4. Description of the Proposed Development

4.1 Introduction

4.1.1 Paragraph 1 of Schedule 4 of the EIA Regulations states that the scheme description should include:

a. "*A description of the location of the development;*

b. *A description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases;*

c. *A description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used;*

d. *An estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation, and quantities and types of waste produced during the construction and operation phases).*"

4.1.2 These requirements are addressed in the sub-sections below.

4.2 Development Description

Site Location

4.2.1 The Development Site is located approximately 4.5km west of Inveraray and approximately 17km to the north-east of Lochgilphead in Argyll and Bute. It is centred at coordinates (E)199418, (N) 704212 and shown on **Figure 4.1**. The Development Site extends to approximately 4,247 hectares (ha), however the permanent wind farm infrastructure would occupy only a small part of the overall Development Site, approximately 27ha (see **Table 4.3**).

4.2.2 The nearest residential property is Killean Farmhouse, which is located adjacent to the site boundary where it joins the A83 to the east. Killean Farmhouse is located 3.8km southeast from the nearest turbine location.

Existing Site and Surroundings

4.2.3 The elevation of the Development Site is between 50m and 482m Above Ordnance Datum (AOD), with the topography being characterised by five summits, Beinn Dearg, Beinn Dubh Àirigh, Beinn Laoigh, Beinn Mheadhon, and Garbh Chruach. The highest of these is Beinn Dearg at 482mAOD.

4.2.4 The majority of the Development Site is used for commercial forestry operations, within Eredine Forest (western area of the Development Site) and Brenchoillie Forest (eastern area of the Development Site). The operational An Suidhe Wind Farm is located to the north of the Development Site, and A'Chruach Wind Farm is located within Kilmichael Forest to the south of the Development Site.

4.2.5 The Development Site access will be the existing An Suidhe wind farm access, east of the site, then via a new access track through the forestry.

Development Proposals

4.2.6 The Proposed Development comprises the infrastructure listed within **Table 4.1**and shown on **Figures 4.2** to **Figure 4.12** and would have an operational life of 35 years.

Table 4.1 Key Features of the Proposed Development

Component	Description
Wind Turbines	Number: up to 22 turbines (see **Table 4.2** for location coordinates). Dimensions: Turbine Heights up to 200m to blade tip. Capacity: In excess of 50 Megawatts (MW). Micro-siting: 50m Turbine Foundations: 960m^3
Turbine Crane Hardstanding	Dimensions (simplified): ~25m by 50m Footprint per Crane Hardstanding: ~0.125ha Micro-siting: 50m
Auxiliary Turbine Crane Hardstanding	Two per wind turbine Dimensions (simplified): ~20m by 12m Footprint per Auxiliary Crane Hardstanding: ~0.024ha Micro-siting: 50m
Blade Laydown Areas	Dimensions: ~83m by 15m Footprint per Laydown Area: ~0.125ha Micro-siting: 50m
Permanent Anemometer Mast	Approximately centred on (E) 201587 (N) 706328 Description: up to 125m high permanent wind monitoring mast Micro-siting: 50m
Substation/Control Building and Compound	Location: Approximately centred on (E) 199094, (N) 705553, Dimensions: up to 180m by 110m Control Building Height: up to 7m Maximum Compound Footprint: up to 1.98h Micro-siting: 100m
Battery Energy Storage and Compound	Location: Approximately centred on (E) 198857 (N) 705224 Compound Dimensions: up to 50m by 50m Battery Container Height: Up to 3m Maximum Compound Footprint: ~0.25ha

Component	Description
	Re-use of area vacated by temporary construction compound 1 Micro-siting: 100m
New Access Tracks	Length: ~22km Running width: Up to 6m (wider on bends) Total footprint: ~13.2ha Micro-siting: 100m
Existing Access Tracks upgraded	Length: ~19km Running width: Up to 6m (wider on bends) Footprint: increased by ~5.59ha
Passing Places	Number: estimated 82 Dimensions: 30m in length, up to 5m wide Total Footprint: ~1.22ha
Watercourse Crossings	Number: up to 92 culverts, 35 new culverts have been proposed in addition to 57 upgrades
Temporary Construction Compound 1	Approximately centred on (E)198857 (N) 705224 Dimensions: ~100m by 50m Maximum Compound Footprint: ~0.5ha Micro-siting: 100m
Temporary Construction Compound 2	Approximately centred on (E) 203995 (N) 707136. Dimensions: ~50m by 50m Maximum Compound Footprint: ~0.25ha Micro-siting: 100m
Cable Trenches	Cables will be installed alongside access tracks. (Indicative dimensions are: 1m depth and up to 1.2m width). Micro-siting: 100m
Potential Borrow Pits	Number: Up to 9 (see **Figure 4.1** for search areas) Micro-siting: 100m
Concrete Batching Plant	Location adjacent to a borrow pit or adjacent to a temporary construction compound.

Wind Turbines

Turbine Layout

4.2.7 The layout of the Proposed Development has taken account of the findings of environmental and engineering studies, including desktop studies, field visits, peat depth surveys, planning designations and wind yield analysis (as noted in **Chapter 3: Design Evolution and Alternatives**, of the EIA Report). It is illustrated within **Figure 4.1**. The turbine locations are presented in **Table 4.2**.

Lighting

4.2.8 In order to safeguard general use of the area by military aircraft during operation, the Applicant confirms that the Proposed Development turbines would be fitted with Ministry of Defence (MoD) accredited aviation safety lighting. The turbines would be fitted with 25 candela omni-directional infrared lighting with an optimised flash pattern of 60 flashes per minute of 200ms to 500ms duration at the highest practicable point. This can be implemented under a suitably worded planning condition.

4.2.9 The lighting arrangement will combine Civil Aviation Authority (CAA) approved Air Navigation Order (ANO) visible lighting and MoD infra-red (IR) lighting. The resulting lighting strategy would therefore involve visible ANO lighting on thirteen turbines and IR lights on all turbines. ANO lighting produces medium intensity red light which is visible to the naked eye but is not visible to pilots flying on Night Vision Goggles (NVG). In contrast, the MOD compliant IR lighting is invisible to the human eye, but highly visible to pilots using NVG.

4.2.10 An aviation lighting strategy has been prepared by Wind Power Aviation Consultants (WPAC) Ltd to address the potential operational adverse effects of the Proposed Development and is included in **Appendix 15A.**

Table 4.2 Wind Turbine Locations

Wind Turbine	Easting	Northing
1	201508.0	706114.0
2	201128.5	707054.8
3	200887.5	705147.7
4	200779.0	706459.0
5	200222.0	704727.0
6	200175.0	705910.0
7	199614.2	704276.6
8	199236.3	705149.8
9	199178.0	707191.0
10	199172.0	705898.0

Wind Turbine	Easting	Northing
11	198999.5	703779.0
12	198805.0	704370.0
13	198850.2	706418.2
14	198423.0	706930.0
15	198350.3	705076.5
16	198155.0	703498.0
17	198091.6	705578.5
18	198064.0	706123.0
19	197886.7	702986.9
20	197534.0	702434.0
21	197029.9	704927.1
22	196547.0	704575.0

Wind Turbine Parameters

4.2.11 A number of turbine models would be suitable for installation at the Proposed Development. The final choice of turbine will depend upon technical and commercial considerations and will be decided by the Applicant following planning consent.

4.2.12 **Figure 4.2** shows the structure of a typical wind turbine. This is a typical modern horizontal axis, upwind design comprising four main components: a rotor (consisting of a hub and three blades), a nacelle (containing the generator gearbox) to which the rotor is mounted, a tower, and a foundation. **Figure 4.3** shows the structure of a typical wind turbine foundation.

4.2.13 Turbines will be fitted with Ministry of Defence (MoD) accredited infrared aviation safety lighting to safeguard general use of the area by military aircraft during operation (refer to **Chapter 15: Aviation**).

4.2.14 A transformer / switchgear, located within the nacelle or tower of the turbine, or immediately adjacent to it in a small kiosk[1], steps up the voltage to 33kV; power from the turbines at this voltage is fed to the substation/control building via underground electrical cabling. For the purpose of the Proposed Development, it is assumed that external kiosks will be required.

4.2.15 The electricity generated by the Proposed Development will be metered and fed into the electricity transmission system to which it will be connected. The Proposed Development will be connected into the transmission system at 33kV.

1 Typically, 5m x 3m x 3m, such that they are generally indistinct from the tower base unless viewed close up or in silhouette against the skyline at greater distances.

4.2.16 This EIA Report has been undertaken using the maximum turbine parameters shown in **Table 4.1**, with which the final turbine used must comply.

Infrastructure Layout

Crane Hardstanding

4.2.17 Each proposed wind turbine requires an area of hardstanding to be built adjacent to the turbine foundation. This provides a stable base on which to lay down turbine components ready for assembly and erection, and to site the cranes necessary to lift the tower sections, nacelle and rotor into place. A typical hardstanding for crane and blade laydown areas is shown in **Figure 4.4**.

4.2.18 The primary crane hard standings will be left in place following construction, to allow for future use of similar plant, should major components need replacing during the operation of the Proposed Development. These hardstandings could also be utilised during decommissioning. The total area of hardstanding at each turbine location will be approximately 1250m^2 (excluding blade laydown areas and auxiliary crane hard standings that will be dressed back once construction is complete).

