Chapter 4
Development Description

Introduction

4.1 This chapter provides details of the components of the Glenmuckloch to Glenglass Reinforcement Project (GGRP), including the 132 kilovolt (kV) overhead line (OHL) components and the new substation at Glenmuckloch, and forms the basis of the assessments presented within **Chapters 6-11**. **Chapter 2: The Routeing Process and Design Strategy** includes a description of the wider area within which the GGRP is located.

4.2 Details of the permanent components of the GGRP are outlined below. Details of the temporary components e.g. working areas, and access tracks, which comprise ancillary development along with the forestry wayleave felling (all of which is included in the application for deemed planning permission), are also provided.

4.3 This chapter also includes details about the construction and operation of the GGRP and describes measures proposed to ensure the protection of the environment during these stages.

4.4 The routeing and Environmental Impact Assessment (EIA) process has been used in combination with technical design work and digital terrain modelling to identify the type of steel lattice tower components and their locations upon which the assessment has been based. However, post consent, following detailed topographical surveys and ground investigation surveys, it is anticipated that it may be necessary and desirable to refine the final design, on an individual tower basis, to reflect detailed topography, ground conditions and to provide scope for further mitigation of environmental effects. The modifications would be assessed to ensure that they are not varied to such a degree as to cause an increase in the significance of likely environmental effects as identified in this EIA Report. The implementation of this design process and that of appraising any likely changes to environmental effects identified in the EIA Report is outlined in the 'Infrastructure Location Allowance' section.

Overview of the GGRP

4.5 The GGRP comprises the construction of a new double circuit 132kV steel lattice tower OHL, approximately 9.3km in length between a new substation at Glenmuckloch to the existing 132kV substation at Glenglass. The new 132kV OHL is to reinforce the network to accommodate several connection requirements as a result of renewable energy development in the Sanquhar area. The new 132kV OHL will be supported on L7 steel lattice towers, with the route described in **Chapter 1: Introduction** and shown in **Figure 4.1.**

Steel Towers

4.6 With the OHL, conductors (or wires) will be suspended at a specified height above ground and supported by the L7 lattice steel towers[1]. Conductors can be made either of aluminium or steel strands. Double circuit OHLs at 132kV and above, such as the L7, carry two 3-phase circuits, with one circuit strung on each side of a tower and an earth wire to provide lightning protection.

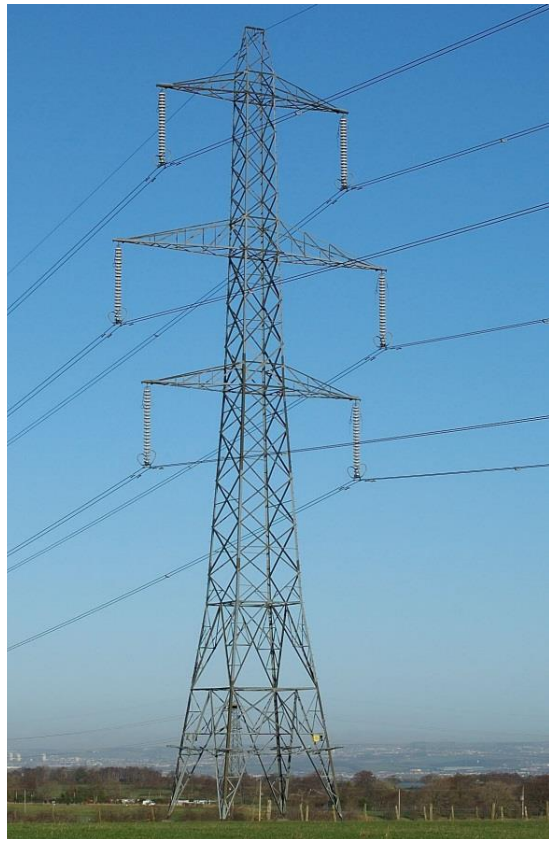
4.7 The L7 towers proposed for the new 132kV OHL are of a lattice steel construction fabricated from high tensile steel which is assembled using galvanised high tensile steel bolts with nuts and locking devices. There are three types of tower as detailed below and illustrated in **Figure 4.2**:

- Suspension or Line: where the tower is part of a straight-line section.
- Tension or Angle: where there is a horizontal or vertical deviation in line direction of a specified number of degrees. There are three main types of angle tower: 30 degrees, 60 degrees and 90 degrees.
- Terminal: where the OHL terminates into a substation or on to an underground cable section via a separate cable sealing end compound or platform.

Steel Tower Heights and Span Lengths

4.8 The L7 lattice steel towers, which have six cross-arms (three on each side) has a standard design height of 27m. An existing L7 tower in the landscape is shown as **Photo 4.1** below.

Photo 4.1: Typical L7 Tower



4.9 The section of OHL between towers is known as the 'span', with the distance between them known as the 'span length'. Span lengths between towers average between 200m and 300m but lengths can be increased if there is a requirement to span something such as a river or a loch. Details of the maximum, minimum and average span are detailed in **Table 4.1** below.

4.10 Towers are used to regulate the statutory clearances required for conductor height, which is determined by the voltage of the OHL (the higher the voltage, the greater the safety clearance that will be required) and the span length required between towers.

Table 4.1: Summary of Tower Heights and Span Lengths

Component	Height/length (m)
Maximum tower height	39m
Minimum tower height	26m
Average tower height	29m

[1] The Electricity Safety, Quality and Continuity Regulations 2002 specify the minimum height above ground of OHLs.

