4 Scheme Description

Introduction

4.1 This chapter describes the components of North Lowther Energy Initiative (hereafter referred to as 'the Development' for which consent under Section 36 of the Electricity Act 1989 is being sought and which have been assessed through the EIA process. It includes details about the construction, operation and decommissioning of the Development, and outlines measures proposed for the protection of the environment during these stages.

4.2 This chapter is supported by the following appendices:

- **Appendix 4.1: Borrow Pit Report**
- **Appendix 4.2: Windfarm Forest Plan**
- **Appendix 4.3: Construction and Decommissioning Environment Management Plan (CDEMP)**
- **Appendix 4.4: Soil and Peat Management Plan**

Overview of the Development

4.3 As outlined in **Chapter 1: Introduction**, the main components of the operational Development will comprise:

- the installation of 35 wind turbines of up to 149m (to blade tip) with a total maximum rated capacity of approximately 147 megawatts (MW)1;
- crane hardstandings for each turbine;
- vehicle turning heads;
- one substation control building (incorporating transformers/electrical equipment);
- two site access points (A and B);
- onsite underground electrical cables;
- site signage;
- 36km of permanent access tracks comprising 3km of upgraded tracks, and 33km of new tracks including passing places and watercourse crossings;
- replanting of 32.50ha of forestry; and
- conservation management plan (including riparian planting).

4.4 In addition to the above components of the operational Development, construction of the Development will also require:

- 3km of existing forest track (which does not require upgrading) for transport of material won from borrow pits No.s 3-5;
- felling of 69.11ha[2] of forestry to accommodate turbines and associated infrastructure;
- the creation of up to five temporary onsite borrow pits for the extraction of stone;
- five temporary construction compounds/laydown areas;
- two potential concrete batching plants (to be located within excavated borrow pits).

4.5 The proposed layout of the Development is shown in **Figure 4.1.** Each component is described in further detail later in this chapter.

4.6 **Table 4.1** details the locations of the proposed turbines:

Table 4.1: Proposed Turbine Locations

Turbine ID	NGR Easting	NGR Northing
1	281396	613870
2	281646	613476
3	281996	613091
4	282184	612662
5	282691	612391
6	283236	612340
7	283779	612310
8	284117	612110
9	284688	612090
10	283666	611400
11	284144	611198
12	284614	611242
13	285168	611347
14	285677	611547
15	282321	614496
16	282540	614100
17	282953	613849
18	283091	613462
19	283523	613952
20	284011	614218
21	283783	614548
22	284165	615930
23	283687	616124
24	283328	616288

[1] Turbines with a capacity of up to 4.2 MW are currently under consideration for the Development, although the final turbine specification will be subject to a competitive tender process. It is important to note that turbine technology is continually evolving to meet the demands of the current and future electricity market and to optimise efficiency of machines. This is showing a trend towards machines with a higher MW capacity rating than are currently being deployed in the UK.

[2] A minimum of 36.61ha (difference between felling and replanting) compensatory planting will be delivered as part of the Compensatory Planting Plan. A 297ha area of native riparian woodland is proposed as part of the Development, part of which will be used to accommodate the 36.61ha of Compensatory Planting Obligation.

Turbine ID	NGR Easting	NGR Northing
25	283165	614745
26	282879	615062
27	282412	615280
28	282418	615845
29	281990	616035
30	282923	616539
31	282388	616588
32	284941	617007
33	284936	616447
34	285450	616260
35	285609	615861

Wind Turbines

4.7 Permission is being sought for the erection of 35 three bladed horizontal axis turbines with a maximum tip height of 149m. However, the installed turbine may have a lesser tip height depending on commercial considerations at the time of turbine procurement, but will be selected to fit within this maximum height parameter.

4.8 The dimensions of the indicative turbines are illustrated in **Figure 4.2**. The blades will be made from glass fibre/carbon spar with glass fibre airfoil shells; while the turbine towers will be of tapering tubular steel construction, likely to be finished in a light grey semi-matt colour.

4.9 Blades will rotate at approximately 6 to 16 revolutions per minute, generating power at all wind speeds between approximately 4 to 25 metres per second (m/s).

Turbine Foundations and Crane Hardstandings

4.10 The turbines will be installed on foundations comprising both stone and steel-reinforced concrete. These typically measure 28m diameter in plan with a concrete depth of between approximately 3m and 4m and overlay of depth approximately 0.35m dressed back with topsoil to allow re-vegetation (**Figure 4.3**). Each foundation will require approximately 558 cubic metres (m^3) of concrete. The detailed design, sizing and specification for each foundation will depend on the conclusive turbine type and the specific ground conditions encountered at each turbine location.

4.11 Adjacent to each turbine, an area of hardstanding approximately 62.5m x 25m will be constructed for use as crane pads. The exact geometry and position of the crane pads will depend on the turbine suppliers standard procedures and the specific crane selected for erection. These areas will be levelled using cut and fill operations and surfaced in crushed stone to provide a durable surface. These hardstandings are used during the erection process as a platform for the cranes to lift the turbine components into position. During operation, the hardstanding provides safe access for maintenance and repairs which may also require the use of a crane. An indicative hardstanding arrangement is shown in **Figure 4.4.**

Transformers and Cables

4.12 Depending on the manufacturer selected, should the transformer not be located within the nacelle or tower, each turbine will require the installation of an external transformer close to the base of the tower[3]. This will normally be placed within steel or glass reinforced plastic housing. The size of housing will depend on the type of transformer selected but in general it will be approximately 3m x 2.5m in plan and 2.5m in height above surrounding ground level.

