4. Description of the Revised Consented Development

4.1. Introduction

4.1.1. This chapter provides a description of the Revised Consented Development, which is located 2 km to the south of the village of Reay in Caithness, has a site area of 1,139 ha and is centred on approximate National Grid Reference (NGR) NC 98270 60620. For EIA purposes, this Chapter also details the changes to the infrastructure associated with the Revised Consented Development, from the infrastructure for the consented Limekiln Wind Farm.

4.2. Consented Development construction works to date

4.2.1. Following the granting of consent for the Consented Development in June 2019, the Applicant has carried out the following work:

- Satisfied all pre-commencement planning conditions in relation to Enabling Works.
- Enabling works completed to date include: forming of a temporary construction compound at site entrance; creation of consented access track from site entrance off A836 to Borrow Pit Search Area B: and the creation of the substation platform.

4.3. The Revised Consented Development

4.3.1. The Revised Consented Development would comprise up to 21 turbines, associated infrastructure and ancillary development, as shown in **Figure 4.1** and as described in detail throughout this chapter.

4.3.2. The primary purpose of this Section 36C variation application is to mitigate conflicts between access track locations and the existing core path. To enable the core path to remain open to the public throughout the construction period the Revised Consented Development has realigned the access tracks throughout the development.

4.3.3. The Consented Development included up to 21 wind turbines with six turbines at a maximum tip height of 126 m and 15 turbines at a maximum tip height of 139 m. The Applicant is proposing to increase the maximum tip height of all the turbines to 149.9 m.

4.3.4. In addition to relocating the majority of the on-site access tracks, the Applicant proposes to:

- Increase the maximum tip height of all turbines to 149.9 m;
- Remove one borrow pit (Borrow Pit A);
- Increase the lifetime period of the wind farm from 30 to 40 years;
- Relocate the construction compound and increase its size from 100 m x 100 m to 150 x 100m.
- Relocate five watercrossings and insert two more;

- Increase the size of the crane hardstandings from 40 m x 22 m to 40 m x 35 m; and
- Removal of permanent anemometer mast.

Overall comparison between Consented Development and the Revised Consented Development

4.3.5. Table 4.1 below provides a summary of the changes between the Consented Development and the Revised Consented Development.

4.3.6. **Figure 1.3** shows the differences between the Consented Development and the Revised Consented Development.

Table 4.1 Summary of Key Changes between the Consented Development and the Revised Consented Development

	Consented Development	Revised Consented Development	Summary of Key Change
Maximum No. of Turbines	21	21	No change
Maximum Turbine tip height	126 m and 139 m	149.9 m	Up to 23.9 m increase
Turbine Foundation	400 m^3	645 m^3	Increase of up to 245 m^3
Crane Hardstandings	40 m x 22 m (880m^2)	40 m x 35 m (1,400 m^2)	Increase of size by 520 m^2
On-site access track length	15.3 km*	12.15 km*	Relocation of some access tracks. 3.15 km of track removed. Additional 750 m length of 4x4/HGV track inserted between T55 and T60.
Temporary Construction Compound	Located to the north east of the site. 100 m x 100 m (10,000 m^2)	Located to the north west of T22, 100 m x 150 m (15,000 m^2)	Relocated approx. 1 km to the south. Width increased by 50 m
Watercourse crossings	5	7	Increase by two. Five crossings are in new locations.
Borrow Pits	2	1	Reduced by one
Permanent Anemometer mast	1	0	No requirement
Construction rock volume Requirements	118,000 m^3	170,100 m^3	Increase of 51,100 m^3. This includes rock already used for the Consented Development enabling works.
Operational Land take	13.24 ha	13.33 ha	Increase of 0.09 ha

Operational lifetime	30 years	40 years	Increase of 10 years

* Access track lengths do not include the sections already consented and constructed. A 3.1km section of access track has already been constructed.

4.3.7. The proposed turbine locations remain identical to the Consented Development. Table 4.2 specifies the expected NGR for each of the proposed turbines.

Table 4.2 Expected turbine grid references and maximum tip heights

Turbine no.	Grid ref.	Consented Development Maximum turbine tip height (m)	Revised Consented Development Maximum turbine tip height (m)
22	NC 98458 61951	126	149.9
23	NC 98785 61581	139	149.9
25	NC 96988 61338	139	149.9
26	NC 97552 61453	139	149.9
27	NC 98118 61260	126	149.9
30	NC 99161 61256	139	149.9
31	NC 97093 60848	139	149.9
32	NC 97731 60965	139	149.9
33	NC 98265 60800	126	149.9
35	NC 98659 61115	126	149.9
36	NC 99273 60738	139	149.9
42	NC 97270 60386	139	149.9
43	NC 97751 60475	139	149.9
44	NC 98367 60322	139	149.9
51	NC 98779 60595	126	149.9
54	NC 97607 60006	139	149.9
55	NC 98078 59956	139	149.9
56	NC 98809 60117	126	149.9
57	NC 99328 60196	139	149.9
60	NC 98510 59713	139	149.9
61	NC 99015 59669	139	149.9

4.3.8. **Figure 4.1** also shows the proposed locations of the infrastructure necessary for the wind development. The control building / substation remains as per the Consented Development. The temporary construction compound has been relocated and resized and borrow pit search area A has also been removed. The grid coordinate locations for the infrastructure are shown below:

- One temporary construction compound NGR NC 98193 62103;
- One control building/substation at NGR NC 97640 62690; and
- Borrow pit search area at NGR NC 97550 62140.

