4 Construction and Decommissioning

4.1 Introduction

4.1.1 This Chapter sets out the construction details of the proposed development as described in Chapter 3 and outlined in Figure 4.1. It discusses the general construction methodology, construction timescales and typical equipment likely to be used, with the following matters covered within this chapter:

- Construction programme;
- Construction and contracting strategy;
- Construction employment;
- Hours of work;
- Construction traffic and plant;
- Description of construction works;
- Description of decommissioning works;
- Construction and decommissioning management; and
- Potential construction and decommissioning phase environmental impacts.

4.1.2 The construction methods detailed below build on best practice methodologies developed at other wind farms and comply with Health and Safety requirements for construction operations. It follows relevant guidelines including SEPA's Pollution Prevention Guidelines, SNH's Good Practice During Wind Farm Construction and SNH's/Forestry Commission Scotland's Floating Roads on Peat guidance.

4.2 Construction Programme

4.2.1 Construction of the proposed development would begin following discharge of the relevant suspensive conditions of consent. It is proposed to construct, erect and commission the turbines in one phase. This process would be fully detailed and agreed with PKC through the Construction Method Statement (CMS).

4.2.2 The construction period for the whole of the proposed development is envisaged to last for 15 months, from commencement of construction through to installation and commissioning of the turbines, ending with site restoration (as shown on the construction programmes). Construction would consist of the following phases which, although presented in a typical sequence, may overlap or occur concurrently:

- Public highway and access route improvements;
- Construction of a site storage compound for off-loading materials and components and to accommodate site offices and mess facilities;
- Construction of site tracks and excavation of cable trenches;
- Construction of turbine foundations, laydown areas and crane pads;
- Works to the on-site substation and control building;
- Laying of on-site cabling;
- Delivery and erection of turbine towers, nacelles and blades;

- Installation of turbine transformers;
- Testing and commissioning of the turbines and the wind farm electrical system; and
- Site restoration (on-going during works).

4.2.3 An indicative construction programme is presented in Table 4.1.

Table 4.1: Indicative Construction Programme

Task Name	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MOBILISATION		■														
ACCESS AND ESTATE ROAD UPGRADE		■	■													
SITE TRACKS			■	■	■											
FOUNDATIONS				■	■	■	■	■	■							
HARD-STANDINGS			■	■	■											
SWITCHGEAR BUILDING					■	■	■	■	■							
CABLING					■	■	■	■								
TURBINE ERECTION								■	■	■	■	■				
COMMISSIONING										■	■	■	■			
RELIABILITY TESTING												■	■			
REINSTATEMENT WORKS													■	■	■	
DEMOBILISATION																■

4.3 Construction Strategy and Contracting Strategy

4.3.1 It is intended that the proposed development would be procured through a number of separate contracts including:

- Contract for the Balance of Plant (BoP) Civil and Electrical Works;
- Contract for the Turbine Supply Agreement (TSA) which includes the wind turbine design, manufacture, delivery, erection, commissioning and testing;
- Contract for the grid connection works (contestable works); and
- Other minor contracts.

4.3.2 The BoP contract would be undertaken on a design and build basis and this party would be appointed as the Principal Contractor. The Principal Contractor would be required to pro-actively coordinate with the following parties during the execution of the Works:

Table 4.2: Responsible Parties and Roles

Party	Role
Owner	To manage the planning condition approval process, manage principal contracts and engage a Construction Design and Management (CDM) Coordinator.
Regulatory Authorities	To ensure the proposed project meets the requirements set out in the planning conditions.
Engineer	To design and detail civil and electrical works
Turbine Supplier	To supply, deliver, erect and commission the turbines.
Distribution Network Operator (DNO)	To provide the grid connection.
Specialist Consultants	To provide specialist input on ecology, geology, hydrology and archaeology.
Technical Advisor	To monitor project progress and costs.

4.4 Construction Employment

4.4.1 Under the contracts described in Section 4.3, the construction of the proposed development would require several contractors responsible for the employment of various people with different skillsets. These people would vary from specialist consultants to site operatives.

4.4.2 A number of site representatives would be employed by the Owner full time to monitor the quality and health and safety aspects of the construction. They would help to ensure the proposed development is carried out in accordance with the Principal Contractor's CMS methodologies. The site representatives would have previous experience of wind farm construction and would be supported on site by suitably qualified specialists including ecologists, hydrologists, geologists and archaeologists.

4.4.3 The site representatives would carry out daily checks on the site to monitor ongoing activities, particularly when subcontractors are being used on site. In addition to this, and in conjunction with the specialists, environmental audits of the site operations would be undertaken on a regular basis accompanied by representatives of the relevant contractors. Where necessary, additional specialists would attend the site.