4.13 The transformers will be either oil-filled with a bunded footing to remove any risk of spillage or a solid cast resin type which is effectively non-polluting. The transformers will increase the electrical voltage to 33 kilovolts (kV) and will be connected to the control building via underground high voltage (HV) cables.

4.14 Approximately 41km[4] of cable trenches will be required for the 33kV cabling that will connect the turbine transformers to the control building. To minimise ground disturbance cable trenches will be excavated along the side of the access tracks where possible. An exception to this will be where the 33kv cabling required to connect turbines 1-9 will follow the shortest most direct route to link this array with the adjacent array (turbines 15-20). Typical cable trench details are shown in **Figure 4.5.**

Grid Connection and Control Building

4.15 The Development will be connected to the national electricity network ('grid'). The grid connection will be subject to a separate consenting process undertaken by the local grid operator as it does not form part of this S36 application and associated EIA. At this stage the proposed point of connection to the existing grid network is at Elvanfoot substation.

4.16 Electrical power from the turbine transformers will be transferred to the electricity distribution system through a switchgear unit, housed within the onsite substation control building. The control building will be located in the northern part of the Development Area as shown in **Figure 4.1.**

4.17 An indicative plan elevation and plan of the onsite substation control building is shown in **Figures 4.6a-c**. The onsite substation compound will comprise the control building and a fenced hardstanding area for vehicle access and parking. The single storey control building will have a pitched roof and measure 24m x15m. The fenced compound will measure 100m x 60m. Subject to grid operator requirements, the building will house welfare facilities for visiting maintenance staff. Rainwater will be collected from the roof of the building via a gutter and inlet pipe to fill a header tank. Waste will be held in a closed system and removed by a licensed contractor at regular intervals. Any associated fencing will be either moorland green/brown or dark grey to blend with the existing landscape colours.

Temporary Construction Compounds/ Laydown Areas

4.18 Two main temporary compounds of 120m x 60m (compounds 1 and 2) and three smaller temporary satellite construction compounds of 40m x 50m (compounds 3, 4 and 5) will be located as shown in **Figure 4.1.**

4.19 Compounds 1 and 2 will be positioned close to the entrances of Access A and Access B (see below for details) and will consist of a hardstanding area which will accommodate temporary site offices, car parking and welfare facilities for site staff. These compounds will also be used to store turbine components, plant and materials for the duration of the works and so will also act as construction laydown areas. The compounds will contain provision for fuel storage, an electrical generator and a temporary septic tank. The fuel storage areas will be above ground with necessary secondary containment in accordance with the Scottish Environment Protection Agency (SEPA) standards (PPG7[i] and PPG8[ii]) and will be situated a minimum of 50m from watercourses to reduce the risk of pollution to watercourses.

4.20 Satellite compounds 3, 4 and 5 are also proposed to provide welfare and storage throughout the Development Area.

4.21 The compound sites will be restored to their current condition once construction is complete and turbines are operational.

4.22 An indicative construction compound is shown in **Figure 4.7**.

Borrow Pits and Concrete Requirements

4.23 Fill and stone requirements for the construction of the access tracks, hardstandings and turbine foundations etc will be met through the extraction of material won from five onsite borrow pits. At this

[3] The landscape and visual amenity assessment presented in Chapter 6 has assumed external transformers. These have also been modelled where appropriate in the accompanying visualisations.
[4] Based on total track length plus approx. 5%.

stage, prior to ground investigations, search areas for each of the borrow pits have been identified as shown in **Figure 4.1** and listed in **Table 4.2** below. It is estimated that approximately 306,000m^3 of stone aggregate will be required for construction of the Development. The initial potential borrow pit search area locations were identified following a desk based geological assessment and verified through fieldwork undertaken by the project civil engineering team.

4.24 The final selection of borrow pit search areas was influenced by the likely availability of stone, proximity to access tracks and by onsite environmental characteristics, including topography, soil/peat depth/stability, surface hydrology and potential visibility from surrounding areas, and which will allow successful restoration measures to be put in place as appropriate. The final location and size of the borrow pits within the search areas will be confirmed following detailed ground investigation, however indicative sizes are provided in **Table 4.2** and further details are presented in **Appendix 4.1**.

Table 4.2: Borrow Pit Details

BP No.	Search Area	Indicative Borrow Pit Sizes					
	Search Area Footprint (m^2)	Nominal Width (m)	Nominal Length (m)	Footprint Area (m^2)	Max Depth, Rear Wall (m)	Potential Volume Extracted (m^3)	Useful Aggregate Volume (m^3)
BP01	16,731	99	73	10,140	13	40,746	32,597
BP02	24,527	157	108	16,290	20	152,621	122,097
BP03	10,563	142	63	10,083	11	38,034	30,427
BP04	13,496	77.5	62	4,745	19	40,530	28,371
BP05	11,916	107	61	5,603	12	34,161	29,037

4.25 The useful aggregate volume indicated in **Table 4.2** is estimated based on various assumptions including loss due to superficial cover, excavation side slopes and potential loss of rock due to unsuitable material. However, intrusive ground investigation works will be required to evaluate these assumptions as well as to assess the suitability of the rock at each borrow pit for its engineering quality. On this basis, prior to the ground investigations, it is anticipated that the majority of stone required can be extracted from the five borrow pits which can provide 242,529m^3, with the balance of stone aggregate being imported.

4.26 The volume of concrete required for the construction of the turbine foundations is estimated to be 558m^3 per turbine (or a total of 19,530m^3 for 35 turbines), plus 1,043m^3 for the substation. For the purposes of the traffic assessment, it has been assumed that concrete will be imported to site from the nearest concrete plant, which is understood to be near Thankerton at the time of writing. However, the source of any imported concrete will be selected following a tender process prior to the commencement of construction.