Micro-siting

4.3.9. Current knowledge of the ground conditions at the development site is based on desk top studies and preliminary site investigations. These will need to be verified by more detailed pre-construction ground investigations which may result in minor adjustments to turbine locations due to environmental or technical constraints. For this reason, an area of +/- 50m has been included surrounding the proposed turbine locations and ancillary infrastructure, this is referred to as micro-siting. The micro-siting area has been taken into consideration throughout the technical and environmental assessments completed as part of the EIA for the proposed development.

4.4. Description of the Wind Farm Elements

Wind Turbines

4.4.1. A diagram of a typical wind turbine is shown in **Figure 4.2**. These figures show a typical horizontal axis wind turbine comprising four main components: a rotor (consisting of a hub and three blades), a nacelle (containing the generator and gearbox), to which the rotor is mounted, a tower, and a foundation. The specific turbine is dependent on the final choice of turbine models available at the time of procurement and will be chosen with the aim of optimising renewable energy generation at the Site. However, the chosen turbines will have a maximum blade tip height of no more than 149.9 m as these are the upper limit environmental and planning parameters considered in this EIA report.

4.4.2. The wind turbines would convert the kinetic energy of the wind into electrical energy, the air passing over the blades causing them to rotate. This low speed rotational motion of the blades is converted into electrical energy using a generator located inside the nacelle.

4.4.3. A transformer then steps up the voltage to 33 kilovolts (kV) which is then fed into the control building via underground electrical cabling linking all of the turbine unit transformers. The turbine transformers are expected to be located within the nacelle or tower of the turbine; however, if required due to the turbine model selected for installation on site, they may be located immediately adjacent to each turbine in a small kiosk, typically 3 m x 2 m x 3 m, such that they are generally indistinct from the tower base unless viewed close up or in silhouette against the skyline at greater distance.

4.4.4. The electricity generated by the wind farm would be metered in the on-site control building and fed into the electricity network to which it is connected.

4.4.5. The turbine dimensions would vary depending on the turbine selected but for the purposes of the EIA, the Vestas V117 (4.2 MW) has been used as the reference wind turbine. The Applicant is also modelling this Section 36C submission on the Nordex N133 turbine (4.8MW), a comparison between the two turbine model dimensions can be seen in Table 4.3. This Section 36C submission is therefore based on an alternative assessment parameter (the Nordex N133 turbine) and has no bearing on the maximum tip height proposed. The potential impacts in EIA terms are therefore limited, which are shown in the following chapters of this EIA Report and with the Nordex N133 being the used as the 'worst case'.

Table 4.3 Revised Consented Development turbine model dimensions

	Vestas V117	**Nordex N133**
Tip Height	149.9 m	149.9 m
Rotor Diameter	117 m	133 m
Hub Height	91.4 m	83.4 m

4.4.6. Turbines have a proven track record for safety, although a very small number have been known to fail through accidental damage due to lightning or mechanical problems. However, turbine control and monitoring systems operate with several levels of redundancy to protect the turbines from damage.

4.4.7. All turbines are controlled by a sophisticated Supervisory Control and Data Acquisition (SCADA) system, which would gather data from all the turbines in order to control them from a central remote location. Communications cables connecting to each turbine would be buried in the electrical cable trenches to facilitate this.

4.4.8. In the case of any fault, such as over-speed of the blades, overpower production, or loss of grid connection, the turbines shut down automatically through braking mechanisms. They are also fitted with vibration sensors so that, if, in the unlikely event a blade is damaged, the turbines would automatically shut down.

4.4.9. Turbines, as with any tall structure, can be susceptible to lightning strike and appropriate measures are included in the turbine design to conduct lightning strike down to earth and minimise the risk of damage to it. In the case of a lightning strike on a turbine or blade the turbine would automatically shut down.

4.4.10. In cold weather, ice can build up on blade surfaces when operating. The turbines can continue to operate with a thin accumulation of snow or ice, but would shut down automatically when there is a sufficient build up to cause aerodynamic or physical imbalance of the rotor assembly.

4.4.11. During the construction phase, heavy lifting cranes will be used to install the wind turbines. The crane type would be confirmed when the specific turbine type has been selected. However, it is anticipated that two teams would carry out turbine erection, each using two road-going cranes (one of approximately 160 tonne capacity and one of 800 to 1,200 tonne capacity). The construction contractors would determine the actual cranes used, together with the exact programme and number of teams on site.

