Strathy South Wind Farm Grid Connection

Volume 4: Appendix V1-9.4: Detailed Peatland Condition Assessment

SSEN Transmission

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Making Sustainability Happen

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1.0 Introduction

1.1 General

SLR Consulting Ltd (SLR) was commissioned by ASH design+assessment Ltd. on behalf of Scottish and Southern Electricity Networks (SSEN) Transmission to prepare a Detailed Peatland Condition Assessment (PCA) for the proposed Strathy South Wind Farm Grid Connection (the "Proposed Development").

This PCA considers the Proposed Development with the Proposed Alignment (hereafter referred to as 'the Proposed Alignment'), which is located approximately 3.0 km south of Strathy and Melvich, Sutherland in northern Scotland, see **Figure V1-9.1.1 Volume 4: Appendix V1:9.1: Peatland Landslide Hazard Risk Assessment.** The work has been undertaken by a team of Geotechnical Engineers and Geologists, with over 10 years' experience in undertaking peat assessments and was led by Dr. Chris Marshall, Associate Consultant at SLR. Chris holds a BSc (hons) Environmental Geology, an MSc in Geochemistry and a PhD in Earth Sciences, with 10 years of experience in peatland condition and restoration monitoring and assessment including peer reviewed scientific papers, policy documents, governmental reports and membership of scientific and technical advisory groups.

1.2 The Proposed Alignment

The Proposed Alignment comprises approximately 10.5 km of 132 kV double circuit overhead line (OHL) supported by steel lattice towers from Strathy North 'T' (near Dallangwell) to a new cable sealing end (CSE) compound, prior to connecting into Connagill 275/132 kV substation via two short sections of single circuit 132 kV underground cable (UGC) and formation of access tracks (permanent, temporary and upgrades to existing) as shown on **Figure V1-9.2.2 Volume 4: Appendix V1:9.2: Outline Peat Management Plan.**

Full details of the Proposed Alignment are provided in **Volume 1: Chapter 3: The Proposed Development.**

1.3 Scope and Objectives

This Detailed PCA outlines the baseline conditions present within the area of the Proposed Alignment and aims to identify areas of active peatland and ensure that peat disturbance of these areas is minimised where technically feasible during detailed design and construction of the development. The PCA has been undertaken in accordance with best practice guidance [1,2,3,4,5].

The PCA aims to:

1. Quantify the current condition status of peatland habitats on-site.

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[1] Burden, A., Radbourne, A., Williamson, J., Evans C., 2020 A rapid method for basic peatland condition and national-scale satellite analysis

[2] Bradley, A.V., Mitchell, E., Dryden, I., Fallaize C., Islam, M,T., Large, D.J., Andersen, R., Marshall C., (In press) Analysis of an InSAR "bog breathing" based classification of peatland condition relative to field observations in Cairnsmore NNR, NatureScot Research Report 1269

[3] Crichton Carbon Centre (2015) Annex 1 Field Protocol and Guidance, Developing Peatland Carbon Metrics and Financial Modelling to Inform the Pilot Phase UK Peatland Code' Report to Defra for Project NR0165.

[4] JNCC. 1994. Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 8 Bogs. JNCC, Peterborough.

[5] SNH Peatland Condition Assessment https://www.nature.scot/sites/default/files/2023-02/Guidance-Peatland-Action-Peatland-Condition-Assessment-Guide-A1916874.pdf [accessed June 2024]

2. Determine the impact of the development on peatland habitats on-site.
3. Inform developmental design and evidence the application of the requirements of the mitigation hierarchy in the Scottish Government's National Planning Framework 4 (NPF4) and the steps that development proposals must follow to reduce their environmental impact namely:

- **Avoid:** Remove the impact at the outset
- **Minimise**: Reduce the impact
- **Restore:** Repair damaged habitats
- **Offset:** Compensate for any remaining impact, preferably on-site

The PCA included the following data collection activities:

- Mapping key peatland condition metrics derived from open access satellite imagery including the distribution and cover of bare peat, non-peat habitats and mineral soil; distribution of drainage (both natural and artificial); erosion features (such as footpaths, hags, gullies, drained pools, and peat landslip scars); and land-use patterns (including burn scars, tracks, and livestock pens). Additionally, the identification of main drainage pathways off-site.
- Combining peatland condition metrics with contextual data regarding the management of the Proposed Alignment, including ecological and peat depth data gathered at the area of the Proposed Alignment, and external resources (including deer management group data etc).
- A field-based peatland condition assessment to validate and provide further information on peatland condition across the site within a 100 m grid.

The data collected is then used to produce a conceptual model derived from the PCA which will guide and demonstrate:

- How peatland condition is distributed across the Proposed Alignment, address the likelihood of extensive ‘active’ or near natural peatland being present across the Proposed Alignment and identify areas of particularly good condition peatland or refugia that should be avoided by design.
- How, through site investigation and iterative design, the Proposed Alignment has been structured and designed to avoid, so far as reasonably practicable, areas of active peatland;
- Identify areas of peatland with the greatest potential for enhancement and the opportunities and risks associated with peatland restoration at and within the area of the Proposed Alignment.

1.4 Basis for Peatland Condition Assessment

1.4.1 Policy Background

NPF4 places significant emphasis on the protection and restoration of peatlands due to their crucial role in carbon storage, biodiversity, and water regulation with relevant policies including;

- **Policy 1**: Addresses the global climate and nature crises, emphasizing the need to protect, conserve, restore, and enhance biodiversity.

- **Policy 3**: Requires developments to provide significant biodiversity enhancements, including restoring degraded habitats and strengthening nature networks.
- **Policy 5**: Focuses on protecting carbon-rich soils, restoring peatlands, and minimizing soil disturbance from development.

NPF4 Policy 5d, requires that '*where development on peatland, carbon-rich soils or priority peatland is proposed, a detailed site specific assessment will be required*'. This should include peat depth surveys (initial, detailed and additional information), Peat Landslide Hazard Risk Assessment (PLHRA), and detailed habitat surveys (National Vegetation Classification (NVC)), including an assessment of condition. As such under NPF4, any development on peatlands must undergo a detailed site-specific assessment. For the Proposed Alignment the following detailed site-specific assessment has been undertaken:

- **Peat Depth Surveys**: To determine the extent and depth of peat.
- **Peat Landslide Hazard Risk Assessment (PLHRA)**: To assess the risk of peatland instability.
- **Habitat Surveys: Including National Vegetation Classification (NVC)** surveys to assess the types of habitat present.
- **Peatland Condition Assessment**: to determine the condition of peatland habitat present on site and guide adherence to the mitigation hierarchy outlined in NPF4 including avoidance of peatland in near natural condition.

PCA in Scotland is generally categorized into four conditions for assessment although Peatland Code subdivides these further to link with emission factors:

1. **Near-Natural**: Dominated by peat-forming species with minimal human impact.
2. **Modified**: Shows signs of human impact such as grazing and burning.
3. **Drained:** Affected by artificial drainage, leading to altered vegetation.
4. **Actively Eroding:** Characterised by extensive bare peat surfaces and significant erosion.

Priority Peatland Habitats are also assessed by NatureScot and include blanket bogs, montane bogs, and other peat-forming communities. These habitats are considered crucial for biodiversity and carbon sequestration. The guidance emphasises avoiding impacts on these high-quality habitats and is assessed using JNCC Site of Special Scientific Interest (SSSI)[6] criteria.

Ideally (a PCA) in a development context should provide enough information on key condition indicators to:

- Provide a baseline of pre-development condition and likely priority peatland status.
- Guide the location of infrastructure and evidence adherence to the mitigation hierarchy.
- Provide information on opportunities for and types of compensatory restoration and habitat enhancement on site.

[6] JNCC. 1994. Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 8 Bogs. JNCC, Peterborough.

2.0 Baseline Conditions

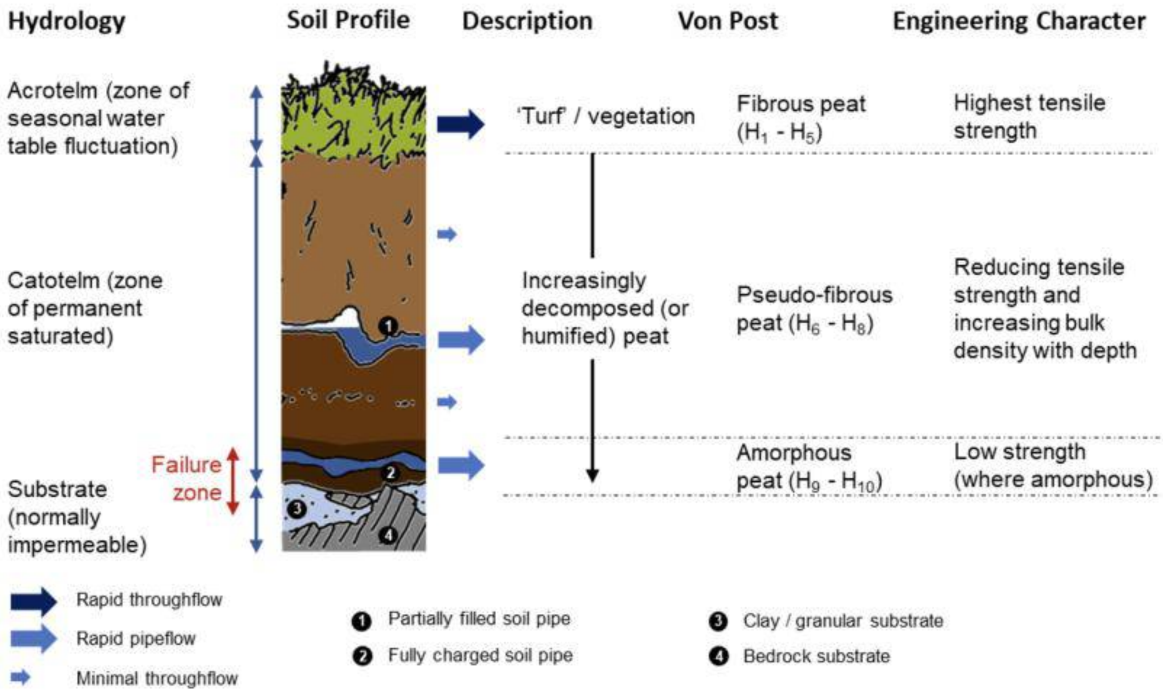
2.1 Definition of Peat

Peat is defined as an organic soil comprising the partly decomposed plant remains that have accumulated in-situ, rather than being deposited by sedimentation. When peat forming plants die, they do not decay completely as their remains become waterlogged due to regular rainfall. The effect of waterlogging is to exclude air and hence limit the degree of decomposition. Consequently, instead of decaying to carbon dioxide and water, the partially decomposed material is incorporated into the underlying material and the peat 'grows' in-situ.

The Scottish Government Peat Landslide Hazard Best Practice Guide (2017) uses the following Joint Nature Conservation Committee (JNCC) report 455 'Towards an Assessment of the State of UK Peatlands' definition for classification of peat deposits:

- Peaty (or organo-mineral) soil: a soil with a surface organic layer less than 0.5 m deep;
- Peat: a soil with a surface organic layer greater than 0.5 m deep which has an organic matter content of more than 60 %; and
- Deep Peat: a peat soil with a surface organic layer greater than 1.0 m deep.

Plate 1 - Typical Peat Profile[7]



There are two principal types of peat in a near natural peatland (see **Plate 1**):

- The upper (acrotelm) layer in which the water table fluctuates, which is fibrous and comprises plant roots etc. The acrotelm is relatively dry and has some tensile strength and its thickness typically ranges from 0.1 m to 0.6 m deep.

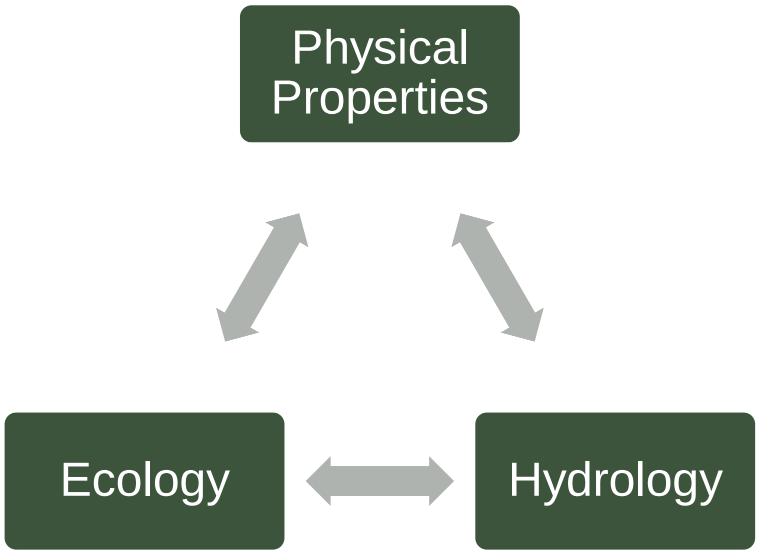
[7] Mills, A.J. and Rushton, D. 2023. A risk-based approach to peatland restoration and peat instability. NatureScot Research Report 1259.

- The lower (catotelm) layer, which is saturated, sitting permanently below the water table. The catotelm layer is highly decomposed, generally becoming more amorphous/liquid in nature and losing structure with increasing depth. The structure of catotelmic peat tends to disrupt completely on excavation and handling.

2.2 Definition of Peatland Condition

Peatland condition reflects a combination of the hydrological, physical (mechanical) and ecological characteristics of a peatland (**Plate 2**). In a functioning actively accumulating peatland each exists within a state of dynamic equilibrium acting through a series of negative feedbacks to buffer against external forcing (e.g climate) ensuring the continued growth and development of the peatland. An ecohydrological basis is commonly used to determine peatland condition although often there is a focus on peatland vegetation due to the expertise of ecological assessors and the difficulty in direct measurement of peatland hydrology and peat condition during a single field campaign.

Plate 2 - Framework for assessing peatland condition



Various peatland condition assessment protocols exist for blanket peatland in Scotland and elsewhere within the UK focusing on evaluating the health and functionality of peatlands, which are crucial for carbon storage, water regulation, and biodiversity. Common key indicators of peatland condition include the presence of extensive Sphagnum moss, the extent of bare peat, and evidence of grazing or burning. A universally accepted measure of peatland condition does not exist, and is therefore somewhat subjective. Consequently, all peatland condition assessments rely to a certain extent on the interpretation of key metrics by the surveyor. There are also common misconceptions regarding peatland condition for example;

- Vegetation often lags peatland condition for example refugia exist on all but the most degraded peatland and therefore low cover of peat-forming species can be expected even on drained and actively eroding peatlands. Likewise in rewetted peatlands, vegetation often lags hydrology with dry indicator species persisting even after rewetting. The presence of low cover peat forming species is not an indicator of active peatland.