4.4.4 During the construction period, it is anticipated that the maximum number of construction operatives carrying out the works would be approximately 20 – 40 individuals at a time. This would include appropriately qualified, competent operatives employed for handling, storing and arranging for the disposal of potentially polluting substances in accordance with guidelines and requirements from the relevant authorities. Licensed waste disposal companies would be used to dispose of potentially polluting wastes.

4.4.5 There would be indirect local benefits arising from the construction phase, including use of accommodation, temporary employment of local work force, hire of equipment and plant, purchase of goods and services and potential contracting of local subcontractors. These benefits are further discussed in Chapter 15.

4.5 Hours of Work

4.5.1 Working hours for construction activities would be designated by the Perth and Kinross Council (PKC) and would typically be restricted to 07:00 hours to 19:00 hours Monday to Friday inclusive and 07:00 hours to 13:00 hours

Saturday. No work would be carried out on a Sunday or Public Holiday and there would be no extension to the construction working hours unless otherwise approved by the PKC

4.5.2 Similarly, delivery of any construction materials or equipment for construction, other than turbine components, would typically be restricted to 07:00 hours to 19:00 hours Monday to Friday inclusive and 07:00 hours to 13:00 hours Saturday. No such deliveries would be carried out on a Sunday or Public Holiday unless otherwise approved by the PKC.

4.6 Construction Traffic and Plant

4.6.1 Prior to mobilisation, a Traffic Management Plan (TMP) would be produced setting out the details of the proposed traffic movements along the access route on the public highway for construction related heavy goods vehicles and for the delivery of abnormal loads (turbine components).

4.6.2 Typically the TMP document would cover the following topics:

- Proposed route for abnormal loads and construction vehicles;
- Swept Path analysis of the proposed route for abnormal loads;
- Scheduling and timing of movements;
- Detailed plans of any works proposed for the public roads to suit the requirements of the relevant authorities;
- Details for improvements at the junction of the public road and the site entrance if required;
- Detailed condition survey of the public roads and highways on the proposed access and delivery routes;
- Public Notifications;
- Management of junctions and crossings of the public highway and other public rights of way;
- Temporary warning signs;
- Temporary removal and replacement of highway infrastructure/street furniture;
- Reinstatement of any signs, verges or other items displaced by construction traffic;
- Banksman/escort details; and
- Monitoring of the physical condition of the public roads used for construction traffic.

4.6.3 The BoP Contractor would adhere to all aspects of the approved TMP during the construction, operation and decommissioning phases of the proposed development.

4.6.4 A large variety of plant would be required on site to construct the proposed development, with the following equipment typically being required. The equipment would be in use on the site or secured and stored on site at appropriate locations overnight or within the construction compound.

- One large mobile or lattice crane up to 1000 tonne for the turbine erection;
- Two 100/200 tonne (or less) capacity mobile cranes for general construction duties such as the preparation of the reinforcement cages at the turbine bases and as tailing cranes for steerage during the turbine erection phase;

- Three 30/40 tonne 360 degree excavators. These would be used for excavation and backfilling of turbine foundations;
- Four smaller excavators in the range of 10 to 20 tonnes would be used for road construction, profiling and restoration of verges, turbine foundations and for excavation of cable trenches;
- Two tracked bulldozer would be used for a number of tasks such as stockpiling material from turbine excavations, road construction, crane pad preparation and re-grading of the track running surface;
- Approximately four dump trucks would be used for moving material around the site, e.g. for moving excavated peat or soils from cut site tracks to any stretches of floating track over deeper peat;
- Two or three heavy duty vibrating rollers would be used to compact new roads, turbine foundation formations, crane pads and turbine backfill;
- One mobile concrete pump would be used during the concrete works for the turbine foundations and the substation building;
- Two cable laying vehicles would be used; comprising a lorry, tractor or tracked excavator with a revolving drum attachment;
- Two small trucks or four wheel drive vehicles with trailers would be used for transporting of small loads around the site i.e. ducting pipes, cables, compressors, pumps, generators, tools etc.;
- Six four wheel drive vehicles would be used for transporting construction workers, site operatives and tools around the site. It is likely that these vehicles would leave the site on a regular basis to transport workers to and from their billets off-site and run general errands;
- Forklift trucks would be used for offloading materials during delivery. These would typically be carried to site for the purpose of offloading and would be transported offsite when the delivery is complete;
- A number of other vehicles would bring materials to the site, but would not be stored at the site. These would include lorries with flatbed extendable trailers for carrying smaller turbine components including transformers and cabling. Lorries would also be used for the delivery of steel reinforcement, building elements and materials. Concrete lorries with revolving drums would be used to deliver concrete. Lorries carrying water, fuels and equipment would also be used;
- A dry wheel wash, manual spray or a wheel washing drive through unit would be used to reduce the risk of mud being transported onto the public road system;
- Cabins and welfare facilities. A number of transportable cabins would be used in the construction compound. These would include offices, canteens, drying-rooms, toilets and washing facilities. The units would be self-contained and no discharge of drainage would be made to the surrounding land unless otherwise agreed with SEPA and the local authority. Smaller, mobile self-contained units would be required as work progresses throughout the site;
- A concrete batching plant for concrete required within the turbine foundations and to minimise the number of concrete deliveries;
- Fuel and Chemical Storage facilities would typically comprise a bunded concrete pit containing a lockable, bunded fuel tank and a separate lockable housing for the storage of construction chemicals;
- One mobile fuel bowser would be used to allow vehicles to be refuelled at their working location. This would reduce loss of time and unnecessary use of fuel returning to the site compound; and
- Emergency spill kits would be kept on site adjacent to the fuel storage area and with the mobile fuel bowser.