4.4.12. The methodology for turbine erection would depend on the crane supplier. Two common methods of blade installation exist: single blade lifts or full rotor assembly on the ground prior to lifting. Turbine manufacturers prefer the latter as it is quicker and does not require re-alignment of turbine components. As described below, lay down areas would accommodate components ready for assembly, and crane hard-standings would provide a firm base for cranes used to erect the turbines. If a full rotor assembly is required to be carried out prior to lifting, then additional temporary supports would be required to be positioned under the hub and blades. Because of the uncertainty of support requirements (it varies by turbine manufacturer) exact details cannot be defined but may include the creation of small additional support areas built off the sides of the crane hardstanding area.

Wind Turbine Foundations

4.4.13. The proposed increased turbine size will result in an increased turbine foundation compared to the Consented Development. It is anticipated that the foundation diameter will increase from 18 m diameter to approximately 25 m diameter. This is subject to the selection of the final turbine along with other factors such as existing ground conditions. A diagram of the updated typical wind turbine foundation for the Revised Consented Development is shown in **Figure 4.6**.

Crane Hardstandings

4.4.14. As a result of the proposed increased maximum tip height, the crane hardstanding area required will also increase. The permanent length will remain 40m, however, the width will increase from 22 m to 35 m. There will be an additional area required for temporary construction and lifting operations, however, these will be removed following completion of the construction phase. A diagram of a typical crane hardstanding is shown in **Figure 4.3**.

On-Site Access Tracks

4.4.15. The total length of onsite access tracks to be constructed will be reduced to approximately 15.3 km. Owing to the size of some of the turbine components, all on-site access tracks will have to be a minimum of 5 m wide with some additional localised bend widening to a maximum of approximately 13 m.

4.4.16. The proposed alignment of access tracks, developed through an iterative process based on the digital terrain model and site surveys, has sought to:

- minimise the overall track length;
- minimise the variation of the vertical alignment of the tracks;
- minimise the number of dead ends within the layout;
- avoid or minimise incursion into identified constraints, such as watercourses, areas of deeper and potentially unstable peat, priority habitats, and steep slopes.
- Remove sections of on-site track which are no longer required due to the removal of the Consented Development's Borrow Pit A.

4.4.17. The location and alignment of the on-site access tracks is shown in **Figure 4.1**. A diagram of a typical road construction is shown in **Figure 4.7.**

4.4.18. Owing to the size of some of the turbine components, all on-site access tracks would be a minimum of 5.0 m wide with some additional localised bend widening to approximately 7 m. Temporary passing places (approx. 50 m x 5 m) would also be provided as required along with turning heads (approx. 30 m length, 50 m radius) to facilitate traffic movements. The new tracks will be unpaved and formed of crushed rock sourced onsite, where possible.

4.4.19. The design of a particular length of site track would depend on local geological, topographical and drainage conditions. To achieve a track structure that meets the conditions encountered on site, whilst meeting the primary track design objectives, three different designs have been developed (each with associated construction techniques), as summarised in Table 4.3 and shown in **Figures 4.7a and Figure 4.7b.**

Table 4.4: Track Construction Techniques

Design	Typical site conditions
Excavated Track	Shallow areas of peat of <1 m depth (estimated road thickness 600 mm)
Rock Filled Track	Shallow areas of peat of <1 m depth (estimated road thickness 600 mm)
Floating Track	Deep, flat, stable areas of peat ≥1 m with (estimated road thickness 1000 mm)

Track Drainage

4.4.20. The need for drainage on the access track network would be considered for all parts of the track network separately, since slope and wetness vary considerably across the Site. In flat areas, drainage of floating tracks is not required, as it can be assumed that rainfall on to the road would infiltrate to the ground beneath the tracks or along the verges. Track-side drainage would be avoided, where possible, 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).

4.4.21. Where tracks are to be placed on slopes, lateral drainage would be installed on the upslope side of the track. The length of drains would be minimised, to prevent either pooling on the upslope side or, at the other extreme, creating long flow paths along which rapid and concentrated runoff could occur. Regular cross-drains would be required to allow flow to pass across the track (as recommended in SEPA's guidance[1]), with a preference for subsequent re-infiltration on the downslope side, rather than direct discharge to the drainage network.

Drainage Ditches along Excavated Tracks

4.4.22. Excavated tracks could cut off natural drainage across it; therefore, drainage ditches would be required. It is anticipated that at times the water in the ditches may contain high concentrations of sediment from excavations and track construction as well as possible accidental pollutants from construction activities; therefore, no water from a drainage ditch would be discharged directly to a watercourse. Instead, it would pass through a sand filter, filter strip, silt trap or other best practice pollution control feature. Drains would not be ended directly into natural channels, ephemeral streams or old ditches.

4.4.23. The ditch design would be considered in line with the recommendations of the Forestry Civil Engineering (FCE) and NatureScot guidance[2], including the use of flat-bottomed ditches to reduce the depth of disturbance.

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

4.4.25. Although drainage would be provided in areas of disturbance as required, areas of hardstanding would be minimised so that this need is reduced. This includes careful design of construction compounds and minimising the size of crane pads at each turbine location.

Cross Drainage

4.4.26. Cross-drainage may be achieved using culverts or pipes beneath the track, in line with the FCE and NatureScot guidance. Drainage would be installed before or during track construction, rather than afterwards, to ensure that the track design is not compromised. The cross drainage would flow out in to shallow drainage, which would allow diffuse re-infiltration to the peat on the downslope side. The cross drains would flow out at ground level and not be hanging culverts. The avoidance of steep gradients for the tracks would also reduce the risk of erosion occurring at cross-drain outflows.