Temporary Construction Compounds

4.2.19 Two temporary construction compounds will be established for the Proposed Development. The primary construction compound (temporary construction compound 1) will comprise an area measuring 100m x 50m, and the secondary (temporary construction compound 2) 50m x 50m, each will be enclosed by appropriate security fencing. The locations of the temporary construction compounds are shown on **Figure 4.1**, and a typical compound configuration is shown in **Figure 4.5**.

4.2.20 The temporary construction compound areas will be constructed of compacted stone to approximately 500mm depth depending on ground conditions.

Substation/Control Building Compound

4.2.21 A control building and substation compound will be established. The substation, and on-site wind farm control building will sit together within a compound with maximum dimensions of up to approximately 180m x 110m, its location is shown on **Figure 4.1**.

4.2.22 A control building will be constructed for the Proposed Development that will house switchgear, metering, protection and control equipment, Direct Current (DC) battery power supply unit, Low Voltage (LV) auxiliary supply and distribution consumer unit as well as welfare facilities. The control building will comprise a single storey building measuring approximately 30m x 20m and have a maximum height of 7m. The substation/control building compound will be enclosed by appropriate security fencing. There will be allocated areas used for storage and maintenance purposes.

4.2.23 The control building will include an adjacent external sub-compound which would accommodate an auxiliary transformer (if required). **Figure 4.6** provides an illustration of the substation/control building compound and sub-compounds as well as illustrative elevations of the control building (indicative footprint of ~0.06ha). Final details including external finishes and screen planting will be agreed with Argyll and Bute Council (ABC).

4.2.24 The substation/control building compound will include an area allocated for the use of the Distribution Network Operator (DNO) for the substation. The substation compound will house the outdoor electrical high voltage (HV) equipment, transformer and control building for the Network Owner. **Figure 4.7** shows an illustrative plan of the substation compound, which will be constructed to the Network Owner’s specification and occupy an area of ~0.35ha enclosed by appropriate security fencing.

4.2.25 The substation/control building compound area will be constructed of compacted stone to approximately 500mm depth depending on ground conditions. The control building will be founded on a concrete foundation and elevated from the surrounding surface.

4.2.26 The turbines will be connected through suitable switchgear to be installed in the control building on-site.

Battery Storage Compound

4.2.27 One battery storage compound will be constructed for the Proposed Development with an anticipated capacity of up to 50MW. An indicative area measuring approximately 50m x 50m has been allowed for the battery storage compound which will be enclosed by appropriate security fencing. The area used will be a vacated portion of the area previously allocated for the temporary construction compound 1. The location of the construction compound is shown on **Figure 4.1**, and a typical battery compound configuration is shown in **Figure 4.8**. Final details, including screen planting and any bunding necessary, will be agreed with ABC.

4.2.28 The battery storage equipment shall comprise up to four containerised inverters, up to four battery control and fire panels, up to 32 battery modules and an auxiliary transformer. The battery modules are liquid cooled and installed with fire a detection and aerosol fire extinguishing system. The associated battery modules, panels and transformer would be enclosed by an appropriate perimeter fence with a low visibility style and colour.

4.2.29 The battery storage compound shall be constructed of compacted stone to approximately 500mm depth, depending on ground conditions. The energy storage equipment will be founded on concrete plinths and elevated from the surrounding surface by a height of approximately 400mm.

4.2.30 Underground cables will link the battery storage facility to the on-site control building. The details of the construction and trenching specification will be the same as for the turbine cables.

Permanent Anemometry Mast

4.2.31 Meteorological conditions will be monitored by a permanent, free standing anemometry mast. The height will match turbine hub-height, i.e., anticipated to be up to 125m. The design of this structure would be of a steel lattice type (an example of a steel lattice type design is shown in **Figure 4.9**), which would have an adjacent crane hardstanding of a similar type to the turbines with dimensions 20m x 20m, and which would be left in situ for the operational period.

On-site Electrical Connections

4.2.32 Wind turbines generally produce electricity at 690V which is typically transformed to 33kV via the turbine transformers. As previously stated, the turbine transformer may be located inside the turbine tower, or nacelle, or it may be installed in a small external kiosk located adjacent to the turbine.

4.2.33 Underground cables will link the turbines to the on-site control building. Detailed construction and trenching specifications will depend on the ground conditions encountered at the time, but typically cables will be laid in a trench approximately 1m deep and up to 1.2m wide. Cables will be laid in coarse sand or other granular material, and the trenches will then be backfilled with excavated soil/peat and sub-soil which has been sieved and graded to remove stones. **Figure 4.10** shows a typical cable trench, though there may be up to three cables within the same trench.

4.2.34 To minimise ground disturbance, cables will be routed alongside the access tracks wherever practicable. Approximately 75km of 33kV underground cable will be required on-site to connect the turbines and the control building.

4.2.35 The position of the underground cables will be marked with permanent posts, to ensure safety of future forest operations and permanent crossing points for forestry machinery will be provided over the underground cables at appropriate access points.

Borrow Pits

4.2.36 Borrow Pits shall be established to provide an on-site source of construction material. These will be sited within one or more of the nine borrow pit search areas identified by a desktop study and shown in **Figure 4.1**. The number, location and size of the borrow pits within the borrow pit search areas will be determined once full ground investigation works and testing are completed.

Concrete Batching Plant

4.2.37 A concrete batching plant will be installed either adjacent to one of the borrow pits or adjacent to one of the site construction compounds, with its location to be determined following ground investigation. The final location of this batching plant would not alter the EIA findings on significant effects, taking into account the adoption of standard mitigation and best practice detailed in the Construction Environmental Management Plan (CEMP) and other relevant documents.

Micro-siting

4.2.38 Micro-siting refers to the precise locating of wind farm infrastructure following more detailed ground investigations that would be carried out post consent. This allows the location of the turbines, crane hardstandings and the permanent met mast to be revised within a specified distance of up to 50m. For all other infrastructure, a micro-siting distance of up to 100m is required. The micro-siting is required as detailed survey work at this present time cannot be conducted due to the presence of the existing forestry, which limits both access and visibility.

4.2.39 Any such repositioning will be limited so as not to involve encroachment into any environmentally or technically constrained areas. In addition, micro-siting provides scope to mitigate potential geo-environmental and geotechnical constraints which may only be identified during detailed site investigation works. The following can potentially be achieved through carefully designed micro-siting:

- Reduction of peat disturbance;
- Avoidance of the most sensitive habitats;
- Avoidance of need for foundation piling; and
- Avoidance of currently undetected archaeological remains.

4.2.40 Where environmental and technical constraints may fall within a micro-siting area, further encroachment on such areas can be restricted in any condition attached to the grant of consent (e.g., micro-siting may be restricted in a particular direction if this encroaches upon a buffer around a water course for example).

On-site Access Tracks

4.2.41 A total of approximately 22km of new on-site tracks and 19km of upgraded on-site access tracks will be constructed.

4.2.42 Owing to the size of some of the turbine components, all on-site access tracks will generally be up to 6m wide, with some additional localised widening required at bends in the track and for passing places to a maximum of approximately 12-14m. It is however noted that tracks are more likely to be 4.5m to 5m wide for most of their length. For the purposes of this EIA Report, a maximum width of 6m has been assumed. Access tracks will be constructed to a depth and quality suitable to bear the load of all envisaged traffic, this will be determined following the detailed design process carried out post consent.

4.2.43 The proposed alignment of access tracks was developed initially through desk study and refined following a site visit by Civil Engineers seeking to:

- Minimise the overall track length; and
- Avoid identified constraints (ecologically sensitive areas, areas of deep peat, waterbodies, etc.).

4.2.44 Depending on the ground conditions identified on the Development Site, a range of road construction methods may be used, for example floating roads where peat deeper than 1m has been identified as being present. Based on current knowledge of the Development Site, approximately 3,338m of new floating tracks will be required; 1,939m of upgraded track will also be floated. Typical road construction is illustrated in **Figure 4.11**.

Temporary and Permanent Land Take

4.2.45 The indicative temporary and permanent land take is shown in **Table 4.3** (where, “temporary” refers to the area required during construction works, whilst “permanent” refers only to Proposed Development footprint post-construction).

4.2.46 No temporary land is required for the control building and substations as they sit within the temporary construction compounds and are therefore already captured in the temporary land take area for this purpose.

4.2.47 No temporary land take has been allocated to access tracks, turning heads and passing places, as these features have an assumed width greater than their operational requirements. Their construction and operational land take figures are therefore identical.

Table 4.3 Indicative Temporary and Permanent Land Take Areas

Component	Indicative Temporary Land Take Areas (ha)	Indicative Permanent Land Take Areas (ha)
Turbine Foundations	2	1.08
Turbine Crane Hardstanding (including auxiliary hardstanding)	3.81	2.75
Blade Laydown Areas	2.74	-
Permanent Anemometer Mast	0.04	0.04

Component	Indicative Temporary Land Take Areas (ha)	Indicative Permanent Land Take Areas (ha)
(foundation and crane hardstanding)		
Control Building and SPEN Substation Compound	-	1.80
Battery Storage Compound	-	0.25
Temporary Construction Compounds	0.75	N/A (0.25ha will be used to locate the battery storage compound, so captured in the corresponding row above)
Access Tracks (including turning heads, junctions, passing places and cable trenches[2])	-	19.85
Passing Places	-	1.22
Borrow Pits	14.24	-
Total	**23.58**	**26.99**

Forestry

4.2.48 Infrastructure and advanced felling is required to create adequate space for the footprint of the Proposed Development. The total felling required to accommodate construction of the Proposed Development totals 142.6 ha.