4.27 Concrete batching on site may also be required, with two batching plants placed within excavated borrow pits close to site accesses A and B. Local water abstraction feasibility will be determined by flow values, with low flow conditions considered a determining factor and key constraint. The local watercourse at BP02 is likely to be feasible but recognised as less so in low flow conditions, but the watercourse adjacent to BP03 is not considered feasible due to the small catchment area. Within the Development Area there are opportunities to abstract water from the larger Wanlock Water and Crawick Water channels, where abstractions will continue to be feasible in low flow conditions. Abstractions will be subject to prior agreement with SEPA and assuming an abstraction rate of 10-50m^3/day, it is likely that a Registration will be required under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended). Opportunities to collect water from interception drainage channels located above the borrow pits, use of rainwater collection systems or applying water re-circulation systems to minimise watercourse abstraction shall also be considered at detailed design stage. Further details on concrete batching abstraction is provided in **Chapter 7 – Hydrology, Hydrogeology, Geology and Soils**.

Site Access from Public Road Network

4.28 The Development will be accessed via two points (Access A and B) off the B740 as shown in **Figure 4.1**, one of which is an existing access junction south of Spango Farm (Access A), the other being two new junctions in proximity to the existing access south of Nether Cog (Access B).

4.29 The existing bellmouth junction at Access A will be upgraded as per **Figure 4.8a** to allow Heavy Goods Vehicles (HGVs) and abnormal loads vehicles to enter the Development Area**.** The two existing bridges within the vicinity of Access A which cross Whitecleuch Burn and Crawick Water, will also be upgraded to be able to accommodate HGVs and abnormal load movements.

4.30 Access B involves the creation of a new junction to serve general construction vehicles and the creation of a separate access junction for abnormal loads which links onto a new section of access track. This access will also require a new bridge crossing over the Crawick Water as shown indicatively in **Figure 4.8b**. The design of the junction at Access B ensures that: access to the property at Nether Cog is maintained (via the existing access junction), the junction for HGV vehicles will comprise the main site entrance which is safer in terms of visibility splays[5], only one new bridge is required (and no upgrades to the existing bridge), and avoids significant earthworks on the opposite side of the road. Following construction, the abnormal loads entrance at Access B will be reinstated and closed off until such time as a replacement abnormal load is required.

4.31 Access A will run from the B740 into the Development Area via upgraded existing tracks. New tracks will be required from Access B into the Development Area.

4.32 Details of the proposed vehicle movements during construction and operation of the Development are provided in **Chapter 12: Access, Traffic and Transport** and more information on the construction requirements for both accesses is provided below.

4.33 **Chapter 12: Access, Traffic and Transport** details the proposed abnormal loads route to the Development Area from the M74. **Appendix 12.1: Abnormal Loads Assessment** provides an indication of the upgrades that may be required along the route to accommodate abnormal load vehicles. The majority of these will involve localised, temporary widening of the road within the existing verge, which will be reinstated following construction. Within Crawfordjohn, there is a bend on the B740 that is not currently suitable for abnormal loads movements. At this location, the preferred option is to construct a new access track through a field on the inside of the road. Any new track will likely be of graded stone material and be closed off from the public highway via a secure gated access.

4.34 The final details of any upgrades will not be known until details of the final turbine specifications are confirmed. However, **Appendix 12.1** provides an indication of the works that will be required at this location. Once further clarity is available on the exact requirements for all roads upgrades, separate planning applications will be submitted as required.

Onsite Access Tracks

4.35 The access track network within the Development Area will comprise new tracks, use of existing tracks and upgraded existing tracks to facilitate access to the turbines and other infrastructure locations. **Figure 4.9** differentiates the upgraded existing track requirements from the new track construction requirements.

4.36 In total, approximately 3km of existing track will be upgraded and 33km of new access track will be constructed. In addition, the 3km existing forest track will be used (without upgrading) to transport material from the three borrow pits in the west of the Development Area. Most of the new and upgraded track will be of 'cut and fill' construction, however, there are particular areas of the Development Area where peat depths were recorded of greater than 1.0m. This has resulted in three distinct sections of 'floating' track being planned, on Slough Hill (between T32 and T33), Duntercleuch Rig (near T25) and Highmill Knowe (near T20). These will be constructed by placing a geotextile base layer directly on top of peat, with an aggregate running surface and avoiding excavation of material. These sections of floating track have a total length of 0.94km and are shown on **Figure 4.1.**

Track Design

4.37 The design of the access track layout was based on the following objectives:

[5] Abnormal loads will be under police escort so visibility is less of a concern.

- to facilitate safe access to each turbine, avoiding steep slopes, ground with potential instability deeper areas of peat and maintaining a sufficient buffer from watercourses;
- to minimise watercourse crossings;
- to minimise requirements for passing places and turning areas;
- to minimise environmental effects, including effects on areas of archaeological interest;
- to minimise crossings of the SUW;
- to keep overall new track length to a minimum, thus reducing stone requirements and associated potential environmental effects;
- to follow the existing ground topography as much as possible (e.g. ridges), minimising the necessity for slope cuttings and embankments and associated visual effects;
- to use floating tracks where peat depths are consistently deeper than 1.0m;
- to build health and safety aspects into track design from as early a stage as possible, including avoiding slopes which are too steep for access and creating clear definitions between turbine working areas and access tracks.

4.38 The requirement for passing place construction has been minimised through consideration of the layout of junctions and/or turbine hardstandings which can generally be used by traffic as an alternative to dedicated passing places. The passing places are not shown on any of the figures accompanying this ES as their locations will be established during construction. As this stage, however, it is anticipated that dimensions will be approximately 70m x 5m, the location of which has been rationalised across the Development Area to reflect the current infrastructure layout. The infrastructure design has allowed for 16 passing places.