4.6.5 Construction plant would be delivered to the site at the commencement of the relevant construction phase and would remain on site until work relating to that phase is completed.

4.6.6 Detailed descriptions of the access, traffic and transport requirements and associated impacts for the proposed development are discussed in Chapter 14.

4.7 Description of Construction Works

Site Entrance

4.7.1 Roadworks and upgrades would be carried out at the proposed site entrance to facilitate the traffic movements in accordance with the approved TMP. This would involve upgrading the existing access junction bellmouth into the Talladh-a-Bheithe Estate on the B846. The upgraded bellmouth would be suitably wide enough to accommodate the abnormal loads associated with the turbine component deliveries including tower sections and nacelles.

4.7.2 In addition to the delivery of turbine components through the estate entrance upgrade, the turbine blades would be delivered to the proposed development by barge along Loch Ericht to a jetty on the southern shore. This is described in detail in Chapter 14 and Appendix 14.1.

Upgraded Estate Roads

4.7.3 Modifications and improvements would be required for the estate roads. These would be widened and upgraded to a suitable width, typically 5.0m wide, to allow access for the abnormal loads. Additional localised widening would be required at bends to accommodate the oversail of these vehicles. Along the length of the access track, burn crossings would be checked for access and bearing strength, with modifications and strengthening works undertaken as necessary.

4.7.4 The construction of the estate road upgrade works is described in Figure 4.2 and would typically involve the following steps.

- The top level of peat/topsoil would be stripped and stored for reinstatement purposes, with the overburden then being removed to solid formation. The amount of peat anticipated is discussed in the Peat Management Plan (PMP) in Appendix 11.3 of Chapter 11. The existing road side ditches would be removed and new ditches formed at the edge of the new road width.
- Concurrently the estate road would be cut back and excavated, creating steps or benches within the pavement and foundation make-up, to allow the new road to be tied in. The extension to the road would be constructed by placing layers of stone and compacting the layers. During the site preparation, the design of the thickness of the road make-up would be finalised based on the ground conditions encountered and the anticipated loading from the wind farm construction and delivery vehicles.; and
- To complete the upgrade, a layer of hot rolled asphalt would be placed across the entire width of the road surface. This would have an appropriate crossfall to direct surface runoff to the new open roadside ditches. The batters would be profiled and left in a condition to avoid blocking drainage ditches. The batters on the upslope side of the track would be re-graded to a shallower angle of repose to reduce the risk of slumping prior to the placement of turfs, where appropriate and the existing landscape allows.

Earthworks

4.7.5 Earthworks would be required across the site to construct new access tracks, crane hardstands, the construction compound and the excavation of the turbine foundations, cable trenches and the substation building.

4.7.6 Prior to excavation, the vegetation layer would be carefully removed followed by any underlying peat. The removed peat would either be relocated to the nearest restoration area or used to sympathetically reinstate around the turbine foundations or temporarily stored for relocation as soon as is practical. Stored peat would be prevented from drying out by storing the turfs close together to prevent drying of the edges. They would be monitored during storage and irrigated if required. After the vegetation layer and peat has been stripped, the natural soil would be excavated to form the required founding level. The vegetation layer (turfs) would be regularly monitored to prevent excessive desiccation. The turfs would be removed and stored separately from the peat.

4.7.7 All excavations would be inspected for tension cracks or suitably supported to prevent collapse. Where surplus mineral soil material is present, this would be stored on site for use in backfilling, restoration and final profiling as applicable. Where stone is won from the excavations it would be re-used for backfilling or restoration, depending on the suitability of the stone.

Site Access tracks

4.7.8 Approximately 12.8 km of access tracks would be required to provide access throughout the wind farm. The width of the corridor for the site tracks, including drainage swales, cable trenches, earthworks etc. would be approximately 20 m. The new track construction would use best practice guidelines and methodology developed from other wind farm sites. Where possible, sensitive areas have been identified and avoided during the design of the site layout.

