase. **Operation** Noise will be emitted by the wind turbines and some ancillary infrastructure (including substation) during operation. Further information is provided in **Chapter 10: Noise and Vibration**.
Light	**Construction** Temporary lighting will potentially be required during construction to light the temporary construction compounds for security purposes and ensure that a safe working environment is provided to construction staff. All temporary lighting installations will be downward facing, and all lights will be switched off during daylight hours and out with working hours. **Operation** No lighting will be required during operation including visible aviation warning lights given that the turbines have tip heights of less than 150 m. Infra-red aviation warning lights will be installed on each turbine nacelle but will not be visible to the naked eye.
Waste	**Construction** A number of different waste streams are likely to arise during construction of the Proposed Development. The Principal Contractor will be responsible for the production of a Site Waste Management Plan that will identify all waste streams and provide an estimate of expected waste volumes for each waste type generated within the waste stream. There will be no residual soil or peat waste following proposed reinstatement measures – see **Technical Appendix 9.5**. **Operation** The general operation and maintenance activities have the potential to produce a small amount of waste. It is unlikely the power generation aspects of the Proposed Development will produce significant waste emissions.
Soil	**Construction**

Topic	Potential Residue/Emission
	Excavation, handling and storage of soil and subsoil will be required during construction. Details regarding open trenches, soil handling and topsoil spreading will be considered in the CEMP, which will be developed by the Principal Contractor. Peat excavated during construction will be managed in accordance with a Peat Management Plan (PMP). A draft PMP has been prepared (**Technical Appendix 9.5**). **Operation** No requirement for soil or subsoil excavation or handling during the operation phase has been identified.
Heat and Radiation	No significant sources of heat and radiation have been identified during either the construction or operation phase of the Proposed Development.

4.9 Decommissioning

4.9.1 The operational life of the Proposed Development and associated infrastructure will be 35 years. Following this, an application could be submitted to retain or replace the turbines, or they could be decommissioned. Decommissioning will involve the following activities:

- Dismantling and removal of wind turbines and electrical equipment;
- Restoration of the turbine areas, hardstanding and tracks; and
- Demolition and removal of substation equipment and Battery Energy Storage System (BESS) equipment.

4.9.2 The CEMP will be updated as required to ensure best practice is adopted during decommissioning of the Proposed Development and that activities are carried out in line with the legislation and guidance that is current at time of decommissioning.

4.9.3 Turbine components and electrical equipment will be dismantled and removed in a similar fashion to their delivery and erection. The turbines will be split into sections which will then be transported from the Site by HGVs unless the components are sold on, in which case, they will be removed as abnormal loads. Turbine components will be cut up offsite in controlled environments ready for reuse, recycling or appropriate disposal.

4.9.4 Some of the access tracks could be left onsite to ensure the continued benefit of improved site access for the landowner and the public or they could be reinstated. It is not commonplace to remove concrete foundations from the Site as this will cause more damage to the environment. The exposed concrete plinth will be removed to a depth of 1m below the surface and the entire foundation will be graded over with soil and replanted if appropriate.

4.9.5 The removal of the top of the turbine base will be undertaken requiring an excavated trench around the upstand to provide a working area. Breakout of the top part of the plinth will be undertaken using an excavator mounted jack hammer. The cables will be cut level with the remaining concrete. Once the broken-out concrete has been removed, the area will be reinstated by backfilling with soil/peat to an agreed method statement, as outlined in the restoration section above.

4.10 Benefits of the Proposed Development

Environmental Benefits

Carbon Emissions Offset and Homes Powered

4.10.1 The principal atmospheric pollutants produced by burning fossil fuels are carbon dioxide (CO_2), sulphur dioxide (SO_2), and oxides of nitrogen (NOx). In contrast, the harnessing of wind energy is non-consumptive and produces no gases or other by-products. The key environmental benefit of the Proposed Development will be the generation of electricity from a renewable energy source that will reduce or avoid the use of fossil fuels through the displacement of electricity generated from other sources of energy.

4.10.2 The purpose of the Proposed Development is to generate electricity from a renewable source of energy, offsetting the need for power generation from the combustion of fossil fuels, and to add capacity to the electrical generating

potential to facilitate a decarbonisation of heat and transport networks, and ultimately contribute towards Scotland's net zero obligations. Consequently, the electricity that will be produced by the Proposed Development will result in a saving in emissions of CO_2 with associated environmental benefit. The 'payback time' is defined as the length of time (in months) required for the Proposed Development to be considered a net avoider of emissions rather than a net emitter. The calculation of payback time includes a consideration of emissions resulting from the construction and operational phases, and the quantification of the carbon storage loss as a result of loss of peat and forestry within the Site (expressed as CO_2 emissions).