Component	Height/length (m)
Maximum span length	285m
Minimum span length	176m
Average span length	238m

Tower Colour

4.11 Towers are constructed using galvanised steel which, depending on prevailing weather conditions, will turn a dull grey colour after about 18 months. It is not possible to colour towers to camouflage them for all times of day or all seasons. However, the colour of towers can only be recognised from a short distance. Beyond this, the colour is generally not distinguishable from the backdrop, and appears as grades of light and dark. Where towers are viewed against the sky, colour cannot be relied upon to diminish visibility, since the lighting characteristics of the sky vary greatly. The majority of OHL components are maintenance free, although periodic painting of towers will be required in order to prevent corrosion and deterioration of steelwork. The requirement for painting will be identified through regular inspection of towers but is generally required at 15-20 year intervals.

Conductors

4.12 These will consist of twin-phase conductors made of aluminium alloy, each with an approximate cross section of 300mm^2. The associated earth wire will have an approximate cross section of 160mm^2 and will incorporate a fibre-optic telecommunication wire for control purposes. Twin bundled conductors will be connected by industry standard spacers to avoid clashing of conductors and vibration dampers throughout each span to minimise conductor oscillation.

Insulators

4.13 Insulators attached to the tower cross-arms support the conductors and prevent the electric current from crossing to the tower body. The insulators are likely to be made from glass or ceramic.

Ancillary Development (Permanent)

The New Glenmuckloch Substation

4.14 The layout of the new Glenmuckloch substation, including proposed drainage, is illustrated on **Figure 4.3**. **Figure 4.4a** and **4.4b** show the elevations of the new Glenmuckloch substation. The extent of cut and fill required is shown on **Figure 4.5**. The new Glenmuckloch substation will consist of the following elements:

- New electrical switchgear and plant.
- A new 3m steel palisade security fence around the perimeter with an additional 1.2 m section of power fencing above this. The total fencing height will be 4.2 m. Warning notices about possible dangers will be displayed on the fencing.
- A control building located within the substation compound, as shown on **Figure 4.3**.
- Drainage works (as illustrated on **Figure 4.3**).
- Removal of 4.41 hectares (ha) of trees.
- Permanent access track.

4.15 An internal fence will also be required to isolate the live compound. The substation will also have CCTV accompanied by covert infra-red lighting which will operate from dusk to dawn. Fixed and pan-tilt-zoom (PTZ) cameras will be located on columns around the perimeter fence, within the compound and/or on the substation building.

4.16 The substation will have perimeter and compound lighting. This will be for operational use or switched on automatically in the event of a detected unauthorised intrusion or intrusion attempt into the substation compound. The white lighting will act as both a deterrent to further dangerous or unlawful acts and allow colour rendered images to be recorded for prosecution purposes. In normal circumstances the lighting will be switched off and only used when operational staff access the substation in the dark and require lighting to enable safe access and egress around the site during planned maintenance or emergency works. White lighting will either be able to be controlled remotely or set to switch off after a predetermined time to avoid possibility of being left on accidentally.

Ancillary Development (Temporary)

4.17 In addition to the components detailed above, which are considered to be permanent for the purposes of the application for Section 37 consent and deemed planning permission and the EIA process, other ancillary development as detailed below will be required during the felling and construction phase of the new 132kV OHL and new Glenmuckloch substation. This ancillary development will be in situ on a temporary basis, i.e. during the felling and construction phases only, and will be reinstated once the GGRP is commissioned.

4.18 Deemed planning permission is sought for these ancillary components comprising:

- 80m wayleave through woodland.
- Access tracks.
- Temporary topsoil storage.
- Watercourse crossings.
- Temporary Sustainable Drainage Systems (SuDS), including settlement ponds and ditches, to prevent pollution of nearby watercourses during construction.
- Temporary lighting (provided via lighting masts and powered via generators or alternative methods of power i.e. battery, solar or mains). For site security reasons, the compounds will be fitted with electrical sensors to activate the compound lighting during the hours of darkness should movement be detected, but otherwise lighting will be limited outside working hours.
- Working areas (around steel towers and the new Glenmuckloch substation).

4.19 Further details of the construction of each temporary component, and forestry felling are provided under the construction details section below.

Infrastructure Location Allowance (ILA)

4.20 The EIA process has been used in combination with technical design work to develop the detailed development footprint upon which the assessments are based. However, it is anticipated that, post consent, it may be necessary and desirable to refine the final vertical and horizontal profile of conductors and tower positions and heights, as well as the lines of access tracks, to reflect the following:

- pre-construction confirmation of dynamic environmental conditions, e.g., the location of protected species;
- more detailed technical survey information, particularly for unconfirmed ground conditions;
- to provide further scope for the effective mitigation of any likely environmental effects; and
- minor alterations requested by landowners.

4.21 To ensure that the final positions of the new 132kV OHL and associated works are not varied to such a degree as to cause an increase in the significance of likely environmental effects outlined in this EIA Report, an ILA is proposed. This would permit the siting of a tower to be adjusted within a 50m radius of the indicative tower locations and a 50m tolerance either side of the indicative access track locations. As noted in **Chapter 3: Approach to the EIA**, the ILA does not apply to the new Glenmuckloch substation. The 50m ILA is shown on **Figure 4.1**.

4.22 Where possible, micrositing within the ILA will be undertaken to move infrastructure further away from sensitive features, and there are a number of areas where, due to existing constraints, micrositing within 50m will not be possible, including:

- As noted in **Chapter 7: Hydrology, Geology, Hydrogeology, Water Resources and Peat**, micrositing of infrastructure will not be undertaken to bring infrastructure closer to or within watercourse buffers.
- Micrositing of the working area associated with Tower 28 to the north or east would also not be undertaken due to the presence of a cultural heritage feature (Deil's Dyke) as detailed in **Chapter 10: Cultural Heritage**. Where the dyke passes close to the working area for Tower 28, the standard practice of cordoning off the working area would ensure that no accidental damage to it arises.