4.7.9 Two types of track construction, cut and floating, are illustrated in Figure 4.3 , and would be used as appropriate on varying ground conditions. The sections of track which would be cut and the sections which would be floating would be identified following planning permission in the detailed design stage and agreed as part of the Construction Method Statement.

4.7.10 At this point in the proposed development, it is expected that approximately 10.8 km would be cut track and 2.0 km would be floating track. The type of access track utilised would be selected to minimise disruption and impact on the site habitat and also, to mitigate against the possibility of peatslide.

4.7.11 For example, the access track to the south of the proposed development, from BP B to T12 would be expected to be cut due to the relatively shallow peat depths along the proposed access track alignment. Similarly, between T25 and T21, cut track construction would be anticipated due to the shallow peat in some sections and to minimise the potential risk of peatslide at T21. However, a mixture of floating and cut construction is envisaged along the access track from T8 to T24 due to the deeper pockets of peat in the valley and to mitigate against any peat slide risk.

4.7.12 Cut construction would be adopted where a suitably stable formation lies within approximately 1000 mm of the ground surface as detailed in Figure 4.3.

- Turfs of the top level of peat approximately 200 mm thick would be stripped and stored separately for reinstatement purposes. Reinstatement would occur as soon as each section of track is finished to minimise the turf storage time and potential for erosion. In areas where the track encounters areas of peat, the excess peat would be moved to parts of the route where floating road sections are to be constructed, and used for reinstating the shoulders of the road. Otherwise, excess peat would be stored in accordance with the methods recommended by the geotechnical consultant and the considerations outlined in the PMP and the Outline Habitat Management Plana (OHMP) in Appendix 9.2 in Chapter 9.
- Overburden would then be removed to solid formation and the road constructed in compacted layers of stone. A layer of structural geogrid and a layer of terram-type geotextile would be laid down on the ground surface, before the stone is added. The thickness of the road make-up would be finalised during the design process and would be dependent on the ground conditions encountered, however typically road stone would be laid down and compacted to a depth of approximately 300-400 mm.
- On completion of the turbine component transportation and turbine erection works the road would receive a final grading and the batters would be profiled and left in a condition to avoid blocking drainage ditches. Any batter on the upslope side of the track would be re-graded to a shallower angle of repose to reduce the risk of slumping prior to the placement of turfs.
- Where this is not possible due to the angle of slope the batter would remain unturfed but care would be taken to avoid vertical or near vertical surfaces. On the downslope side of the track, the batter would be formed from surplus peat again at angles of less than 25 degrees where possible.
- Any cut batters of less than 25 degrees which lack turf, would be reseeded using an appropriate technique and with a seed mix agreed with SNH.
- In order to reduce runoff from cut faces a cut-off drain would be installed above the cuttings, where possible, to prevent silt migration.

4.7.13 Floating construction would be adopted where the peat depth consistently exceeds 1000 mm for a length of 100 m or more.

- The track would be constructed on top of the current, undisturbed ground surface. A layer of structural geogrid and a layer of terram-type geotextile would be laid down on the ground surface, and a capping layer added to a total depth of approximately 400-600 mm. Additional layers of structural geotextile or timber rafts may be added depending upon the adopted final design.
- Excess peat overburden from cut road sectors and turbine bases would be used to create gently sloping batters on either side of the road
- On completion of turbine component transportation and turbine erection works at the wind farm site the site tracks would receive a final grading and the batters would be dressed with a layer of peat or excess stripped turfs, obtained from elsewhere within the works and re-seeded if necessary.
- Reinstatement of the track edges up to the road surface for both methods would be based on best practice techniques.

Borrow Pits

4.7.14 It is expected that new stone for upgrades to the estate access road and new tracks would be won from borrow pits within the search areas shown on the site layout in Figure 4.1, with the finalised locations and extraction methodologies being determined during detailed site investigation post consent and agreed as part of the CMS. Should further stone be required, any further borrow pit locations would be subject to the successful outcome of obtaining the relevant licences and consents. The final reinstatement of these borrow pits would be agreed with PKC in consultation with SNH prior to reinstatement works commencing. Further details on the potential borrow pits are discussed in Appendix 4.1 Borrow Pit Search Report.

Watercourse Crossing

4.7.15 The design of the new crossing would be agreed with SEPA prior to construction and would be dealt with under the usual General Binding Rules of the CAR. Guidance on the sizing design and construction of the crossing would be taken from the CIRIA Culvert design and operation guide (C689). The crossing would be designed to ensure it does not disconnect the watercourses at times of low flow, and shall have appropriate flood capacity. Several watercourse crossing will be required across the site and the potential types are discussed in detail in Chapter 11.

Drainage

4.7.16 Drainage would be provided as necessary; adjacent to all site tracks, for the construction compound, turbines, crane pads and substation building. A typical drainage arrangement is described in Figure 4.10.