4.39 The tracks will generally comprise a running surface width of 5m to facilitate HGV and abnormal load vehicles with additional localised bend widening to accommodate the swept path of vehicles carrying long and wide loads. This is shown in **Figure 4.9**. Adjacent to this track will be verges approximately 3.5m in total width as well as 1.0m wide trench for cabling and appropriate drainage.

4.40 A number of spurs (typically 200m – 300m in length) leading off the access tracks are proposed to allow a loaded turbine delivery vehicle to turn around following delivery of turbine components. These are shown in **Figure 4.1.**

Watercourse Crossings

4.41 To access the turbines and associated infrastructure, 12 watercourse crossings are required, comprising eight existing crossings potentially requiring upgrade and four new crossings. Typical new crossing structures will comprise pipe culverts for drainage ditches and open base arches for mid-size streams (generally 1m width or more) Three bridge crossings will be necessary comprising two upgrades at Access A and one new bridge at Access B. Indicative watercourse crossing methods are provided in **Figures 4.10a-4.10c** and more details of the proposed watercourse crossings are provided in **Appendix 7.7**: **Watercourse Crossings** and shown on **Figure 7.7**.

4.42 Monitoring of water quality will be undertaken during construction of the Development and a water quality monitoring plan will be devised in consultation with SEPA. Further information in relation to watercourse crossings and water quality monitoring is provided in **Chapter 7.**

Forestry

4.43 There are 474.42ha of predominantly Sitka spruce dominated commercial woodlands within the Development Area, currently managed under a Forestry Commission approved Forest Plan, which has been used as a baseline against which to assess the changes and associated effects arising from the Development. The current forestry composition is shown in **Figure 4.11.**

Baseline Forestry

4.44 The forest is approaching the end of the restructuring of the first rotation of commercial conifers, with **Table 4.3** below summarising the change in species composition over the Baseline Forest Plan period:

Table 4.3: Species Composition Change over Baseline Forest Plan

Species	Current Area (ha)	Percentage	End of Baseline Plan Period (2031)	Percentage
Sitka spruce	334.90	71%	331.86	70%
Mixed Conifers	24.95	5%	16.28	3%
Native Broadleaves	48.61	10%	58.83	12%
Open Ground	65.96	14%	67.44	14%
TOTAL	**474.42**	**100%**	**474.42**	**100%**

4.45 The table shows that relatively little change is forecast as much of the restructuring has already occurred to ensure the forest meets best practice guidelines set out in the UK Forest Standard. The greatest change relates to a decrease in the area planted with Sitka spruce and mixed conifers, in favour of larger areas of native woodlands.

Development Forestry Proposals

4.46 The proposals for felling and replanting to accommodate the Development were designed in consultation with FCS and Buccleuch Estates, including combined visits to the Development Area. The Windfarm Forest Plan (see **Appendix 4.2**) has followed the felling and replanting proposals within the Baseline Forest Plan as closely as possible, to minimise the effect on woodland. The diverse age classes and wind-firm boundaries established through the restructuring process allowed for minimal disturbance, without the need for extensive additional felling to accommodate key-hole felling for turbines. The felling and replanting proposals to accommodate the Development are shown on **Figure 4.12 and Figure 4.13**. **Table 4.4** below summarises the changes in species composition over the Windfarm Forest Plan Period:

Table 4.4: Species Composition Change over Windfarm Forest Plan

Species	Current Area (ha)	Percentage	End of Windfarm Plan Period (2031)(2031)	Percentage
Sitka Spruce	334.90	71%	295.18	62%
Mixed Conifers	24.95	5%	16.28	3%
Native Broadleaves	48.61	10%	59.48	13%
Open Ground	65.96	14%	103.48	22%
TOTAL	**474.42**	**100%**	**474.42**	**100%**

4.47 The main changes to the woodland structure arises from additional open ground, loss of Sitka spruce and an increase in native woodland to accommodate the Development. This change is predominantly focused on the upper treeline of the forest areas, where tree free bat protection buffers around turbines have been incorporated into re-designed upper margins.

4.48 Importantly, this has been achieved with minimal change to the Baseline felling programme, with only 35.10ha of additional felling required in Phase 2 over and above the existing consented felling programme to accommodate the Development (planned for construction in 2020). Of the additional felling, the majority is represented by a single coupe, detailed for felling in the Baseline Forest Plan in 2023 (Phase 3), i.e. the additional felling is largely represented by bringing forward a planned felling coupe by three years.

Summary of Forestry Proposals

4.49 By working closely with the existing forest structure and Baseline Forest Plan, the Development has been designed to minimise effects on the existing forest. The following is a summary of the areas of felling and replanting required to construct and operate the Development and for which consent is being sought:

- Felling approval for 69.11ha of commercial forest to accommodate construction of the Development and associated infrastructure (Figure 4.12);
- Felling approval to be conditioned on replanting 32.50ha of woodland (Figure 4.12);

- Delivery of compensatory planting extending to a minimum of 36.61ha (balance between felling and replanting) (Figure 4.13); and
- Subject to consenting of the Development, approval will be sought for a new Forest Plan through the standard FCS process to implement the Windfarm Forest Plan including amended phasing and replanting.

4.50 In addition, three indicative woodland search areas as shown on **Figure 4.13** are proposed, within which up to 297ha of native riparian planting is proposed as part of the Development. Part of this area will include the 36.61ha Compensatory Planting Obligation (also shown as woodland removal in **Figure 4.12** and **Figure 4.13**), however the remaining area will represent new woodland cover, resulting in a significant net expansion in woodland as a result of the Development.