4.10.3 Use of the Scottish Government's latest carbon calculator with best estimate values, based on available information, indicates that the Proposed Development will pay back the carbon emissions associated with its construction, operation and decommissioning in roughly 0.7 years (roughly 8.5 months). The amount of carbon that will be offset by the Proposed Development each year is estimated to be approximately 16,000 tonnes (tCO_2), giving a total of approximately 567,840 tCO_2 over its operational life. Given the total net emissions of CO_2 due to the construction and operation, there will be a total net saving of approximately 553,645 tCO_2 over the lifetime of the Proposed Development. Further details are provided in **Technical Appendix 12.1**.

4.10.4 With the Proposed Development having an indicative capacity of 19.2MW (turbines only) it is also calculated that approximately 24,200 UK householders per year could be powered by green electricity[1].

Habitat Restoration and Enhancement

4.10.5 An Outline Biodiversity Enhancement and Management Plan (OBEMP) has been prepared and is provided in **Technical Appendix 7.5**. The OBEMP proposes a Biodiversity Enhancement Area (BEA) of approximately 24.62 ha, comprising six land parcels (A-F) (see **Figure 7.10**) within which management and enhancement works are being considered. The overall goal of the BEMP is to restore, enhance and create habitats of ecological value in these areas, which in turn will benefit existing flora and fauna as well as increase biodiversity in general. The OBEMP proposes and includes moorland restoration and enhancement measures (up to 13.01 ha[2]) that provides more than the suggested 1:10 compensation ratio plus 10% enhancement for priority peatland habitats (at least 10.36 ha) as contained within NatureScot guidance. In summary, the overarching aims of the Outline Biodiversity Enhancement Management Plan (OBEMP) include the following (see **Technical Appendix 7.5** for specific objectives and management prescriptions for each):

- Area A (12.35 ha) - Restore and enhance blanket bog habitat and improve bog habitat condition through stock management, removal of rhododendron, drain blocking (if applicable) and restoration of any erosional features such as peat haggs (if applicable).
- Areas B, C and D (6.43 ha) - Reclaim, restore and enhance moorland habitat through a scheme of rhododendron removal and management. It is estimated that the proposals in these areas would result in the reclamation of up to approximately 2.01 ha of moorland habitats from stands of dense rhododendron where the moorland habitats have been lost, and the enhancement of up to 4.42 ha of moorland habitats where there is extensive rhododendron encroachment.
- Area E (3.70 ha) - Undertake a scheme of extensive rhododendron removal and management within this woodland which would be followed up with enhancement measures, such as enrichment planting with native species.
- Area F (2.14 ha) - Undertake a scheme of rhododendron and bracken removal and management within this area which will have general beneficial effects for biodiversity.

4.10.6 The OBEMP will be refined and developed into a final BEMP post-consent. The final BEMP will confirm the overarching Biodiversity Enhancement Area (BEA) encompassing all habitat management proposals, and any finalised management units (i.e., the refined land parcels/areas for specific habitat management proposals) therein, where the aims, objectives and management prescriptions will apply. The final BEMP will be agreed with Dumfries and Galloway Council (DGC) in consultation with NatureScot prior to the commencement of construction of the Proposed Development.

[1] Based on the latest Department for Energy Security and Net Zero (DESNZ) and Digest of UK Energy Statistics (DUKES) figures, which provide an average UK annual household electrical consumption of 3,239 KWh. Site specific wind data and modelling found that the Site has a capacity factor of 46.6%.
[2] Comprising 9.68 ha in Area A, 2.14 ha in Area B, and 1.19 ha in Area C.

4.10.7 Monitoring will establish whether the aims and objectives of the BEMP are being met and will inform adaptive management to ensure the aims and objectives are achieved through the life of the BEMP.