4.7.17 The design of hardstanding surfaces, in particular the site tracks, would be such that they do not act as a channel for water runoff or a barrier to natural water flow. The track design would also employ appropriate cross drains to minimise the collection of water and ensuring overall surface water catchment and runoff characteristics are maintained. All collected surface water would be filtered prior to discharge onto the natural ground or into existing watercourses.

4.7.18 Existing watercourses would be monitored during the works, to prevent water entering the excavations, and to prevent silt escaping and entering the watercourses. These may need temporary diversions/piping until the works are complete and the watercourses can be reinstated.

Turbine foundations

4.7.19 From the geology review outlined in Chapter 11, it is envisaged that gravity foundations would be utilised to support the proposed wind turbines. The proposed turbine locations in general avoid areas of deep peat across the site to minimise the potential requirement for the turbine foundations to be a piled solution. Where there is concern over the bearing capacity of the foundation formation, the excavation will be over dug to a deeper sub-formation and engineered replacement fill provided to improve the formations bearing capacity and stiffness. The final decision on the foundation type would be made at the detailed design stage based on detailed site investigations and the selected turbine. A typical turbine anticipated to be utilised for the proposed development is described in Figure 4.4.

4.7.20 Gravity foundations are typically a large reinforced concrete pad, circular or octagonal in shape, with a protruding upstand left approximately 150 mm proud of the finished ground level. The foundation would be backfilled with selected material processed from the excavation or stone material won from the borrow pits placed and compacted over the foundation. The base tower section of the turbine is subsequently connected to the foundation either via an embedded end can (short tower section) or a holding down bolt arrangement that is cast into the upstand section of the foundation. Stability for the turbine is provided through the weight of the foundation and the material replaced and compacted over it.

4.7.21 A typical turbine foundation specification is described in Figure 4.5. Detailed design specifications for each foundation would depend on the site specific factors such as ground conditions, the specific turbine used and various other engineering considerations. Typically a reinforced concrete foundation of approximately 18.0 m diameter would be suitable for the proposed wind turbine. The overall depth of the foundation would be around 3.5 m. Each turbine foundation would comprise approximately 350 cubic metres of concrete and 40 tonnes of reinforced steel bar.

4.7.22 To construct the foundation, the area would be initially stripped of vegetation and topsoil. Depending on the findings of the ground investigation, some preparatory ground work may be required. This might include soil replacement with selected granular fill to the formation level. The formation would be tested to ensure the correct bearing capacity and soil stiffness is provided for the foundation. A layer of blinding concrete would then be placed to allow the steel reinforcement to be arranged, the turbine tower connection piece installed and the concrete poured. Following construction of the foundations and once concrete curing, testing and certification has been completed; the concrete foundation would be backfilled. This would be carried out to the required levels using suitable material, laid and compacted in accordance with the approved construction drawings. A layer of peat, peat turfs and/or mineral soils that were excavated from the turbine foundation area would be reinstated over the backfill. Depending on the final turbine selection, transformers would be located within housings, as shown in Figure 4.4, adjacent to the turbines with power cables from the turbines passing through ducts cast into the foundation. Otherwise they would be installed within the tower of the turbine.

4.7.23 A drainage system may be installed around the foundation to prevent the build-up of water pressure under the foundation. Alternatively, a submerged foundation design could be employed which would not require a drainage system around the foundation. The different types of foundation would be dependent on the water table level relative to natural ground or in locations that were particularly sensitive to hydrological disturbance.

Crane Pads

4.7.24 Cranes would be required during the erection of each turbine at the turbine site: typically a 1000 tonne crane and a smaller 100/200 tonne crane. To provide stable, firm ground for cranes to stand on during the installation of turbines, hard-standing areas would be created adjacent to the foundation. These would be suitable for the outriggers of the respective cranes. The final configuration would be dependent on the chosen turbine supplier but would be no greater than an area of approximately 45 m x 25 m for simultaneous use of both cranes. Depending on the chosen turbine supplier and their requirements for erecting the turbines, it might be necessary to provide additional hardstanding areas. For example, temporary levelled strips up to 100 m in length might be required for assembling the crane boom to erect the turbines.

4.7.25 The positions and orientations of the crane pads have been selected based on topographical information, peat locations and depths, habitat and construction and delivery requirements. Typically, construction of the hard-standing areas would be similar to the construction of the site tracks (on shallow soils), with 100-150 mm of topsoil removed and stored adjacent to the sites, and remaining soil removed down to the hard substrate. Geotextile material would be laid down and crushed stone laid on top to a depth required for the crane out riggers. In areas of deeper peat, the area for hard standing would be excavated to a suitable bearing stratum and built up with crushed stone to the height of the access track.