4.51 Further details on forestry are provided in **Appendix 4.2.**

Micro-Siting

4.52 Prior to construction, micro-siting may take place to allow adjustment within a defined radius of the proposed turbine locations, and a similar tolerance either side of indicative access track locations. This will ensure that the final position of the turbines and associated infrastructure are not varied to such a degree as to cause a notable change in the predicted environmental effects outlined in the ES but allows flexibility should unfavourable or unforeseen ground conditions be encountered.

4.53 It is anticipated that an agreed micro-siting distance will form a condition accompanying S36 Consent for the Development. Beyond this distance, any relocation of development components will require either written approval from The Scottish Ministers or will be treated as a formal variation to the application. In line with recent windfarm planning decisions, it is proposed that up to a 100m micro-siting distance from the centre point of all infrastructure is applied to this Development, with the following requirements:

- 0-30m sign off required by ECoW;
- 30-50m prior notification of Dumfries and Galloway Council;
- 50-100 m updated assessment of new locations provided to Dumfries and Galloway Council for approval through condition discharge process.

Construction Details

4.54 The construction period for the Development will last up to 24 months and will consist of the following principal activities:

- Site establishment: construction of upgraded/new access junctions, upgrading of bridge at Access A, new bridge at Access B and new and, primary construction compounds (x2),offices and car parking;
- forest felling;
- upgrading/creation of site access tracks, including passing places and drainage;
- construction of control building;
- construction of turbine foundations and external transformer bases (if required) at each turbine location;
- construction of crane hardstandings at each turbine base location;
- delivery and erection of wind turbines;
- excavation of trenches and laying of electrical and control cables adjacent to the access tracks connecting the turbines to the control building;
- testing and commissioning of site equipment including wind turbines;
- site restoration (including forestry replanting) and implementation of habitat management measures.

Construction of New Site Accesses

4.55 The construction of Access A involves the upgrading of an existing access junction from the B740 to create an access that can be used by general construction vehicles and abnormal loads. A new bellmouth will be created to full road construction standards and the access track will have a tarmac surface for the first 16m. An over-run area will be created adjacent to the junction in order to accommodate the turning manoeuvres associated with the abnormal loads. This area will be constructed by digging out the existing soft top soil level down to a suitable formation layer and then building up the surface in suitable crushed rock fill material to the match the level of the adjacent bellmouth. When not in use, the overrun area will be fenced off and a gate will be placed on the access track to prevent unauthorised access to the Development Area. The preliminary design for Access A is provided in **Figure 4.8a**.

4.56 The preliminary design for Access B is provided in **Figure 4.8b**. The new access for general construction vehicles will be constructed to full road design standards and the access track will have a tarmac surface for the first 42m to connect the track to the new bridge structure. The bridge is yet to be designed in detail, but it is likely to be a concrete structure which will be constructed on an angle over the river to avoid the requirement to cut into the hillside on the southern side of the watercourse. The land to the south of the abnormal load track (between the river and the B740) will be used as a construction compound for the construction of the bridge.

4.57 The abnormal loads access at Access B will be formed some 100m to the south of the access for general construction vehicles and the access will only be used for abnormal load vehicles. The access will be formed by excavating down to a suitable formation level within the field that lies between the B740 and the river. A large over-run area and access track will then be provided which links back up to the new bridge structure and the access track that connects with the general construction access point and track. The over-run area and section of track for abnormal loads will be constructed in crushed rock fill material. As mentioned above, the abnormal load access will be reinstated and closed off following construction. The general construction access point at Access B will remain open for accessing the Development Area during operation.

Forest Management

4.58 As can be seen from the Construction Programme (**Table 4.5**), forestry felling will be undertaken over 10 consecutive months from the beginning of construction. Operations associated with the Development will be undertaken in close liaison with the forest owner's Manager. This work will include the harvesting and extraction of timber, replanting ground identified for planting post harvesting, delivery of woodland creation and compensatory planting detailed in this ES, plus monitoring, reporting and management recommendations set out in the Compensatory Planting Plan. All forestry operations will continue to be managed to the national UKFS standards as well as the UKWAS certification requirements, ensuring both statutory and best practice procedures are complied with at all times.

Construction of Temporary Construction Compounds

4.59 The compounds will be formed by stripping organic and soft surface material and laying geotextile and crushed rock to create a firm regular surface. Perimeter drainage will intercept rainfall and then channel water to temporary filtration and dispersion structures, utilising where possible the natural contours of the landscape. The stripped surface material will be stockpiled nearby for reinstatement.

Working of Borrow Pits

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

Construction of Tracks

4.61 It is not anticipated that any track upgrading will be required to access borrow pits BP03, BP04 and BP05 (shown in **Figure 4.1**) as these are located within forestry which is currently accessed via an existing track.

4.62 Where existing tracks require upgrading this will be undertaken by localised widening, shown in **Figure 4.9**. It is expected that the material for upgrading the existing tracks will be supplied from material won from onsite borrow pits.

4.63 As there is limited peat onsite, a cut track design is proposed and will be constructed by excavating through to a suitable formation. During construction, vegetation, topsoil and subsoil will be placed to the

sides of the tracks. A layer of stone will be compacted on top of the base formation to a thickness of around 150-250millimetres (mm) dependent upon ground conditions. The total track depth will depend on the strength of the base formation and upon the gradient of the slope being traversed but will typically be 450mm to 800mm thick which will be supplied from material won from onsite borrow pits. Drainage ditches will be constructed as described in paragraph 4.39. Surplus soil will be placed and dressed alongside the track to blend in with the surrounding landscape and finally topsoil will be placed on the track shoulders and seeded to promote vegetation.