[1] Version 3 of the Good Practice During Wind Farm Construction, 2015, Scottish Renewables, SNH, SEPA, FCS

[2] Floating Roads on Peat, August 2010, Forestry Civil Engineering and SNH

Check Dams

4.4.27. Check dams may be implemented in drainage ditches where necessary to reduce flow velocities to aid in the sedimentation of silt from suspension and to also direct water into the cross drains so that natural flow paths are maintained as far as possible.

Interface between Different Types of Road Drainage

4.4.28. Where the track construction method changes, the drainage methods would also change. If this results in an end point for a drainage ditch, the ditch would be piped across the road and allowed to discharge to land on the down side of the slope taking into account the precautions against peat instability, pollution and erosion discussed later in this chapter.

4.4.29. As discussed above, the alignment of the on-site tracks has already been subject to initial review and rerouting to respond to readily identifiable constraints. The final decision on alignment and on the appropriate type of access track design to adopt for a particular length of track would be made by a team of engineers, geologists, and the Environmental Clerk of Works (ECoW), in advance of construction and giving enough time to produce method statements and define working areas for discussion with SEPA prior to construction.

4.4.30. Construction timing and design of access tracks can strongly influence the potential for effects on the freshwater environment. Construction during wetter periods of the year poses a significantly greater risk of causing erosion and siltation, which can be particularly severe following major rainfall or snowmelt events. Whilst there is no proposal to restrict construction during such periods, the awareness of the increased potential for effects to arise following precipitation would be captured within the Construction Method Statement.

Watercourse and Service Crossings

4.4.31. Whilst every attempt has been made to avoid the increase in watercourse crossings, it has been necessary for the on-site access tracks to cross two extra local watercourses. Seven watercourse crossings have been included in the project design, an increase of two from the Consented Development. The locations of these watercrossings are shown on **Figure 4.1**. Five of the proposed watercourse crossings are proposed in new locations. A diagram showing a typical culvert crossing is shown in **Figure 4.9**.

Temporary Construction Compound

4.4.32. One main temporary construction compound will be constructed for the development site. An increased allowance from 100 m x 100 m to 150 m x 100 m for the main compound is being proposed with the Revised Consented Development. The location of the compound is shown in **Figure 4.1** and a diagram of a typical construction compound is shown in **Figure 4.4**.

4.4.33. Surface vegetation, top and subsoil would be removed from the area of the construction compound and temporarily stored within the disturbed area at its margins. The area would then be overlain by geogrid materials and covered with compacted stone to approximately 1,500 mm depth depending on ground conditions.

4.4.34. Temporary cabins, to be used for site offices and welfare facilities (including toilets and drying rooms) with provision for sealed waste and storage) are proposed. Welfare facilities would be installed as required by the Construction (Design and Management) Regulations 2015. If possible, the site welfare facilities would utilise services already in existence, for instance, low voltage power. If connection to local power is not possible, a diesel generator (bunded to 110 % diesel capacity) would be used to service the site facilities.

4.4.35. Where possible, water for welfare facilities would be provided via mains water supply. Where a mains supply is not available, water would be provided by ground water extraction.

4.4.36. The temporary site construction compound area would be fully reinstated following the construction period.

Substation Compound and Control Buildings

4.4.37. Following consent being awarded to the Consented Development, drawings for the substation compound and wind farm control buildings were subsequently approved by discharge of planning conditions via The Highland Council.

4.4.38. **Figures 4.5a-4.5d** show the approved elevations and dimensions, which are likely to remain the same for the Revised Consented Development.

4.4.39. As part of the wind farm control building facility the Applicant will seek to include facilities for electric vehicle charging.

Electrical Connections On-Site

4.4.40. The wind turbines typically produce electricity at 690 V, which is normally stepped-up to 33 kV via the turbine transformers.

4.4.41. Underground cables would link the turbines to the on-site control building and substation. Detailed construction and trenching specifications would depend on the ground conditions encountered at the time. To minimise ground disturbance, cables would be routed alongside the access tracks wherever practicable and, if not, the total footprint of construction activity would be stated within the CMS. Approximately 13 km of cable trenches would be required to connect the turbines to the on-site control building. **Figure 4.10** shows a typical cable trench detail. The method of installation would be selected to have minimum disturbance to the peat at the time of installation and afterwards.

4.4.42. The following methods would be used where appropriate:

- burial in ducts across the tracks;

- fitted in ducts along bridges;
- burial in trenches; and
- ploughing.

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

Borrow Pit

4.4.44. The Applicant has reviewed the material requirements for the development and the potential borrow pit locations. As a result, for the Revised Consented Development one previously proposed borrow pit search area has now been removed. One borrow pit location remains as shown in **Figure 4.1**.

Borrow Pit Workings

Stone Requirements and Sourcing

4.4.45. Table 4.5 below provides a breakdown of the required rock volumes for each construction element of the Revised Consented Development. Where possible rock would be sourced from borrow pit workings within the wind farm site. This has several distinct advantages over importing all of the rock from external sources; it greatly reduces the number of stone lorries on the public highways, reduces haulage distances for stone haulage lorries and hence, reduces fuel consumption.

Table 4.5: Estimated Rock Volumes Required during Construction

Infrastructure	Consented Development Total Rock Volume (m^3)	Revised Consented Development Total Rock Volume (m^3)
Hardstandings	28,000	60,400
Tracks (new and upgraded)	77,200	95,100
Temporary construction compound	7,200	9,000
Substation compound	5,600	5,600
Total Rock Volume	**118,000**	**170,100** (57,000 of which has already been used for the Consented Development enabling works)

* Rock volume for the initial section of track, from site entrance to the borrow pit has been included here although it has now been constructed via the Consented Development enabling works.

Borrow Working Area

4.4.46. The search area shown in **Figure 4.1** represents the suitable area on site in which a borrow pit has already begun excavating to meet the rock requirements for the Consented Development enabling works.

4.4.47. Following additional geotechnical investigatory work, the estimated volume of rock in this borrow pit is likely to be in excess of the likely required volume of stone for construction of the Revised Consented Development.

Concrete Batching Plants

4.4.48. As for the Consented Development, it is likely that concrete would be batched on-site. Table 4.6 provides estimated volumes of concrete required for the installation of 21no. wind turbines at the Site. The majority of the concrete used on-site is required for turbine foundations with additional material for the substation and transformer (if required).

Table 4.6: Estimated Volume of Concrete

Infrastructure	**Consented Development total Volume of Concrete (m^3)**	**Revised Consented Development total Volume of Concrete (m^3)**
21 Wind Turbine Foundations	8,400	13,545
Substation/Control Building Foundations	200	200
Total Concrete Volume	**8,600**	**13,745**

4.4.49. On-site concrete batching would result in a significant reduction in the number of vehicle movements on the local road network. The on-site batching plant is likely to be situated within or adjoining the construction compound.

Site Access

4.4.50. Due to the increased abnormal size and loading of wind turbine delivery vehicles, it is necessary to review the public highways that would provide access to the Site to ensure they are suitable and to identify any modifications required to facilitate access. An updated preliminary transport access study is included in **Appendix 7.A**.

4.4.51. The abnormal loads delivery route remains the same as the Consented Development.

4.4.52. A more detailed study would be carried out by the turbine supplier should the Revised Consented Development be granted consent. As the turbine delivery vehicles are abnormal indivisible loads, a Special Order is required under The Road Vehicles (Authorisation of Special Types) (General) Order 2003.

4.4.53. The detailed off-site access requirements would be confirmed with Transport Scotland and the Highland Council's Highway Department once the exact requirements are established. A Traffic Management Plan would also be put in place to ensure safe operation, and this would also be established in conjunction with the aforementioned authorities.

Development Land Take

4.4.54. The total infrastructure land take (footprint) is 13.33 ha. Table 4.8 shows the comparison between the Consented Development and the Revised Consented Development.

Table 4.7 Development Land Take

Component	Consented Development Area (ha)	Revised Consented Development Area (ha)
Tracks	9.7	8.6
Crane Pads	2.16	2.94
Control Building and	0.78	0.78
Turbine Bases	0.60	1.01
TOTAL LAND-TAKE	**13.24**	**13.33**
Temporary Construction Compound	1	1

Forestry

4.4.55. An assessment of the effects on Limekiln Plantation resulting from the Revised Consented Development has been undertaken comparing the variation proposed in terms of felling and replanting with the Consented Development. Furthermore, the assessment identifies the area of woodland which will be required to be permanently removed for the wind farm infrastructure which includes revised stand-off requirements.

4.4.56. Mitigation is proposed with at least an equal increase to be planted off site as compensatory planting (CP) to the net woodland loss resulting from this variation.

4.4.57. The Revised Consented Development has provided the varied felling and replanting plans in the format for further amending the approved Amended Limekiln Plantation Long Term Forest Plan (LTFP) which follows the requirements of the UK Forestry Standard (UKFS) in terms of species diversity and age separation over the 20 year plan.

4.4.58. Prior to, and during construction, forest crop felling and timber extraction will be carried out. Felling of 73.90 ha is required for the permanent infrastructure which includes access tracks, hard stands and the required bat mitigation stand-off areas around turbines. This compares with 60.15 ha for the Consented Development.

4.4.59. Temporary felling of 148.92 ha for wind resource and temporary construction requirements will be replanted on site. This is represented as Phase 1 felling and phase 1 replanting within the varied LTFP. The Consented Development identified 150.40 ha as Phase 1 temporary felling and replanting on site.

4.4.60. The off-site planting plan will be further developed, to provide for at least an additional 13.04 ha net woodland area, equating to the area of permanent woodland loss on site. This CP area will be developed according to UKFS with species diversity and the gross area including open ground.

4.4.61. The summary of effects is that although there is an increase in woodland loss from site, with compensatory planting, there is no significant effect to forestry. There is no significant change to the long term forest structure compared to the Consented Development and the current amended LTFP.