4.7.26 Following construction the areas of hard standing would be left in-situ to facilitate future maintenance operations. Preservation of hard standing reduces the amount of material needed to be brought to site to reinstate the crane pad should a crane be required for turbine maintenance. A diagram of the crane hard standings can be found in Figure 4.6 at the end of this section.

Substation

4.7.27 The wind farm substation would house a variety of equipment and facilities essential to the operation of the wind farm including switchgear, metering equipment and communication equipment. A store room and outside compound for compensation equipment (e.g. auxiliary transformers) would also be incorporated. This is to be located adjacent to the construction compound. The building would contain welfare facilities – showers, toilets and canteen facilities – and office space for the wind farm operators and turbine suppliers' representatives. A non-potable water system would be supplied to the building in addition to a grey (rain) water collection system. Foul drainage would run to a new septic tank (subject to satisfactory soak-away drainage conditions). A small emergency back-up generator may be housed within a small enclosure adjacent to the building to provide power in case of grid supply interruption.

4.7.28 The final configuration, layout and finish of these buildings would be agreed with PKC prior to construction as part of the Building Warrant process and would be required to meet the technical and safety requirements of the grid operator and turbine supplier. Indicative drawings showing the layout of the proposed control building are shown in Figures 4.7 and 4.8. The buildings would be contained within a compound up to 50 x 30 m.

4.7.29 Communication to the control building would be via a number of options. Underground communications cables would be laid within the off-site grid connection route or adjacent to the access track. A communication mast would also be erected close to the building to a height of approximately 15 m, to boost mobile phone signal across the site and/or for a digital radio communication system.

4.7.30 The substructure of the building would be constructed from reinforced concrete in the form of a raft foundation. This would involve stripping the topsoil in the area and excavating down to a competent stratum. A layer of controlled engineered fill would be laid to prepare the formation, before blinding concrete is placed to allow the construction of the foundation slab. From this slab, blockwork would be built up to form the under-floor trenches for the electrical conduits and connectors. The blockwork would be reinforced as required depending on the depth of the foundation. The voids between the blockwork would be filled with compacted selected granular fill, with a reinforced concrete ground slab constructed for the building floor.

4.7.31 The building superstructure would be a traditional construction, with the external, load bearing walls being a cavity wall construction consisting of brick and block work. Steel wind posts and roof straps would be incorporated within the walls as required to deal with the wind loading on the building. The appropriate insulation would be provided to meet the required building regulations. The internal walls would be single leaf blockwork to construct the different rooms. The roof structure would be a timber truss and completed with insulation, sarking and natural slate.

Cabling

4.7.32 High voltage cables would be routed from the turbines and brought together via an underground circuit to the onsite substation. The electricity collected at the substation would be sent to the national grid via a cable route laid to connect the wind farm into the substation at Rannoch Power Station to the southeast of the site. Details of this grid connection would be covered under a separate planning application.

4.7.33 This cabling would be placed in trenches located to minimise the area of disturbance, up to 5 m beyond the edge of the site track. Trench excavation, cable laying and backfilling would be carried out in a continuous operation (minimising the length of trench open at any one time). After soil stripping, a trench would be dug with a small excavator or backhoe to approximately 1.0 m in depth and up to 1.0 m in width. In areas where the surrounding soils are very coarse gravel or peat, the cable trench footprint would have a geo-textile wrap placed within it to prohibit fines migrating from the backfill into the surrounding sub-soils. These areas would be identified on site during the commencement of the works.

4.7.34 Cables would be laid in sand for protection with warning tapes/boards placed above to mitigate the risk of unintentional excavation. Impermeable barriers, or check dams, would be placed in the sand layer at regular intervals to prevent the trench acting as a water conduit with more frequent spacing between barriers on steeper gradients. Restoration would be carried out to relay the previously stripped top layer of peat turfs containing the seed bank, over the top of the cable trench. This restoration would be conducted following the backfilling of each cable trench section

4.7.35 In all cases, the cables would be buried to a depth of approximately 1 m. At track crossings and within concrete foundations, the cables would be laid within plastic ducts.

Meteorological Monitoring Mast

4.7.36 As discussed in Chapter 3, up to two permanent met masts would be required as part of the proposed development. The mast would be a free standing, steel lattice tower, connected to a concrete base which would typically be 6 m x 6 m and 3 m deep. The mast would be up to 80 m in height. The foundation for the meteorological mast would be constructed similarly to the turbine foundations, as described in Section 4.7.22.