4.64 The tracks will have adequate crown or cross-slope to allow rainwater to be shed and, where gradients are present, lateral drainage will intercept flow. A drainage ditch will be formed on the upslope side of the track, dependent on a detailed drainage design. Cross pipes will be laid as required in areas where the position of the access track could lead to ponding on one side. As far as possible these will coincide with naturally occurring drainage channels. Experience at other sites has shown that cross pipes simply placed at regular intervals are often ineffective and unnecessary. When the track slopes downhill, 'waterbars' will be placed to divert the flow into naturally occurring channels. The advice of the Ecological Clerk of Works (ECoW) will be sought to ensure that the location and outfall of cross pipes and waterbars minimises vegetation damage or change.

4.65 Final track drainage design will be determined prior to the commencement of construction of the relevant track section. The design of track and ancillary drainage will comply with Sustainable Drainage Systems (SuDS) standards and be agreed with SEPA.

Construction of Turbine Foundations and Hardstandings

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

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

4.68 The area around the turbine will be back filled with selected excavated material. Should an external transformer be required at the base of each turbine, the fill beneath the transformer slab will be of such a nature as to provide sufficient structural support.

Construction of Substation and Control Building

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

4.70 The ground floor of the building will be a ground bearing slab and will incorporate ducts and trenches. There will be cable pits under the high voltage and low voltage rooms.

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

Installation of Cabling

4.72 The cabling connecting each turbine to the control building will be laid in a trefoil arrangement. Detailed construction and trenching specifications will depend on ground conditions encountered. Typically cables will be laid in a trench 1m deep and 1m wide. To minimise ground disturbance cables will be routed along the side of the access tracks where practicable. As mentioned above, an exception to this will be where the 33kv cabling required to connect turbines 1-9 will be laid in trenches along the shortest most direct route between this array and the adjacent array (turbines 15-20).

4.73 Cables will be laid within a sand or granular bedding to prevent damage to the cables from sharp stones. Trenches will be backfilled with excavated material and the surface redressed.

Erection of Turbines

4.74 The erection process for each turbine will take approximately 2 to 3 days, although this will depend on weather conditions, as generally, turbines are erected in wind speeds not exceeding 8 to 10 m/s for health and safety reasons.

Construction Lighting

4.75 Depending on the time of year and the stage of the construction programme, temporary lighting may be required at the temporary compounds and substation during working hours. It is not proposed that the lighting will be on outside of working hours.

Construction Programme

4.76 Construction is estimated to take 24 months. An indicative programme for the construction activities is shown in **Table 4.5** below.

Table 4.5: Indicative Construction Programme

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Site Est.																								
Forest Felling																								
Working of Borrow Pits																								
Access Junctions and Access Track Construction																								
Turbine Foundations and Hardstands																								
Substation Control Building																								
Onsite Cabling																								
Turbine Erection and Commission																								
Site Restoration																								

4.77 Many of these operations will be carried out concurrently, although predominantly in the order identified, reducing the overall length of the construction programme. Site restoration will be programmed and carried out to allow the restoration of disturbed areas as early as possible and in a progressive manner.

4.78 Depending on the month of commencement of construction, pre-construction surveys and construction timing constraints may be required to reduce potential effects on breeding birds. Appropriate exclusion zones will be marked out around sensitive archaeological and ecological sites where necessary. An ECoW will be onsite during construction in certain areas/months as agreed with Dumfries and Galloway Council.

4.79 Further specific measures proposed to avoid or minimise effects during construction are discussed on a topic-by-topic basis in **Chapters 6 to 14**.

Working Hours

4.80 In general, working hours for construction will be from 07.00 to 19.00 Monday to Friday and 07.00 to 13.00 on Saturday. No working is proposed on Sundays and public holidays.

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

Site Restoration

General Approach

4.82 Following construction, the Development Area will be reinstated by the contractor. The anticipated type and extent of reinstatement is outlined below.

4.83 Where a re-turfing method is appropriate, such as along track verges, the surface layer of soil and vegetation will be stripped and stored separately from the lower soil layers, and replaced as intact as possible once construction is complete.

4.84 Local restoration will be carried out to retain the structure and composition of the original plant communities, as well as forming a stable area over reformed ground, thus reducing erosion by rain, run-off and wind.

4.85 Bare soil areas will be allowed to re-vegetate naturally in combination with reseeding using a low density (~20kg per hectare) seed mix which mirrors local vegetation to help bind the soil more quickly.

Site Tracks

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

4.87 Generally the sloping verges of access tracks will be dressed with site sourced turf or seed bank material. If suitable material is generated during the construction of the track, this material can be used to form a low lying bund along the downhill side of the track, to be dressed as per the track verges. This will assist in reducing the visibility of the track.

Turbine Bases and Crane Hardstandings

4.88 Turbine foundations will be capped with a minimum of 150mm of soil material, which may form a raised mound between 300mm and 500mm above the existing ground level. These will be re-turfed with the removed material, but where vegetation is sparse or unlikely to regenerate, reseeding with an appropriate local seed mix may be undertaken as outlined above.

4.89 The condition of turfs will be monitored regularly during the first two months following reinstatement. If necessary, water will be imported to the Development Area to ensure the re-establishment of this vegetation.

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

Temporary Construction Compounds

4.91 The temporary construction compounds will be reinstated into the surrounding landscape, and restored to their original condition.