4.4.62. For further information please refer to **Volume 1, Chapter 14 Forestry**.

Grid Connection

4.4.63. The wind farm will be connected into the national transmission system at 132kV at Dounreay substation, located approximately 4km away.

4.4.64. Overhead lines will be utilised to connect both substations, the route will follow existing power lines where possible to minimise impact, as shown on **Figure 4.12**. A new sub-station at the proposed development site will be built, and will be connected into the existing grid transmission network at Dounreay sub-station using a 132kV line.

4.5. Construction of the Revised Consented Development

Timetable of Events and Indicative Programme

4.5.1. The construction period for the Revised Consented Development would be approximately 22 months in duration and as the enabling works have already been completed, would comprise the following activities:

- construction of borrow workings and sourcing of rock;
- formation of site compound(s) including hardstanding and temporary site office facilities;
- construction of new access tracks and passing places (as required), inter-linking the turbine locations and substation compound;
- construction and upgrade of culverts under roads to facilitate drainage and maintain existing hydrology;
- construction of bridges where required i.e. watercourse crossings;
- construction of crane hardstanding areas;
- construction of turbine foundations;
- construction of site control building and associated substation;
- excavation of trenches and cable laying adjacent to site roads;
- connection of on-site distribution and signal cables;
- remedial works to the public highway to accommodate turbine deliveries;
- delivery and erection of wind turbines;
- commissioning of site equipment; and
- site restoration.

4.5.2. **Figure 4.11** outlines the anticipated construction programme for the Revised Consented Development.

4.6. Construction Working Practices

Construction Method Statement

4.6.1. It is anticipated that the Highland Council would wish to secure (within the deemed planning permission) the conditional approval of a Construction Method Statement (CMS) so that construction is completed in accordance with an approved document. This section sets out the basis of the Applicant's approach to construction. Should consent be obtained, a CMS would be submitted to the planning authority for approval prior to any construction activity taking place. In turn, the Applicant would bind the selected contractor to the terms of the CMS.

4.6.2. Selection of the construction contractor would be based partly upon the contractor's record in dealing with environmental issues and on its provision of evidence that it has incorporated all environmental requirements into its method statements as well as its staffing and budgetary provisions. The Applicant would retain the services of specialist advisers, for example on 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 technical sections, where appropriate.

4.6.3. The contract between the Applicant and the contractor would specify the measures to be taken to reduce or mitigate the environmental impact of the construction process (as detailed in the technical chapters of this EIA Report). A copy of any conditions associated with the deemed planning permission would be incorporated into the contract with the contractor and any subcontractors responsible for constructing the Revised Consented Development. All contractors will be contractually obliged to adhere to the planning conditions.

4.6.4. All of the general mitigation measures would be set out within a Construction Environmental Management Plan (CEMP) which would be produced prior to the commencement of construction of the development. The CEMP would set out how the development would be constructed and additional mitigation commitments. These additional commitments would include both specific mitigation measures as well as proposals for monitoring and emergency procedures. Such emergency procedures would include a site-specific Pollution Incident Response Plan in order to prevent and mitigate damage to the environment caused by accidents such as spillages and fires.

4.6.5. The CEMP would be fully developed following the grant of consent and be subject to approval by the local authority in conjunction with relevant consultees for the attendant elements. The CEMP would incorporate the following:

- Pollution Prevention Plan (PPP);
- Drainage Management Plan (DMP);
- Traffic Management Plan (TMP);
- Site Waste Management Plan (SWMP);
- Stakeholder Management Plan (SMP);
- Habitat Management Plan (HMP, see **Appendix 11.G**);
- Peat Management Plan (PMP, for the outline PMP refer to **appendix 13.C**);
- Peat Slide Risk Assessment (outline PSRA, **Appendix 13.B**); and
- Geotechnical Risk Register (containing, among others, peat stability-specific input from PSRA).

4.6.6. The CEMP would propose to capture a diverse range of environmental management controls. Examples of the measures proposed and expected to be incorporated into the CEMP include the adoption of best practice guidance; the appointment of an Environmental Clerk of Works (ECoW) to oversee correct implementation of agreed commitments; completion of a Traffic Management Plan presenting detailed access routes and delivery timings, car parking arrangements, temporary signage etc; demarcation of working area following the micrositing exercise with temporary fencing as required along with location specific method statements if habitat sensitivity is high; completion and implementation of a Habitat Management Plan; development of an infrastructure monitoring programme to identify any requirement for remedial work; and an exclusion of equipment from watercourses and, as far as possible from immediate riparian zones during watercourse crossing construction along with measures to minimise change in in stream substrates.

4.6.7. The developed CMS and CEMP would be submitted for agreement with the appropriate planning authorities and bodies, such as SEPA, prior to construction and development. In order to ensure that the CMS and CEMP are being suitably adhered to by the appointed contractors, an independent and suitably qualified Owner's Engineer would be employed during the construction phase of the project to monitor implementation and provide specialist advice. The Owner's Engineer would liaise with the various environmental, archaeological and other advisers who would have input into the project to ensure compliance is met in relation to any imposed planning conditions as well as the approved CMS and CEMP.

Construction Working Hours

4.6.8. As with the Consented Development, construction activities would be limited to the working hours of 0700 to 1900 Monday to Friday and 0700 to 1300 on Saturdays. Quiet on-site working activities such as electrical commissioning have been assumed to extend outside the core working times noted above where required. No work at the site will be undertaken on Sundays, except in a period of low wind whereupon heavy crane lifting and turbine erection may continue. The Applicant is committed to proper rest periods for the workforce during the work cycle.

4.6.9. Work outside these hours is not usual, though if it was required to meet specific demands (e.g. during foundation pours, or to undertake work which is highly weather dependent e.g. low wind speeds are needed for turbine tower erection), permission for short term extensions to these hours would be sought from the planning authority as required.

General Construction Methodology

4.6.10. The following sections describe the outline construction methodologies proposed and serve as a basis for completion of the technical assessments.

4.6.11. The Revised Consented Development would be constructed in accordance with documented ISO 14001 (2015) environmental management procedures which ensure compliance with applicable environmental legislation and best practice. Effective communication underpins the whole system of environmental management, ensuring appropriate information passes between the Applicant and the consultants / contractors engaged. This ensures that environmental considerations are fully integrated into the management of the wind farm throughout construction, the operation, and maintenance of the completed project and ultimately to decommissioning.

Construction Working Practices

4.6.12. Contractors' working areas would be made available, and the location would be clearly delineated on-site to ensure that no unnecessary disturbance is caused to any sensitive areas.

4.6.13. Particular attention would be given to the storage and use of fuels for the plant on-site. Oil would be stored in accordance with the Water Environment (oil storage) (Scotland) Regulation 2006. Drainage within the temporary site compound, where construction vehicles would park and where any diesel fuel would be stored, would be directed to an oil interceptor to prevent pollution if any spillage occurred. Storage of diesel fuel would be within a bunded area or self-bunded tank in accordance with the SEPA Pollution Prevention Guidelines (PPG). PPGs are considered to constitute 'best practice' within the industry. The PPGs relevant to the Revised Consented Development are shown in Table 4.9 and are available from: http://www.sepa.org.uk/about_us/publications/guidance/ppgs.aspx.

Table 4.8: Applicable PPG Guidelines

PPG Number		
PPG1	General guide to the prevention of pollution	All activities
PPG2	Above ground oil storage tanks	Plant related activities
PPG3	The use and design of oil interceptors	Plant related activities
PPG4	Treatment and disposal of sewage	On-site facilities
PPG5	Works and maintenance in or near water	Works adjacent to on site watercourses
PPG6	Working at construction and demolition sites	All activities
PPG7	Refuelling facilities	Plant related activities
PPG8	Safe storage and disposal of used oils	Plant related activities
PPG13	Vehicle washing and cleaning	Plant related activities
PPG18	Managing fire water and major spillages	All activities
PPG21	Pollution incident response planning	All activities
PPG22	Incident response – dealing with spills	All activities
PPG26	Storage & handling of drums & intermediate bulk containers	Plant related activities

4.6.14. Standard construction working practices would be implemented during construction and any maintenance works, in order to ensure adherence to relevant guidance and other current best practice.

Construction and Operational Wastes

4.6.15. Any substrate generated by excavation of foundations is expected to be reused on site. Substrate would be reused in restoration of disturbed areas, and other material would be used to backfill excavations where needed. It is not expected that any material would be unsuitable for re-use in these ways, though in the unlikely event that small amounts of such material arise they would be disposed off-site in line with relevant waste disposal regulations. Steps would be taken to minimise the extraction of peat as per the updated PMP (refer to **Appendix 13.C**). The updated PMP would ensure that peat excavated during construction is safely and suitably re-used within the extent of the Site.

4.6.16. Construction waste is expected to be restricted to normal materials such as offcuts of timber, wire, fibreglass, cleaning cloths, paper and similar materials. These would be sorted and recycled, if possible, or disposed of to an appropriately licensed landfill by the relevant contractor.

4.6.17. Operational waste would typically be restricted to very small volumes of normal materials associated with machinery repair and maintenance. All such materials would be disposed of by the maintenance contractors in line with normal waste disposal practices.

Fuel Storage and Refuelling Activities

4.6.18. Fuel storage and refuelling activities have been identified as having potential effects that can be controlled by the implementation of pollution prevention and control measures and best practice by the site operator.

4.6.19. In order to minimise potential releases into the water environment, fuel would be stored in either a bunded area or self bunded Above Ground Storage Tank (AGST) on site during the course of the construction phase in accordance with PPG2 and other SEPA Pollution prevention guidelines.

4.6.20. Surface water drainage would be directed to a hydrocarbon interceptor prior to discharge, in areas where there is a potential for hydrocarbon residues from runoff / isolated leakages such as in plant storage areas and the location of the fuel storage tanks and refuelling activities in the proposed temporary site compound. The interceptor would filter out hydrocarbon residues from drainage water and retain hydrocarbon product in the event of a spillage to prevent release into surface waters at the discharge point and deterioration of downstream water quality.

Peat Management during Construction

4.6.21. The interpolated peat depth map indicates that approximately one third of the Development Site contains peat depths between <0.5m. In the west of the site between T26 and T43 the proposed access track between T26 and T32 passes through a large area of peat with thicknesses in excess of 2.0m, ranging up to approximately 4.5m. In addition, further pockets of peat with thicknesses >2.0m are identified throughout the site in or near the location T25, T54, T55, T30 and T57. The wind farm layout, design, and construction methodology has been refined to minimise peat excavation from tracks and turbine infrastructure, but it has not been possible to avoid it entirely.

4.6.22. Peat would be excavated during the construction of tracks, foundations, hardstandings, substation, and temporary compounds. The majority of peat would come from foundations, hardstandings and track construction and, to a lesser extent, temporary compounds.

4.6.23. The updated PMP provided, as **Appendix 13.C**, would be updated prior to construction, following completion of detailed ground investigations and micro-siting, and agreed with SEPA and NatureScot. This would address methods in respect of peat excavation, haulage, storage, re-use, and disturbed habitat restoration.

4.6.24. **Appendix 13.B** provides the Peat Slide Risk Assessment. The updated Peat Management Plan together with the mitigation measures in the chapter and the Peat Slide Risk Assessment would ensure that peat excavated during construction is safely and suitably re-used within the extent of the Site.

4.7. Operation of the Revised Consented Development

General Servicing

4.7.1. Each turbine manufacturer has specific maintenance requirements, but typically, routine maintenance or servicing of turbines is carried out twice a year, with a main service at twelve monthly intervals and a minor service at 6 months. In the first year, there is also an initial three month service after commissioning. The turbine being serviced is switched off for the duration of its service.

4.7.2. Teams of two people with a 4x4 vehicle would carry out the servicing. It takes two people (on average) one day to service each turbine.

4.7.3. At regular periods through the project life, oils and components would require changing, which would increase the service time on-site per machine. Gearbox oil changes are required approximately every 18 months.

4.7.4. Changing the oil and worn components would extend each turbine service by one day. The typical duration of other repair / replacement procedures together with the equipment and personnel that would be required for different tasks is shown in Table 4.10. It should be noted that these figures are only estimates.

4.7.5. Blade inspections would occur as required (somewhere between every two and five years) using a Cherry Picker or similar, but may also be performed with a 50T crane and a man-basket. It could take approximately two weeks to inspect the turbines at the Revised Consented Development. Repairs to blades would utilise the same equipment.

4.7.6. Blade inspection and repair work is especially weather-dependent. Light winds and warm, dry conditions are required for blade repairs. Hence summer (June, July and August) is the most appropriate period for this work.

4.7.7. The following factors could have significant effects on the duration of repair operations:

- working with cranes is highly weather-dependent;
- the availability of spares; and
- the stage in the component's life cycle.

Table 4.9 List of Potential Operational and Maintenance Activities

Item	Personnel	Equipment	Likely Duration of Job
Generator	2 x fitters	50T (3 axle) or 100T (6 axle) crane. 10T flat bed lorry	1 day
Gearbox	4 x fitters	50T or 100T crane 10T flat bed lorry	6 days
Blade/Rotor	6 x fitters	100T crane and 50T crane Articulated delivery lorry	4 days

Item	Personnel	Equipment	Likely Duration of Job
Transformer	2 x fitters	50T crane and or 20T flat bed lorry with own crane	1 day
Track Maintenance	Drivers	40T stone delivery lorries, Grader / roller and Excavator	Very limited, likely to be occasional patching
Snow Clearance	Driver	Excavator	Conditions specific (unlikely to occur)
Dismantling a turbine	8 x fitters	500T crane and support lorries plus 100T crane. Articulated lorries for components	3 days per turbine
HV/comms. Cable faults	6 x fitters	Vans or tracked vehicles for off-site work	Variable

Track Maintenance

4.7.8. The frequency of track maintenance depends largely on the volume and nature of the traffic using the track, with weathering of the track surface also having a significant effect. Since the volume of traffic using the access tracks during operation would be low (although heavy plant is particularly wearing), the need for track maintenance is anticipated to be low and infrequent. Any maintenance that is required would generally be undertaken in the summer months when the tracks are dry. However, maintenance can be carried out when required.

Land Management

4.7.9. It is anticipated that long term land management practices would continue unaffected by the Revised Consented Development with normal forestry practices continuing unimpeded.

4.7.10. On-site access tracks could be utilised by transport vehicles, and re-planting can commence soon after turbine construction (refer to **Chapter 14 Forestry**).

4.8. Decommissioning of the Revised Consented Development

4.8.1. The Revised Consented Development has been designed with an operational life of 40 years. At the end of the operational period, it would be decommissioned and the turbines dismantled and removed. Any alternative to this action would require consent and is not considered in this EIA Report.

4.8.2. During decommissioning, the bases would be broken out to below ground level. All cables would be cut off below ground level, de-energised, and left in the ground. Access tracks would be left for use by the landowner. No stone would be removed from the Site. The decommissioning works are estimated to take six months. This approach is considered to be less environmentally damaging than seeking to remove foundations, cables and roads entirely.