Socio-Economic Benefits

Direct and Indirect Employment and Economic Benefits

- A maximum workforce of 20 people will be employed at any one time during the 12-month construction period for the Proposed Development. It is standard practice in economic appraisals to convert temporary employment levels into full-time equivalents (FTEs). For the construction period, this employment is estimated to be approximately 20 full-time jobs. Using a conversion factor of ten years of full-time employment to one permanent FTE, the total employment generated through construction will be approximately two permanent FTEs.
- It will be made a condition of tender that the main contractor will be required to demonstrate how it has given preference to appointing subcontractors that are based in the Dumfries and Galloway Council area, subject to meeting minimum procurement criteria and value. A similar condition will apply to suppliers of consumables plant and equipment such as oil, accommodation, concrete and vehicles, who should be chosen using a similar process. The main contractor is likely to be Scotland-based, but it is assumed that whoever is appointed as the main contractor, that a significant proportion of the work will be carried out by sub-contractors and labour resident in Dumfries and Galloway. The Applicant is committed to giving local businesses every possible opportunity to share in the financial and employment benefits of the construction and operation of the Proposed Development. If consented and constructed, the Proposed Development will offer opportunities for local businesses such as accommodation providers, hire companies, fencing contractors, tradespeople and machinery plant owners.
- The estimated construction cost of the Proposed Development is expected to be approximately £24 million based on an estimated capital expenditure (CAPEX) of £1.2m per installed MW[3]. Assuming up to 12% of construction costs are spent locally[3], the overall value of contracts that could be realised locally could be up to £2.8 million.
- It is likely that there will be some local employment generated as an indirect result of the construction of the Proposed Development. This could include supply chain spin-offs for local businesses and sub-contracted works relating to the transportation of construction workers and materials. Any construction workers not living locally may choose to reside in local accommodation which will further benefit the local economy through spending in local hotels, B&Bs, shops and restaurants. Scottish Government 'Type II Multipliers'[4] can be used to assess the likely scale of indirect employment effects generated by the purchase of goods and services by businesses associated with construction of the Proposed Development, and also induced employment generated by the expenditure of those directly and indirectly employed by the businesses involved with the Proposed Development. The Type II indirect plus induced employment multiplier has been chosen for 'construction activity' and is 2.1[5][6]. The indirect and induced employment during the construction period is estimated to be around 4.2 FTEs.
- Any construction workers not living locally may choose to reside in local accommodation which will further benefit the local economy through spending in local hotels, B&Bs, shops and restaurants. Based on an average salary of £35,000 for onshore wind construction workers[7], and assuming a 10% local spend rate, it is estimated that there will be a local indirect expenditure by construction workers of approximately £7,000[8] .
- Once operational, the Proposed Development will require a small team of personnel to service, maintain and operate it. It is predicted that one permanent site operator will be employed (one FTE) who will be responsible for overseeing the operation and maintenance of the Proposed Development during its lifetime (of up to 35

[3] RenewableUK (2015), Onshore Wind: Economic Impacts in 2014.
[4] Scottish Government (2014) Input-Output Tables and Multipliers for Scotland, Available [online] at: http://www.gov.scot/Topics/Statistics/Browse/Economy/Input-Output/Multipliers
[5] Using 'construction' employment multiplier for indirect and induced effects (2.1).
[6] Scottish Government (2014) Input-Output Tables and Multipliers for Scotland, Available [online] at: Supply, Use and Input-Output Tables: 1998-2020 - gov.scot (www.gov.scot)
[7] cited in BiGGAR Economics (2012). Onshore Wind – Direct and Wider Economic Impacts
[8] FTEs (2) x £35,000 x 0.10

years). The Site operator may oversee a number of other wind farms in the region, and so will not be permanently based onsite.

- The Applicant will pay community benefit funds at the prevailing Scottish Government recommended value, currently £5,000/MW of installed capacity, for each year of operation for up to 35 years, to help fund local community projects. At the current recommended rate, community benefit payments could total £96,000 per annum (index linked) and £3.36 million (index linked) over the course of the Proposed Development's 35-year operational life, although this will be dependent on the rating of the turbines chosen. Community benefit funds would be administered by a trust or similar body, and the distribution amongst communities would be determined following planning permission being granted.
- Skills and training are a vital part of Scotland's transition to a green economy that is powered by renewable energy. The Applicant is committed to supporting skills development and local job opportunities through the Proposed Development. In 2014, the Larbrax Wind Farm Skills Fund was announced as part of the original Consented Larbrax Wind Farm, which the Applicant wishes to continue. The Applicant will work with Dumfries and Galloway College to explore additional educational opportunities in the energy sector, helping to reinforce the College's existing offering in Stranraer and bridging local skills gaps.
- The Applicant offers local communities surrounding its projects the opportunity to own part of the project. By owning a part of Scotland's green energy supply, local communities have the chance to benefit directly from the long-term economic benefits onshore wind energy brings. The Applicant will discuss shared ownership opportunities with the local community in further detail should planning permission be granted.