Construction compound

4.7.37 The construction compound is to be located on the west of the site to the North of T2 and adjacent to the existing estate roads. This area for construction facilities, material storage, fuel and chemical storage and site vehicles would be built by firstly stripping topsoil/peat layer down to a firm substrate. A layer of geotextile and geogrid material would then be placed, with a layer of granular fill approximately 500 mm deep compacted on top. The stripped topsoil/peat layer would be stored adjacent to the site, with the subsoil stripped and stored separately. No materials would be stored near any watercourses

4.7.38 The facilities would be self-contained and no discharge of drainage would be made to the surrounding land unless otherwise agreed with SEPA and the local authorities. A typical layout is described in Figure 4.4.

Restoration

4.7.39 On completion of erection and installation works, it is proposed that the areas of hardstanding would remain as they would be required during the operational and decommissioning phase of the wind farm.

4.7.40 For all other areas affected by the works, the vegetation layer would be reinstated as soon as is practical and the surrounding grassland vegetation would be promoted to re-colonise the area and reduce the visual impact.

4.8 Construction and Decommissioning Management

4.8.1 Prior to the commencement of construction, a CMS would be produced setting out in detail the individual items of works associated with the construction of the proposed development. It would consider relevant planning conditions and ensure that each activity is carried out safely, in accordance with best practice and the relevant guidelines, to minimise environmental impact, and in accordance with SEPA's pollution prevention guidance.

4.8.2 All phases of the construction and decommissioning would be carried out in accordance with the approved CMS and would be managed by the Principal Contractor.

4.8.3 Typically the CMS document would cover the following topics:

- Site Health and Safety Plan;
- Environmental considerations e.g. sympathetic construction methodology with regard to the site specific Ecological, Hydrological, Geotechnical and Archaeological conditions;
- Location and Description of proposed development;
- Consent and Regulation Approvals e.g. discharge of planning conditions;
- Phasing of all construction works;
- Environmental Management Plan (EMP) including: Baseline Monitoring, Construction Monitoring and Ongoing Operational Monitoring - Ecological, Hydrological, Geotechnical and Archaeological;
- Pre-construction survey work and site investigations;
- Working Hours for construction and deliveries;
- Identification of pollution prevention measures and mitigation;
- Measures to mitigate the effect on the living conditions of local residents with particular reference to noise, dust, shadow flicker/reflected light and visual impact;
- Site surface water drainage during construction and post construction;
- Control of substances hazardous to health (COSHH);
- Turbine Description/Specification;
- Construction Schedule;
- Public Highway Works;
- Site Tracks;
- Temporary Construction Compound;
- Crane Pads;
- Cable Trenches;
- Foundation Works;
- On-site Substation and Control Building;
- Emergency Procedures;
- Restoration and Decommissioning; and
- Ongoing operational monitoring.

4.8.4 Agreeing the construction methodology during the post-consent/pre-construction stage can prove effective in securing accurate and realistic method statements. At that stage of the project, additional data would be available for consultation in the form of detailed site investigations. Furthermore, the civil engineering contractor and the turbine supply contractor would have been chosen, enabling more detailed preparation of individual method statements.

4.8.5 During the preparation of the CMS, correspondence and meetings with SNH, SEPA, Perth and Kinross Council (PKC) and other relevant consultees would be undertaken to review the working methods proposed and if necessary, incorporate changes. The iterative process of preparing the CMS ensures that when construction commences there is a documented procedure and risk assessment in place. This makes monitoring of the construction activities, either by the appointed site representative or by the various bodies associated with the preparation of the document, more straightforward.

4.8.6 Each section of the CMS would provide a detailed description of the task to be completed along with risk assessments, where necessary, covering items such as waste management, pollution prevention, control of waters, nuisance and material use.

4.8.7 A section of the CMS regarding the handling and storage of peat would be prepared in accordance with recommendations from a suitably qualified geotechnical engineer, ecologist and hydrologist following the detailed site investigation. Peat slide risk assessment works have been carried out to provide input to the layout design and the results show that through geotechnical risk management, strict construction management and implementation of relevant control measures, the risk of peat failure across the site is low to very low.

4.8.8 The peat slide risk assessment is discussed further in Chapter 11 of this environmental statement. Additional detailed ground investigation would be conducted prior to construction. In respect of matters regarding construction methodology and peat stability at the site, the following general recommendations would be adhered to and would form part of the overall CMS documentation:

- Environmental awareness briefings would be provided to all staff entering the site; this would include a basic environmental site induction;
- Avoid placing excavated material and local concentrated loads on peat slopes;
- Avoid uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge;
- Avoid placing fill and excavations in the vicinity of steep slopes;
- During construction install and regularly monitor geotechnical instrumentation as appropriate, in areas of possible poor ground such as deeper peat deposits;
- Implement site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions are to be assessed by a suitably experienced geotechnical engineer;
- Form a contingency plan to detail the level of response to observed poor ground conditions;
- Routinely inspect the wind farm site by maintenance personnel including an assessment of ground stability conditions;
- Carry out an annual inspection of the site following completion of works by suitably experienced and qualified geotechnical specialist;
- Maintain stored peat in a suitable condition to minimise the peat drying out; and

- Minimise the need to handle stored peat so as to reduce any drying or changes to the peat.

4.8.9 The layout of the site infrastructure has predominantly been sited on the shallower and more stable areas of peat to minimise the impacts on the peat habitat. This is discussed in detail in the Peat Stability Risk Assessment in Appendix 11.1. However all procedures would follow best practice guidelines.

4.8.10 Other sections relating to site-specific items including landslide hazard and geotechnical risk register, identified during the pre-construction phase would also form part of the CMS. It is intended that the CMS would be an evolving document and staged completion of the document would be undertaken in line with the progression of construction. Updating of the document to reflect changes in the methods to be used would also be carried out, as and when necessary.

4.8.11 Any construction works required at the onsite substation and the grid connection can be lengthy processes which would commence early in the construction programme to allow a live grid connection to coincide with the commissioning of the first phase of turbines.

4.9 Potential Construction and Decommissioning Phase Environmental Impacts

4.9.1 This section discusses the mitigation measures that would typically be employed during construction, operation and decommissioning to ensure that environmental impacts are avoided or minimised.

4.9.2 Mitigation measures are discussed further within this environmental statement; however, the potential construction and decommissioning phase environmental impacts would be addressed through specific mitigation outlined within specific construction method statements prepared prior to construction commences, e.g. CMS, EMP, TMP, Drainage Management Plan (DMP), PMP etc.

4.9.3 Some of the activities with the potential to impact on the environment and typically taken into consideration are as follows:

Earthworks

4.9.4 Excavation and filling operations have the potential to impact the environment. All excavations would be inspected for water inflow and supported, where necessary, to prevent collapse. All filled embankments would be graded and drained to prevent slippage and possible siltation of the existing water courses

4.9.5 Settlement lagoons would be used where there is a risk of siltation. These lagoons would be located away from watercourses with details included as part of the CMS. Any drainage from the works would be collected and treated prior to discharge via the Sustainable Drainage System (SuDS).

Drainage

4.9.6 Inadequate or inefficient drainage has the potential to affect the natural hydrology. SEPA Pollution Prevention Guidelines 5: Works In, Near or Liable to Affect Watercourses as well as Pollution Prevention Guidelines 6: Working at Construction and Demolition Sites would be adhered to.

Concreting

4.9.7 Cement entering a watercourse can have a detrimental effect by drawing oxygen from the water and increasing its alkalinity. Particular care would be taken when pouring concrete in the vicinity of watercourses and in areas of deeper peat to prevent cement or concrete from entering the natural systems.

4.9.8 SEPA would be consulted during the preparation of the CMS to ensure that the appropriate measures are in place. This may include construction of a settlement pit within the construction compound or elsewhere for treating rinse water from concrete delivery vehicles and measures to prevent water from entering excavations in the vicinity of watercourses.

Construction Compound and Facilities

4.9.9 Fuel and chemical spillage would present a risk to the natural environment. All construction equipment would be inspected on a daily basis to check for spillages. Drip trays would be used when refuelling vehicles on the site. Emergency spill kits would be kept on site adjacent to the fuel storage area and with the mobile bowser.

4.9.10 Site operatives would be briefed on the emergency procedures to be undertaken in the event of a spillage. The principal contractor would have a 24-hour emergency response company on standby in the event of a spillage incident. Vehicles would be refuelled at their working location to prevent loss of time and use of fuel returning to any designated refuelling areas. All previous stated measures would be used when refuelling vehicles and the bowser operator would be suitably trained to deal with any spillage.

4.9.11 The washout bay would be maintained as necessary by replacing the granular fill with clean stone. At close of construction, all material within the washout bay would be removed from site and the area reinstated.

Public Safety

4.9.12 Throughout the construction phase of the proposed development the relevant statutory requirements would be adhered to. All potentially hazardous areas would be fenced off and all unattended machinery would be stored in the site compound or immobilised to prevent unauthorised use. In addition, temporary construction safety signs would be placed at each site entrance and in areas where there may be further danger, e.g. edge protection around settling lagoons and excavations.

4.9.13 Throughout construction, measures to manage diversion routes would be put in place. The diversion routes would be clearly marked and for safety reasons would direct the user away from any areas of construction.

4.10 Glossary

CMS – Construction Method Statement

COSHH - Control of Substances Hazardous to Health

EMP - Environmental Management Plan

TMP – Traffic Management Plan

DMP - Drainage Management Plan

OHMP – Outline Habitat Management Plan

PMP - Peat Management Plan

PKC – Perth and Kinross Council

SEPA – Scottish Environment Protection Agency

SNH – Scottish National Heritage

SuDS – Sustainable Drainage Systems