Environmental Management

4.92 Prior to the construction of the Development, NLEI Ltd will develop a detailed Construction and Decommissioning Environmental Management Plan (CDEMP) with the appointed Principal Contractor. The CDEMP will establish the project management structure and clearly identify the roles and responsibilities in the management and reporting on the construction phase environmental aspects. The CDEMP will be used to ensure that all relevant planning conditions and mitigation identified within the ES to protect the environment are implemented through agreed procedures and working methods. Adherence to the CDEMP, as well as referenced legislation and guidance documents, will be a contractual requirement for the appointed Principal Contractor and their sub-contractors.

4.93 The purpose of the CDEMP will be to:

- provide a mechanism for ensuring that construction methods avoid, minimise and control potentially adverse significant environmental effects, as identified in the ES;
- ensure that good construction practices are adopted and maintained throughout the construction of the Development;
- provide a framework for mitigating unexpected effects during construction;
- provide assurance to third parties that agreed environmental performance criteria are met;
- establish procedures for ensuring compliance with environmental legislation and statutory consents;
- detail the process for monitoring and auditing environmental performance.

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

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

- a Pollution Prevention Plan (following the principles set out in the draft PPP);
- Construction Method Statements (CMS);
- a Soil and Peat Management Plan (SPMP);
- a Site Waste Management Plan (SWMP);
- a Traffic Management Plan (TMP).

4.96 The CDEMP will also contain the following information:

- the name, qualifications and CV of the nominated person(s) with the responsibility for all environmental matters, for approval;
- a completed register of contacts confirming the contact details for all key personnel for managing environmental issues, including DLWL representatives, the ECoW, Principal Contractor contacts, Scottish Water contacts and appropriate regulator contacts;
- Construction Programme and detailed working method statements;
- a site specific actions plan, providing a register of environmental risks and outlining the requirement for accompanying site specific mitigation, monitoring and reporting procedures;
- audit and inspection procedures.

4.97 The CDEMP and associated plans will be submitted to Dumfries and Galloway Council, and others as appropriate, prior to the commencement of works. A copy of the CDEMP will be kept in the construction site office for the duration of the works and will be available for review at all times.

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

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

4.100 Performance against these documents will be monitored by NLEI Ltd's Construction Project Manager and the ECoW throughout the construction period. They will ensure that the works carried out are in accordance with the relevant best practice guidance documents. A template CDEMP is provided as **Appendix 4.3**. This contains the sections that would be expected to be included within the final CDEMP, which will be agreed subject to an appropriately worded planning condition.

4.101 Regular meetings will be held throughout the construction period to discuss environmental management, providing updates on the performance of the environmental mitigation measures and identifying any actions for performance improvement. The meetings will be attended by the ECoW, the NLEI Ltd Construction Project Manager, the Principal Contractor, Site Manager and any other relevant personnel or regulatory agency representative as required.

Peat Management

4.102 Whilst the Development has been designed to minimise disturbance to peatland, it has not been possible to avoid areas of peatland entirely. Consequently, a Soil and Peat Management Plan (SPMP) is presented at **Appendix 4.4** and includes the following information:

- estimation of the volume of soil and peat likely to be excavated during construction;
- identification of opportunities to minimise excavation volumes;
- options for onsite reuse of excavated material; and
- good practice methods to be employed in relation to handling and storage of excavated soil and peat.

4.103 Adherence to the SPMP will ensure that excavated soil and peat is appropriately managed and re-used onsite. It is anticipated that all excavated peat can be reused for reinstatement of ground, at both the point of excavation as well as in the landscaping of track shoulders and hardstandings. Prior to construction and on completion of ground investigations and micro-siting, the SPMP will be refined and agreed with SEPA and SNH.

4.104 Prior to construction and on completion of ground investigations and micro-siting, a site waste management plan shall be produced, including for site soil and peat management good practice. It will ensure that excavated peat is appropriately managed and re-used within the Development Area.

4.105 In accordance with Scottish Government Guidance[iii], the Development has been designed to avoid peat landslide hazard. A Peat Stability Assessment has been carried out and a copy of the report is included at **Appendix 7.2: Peat Stability Assessment** with further consideration in **Chapter 7**.

Waste Management

4.106 Materials will be generated, and will require management, during construction, in particular the topsoil removed and stockpiled prior to construction area activities, and construction waste such as packaging and used formwork.

4.107 The principal contractor will be required to prepare a Site Waste Management Plan to ensure best practice principles are applied to reduce, re-use or recycle all materials.

4.108 Measures to reduce potential environmental effects associated with the storage and transportation of waste will include:

- the careful location of stockpiles and other storage areas;
- the use of good practice in the design of storage areas and the use of suitable containers;
- the use of sheeting, screening, and damping where appropriate and practicable;
- the control and treatment of runoff from soil and soil stockpiles;
- minimising storage periods; and
- minimising haulage distances.

4.109 All materials will be identified, classified, quantified and, where practicable, appropriately segregated. Any materials that cannot be reused will be disposed of according to relevant waste management legislation which will serve to address a number of possible environmental effects. This includes:

- the Duty of Care imposed by Section 34 of the Environmental Protection Act 1990; and
- the Waste Management Licensing Regulations 1994 (as amended), particularly provisions relating to registered exemptions from waste management licensing.

4.110 All materials removed from site will be handled in accordance with relevant waste and environmental regulations. Waste will be transferred using a registered waste carrier to a licensed waste disposal site or recycling centre.

Good Practice Construction Measures

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

4.112 All good practice measures are clearly stated below and any further specific mitigation measures are identified in the assessment of likely construction and operational effects.

4.113 Good practice measures to minimise the effects of the Development on geology, hydrology, hydrogeology and soil have been provided below. A list of good practice documents are provided in the assessment methodology section of **Chapter 7**, and many of the items proposed are taken from these publications.