4.23 Implementation of the ILA would be controlled through the proposed detailed Construction and Environmental Management Plan (CEMP). Should a request to vary a tower or access track position within the ILA be raised, the relevant environmental baseline surveys undertaken to inform the EIA would be reviewed in the first instance as these surveys extend beyond the proposed 50m ILA tolerance. Should this review 'flag up' any potential issues, further environmental advice would then be sought from retained specialists as appropriate. A procedure for notifying relevant statutory consultees of proposed ILA movements would also be agreed with these bodies prior to construction commencing.

Construction Details

Construction Process

4.24 The construction of the GGRP will follow a well-established sequence of activities as outlined and described in further below:

- Felling of forestry;
- Preparation of accesses;
- Platform formation for the new Glenmuckloch substation;
- Excavation of foundations;
- Tower delivery;
- Erection of towers;
- Delivery of conductors and stringing equipment;
- Insulator and conductor erection and tensioning; and
- Clearance and reinstatement.

4.25 The assessments included in EIA Report **Chapters 6-11** are based on the approach and extent of work described below.

Forestry Felling

4.26 This section provides details of the felling required for the GGRP which is being sought in the context of the of the deemed planning permission for GGRP. Each specialist topic chapter includes consideration of the felling required and implications for the assessments, based on the information provided in this chapter. As noted in **Chapter 3: Approach to the EIA**, the potential effects on forestry have been scoped out of detailed assessment.

4.27 The felling of approximately 50.4ha. of forestry is required for the GGRP, with the majority of the trees proposed for felling comprising Sitka Spruce, the dominant species in Scottish forestry[2]. The required felling area to accommodate the GGRP is detailed in **Table 4.2** below, and shown on **Figure 4.6**. Of this, 27.88ha is assumed to be lost permanently for the new Glenmuckloch Substation (4.41ha), wayleave corridor (23.24ha) and accesses (0.23ha).[3].

Table 4.2: GGRP Felling and Windthrow Areas (ha)

Forestry Type	New Glenmuckloch Substation	Wayleave Corridor	Access	Windthrow	Total
Broadleaves[4]	0.72	1.42	0.2	0	2.34
Mature Conifers	1.05	11.66	0	22.52	35.23
Young Conifers	2.64	10.16	0.03	0	12.83
Total	**4.41**	**23.24**	**0.23**	**22.52**	**50.4**

4.28 It is important to note that the data provided in this chapter approximates the felling based on the existing forest baseline at the time of survey as, in some areas, the trees may already have been harvested by the landowner by the time felling and construction of the GGRP takes place. Similarly, areas recently felled may have been replanted by the time the GGRP is constructed. The baseline for forestry comprises the existing woodland cover and structure at the time the EIA was undertaken, on the basis that this represents the baseline situation with the highest degree of certainty. This is on the basis that it has been normal practice to use the existing status of the forest and not allow for the proposals in the long-term forest plan, which simply identify within which five year period the landowner anticipates felling the forest.

Wayleave Requirement

4.29 An 80m wayleave or servitude right (i.e. 40m either side of the centre line of the OHL) will be required to safely construct and maintain the new 132kV OHL. To achieve this, the minimum clearance corridor (wayleave) required through commercial forestry is 80m however, where an OHL is proposed to go through other woodland areas, such as broadleaf, the extent of tree clearance within the wayleave is determined based on a detailed assessment of the type, age and condition of trees in that location to minimise loss of trees. SP Energy Networks (SPEN) will undertake annual inspections throughout the lifetime of the GGRP, to ensure that no clearance infringements occur. Should these be identified then SPEN would undertake necessary assessments to ensure that clearance works are undertaken in line with SPEN's statutory and licence duties. The forestry felling required as part of GGRP will not affect any areas of Ancient Semi Natural Woodland, Plantations on Ancient Woodland Sites or sites identified in the Native Woodland Survey of Scotland.

4.30 It is anticipated that a number of measures will be implemented within the wayleave corridor to reduce the effect of windthrow, including, wherever feasible, the restriction of the width of the felling corridor to the minimum required for the statutory safety clearances associated with the GGRP, as illustrated on **Figure 4.8**. Felling boundaries will aim to follow existing stable forest edges where this can be achieved while delivering the safe construction and operational areas for the GGRP.

Windthrow outside the Wayleave

4.31 In some areas, the felling of forestry for the wayleave will only be part of a forest compartment and as such, expose those remaining, and previously sheltered trees to the wind. Where these trees are semi-mature or mature this is described as creating a 'brown edge'. The remaining trees in these forest compartments in many cases will be less stable and as such, prone to future windthrow. Due to the site specific conditions in terms of exposure, soils, drainage, altitude and aspect, there is a risk that these trees will fall down or fail to reach commercial maturity. These areas are shown on **Figure 4.6** and the total area likely to be subject to windthrow is likely to be 22.52ha., as noted in **Table 4.2** above.

Felling Process

4.32 Tree felling and timber extraction will be undertaken using conventional machinery for the felling of mature and semi-mature accessible timber as detailed below. Key stages in the felling process comprise:

- Felling (including environmental protection measures);
- Timber stacking;
- Timber transportation;
- Post harvesting site treatment; and
- Replanting (where appropriate).

Felling

4.33 Felling will be undertaken using a mixture of mechanical harvesting (a typical mechanical harvester is shown in **Photo 4.2** below), mulching and hand felling techniques. These operations will require access tracks to be installed to allow the felling contractor to facilitate timber extraction. When trees are felled within a wayleave, the root system will be left in place to reduce possible adverse

[2] There are also areas of Forest Open Land within the Glenmuckloch Substation area (0.39ha.) and the Wayleave Corridor (6.86ha.).
[3] The figures shown in **Table 4.2** assume a maximum case that all broadleaves within the 80m wayleave corridor will be felled, the permanent loss figure of 27.88ha. excludes the windthrow areas (22.52 which it is assumed will be replanted). Whilst this total includes all broadleaves, in practice it is likely that it will be possible to avoid felling up to 50% of broadleaves within the wayleave corridor. The wayleave corridor is defined by the maximum anticipated height for conifers (i.e. 35m). As broadleaves are unlikely to reach these heights and, as they are not grown commercially, their stocking and growing conditions are more wind stable. As such, where the corridor passes broadleaves the corridors could be reduced.
[4] It should be noted that should be noted that, in relation to the areas of broadleaved woodland, the figures presented within this chapter differ from those noted in **Chapter 8: Ecology** due to differences in the methodology used to calculate the affected areas in relation to the effects being assessed. Both chapters have been informed by field surveys.

effects on soil structure/stability. The exception to this will be in the identified tower working areas where the surface will need to be levelled prior to introduction of the required installation equipment.

Photo 4.2: Mechanical Harvester

4.34 Where access or maturity of timber dictates that a mechanical means of felling the timber is not practical, it may in some instances be necessary to mulch the standing timber using specialised mulching machinery or to hand fell it.

Timber Extraction

4.35 Timber extraction to roadside will be by custom built six or eight wheeled ‘forwarders’. A typical forwarding vehicle is shown in **Photo 4.3**.

Photo 4.3: Timber Forwarding Vehicle

Timber Stacking

4.36 The timber having been extracted by the forwarder it is stacked at the forest roadside to await uplift by timber lorry to the appropriate market. The final market will be determined by the quality and size of the timber. The higher quality and larger timber sizes will go to the sawmill for a range of uses including construction. The smaller diameter and lower quality timber will tend to go to pulp, chipwood or biomass markets.

Timber Transportation

4.37 A total of 11,240 tonnes of timber (450 lorry loads) will be transported from the areas of felling/timber stacking to a range of end users including sawmills, chipboard and pulp mills and also woodfuel processing depots. Where appropriate, load going timber HGV lorries will be used to uplift the felled timber directly from the timber stacking areas and transport it to the end user. A typical vehicle is shown in **Photo 4.4**.

Photo 4.4: Typical Timber Lorry

4.38 If the use of HGV lorries is deemed unsuitable in any locations, specialised in-forest haulage machines will be used which are designed to minimise damage to the forest roads and also the number of trips required to remove the timber from site. These machines will transfer timber from the initial stacking area where the Forwarder has deposited the timber to an area known as a ‘landing area’ located at a suitable point within the forest complex to allow transfer onto road going HGV’s for final transportation.

Post-Harvesting Site Treatment

4.39 The treatment of the woodland areas post harvesting and post construction of the GGRP will require agreement with the individual landowners. For that area within the 80m wayleave corridor there will continue to be a requirement from SPEN to maintain safe operation of the new 132kV OHL. In particular there is a need to retain a safe separation distance between the infrastructure (towers and conductors) and any vegetation which may be introduced to the wayleave corridor. This vegetation may either be introduced by the natural reseeding, regrowth of existing trees and shrubs or in certain areas by active replanting. There are a range of environmental and landscape advantages to the active management of such vegetation within the wayleave, in particular where this vegetation is of shrub type species which tend to be lower growing with less risk to the safe operation of the new 132kV OHL. For example, the introduction of such shrub species to areas can create linkage pathways for wildlife across the wayleave corridor.

4.40 The treatment of land felled to address windthrow risk, outwith the wayleave corridor will be at the discretion of the landowner. SPEN will work with the landowner to encourage a design of those replanted areas which addresses the impact of the new 132kV OHL’s introduction to the local landscape and/or on ecology. The redesign of the forest area outside the wayleave will require to be acceptable to SF as the statutory body. As such there is a reasonable level of control to that design albeit outwith the direct control of SPEN.

4.41 The brash (tree-tops and branches) resulting from tree felling operations will be left onsite to degrade and slowly release nutrients back into the soil, in keeping with the normal forest practice.

4.42 Where replanting is undertaken this will normally follow a process starting with ground preparation in advance of replanting, in accordance with current best practice.

Accesses

4.43 To facilitate construction of the GGRP, and reduce effects on the local transport network, access will be via a number of different access points from the public road network. These temporary access points will be confirmed by the contractor following appointment; however, based on SPEN's experience of constructing similar OHLs, a series of access points have been identified (labelled from Access A to Access H on **Figure 4.1**). Based on the indicative construction programme, each tower location has been allocated one of these access points as noted in **Table 4.3** below. It is anticipated that construction plant requiring access to a tower area will then use the corresponding access point (see **Chapter 11: Traffic and Transport**). Traffic management measures on the public road network during construction are outlined in **Chapter 11:**.

Table 4.3: GGRP Access Points

Access Point	Road	X	Y	Work Areas Accessed
A	U432N	272281	606614	1, 2, 3, 4
B	U432N	272769	606940	5, 6, 7, 8, 9
C	C125N	273977	610839	10, 11, 12, 13, 14, 15, 16
D	C125N	272102	612220	17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27
E	A76	270593	612212	28, 29, 30
F	A76	270528	612279	31, 32, 33, 34
G	U459N	271710	612879	35, 36, 37, 38, 39, 40

4.44 Some of the access points will require access via bellmouths from the public road. These will be designed in accordance with the approved Traffic Management Plan (TMP), appropriate legislation, and consent sought within the application for deemed planning permission. Details of a typical bellmouth design are presented in **Chapter 11 (**see **Appendix 11.2: Construction Access Routes and Temporary Access Locations Review)**.

4.45 Access to every steel tower of the new 132kV OHL is required during construction. The overall design objective for the access tracks has been to avoid and/or reduce effects upon natural and cultural heritage interests and to cause least disturbance to current land use and land management practices. The principle method employed to achieve this has been to maximise the use of existing tracks, with upgrading of these tracks where necessary. Where this is not possible, or where the use of existing tracks would result in unnecessarily long connecting tracks, two options for temporary access tracks have been considered as follows:

- The construction of temporary spurs from existing roads/tracks to each tower; and
- The construction of temporary tracks between towers which connects to an existing road or track.

4.46 For the purposes of assessment all temporary tracks are considered to be removed after commissioning.

4.47 All access tracks will have a width of 5m to permit access by the largest construction vehicles, including a 60 tonne multi-axle crane. Stone from quarries offsite will be used where existing forest and farm tracks require upgrading. Reinstatement along the verges of the upgraded existing tracks will be undertaken as construction progresses.

4.48 Following the same design objective as for the access tracks, suitable locations for the construction of turning bays places will be identified during the pre-construction stage, passing places will have a standard width of 10m to 15m**.**

4.49 The type of temporary track required will depend on a variety of factors including the sensitivity of the location, the type of land use and the ground conditions, with the latter confirmed through pre-construction ground investigations. **Table 4.4** indicates the different temporary track options which are likely to be utilised and how these relate to ground conditions and land use. The CEMP will contain a detailed requirement for the appropriate phased re-instatement and restoration of all temporary track types. Photographs of each track type are also provided below.

Table 4.4: Temporary Track Types

Temporary Track Type (Photo Reference)	Ground Conditions/Land Use
Low pressure vehicle use (no track required) (A)	When the use of heavy plant and machinery is not required and the volume of traffic to carry out the works is not substantial, use can be made of low ground pressure vehicles which do not require a track. It is important to note however, that the movement of these vehicles will still be restricted to the access routes identified. See **Photo 4.5**.
Stone Tracks: ■ Cut and fill tracks (B1) ■ Floating tracks (B2)	Stone tracks will be required when heavy plant and a substantial volume of traffic is anticipated. (B1): Cut-and-fill tracks. These tracks are usually utilised where the ground is competent (i.e., not in peat >1m). The topsoil is stripped and stockpiled onsite. The topsoil will be used during the restoration phase to reinstate the land to the original condition. If the ground requires to be levelled, then material is cut on one side of the slope and used to fill the other side of the slope. Stone is then laid and compacted on top of this surface to build the access track. Geotextiles and geogrid will be placed on the existing surface then stone placed and compacted as required. See **Photos 4.6 (a)** and **(b)**. (B2): Floating tracks. A floating track is used during the construction of temporary tracks on less competent materials such as peat, where the depth of peat is greater than 1m deep. Geotextiles and geogrid will be placed on the existing surface then stone placed and compacted as required. See **Photos 4.7 (a)** and **(b)**.
Wood/Aluminium/Plastic Matting (C)	In areas identified as sensitive, temporary matting would be used for access, provided that the ground is relatively level. See **Photos 4.8 (a)** and **(b)**.

Photo 4.5: Low Pressure Vehicle Use (No Track Required) (A)

Photo 4.6 (a) and (b): Stone Tracks – Cut and Fill Tracks (B1)

Photo 4.7 (a) and (b): Stone Tracks – Floating Tracks (B2)

Photo 4.8 (a) and (b): Plastic and Aluminium Matting (C)

Watercourse Crossings

4.50 Where a new temporary access track is required to cross a watercourse, a temporary bridge will be utilised. The type of bridge will depend on the width of the watercourse as follows:

- narrow burns: a mat of timbers will be used, supported by steel beams; and
- larger watercourses: a steel plate decking including safety barriers either side will be used, supported by main support beams with steel cross members.

4.51 Photographs of these watercourse crossings and details of proposed watercourse crossings are provided in **Appendix 7.1: Watercourse Crossings**.

4.52 Where a watercourse is required to be crossed during conductor stringing, steel bond wire will be pulled by hand across watercourse. Where this is not possible then boats will be used to pull bond wire (attached to the conductor on a drum), and thereafter used to pull conductors through under continuous tension. No works will take place within the watercourse.

Construction Process

Temporary Working Areas

4.53 Temporary working areas around towers will be prepared prior to foundation excavation, with average dimensions of typical working areas for steel towers of 25m x 25m for standard towers and 50m x 50m for angle towers. **Photo 4.9** shows a typical working area.

Photo 4.9: Typical Working Area

4.54 Each working area will be taped off to delineate the area for environmental protection reasons. The proposed working areas are illustrated in **Figure 4.1** however in accordance with the proposed ILA, further consideration will be given to varying the shape of the working area at each tower further to avoid environmental constraints identified prior to construction.

4.55 Following the completion of the construction works, the temporary working areas will be reinstated and restored.

Steel Tower Foundations

4.56 The foundation type and design for each tower will be confirmed following detailed ground investigations at each tower location.

4.57 The majority of the foundations of each tower leg are likely to be of a concrete pyramid type. However, depending on particular geological conditions, there may be a requirement to use mini-piled, auger or rock foundations, which generally requires less ground disturbance but greater volumes of concrete. These require the drilling or auguring of several holes for each leg of the tower. These holes are then reinforced with steel and concreted or grouted. The tower steelwork connection points to foundations are known as 'stubs' and these are located and fixed by means of a pile cap at each leg position.

4.58 Excavations will be undertaken for each leg of the tower. The dimensions of the excavation will vary depending on the tower type to be constructed. For an L7 tower, a typical leg excavation will be 16m^2 by 4m for the line towers, increasing to 25m^2 by 5m deep for angle towers. Some breaking of rock using a hydraulic pecker may be required to achieve the required depths for the tower foundations. The excavated material will be sorted in appropriate layers and used for backfilling purposes.

4.59 Once the excavations are formed, the tower legs will be fixed in accordance with the foundation design before assembling the 'pyramid' formwork around the stub. The foundation will then be concreted. The average concrete requirements are 4x10m^3 and 4 x 25m^3 for a suspension and angle L7 tower respectively. The total estimated concrete requirements for the new 132kV OHL are provided later in this chapter.

Assembly and Erection of Towers

4.60 Steelwork for each tower will be delivered to site in sections via HGV. Tower assembly will commence by either setting up a derrick crane and building up the tower in steel sections or, alternatively, assembling the tower in part at ground level and lifting the tower in sections by crane to complete assembly. Erection of a steel tower is shown in **Photo 4.10**.

Photo 4.10: Typical Working Area

Stringing of Conductors and Commissioning of the OHL

4.61 Once a sufficient number of sequential sections of towers have been erected, stringing of the conductors can commence. This requires temporary 'pulling' (or 'stringing') areas at tower locations approximately every 3-4km along a line, or where a deviation in the route occurs. In some cases, the temporary pulling areas overlap with the temporary working areas, and elsewhere, they are located outwith the working areas. The typical pulling area comprises approximately 20m x 50m for steel towers.

4.62 The temporary pulling areas will be formed using one of the following:

- stone laid on a membrane (as similar to the floating road access track);
- timber matting; and
- aluminium panels.

4.63 All temporary surfacing materials will be removed from site on completion of the stringing operations.

4.64 Where stringing of conductors requires to cross a watercourse, steel bond wire will be pulled by hand across watercourse. Where this is not possible then boats will be used to pull bond wire (attached to the conductor on a drum), and thereafter used to pull conductors through under continuous tension. No works will take place within the watercourse.

4.65 At each tower pulling area, a winch will be positioned and set up at one end of the stringing section, with a 'tensioner 'set up similarly at the other end of the section. Pilot wires will be placed in blocks hanging from the insulators on the towers and connected around the winch and tensioner at either end. Using the winch to pull the pilot wires, the conductor will then be drawn through the section, using the tensioner to maintain a constant tension. This allows the conductor to be controlled without touching the ground, avoiding damage to both the conductor and the underlying ground. The stringing of a tower is shown on **Photo 4.11**.

Photo 4.11: Stringing of Steel Tower

4.66 Where the conductor needs to be strung over existing roads and the railway, protection in the form of scaffolding will be erected prior to the commencement of stringing, in consultation with the appropriate rail/road authorities. Scaffolding will be erected at either side of the crossing, with netting placed in the span in between the scaffolding. The locations where scaffolding is required are shown on **Figure 4.1** and typical scaffolding details are provided in **Figure 4.7.** Examples of typical scaffolding are shown in **Photo 4.12**.

Photo 4.12: Typical Scaffolding

Construction of the New Glenmuckloch Substation

4.67 The construction of the new Glenmuckloch substation will follow a well-established sequence of activities as outlined below:

- pre-construction activities;
- enabling works (e.g., erection of secure compound for construction works);
- earthworks to establish substation foundation level;
- formation of substation base and plant foundation bases;
- construction of substation buildings and associated infrastructure;
- electrical plant and cable installation works; and
- removal of temporary working areas, temporary infrastructure and reinstatement.

Concrete Requirements and Delivery

4.68 Between 18 and 40 cubic metres (m^3) of concrete is required for each lattice steel tower foundation, depending on ground conditions and the extent of excavation required. The substation foundation requires 370m^3 of concrete.

4.69 Concrete will be transported to site by ready-mix lorry (assumed at 6m^3 truck) and delivered directly to the required excavated tower foundation position. Alternatively, the ready-mix lorry would stop at a predetermined point where the concrete would be loaded into a tracked dumper, which could then track to the tower position if the ground conditions were suitable.

4.70 Following the delivery of concrete, the wash-out of vehicles onsite will be restricted to the concrete chute only. The residue will be directed into a suitable container for disposal at a suitably licensed facility after it has settled. The concrete delivery vehicles will be directed to washing areas where excess concrete and washings from the delivery trucks will be contained within identified bunded settling areas to allow solids to settle and liquids to filter through a straw bale wall.

Construction Working Hours, Timescales and Personnel

4.71 A 48 week working year and construction over a seven day working week has been assumed for assessment purposes. Construction activities will be undertaken during daytime periods only, between approximately 07.00 to 19.00 for felling and access installation activities and in summer (April to September) and 08.00 to 17.00 (or as daylight allows) for all other activities and in winter (October to March). It is anticipated that any variations to the hours stated here will be agreed in advance with Dumfries and Galloway Council (D&GC).

4.72 It is anticipated that approximately 225,370 man-hours (70 construction staff average and 97 construction staff peak) will be required during the construction period to undertake tree clearance activities, construction of the new 132kV OHL, construction of the new Glenmuckloch substation and restoration works.

4.73 Subject to the granting of Section 37 consent and deemed planning permission and the fulfilment of any associated conditions, construction of the Glenmuckloch substation is programmed to commence in month one of the construction programme shown in **Table 4.5**, with the overhead line work due to commence in month three. Construction of the substation is anticipated to commence in July 2025 with the overhead line starting in September 2025, with all elements scheduled for completed in October 2026.

4.74 The GGRP will be constructed on a rolling programme. For the towers, specific construction teams will move from one area of the connection to the next as sections are completed. For example, the foundation construction team will start at towers one to six and then move to seven to thirteen when the team's work at towers one to six has been completed. The next team, the tower fabrication workers, will then commence work at towers one to six whilst the foundation team are working on towers seven to thirteen. Whilst the total duration of construction activity at any one tower site will be approximately five working weeks, this is likely to be spread over a longer time period.

Table 4.5: Summary Indicative Construction Programme

Activity	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16
Overhead Line																
Surveys																
Procurement / Design																
Access Installation																
Foundation Install																
Tower Erection																
Wiring Works																
Substation																
Earthworks																
Civil Engineering Works																
Control Building Works																
Balance of Plant Works																
Commissioning Works																

Environmental Management

Construction Environmental Management Plan

4.75 Prior to the construction of the GGRP, SPEN will develop a detailed CEMP with its appointed contractors. The CEMP will identify those responsible for the management and reporting on the environmental aspects during the construction of the GGRP. The CEMP will be used to ensure a commitment to meeting all relevant conditions attached to the Section 37 consent and deemed planning permission and delivering the environmental mitigation measures identified in the EIA Report. Adherence to the CEMP will be a contractual requirement of each contractor that SPEN appoints.

4.76 The purpose of the CEMP will be to:

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

4.77 The CEMP will be updated when necessary to account for changes or updates to legislation and good practice methods throughout the construction phase. The CEMP will also be amended to incorporate information obtained during detailed ground investigations which will be undertaken post consent and prior to construction activities for the GGRP. Compliance with the CEMP (including procedures, record keeping, monitoring and auditing) will be overseen by a suitably qualified and experienced Environmental Manager from SPEN. The CEMP will contain the following information:

- Policies and objectives;
- Regulatory controls and guidance to be followed;
- A completed register of contacts confirming the contact details for all key personnel for managing environmental issues, including SPEN representatives, the Ecological Clerk of Works (ECoW), Principal Contractor contacts, Scottish Water contacts and appropriate regulator contacts;
- Construction Programme and detailed working method statements;
- A site-specific action plan, providing a register of environmental risks and outlining the requirement for accompanying site;
- Specific mitigation, monitoring and management system reporting procedures; Audit and inspection procedures;
- Training plans; and
- Communication (onsite, key stakeholders, neighbours and community).

4.78 In addition, the CEMP will contain the following documents, which the Principal Contractor and their sub-contractors will be required to adhere to throughout the construction process:

- a Pollution Prevention Plan (PPP);
- Construction Method Statements (CMS);
- a Water Protection Plan (WPP);
- a Site Waste Management Plan (SWMP); and
- a Construction Traffic Management Plan (CTMP).

4.79 The CEMP and associated plans will be submitted to D&GC and others as appropriate, prior to the commencement of construction works. A copy of the CEMP will be kept in the construction site office for the duration of the works and will be available for review at all times.

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

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

4.82 Performance against these documents will be monitored by SPENs Construction Project Manager and the ECoW throughout the construction phase. They will ensure that the works carried out are in accordance with the relevant best practice guidance documents. An example CEMP is provided at **Appendix 4.1: Outline CEMP**. This contains the sections that would be expected to be included within the final CEMP, which will be agreed subject to an appropriately worded planning condition.

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

4.84 All site staff will be given appropriate environmental training before starting work onsite. The CEMP will also include a series of specialist information packs, ‘toolbox talks’, to inform site operatives of the sensitivity of particular areas and of wider safeguards to protect natural and cultural heritage. An example toolbox talk relating to cultural heritage is provided as **Appendix 4.2: Example Toolbox Talk.**

Embedded Mitigation Measures

4.85 Embedded mitigation measures, comprising general good practice measures will be employed as standard techniques during tree felling, the construction of the GGRP. Therefore, these are not considered to be mitigation as such, but an integral part of the design and implementation of the construction phase. This is considered a realistic scenario given the current regulatory context and accepted good practice across the construction industry.

4.86 The assessments in this EIA Report assume the implementation of these embedded/good practice measures. Any further issue/location specific mitigation measures are identified in the assessment of likely significant effects within each chapter of the EIA Report. A list of embedded mitigation measures, identified in each topic chapter, is provided in the Schedule of Mitigation at **Appendix 3.3: Schedule of Mitigation**. Embedded measures will include (but are not limited to) measures associated with:

- Flood Risk and Increased Run-Off (such as the construction of SuDS);
- Pollution and Accidental Spillage Incidents (such as the safe storage of chemicals and fuels);
- Sedimentation and Erosion (such as temporary hay bale barriers or silt and splash fences);
- Watercourse Crossings (no works taking place within watercourses);
- Forestry Felling (adherence to Scottish Forestry Guidelines e.g., to ensure protection and enhancement of the water environment); and
- Peat Management (such as micrositing infrastructure to avoid peat disturbance/excavation and unnecessary waste).

Waste Management

4.87 Materials will be generated, and will require management, at a number of construction stages including excavation of materials for construction of tower and substation foundations, construction of ancillary infrastructure and occupation of temporary construction premises.

4.88 The Principal Contractor will be required to prepare a SWMP to ensure best practice principles are applied to reduce, re-use or recycle all materials as part of the CEMP. Measures to reduce possible environmental effects associated with the storage and transportation of wastes will include:

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

- minimising storage periods;
- minimising haulage distances; and
- the sheeting of vehicles.

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

- the Duty of Care imposed by Section 34 of the Environmental Protection Act 1990; and
- the Waste Management Licensing (Scotland) Regulations 2011 (as amended), particularly provisions relating to registered exemptions from waste management licensing.

4.90 If materials are required to be removed from site, these will be handled in accordance with relevant waste and environmental regulations. Waste will be transferred using a registered waste carrier to a licensed waste disposal site or recycling centre.

Peat Management

4.91 Whilst the GGRP has been designed to minimise disturbance to peatland, it has not been possible to avoid areas of peatland entirely. The assessment of potential effects on peat is presented in **Chapter 7: Hydrology, Geology, Hydrogeology, and Peat**. An Outline PMP is presented at **Appendix 7.3: Outline Peat Management Plan** and includes the following information:

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

4.92 Adherence to the PMP will ensure that excavated soil and peat is appropriately managed and re-used onsite. It is anticipated that all excavated peat can be reused for reinstatement ground, ad the point of excavation. Prior to construction and on completion of ground investigations and micrositing utilising the ILA, the PMP will be refined and agreed with Scottish Environment Protection Agency (SEPA) and NatureScot.

4.93 Prior to construction and on completion of ground investigations and micrositing, a SWMP shall be produced, including for site soil and peat management good practice. It will ensure that excavated peat is appropriately managed and re-used.

4.94 Where the GGRP passes through peatland environments, best practice has been used to identify, mitigate and manage potential peat landslide hazards and their associated risks in accordance with guidance[5]. A summary of the methodology and findings of the Peat Landslide Hazard and Risk Assessment (PLHRA) is presented in **Chapter 7** and full details provided as **Appendix 7.4: Peat Landslide Hazard Risk Assessment**.

Resource and Energy Use

4.95 It is good practice to consider energy usage during the construction of a proposed development, including associated emissions of greenhouse gases. It is recognised that energy will be used during the construction phase, including the fuel for construction plant and the energy required for the transportation of personnel. The materials used to construct the GGRP will also incorporate embodied energy, i.e. energy required to manufacture construction materials, including the energy used in the transport of the material from its source to the site, via processing plant where applicable.

4.96 The current scope to reduce the consumption of energy and associated CO^2 emissions by selecting energy efficient equipment, and fuels and materials with low embodied energy is considered to be limited, for example biodiesel fuel could not be used at present for all construction vehicle trips as it is not commercially available to large scale users. However, work to progress the practical application of emerging technologies is ongoing will be given further consideration prior to construction.

Community Liaison

4.97 In partnership with SPEN, the appointed contractors will be required to maintain close liaison with local community representatives, landowners and statutory consultees throughout the construction period. This is likely to include circulation of information about ongoing activities, particularly those that could potentially cause disturbance. A telephone number will be provided and persons with appropriate authority to respond to calls and resolve any problems made available.

4.98 SPEN and the appointed contractors will liaise with the local councils and communities to identify any major events in the area and to programme construction works to ensure that these do not disrupt the local road network on those days.

Reinstatement

4.99 Upon completion of the construction works associated with the GGRP, the contractor shall remove the temporary tracks/accesses and repair any damage. This will be undertaken as soon as possible after construction is completed and temporary road materials are removed. This will enable the subsoil to be sealed preventing sediment run-off. As described previously, topsoil will be stripped and stored adjacent to the works in a manner which ensures that the soil quality is retained. Restoration of moorland, arable and pasture areas will aim to achieve original soil profiles. The topsoil will be transported from the topsoil storage locations to the works and will be placed by a tracked excavator. Appropriate seeding if deemed necessary by the GGRP may be by hand or by machine spreading. An example of recent reinstatement is shown in **Photo 4.13**.

Photo 4.13: Ground Reinstatement

4.100 Where there is disturbance to or temporary removal of existing stone dykes along the GGRP route, they will be reinstated using locally sourced stone and built to match the style and height of existing stone dykes in the area, as per the indicative stone dyke section illustrated in **Chapter 6**.

[5] The Scottish Government (2017), Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments.

Operational Details

OHL Maintenance

4.101 Whilst most steel tower OHL components are maintenance free, periodic paining of the tower steelwork may be required and the exposed elements which suffer from corrosion, wear, deterioration and fatigue need to be inspected (one inspection per year; alternating between inspections by helicopter with the following year by foot). OHLs require refurbishment after approximately 20 to 40 years. Whilst towers are expected to have a lifespan of approximately 80 years, the condition of the tower steelwork and foundations will be monitored regularly. If deterioration cannot be remedied, a tower will be dismantled carefully, either for re-use or complete removal and replacement.

Substation Maintenance

4.102 The new Glenmuckloch substation will be unmanned. Maintenance will take place regularly during the lifetime of the substation and this is usually carried out during periods of planned operational outages in the operation of the electricity network, e.g., when electricity demand is low, typically during the summer period.

Wayleaves

4.103 Appropriate tree clearance at the outset should minimise the likelihood of any major secondary undergrowth in the wayleave. However, should secondary growth be identified during the inspection visits, a maintenance team will be required to re-establish the statutory wayleave clearances to the line.

4.104 It is not considered likely that temporary tracks will be needed for wayleave maintenance purposes as access is likely to be by vehicles which have tracked or low ground pressure. The wayleave would then be walked, and mechanical saws used to clear the secondary growth. It is likely that the volume of cut timber would be such that it could be left to decay naturally.

Decommissioning of the New 132kV OHL and Glenmuckloch Substation

4.105 When the operational life of the new 132kV OHL comes to an end, the line may be i) re-equipped with new conductors and insulators, or if the towers are 80 years old, the towers replaced, or ii) the towers dismantled and removed. The operational lifetime of the new Glenmuckloch substation is likely to be shorter than the new 132kV OHL (approximately 40 years) at which point it may be i) fitted with new equipment or ii) demolished and removed. On this basis, the operational environmental effects of the GGRP are assumed to be long term.

4.106 An assessment of the decommissioning of the GGRP has not been undertaken as part of this EIA as i) the baseline conditions (environmental and other development) cannot be predicted accurately at this stage and ii) the proposals for refurbishment/decommissioning are not known at this stage.

Health and Safety

4.107 Health and safety is of primary importance to SPEN, with commitment from the highest levels. In constructing and operating the GGRP, SPEN will take account of the health and safety of all those who could potentially be affected, including construction workers, felling operatives, SPEN company operatives and the general public.

Construction

4.108 All construction activities will be managed within the requirements of The Construction (Design and Management) Regulations 2015 and will not conflict with the Health and Safety at Work etc Act 1974. To further reduce possible health and safety risks, a Health and Safety Plan for the GGRP will also be drawn up. All staff and contractors working on the GGRP will be required to comply with the safety procedures and work instructions outlined in the Plan at all times.

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

4.110 Current industry standards will be followed to manage the risks posed by heavy equipment, falls from heights and rough and dangerous terrain. Information will be made available to the public with respect to any possible safety hazards and open excavations will be fenced off.

Operation and Maintenance

4.111 The new 132kV OHL components, including conductors and insulators, will be designed and tested at the manufacturers to ensure compliance with relevant UK and European Standards. This will include testing the performance of insulators under stress, the carrying capability of conductors and the effects of voltage and current on the mechanical strength of the fittings. In accordance with standard practice, the public will be advised of the possible danger presented by OHLs by a warning notice placed on each tower.