4.2.49 The Baseline Restocking Plan has been amended to integrate the Proposed Development infrastructure requirements into the forest design and to take account of the site conditions. The changes in the structure of the woodlands due to the Proposed Development can be summarised as follows:

- Net reduction in the area of Sitka spruce either pure or in mixed stands of 78ha;
- Increase in the area of broadleaf woodland of 1.8ha;
- Increase in the area mixed conifer woodland of 12.6ha;
- Increase in the area of mixed woodland of 0.5ha;
- Wind farm permanent open ground would total 79.4ha; and
- Net reduction in stocked woodland area within the Forestry Study Area (FSA) would be 91.2ha, equivalent to 0.9% of the FSA.

[2] It is assumed cable trenches will be circa 1m wide and adjacent to access tracks

4.2.50 To comply with the criteria of the Scottish Government's Control of Woodland Removal Policy, compensation planting is required. The Applicant is committed to providing appropriate compensatory planting. The extent, location and composition of such planting is to be agreed with Scottish Forestry, taking into account any revision to the felling and restocking plans prior to the commencement of construction of the Proposed Development.

4.2.51 Further information can be found in **Appendix 4A: Forestry Assessment**.

4.3 Proposed Site Access

Site Entrance

4.3.1 The Development Site access will be the existing An Suidhe wind farm access, east of the Development Site, then via a new access track through the forestry block.

Abnormal Loads

4.3.2 Due to the abnormal size and loading of wind turbine delivery vehicles and the crane, it is necessary to review the public roads that will provide access to the Development Site to ensure they are suitable, and to identify any modifications (e.g., widening) required to facilitate access for delivery vehicles.

4.3.3 A Route Survey Report (RSR) (**Appendix 13A**) incorporating swept path analysis for the Siemens Gamesa SGRE155 turbine with a rotor diameter of 155m (blade length ~77m) have been carried out to review potential access routes. It is anticipated, all blades would be carried on a Superwing Carrier trailer. Where constraints are particularly challenging, a blade lifting trailer may be used. The blade lifting trailer can lift blades up to a maximum angle of 60 degrees and therefore shortening the length plan view (see **Appendix 13A** for further information). The proposed route for abnormal loads (shown on **Chapter 13; Traffic and Transport** of the EIA Report, **Figure 13.2**) is from Campbeltown Harbour. Loads could be offloaded and transported via the access road to and from the quay. From here the access route would the join the A83, B8024, rejoin the A83 and turn left into the existing An Suidhe wind farm access. The temporary works to facilitate access for abnormal indivisible loads vehicles will be undertaken and an agreement for the third-party land identified in the RSR will be sought. As the turbine delivery vehicles are abnormal indivisible loads, a Special Order is required under The Road Traffic Act 1984. This will be obtained prior to any deliveries taking place.

4.3.4 As discussed in **Chapter 13** of the EIA Report, a Construction Traffic Management Plan (CTMP) will be developed in discussion with relevant consultees following the grant of planning permission and will set out all traffic management measures including any diversions, programming, stacking areas and vehicle movements on and off-site etc.

General Construction Traffic

4.3.5 General construction traffic, which would include flatbed trucks and Heavy Goods Vehicles (HGVs) delivering plant and equipment (e.g., excavators) as well as vans and cars associated with construction staff movement, will also access the Development Site from the east via the A83. The access routes for these vehicles will vary depending on the origin of the contractors and materials (depending on location of any quarries used to source stone).

4.4 Construction Process

Proposed Programme

4.4.1 The Development Site is located in an area of commercial plantation forestry. Prior to the commencement of construction, approximately 198.1ha of commercial tree crop will require felling. Access for tree felling will be via the existing access track that Forestry Land Scotland currently use for that activity. Details of tree felling are provided in **Appendix 4A**.

4.4.2 The construction period for the Proposed Development is anticipated to be approximately 24 months. It will comprise the following activities broadly listed in sequence:

- Upgrading of the Development Site access point and tracks to the main part of the Development Site, including temporary construction compound No.2;
- Formation of the temporary construction compounds including hardstanding and temporary site office facilities;
- Felling of commercial forestry to create areas for wind turbines, access tracks and other associated infrastructure;
- Construction of on-site access tracks and passing places (as required), inter-linking the turbine locations and control building/substation compound;
- Construction and upgrade of culverts under roads to facilitate drainage and maintain existing hydrology;
- Opening and operating site borrow pits, starting during the construction of new tracks, from construction compound No. 2;
- Operation of on-site concrete batching plant;
- Construction of crane hard standing areas;
- Construction of turbine foundations;
- Construction of on-site control building/substation compound and infrastructure required to provide a connection point to the Network Operator substation;
- Excavation of trenches and cable laying adjacent to site access tracks;
- Connection of on-site distribution and signal cables;
- Delivery and erection of wind turbines;
- Commissioning of site equipment;
- Construction of battery compound, which will be a modification to half of the temporary construction compound;
- Installation of battery storage equipment and commissioning; and
- Development Site restoration (e.g., reinstatement of vegetation at track edges, compensatory replanting etc.).

4.4.3 Where possible, construction operations will be carried out concurrently (thus minimising the overall length of the construction programme). In addition, the Proposed Development will be phased such that, at different parts of the Development Site, the civil engineering works can continue whilst the proposed turbines are being erected. Development Site restoration will be programmed and carried out to allow restoration of disturbed areas as early as possible and in a progressive manner.

4.4.4 An indicative programme for construction activities is shown in **Figure 4.14**. The starting date for construction activities is largely dependent upon the date planning permission might be granted (which is outside the Applicant's control), and the grid connection date; subsequently the programme will be influenced by constraints on the timing of delivery and duration of any mitigation measures required, as outlined in the technical chapters of this EIA Report and/or conditions to the planning permission.

4.4.5 The length of the construction programme will be dependent on seasonal working and weather conditions. Summer months are favoured for construction due to longer periods of daylight allowing longer working days (subject to any restrictions on construction hours). Summer months are generally also drier which aids the construction progress and reduces the amount of site debris (mud etc.) reaching the public road. A watching brief will be maintained on the cleanliness of the public roads, with cleaning carried out by contracted road sweepers (if required). Weather, particularly wind, has a strong influence on the timing of construction activities. Crane lifting activities are generally limited during strong winds (>11 m/s) and erection of cranes and/or turbines during these weather conditions may be avoided for safety reasons. The actual limiting conditions will be reviewed as part of the crane lifting plan. During periods of cold weather, concrete pouring for the turbine bases may be prohibited (temperatures <4°C) and/or subject to specific cold weather working practices.

Hours of Working

4.4.6 For the purposes of this EIA Report, construction activities have been assumed to take place between 07:00 to 19:00 hours on weekdays (Monday to Friday). For Saturdays, assumed hours will be between 07:00 to 19:00 during summer months, and 07:00 to 17:00 in winter months. Quiet on-site working activities (for example electrical commissioning) have been assumed to extend outside the core working times noted (where required). Working hours may be reduced at times due to seasonal or weather restrictions. Some works such as delivery of the components of turbines may take place outside the core working hours to reduce disturbance to other users of the road network.

4.4.7 Work outside these hours is not usual, though if required to meet specific demands (e.g., during foundation pours, tower erection and highly weather dependent activities), where possible permission for short term extensions to these hours would be sought from ABC as required.

Standard Construction Working Practices

4.4.8 Contractors' working areas will be clearly delineated on-site to ensure that no unnecessary disturbance is caused to any potentially sensitive areas.

4.4.9 Particular attention will be given to the storage and use of fuels for the plant on-site. Oil will be stored in accordance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR Regulations). Drainage within the temporary construction compound, where construction vehicles will park and where any diesel fuel will be stored, will be directed to an oil interceptor, to prevent pollution in the event of any spillage occurring. Storage of diesel fuel will be within a bunded area or self-bunded tank in accordance with the CAR Regulations and the Scottish Environment Protection Agency (SEPA) Pollution Prevention Guidelines (PPGs) and Guidance for Pollution Prevention (GPP).[3] Standard working practices will be implemented during construction, operation and decommissioning in order to ensure adherence to Construction Industry Research and Information Association (CIRIA) guidance and other current best practice, including the following the PPG and GPP:

[3] The GPP are the documents that replace the former PPGs. At the time of writing, some documents remain PPGs.

- GPP 1 Understanding your environmental responsibilities – good environmental practices;
- GPP 2 Above Ground Oil Storage Tanks;
- GPP 3 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP 4 Treatment and Disposal of Sewage Where No Foul Sewer is Available;
- GPP 5 Works and Maintenance in, or Near, Water;
- GPP 6 Working at Construction and Demolition Sites;
- GPP 8 Safe Storage and Disposal of Used Oils; and
- GPP 21 Pollution Incident Response Planning.

4.4.10 The Proposed Development will be constructed in accordance with a construction site licence under the CAR Regulations will also contain such documents as the Pollution Prevention Plan to be approved by the SEPA.

4.4.11 Due consideration will also be given to the following guidance documents:

- *Good Practice during Windfarm Construction* produced by Scottish Renewables (SR), Scottish Natural Heritage (SNH), SEPA, Forestry Commission Scotland (FCS) and others (Version 4, 2019);
- *Control of Water Pollution from Linear Construction Projects* (Construction Industry Research and Information Association (CIRIA) C648, 2006), produced by CIRIA;
- *Constructed Tracks in the Scottish Uplands* 2nd Edition, 2013, updated 2015, published by SNH; and
- *Floating Roads on Peat*, 2010, published by Forestry Civil Engineering (FCE) and SNH.

Health and Safety during Construction

4.4.12 Health and Safety is of vital importance to the Applicant and the requirements of the Construction (Design and Management) Regulations 2015 ('CDM 2015') will be observed throughout the construction stage of the Proposed Development. If planning permission is granted, the Principal Contractor will be required to produce a Construction Phase Health and Safety Plan in accordance with CDM 2015 to outline and define the approach to Health and Safety that will be adopted specifically for the Proposed Development. In addition to CDM 2015, the Developer and its Contractors will also adhere to other relevant UK Health and Safety legislation and guidance, including but not limited to:

- Health and Safety at Work Act 1974;
- Management of Health and Safety at Work (Amendment) Regulations 2006;
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR), (2013); and
- Onshore Wind Health and Safety Guidelines, Renewable UK, 2015.

4.4.13 Method statements will be prepared, and risk assessments undertaken for each work package, prior to activities taking place.

4.4.14 The Applicant will directly appoint suitably experienced Contractors for the detailed design, procurement and construction of the Proposed Development. Selection will be based partly upon a Contractors' record in dealing with Health, Safety, Security and Environment (HSSE) issues and on the provision of evidence that it has incorporated HSSE considerations into its method statements, staffing and budgetary provisions.

4.4.15 The Applicant will also appoint a Project Manager for the duration of construction to act as an interface between it and the Contractors. The Project Manager will also monitor the construction works and undertake the duties as defined in the CDM Regulations 2015.

4.4.16 Appropriate signage will be provided on the Development Site to highlight any hazards, areas that should be avoided or where unauthorised entry is prohibited. During the construction phase, public access on-site will be restricted for health and safety reasons.

Environmental Management during Construction

Construction Method Statement (CMS)

4.4.17 The Applicant will engage a Contractor to construct the Proposed Development. During the construction process, the Applicant will retain the services of any specialist advisers that may be required, for example relating to archaeology, ecology, and peat restoration, to be called on as required to advise on specific issues, including micro-siting. More detailed information on the role of such specialist advisors during construction is provided in the relevant chapters of this EIA Report.

4.4.18 The final range of measures to be taken to reduce or mitigate the environmental impact of the construction phase will be captured in the CEMP, Pollution Prevention Plan (PPP), Site Waste Management Plan (SWMP) and emergency procedures that will all fall under the wider Construction Method Statement (CMS). The Contractor will employ an independent and appropriately qualified environmental scientist or ecologist as an Ecological Clerk of Works (ECoW). The ECoW will be employed on a part time basis during the construction phase and will take a key role in the preparation of the CEMP. The CEMP will ensure environmental specialists support the ECoW, as required.

4.4.19 The CEMP will, as a minimum, implement all of the mitigation measures required during construction, as identified as necessary within this EIA Report or planning conditions set by the determining authorities, to mitigate any likely significant adverse effects, and will outline a suite of control measures to manage the potential environmental impacts during this phase (including noise, pollution, surface water runoff and waste). It would draw on the standard construction practices outlined in this chapter in **Sections 4.4.8** to **4.4.11**.

4.4.20 The CMS and supporting documents will be submitted for approval by ABC following consultation with bodies such as SEPA, prior to construction and development. In order to ensure that they are being suitably adhered to by the appointed contractors, an independent and suitably qualified Engineer, who will also liaise with the various environmental advisers employed during the construction phase, will be appointed by the Applicant to monitor implementation and provide specialist advice.

Dust and Air Quality

4.4.21 There is the potential for an increase in dust during construction. However, as established and effective dust control measures are used during the construction of wind farms, it is not expected that air quality will be affected. The main measures for managing dust, that will be used where necessary, are:

- Adequate dust suppression facilities will be used on-site. If required, this will include the provision of on-site water bowsers with sufficient capacity and range to dampen down all areas that may lead to dust escape;

- Any on-site storage of aggregate or fine materials prone to dust generation will be managed using enclosures and screening, if required, so that dust escape from the Development Site is avoided. Sheeting can also be provided for the finer materials that are prone to *‘wind whipping’*;
- Where required, HGVs entering and exiting the Development Site will be fitted with adequate sheeting to totally cover any load carried that has the potential to be *‘wind whipped’* from the vehicle;
- Vehicles used on-site will be regularly inspected and maintained, to minimise vehicle emissions and the risk of leaking diesel or hydraulic fluids;
- Good housekeeping or *‘clean up’* arrangements will be employed so that the Development Site is kept as clean as possible. There will be regular inspections of the working areas and immediate surrounding areas to ensure that any dust accumulation, litter or spillages are removed/cleaned up as soon as possible; and
- A site liaison person will investigate and take appropriate action where complaints or queries about construction arise.

4.4.22 These measures would be included in the CEMP.

Site Waste Management

4.4.23 Where possible, and subject to geotechnical testing, any topsoil material generated by excavation of foundations is expected to be re-used on site. This would be re-used on the working areas or allocated for restoration purposes in cutover areas of the Development Site. Excavated material will (depending on type) be used to backfill excavations and for general restoration purposes where appropriate. It is not expected that any material will be unsuitable for re-use in this way, though in the unlikely event that such materials arise, they would be disposed off-site in line with relevant waste disposal regulations.

4.4.24 Soil movement would be undertaken with reference to best practice guidelines available in the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009). In the unlikely event there is a sustained period of dry weather, soil excavation would be undertaken with backacters and dump trucks wherever possible. Topsoil and subsoil would not be mixed or stored together.

4.4.25 The stockpiling of materials would be minimised where possible and agreed with the ECoW, and any essential stockpiles would be located at least 50m away from watercourses, though ideally as far away as possible.

4.4.26 Steps would be taken to minimise the extraction of peat as per the Outline Peat Management Plan (PMP) described in **Chapter 6: Renewable Energy, Carbon Balance and Peat**. The final PMP would ensure that peat excavated during construction is safely and suitably re-used within the extent of the Development Site wherever possible.

4.4.27 Construction waste is expected to be restricted to normal non-hazardous materials such as off-cuts of timber, wire, fibreglass, cleaning cloths, paper and similar materials. These will be sorted and recycled if possible or disposed of to an appropriately licensed landfill by the relevant contractor.

4.5 Construction Details

Infrastructure Construction

4.5.1 The total felling required to accommodate construction of the Proposed Development, including infrastructure and advanced felling, totals 198.1ha.

4.5.2 Construction of the Proposed Development would consist of two main elements. Firstly, civil and electrical construction of the infrastructure and secondly, erection and commissioning of turbines. Construction of the control building and the grid connection are lengthy processes which will commence early in the construction programme to allow a live grid connection to coincide with the commissioning of the turbines. It should be noted that many individual construction processes would run partly or fully concurrently whilst others would progress in a sequence with or without some overlap in time.

4.5.3 The location of the Development Site infrastructure is shown in **Figure 4.1**.

Temporary Works: Construction Compound and Lay Down Area

4.5.4 It is proposed that two temporary construction compounds with maximum areas of 5,000m^2 and 2,500m^2 will be constructed. Typical compound arrangements are shown in **Figure 4.5**.

4.5.5 Surface vegetation and topsoil will be removed from the area of the temporary construction compounds and laid on geogrid over the surrounding undisturbed vegetation until required for reinstatement, post-construction. Geogrid will be laid on the exposed ground and stone added to an approximate depth of 500mm and compacted to a suitable engineering specification.

4.5.6 The temporary construction compounds will be located inside areas contained by security fencing, if required by the Contractor. During periods of darkness, directional security lighting may be used. This lighting would conform to the institute of lighting professionals' guidance for Zone E1 (Guidance Notes for the Reduction of Obtrusive Light GN01:2021) and would use a shielded downwards pointing installation.

4.5.7 The temporary construction compounds will include: an area for portable temporary offices (to be used as site offices and for the storage of various materials and small components); car parking; and welfare facilities including toilets, a kitchen and a mess room; storage and laydown areas for equipment, plant and construction vehicles; areas for storage of oils and fuel; and facilities for aggregate recycling and concrete batching (may be located adjacent to borrow pit(s)). Foul drainage will be collected in a holding tank for regular collection and disposal off-site. Areas of the compounds which represent an increased pollution risk, e.g., oil or fuel storage and vehicle refuelling, would be self-bunded.

4.5.8 Water will be provided by a bowser or smaller containers. Compliant drinking water arrangements will be put in place. Water extraction for welfare facilities (non-potable) will be provided via mains water supply, where available, and if not, by a water harvesting and Ultraviolet (UV) filter system. A rainwater collection system will be installed to provide water for flushing which, if necessary, will be topped up with water brought to site by tanker delivery in dry periods

4.5.9 Approximately half of the temporary construction compound 1 will be repurposed for the battery storage compound, the remaining area will be reinstated at the end of the construction phase.

4.5.10 The detailed configuration, layout and size of the temporary construction compounds would be finalised post grant of planning permission and after appointment of a construction contractor. Typical compound arrangements are shown in **Figure 4.5**.

General Plant and Equipment

4.5.11 A range of plant and equipment is expected to be delivered to the Development Site near the onset of the works and will be removed as soon as practical at the end of the activity for which the equipment relates.

Turbine Foundations

4.5.12 The final foundation design will be informed by the choice of turbine and detailed geotechnical investigation prior to construction. Foundation design will be undertaken by geotechnical engineers and structural designers, once ground conditions are established and the final turbine model selected.

4.5.13 Wherever ground conditions permit, turbine foundations will be constructed from reinforced concrete using a 'submerged gravity base' approach. If, following intrusive geotechnical investigation works, ground conditions are proven to be unsuitable for this approach, other forms of foundation will be used, such as piled turbine foundations (though this is not anticipated as being necessary at this stage, due to the depths of peat encountered on-site and the desk-based assessment of the Development Site geology; and it is considered that gravity base foundations will be suitable). Gravity base foundations also constitute a worst-case scenario in terms of land take.

4.5.14 A typical gravity foundation is presented in **Figure 4.3**. Construction of gravity base foundations will involve the excavation of soil/peat and subsoil to expose the underlying load bearing strata or bedrock. Any topsoil and other vegetation removed will be laid on geogrid over the surrounding undisturbed vegetation until required for reinstatement once the turbine is installed.

4.5.15 An area of approximately 910m^2 will be excavated for the gravity foundations, due to the excavation depth and batter angle of the side wall. The depth of the excavation will be approximately 3-4m, depending on the depth of the load bearing strata or bedrock. The sides of the excavation will be battered back to ensure that they remain stable during construction.

4.5.16 The load bearing strata or bedrock will be levelled, and stone added to an approximate depth of approximately 1.4m and compacted to a suitable engineering specification to create a formation layer. The formation layer is then blinded[4] prior to the in-situ casting of the steel reinforced concrete slab that will be approximately 25m in diameter. Each foundation will be made up from approximately 960m^3 of concrete and approximately 100 tonnes of reinforcing steel.

4.5.17 On top of the slab, a concrete pedestal will then be cast, to which the turbine tower will later be bolted. The excavated area will be backfilled with compacted layers of graded material from the original excavation and capped with topsoil. The exact details of each foundation will vary across the Development Site in response to the actual ground conditions encountered. A detailed ground investigation will be undertaken prior to construction to establish the requirement at each foundation.

[4] A process whereby a 50mm layer of low-grade concrete is placed directly onto the bedrock to provide a level and firm working base to support the foundation reinforcing cage.

4.5.18 Turbine excavations may be open for four to eight weeks during the construction programme. During this time, excavations will be kept free from water (rainwater and run-off). If local topography permits, the excavations will be free draining. If not, excavations may be mechanically pumped, with all dewatering works carried out in accordance with the CAR Regulations and SEPA's GPPs including discharges through either settling ponds, swales or mechanical silt traps.

4.5.19 Alternative methods of turbine foundation construction will be considered if required in light of the results of a detailed geotechnical site investigation.

Crane Hardstanding and Blade Laydown Areas

4.5.20 Each wind turbine requires an area of hardstanding to be built adjacent to the turbine foundation. A typical crane hardstanding arrangement is shown in **Figure 4.4**. The total area of hardstanding at each turbine location, including the primary and auxiliary crane hardstanding and blade laydown areas will be approximately 2,975m^2.

4.5.21 Surface vegetation and soil/peat will be removed from the area of the crane hardstanding and laid on geogrid over the surrounding undisturbed vegetation until required for reinstatement. The area will then be covered with geo-grid overlain with compacted stone to approximately 500mm depth, dependent on ground conditions and load capacity.

4.5.22 As noted, crane hard standings will be left in place following construction in order to allow for the use of similar plant should major components need to be replaced during the operational phase of the Proposed Development. These could also be utilised during decommissioning phase. The blade laydown areas and auxiliary crane hardstanding will be reinstated at the end of the construction phase; this would involve removal of the geogrids and compacted gravel and placement of previous cover

Substation/Control Building and Compound

4.5.23 The control building and substation compound will comprise a hardstanding with maximum dimensions of approximately 180m x 100m and contain a single storey building approximately 22m x 13m. Concrete foundations will be required to take the weight of the components housed within the control building.

4.5.24 Foul drainage will be collected in a septic tank (>5m from the building) with soakaway. Water for welfare facilities (non-potable) will be provided via mains water supply where available, and if not available, water will be provided by a water harvesting and UV filter system.

4.5.25 **Figure 4.6** provides an illustration of the indicative control building and compound; and **Figure 4.8** provides an illustration of the indicative substation. The external finishes/materials would be chosen to blend in with the local vernacular of the area. Final details including external finishes would be agreed with ABC as a condition following planning permission being granted.

4.5.26 Surface vegetation and soil/peat will be removed from the area of the compound and laid on geogrid over the surrounding undisturbed vegetation until required for reinstatement, post-construction. The area of the compound will then be overlain with compacted stone to approximately 500mm depth depending on ground conditions. The area of the control building is then blinded[5] prior to the in-situ casting of the steel-reinforced concrete slab that will form the building foundation. The control building foundation will be made up from approximately 360m^3 of concrete and 27 tonnes of reinforcing steel. The transformer / generator plinth will be made up of approximately 72m^3 of concrete and 5 tonnes of reinforcing steel.

[5] A process whereby a 50mm layer of low-grade concrete is placed directly onto the bedrock to provide a level and firm working base to support the foundation reinforcing cage.

Battery Storage Compound

4.5.27 The Battery Storage Compound will comprise hardstanding with maximum dimensions of approximately 50m x 50m. The compound shall house battery energy storage equipment mounted on concrete plinths. **Figure 4.8** provides an illustration of the indicative battery storage compound and final details, including screen planting and any bunding necessary, will be agreed with EAC.

4.5.28 Surface vegetation and soil/peat will be removed from the area of the compound and laid on geogrid over the surrounding undisturbed vegetation until required for reinstatement, post-construction. The area will then be overlain with compacted stone to approximately 500mm depth depending on ground conditions. The areas of the inverters, battery controllers, and battery modules is then blinded[6]prior to the in-situ casting of the steel-reinforced concrete plinths that will form the foundations, which will be made up from approximately 60m^3 of concrete and 5 tonnes of reinforcing steel.

Power Cabling

4.5.29 Underground cables will link the turbines to the on-site control building. Detailed construction and trenching specifications will depend on the ground conditions encountered at the time, but typically cables will be laid in a trench approximately 1m deep and up to approximately 1.2m wide. To minimise ground disturbance, cables will be routed alongside the access tracks wherever practicable and, if not, the total footprint of construction activity will be stated within the CMS. Approximately 25km of cable trenches will be required to house the cables that connect the turbines to the on-site control building, with installation methods potentially including burial in ducts across the tracks, burial in trenches and mole-ploughing. **Figure 4.10** shows a typical cable trench detail, though there may be up to three cables within the same trench

4.5.30 Any excavations will be cordoned off and marked clearly. Cable hauling operations will be coordinated with traffic movements, especially when hauling is being carried out from the roadway. Cable off-cuts and waste from terminations will be systematically collected, stored, and recycled or disposed of properly.

4.5.31 The trenches would be dug during periods of relatively dry weather. The cables would be placed within the trenches, and soils quickly replaced to minimise the ingress of water into the trenches. Regularly spaced clay bunds may be required in the trench backfill to prevent the introduction of preferential flow paths within the cable trenches.

On-site Access Tracks

4.5.32 Typical track cross sections are shown in **Figure 4.11**. The design of a particular length of Development Site access track will depend on local geological, topographical and drainage conditions. The primary objectives that have informed the design of the access tracks are:

- Requirements to maintain water flows across tracks and minimise disruption to the current hydrology;
- Minimisation of peat spoil by routing tracks through areas of shallow or no peat where possible;
- Mitigation and management of silt run off and surface water;

[6] A process whereby a 50mm layer of low-grade concrete is placed directly onto the bedrock to provide a level and firm working base to support the foundation reinforcing cage.

- Serviceability requirements for construction and wind turbine delivery vehicles; and
- Constructability considerations.

4.5.33 To achieve a track structure that meets the conditions encountered on the Development Site, whilst meeting the primary track design objectives, two different designs have been developed (each with associated construction techniques) as summarised in **Table 4.4**.

Table 4.4 Typical Access Track Construction Techniques

Design	Construction Method	Typical Site Conditions	Peat Depth (m)
1	Floating road	Deep, flat, stable areas of peat (track thickness estimated 600mm to 1,000mm)	≥1 m
2	Excavated road	Flat with simple drainage condition (track thickness estimated 450mm to 600mm)	<1 m

4.5.34 The alignment of the on-site tracks has been subject to initial review by an experienced Civil Engineer and re-routed to respond to any constraints identified during surveys. The final decision on alignment and on the appropriate type of access track design to adopt for a particular length of track will be made in advance of construction and may involve input from the ECoW as well as site engineers (and any other environmental specialists as required).

4.5.35 A peat depth survey has been carried out (see **Appendix 6B** and **Figure 6.11)** and identified areas of peat, which due to the depth may therefore have the potential to require floating roads. The weight of a floating road is supported by the peat beneath, thereby avoiding the need for construction foundations to be excavated through to the underlying solid bedrock.

4.5.36 Based on current knowledge of the Development Site, approximately 3,338m of new floating tracks will be required; 1,939m of upgraded track will also be floated. These will be constructed in line with Good Practice during Windfarm Construction produced by SR, SNH, SEPA, FCS and others (Version 4, 2019) and Floating Roads on Peat by FCE and SNH (2010) and will include the use of geogrids.

4.5.37 It is anticipated that approximately 22km of new access track will be required for the Proposed Development. Approximately 19km of existing track will be upgraded. It is expected that aggregates for the Proposed Development (including the access tracks) would be taken from an on-site borrow pits wherever possible. However, where this may not be feasible, aggregates would be delivered from existing quarries and batching plants from the surrounding area, the effects of which have been assessed in **Chapter 13: Traffic and Transport** of the EIA Report.

4.5.38 As previously noted, the running width of all on-site access tracks will be a maximum of 6m wide, with some additional localised bend widening to a maximum of approximately 12-14m (for the purposes of this EIA Report, a maximum running width of 6m has been assumed).

4.5.39 In general terms, the construction method for access tracks and passing places will see the topsoil removed (and laid on geogrid over the surrounding undisturbed vegetation until required for reinstatement) to expose a suitable sub-soil horizon on which a track can be constructed. A geogrid will then be placed to minimise the need for aggregate and to reduce the impact on the sub-soils. The track will then be built up on the geo-grid by laying and compacting graded rock to a depth of approximately 450-600mm, dependent on ground conditions and load bearing capacity.

4.5.40 Post-construction, the topsoil, which was stripped for access track construction, will be re-laid along the edges of the access tracks to allow revegetation.

4.5.41 The detailed drainage design will be finalised following planning permission being granted but, for the purpose of this EIA Report, the basic principles are that the drainage system would be developed:

- Based on Sustainable Drainage Systems (SuDS) principles;
- In accordance with the CAR Regulations; and
- In accordance with the appropriate licence under the CAR Regulations.

Watercourse Crossings

4.5.42 There is an extensive network of watercourses within the Development Site and the Proposed Development will require the upgrade of 57 existing watercourse crossings that lie beneath the existing on-site access tracks. Thirty-five additional water course crossings associated with new access track will also be required (92 crossings in total). The water crossing locations are detailed in **Chapter 12: Geology, Hydrology and Hydrogeology** and are shown on **Figure 4.1**. A typical culvert detail is shown on **Figure 4.12**.

Culverts

4.5.43 At this stage, it is proposed that a simple culvert type construction will be employed, using a cross-sectional area that will not impede flow of water. All crossings would be designed to accommodate 1-in-200-year peak flows (with an allowance for climate change) to reduce the risk of flooding. Culverts would be developed in accordance with CIRIA Culvert Design and Operation Guide (RP901), Engineering in the Water Environment Good Practice Guide - River Crossings: Second Edition (SEPA, 2010) and River Crossings and Migratory Fish: Design Guidance (Scottish Executive 2000). Watercourse crossings will be subject to detailed design following the granting of planning permission.

4.5.44 The need for drainage will be established on-site during pre-construction surveys. The access tracks will have a suitable cross-fall to allow rainwater to be shed and, where gradients are present, lateral drains will intercept any flow along the access tracks. A Water Management Plan will set out the specific details of surface water drainage, management of dewatered groundwater from excavations and watercourse crossings. A programme for inspection and monitoring will be undertaken during the construction phase to ensure the effectiveness of drainage measures.

4.5.45 To prevent silt entering watercourses, an ongoing scheme of silt mitigation will be carried out, which may include use of silt traps; silt fences; silt mats etc, all installed to suit the local conditions. The silt mitigation measures will be monitored throughout the construction period by the Contractor and ECoW.

Bridges

4.5.46 Bridges are the preferred solution for larger crossings due to their lesser hydrological and ecological effects and are particularly suited to higher flow watercourses. Bridge construction is unlikely to interfere with the watercourse to the same extent as culvert construction and can be built over the existing alignment of the river without the need for diversion. Douglas Water (WC16) is a larger watercourse than others on-site and therefore requires a bridge to cross. Foundations will be required on both banks (down to a competent bearing stratum) in order to support the bridge deck. A typical bridge section is shown in **Figure 4.13**.

4.5.47 Local widening of the access track will be required on one side of the bridge; if necessary the road will need to be strengthened to allow a hardstanding area for the crane when the beams are lifted into place. The size of this area will be determined by factors governing the size of the crane, for instance the bridge span.

Peat Management during Construction

4.5.48 The Development Site is situated in an area where peat deposits are found. The infrastructure design and construction methodology has been refined to minimise excavation in areas of deeper peat required for tracks and turbine infrastructure, but it has not been possible to avoid it entirely. The majority of peat spoil will come from foundations, hard standings and track construction and, to a lesser extent, temporary compounds.

4.5.49 An Outline Project Management Plan (PMP) has been prepared and it will be finalised prior to construction and following completion of detailed ground investigations and micro-siting. The Outline PMP will be further refined, and detailed methods and specifications agreed with SEPA and NatureScot. This will address methods in respect of peat excavation, haulage, storage, re-use. The Outline PMP will ensure that peat excavated during construction is safely and suitably re-used within the extent of the Development Site wherever possible. The Outline PMP indicates suggested areas where it is considered potentially suitable excavated peat to be reused on-site.

4.5.50 Details of the Outline PMP (**Appendix 6A)** are provided in technical chapters- **Chapter 6: Renewable Energy, Carbon Balance and Peat** and **Chapter 12: Geology, Hydrology and Hydrogeology** of the EIA Report.

Track Drainage

4.5.51 The need for drainage on the access track network will be considered for all parts of the track network separately, since slope and wetness vary considerably across the Development Site. In flat areas, drainage of floating tracks is not required as it can be assumed that rainfall on the road will infiltrate to the ground beneath the tracks or along the verges. Track-side drainage will be avoided where possible, in order to prevent any local reductions in the water table or influences on the tracks structure and compression (the latter can occur where a lower water table reduces the ability of the peat to bear weight, increasing compression).

4.5.52 Where tracks are to be placed on slopes, lateral drainage will be installed on the upslope side of the track. The length of drains will be minimised, to prevent either pooling on the upslope side or, at the other extreme, creating long flow paths along which rapid runoff could occur. Regular cross-drains will be required to allow flow to pass across the track (as recommended in SEPA's Position Statement WAT-PS-06-02 Culverting of Watercourses (June 2015)), with a preference for subsequent re-infiltration on the downslope side, rather than direct discharge to the drainage network.

Drainage Ditches along Excavated Tracks

4.5.53 Excavated tracks can impede the natural drainage across them and consequently drainage ditches are required. It is anticipated that at times, the water in the drainage ditches will contain high concentrations of sediment from excavations, track construction and possibly other accidental pollutants from construction activities. Therefore, no water from a drainage ditch will be discharged directly to a watercourse. Instead, water from drainage ditches will pass through silt fences, silt traps or other best practice pollution control features. Drains will not be discharged directly into natural channels, ephemeral streams or old ditches.

4.5.54 If required, any discharge, once sediment has been removed as described above, would occur under the appropriate SEPA consent.

4.5.55 The drainage ditch design will be considered in line with the recommendations of the FCE and SNH guidance (2010), including the use of flat-bottomed drainage ditches to reduce the depth of disturbance.

4.5.56 In instances of drainage close to surface watercourses, discharge from the drainage system may be to surface water rather than re-infiltration into the ground. In these situations, best practice control measures including sediment settlement will be undertaken before the water is discharged into surface water systems. The discharges will be small and collect from only a limited area, rather than draining a large area to the same location.

4.5.57 Although drainage will be provided in areas of disturbance as required, areas of hardstanding will be minimised so that this need is reduced. This includes careful design of construction compounds and minimising (where possible) the size of crane hardstanding at each turbine location.

Cross Drainage

4.5.58 Where tracks are to be placed on slopes, lateral drainage will be required on the upslope side of the road. The length of drains should be minimised, to prevent either pooling on the upslope side or, at the other extreme, creating long flow paths along which rapid runoff could occur. The spacing of cross drains will depend on the area draining to the cross drain, gradient, choice of material for the drain, and design objective. Where cross drains are required, depending on-site conditions, the aim will be for subsequent re-infiltration on the downslope side rather than direct discharge to the drainage network.

4.5.59 Cross-drainage may be achieved using culverts or pipes beneath the track, again in line with the FCE and SNH (2010) guidance. Drainage will be installed before or during track construction, rather than afterwards, to ensure that the track design is not compromised. The cross drainage will flow out into shallow drainage, which will allow diffuse re-infiltration to the peat on the downslope side. The cross drains will flow out at ground level and will not be hanging culverts. Steep gradients have been avoided through the design process in relation to site access tracks, this will also reduce the risk of erosion occurring at cross-drain outflows.

Check Dams

4.5.60 Check dams (small dams built across channels or drainage ditches) may be required at regular intervals in the drainage ditches alongside an excavated track. They are required for two principal reasons. Firstly, they act as a silt/pollution trap slowing the flow of water so allowing sediment to settle out. Secondly, they help to direct water into the cross drains and so allow natural drainage paths to be maintained as much as possible. The spacing of the check dams will depend on the following factors:

- The gradient of the track;
- The spacing of cross-drains; and
- The depth of excavation.

4.5.61 Regular maintenance and clearing of the check dams will be applied to ensure their effectiveness is maintained.

Interface between different Types of Road Drainage

4.5.62 Where the track construction method changes, the drainage methods will also change. If this results in an end point for a drainage ditch, it will be piped across the road and allowed to discharge to land on the downward side of the slope (taking into account precautions against pollution and erosion).

Employment Proposals

4.5.63 It is envisaged that the Proposed Development would be constructed employing several main contractors; one for the civil infrastructure works, one for the electrical works, one for the supply, erection and commissioning of the wind turbines and a battery installation contractor - all of whom would be coordinated and overseen by a Project Manager. In order to monitor the works, a number of site representatives would be employed full time to ensure the quality and health and safety aspects of the construction, and to ensure the development is carried out in accordance with the CMS and CEMP methodologies.

4.5.64 The site representatives would be individuals with previous experience of wind farm construction and would be supported on-site by a suitably qualified ecology/environmental clerk of works, as required. The site representatives would carry out daily checks on the Development Site to monitor on-going activities, particularly when subcontractors are being used on-site. In addition to this, and, in conjunction with the ecologist and hydrologist, environmental audits of the site operations would be undertaken on a regular basis accompanied by representatives of the relevant contractors. Where necessary, additional specialists may attend the site including geotechnical and archaeological representatives.

4.5.65 In line with appropriate guidance, competent operatives would be employed for handling, storing and arranging for the disposal of potentially polluting substances. Licensed waste disposal companies would be used to dispose of potentially polluting wastes.

4.5.66 During the construction period, there will be construction operatives carrying out the works on-site that have been described. There would be indirect local benefits arising from the construction phase, including use of hotels, Bed & Breakfasts and other accommodation, hire of local equipment and plant, temporary employment of local work force and potential contracting of local subcontractors. The construction mobilisation would likely be spread over an approximate 24-month period.

Materials Import

Rock Requirements.

4.5.67 Construction of access tracks, hard standings, foundations, and compounds within the Proposed Development will require approximately 200,618m^3 of rock. **Table 4.5** below provides a breakdown of the required rock volumes for each construction element.

Table 4.5 Summary of Indicative Rock Volumes Required During Construction

Infrastructure	Total Rock Volume (m^3)
Hard standings and foundations	~51,850
Access tracks	~102,585

Infrastructure	Total Rock Volume (m^3)
Temporary construction compounds	~3,750
Substation/Control building compound	~9900
Total Rock Volume	**~168,085**
~20% Contingency	**~33,617**

On-site Rock Source Areas & Borrow Pits

4.5.68 Nine potential borrow pit search areas have been identified, based on geological information from a high-level desk study, along with knowledge of the site gained from surveys and walkovers. The final number, size and location of each borrow pit within each search area, and an estimate of material to be won from each, can only be determined once full ground investigation works and testing have been completed. The search areas shown in **Figure 4.1** represent suitable areas on-site in which borrow pits could be excavated.

4.5.69 It is recognised that the borrow pits have the potential to give rise to a range of environmental effects which would need to be managed. As noted above, the extraction requirement, and thus the potential for precise environmental effects, cannot be confirmed until detailed intrusive investigations are undertaken. Once these are completed, a detailed plan for each borrow pit will be developed and agreed with key consultees, i.e. ABC, SEPA and NatureScot. Each plan would address establishment, extraction and restoration phases with the management protocols for the borrow pits included in the CMS, which is envisaged to be subject to an appropriate planning condition. Any quarrying activities will also follow the Approved Code of Practice, Health and Safety at Quarries Regulations 1999. Nonetheless, in the absence of detailed intrusive investigation works, the likely effects and proposed mitigation that would be anticipated to address effects have been considered based on a typical borrow pit excavation and are set out below. Further detailed assessment is also provided within the technical chapters of the EIA Report as deemed relevant.

- Traffic – it is expected that traffic moving stone will use on-site access tracks within the site, resulting in effects which are not significant. It is not anticipated that vehicles moving stone from borrow pits will require to access the public highway. However, in the unlikely event there is a requirement to access highways, this will be addressed through a Traffic Management Plan (TMP);
- Blasting – Effects from blasting will be controlled through use of relevant protocols, blast mats if required, and through appropriate communication and publicity about blasting occurrence. Blasts at each borrow pit can be expected to be at some distance from residential receptors (the closest receptor is over 1.5km from the nearest borrow pit). Blasting is therefore not anticipated to be of any substantive concern, nor likely to give rise to significant effects;
- Noise / vibration – Potential effects arise from blasting itself as well as the use of excavation and stone crushing equipment. Mitigation for this would include: use of appropriately silenced equipment (e.g. equipment fitted with silencers or mufflers); publicity over blasting; adherence to borrow pit operational hours (anticipated to be 10.00 to 16.00 on Monday to Friday and 10.00 to 12.00 on Saturdays which is expected to be covered by planning condition);and suitable distance from residential receptors (closest at >1.5km). These mitigation measures are anticipated to reduce

effects to within acceptable parameters, as per established guidance (BS 6472 & BS 5228), avoiding any significant effects;

- Dust – Residential receptors are at a considerable distance from potential borrow pit areas (closest at >1.5km) and thus no dust effects on them are expected. Some potential for dust to be deposited on adjacent vegetation exists, though with damping down of surfaces or use of mist sprays as appropriate, this should avoid any significant effects (and this would be assessed by the appointed ECoW);
- Visual intrusion – Construction effects will be discernible through the presence of construction machinery. Long term, an appropriate restoration plan for the borrow pit(s) will be developed in agreement with consultees (SEPA, NatureScot, ABC) which is expected to include some re-grading of the final profile and measures to encourage re-vegetation and potentially peat habitat restoration. Furthermore, the majority of borrow pits are located within forestry which is to be retained during operation. Sufficient screening would therefore continue throughout the construction period, post construction restoration and beyond, to avoid wider visibility or significant visual effects from surrounding receptors. Refer to **Chapter 8: Landscape and Visual** for further detail;
- Water – The potential for sediment laden water to be released will be controlled through appropriate design and treatment facilities at the borrow pit(s). Design will be specific to each location and where possible will encourage natural infiltration. A 50m buffer to watercourses has been applied where possible during the design process. There are no likely significant adverse effects anticipated. Refer to **Chapter 12: Geology, Hydrology and Hydrogeology** for further detail;
- Water - The potential for ingress of water to excavations will be controlled by gravity drainage to settlement lagoons and encouraging natural infiltration. Where dewatering is required, giving rise to additional potential effects of excavations on the surrounding groundwater levels, the re-use of filtrated water from the settlement ponds may be used to provide a compensatory water source for any groundwater-dependent features by discharging to a vegetated surface upgradient of their location. There are no likely significant adverse effects anticipated. Refer to **Chapter 12: Geology, Hydrology and Hydrogeology** for further detail; and
- Wastes – Any waste arisings will be handled as per other construction wastes.

Concrete Requirements.

4.5.70 Construction of foundations within the Proposed Development will require approximately 21,100m^3 of concrete. **Table 4.6** below provides a breakdown of the required concrete volumes for each construction element.

Table 4.6 Estimated Volume of Concrete

Infrastructure	Total Volume of Concrete (m^3)
Wind turbine foundations	~21,120
Control building foundation	~360
Transformer / Generator Plinth	~72
Battery Storage Plinths	~401

Infrastructure	Total Volume of Concrete (m^3)
Turbine kiosk foundations	~66
MET mast foundation	~15
Total Concrete Volume	~22,034

Concrete Batching Plants

4.5.71 A concrete batching plant will be required as there are no nearby ready-mix concrete suppliers[7]. The batching plant will require the import of sand and cement, as well as a supply of water in order to produce concrete (a water extraction license under CAR will be required, assuming up to 50m^3 per day).

4.5.72 The batching plant would contain conveyor belts, hoppers and a loading area where the concrete mixers will be filled up from above. Concrete mixers would travel between the batching plant and the wind turbine foundations and would thus stay within the confines of the Development Site during the construction phase. Areas of the batching plant will be enclosed within a bund and have an impervious base that would drain to a silt lagoon. The raw material storage area within the batching plant would comprise sand and processed rock bays and cement silos.

Post-Construction Development, Site Restoration and Commissioning

4.5.73 If required for major maintenance works during operations of the Proposed Development, the crane hard standings can be re-used in their entirety by removing the vegetation. Excavated material which does not have a viable use will be classified as waste material and would be managed and removed from the Development Site and disposed of in accordance with the relevant legislation (including the Environmental Protection Act 1990, Landfill (Scotland) Regulations 2003 (as amended) and the Waste Management Licensing (Scotland) Regulations 2011).

4.5.74 The temporary construction compound areas not repurposed for use as the battery storage compound and the associated facilities will be removed and fully re-instated with vegetation/peat displaced from elsewhere on the Development Site and landscaped to match the local topography.

4.5.75 There will be a period of commissioning and testing prior to the start of the full operational phase of the Proposed Development.

4.6 Operational Details

Land Management

4.6.1 It is anticipated that the long-term land management practices in relation to the forestry undertaken at the Development Site will continue unaffected by the Proposed Development, with normal practices within retained forestry continuing unimpeded after completion of construction.

[7] A worst case that all aggregates will need to be imported has been assessed for vehicle movements (Chapter 13 Traffic and Transport).

Meteorological Effects and Turbine Control

4.6.2 A Supervisory Control and Data Acquisition (SCADA) system will be implemented which would obtain information from each of the turbines on their performance and would allow them to be controlled remotely. This would allow the operations team to be immediately alerted to any faults with the equipment at the Proposed Development.

4.6.3 Although wind turbines are designed to stop generating at wind speeds over 25m/s, they are built to withstand very high wind speeds.

4.6.4 Turbines are fitted with a lightning protection system as part of their design. Snow does not generally pose problems other than for gaining access to the Development Site. Occasionally, very heavy snow and ice may affect anemometers or the aerodynamics of the turbine blades resulting in temporary automatic shutdown. After shutdown due to icing, the turbine can be restarted remotely further to a manual, visual or technical inspection to ensure that the turbine blades are free of ice, thereby eliminating the potential for *'ice-throw'*. The wind turbines will also be fitted with vibration sensors which would detect any imbalance which might be caused by icing, which would allow the turbines to be shut down automatically.

Turbine Maintenance

4.6.5 Turbines will be maintained at regular intervals, in accordance with manufacturer recommendations and industry best practice.

4.6.6 Access to all turbines and electrical infrastructure will be controlled to authorised individuals only.

Environmental Management during Operation

4.6.7 The Applicant's wind energy developments are operated in accordance with documented ISO 14001 environmental management procedures which ensure compliance with applicable environmental legislation and best practice.

4.6.8 Although activity at the Development Site will be limited during the operational period, the measures outlined in site and task specific risk assessments and method statements including control measures in relation to surface water runoff, dust, pollution control and waste will remain in place to cover any maintenance works which may be required.

4.6.9 The Proposed Development will be managed by a team of wind energy engineers whose duties will include compliance with statutory Health, Safety and Environment (HSE) requirements. Where potential environmental or health and safety hazards are identified, a site-specific risk assessment is completed, and control measures implemented to ensure that the risks are minimised as far as possible.

4.6.10 The operational phase of the Proposed Development would be managed under the requirement of the Applicant's internal Environmental Management Systems (EMS). This would include measures and considerations such as the following:

- The battery cells are a Lithium ion polymer rechargeable batteries. The cells contain chemicals that are hazardous to the environment as well as toxic and corrosive. Under normal conditions, the battery is hermetically sealed and does not pose a risk of exposure. Therefore, safe handling procedures will be followed;
- The battery fire extinguishing system will be activated in the event of a fire;
- The leakage of coolant from the battery cabinet is considered low risk due to the density of the fluid and cabinet design, as well as the potential presence of bunding;

- Sufficient emergency spill response kits to support adequate provision shall be situated at key locations across the operational site area; and
- In the unlikely event that an environmental pollution incident occurred, SEPA would be informed, and any spillage will be cleaned in a safe and timely manner.

Site Waste Management

4.6.11 Operational waste will generally be restricted to small volumes of waste associated with machinery repair and maintenance disposed of by the maintenance contractors in line with normal waste disposal practices.

4.7 End of Life

4.7.1 As the Proposed Development nears the end of its operational life, a decision will be taken as to whether or not a life extension, repowering or decommissioning will be required.

4.7.2 Repowering operations would involve the installation on the Development Site of new turbines, which would require a new application and further environmental assessment. Decommissioning would involve the removal of the wind turbines, kiosks, control building and substation, battery storage and re-instatement of the Development Site.

4.7.3 However, for the purpose of the assessment of the likely significant effects of the Proposed Development, the EIA Report assumes that the project will be decommissioned at the end of its operational life.

4.7.4 A description of the decommissioning activities considered within the EIA Report is provided in the sections below.

Wind Farm Decommissioning Requirements

4.7.5 As part of the decommissioning process, it is generally proposed that the above ground structures (wind turbines, kiosks, and control building/battery storage) will be removed (per any condition attached to the consent if granted) and the hardstanding areas re-instated where appropriate. It is assumed that access tracks will be left in situ for use by the landowner as the environmental impacts of removal are considered to be greater than leaving in situ.

4.7.6 Prior to infrastructure removal, due consideration will be given to any potential impacts arising from these operations. Some of the potential issues could include:

- Potential disturbance by the presence of cranes, HGVs and engineers on-site;
- On-site temporary construction compound(s) would need to be located appropriately;
- Time of year and timescale (to be outside sensitive periods); and
- Access tracks may remain in use for the benefit of the landowner and other stakeholders.

4.7.7 A comprehensive plan for the work will be drawn up in advance of decommissioning to ensure safety of the public and workforce and the use of the best available techniques at that time.

4.7.8 Decommissioning will be carried out in accordance with a decommissioning plan prepared by the wind farm operator and agreed with the relevant authorities at least six months in advance of decommissioning.

Decommissioning Process

4.7.9 For the purpose of the assessment presented in the EIA Report, it is assumed that the Proposed Development will be decommissioned at the end of its operational life, which will take approximately 12 months.

4.7.10 The wind turbines (towers, nacelle, hub, blades and electrical kiosk) will be completely removed using cranes and taken off-site for recycling. The only parts which are currently difficult to recycle are the composite blades. Most items will be broken down so that specialist vehicles are not required unless there is a potential follow-on use for the components in one piece.

4.7.11 During decommissioning, the bases will be broken out to below ground level and covered by soil/peat, which will be reinstated and re-vegetated (this is considered to be less environmentally damaging than removing them completely). All cables would be cut off below ground level, de-energised and left in the ground.

4.7.12 A Site Restoration Plan would be submitted for approval by ABC before construction begins. The key elements would include the reinstatement of the borrow pit working areas, construction compounds, laydown areas and cable trenches. Site tracks would be 'softened' with shoulders graded with excavated subsoil or peat and completed with the original topsoil or turfs where available. Any applicable new legislation or guidelines published prior to decommissioning would be considered and taken into account in relation to any design of mitigation prior to decommissioning taking place.

Control Building / Substation Compound, Battery Storage and Distribution System Decommissioning

4.7.13 The battery storage facility, control building / substation compound and associated equipment will be removed, and the components reused or recycled. As with turbine bases, the foundations themselves will be cut down to below ground level and left in situ covered in soil/peat which will be re-vegetated.

4.7.14 The buried distribution cables will be de-energised and will be cut off below ground level at the ends. An assessment will be carried out closer to the time to take into account any changes in best practice, and if it is considered to be viable, cables may be recovered for recycling where appropriate.

Access Track Decommissioning

4.7.15 The access tracks are unlikely to be removed. The current view is that the disturbance associated with the removal and disposal of the material would have a greater environmental impact than leaving them in place. Upon decommissioning the tracks would therefore likely be left in situ for future use by the landowner and other stakeholders.

4.8 References

- Construction (Design and Management) Regulations 2015
- Constructed Tracks in the Scottish Uplands 2nd Edition (SNH) 2015
- Control of Water Pollution from Linear Construction Projects (C648) (CIRIA), 2006
- Culvert Design and Operation Guide (C689) (CIRIA), 2010
- Electricity Act (C29) 1989

- Environmental Protection Act 1990, Landfill (Scotland) Regulations 2003
- Floating Roads on Peat, (FCE and SNH), 2010
- Good practice during Wind Farm construction Fourth Edition (SR, SNH, SEPA, FCS, HES, MSS, AEECoW), 2019
- Guidance Note 1 for the reduction of obtrusive light (Institute of Lighting Professionals), 2021
- Health and Safety at Work Act, 1974
- Legislation.gov.uk. 2015. Health and Safety at Work etc. Act 1974. [online] Available at: <http://www.legislation.gov.uk/ukpga/1974/37> [Accessed 21 October 2022].
- International Standards Organisation (2015) Environmental management systems (ISO standard 14001:2015)
- Management of Health and Safety at Work (Amendment) Regulations 2006
- Onshore Wind Health and Safety Guidelines (Renewable UK) 2015
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995
- River Crossings and Migratory Fish: Design Guidance (Scottish Executive), 2000
- Road Traffic Regulation Act 1984
- The Road Vehicles (Authorisation of Special Types) (General) Order 2003
- The Pollution Prevention and Control (Scotland) Regulations 2012
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017
- Waste Management Licensing (Scotland) Regulations 2011
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011
- WAT-PS-06-02: Culverting of Watercourses - Position Statement and Supporting Guidance (SEPA), 2015
- Water Environment Good Practice Guide - River Crossings Second Edition 2010