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

- Pollution incidents;
- Mobilisation of Heavy Metals;
- Erosion and Sedimentation;
- Modification of Surface Water Drainage Patterns;
- Modification of Groundwater Levels and Flows;
- Loss of Soils and Compaction of Soils;
- Peat Stability.

4.115 The good practice measures will be incorporated into the CDEMP, and further details are presented in **Appendix 4.3.**

Health and Safety

4.116 The Construction (Design and Management) Regulations 2015 have formed an integral part of the conceptual design and the resulting layout presented within the ES. Any 'significant' (as defined by the regulations) health and safety risks have been taken account of and their consideration reflected in the design. Surveys and investigations have been undertaken throughout the pre-consent phase to, as far as reasonably practicable, identify, manage and if possible avoid any potential risks during construction.

4.117 All construction activities will be managed within the requirements of the Regulations and will not conflict with the Health and Safety at Work etc. Act 1974. To further reduce possible health and safety risks, a

Health and Safety Plan for the project will also be drawn up. All staff and contractors working on the construction will be required to comply with the safety procedures and work instructions outlined in the Plan at all times.

4.118 To ensure that hazards are appropriately managed, risk assessments will be undertaken for all major construction activities, with measures put in place to manage any hazards identified.

Outline Conservation Management Plan

4.119 An Outline Conservation Management Plan (OCMP) has been prepared based on the findings of **Chapter 8: Ecology** and **Chapter 9: Ornithology**. This is provided as **Appendix 8.6: Outline Conservation Management Plan (OCMP)**.

4.120 The ecological surveys identified that much of the Development Area is in sub-optimal condition and a large proportion of the area surveyed shows evidence of extensive anthropogenic influences. As such, there is scope for widespread habitat enhancement which can be tailored to benefit birds, particularly raptors and waders.

4.121 The key habitats are Annex I habitats, including wet modified bog, blanket bog, wet heath and dry heath. The key ornithological species considered are ground-nesting raptors (hen harrier, merlin, short-eared owl) and black grouse, with benefits also likely to be seen for waders (curlew and lapwing) and other raptors.

4.122 The main enhancement measures included within the OCMP include:

- A Funded Regional Hen Harrier Project Officer: A Project Officer will be funded for the lifetime of the Development to help implement a South Scotland Regional Hen Harrier Conservation Management Plan (RHHCMP). The primary aims of this RHHCMP are to review the current status of the hen harrier population breeding in the region, to provide context to the constraints operating in this landscape and, where possible, to undertake practical conservation management actions to enhance the hen harrier population by increasing its size and productivity.
- Enhancement of Annex 1 Bog, Wet Heath and Dry Heath Habitats: The area proposed for conservation management within the CMP will be considerably more than the direct habitat loss that is predicted to occur to key habitats listed above.
- New Native Woodland Planting: The OCMP also proposes to plant large areas of native broadleaved woodland and scrub to help enhance the habitat for black grouse, harriers and merlin and to have wider biodiversity benefits.

4.123 A final CMP, which will include confirmed Management Units where the aims will apply, will be agreed with Dumfries & Galloway Council in consultation with Scottish Natural Heritage (SNH) prior to the commencement of construction of the Development.

4.124 The aim of the CMP is to bring an area under positive management measures that are equivalent to 20 times the habitat loss area (excluding commercial forestry) to ensure that an overall net benefit will be delivered for these habitats over the lifetime of the Development.

Operational Details

4.125 The Development has been designed to have an operational lifespan of up to 25 years.

4.126 The Development Area will not be manned and it is envisaged that the amount of traffic associated with the Development will be minimal. Traffic generated will comprise routine service and maintenance team visits, together with the occasional need for more extensive maintenance or repair. Wind turbine operations will be overseen by suitably qualified contractors.

4.127 Once operational, staff will be employed to operate the Development and undertake routine maintenance work during its lifetime.

4.128 Routine maintenance and servicing will take place two to four times per year. Servicing will include the performance of tasks such as maintaining bolts to the required torque, adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. Other visits to the Development Area will take place more frequently to ensure that the turbines are operating at their maximum efficiency. In the event of any unexpected events onsite appropriate repair works will be carried out.

4.129 The vehicle used for the majority of these visits is likely to be a small four wheel drive vehicle, although there may be an occasional need for an HGV or crane to access the Development Area for heavier maintenance and repairs.

4.130 On-going track maintenance will generally be undertaken in the summer months when tracks are dry. Safe access will be maintained all year round.

Decommissioning

4.131 The operational lifespan of the Development and associated infrastructure will be 25 years. Following this, an application may be submitted to retain or replace the turbines, or they could be decommissioned.

4.132 Decommissioning will involve the following:

- dismantling and removal of wind turbines and electrical equipment;
- restoration of the turbine areas and hardstandings;
- demolition and removal of control building and compound.

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

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

4.135 The high voltage and SCADA cables will be left in place to avoid unnecessary ground disturbance.

4.136 A Decommissioning Environmental Management Plan will be produced to ensure best practice is adopted during decommissioning of the Development. This may include measures such as draining and removing hazardous liquids prior to the dismantling of the Development components.

4.137 Overall, it is estimated that the decommissioning period for the Development will be approximately 18 months.

4.138 An assessment of the decommissioning of the Development has not been undertaken as part of the EIA as: i) the future baseline conditions (environmental and other developments) cannot be predicted accurately at this stage and ii) the proposals for refurbishment / decommissioning are not known at this stage. However, an outline decommissioning strategy is included at **Appendix 4.3**.

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[i] SEPA, 2011, 'PPG7: Safe Storage – The Safe Operation of Refuelling Facilities

[ii] SEPA, 2004, 'PPG8: Safe Storage and Disposal of Used Oils

[iii] The Scottish Government (2006), Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments.