TA2.1 Construction Environmental Management Plan

Glenshero Wind Farm
Technical Appendix 2.1
Construction Environmental Management Plan

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1.0 INTRODUCTION

This is an Outline Construction and Environment Management Plan (CEMP) which is intended to show the principals which would be detailed in a CEMP which would be agreed prior to construction commencing. This would be agreed with The Highland Council (THC) and relevant statutory consultees. The CEMP would, as a minimum, include details of:

- schedule of mitigation;
- construction methodologies;
- pollution prevention measures;
- public liaison provision;
- peat slide, erosion and compaction management;
- control of contamination/pollution prevention;
- drainage management;
- water quality monitoring;
- management of construction traffic;
- control of noise and vibration; and
- control of dust and other emissions to air.

2.0 GENERAL CONSTRUCTION MANAGEMENT PRINCIPLES

The Principal Contractor would be responsible for ensuring that a Construction Phase Plan is prepared and implemented on site. All work would be carried out in accordance with:

- The Health and Safety at Work etc. Act 1974;
- The Construction (Design and Management) Regulations 2015; and
- All applicable third party safety guidelines.

2.1 Environmental Management and Pollution Prevention

2.1.1 Pollution Prevention and Control

The CEMP would detail a number of measures to deal with pollution prevention, including procedures such as 'Environmental Requirements of Contractors', 'Water Quality Monitoring Procedure' and 'Procedure in the Event of a Contaminant Spill'.

SEPA has produced Guidance for Pollution Prevention (GPP) for Works and maintenance in or near water: GPP 5 (Version 1.2 February 2018) and PPG 6 for Working at Construction and Demolition Sites for civil engineering contractors (2012). The proposed wind farm would be constructed using best practice to conform with these requirements.

Contractors and sub-contractors would be required to follow the Pollution Prevention Guidance published by SEPA, and the following pollution control measures would be incorporated into the CEMP:

- equipment would be provided to contain and clean up any spills to minimise the risk of pollutants entering watercourses, waterbodies or flush areas;
- trenching or excavation activities in open land would be restricted during periods of intense rainfall and temporary landscaping would be provided as required to reduce the risk of oil or chemical spills to the natural drainage system;
- sulphate-resistant concrete would be used for the construction of turbine bases to withstand sulphate attack and limit the resultant alkaline leaching into groundwater;

- all refuelling would be undertaken at designated refuelling points. There would be no refuelling within catchments contributing to private water supply points;
- equipment, materials and chemicals would not be stored within or near a watercourse. At storage sites, fuels, lubricants and chemicals would be contained within an area bunded to 110%. All filling points would be within the bund or have secondary containment. Associated pipework would be located above ground and protected from accidental damage;
- any on-site concrete wash-out would occur in allocated bunded areas;
- drip trays would be placed under machinery left standing for prolonged periods;
- all solid and liquid waste materials would be properly disposed of at appropriate off-site facilities;
- routine maintenance of vehicles would be undertaken out with the site;
- there would be no unapproved discharge of foul or contaminated drainage from the proposed wind farm either to groundwater or any surface waters, whether direct or via soakaway;
- sanitary facilities would be provided and methods of disposal of all waste would be approved by SEPA;
- a programme of surface water quality monitoring would be undertaken during the construction phase to provide assurances as to the absence of water quality impacts; and
- no wind turbines, auxiliary and electrical equipment would contain askarels or Polychlorinated biphenyls (PCBs).

In the unlikely event of an environmental pollution incident, there would be an emergency response procedure to address any accidental pollution incident. For example, a procedure requiring the use of spill kits to contain the material and procedures to ensure that SEPA is notified immediately would be applied.

2.1.2 Contractors Requirements

A Principal Contractor would be appointed and they would ensure that all employees, sub-contractors, suppliers and other visitors to the site are made aware of the content of the CEMP and its applicability to them. Accordingly, environmental specific induction training would be prepared and presented to all categories of personnel working on and visiting the site.

As a minimum, the following information would be provided to all inductees:

- Identification of specific environmental risks associated with the work to be undertaken on site by the inductee;
- Summary of the main environmental aspects of concern at the site as identified in the CEMP; and
- Environmental Incident and Emergency Response Procedures (including specific Environmental Communication Plan requirements).

A conveniently sized copy of an Environmental Risk Map or equivalent would be provided to all inductees showing all of the sensitive areas, exclusion zones and designated washout areas. The map would be updated and reissued as required. Any updates to the map would be communicated to all inductees through a tool box talk given by specialist environmental personnel. Regular tool box talks would be provided during construction to provide ongoing reinforcement and awareness of environmental issues.

2.1.3 General Drainage Design

Buffers to watercourses have taken into consideration, and the proposed wind farm’s infrastructure has been designed in accordance with best practice guidance.

The potential impact of preferential routing of drainage and associated erosion and sediment wash-off within the sub-catchments draining the site would be mitigated through the following measures which would be incorporated into the SuDS Design:

- site track construction materials would be free draining, strong, durable and well graded;
- attenuation ponds and silt fences would be provided adjacent to the drains to prevent pollution and sedimentation of watercourses;
- direct drainage into existing watercourses would also be avoided to ensure that sediment and runoff from disturbed ground is not routed directly to the watercourses;
- Appropriate scour prevention and energy dissipation structures would be constructed at each culvert outlet. Where appropriate, a shallow, lateral drainage swale would be installed at the toe of site track cuttings to intercept the natural runoff. This lateral drain would be piped under the track at regular intervals through correctly sized cross drains away from watercourses. Appropriate scour prevention and energy dissipation structures would be constructed at each culvert outlet;
- flow and sediment transport in any track drainage swales would be minimised by reducing concentrated flows, installing regular cross culverts and the use of checkdams placed at regular intervals within the trackside drainage swales;
- track drainage swales, where required, would discharge into attenuation ponds excavated on the downslope side, or silt fences. A shallow drainage swale would be cut directly downhill as a fan and at minimum slope until the bottom of the swale reaches the natural surface level. The discharge point of track drains would be constructed to minimise concentrated flows and ensure flows are dispersed over a large area with appropriate surface protection;
- the depth of individual drainage swales would be kept to the minimum necessary to allow free drainage of the tracks and swale lengths would be minimised to avoid disruption of natural drainage paths. Direct drainage into existing watercourses would be avoided to ensure that sediment and runoff from disturbed ground is not routed directly to the watercourses; and
- clay or peat plugs would be inserted within cable trenches at a frequency agreed with the Ecological Clerk of Works (ECoW) to suit the specific location to prevent gullying of trenches and preferential routing.

2.1.4 SuDS

A full SuDS solution would be developed prior to construction in consultation with SEPA.

A SuDS design would reduce the sediment/silt loads in construction and post construction runoff by providing a "treatment train" of pollutant removal to all surface water runoff, nominally by:

- ensuring that drainage swales are designed to convey flows at a low velocity by using a flat-bottomed swale profile;
- encouraging vegetation growth in the base of all linear drainage to provide additional sediment removal from flows;
- providing settlement and filtration features in all linear drainage swales (stone check dams, filtration dams) to reduce flow velocity and encourage settlement of silts;
- installing temporary silt fencing to provide extra protection to waterways / environmentally sensitive areas during the construction phase;
- providing settlement ponds at turbine hard standing areas to manage both sediment generated both during and post construction;
- ensuring that the final discharge points of the SuDS treatment train are located on stable, undisturbed, vegetated ground, allowing flow entrained sediment to drop out of flows. Providing silt fencing at outlets if required; and

- preventing discharge of construction runoff directly to existing watercourses or natural drainage channels. All discharges are to be via a SuDS feature to improve water quality prior to final discharge to the environment.

2.1.5 Runoff and Sediment Control Measures

The following measures would be used to mitigate any potential impacts on the water quality of the sub-catchments through peat erosion, stream acidification and metals leaching during construction. These are incorporated into the CEMP:

- appropriate sediment control measures (silt fences, attenuation ponds, etc.) would be used in the vicinity of watercourses, springs or drains where natural features (e.g. hollows) do not provide adequate protection;
- sediment control measures (e.g. checkdams, silt fences etc.) would be employed within the existing artificial drainage network during construction. These would be regularly checked and maintained during construction and for an appropriate period following completion. Consideration would be given to the permanent infilling of any major drains;
- watercourses would be monitored throughout the construction period by the ECoW to identify any enhanced scouring of the catchment surface. If sediment from disturbed peat is excessively mobilised through the minor channels network these would be mitigated by temporary sediment control measures (e.g. geotextiles/straw/bales/brash);
- the extent of all excavations would be kept to a minimum and during construction activities surface water flows would be captured through a series of cut-off drains to prevent water entering excavations or eroding exposed surfaces. If dewatering of excavations is required, pumped discharges would be passed through attenuation ponds and silt fences to capture sediments before release to the surrounding land;
- where there is a permanent relocation of peat, the ground would be reinstated with vegetation as soon as practicable;
- where practicable, vegetation over the width of the cable trenches would be lifted as turfs and replaced after trenching operations to reduce disturbance.

2.1.6 Foul Water Management

Foul drainage would be provided in agreement with the relevant authorities and most likely involve the installation of a septic tank and soakaway.

2.1.7 Site Waste Management

A Site Waste management plan would be prepared designed to follow the principles of;

- Avoidance – select products and processes which remove the production of waste;
- Minimisation- minimise waste generated through specification of products and methods;
- Separable- any waste products generated should be easy to separate into distinct types for ease of handling and;
- Recyclable- where possible any waste generated should be suitable for re-use or recycling.

Any residual waste should then be handled, transferred and disposed of in line with best practice and current legislation.

2.1.8 Noise Management & Construction Working Hours

The sources of construction noise are temporary and vary in location, duration and level as the different elements of the wind farm are constructed. Construction noise arises primarily through the operation of large items of plant and equipment such as bulldozers, diesel generators, vibration plates, concrete mixer trucks, rollers etc. Noise also arises due to the temporary increase in construction traffic near the site.

BS 5228-1:2009 *Noise control on construction and open sites; Part 1 – Noise* is identified as being suitable for the purpose of giving guidance on appropriate methods for minimising noise from construction activities.

For all activities, measures would be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Section 72 of the Control of Pollution Act 1974.

The following noise mitigation measures would be implemented where appropriate and in line with further guidance from BS 5228-1;

- Consideration would be given to noise emissions when selecting plant and equipment to be used on site. Where appropriate, quieter items of plant and equipment would be given preference.
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources would be sited as far as reasonably possible from residential properties and, where necessary and appropriate, acoustic barriers installed to further reduce the impact;
- The movement of vehicles to and from site would be controlled; and
- Employees would be instructed to ensure compliance with the noise control measures adopted.

Should it be considered necessary to further reduce noise levels, mitigation measures would be considered and appropriate measures would be undertaken.

There are many strategies that could be employed to reduce construction noise levels; BS 5228-1 also states that the 'attitude to the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local community should occur. Non-acoustic factors such as mud on roads and dust generation, which can also influence the overall level of complaints, would also be controlled as detailed elsewhere in the CEMP.

In the event that noise complaints are received, the complainant would be contacted and if required, the property visited to discuss the complaint and subjectively assess the noise levels. If the noise complaint is found to be merited, additional mitigation measures would be put in place.

In the event a resolution cannot be reached, the planning authority would be informed in order that they can carry out their own subjective assessment and if required agree any additional mitigation.

All noise complaints would be recorded along with actions taken to resolve the issue. These records would be available to the Council on request.

The normal hours of work for the construction phase would be restricted in time to Monday to Saturday from 7.00am to 7.00pm. There would be no deliveries made to the site after 13:00 on Saturdays.

2.1.9 Dust Management

The potential issue of dust creation during the works would be weather and season dependant, therefore detailed dust management methods would be subject to the works programme and contractor working methods.

Dust management would be carried out at all times in accordance with industry best practice to ensure that any local sensitive receptors are not affected by nuisance levels of dust from the works.

With reference to planning condition 6e, the following methods of dust suppression would be implemented during the construction phase of the wind farm as required:

- Site tracks to be damped down using bowser or other suitable system;

- Road sweeper to be used to remove loose material from adjacent public roads during construction;
- Cleaning of vehicles, including provision of waterless wheel washing facilities, prior to exiting site onto the public road;
- Soil erosion control measures;
- Speed limits to be put in place to ensure low vehicle speeds;
- Vehicle loads to be covered;
- Damping of dry excavations and cutting activities which generate dust; and
- Sequencing of works to minimise the time that soils are exposed.

2.1.10 Peat Management Plan

A separate Draft Peat Management Plan is provided as EIAR Volume 4: Technical Appendix 2.5. This provides details of the predicted volumes of peat that would be excavated for the proposed wind farm, the characteristics of the peat that would be excavated, and how the excavated peat would be reused and managed. This document would be updated during the detailed design stage and agreed with SEPA prior to construction.

In line with best practice, the following order of preference would be used to relocate predominantly excess peat spoil:

- reinstatement locally around construction works – peat excavated for the construction compound and turbine foundations would be replaced on completion of the works as part of the reinstatement of the site to minimise movement of materials;
- along access tracks – floated tracks would incorporate stabilisation bunds to enhance stability. In addition, the peat would be stored in strips on one or both sides of the tracks as identified during detailed design. Design criteria would include consideration of peat thickness and strength, slope angle and effect of surcharge on stability and would include specification of maximum permitted mound heights;
- landscaping in and around the site infrastructure – any cut and/or fill sections of infrastructure would be landscaped using excess peat from excavations to reduce visual impact;
- any additional stockpile locations would be identified based on similar criteria to track-side storage; and
- at locations where relocation of excess material is required, the vegetation would be stripped, stored and replaced to re-establish growth and provide erosion protection as soon as reasonably practicable. All stockpiles, temporary and permanent, would be designed with appropriate drainage systems and include a monitoring plan to provide early warning of potential peat slide events. A response plan would also be put in place to provide fast and effective action in the event of any peat movement.

2.2 Temporary Lighting

Temporary lighting would be required at the temporary construction compounds for security purposes and to ensure that a safe working environment is provided to construction staff. In addition, temporary lighting may be required to ensure safe working conditions at infrastructure locations during construction.

All temporary lighting installations would be downward facing and all lights would be switched off during daylight hours and out with working hours.

2.3 Peat Slide, Erosion and Compaction Management

Management of the risk of peat slides is now recognised in literature, and a range of measures have now become standard engineering practice for construction of roads over peat. These measures would be adopted, as appropriate, on site, ensuring that:

- concentrated loads, such as those arising from stockpiling of material from turbine foundation excavations, would not be placed on marginally or potentially marginally stable ground;
- concentrated water flows arising from any aspect of construction or operation of the proposed wind farm would not be directed onto peat slopes and unstable excavations;
- construction would be supervised on a full-time basis by engineers fully qualified and experienced in geotechnical matters;
- robust drainage plans would be developed;
- work practices would be reviewed, modified as necessary and adopted to ensure that existing stability is not compromised; and
- appropriate ground investigation and movement monitoring practices would be adopted.

The major contributory factor resulting in peat slide is heavy rain. Almost invariably, peat-slide events are preceded by unusual weather conditions typically characterised by a long dry summer that leads to desiccation cracking of the peat profile followed by a prolonged continuous rainfall including exceptionally heavy rainstorms.

The condition of the sliding surface at the base of the profile has a strong influence on potential mobility and depends on the regularity and smoothness or roughness of the underlying rock-head.

According to the 'Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments', peat slides tend to occur in shallow peat (less than 2 m deep) and where the slope is steeper, between 5° and 15°.[1]

A separate Peat Landslide Hazard and Risk Assessment is provided as EIAR Volume 4: Technical Appendix 2.6. This document recommends the adoption of the following list of controls that should be considered for incorporation into the development of construction methodologies for the works in all areas of peat during detailed design stage and agreed with SEPA prior to construction:

- Appropriately experienced and qualified engineering geologist/geotechnical engineer is appointed during the construction phase, to provide advice during the setting out, micro-siting and construction phases of the works;
- Geotechnical Risk Register is developed and maintained by the appointed geotechnical engineer;
- A minimisation of "undercutting" of peat slopes, but where this cannot be avoided, a more detailed assessment of the area of concern by the geotechnical engineer would be required;
- Careful micro-siting of turbine bases, crane hardstandings and access track alignments to minimise effects on the prevailing hydrology;
- Although the risk of a peat slide is considered to be low for the majority of the proposed development, it is recommended that methodologies should be developed as a contingency to minimise the effects to watercourses in the unlikely event of peat instability; and
- Use of floating track across areas of deep peat.

2.4 Post Construction Restoration and Reinstatement

During construction of the infrastructure elements (detailed in Section 3), the vegetated layer would be stripped from the area of the excavation and stored locally with the growing side up. The remaining organic topsoil and subsoils would be excavated down to formation level, or a suitable stratum, and again would be stored local to the point of excavation but would remain segregated to avoid mixing of materials.

[1] Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments Second Edition, April 2017, Prepared for Energy Consents Unit Scottish Government

Temporary storage areas would take cognisance of all identified buffer areas and be stripped of vegetation prior to stockpiling in line with best working practices. As construction is progressed the effectiveness of the buffer zones would be reviewed and if necessary adjusted. Alternatively the construction procedure may be reviewed and altered or additional control measures put in place.

Post-construction reinstatement would be undertaken as work progresses to minimise the period of time any organic material is stockpiled. Subsoils would be used in landscaping and backfilling around structures while the vegetated layer and/or topsoil would be used to reinstate storage and working areas, road verges, drainage swales and embankments. In addition, following the completion of the works, a final inspection of the wind farm site would be undertaken and in circumstances where reinstatement using vegetation and/or topsoil is unsuccessful alternative methods would be considered.

Upon completion of all construction works, the temporary construction compounds would be reinstated to their approximate pre-wind farm condition. All temporary structures and construction equipment would be removed and the granular material that forms the hardstands would be moved to areas agreed with the landowner or removed from site. Following this, the areas would be backfilled with material stripped and stored during the construction of the wind farm and reseeded as required.

In line with construction best practice and to suit the ground conditions anticipated on site, the track and hardstanding design has endeavoured to minimise spoil generated during construction.

2.5 Traffic Management

As detailed in EIAR Volume 2: Chapter 8: Traffic and Transport, a Construction Traffic Management Plan (CTMP) and aTraffic Management Plan (TMP) would be developed to ensure road safety for all users during transit of development loads. The TMP would outline measures for managing the convoy and would set out procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. The TMP would be developed in consultation with THC, the police, highways authorities and the local community and agreed before deliveries to the proposed wind farm commence.

2.6 Environmental

An Ecological Management Plan (EMP) would be prepared and implemented through the CEMP to set out the measures required to protect and enhance ecology and hydrology at the proposed wind farm during the construction phase, including pre-construction surveys, habitat management, water quality and biodiversity enhancement. The detail of the EMP would be prepared and agreed with SNH prior to commencement of construction.

An ECoW would be appointed and would be present during the construction and restoration period to ensure that ecological and hydrological impacts are appropriately mitigated in accordance with the EMP.

It would be the duty of the ECoW to check the status of the protected species and associated protected features immediately prior to construction activity progressing across the proposed development and to continue spot checks during construction for any new protected species features in the vicinity of the construction works.

Arrangements for pre-construction ecological monitoring would be conducted within 6 months of construction commencement. A protection plan designed to increase the protection levels and reduce general disturbance of protected species and associated protected features from the proposed development are detailed in EIAR Volume 4: Technical Appendix 6.6: Species Protect Plan.

2.7 Archaeological

Whilst no specific archaeological or cultural heritage concerns have been identified during the development of Glenshero Wind Farm, all staff involved in intrusive works would be briefed on the potential to uncover features or items of archaeological interest. The site induction would contain details of how in the unlikely event of uncovering something, work would be stopped and matters escalated as appropriate.

2.8 Community Liaison

During the construction period, a community liaison group would be set up to disseminate information and take feedback and the project website would be regularly updated to provide the latest information relating to traffic movements associated with vehicles accessing the site. This would be agreed with THC as the Local Roads Authority. An Outdoor Access Management Plan is provided in EIAR Volume 4: Technical Appendix 2.10 and sets out public access arrangements that would be put in place during the construction period.

3.0 DESIGN PHILOSOPHY AND CONSTRUCTION METHODS

3.1 Site Entrance and Public Road Upgrades

Access to the site would be via the existing site entrance constructed as part of Stronelairg Wind Farm. Wheel cleaning facilities would be set up at the site entrance to remove mud from the wheels of vehicles leaving the site. Public roads would be inspected daily and the road swept to remove any mud or debris transferred onto the roads from site activities.

3.1.1 General Construction Method

No works to upgrade the existing site entrance is envisaged based on the current candidate turbine.

3.2 Temporary Construction Compounds, Site Tracks and Crane Hardstands

3.2.1 Temporary Construction Compounds

Temporary construction compounds would be required for the provision of site offices, welfare facilities and storage arrangements for materials, plant and equipment. There are a total of three temporary construction compounds required for different areas and stages of the project.

The temporary construction compounds would be constructed at the locations indicated on (EIAR Volume 3: Figure 2.1).

The gatehouse compounds would be built to provide security points and to control movements on site along with the provision of car parking for personnel working on the wind farm.

The central temporary construction compound would be the main compound for the site with welfare facilities at this location.

An area would be assigned for the storage of fuels and chemicals, ensuring any spillage is captured and appropriately dealt with.

3.2.2 Site Tracks

The running width of the tracks would be typically 4.5 m on straight sections, increasing at corners and passing places to accommodate the swept path of wind turbine generator delivery vehicles. The track working area would be kept to the minimum required allowing for working area, safe access, drainage and electrical works.

Site tracks would consist of a compacted stone structure and a number of track designs may be utilised on site which would be determined during detailed design, dependent on the ground conditions encountered on site and include:

- Excavated track; and
- Floating track.

Track drainage would be incorporated within the design in accordance with sustainable drainage design principles. Where the road alignment crosses existing drainage channels, crossings appropriate to the location would be designed in accordance with the relevant guidelines.

A buffer zone in accordance with the relevant guidance from SEPA would be maintained around watercourses. Site personnel would be made aware of the buffer zones through the site induction and specific tool box talks.

Excavated Track

Excavated track construction would be used in areas identified where the thickness of soft soils is low, and the underlying layer has adequate load bearing properties. This track system would likely consist of a suitable capping layer and then a suitable running layer.

Floating Track

Floating track construction would be adopted where the ground conditions require. This track system involves installing geosynthetic reinforcement directly onto the organic or exposed soil layer and placing layers of suitable stone and additional geosynthetic reinforcement (as required) above until the track design level is achieved.

Floating track would also be adopted where it would be appropriate to protect areas of GWDTE by minimising impacts on shallow sub-surface flow paths as detailed in EIAR Volume 4: Technical Appendix 6.1.

3.2.3 Crane Hardstands

The main crane hardstand area is anticipated to be 40m x 20m. There may be additional temporary hardstand areas required for the erection of the main crane, lay down of materials and turbine components.

The main crane hardstand area would be left uncovered for the operational lifetime of the wind farm in line with good practice outlined in the Scottish National Heritage guidance *Good Practice during Windfarm Construction.* Temporary crane hardstand elements would be reinstated post construction.

All crane hardstands would consist of one or a combination of the following:

- A compacted stone structure bearing directly on a suitable formation strata;
- A compacted stone structure bearing on a formation strata strengthened through ground improvement techniques; or
- A compacted stone structure bearing on a strengthened soil mass created by the installation of multiple stone or concrete columns.

3.2.4 General Construction Method

Where competent soils exist close to the existing ground surface the following construction method would typically be followed:

- Track alignments would be established from the construction drawings and marked out with ranging rods, timber posts or steel pins.
- Track corridors would be pegged out 500m - 1000m in advance of operations.
- Where possible, upgraded tracks would re-use the structure of the existing track to reduce construction requirements.
- Material would be excavated and stored.
- Excavated track construction would be used where soils are identified as being shallow. This track system would likely consist of a suitable layer of crushed aggregate, either spread by a dozer or placed by an excavator, prior to being compacted in layers by vibratory rollers. If ground conditions dictate a geotextile membrane would be applied.
- Floating track construction may be adopted where the ground conditions dictate. This system involves installing a geosynthetic reinforcement directly onto the organic vegetated layer and placing layers of suitable stone and additional geosynthetic reinforcement (if

required by the design) above. If ground conditions require a geotextile membrane may be applied also.

- Drainage swales would be excavated adjacent to the tracks where required. Surface water runoff would not be allowed to discharge directly into existing watercourses but would be routed through a Sustainable Drainage System (SuDS).
- A surface water cut off ditch may be installed on the slope above the earthworks footprint where achievable given the topography.
- Where the road alignment crosses existing drainage channels, crossings appropriate to the location would be designed in accordance with the relevant guidelines.
- Depending on depth and type of material, cut slopes are anticipated to be between 1:1 to 1:3.
- Post construction reinstatement shall be in line with the details of section 2.5.

Should the load bearing properties of the underlying soils are determined to be insufficient, ground stabilisation may be carried out to provide adequate bearing capacity of the formation level. Due to the variable nature of the ground at the site, specific construction methods shall be selected at detailed design stage in consultation with specialist contractors. Such methods may consist of:

- Compaction of the existing in situ soils;
- Lime/cement stabilisation of the existing in situ soils; or
- Installation of stone or concrete columns to provide adequate support.

3.3 Turbine Foundations

Wind turbine generator foundations would be designed in accordance with the relevant design standards. Due account would be taken of guidance provided in appropriate codes and standards such as Eurocodes, British Standards and other specialist design documents.

Due to the anticipated load bearing capacity of the near surface soils, gravity base turbine foundations are expected to be used to support the wind turbine.

The foundations would be designed as a reinforced concrete slab. The foundation geotechnical design would be based on the information contained in the site investigation reports, yet to be carried out.

3.3.1 Gravity Base Turbine Foundation Construction Method

The gravity base turbine foundation construction method would generally be as follows:

- The topsoil would be excavated and stored to one side for reuse during the landscaping round the finished turbine;
- Excavation would be undertaken to competent material. Excavated subsoil material may be stockpiled temporarily adjacent to the excavation for later use as backfill or stored elsewhere on site. Temporary and permanent drainage shall be installed at the same time as the excavation works;
- In the case where competent material is lower than the required formation level the foundation would likely be over-excavated to competent material and compacted engineering fill placed to the required formation level;
- Where excavation is required to extend below the water table or in material which does not drain freely, appropriate pumping would be employed to keep the excavation dry. Water pumped from an excavation shall not be discharged directly to any watercourse;
- A layer of concrete blinding would be laid directly on top of the newly exposed formation, finished to ensure a flat and level working surface;
- Steel reinforcement, the turbine anchorage system and cable ducts would be fixed in place and formwork erected around the steel cage;

- Concrete would be placed using a crane, pump or other suitable lifting device and compacted using vibrating pokers;
- The foundation would be backfilled with suitable material, and landscaped using the vegetated soil layer set aside during the initial excavation; and
- A gravel path would be built leading from the access track or crane hardstanding to the turbine door or access steps and around the turbine for maintenance.

3.4 Turbines and Turbine Transformers

3.4.1 Turbines

The turbine would be supplied with a light grey semi-matt finish (RAL colour 7035).

The turbines would not carry any symbols, logos or other lettering except where required under other legislation. However, turbine numbers would be added to the base of each tower to aid service engineers during the operational phase of the wind farm.

In line with health and safety best practice, turbine manufacturers have indicated a preference to locate a passive infra-red (PIR) detector and light above each turbine door. It should be noted that this lamp would not be permanently lit and would only be switched on by the PIR when personnel approach a particular turbine.

3.4.2 Turbine Transformers

Turbine transformers would either be placed internally within the turbine.

Oil or gas cooled transformers would be supplied full of oil and would not require topping up on site. The transformers would be sealed and would be inspected for any damage prior to offloading. Air cooled or cast resin transformers do not require cooling oil.

The transformers would be located within the turbines which shall be locked, accessible by trained and authorised personnel only, and displaying appropriate warning signs.

3.4.3 General Turbine Erection Method

The following general steps would be undertaken in order to erect the turbines on site:

- Some turbine components would be pre-delivered in sections to the site and offloaded at the crane hardstands;
- The remaining turbine components would be delivered on a just-in-time basis and be lifted directly from vehicle trailers;
- Turbine components would be lifted by adequately sized cranes (one main crane and one smaller assist crane) and positioned on the foundations / other turbine sections until the entire turbine is erected;
- Upon completion of the erection all fasteners would be tightened and the internal fit out of the turbine undertaken;
- The turbines would then be connected to the wind farm substation; and finally
- Turbine testing and commissioning would be undertaken before the turbines would be handed over as complete.

3.5 Control Building and Substation Compound

Cables would export power from the wind turbines to the control building and substation compound before being transferred to the local distribution network. The location of the control building and substation compound is shown in EIAR Volume 3 Figure 2.1.

The wind farm substation and control buildings have been designed, sized and positioned to be minimise visual impact. The control buildings would be constructed using steel portal frames clad in a visually recessive colour with major openings positioned away from major view sheds to minimise visual clutter.

The detailed design of the foundations for the building would be based on the site investigation reports and building requirements, and would ensure loads associated with the building are transferred to the appropriate bearing layer in the sub-stratum.

Foul drainage would be provided in accordance with Building Control requirements and in agreement with SEPA.

3.5.1 General Construction Method

The control building and substation compound would generally be constructed in accordance with the following:

- The plan area of the control building and substation compound would be set out and the topsoil stripped and removed to a temporary stockpile;
- The building foundations would be excavated and concrete poured;
- The steel building units would be erected;
- The internal fit out of the building including installation of services would be completed.

3.6 Cabling Works

All electricity and other service cables between the turbines and the control building and substation compound would be placed underground. Small collector cabinets may be required to minimise the number of cables buried and hence the area of ground disturbed.

The detailed construction and trenching specifications would depend on the ground conditions encountered but typically cables would be directly buried inside a trench, except at road crossings where cables would be ducted.

3.6.1 General Construction Method

The following construction method would typically be used:

- Trenches would be excavated and a suitable bedding material placed for which to lay the cables upon. The ground is trenched typically using a mechanical digging machine;
- The cables shall be laid directly onto the bedding material;
- The trench would then be backfilled and compacted with suitable material up to the required level and finished with a layer of topsoil to aid in the trench reinstatement;
- A suitable marking tape is installed between the cables and the surface; and
- The cables are terminated on the switchgear at each turbine and at the control building and substation compound.

4.0 DECOMISSIONING AND RESTORATION PLAN

At the end of the operational life of the wind farm a decision would be made as to whether to refurbish, remove, or replace the turbines. If refurbishment or replacement were to be chosen, relevant planning applications would be made.

If a decision were to be taken to decommission the wind farm the following draft Decommissioning and Restoration Plan (DRP) would be reviewed (no later than three years prior to final decommissioning of the wind farm) and, if required, revised to a detailed DRP. The DRP would be submitted to and approved in writing by The Highland Council in consultation with SNH and SEPA no later than twelve months prior to the final decommissioning of the wind farm.

The detailed DRP would be implemented within eighteen months of the final decommissioning of the development unless otherwise agreed in writing with the planning authority.

4.1 Site Track & Hardstand Areas

New site tracks and hardstand areas constructed during development of the wind farm would be reinstated to the approximate pre-wind farm condition, unless otherwise agreed with the

Landowner and/or The Highland Council. Areas to be reinstated would be treated in the following way:

- The material used to construct the tracks would be taken up and removed to areas identified in the site restoration scheme;
- The areas would be backfilled with suitable fill material, covered with topsoil and reseeded as required; and
- Backfilling of access tracks would be carefully planned in advance to avoid having to unnecessarily move plant and equipment on freshly reinstated land.
- Any tracks which were upgraded during the development of the wind farm would be left unchanged from the conditions used during the operation phase of the wind farm.

4.2 Wind Turbine Generators

The decommissioning of the wind turbine generators would be the reverse of the erection process involving similar lifting plant and equipment:

- Wind turbine generators would be disconnected from the cabling and internal components stripped and taken off site;
- It is anticipated that the nacelle would then be taken down and loaded straight onto the back of transport vehicles and removed from site for reconditioning or scrap; and
- The towers and blades would be taken down and either transported directly off site or broken down into smaller components if required.

4.3 Wind Turbine Foundations

It is widely accepted that there is no appreciable effect on the local environment from buried reinforced concrete structures left in-situ due to the inert state of concrete. Therefore, the foundations would be reinstated as follows:

- Following the removal of the wind turbine, topsoil and subsoil would be excavated to expose the top of the foundation and set aside for reuse;
- The reinforced concrete foundation would then be broken out to an agreed depth below existing the ground level and the material would be taken up and removed; and
- The excavation would be then backfilled with suitable fill material, covered with topsoil and reseeded as required.

4.4 Control Building and Substation Compound

The control building and substation compound would be decommissioned by disconnecting and dismantling all the surface plant. Solid structures such as the building and equipment plinths would be demolished and the foundation would be removed to an agreed depth below ground level. Ducting and cabling that is within the depth to be cleared would be removed.

The fence surrounding the compound would be removed and the area covered with topsoil and reseeded as required.

4.5 Electrical Equipment

The electrical equipment would be decommissioned in the reverse of the installation method involving similar plant. The equipment would be dismantled, removed from site and disposed of in an appropriate manner.

4.6 Cabling

Cables would remain in-situ to avoid any effect to the local environment through their removal.

5.0 RECORDS

Records, as-built drawings, specifications, operational maintenance manuals and residual risks would be collated and filed in the project health and safety file based upon the requirements of the Construction (Design and Management) Regulations 2015.