- Key positive indicators such as peatland microtopography can be present in full but each component hydrologically isolated from other parts due to deep incision particularly on upland peats indicating that full functionality is not present.
- Small scale (Quadrat scale) observations are generally unrepresentative of peatland condition at larger scale, therefore whilst useful for identifying species present, peatland hydrology and mechanics often operates on multiple scales not captured by this approach. Also due to canopy effects these measures are often incompatible with remote sensing data limiting their ability to be upscaled using new technologies for monitoring peatland condition e.g. InSAR.

In order to counter this and provide a means of upscaling NVC data across the Proposed Alignment, the PCA uses a combination of a desk study with the field based approach, and metrics based on the rapid peatland condition assessments supplemented by specific information required for the JNCC SSSI selection criteria on a 100 m grid. The results can be seen within the following sections of this report.

2.3 Topography

Based on the digital terrain model available from the British Geological Survey (BGS) Geoindex[8], the topography across the Proposed Alignment is generally low-lying (20 to 150 m AOD) with typically moderate slopes with some locally steep slopes around hilltops and surface water and river valleys.

The Proposed Alignment exhibits moderate to steep slopes in the western extents which climb towards the east before reaching a peak of approximately 150 m AOD near Tower 39 in the central areas. The Proposed Alignment gently slopes towards the east with a steeper descent at Kirkton before reaching the lowest elevation of approximately 20 m AOD on the banks of the Halladale River. There are extensive flatter expanses and gentle slopes situated throughout the Proposed Alignment, particularly between Towers 41 and 48.

2.4 Peatland Classification

The Carbon and Peatland Map 2016[9] indicates that approximately 6.1 km and 3 km of the proposed OHL alignment is located within an area of Class 1 and Class 2 peatland respectively. Class 1 and 2 peatland are considered nationally important carbon-rich soils, deep peat and priority peatland habitat with areas likely to be of high conservation value. In addition, Class 2 peatland is considered to be of high restoration potential.

There are areas of Class 1 peat mapped in the western extents of the Proposed Alignment, at proposed Towers 19, 20 and 22. In addition, there are areas of Class 1 peat mapped across the majority of the northern areas of the Proposed Development including at Tower 26, between Towers 29 and 32, between Towers 35 to 39, Towers 41 to 49 and at Tower 54.

The cable sealing end (CSE) compound, underground cables (UGCs) and Towers 23 to 25, Tower 27, Tower 28, Tower 33, Tower 34, Tower 51, Towers 55 to 61, and Tower 64 are located in mapped Class 2 peatland.

The remainder of the Proposed Alignment is mapped as Class 5 peatland with a very localised area of Class 3 peatland mapped in the western extents of the Proposed Development adjacent to the River Strathy and Tower 19.

8 BGS Online Viewer, available at [https://mapapps2.bgs.ac.uk/geoindex/home.html?_ga=2.133433804.376188765.1646739904-1030004651.1646739904]

9 NatureScot, Carbon and Peatland Map 2016, Available online at: map.environment.gov.scot/soil_maps/

Class 3 peatland is not considered priority peatland habitat, however, most of the soils are carbon-rich and areas of deep peat may be present. Class 5 peatland is not associated with peatland habitats, but soils are carbon-rich and deep peat may be present.

The proposed access tracks to the towers and infrastructure are located within areas of Class 1, 2, 3 and 5 peatland.

Peat and peat soils at and surrounding the Proposed Alignment have been used intensively over the past century. Sheep grazing, artificial drainage and peat cuttings have been observed across the Proposed Alignment using aerial imagery and observed during site walkovers. In addition, plantation forestry is present to the west of the Proposed Alignment.

In addition, the east of the Proposed Alignment was subject to intense peat loss as a consequence of the Flow Country wildfire in 2019 (see **Plate 8**).

The Carbon and Peatland classifications are provided in **Volume 2: Figure V1-9.4** of the EIA Report.

2.5 Hydrology

The Proposed Alignment is located within three main surface water catchments: the River Strathy to the west, the Halladale River surface water catchment to the east, and the Tongue Coastal catchment to the north. The Proposed Alignment crosses over the Halladale River at NGR NC 90230 59519, between Tower 63 and 64.

The Proposed Alignment is drained by the following sub catchments:

- Bowside Burn sub catchment of the River Strathy which drains a small area to the south-west of the Proposed Development. The burn flows generally westwards before discharging into the River Strathy approximately 420 m downstream of the Proposed Alignment. The Proposed Alignment would cross the burn at NGR NC 83133 60994 (between towers 21 and 22 (no track is proposed to cross the burn) and poles associated with the existing 132 kV OHL would be dismantled within this catchment; and,
- Allt na n Eaglaise sub catchment of the Halladale River which drains a large area to the south and south-east of the Study Area. Allt ne n Eaglaise flows generally northwards, through the eastern extent of the Proposed Alignment, before discharging into the Halladale River approximately 680 m downstream of the Proposed Alignment. The Proposed Alignment would cross Allt na n Eaglaise at NGR NC 88565 60876 (between towers 53 and 54). There are several tributaries of Allt na n Eaglaise within the area of the Proposed Alignment.

2.6 Hydrogeology

Information from Scotland's environment map[10] indicates that the Proposed Alignment is underlain by the Moine Supergroup, the Middle Old Red Sandstone, the Lower Old Red Sandstone and an unnamed igneous intrusive complex (Late Silurian to Early Devonian). The Moine Supergroup is a low productivity aquifer yielding small amounts of groundwater in near surface weathered zones and secondary fractures. This aquifer type is mapped throughout the majority of the Proposed Alignment, in the east underlying Towers 21 to 28, and throughout the north and east from Towers 40 to 53. The Middle Old Red Sandstone is a moderately productive aquifer comprised of sandstones, siltstones, mudstones and conglomerates which

10 Scotland's Environment Online Viewer. Available at [https://map.environment.gov.scot/sewebmap/]

locally yield small amounts of groundwater. This aquifer is mapped throughout the northern area of the Proposed Alignment, between Towers 29 and 39.

2.7 Sensitive Receptors

Review of NatureScot Sitelink confirms that approximately 250 m of the Proposed Alignment is located within the western edge of West Halladale Site of Special Scientific Interest (SSSI) which is also part of the larger Caithness and Sutherland Peatlands Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. The SSSI, SAC, SPA and Ramsar site have been designated for breeding bird assemblage, otters, marsh saxifrage and various freshwater and upland habitats including blanket bog habitats. The qualifying or notified features of the designated sites are sensitive to changes in peat and water quality.

The Proposed Alignment is also partially located within the northern extent of the Flow Country World Heritage Site (WHS). Assessment is detailed within **Volume 4: Appendix V1-7.7: Flow Country WHS Assessment**.

2.7.1 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

Review of the NVC habitat mapping concluded that GWDTE's are sustained by incident rainfall and local surface water runoff, therefore the buffers proposed in SEPAs GWDTE guidance need not apply. Further details on GWDTE are provided within **Volume 1: Chapter 7: Ecology** and **Volume 1: Chapter 9: Soils, Geology and Water**.

3.0 Fieldwork

3.1 Peat Surveys

The following peat depth surveys were undertaken by SLR;

- Phase 1 survey undertaken in November 2023.
- Phase 2 surveys undertaken in April, May, July and September 2024.

Peat surveys were carried out in accordance with best practice guidance for developments on peatland**Error! Bookmark not defined.**,[Error! Bookmark not defined.]. Phase 1 peat probing resulted in probing on a 100 m grid on initial assessment areas of the OHL route which was used in preliminary site layout designs. Phase 2 probing saw detailed probing undertaken across the Proposed Alignment layout, focussing on access tracks, tower locations and other site infrastructure. The Phase 1 survey informed the site design such that areas of recorded peat could be avoided where technically feasible.

Phase 2 probing was typically undertaken on linear infrastructure (permanent / temporary tracks) at 25 m to 50 m spacings with offset probing locations either side (approximately 10 m to 25 m). Infrastructure (towers, CSE compound and UGC) was typically probed at 10 m grid spacings.

The proposed OHL and Tower 19 are in proximity to the existing Strathy North 132 kV trident 'H' wood pole OHL. In addition, the alignment at Tower 19 intercepts an existing BT cable. Therefore, where the proposed OHL intercepts existing utility infrastructure, peat probes were undertaken at a safe offset distance as agreed with SSEN Transmission.

The thickness of the peat was assessed using a graduated peat probe, approximately 6 mm diameter and capable of probing depths of up to 10 m. This was pushed vertically into the peat to refusal and the depth recorded, together with a unique location number and the co-ordinates from a handheld Global Positioning System instrument (GPS). The accuracy of the GPS was quoted as ±2 m, which was considered sufficiently accurate for this survey. All data was uploaded into a GIS database for incorporation into various drawings and analysis assessments.

Where the peat probing met refusal on a hard substrate, the 'feel' of the refusal can provide an insight into the nature of the substrate. The following criteria were used to assess material:

- Solid and abrupt refusal – rock;
- Solid but less abrupt refusal with grinding or crunching sound – sand or gravel or weathered rock;
- Rapid and firm refusal – clay; or
- Gradual refusal – dense peat or soft clay.

The relative stiffness of the peat was also assessed from the resistance to penetration of the probe and from the effort required to extract the probes. In all instances refusal was met on obstructions allowing identification of subsurface geology.

3.2 Peat Depth

As indicated within Section 2.1, peat is generally defined as a soil with a surface organic layer in excess of 0.5 m**Error! Bookmark not defined.**. Where the probing recorded less than 0.5 m thick, it is considered to be a peaty soil (or organo-mineral soil). Soils with a peaty organic horizon over mineral soil are often referred to as 'peaty soils'. These organo-mineral soils are extensive across the UK uplands, but do not meet recognised definitions of peat as they are either shallower than true peat or have a lower carbon density.

A total of 10,762 peat probes were undertaken across all survey phases. **Figures V1-9.1.6** and **V1-9.2.7 within Technical Appendix 9.2 - Outline Peat Management Plan** detail the interpolated peat depth across the Proposed Alignment based on the results of the survey work.

3.2.1 Peat Deposits

There are localised deep peat deposits (>1 m depth) situated across the Proposed Alignment. However, these deposits are generally situated across flatter expanses and in minor topographic lows. The peat deposits are generally confined by topography and rarely situated across steeper slopes.

Within the central areas of the Proposed Alignment, deep peat of up to 2 m was recorded within the area of Towers 32 – 35, with most peat depths ranging from 1 to 1.5 m.

Deep peat up to 2.5 m was encountered within the area of Tower 41 with a shallowing of peat depths towards Tower 39 where steeper slopes are present. Towards the eastern extends of the Proposed Development peat depths of over 2 m were recorded at Towers 43 and 44 as these towers are within flatter expanses. Towers 47, 48 and 49 are also positioned within flatter expanses and peat depths up to 3 m were mapped.

Further to the south-east deep peat up to 2.5 m is recorded at Tower 61. The western areas of the Proposed Alignment do not feature many areas of deep peat. There is localised deep peat of up to 2 m at Tower 19 in the south-west.

Deeper peat (>1m) was present in localised areas of proposed access tracks. Areas of localised of deeper peat were recorded at the permanent access track north-east of Tower 32 and the temporary access track to the east towards Tower 35.

Localised areas of deeper peat were recorded at the existing access track (to be upgraded) north of Tower 42 and with sections of permanent track at Tower 43, 44 and sections of temporary access track between Towers 45 to 46 and between 47 and 48.

Localised pockets of deep peat were recorded on the permanent access track connecting up the sections of existing access track to be upgraded, located approximately 1 km south-west of Melvich.

The access tracks in the south-east generally recorded shallow peat depths with only localised deeper peat recorded at the temporary access track around Towers 51, 54, 57 and 58. An area of more extensive deeper peat is present on the permanent access track around Tower 61 with some minor localised areas of deeper peat present between Tower 62 and 63.

Table A: Peat Probing Results

Peat Thickness (m)	No. of Probes	Percentage (of total probes undertaken on-site)
0 (no peat)	129	1.2
0.01 – 0.49 (peaty soil)	6626	61.6
0.50 – 0.99	1809	16.8
1.00 – 1.49	727	6.8
1.50 – 1.99	545	5.1
2.00 – 2.49	346	3.2

Peat Thickness (m)	No. of Probes	Percentage (of total probes undertaken on-site)
2.50 – 2.99	294	2.7
3.00 – 3.49	164	1.5
3.50 – 3.99	71	0.7
> 4.0	51	0.5

3.2.2 Peat Depth and Peatland Condition

Peat and peat soils at and within the area of the Proposed Alignment have been subject to a number of pressures over the past century which include grazing (deer and sheep), peat cutting (turbary) and wildfire which has contributed to significant degradation of peat habitats in areas of the Proposed Alignment.

This is reflected by the patchy nature of peat across the Proposed Alignment with large areas of peat cutting leading in many cases to loss of peat down to underlying mineral soil. Elsewhere elevated and isolated peat banks have been subject to desiccation and have been colonised by dry heath species which whilst retaining greater peat depth has reduced resilience to wildfire with extensive charring and peat loss observed. In many places within the Proposed Alignment, subsidence has led to compaction and peat loss to a significant extent leading to replacement with dry heath vegetation and thin organic rich soils. Exposed boulders clearly show acid erosion above the current peat surface evidencing extensive peat loss due to peat cutting, erosion, grazing and drainage. This process appears to be particularly concentrated within central areas of the Proposed Alignment within the Flow Country WHS.

Overall, the heterogenous nature of peat depth across the Proposed Alignment indicates a highly modified and disturbed landscape which retains only small modified fragments of the original peat bodies which colonised the landscape. This is reflective of a loss of ecosystem services including the impairment of the peatlands ability to sequester and permanently store carbon.

4.0 Peatland Condition Assessment

Key peatland condition metrics have been mapped, through a desk-based review, supported by a detailed peat condition survey undertaken on week commencing 13th January 2025 (**Annex B Figure V1-9.4.1 – Site Layout**). A major factor affecting peatland condition on the Proposed Alignment was the 2019 Flow Country Fire. The extent can be seen in **Plate 8** and **Section 4.3.1**.

4.1 Hydrological and Peat Condition Assessment

4.1.1 Artificial Drainage

In this context, drainage means the creation of artificial channels or the artificial deepening of existing channels or peat cutting that lower the water table and inhibit or prevent peatland formation. This represents a negative condition indicator, with indirect impacts assumed on average to be 30 m from the drainage feature, as utilised within the Peatland Code and best practice guidance.

Desk Based Assessment

Artificial Drainage in the form of peat cuts represents the most prevalent type of drainage across the Proposed Alignment, covering an area of 476 hectares (Ha). Peat cutting is present in a range of ages with potentially centuries old vegetated cuts ranging to recent peat cutting (2019). Peat cutting has typically not been ongoing within the area of the 2019 Flow Country wildfire due to the impact of the fire on the peat and limiting its use as a fuel. Peat cutting is concentrated in the central and western parts of the Proposed Alignment, however the peat cuts appear in a range of conditions from fully vegetated to bare peat and mineral dominated.

All peat cuts appear to be linked by drainage networks. A variety of different approaches and forms have been used, ranging from larger formalised rectangular cuts to much more disordered radial cuts with evidence of multiple phases present in many peat cuts, especially where peat was thicker. In some areas mineral and bare peat is exposed, indicating peat condition/depth is not sufficient for recovery. There is also evidence that in areas of multiple phases of peat cutting, peat banks have been cannibalised leading to complex drainage patterns with some similarities to micro-erosion.

Artificial Drainage in the form of hill drains is extensive (approximately 81 km) across the Proposed Alignment and is generally associated with peat cutting with lesser amounts of peatland drainage for rough/improved pasture, hill tracks and plantation/native forestry. Drains not linked to peat cutting are generally concentrated to the east and west of the Proposed Alignment.

The impact of multiple phases of intensive peat cutting and drainage to support this activity is likely to have resulted in drying of the peat and loss of peat species, with replacement by areas of bare peat, heath species and erosion. This is likely exacerbated by historic land management on the site, including sheep grazing, for which the hill drains were excavated and the impact of the 2019 Flow Country wildfire which affected much of the Proposed Alignment.

Field Based Assessment

Field observations (**Annex B: Figure V1-9.4.2 - Erosion and Landuse Features**) collected on-site confirm the distribution of artificial drainage along the Proposed Alignment that were identified during the desk-based assessment, with active drainage covering approximately 46% of the surveyed area.

Drains not associated directly with peat cuts were predominantly deep and narrow (<0.5 m wide and >0.5 m depth), with shallow, narrow drains (<0.5 m wide and <0.5 m depth) in areas of shallower peat. Wider drainage features were rare and predominantly present alongside access tracks. In general, drains were open and free-flowing, although a small minority were collapsed, often due to deer/sheep impacts. Drains in general within the footprint were partially vegetated primarily by young heather with very few showing vegetation colonisation within the channel. Water levels within ditches showed moderate flow with approximately 0.1-0.2 m water depth. Drain boundaries were often charred indicating that the reduction in water depth increased the wildfire impacts during 2019.

Peat cuts showed a range of conditions, most if not all showed signs of active drainage independent of revegetation. In most cases the edges of peat banks were exposed bare peat which were charred and characterised by hydrophobic altered peat due to the 2019 wildfire (**Plate 3**). Where peat depths were low within cuts (<0.5 m), revegetation since 2019 has been limited with exposed bare peat and mineral soil dominating with evidence of fragmentation and weathering of the bare peat surface by wind and water. Where peat depths were deeper (>0.5 m) revegetation of peat cuts has been more extensive, although this has been primarily dominated by heath species *Calluna vulgaris*, at the expense of other peatland species (**Plate 4**). Whilst to be conservative, areas of peat cutting are predominantly within the drained class, it is likely that on average 10-20% of the peat cuts are actively eroding due to the actions of frost heave, water and wind.

Plate 3 - Hydrophobic and Charred Peat at edge of Peat Banks near Tower 30

Plate 4 - Colonisation of charred peat by *Calluna vulgaris* at base of peat cutting near Tower 47

Infrastructure Assessment

Most infrastructure (**Annex A - Table D**) across the Proposed Alignment would lie adjacent to active drainage or peat cutting, with only four (of 46) towers not impacted by either peat cutting or artificial hill drains.

Table B – Overview of Artificial Drainage Features present adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Artificial Drainage Feature		
T19, T20, T22, T23, T24, T25, T26, T29, T30, T31, T32, T33, T34, T36, T37, T39, T40, T41, T42, T43, T45, T46, T47, T48, T50, T51, T52, T53, T54, T55, T56, T57,	Unblocked Drains	Active drainage reduces water tables leading to compaction, lower tables and colonisation of heath species such as *Calluna vulgaris*. Where present this is a negative indicator of peatland condition.

INFRASTRUCTURE	PARAMETER	COMMENTS
T59, T60, T61, T62, T63 CSE Compound Existing Tracks		
T19, T27, T28, T29, T30, T31, T36, T37, T38, T39, T40, T41, T42, T46, T47, T48, T60, T64 CSE Compound Proposed Temporary Tracks in central area	Peat Cutting	Peat cutting causes the removal of the peat resource, drainage of remaining peat banks and where turves are not placed back active erosion of the bank and base of the peat cut. Where present this is a negative indicator of peatland condition.
T35, T43, T49, T58	None	Artificial drainage is not a significant influence on peat condition in these areas.

Artificial Drainage and Peatland Condition

Overall, 46% of the Proposed Alignment would lie within 30 m of an active drain or peat cutting. Where present, these are predominantly peat cuts or narrow hill drains. Many of these drains are still active, although a minority have not been maintained, with some showing evidence of localised collapse and colonisation by peatland species. The combined impacts of peat cutting, drainage, grazing and fire has resulted in the colonisation of the peatland by dry heath, hindered recovery and indicates a negative condition trajectory without intervention.

4.1.2 Peatland Erosion and Gullies

Peatland erosion has several detrimental impacts on the condition of peatlands:

- **Loss of Vegetation Cover**: Erosion strips away vegetation, leading to the drying out of peat surfaces. This makes it difficult for plants to re-colonize, exacerbating erosion.
- **Formation of Gullies:** Small gullies can develop into complex networks of eroding peat hags, further destabilising the peatland.
- **Carbon Release:** Erosion disrupts the peat structure, leading to the release of stored carbon into the atmosphere, which contributes to greenhouse gas emissions.
- **Hydrological Changes**: Erosion can alter the hydrology of peatlands, affecting water retention and flow patterns, which can impact the overall ecosystem.
- **Biodiversity Loss**: The degradation of peatland habitats due to erosion can lead to a decline in species that depend on these environments.

In general, any form of drainage will have negative impacts on peatland condition, however impacts are not uniform, e.g. a vegetated gully will have lower impact than a hagged (bare sided) gully, which in turn would have lower impact than a bare peat gully or peat pan, due to the area of exposed peat. Similarly, the presence of extensive erosion is often an indication of prolonged intensive management of a site by fire, grazing and drainage, leading to degradation. This section also includes observations of mass wastage, which may represent a sporadic but locally significant mechanism for peatland loss on-site, as well as contribute towards **Volume 4: Appendix V1:9.1: Peatland Landslide Hazard Risk Assessment**.

Desk Based Assessment

Peatland Erosion is present across the Proposed Alignment in a number of forms, namely:

- Micro-erosion complexes, lying in between artificial drainage or associated with animal and hill tracks, predominantly found on lower gradient areas and representing the majority of actively eroding areas on the site. Present as both isolated areas of bare peat and interconnected networks of small scale drainage. These areas appear to be largely associated with multiple phases of historic peat cutting.
- Linear gullies parallel to slope – often with bare peat and mineral bases on the upper slopes and revegetated along lower slopes by non-peatland vegetation.

Field Based Assessment

Field observations (**Annex B: Figure V1-9.4.2 - Erosion and Landuse Features**) confirm the general distribution of erosion and types of erosion present across the Proposed Alignment. It also showed that micro-scale erosion and bare peat patches, which are difficult to quantify from aerial photography, are extensive. In many areas due to the intensive artificial drainage, erosion features have been utilised as part of the drainage scheme for peat cuts, making them hard to differentiate. Where erosion is present away from peat cutting, it is concentrated on slopes and in drained areas of deeper peat where water-levels have been reduced and overland flow dominates.

The most common erosion type across the Proposed Alignment is micro-erosion, which comprise complex, small scale erosion features ranging from small gullies, areas of unvegetated peat and small scale drainage features. These tend to be located at the break in slope, such as either side of a watershed or at the base of slope where higher gradient slopes meet flatter areas. There are some areas where livestock paths have merged forming complex drainage pathways and erosion, these tend to cluster around the north and west of the site where grazing is more prevalent. Gullies tend to be linear features along steeper slopes often draining former areas of peat cutting. These tend to be vegetated or hagged although due to the low peat depths across the Proposed Alignment, the base of many gullies is mineral soil or rock.

Signs of peat instability are not present across the Proposed Development as detailed in **Volume 4: Appendix V1-9.1: Peat Landslide Hazard and Risk Assessment**.

Infrastructure Assessment

Due to the dominance of artificial drainage across the Proposed Alignment (**Annex A;Table C**), drains have largely removed erosion features in many areas or subsumed them into drainage schemes for peat cutting. Where present, erosion is mainly present within the eastern and western parts of the Proposed Development where it is having a negative impact on peatland condition.

Table C - Overview of Erosion Features present adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Type of Erosion Feature		
T23, T25, T26, T27, T28, T31, T32, T43, T44, T46, T54, T56	Micro-erosion	Micro-erosion represents early stage active erosion in these areas representing a negative peat condition indicator.

INFRASTRUCTURE	PARAMETER	COMMENTS
T45, T48	Micro-erosion and vegetated gullies	The combination of micro-erosion and vegetated gullies likely reflects a combination of drained and actively eroding peatland and is a negative condition indicator.
T47, T49	Vegetated Gullies	Vegetated gullies are stable drainage features and are likely to represent a minor drainage impact on surrounding peatland
T19, T20, T21, T22, T24, T29, T30, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T50, T51, T52, T53, T55, T57, T58, T59, T60, T61, T62, T63, T64 CSE Compound Upgraded and Temporary Tracks	None	Erosion is not a significant influence on peat condition in these areas.

Erosion and Peatland Condition

4.1.3 Peat Density, Hydrology and Soil Moisture

The water table plays a crucial role in determining the condition of peatlands including:

- **Hydrology and Vegetation**: The water table level directly influences the hydrology of peatlands. High water tables maintain the saturated conditions necessary for the growth of peat-forming vegetation like Sphagnum mosses. When the water table drops, these plants become desiccated, leading to a decline in peat formation.
- **Carbon Storage:** Peatlands are significant carbon sinks, storing vast amounts of carbon in their waterlogged soils. A high water table limits oxygen penetration, slowing down decomposition and reducing carbon dioxide (CO_2) emissions. Conversely, a lowered water table increases oxygen availability, accelerating decomposition and releasing stored carbon as CO_2.
- **Methane Emissions**: While high water tables reduce CO_2 emissions, they can increase methane (CH_4) emissions due to anaerobic conditions. Methane is a potent greenhouse gas, so the balance between CO_2 and CH_4 emissions is crucial for understanding the overall climate impact of peatlands.
- **Erosion and Stability**: A stable, high water table helps maintain the structural integrity of peatlands. Lowering the water table can lead to peat drying and shrinkage, making the peatland more susceptible to erosion and physical degradation.
- **Biodiversity**: The water table level affects the types of species that can thrive in peatlands. High water tables support a unique range of wetland species, while lower water tables can lead to the encroachment of more terrestrial species, reducing biodiversity.

The mechanical strength/peat density is also a critical factor in assessing peatland condition and has several implications:

- **Water Retention**: Peat with lower density typically has higher water retention capacity, which is crucial for maintaining the saturated conditions necessary for peat formation and the survival of peatland vegetation.
- **Decomposition and Humification**: Higher peat density often correlates with greater decomposition and humification. This can reduce the peatland's ability to sequester carbon and support typical peatland species.
- **Carbon Storage**: The density of peat affects its carbon storage capacity. Denser peat may appear to store more carbon per unit volume, but it also indicates a higher degree of decomposition, which can lead to increased carbon emissions if the peatland is disturbed.
- **Peatland Resilience**: The ability of the peatland surface to mirror the rise and fall of the water table is a key mechanism for peatland to adapt to changing climatic conditions. Lower density peats are able to track the water table closely in response to drought and therefore can maintain high water tables for longer periods of time. Whereas drained peatland, is denser, cannot collapse and therefore is more vulnerable to cracking, oxidation and colonisation of non-peat species.

Assessing water table height on-site within a single survey is difficult as it requires a significant period of monitoring before it can be accurately determined. Consequently, proxies including vegetation type, surface moisture and direct observation such as pools where close to the surface are often used to indicate if water tables are supressed. The Moisture Index uses satellite imagery to determine the peatland response to water stress and may indicate areas of low resilience, an indication of loss of function.

This assessment uses proxies[11] [12] for water table height observable on-site, such as:

- **Presence/absence of pools**; observable saturation of the peat surface in order desiccated <dry <saturated <surface water, with saturated conditions indicating higher water tables.
- **Peat density**, which was determined at each survey location using a scale of hard <firm <soft <quaking, with firm/hard considered a negative indicator of humified/oxidised condition peat whereas soft and quaking peat is likely to be an indication of peatland in good condition.

Desk Based Assessment

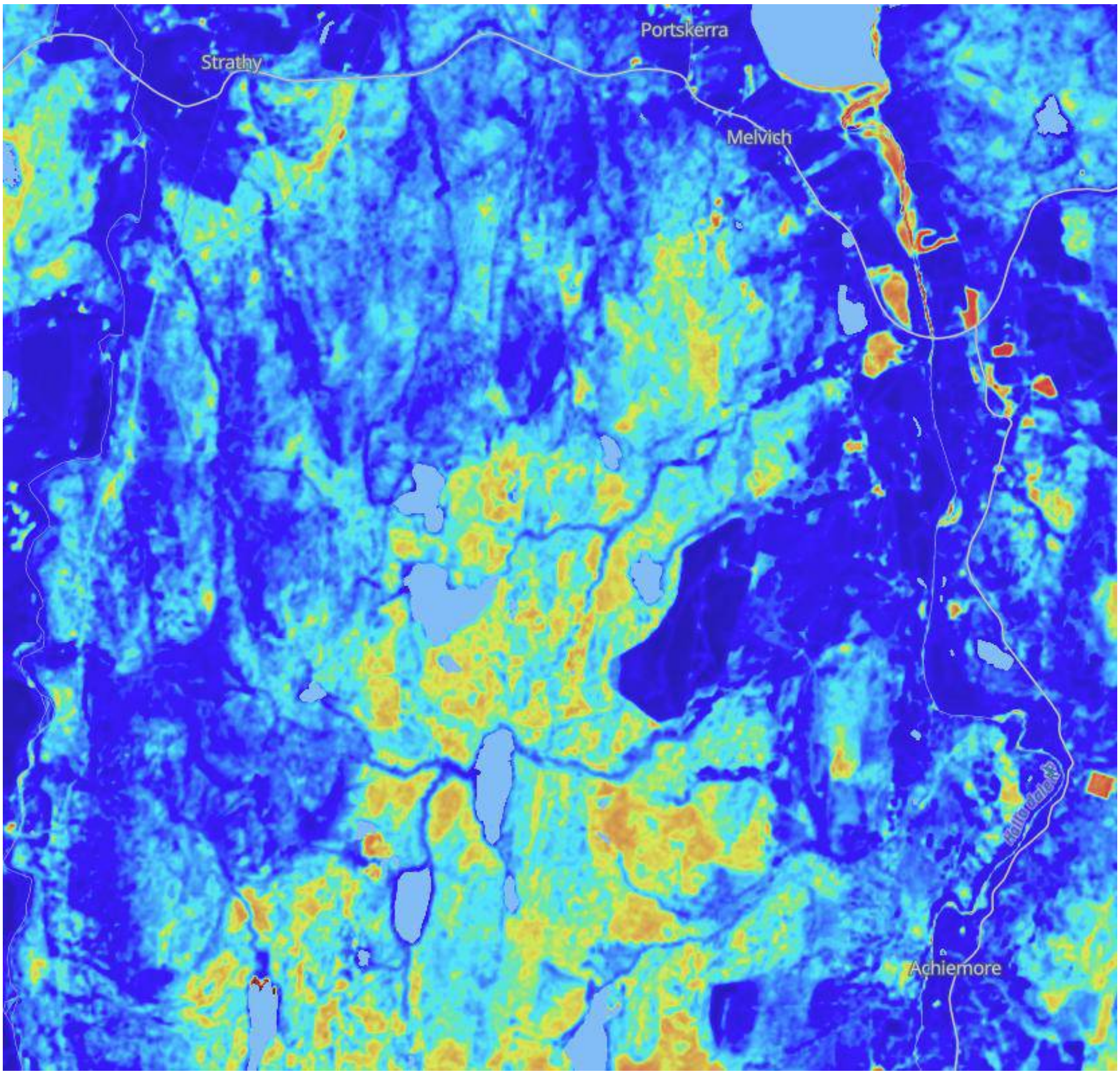
Consideration of the moisture index derived from Sentinel 2 (optical data; **Plate 5**) indicates that across the Proposed Alignment water stress was more similar to areas dominated by vascular plants and rough pasture in many areas compared to adjacent near natural peatland indicating different hydrology in these areas. Tracks and exposed mineral soil show no impact from drought conditions as might be expected. Areas to the west of the Proposed Alignment

[11] Burden, A., Radbourne, A., Williamson, J., Evans C., 2020 A rapid method for basic peatland condition and national-scale satellite analysis

[12] Bradley, A.V., Mitchell, E., Dryden, I., Fallaize C., Islam, M,T., Large, D.J., Andersen, R., Marshall C., (In press) Analysis of an InSAR "bog breathing" based classification of peatland condition relative to field observations in Cairnsmore NNR, NatureScot Research Report 1269

show patches of high-water stress likely reflecting softer wetter peat with greater cover by non-vascular plants

Plate 5 - Moisture Index[13] during the June 2023 drought over the Proposed Development indicating increased drought stress (orange) within deeper peat bodies and lower drought stress (blue) in non-peatland habitats.



Field Based Assessment

Field observations show that:

- 85 % of the Proposed Alignment shows dry or desiccated surface conditions, indicating the peatland is modified/highly modified with a lower water table (**Annex B: Figure V1-9.4.3 - Peat Surface Wetness**).

[13] Modified Copernicus Sentinel data 2023 Sentinel Hub

- 89 % of the Proposed Alignment has firm or hard peat underfoot indicating extensive compaction, humification and increased bulk density due to drainage and oxidation (**Annex B: Figure V1-9.4.4 - Peat Density**).
- Natural Filled Pools not associated with peat cutting are present at three locations close to Coulbackie Forest and bare peat pools generally associated with drainage features such as peat cuts were present primarily adjacent to existing access tracks associated with ponding (**Annex B: Figure V1-9.4.5 - Pools**).

Infrastructure Assessment

Overall, most infrastructure (**Annex A**: **Table D**) within the Proposed Alignment is located on dense dry peat reflecting the highly modified and drained nature of peatland, which reflects the degraded condition of peatland across the Proposed Alignment. Where softer peat is present it should be possible to optimise positioning with micro-siting within the Limit of Deviation (LoD), as set out in **Volume 1: Chapter 3: The Proposed Development**.

Table D - Overview of Hydrological Features present adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Peat Density		
T19, T20 T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31 T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T43, T44,T45, T49, T50, T51, T52, T53, T55, T56, T57, T59, T59, T60, T61, T62, T63, T64	Hard/Firm	Hard/Firm surface peat indicates highly humified and oxidised peat that has been subject to long standing drainage and compaction. This compromises peatland function and is a negative condition indicator
T46, T47, T48, T54, T58	Soft	Soft peat indicates lower peat density peat indicating consistently higher water tables and lower levels of compaction and subsidence. This is generally a positive condition indicator.
Peat Surface Wetness		
T19, T20, T21, T22, T23, T24, T25 T26, T27, T28, T29, T30, T31, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T43 T49, T50, T51, T52, T53, T55, T56, T57, T59, T60, T61, T62, T63, T64	Dry	Dry surface peat (especially during winter) indicates low water tables and high overland flow, this is often associated with compacted firm peats where infiltration and dominance of vascular plants mean soil moisture is reduced. This is generally a negative condition indicator.

T44, T45, T46, T47, T48, T58	Saturated	Saturated peat indicates higher water-tables with peat surface connectivity this indicates wetter conditions and more hydrologically functional peatland. This is generally a positive condition indicator.
T54	Ponding	Surface ponding can be an indicator of high water tables however in this case it likely reflects ponding on a compacted peat surface which is a negative condition indicator.
Presence of Peat Pools		
All towers (excluding T44 and T54)	None	The absence of peat pools is not in itself an indicator of poor condition but does indicate lower water table conditions.
T44, T54	Bare Peat Pools Nearby	Bare peat pools indicate locally high water tables which is a positive condition indicator. However, this is impacted by the lack of associated peatland vegetation.

Impact of Peat Density, Humification and Soil Moisture on Peatland Condition

Overall, the field Alignment desk study show that water tables are suppressed across much of the Proposed Alignment, likely associated with intensive historic management practices and drainage. This has led to dense, humified peat across the Proposed Development which has lower water holding capacity and reduced resilience to water stress. This is observable during the summer months by Sentinel 2 optical satellite imagery. This indicates that peat on-site has reduced hydrological and mechanical functionality compared to near natural sites.

4.2 Ecological Condition Assessment

4.2.1 Peatland Species Cover Assessment

A key component of an active peatland are the species present, with the presence/absence and cover of different plant functional types an indication of the degree the peatland is modified from near natural conditions. The extent of plant functional types such as sphagnum is often a good proxy for the height of the water table and therefore to what extent the peatland is still functional (e.g. still sequestering carbon and providing key ecosystem services) or in the case of negative indicators e.g. bare peat, heather, purple moor grass, not peatland mosses, the degree to which the peatland is modified. The extent to which each plant functional type was assessed at 100 m intervals, at a 5 m radius using a modified DAFOR scale (dominant, abundant, locally abundant, scarce and absent) as shown in **Table E**. A modified scale was used as dominance of a single plant functional type is rare within peatland ecosystems, and therefore increased granularity is not considered useful above 50 % cover. This assessment is also not meant to replace more detailed NVC surveys but provide a basis to understand within class variability in condition across the Proposed Alignment.

Table E - Adapted DAFOR scale used for assessing peatland vegetation on cover

ADAPTED DAFOR SCALE	COVER %
D = Dominant	50-100
A = Abundant	30-50
F = Locally Abundant	15-30
O = Occasional	5-15
R = Rare	0-5
A = Absent	0

Field Based Assessment

Sphagnum Moss Cover

Sphagnum mosses are crucial indicators of peatland condition due to their unique ecological roles and sensitivity to environmental changes.

- **Water Retention**: Sphagnum mosses have a high water-holding capacity, which helps maintain the waterlogged conditions necessary for peat formation. A healthy cover of Sphagnum indicates good water retention and a stable water table.
- **Carbon Sequestration**: Sphagnum mosses contribute significantly to carbon sequestration in peatlands. Their presence suggests active peat formation and carbon storage, which are essential for mitigating climate change.
- **Acidic Environment**: Sphagnum mosses create and maintain acidic conditions in peatlands, which are necessary for the growth of other peat-forming species. A decline in Sphagnum cover can lead to changes in pH and the overall peatland ecosystem.
- **Biodiversity**: Sphagnum-dominated peatlands support a diverse range of plant and animal species. The abundance and diversity of Sphagnum species can reflect the overall biodiversity and health of the peatland.
- **Indicator of Degradation**: A reduction in Sphagnum cover often indicates peatland degradation due to factors like drainage, burning, or overgrazing.

Consequently, abundant or dominant sphagnum is likely to be a positive indicator of peatland condition, whereas below expected or absence of sphagnum is an indicator of degraded peatland conditions.

Field monitoring (**Annex B: Figure V1-9.4.6 - Sphagnum Cover**) shows that 76.9 % of the Proposed Alignment has no or rare coverage (<5 %) of *Sphagnum spp* cover. In these low coverage areas, sphagnum is dominated by *Sphagnum Cappillofolium*. Areas within the footprint of the 2019 wildfire, show evidence of previously higher cover, in the form of burnt hummocks, however there is very little evidence of recolonisation with cover replaced by bare peat.

The remaining areas contains occasional Sphagnum (5-15%) with small areas of locally abundant (15-30%) Sphagnum cover (15.5% and 7.6% of the Proposed Alignment respectively). These are entirely located to the east of the Proposed Alignment close to Towers

44 - 48 in an area of deeper peat. Sphagnum distribution in these areas is patchy and is concentrated within surface drainage features and surface depressions with free floating species such as *Sphagnum cuspidatum*, found alongside *Sphagnum papillosum*, *Sphagnum fallax* and *Sphagnum capillofolium*. These areas should be avoided by infrastructure however due to the sporadic nature of sphagnum within these areas it should be possible with micrositing within the LoD.

Infrastructure Assessment

Overall, Sphagnum cover **(Annex A ;Table F**) is absent or rare in most of the areas of planned infrastructure within the Proposed Alignment. Where more common, namely close to Towers T44 -T48, Sphagnum occurs alongside elevated Molinia (locally abundant) and abundant/dominant *Calluna vulgaris*. In these areas any impacts on more intact parts of the peatland should be possible to be mitigated with micro siting within the LoD.

Table F – Sphagnum cover, diversity and size adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Sphagnum Abundance		
T21, T22, T23, T24, T25, T26, T27, T28, T30 T32, T33, T35, T36, T37, T38, T39, T40, T41, T42, T49, T50, T51, T53, T55, T57, T59, T60, T61, T62, T63, T64	Absent	A lack of sphagnum, a keystone species within blanket peat is generally a negative peatland condition indicator.
T19, T20, T29, T34, T43, T56	Rare	Rare sphagnum, a keystone species within blanket peat is generally a negative peatland condition indicator.
T31	Rare-Occasional	Rare-Occasional sphagnum, a keystone species within blanket peat is generally a negative peatland condition indicator.
T44, T45	Occasional	Occasional sphagnum, a keystone species within blanket peat is generally a negative peatland condition indicator.
T46, T47, T48, T52, T58	Occasional/Locally Abundant	Locally Abundant sphagnum, a keystone species within blanket peat is generally a positive peatland condition indicator.
T54	Abundant	Abundant sphagnum, a keystone species within blanket peat is generally a very positive peatland condition indicator.

More Than One Type of Sphagnum?		
T44, T46, T47, T48, T54, T58	Yes	Multiple types of sphagnum indicates a diversity of peatland environments on site and is generally indicative of better peatland conditions.
T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T43 T45, T49, T50, T51, T52, T53, T55, T56, T57, T59, T60, T61, T62, T63, T64	No	The absence of multiple species of sphagnum indicates a lack of diversity seen within near natural sites and is generally a negative indicator.
Sphagnum Size		
T21, T22, T23, T24, T25, T26, T27, T28, T30, T32, T33, T35, T36, T37, T38, T39, T40, T41, T42, T49, T50, T51, T53, T55, T57, T59, T60, T61, T62, T63, T64	N/A	A lack of sphagnum, a keystone species within blanket peat is generally a negative peatland condition indicator
T19, T20, T29, T31, T34, T45, T46, T52, T56	Thin	Thinner species of Sphagnum are generally associated with drier conditions and in the case of the Proposed Alignment are largely *Sphagnum Capillofolium* (a hummock forming species found on dry and wet heath as well as blanket peatland).
T43	Large	Larger species of sphagnum generally represent more peat forming species and are indicative of better condition peatland.
T44, T47, T48, T54, T58	Both	The presence of both large and thin species of sphagnum is indicative of a range of peatland conditions common within better condition peatlands.

Non-Sphagnum Mosses and Lichen Cover

Non-Sphagnum mosses can impact peatland condition in several ways:

- **Vegetation Composition**: Non-Sphagnum mosses, such as Polytrichum and Hypnum, can alter the vegetation composition of peatlands. While they can coexist with Sphagnum, their dominance can reduce the abundance of Sphagnum mosses, which are crucial for peat formation. They also tend to be disturbance and/or elevated nutrient concentrations which are not favourable to sphagnum.

- **Hydrology:** These mosses can influence the hydrology of peatlands by affecting water retention and flow patterns. Non-Sphagnum mosses generally have different water-holding capacities compared to Sphagnum, which can lead to changes in the water table and moisture levels.
- **Carbon Storage**: Non-Sphagnum mosses contribute to peat formation, but not as effectively as Sphagnum mosses. Their presence can lead to slower peat accumulation rates and potentially lower carbon sequestration capacity.
- **Decomposition Rates**: The litter from non-Sphagnum mosses decomposes at different rates compared to Sphagnum. This can influence the overall decomposition dynamics and nutrient cycling within the peatland.

Field monitoring shows that non-sphagnum mosses are generally rare to scarce within the 2019 wildfire footprint with non-sphagnum mosses dominated by relic hummocks of *Racomitrium Languinosum*, (wooly fringe moss). This is likely due to the vulnerability of such hummocks and the dry conditions they represent to burning during wildfire. As with sphagnum hummocks the charred remains of dead *Racomitrium* are widespread within the 2019 wildfire footprint and show little evidence of recolonisation. Where burning was less severe or absent *Racomitrium* hummocks form in drained areas such as on peat banks or in areas of dry heath. Similarly lichen (*Cladonia spp*.) is absent from burnt areas but present within unburnt areas. In flushes and adjacent to natural drainage where burning was less severe and nutrients higher *Pleurozium schreberi* and *Polytrichum* commune tend to dominate.

Overall due to the impact of the 2019 wildfire non-sphagnum mosses represent a minor component of vegetation cover across the Proposed Alignment. They have also shown limited recovery post fire.

Ericaceous Shrub Cover

Common Heather can significantly impact peatland condition in various ways:

- **Vegetation Dominance**: Heather can become dominant in peatlands, especially when not managed properly. This dominance can suppress the growth of other important peat-forming species like Sphagnum mosses.
- **Hydrological Changes**: Dense heather cover can alter the hydrology of peatlands by reducing water retention and increasing evapotranspiration. This can lead to drier conditions, which are less favourable for peat formation.
- **Fire Risk**: Unmanaged heather can increase the risk of wildfires, especially during warmer and drier periods. Wildfires can cause significant damage to peatlands, leading to the loss of vegetation and peat soil.
- **Biodiversity:** While heather can provide habitat for certain species, its dominance can reduce overall biodiversity by limiting the variety of plant species that can thrive in peatlands.
- **Carbon Storage**: Heather-dominated peatlands may have reduced carbon sequestration capabilities compared to those with a diverse mix of peat-forming species. This is because heather does not contribute to peat formation as effectively as Sphagnum mosses.

Field observations (**Annex B: Figure V1-9.4.7 – Calluna Vulgaris Cover**) show that *Calluna vulgaris* (common heather) is abundant to dominant across 57 % of the Proposed Alignment. In many areas of the 2019 wildfire footprint heather and bare peat dominate cover, with lesser recovery of other ground covering species such as cotton grass and deer grass. *Calluna* *vulgaris* growth is also stunted across large areas of the Proposed Alignment at <10 cm, despite, in areas with reduced fire impacts these are maximum 20 cm in height. Indicating relatively recent colonisation and potentially harsher growing conditions post fire. Outside the burn scar area heather height is much more varied although intensive grazing by sheep in these areas has limited heather heights and promoted side branching.

Other *Erica* species are present across the Proposed Alignment, namely *Erica tetralix* and *Erica cinerea*. *Erica tetralix* is generally found on lower slopes and within valleys whereas *Erica cinerea* is found in higher nutrient flushes and adjacent to water courses. Neither species is present above rare or occasional cover within the 2019 wildfire footprint indicating widespread replacement by *Calluna vulgaris*. Outside the wildfire footprint *Erica tetralix* is more common (up to locally abundant cover) but appears to be outcompeted by *Calluna vulgaris* in most cases.

Overall dominance of *Calluna vulgaris* indicates a highly modified peatland landscape with replacement with low diversity dry heath species at the expense of peatland species due to widespread drainage, grazing and peat cutting. This has been exacerbated by the 2019 wildfire which appears to have further favoured Calluna dominance across the Proposed Alignment.

Infrastructure Assessment

The majority of the Proposed Alignment infrastructure (**Annex A; Table G**) contains abundant or dominant *Calluna vulgaris* cover reflecting overall drained and heavily modified conditions. The monoculture of heather is likely to contributing significantly to drainage and drying of the peat surface and is also contributing to increased fire risk on the site. Overall, the high coverage of Calluna indicates that most of the proposed infrastructure lies within non active/ peat forming peat in drained condition.

Table G – *Calluna vulgaris* cover adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Calluna vulgaris Cover		
T50, T51, T52, T53, T59	Absent	*Calluna Vulgaris* cover is usually a component of natural blanket peatlands its absence may indicate modification.
T47	Rare	*Calluna vulgaris* cover is usually a component of natural blanket peatlands where rare it may indicate modification.
T49, T54	Occasional	*Calluna vulgaris* cover at this level is usually a component of natural blanket peatlands.
T56	Locally Abundant	*Calluna vulgaris* cover at this level is usually a component of natural blanket peatlands.

T19, T20, T21, T26, T27, T29, T31, T32, T34, T35, T36, T37, T43, T44, T45, T46, T48, T57, T61	Abundant	*Calluna vulgaris* cover is usually a component of natural blanket peatlands however at abundant cover it may indicate drier conditions favouring vascular plants.
T22, T23, T24, T25, T28, T30, T33, T38, T39, T40, T41, T42, T55, T58, T60, T62, T63, T64	Dominant	*Calluna vulgaris* cover is usually a component of natural blanket peatlands however at dominant cover it may indicate intensively managed and drained conditions.

Sedge and Grass Cover

Cotton grass (*Eriophorum spp.*) can have several impacts on peatland condition[14]:

- **Nutrient Dynamics**: Cotton grass tends to deplete phosphorus and nitrogen from the peat, which can favour sphagnum forming species.
- **Decomposition Rates**: The litter from cotton grass decomposes more slowly under the anoxic conditions typical of peatlands. This slow decomposition does not significantly enhance microbial biomass or activity.
- **Carbon Storage**: Despite its presence, cotton grass does not necessarily increase organic matter decomposition. Therefore, its spread is unlikely to negatively impact the peatland's function as a carbon sink.

Overall, while cotton grass can influence nutrient cycling and vegetation structure, it does not significantly alter the fundamental carbon storage function of peatlands and can be classed as a neutral/positive peatland condition indicator. However, conversely Molinia caerulea, commonly known as purple moor grass, can significantly impact peatland condition in several ways:

- **Vegetation Dominance:** Molinia can outcompete and dominate other peatland species, particularly Sphagnum mosses, which are crucial for peat formation. This shift can reduce the overall biodiversity of the peatland.
- **Nutrient Cycling**: Molinia has a higher nutrient content in its litter compared to Sphagnum. This can lead to faster decomposition rates and increased nutrient cycling, which may alter the peatland's nutrient dynamics.
- **Hydrological Changes:** The dense root systems of Molinia can affect the hydrology of peatlands by altering water retention and flow patterns. This can lead to drier conditions, which are less favourable for peat formation.
- **Carbon Storage:** The invasion of Molinia can reduce the carbon sink capacity of peatlands. The faster decomposition of Molinia litter compared to Sphagnum can result in higher carbon emissions.
- **Fire Risk:** Molinia-dominated peatlands can be more susceptible to fires, especially during dry periods. Fires can cause significant damage to peatlands, leading to the loss of vegetation and peat soil.

As such the presence of dominant Molinia caerulea and non-peatland grasses can be considered a negative peatland condition indicator.

[14] Kaštovská, E., Straková, P., Edwards, K. *et al.* Cotton-Grass and Blueberry have Opposite Effect on Peat Characteristics and Nutrient Transformation in Peatland. *Ecosystems* **21**, 443–458 (2018).

Field observations show that Cotton grass (both *Eriophorum Angustifolium* and *Vaginatum)* are present across the Proposed Alignment, however cover is predominantly *Eriophorum Vaginatum* indicating drier conditions. *Tricophorum Germanicum* (Deer Grass) is also present alongside the cotton grasses. Within the 2019 wildfire footprint, both Cotton grass and Deer grass are supressed with relatively low abundance (occasional to locally abundant (5-25%)) compared to unburnt parts of the site. Both Cotton grass and Deer grass are absent or rare within areas of rough grazing or improved pasture being largely replaced by non-peatland vegetation. These areas generally lie within the westernmost and easternmost parts of the Proposed Alignment site, where agricultural usage is greatest.

Molinia caerulia forms a natural but minor component of peatlands within the western Flow Country, and is generally outcompeted by Cotton grasses and Deer grass within the drained peatland which forms the central part of the Proposed Alignment site (**Annex B: Figure V1-9.4.8 – Molinia Cover**). In these areas it also appears to have been suppressed by the 2019 wildfire. However in areas of higher density grazing on the western and eastern edges of the Proposed Alignment site (T19 - T36 and T46 - T56 respectively) Molinia begins to predominate, with Molinia tussocks where grazing pressure increases.

Overall, Cotton grass and Deer grass is supressed across much of the site, with low recovery within the 2019 wildfire footprint. This is also true of Molinia within the 2019 wildfire footprint. This indicates that the high degree of modification of this landscape has hydrologically compromised the remaining peatland, impeding post fire recovery and favouring replacement by *Calluna vulgaris*. In more heavily grazed areas, Molinia tussocks outcompete Cotton grass and Deer grass providing drier, more nutrient rich and less biodiverse conditions.

Infrastructure Assessment

Molinia cover near infrastructure is at occassional to locally abundant cover across large parts of the Proposed Alignment (**Annex A; Table H**), particularly where burn severity within the 2019 wildfire footprint was greatest. It is generally absent where infrastructure coincides with areas of improved pasture.

Table H – *Molinia caerulia* cover adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Molinia Cover		
T21, T50, T51, T58, T59, T60, T61, T62, T63	Absent	Although Molinia caerulia cover is usually a component of natural blanket peatlands in this area its absence is not an indicator of positive or negative condition.
T43, T45	Rare	*Molinia caerulia* cover is usually a component of natural blanket peatlands in this area its cover at this level is not a concern.
T24, T25, T26, T31, T32, T37, T38, T39, T40, T41, T42, T44, T53, T54, T56	Occasional	*Molinia caerulia* cover is usually a component of natural blanket peatlands in this area its cover at this level is not a concern.

T20, T23, T27, T33, T34, T35, T36, T46, T47, T48, T49, T52, T55, T57, T64	Locally Abundant	*Molinia caerulia* cover is usually a component of natural blanket peatlands in this area however it is usually secondary to cottongrass and deer grass in this area and is a negative indicator.
T19, T28, T30	Abundant	*Molinia caerulia* cover is usually a component of natural blanket peatlands in this area however at abundant cover it likely reflects highly modified conditions and is a negative indicator.
T22, T29	Dominant	*Molinia caerulia* cover is usually a component of natural blanket peatlands in this area however at abundant cover it likely reflects highly modified conditions and is a negative indicator.

Bracken

Bracken (*Pteridium aquilinum*) can significantly impact peatland quality in several ways:

- **Vegetation Composition**: Bracken can dominate the vegetation, reducing biodiversity by outcompeting native species. This can lead to a decline in plant diversity and negatively affect the overall ecosystem.
- **Soil and Hydrology:** The dense canopy of bracken can alter the soil structure and hydrology of peatlands. It can increase soil erosion and affect water retention, which is crucial for maintaining peatland health.
- **Carbon Storage**: Peatlands are important carbon sinks, and the presence of bracken can influence carbon dynamics. Bracken litter can contribute to changes in soil carbon content and decomposition rates.
- **Management Challenges**: Controlling bracken is challenging and often requires repeated interventions. Methods like cutting, herbicide application, and grazing have varying degrees of success.

Field observations show that Bracken is not present across large amounts of the site, however, can be locally dominant, this is of particular note around Tower 21. This lies on an area of mineral soil adjacent to disturbance from the creation of a septic tank for the adjacent cottage.

Forestry

Native forestry can have several impacts on peatlands:

- **Hydrology Alteration**: Tree roots can change the water table levels in peatlands. Native trees, although better suited than non-native species, can still affect the hydrology by drawing water from the peat, potentially leading to drier conditions.
- **Carbon Storage**: Peatlands are significant carbon sinks, and the introduction of trees can alter carbon dynamics. While trees sequester carbon, the disturbance to peat can release stored carbon, potentially offsetting the benefits.
- **Biodiversity**: Native forestry can enhance biodiversity by providing habitats for various species. However, it can also lead to changes in the native peatland flora

and fauna, sometimes reducing the abundance of species that are specifically adapted to open, treeless peatland environments.

- **Peatland Restoration**: In some cases, removing trees from peatlands can be beneficial for restoration efforts. This helps to re-establish the natural hydrology and promote the growth of peat-forming vegetation.

Non-native forestry can have several significant impacts on peatlands:

- **Hydrology Disruption**: Non-native trees, such as Sitka spruce and lodgepole pine, often require drainage to thrive. This drainage can lower the water table in peatlands, leading to drier conditions that are detrimental to peat formation and maintenance1.
- **Carbon Release**: Peatlands are crucial carbon sinks, storing vast amounts of carbon. The disturbance caused by planting and maintaining non-native forests can lead to the release of stored carbon, contributing to greenhouse gas emissions.
- **Biodiversity Loss**: The introduction of non-native trees can alter the native plant and animal communities. Species that are adapted to open, wet peatland environments may decline, while forest species may increase.
- **Soil Erosion and Degradation**: The physical disturbance from forestry operations, including planting and harvesting, can lead to soil erosion and degradation. This can further impact the hydrology and carbon storage capacity of peatlands.
- **Restoration Challenges**: Once non-native forests are established, restoring the peatland to its natural state can be challenging and resource-intensive. It often requires removing the trees, blocking drainage channels, and re-establishing native vegetation

The Proposed Alignment lies adjacent to plantation forestry (**Plate 6**, and **Annex B: Figure V1-9.4.2 - Erosion and Landuse Features**) adjacent to Towers 49 and close to Towers 48 and 50. Forestry is comprised primarily of Sitka Spruce and Lodgepole Pine with deep furrows and feeder drains leading to drainage of the peatland surface. There is also evidence of conifer regeneration outside the plantation area within adjacent open peatland areas. Conifer encroachment is likely further reducing water tables in these areas. If untreated it is likely that this drying effect will promote further colonisation of open areas of peatland unless action is taken to increase water tables.

Plate 6 - Plantation Forestry adjacent to Tower 49 including minor conifer colonisation of open peatland

Native forestry (**Plate 7** and **Annex B: Figure V1-9.4.2 - Erosion and Landuse Features**) can be found close to Towers 51, 54, 58, 59, with only the woodland at Tower 54 being located on peat. Planting in this area has generally used mounding where trees are raised above the water table with an adjacent open borrow pit forming a pool leading to discontinuous drainage. Further drainage is applied in the form of narrow hill drainage although not at the density observed within commercial forestry.

Overall native and plantation forestry is likely to have a negative impact on peatland condition where present on peat due to the presence of drainage and vascular plants reducing water tables and the potential for conifer encroachment onto currently open areas of peatland.

Plate 7 - Native Forestry using mounding and pit techniques on organic rich soils causing drainage near Tower 51

Infrastructure Assessment

Where infrastructure is present or adjacent to forestry (**Table I**) it is likely that a combination of drainage and conifer colonisation of peat areas is having a severe negative impact on peatland condition.

Table I – Forestry / Woodland cover adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Presence of Forestry		
T48, T50, T55	Nearby	Nearby forestry / woodland is likely to cause increased drainage and risk of regen/conifer colonisation and is likely to negatively affect condition

T49, T51, T52, T54, T58, T59	Yes	Peatland within forestry / woodland is likely to be subject to intensive modification, increased drainage and risk of regen/conifer colonisation and is likely to have a severe negative impact on condition.

Bare Peat Cover

Bare peat is a significant indicator of peatland condition[15] and often signals degradation as it indicates:

- **Lowered Water Table:** The presence of bare peat usually indicates that the water table has dropped. This drying out of the peatland can lead to further degradation.
- **Erosion Susceptibility**: Without vegetation cover, bare peat is highly susceptible to wind and water erosion. This can lead to the formation of peat hags and gullies, further destabilising the peatland.
- **Vegetation Loss**: The loss of surface vegetation, especially mosses like Sphagnum, is a common precursor to the development of bare peat. This loss reduces the peatland's ability to retain water and support typical bog species.
- **Indicator of Modification**: Extensive areas of bare peat are often found in highly modified peatlands. These areas are less likely to function effectively as carbon sinks and are more prone to further degradation.

Field observations (**Annex B: Figure V1-9.4.9 – Bare Peat Cover**) show that bare peat ranges between occasional (5-15%) and locally abundant (15-30%) cover across much of the Proposed Alignment. This is largely characterised within the 2019 wildfire footprint as the lack of ground cover between juvenile heather at the expense of cover species such as Sphagnum mosses, non-sphagnum mosses and sedges. Bare peat is generally absent in unburnt areas and cultivated areas on the eastern and western margins of the Proposed Alignment site. Overall, the presence of bare peat particularly within the 2019 wildfire footprint is a consequence of intensive land management practices which have lowered water tables and reduced the resilience of the remaining peatland to sustain vegetation. It also makes the peatland more vulnerable to erosion or subsequent peatland fires.

Infrastructure Assessment

Bare peat cover near infrastructure (**Annex A; Table J**) is at occassional to locally abundant cover across large parts of the Proposed Alignment particularly where burn severity within the 2019 wildfire footprint was greatest. These areas reflect where drainage and compaction caused smouldering of the peat surface and destruction of the seedbank compromising post fire recovery. Bare peat is exacerbated by historic and current peat cutting across the Proposed Alignment site, and grazing pressure. It is also common adjacent to hill tracks on the site which have been cut down to mineral soil in many cases acting as drains. The bare peat on site indicates these area are not in active peat forming condition.

[15] https://www.nature.scot/sites/default/files/2023-02/Guidance-Peatland-Action-Peatland-Condition-Assessment-Guide-A1916874.pdf

Table J – Bare Peat cover adjacent to proposed infrastructure of the Proposed Alignment

Infrastructure	Parameter	Comments
Bare Peat Abundance		
T30, T33, T35, T47, T48, T49, T50, T52, T54, T58, T59, T60, T61, T62, T63, T64	Absent	The absence of bare peat is a positive indicator for peatland condition.
T19, T20, T21, T22, T34, T45, T53, T55, T56	Rare	Rare bare peat is a positive indicator for peatland condition.
T23, T25, T27, T28, T29, T31, T32, T37, T38, T39, T40, T41, T42, T43, T44, T46, T51, T57	Occasional	Occasional bare peat is a likely a negative indicator for peatland condition indicating modification and drying of the peat surface.
T24, T26, T36	Locally Abundant	Locally abundant bare peat is a likely a negative indicator for peatland condition indicating modification and drying of the peat surface.

Peatland Species Cover and Peatland Condition

Overall, key indicators of ecological condition indicate that whilst small areas of somewhat intact peatland remain across the Proposed Alignment within ecological refugia, the majority of the Proposed Alignment is highly modified. The key indicators of this are:

- Sphagnum is absent across much of the Proposed Alignment site. Where it is present it is not present in both the abundance or in the diversity that might be expected from intact, non-modified peatland. Sphagnum species are limited to more low water table-tolerant species such as *Sphagnum capillofolium* which are also common across dry heath communities. Bog forming species are by contrast relatively rare.
- *Calluna vulgaris* is abundant or dominant across large parts of the Proposed Alignment with covers in excess of 50 %.
- Bare peat is present across the Proposed Alignment, particularly within the 2019 wildfire footprint and reflects intensive management of the site for peat extraction and grazing combined with slow recovery from fire due to the degradation of peat across the Proposed Alignment.
- Cover of Cotton grass and Deer grass is lower than expected in most areas and is struggling to colonise areas of charred peat. In areas of higher grazing Molinia tussocks dominate over sedges reflecting the drier more nutrient rich conditions and high levels of disturbance.

4.2.2 Peatland Microtopography and Patterning

Peatland microtopography refers to the small-scale variations in surface elevation within peatlands, which significantly influence their ecological and hydrological processes. The main features of peatland microtopography include:

- **Hummocks**: These are raised areas that are typically drier and support vegetation like dwarf shrubs and certain mosses. Hummocks have higher carbon dioxide (CO_2) fluxes due to their aerobic conditions.
- **Hollows**: These are lower, wetter areas that often remain saturated. They are dominated by graminoids and Sphagnum mosses, which thrive in these conditions. Hollows are associated with higher methane (CH_4) emissions due to anaerobic decomposition.
- **Lawn**: Intermediate areas between hummocks and hollows, which can support a mix of vegetation types depending on the water table level. Low lawn is likely dominated by graminoids and Sphagnum mosses whereas high lawn is likely more dominated by dwarf shrubs and drier sphagnum species. These are often the most common features on blanket peatland.
- **Pools:** Permanently inundated parts of the peatland with free floating sphagnum species and bog bean. These are often important hotspots for invertebrates such as dragonflies.

Microtopography affects various ecological processes, including:

- **Water Table Dynamics**: The position of the water table relative to the surface influences the types of vegetation that can thrive and the rates of decomposition and carbon cycling.
- **Carbon Storage and Emissions**: The balance between CO_2 and CH_4 emissions is influenced by the microtopographic features, with hummocks generally emitting more CO_2 and hollows more CH_4.
- **Biodiversity**: Different microtopographic features support different plant and animal communities, contributing to the overall biodiversity of peatlands.

Understanding and preserving the microtopography of peatlands is crucial for maintaining their ecological functions and mitigating climate change impacts. As such the presence of peatland patterning and sphagnum rich ridges is an important indicator of ‘near natural’ peatland and thus form a key part of the SSSI assessment criteria.

This assessment uses a presence absence approach within a 25 m radius of each survey point to indicate whether the full suite of microtopographic features are present, e.g. pools, hollows, lawn, hummock representing the most diverse and intact peatland assemblage. Whether there is a partial assemblage, for example mainly high lawn and hummocks indicating a drier (potentially drained system) or a predominance of hollows and low lawn indicating wetter water-table conditions indicating slightly better conditions. Conversely the presence of one type of microtopography e.g. High lawn is likely indicative of disturbance such as burning/drainage which has artificially lowered water tables and favoured heath species such as *Calluna vulgaris*. A natural surface pattern such as hummocks, hollows and lawns, is assumed to be good evidence of conditions approaching near-natural.

Distribution of Peatland Microtopography and Patterning

Field observations show that microtopography is absent from the majority of areas and is dominated by dry heath vegetation, which demonstrates a longstanding reduction of water tables across the Proposed Alignment by drainage, grazing and peat cutting. This has led to dominance by low diversity dry heath such as *Calluna vulgaris*. Only one pool system remains within the landscape and lies outside the Proposed Alignment area.

Peatland Microtopography and Patterning and Peatland Condition

The lack of microtopography across the Proposed Alignment indicates that the full suite of peatland microhabitats are not present at the Proposed Alignment site. The Proposed Alignment is dominated by high lawn communities typical of dry heath, indicating that water tables across the Proposed Alignment are consistently low, due to artificial drainage and peat cutting. Overall, this indicates that most, if not all, of the peatland is not in active peat forming condition.

4.2.2.3 Infrastructure Assessment

Infrastructure (**Table K**) across the Proposed Alignment largely avoids any areas of microtopography with only one tower close to low lawn and bare peat pools, which should be possible to avoid within the LoD micro siting allowances.

Table K – Microtopography cover adjacent to proposed infrastructure of the Proposed Alignment

Infrastructure	Parameter	Comments
Microtopography		
All towers (excluding T54)	None	Microtopography, which includes small-scale variations in the surface such as hummocks and hollows, plays a crucial role in maintaining the hydrological and ecological balance of peatlands. Consequently the absence of this is a negative indicator of peatland condition.
T54	Low Lawn and Pools	The partial presence of microtopography is a minor positive peatland indicator demonstrating variability in peatland microtopes in this area.

4.3 Land Use Related Factors

4.3.1 Wildfire and Prescribed Burning

The impact of burning on peatland condition is contentious however a number of core impacts are broadly agreed[16]:

- **Consensus on Damage**: There is a broad agreement among scientists and policymakers that burning is harmful to peatlands. The England Peat Action Plan[17] supports this, citing extensive evidence that managed burning degrades peatlands.

[16] IUCN position statement: Burning and Peatlands IUCN UK PP Burning and Peatlands Position paper v3 May 2021_0.pdf

[17] DEFRA 2021 England Peat Action Plan https://assets.publishing.service.gov.uk/media/6116353fe90e07054eb85d8b/england-peat-action-plan.pdf

- **Degradation Effects**: Burning can lead to the loss of key bog species, development of micro-erosion networks, increased tussock formation, and dominance of non-peat forming vegetation like heather and certain mosses.
- **Recovery Factors:** The impact of fire on peatlands, especially on Sphagnum moss recovery, depends on burn frequency and intensity, soil water levels, livestock trampling, climate, altitude, and the initial condition of the peatland.
- **Rotational Burning Consequences:** Regular burning results in drier vegetation communities, which can increase erosion rates, reduce soil moisture, and negatively affect biodiversity, carbon emissions, water quality, and flood management.

This assessment aims to quantify the presence/absence of key burning indicators on-site to determine the degree of confidence that the site has been subject to managed burning. This does not represent a comprehensive fire intensity assessment, but it is likely that areas with more evidence of impact, for example surface charring and multiple fire indicators, are likely to have greater fire impacts than where such evidence is absent. Where charring, burn scars are observed on-site, this is taken as direct evidence of burning and is therefore weighted more highly than other indicators such as uniform heather size, cracking, presence of grouse butts which are more contextual evidence sources.

Desk Based Assessment

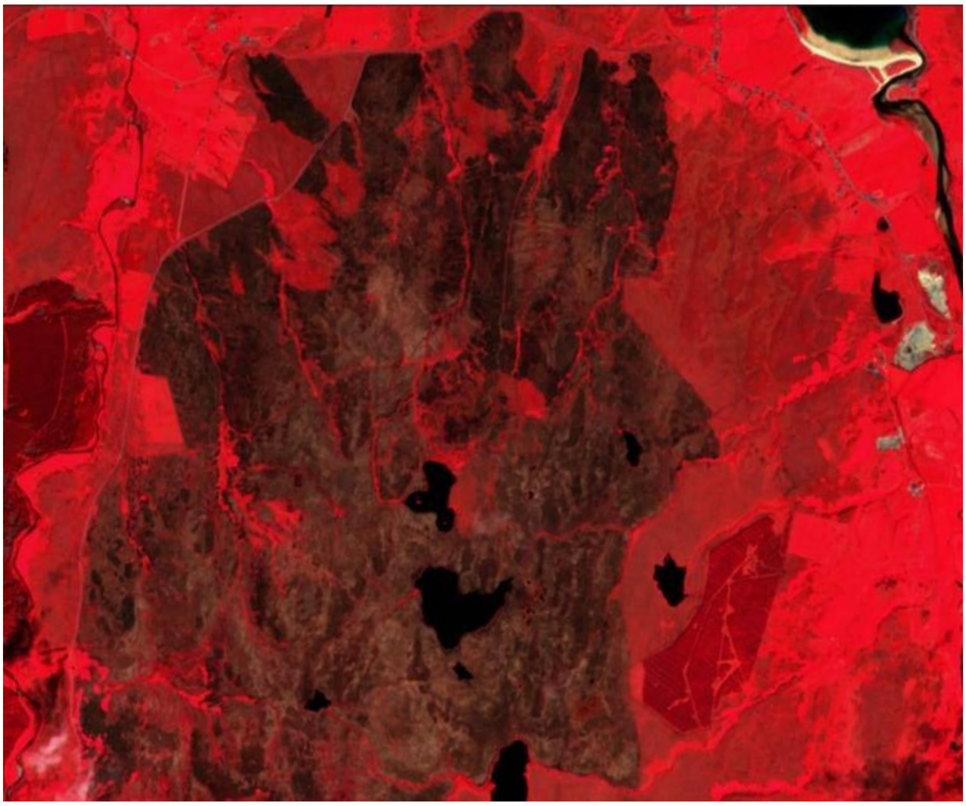
The Flow Country wildfire in May 2019 burned for six days, impacting about 22 square miles (5,700 hectares) of the peatland between Melvich and Strathy. This fire released an estimated 700,000 tonnes of greenhouse gases into the atmosphere. A recent study[18] highlights that the Melvich (ME) area was the most severely impacted by the 2019 wildfire. The impacts are listed below:

- **Vegetation**: Nearly all vegetation biomass was consumed, with the area dominated by dense, monospecific stands of Calluna vulgaris, making it particularly vulnerable.
- **Peat Characteristics**: The peat in Melvich is shallow (up to ~0.5 m) and has a history of peat cutting, grazing, and burning, leading to drying and compaction.
- **Drought Effects**: During the drought, the sustained drop in the water table caused prolonged aeration and severe cracking of the peat, especially on the sides of peat cuttings, creating hotspots for smouldering.
- **Fire Severity**: The denser and drier peat burned hotter and longer, causing higher severity and deeper burning into the peat and seed bank.
- **Long-Lasting Impact**: This severe burning is linked to long-lasting impacts on vegetation, with drier moorland community types at greater risk of severe burns compared to wetter blanket bog communities.

The 2019 wildfire footprint (**Plate 8**) covers most of the western and central parts of the Proposed Alignment and is therefore likely to have a significant impact on peatland condition in these areas.

[18] Andersen, R., Fernandez-Garcia, P., Martin-Walker, A. *et al.* Blanket bog vegetation response to wildfire and drainage suggests resilience to low severity, infrequent burning. *fire ecol* **20**, 26 (2024). https://doi.org/10.1186/s42408-024-00256-0

Plate 8 - Sentinel 2 NIR imagery of the extent of the 2019 Flow Country Wildfire with burned areas shown in black within the area of the Proposed Alignment.



Field Based Assessment

Evidence of fire is high across the footprint of the 2019 wildfire with widespread charring and loss of vegetation. Revegetation is dominated by juvenile heather (5-10 cm) which appears to be stunted. Recovery of other species appears to be slower with negligible recovery of keystone peatland species such as sphagnum. Peat cuts show evidence of smouldering and cracking in response to the fire indicating deep burning of the peat surface with peat loss in excess of 5 cm in some areas. Relic dead sphagnum and Racomitrium hummocks remain however these do not show any sign of regrowth or recolonisation indicating loss of the seed bank and low resilience. The peat surface also appears to have become highly hydrophobic which has likely compromised infiltration of water deeper within the remaining peat surface and will hinder natural recovery. Where water tables were locally higher, vegetation cover is higher but is generally dominated by Molinia tussocks and heather reflecting only the loss of surface biomass. Overall observations within the wildfire footprint match those in *Andersen et al.* (2024)[18].

Outside the wildfire area there is some evidence of past of localised burning as a management tool with low amounts of charred peat, charred vegetation which is likely to have contributed to tussock formation within these areas. However, it is likely that grazing by sheep is likely to form the greatest land-use pressure within these areas.

4.3.2 Infrastructure Assessment

Overall, peat condition at all infrastructure locations (**Table L**) within the 2019 wildfire footprint has been severely impacted by the impacts of fire. Extensive bare peat and slow recovery of keystone peatland species is likely to be leading to enhanced erosion and active degradation of the remnant peat bodies present. Outside the wildfire footprint, whilst it is likely that past burning is likely to have been used for agricultural purposes to create rough grazing and improved pasture, leading to degradation of the peat surface, fire impacts are likely to be low. Field observations indicate it is highly unlikely that peat within the 2019 wildfire footprint is actively sequestering carbon and is likely in long term decline.

Table L - Impact of burning on Peatland Condition adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Evidence of Burning		
T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T43, T44, T45, T46,	High Evidence	Areas with high evidence of burning including a range of burn indicators such as peat charring, vegetation charring, bare peat, peat cracking is a highly negative peatland condition indicator.
T47, T48, T49, T50, T51, T52, T53, T54, T55, T56, T57, T58, T59, T60, T61, T62, T63, T64	Low Evidence	Areas with low evidence of burning indicate that past burning management may have impacted peatland condition in the past contributing towards current condition but is not a major impact on peatland. This is a slight negative indicator.

4.3.2 Grazing

Grazing, browsing and trampling by native wild animals are components of natural bog ecosystems in the UK but unsustainable levels of grazing and trampling from grazing livestock (sheep, cattle and deer) can have adverse effects on the peatland ecosystem.

The immediate impacts on the blanket peatland result from physical damage caused by trampling, grazing, and urine/faecal deposits on vegetation and bog surfaces. These actions create tracks and small areas of exposed peat, which can become focal points for erosion. Over the long term, there may be a reduction in the annual biomass retained in the living surface layer (both above and below ground). At particular risk is *sphagnum spp.* which are sensitive to trampling and cannot withstand more than two trampling events in a year, taking multiple years to recover. In the long term, persistent high stocking levels lead to the loss of peat-forming vegetation and subsequent drying out of the bog surface. In sensitive areas, this results in the complete loss of the acrotelm layer, colonisation by non-peat-forming species on the drier surface, the emergence of bare peat patches, and an increased risk of erosion.

When present at an appropriate density, wild deer contribute to maintaining natural habitats in good condition and can yield positive effects. However, since the 1960's red deer counts nationally within Scotland have trebled and whilst Scotland's population has stabilised over the last 20 years, it is currently at a historic high and has had severe consequences for both native forestry and blanket peatland habitats. Specifically, within a blanket peatland context, high deer densities result in soil compaction, gully erosion and creation, peatland fertilisation through urine, as well as grazing pressure on peatland species. Trampling is also likely to be exacerbated by freeze-thaw processes within more exposed terrain.

Grazing can significantly impact the condition of peatlands in several ways[19]:

- **Vegetation Changes**: Over-grazing can suppress typical peatland vegetation, leading to a reduction in species like Sphagnum mosses, which are crucial for peat formation. This can result in a shift towards more grazing-tolerant species, such as grasses and shrubs.
- **Soil Compaction**: The trampling by livestock can compact the peat soil, reducing its ability to retain water and increasing the risk of erosion.
- **Hydrological Alterations**: Grazing can alter the hydrology of peatlands by damaging the vegetation that helps maintain the water table. This can lead to drier conditions, further degrading the peatland.
- **Carbon Release**: Disturbance from grazing can lead to the release of stored carbon from the peat, contributing to greenhouse gas emissions.
- **Biodiversity Impact**: High grazing levels can reduce the diversity of plant and animal species in peatlands, impacting the overall ecosystem health.

This assessment aims to quantify the presence/absence of key grazing indicators on-site to determine the degree of confidence that the site has been subject to intensive grazing. This does not represent a comprehensive grazing analysis, but it is likely that areas with evidence of impact, for example grazer observations, trampling, track indicators are likely to have some grazing impact. Field observations will also be supported by literature evidence regarding current and historic grazing on-site.

Desk Based Assessment

The Northern Deer Management Group indicates that within the northern subgroup (of which the Proposed Development is part) deer densities are in general <10 deer/ha with cull rates reducing this overtime to around 5.4 deer/ha by 2024. Deer counts in 2021/2022 indicate that whilst on average deer densities remain below 10 deer/ha concentrations greater than this were observed, this is likely due to habitat usage where deer populations are concentrated due to topography, access to food source and shelter. Consequently, it is likely that in some areas, deer impacts are likely to be still having a negative impact on peat condition across the Proposed Alignment. It is also likely that past deer numbers exceeded 10 deer/ha given the trajectory shown in past deer management plans.

Grazing by sheep is widespread across the Proposed Alignment and is likely to be the primary grazing pressure on peatlands within the area. A number of areas have been converted for rough and improved pasture (**Plate 9** and **Annex B: Figure V1-9.4.9 – Bare Peat Cover**) which have likely converted areas of previous dry and wet heath as well as peatland.

[19] Littlewood, N., Anderson, P., Artz, R., Bragg, O., Lunt, P., Marrs, R., 2010 Peatland Biodiversity - A Technical Review for the IUCN Peatland Program https://www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/Review%20Peatland%20Biodiversity%2C%20June%202011%20Final.pdf

Field Based Assessment

Grazing evidence by sheep is present across the Proposed Alignment primarily as evidence of footprints, scats and actual sightings. Where present evidence of scrabbling and puddling is frequent especially where feeders are placed. In areas with higher sheep densities, Molinia tussocks and grazed heather predominate replacing peatland and heath species. Whilst it is likely that sheep numbers have reduced over time across the Proposed Alignment, livestock continue have to have a negative impact on peatland condition

Plate 9 - Improved Pasture in western part of Proposed Alignment adjacent to T50

Infrastructure Assessment

Whilst the assessment does not constitute a detailed herbivore impact assessment, it does provide clear evidence of historic and current herbivore impact on the Proposed Alignment (**Annex A; Table M**). Herds of deer and sheep were observed (January 2025) and most points visited show herbivore impacts. The area is likely to have had high historic deer populations and there is clear evidence on-site that deer and sheep impacts are contributing negatively to peatland recovery. Overall, grazing is therefore likely to have had and continues to have a significant negative impact on peat condition across the Proposed Alignment.

Table M – Impact of grazing on Peatland Condition adjacent to proposed infrastructure of the Proposed Alignment

INFRASTRUCTURE	PARAMETER	COMMENTS
Evidence of Grazing		

All Towers	High Evidence of Grazing	Areas with high evidence of grazing impact are likely to have vegetation compaction and erosion impacts on peatland condition and can be considered a negative condition indicator.
Pasture Type		
T50, T52, T53, T59, T63	Improved Pasture	Areas of improved pasture have likely been highly modified with ploughing, sowing of non-peatland species, drainage and fertilisation and therefore represents a negative impact on peatland condition.
T19, T20, T21, T22, T23, T24, T25, T26, T27, T28	Rough Grazing	Areas of rough grazing are likely to have experienced more intensive grazing including drainage, nutrient inputs from feed and scats and compaction and therefore represent a negative indicator of peatland condition.

4.3.3 Hill tracks, Footpaths and Quad Tracks

Tracks on peatlands can have several significant impacts[20],[21]:

- **Hydrological Disruption**: Tracks can alter the natural water flow in peatlands, leading to changes in water levels. This can cause drying out of the peat in some areas and waterlogging in others, which affects the overall health of the peatland.
- **Erosion and Sedimentation:** The construction and use of tracks can lead to erosion of the peat, which then gets deposited in nearby water bodies, affecting water quality and aquatic habitats.
- **Vegetation Damage**: The physical presence of tracks and the movement of vehicles can damage the delicate vegetation that is crucial for peat formation and maintenance.
- **Carbon Release:** Disturbance of peatlands through track construction can lead to the release of stored carbon into the atmosphere, contributing to greenhouse gas emissions.
- **Habitat Fragmentation**: Tracks can fragment peatland habitats, making it difficult for species to move and thrive, which can reduce biodiversity.

[20] Natural England 'The impacts of tracks on the integrity and hydrological function of blanket peat' http://publications.naturalengland.org.uk/publication/5724597

[21] SNH 'Constructed tracks in the Scottish Uplands' http://www.snh.gov.uk/publications-data-and-research/publications/search-thecatalogue/publication-detail/?id=513

This assessment notes the presence of any tracks on the site and would in general consider them to be a negative condition indicator.

Desk Based Assessment

Optical imagery shows that across the Proposed Alignment, many historic tracks associated with peat cutting and grazing, feature. These are generally cut to mineral soil and serve as access to pasture and peat cuts as well as infrastructure such as the water treatment facilities at Melvich and broadcast tower. These appear to be generally associated with areas of extensive drainage with most containing associated drainage. In addition, there are numerous smaller hill tracks and all terrain vehicle (ATV) tracks which cross the heath and peatland generally serving as access to areas of pasture or livestock infrastructure. In the east and west of the Proposed Alignment, there are numerous livestock paths which are likely to have a drainage effect on peatland.

Field Based Assessment

Field based observation of tracks across the site shows that most are bounded by active drains and are generally within shallow parts of the peatland. Many of the peat cut and farm tracks are cut down to mineral soil, and peats alongside are colonised by non-peat grasses or dominated by heather. Due to their purpose most are bounded by peat cuts or pasture which consists of highly modified peatland. Where present outside of peat cutting areas, these tend to show moderate peat erosion with elevated bare peat cover.

Infrastructure Assessment

The reuse of these existing tracks for the Proposed Alignment is likely to mitigate impacts on peat significantly as these are located on shallower peat and are generally bounded by peat in at least drained if not actively eroding condition. This would avoid areas of relatively more functional peat.

5.0 Overall Peatland Condition Assessment

5.1 Extent and Distribution of Condition Indicators

Peatland condition can be divided into Land Management, Ecological, Hydrological and Physical condition indicators. This section gives a summary of the observations set out in previous sections of this report.

5.1.1 Hydrological and Physical Indicators

Overall, the assessment of hydrological indicators on-site indicates two main areas – areas of active drainage associated with hill drainage and peat cuts and at the periphery of the Proposed Alignment conversion of heath and peatland to rough and improved pasture or for native or conifer forestry.

- **Areas of active drainage** - extensive areas of active drains, peat cuts, vegetated gullies and micro-erosion reflect long term drainage and erosion of the site. These areas are drained and actively eroding. The poor condition of the peatland has resulted in high density compacted and dry peat, providing evidence of low water tables conditions over a prolonged period of time and humification of the peat as a result. This is also likely to have exacerbated the impact of the 2019 wildfire.

5.1.2 Ecological Indicators

Overall, the assessment of ecological indicators on-site presents a clear narrative, almost all constituent parts of a functional peatland are absent at the site level e.g. peat forming species, microtopography, full assemblages and where present are very rare and fragmented, representing refugia in hydrologically favourable locations. Across large parts of the site, peat forming vegetation has been replaced by more drought tolerant and heath species such *Calluna vulgaris* and *Molinia caerulia* . Extensive areas of bare peat are present as a result of land management and loss of sphagnum cover during the 2019 wildfire. In detail:

- Peat-forming sphagnum species are present on-site but are very rare with most located to the east of the site. *Sphagnum capillofolium* is more common but remain generally scarce across the site. This species can tolerate lower water tables and can be found within non peat forming habitats such as wet and dry heath but appears to have been adversely impacted by the 2019 fire.
- Hummocks are almost absent with relic burnt hummocks still present but showing little evidence of recolonisation.
- Cover is dominated by Calluna Vulgaris which is dominant across large parts of the site; an indication of lower water tables, higher grazing and management by burning.
- *Tricophorum germanicum* and *Eriophorum spp*. are the predominant ground cover, however *Molinia caerulia* dominates in more heavily grazed areas. This assemblage whilst indicative of fairly typical cover within blanket peatland shows, in general, lower coverage than expected. This is a negative peatland condition indicator and is largely due to the impact and lack of recovery from fire.
- Microtopography is absent from the footprint of the Proposed Alignment with large areas dominated by high lawn (heath species).
- Bare peat is common and is present at occasional to locally abundant cover across a large part of the site largely associated with land management and the impacts of wildfire.

5.1.3 Land Use Related Factors

Overall, the assessment of peatland condition indicates that the site has been subject to intensive management over the last century including:

- Deer management plans and recent surveys indicate a historically high level of grazing both of deer and sheep on the site which has reduced in recent years.
- High intensity burning recently in 2019 with poor peatland condition contributing to both increased fire severity and impact as well as compromising recovery across the Proposed Alignment.
- Large areas of drainage and peat cutting which has actively removed peat from the site and also lead to colonisation of non-peat species.
- Extensive tracks used to reach peat cuts and pasture which have generally caused drainage and removal of peat in its entirety where present.

5.2 Peatland Condition Assessment

Overall, the Proposed Alignment (**Annex A; Annex B: Figures V1-9.4.10a – Peat Condition and V1-9.4.10b – Peat >0.5m Condition**) is drained and actively eroding, with rare occurrences of peat forming species and microtopography in long term decline as a result of intensive management and the impacts of wildfire.

The Proposed Alignment can be categorised into:

- **476 ha (46 %) of drained (artificially and hags) peatland and organic rich soils** within 30 m of active drains (predominantly deep narrow hill drains, peat cuts and drained hill tracks) and of active gullies and micro-erosion. These are extensive across most of the Proposed Alignment . To the east these have in some cases been subject to native forestry planting and conversion to improved pasture.
- **382 ha (36%) of undrained modified peatland and organic rich soils** where grazing and unfavourable historic management practices have modified peatland condition from near natural, but where little erosion or artificial drainage has taken place. Within the site this is restricted to low peat depth areas on slopes away from the focus of peat cutting and grazing.
- **0 ha (0 %) of intact near natural condition peatland** whilst areas with some near natural condition indicators exist, these are present as fragments within a deeply modified and drained context. Peatland communities represent a complex mosaic of different microhabitats and in isolation do not by themselves indicate peatland function, for example relic areas of surviving good condition peatland are isolated in small patches, and likely represent hyper localised hydrological niches rather than evidence of widespread ecohydrological functionality.
- **176 Ha (18%) of Forested (Native and Plantation) and Pasture (Rough Grazing and Improved) –** Areas of highly modified and converted peat and organic soils for forestry planting and grazing, likely subject to ploughing, nutrient enrichment and planting of non-peatland species. These are primarily located in the Strath Halladale valley in the eastern extent of the Proposed Alignment.

5.3 Final Infrastructure Peatland Impact Assessment

The following section, alongside the detailed assessment in **Annex 1**, presents an overview of the peatland impacts of the infrastructure across the Proposed Alignment.

5.3.1 Steel lattice towers and adjacent tracks

Overall, the impacts of steel lattice towers and adjacent tracks is considered to be **low** due to the targeting of actively eroding and drained parts of the site. This infrastructure avoidance criteria was conservative meaning even scarce cover of peat forming sphagnum species and partial microtopography and bare peat pools were considered during route selection. In detail:

- 30 out of 46 towers do not lie on peat soils and target shallow areas of peat with only 10 towers lying on deep peat (>1m).
- Where towers and adjacent tracks are located on deep peat, nine are located within areas of artificial drainage (peat cutting and/or hill drains) with one tower in the modified condition class.
- Towers 43 - 48 show elevated Sphagnum cover **(Annex A)** compared to elsewhere across the Proposed Alignment. Where present, field observations show Sphagnum cover to be concentrated around areas of ponding and therefore significant peatland impacts should be avoided by utilising micrositing allowances within the LoD for these towers.
- Where possible, towers have avoided most positive indicators assessed **(Annex A)** and are located in areas where all negative peatland condition indicators are present. Where locally abundant sphagnum has been identified and bare peat pools are present, avoidance should be possible through micrositing within the LoD.
- As can be seen from the aerial imagery (and field observations **(Annex A),** most tower infrastructure is located in areas of peat cutting, converted rough and improved pasture and forestry, which are heavily drained, actively eroding and dominated by non-peat vegetation.
- It is highly unlikely that any area of peatland along Proposed Alignment is actively sequestering carbon due to the long history of intensive land management on the site.

Table N – Overall Peatland Condition Assessment of proposed infrastructure of the Proposed Alignment

Infrastructure	Parameter	Comments
Peatland Condition Classification		
T21, T22, T24, T25, T26, T27, T28, T29, T32, T33, T34, T35, T40, T51, T56, T57, T58, T61, T62, T63 New temporary tracks close to T29 - T35	Modified	Modified condition peatlands show evidence of burning and grazing but are not obviously drained. Within the 2019 fire footprint sphagnum and other mosses is largely supressed and showing slow recovery. These are largely located within the Eastern and Western parts of the Proposed Alignment.

T19, T23, T30, T31, T36, T37, T38, T39, T41, T42, T43, T46, T47, T48, T49, T52, T53, T59, T60, T64 Existing tracks to be upgraded and new temporary tracks close to T43-T48 CSE compound and bell mouths	Drained Artificial	Artificial drainage on the site comprises high intensity peat cutting, road cutting and hill drainage leading to large areas of former peatland to be converted to heath. These areas were particularly vulnerable to burning during the 2019 wildfire and show slow recovery if any.
T20, T44, T45, T54, T55	Drained Hagg/Gulley	Erosion on the site is concentrated to the western and easternmost part of the Proposed Alignment. It is primarily in the form of microerosion and vegetated gullies although many of these are eroded to mineral soil.
T49	Forestry	Plantation forestry forms only a small part of the Proposed Development however this area is likely to be heavily drained with impacts from conifer regeneration

5.3.2 Peatland Tracks (Upgraded Existing)

Overall, the impacts of upgrading peatland tracks is considered to be **low** as the tracks are already present with active drainage and peat-cutting either side. These in general are already excavated to mineral soil and are located in low peat depth areas or non-peat areas.

5.3.3 Peatland Tracks (New Tracks)

Overall, the impacts of construction of new peatland tracks is considered to be **low** as the majority of tracks follow the line of the proposed OHL which passes primarily over areas with active drainage and peat-cutting. In detail:

- Where new tracks are located on deep peat these lie within areas of artificial drainage (peat cutting and/or hill drains) for the most part with only limited areas in Modified Condition.
- New tracks away from the Proposed Alignment lie in areas of shallow organic and mineral soils dominated by heather and heavily impacted by peat cutting and grazing.

5.4 Other Infrastructure

Overall, the impacts of other infrastructure on-site is considered to be **low** due to targeting areas of past peat cutting and drainage. Where possible, avoidance criteria were conservative, meaning even scarce cover of peat forming sphagnum species and partial microtopography and bare peat pools were avoided. In detail:

- The CSE compound and associated infrastructure lies within Drained (Artificial) conditions
- In general, all additional infrastructure has targeted areas with large amounts of negative indicators of peatland condition, and few, if any, positive condition indicators.

Regards,

SLR Consulting Limited

Dr Chris Marshall
Associate Consultant, Land Quality

Annex A Infrastructure and Peatland Condition Metric Overview

Strathy South Wind Farm Grid Connection

Volume 4: Appendix V1-9.4: Detailed Peatland Condition Assessment

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Infrastructure	Soil Type	WHS Status	Condition Class	Peat/Soil Depth	Sphagnum	>1 Sphag spp.	Sphag Type	Microtopography	Pools	Peat Density	Soil Moisture	Burning	Grazing	Erosion	Bare Peat	Molinia C.	C. Vulgaris	Drains	Peat Cut	Foresty	Pasture
Tower 19	Peat >0.5m	No	Drained Artificial	0.9	Rare	No	Thin	None	None	Hard	Dry	High Evidence	High Evidence	None	Rare	Abundant	Abundant	Yes	Nearby	None	Rough Grazing
Tower 20	Organic Rich Soil (<0.5m)	No	Drained Hagg/Gulle	0.41	Rare	No	Thin	None	None	Hard	Dry	High Evidence	High Evidence	None	Rare	Locally Abundant	Abundant	Yes	None	None	Rough Grazing
Tower 21	Mineral Soil	Yes Just	Modified	0.38	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Rare	Absent	Abundant	None	None	None	Rough Grazing
Tower 22	Organic Rich Soil (<0.5m)	No	Modified	0.35	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Rare	Dominant	Dominant	Yes	None	None	Rough Grazing
Tower 23	Thin Mineral Soil	No	Drained Artificial	0.32	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Occasional	Locally Abundant	Dominant	Yes	None	None	Rough Grazing
Tower 24	Organic Rich Soil (<0.5m)	No	Modified	0.38	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Locally Abundant	Ocassional	Dominant	Nearby	None	None	Rough Grazing
Tower 25	Thin Mineral Soil	No	Modified	0.42	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Occasional	Ocassional	Dominant	Nearby	None	None	Rough Grazing
Tower 26	Organic Rich Soil (<0.5m)	No	Modified	0.41	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Locally Abundant	Ocassional	Abundant	Yes	None	None	Rough Grazing
Tower 27	Thin Mineral Soil	No	Modified	0.28	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Occasional	Locally Abundant	Abundant	None	Nearby	None	Rough Grazing
Tower 28	Organic Rich Soil (<0.5m)	No	Modified	0.38	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Occasional	Abundant	Dominant	None	Nearby	None	Rough Grazing
Tower 29	Organic Rich Soil (<0.5m)	No	Modified	0.33	Rare	No	Thin	None	None	Hard	Dry	High Evidence	High Evidence	None	Occasional	Dominant	Abundant	Nearby	Nearby	None	None
Tower 30	Organic Rich Soil (<0.5m)	Yes Just	Drained Artificial	0.49	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Absent	Abundant	Dominant	Nearby	Nearby	None	None
Tower 31	Peat >0.5m	Yes	Drained Artificial	0.52	Rare-Occasional	No	Thin	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Occasional	Ocassional	Abundant	Nearby	Yes	None	None
Tower 32	Deep Peat >1.0m	Yes	Modified	1.54	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Occasional	Ocassional	Abundant	Nearby	None	None	None
Tower 33	Deep Peat >1.0m	Yes	Modified	1.05	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Absent	Locally Abundant	Dominant	Nearby	None	None	None
Tower 34	Organic Rich Soil (<0.5m)	Yes	Modified	0.47	Rare	No	Thin	None	None	Hard	Dry	High Evidence	High Evidence	None	Rare	Locally Abundant	Abundant	Nearby	None	None	None
Tower 35	Deep Peat >1.0m	Yes	Modified	1.39	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Absent	Locally Abundant	Abundant	None	None	None	None
Tower 36	Deep Peat >1.0m	Yes	Drained Artificial	1.02	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Locally Abundant	Locally Abundant	Abundant	Nearby	Yes	None	None
Tower 37	Peat >0.5m	Yes	Drained Artificial	0.6	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Ocassional	Ocassional	Abundant	Nearby	Yes	None	None
Tower 38	Thin Mineral Soil	Yes	Drained Artificial	0.15	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Ocassional	Ocassional	Dominant	None	Yes	None	None
Tower 39	Thin Mineral Soil	Yes	Drained Artificial	0.23	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Ocassional	Ocassional	Dominant	Yes	Nearby	None	None
Tower 40	Organic Rich Soil (<0.5m)	Yes	Modified	0.44	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Ocassional	Ocassional	Dominant	Yes	Yes	None	None
Tower 41	Thin Mineral Soil	Yes	Drained Artificial	0.21	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Ocassional	Ocassional	Dominant	Yes	Yes	None	None
Tower 42	Organic Rich Soil (<0.5m)	Yes	Drained Artificial	0.41	Absent	No	N/A	None	None	Hard	Dry	High Evidence	High Evidence	None	Ocassional	Ocassional	Dominant	Yes	Yes	None	None
Tower 43	Deep Peat >1.0m	Yes	Drained Artificial	2.52	Rare	No	Large	None	None	Hard	Dry	High Evidence	High Evidence	Microerosion	Occasional	Rare	Abundant	Yes	None	None	None
Tower 44	Deep Peat >1.0m	Yes	Drained Hagg/Gulle	2.19	Occasional	Yes	Both	None	Bare Peat Pools	Hard	Saturated	High Evidence	High Evidence	Microerosion	Occasional	Ocassional	Abundant	None	None	None	None
Tower 45	Peat >0.5m	Yes	Drained Hagg/Gulle	0.59	Occasional	No	Thin	None	None	Firm	Saturated	High Evidence	High Evidence	Veg Gulleys and Microerosion	Rare	Rare	Abundant	Nearby	None	None	None
Tower 46	Deep Peat >1.0m	Yes	Drained Artificial	1.82	Abundant	Yes	Thin	None	None	Soft	Saturated	High Evidence	High Evidence	Microerosion	Occasional	Locally Abundant	Abundant	Yes	Yes	None	None
Tower 47	Deep Peat >1.0m	Yes	Drained Artificial	1.45	Locally abundant	Yes	Both	None	None	Soft	Saturated	Low Evidence	High Evidence	Vegetated Gulleys	Absent	Locally Abundant	Rare	Nearby	Yes	None	None
Tower 48	Deep Peat >1.0m	Yes	Drained Artificial	2.71	Locally abundant	Yes	Both	None	None	Soft	Saturated	Low Evidence	High Evidence	Gulleys and Microerosion	Absent	Locally Abundant	Abundant	Yes	Nearby	Nearby	None
Tower 49	Peat >0.5m	Yes	Drained Artificial	0.53	Absent	No	N/A	None	None	Firm	Dry	Low Evidence	High Evidence	Vegetated Gulleys	Absent	Locally Abundant	Occassional	None	None	Yes	None
Tower 50	Thin Mineral Soil	No	Forestry	0.11	Absent	No	N/A	None	None	Hard	Dry	Low Evidence	High Evidence	None	Absent	Absent	Absent	Yes	None	Nearby	Improved Pasture
Tower 51	Thin Mineral Soil	No	Modified	0.2	Absent	No	N/A	None	None	Hard	Dry	Low Evidence	High Evidence	None	Occasional	Absent	Absent	Yes	None	Yes	None
Tower 52	Thin Mineral Soil	No	Drained Artificial	0.39	Locally abundant	No	Thin	None	None	Firm	Dry	Low Evidence	High Evidence	None	Absent	Locally Abundant	Absent	Yes	None	Yes	Improved Pasture
Tower 53	Thin Mineral Soil	No	Drained Artificial	0.14	Absent	No	N/A	None	None	Hard	Dry	Low Evidence	High Evidence	None	Rare	Ocassional	Absent	Nearby	None	None	Improved Pasture
Tower 54	Peat >0.5m	No	Drained Hagg/Gulle	0.57	Abundant	Yes	Both	Low Lawn Pools	Bare Peat Pools	Soft	Ponding	Low Evidence	High Evidence	Microerosion	Absent	Ocassional	Occassional	Nearby	None	Yes	None
Tower 55	Organic Rich Soil (<0.5m)	No	Drained Hagg/Gulle	0.22	Absent	No	N/A	None	None	Hard	Dry	Low Evidence	High Evidence	None	Rare	Locally Abundant	Dominant	Nearby	None	Nearby	None
Tower 56	Thin Mineral Soil	No	Modified	0.21	Rare	No	Thin	None	None	Firm	Dry	Low Evidence	High Evidence	Microerosion	Rare	Ocassional	Locally Abundant	Nearby	None	None	None
Tower 57	Thin Mineral Soil	No	Modified	0.24	Absent	No	N/A	None	None	Firm	Dry	Low Evidence	High Evidence	None	Occasional	Locally Abundant	Abundant	Yes	None	None	None
Tower 58	Organic Rich Soil (<0.5m)	No	Modified	0.26	Locally abundant	Yes	Both	None	None	Soft	Saturated	Low Evidence	High Evidence	None	Absent	Absent	Dominant	None	None	Yes	None
Tower 59	Thin Mineral Soil	No	Drained Artificial	0.1	Absent	No	N/A	None	None	Firm	Dry	Low Evidence	High Evidence	None	Absent	Absent	Absent	Yes	None	Yes	Improved Pasture
Tower 60	Organic Rich Soil (<0.5m)	No	Drained Artificial	0.13	Absent	No	N/A	None	None	Firm	Dry	Low Evidence	High Evidence	None	Absent	Absent	Dominant	Yes	Yes	None	None
Tower 61	Deep Peat >1.0m	No	Modified	1.53	Absent	No	N/A	None	None	Firm	Dry	Low Evidence	High Evidence	None	Absent	Absent	Abundant	Yes	None	None	None
Tower 62	Organic Rich Soil (<0.5m)	No	Modified	0.21	Absent	No	N/A	None	None	Firm	Dry	Low Evidence	High Evidence	None	Absent	Absent	Dominant	Nearby	None	None	None
Tower 63	Organic Rich Soil (<0.5m)	No	Modified	0.23	Absent	No	N/A	None	None	Firm	Dry	Low Evidence	High Evidence	None	Absent	Absent	Dominant	Nearby	None	None	Improved Pasture
Tower 64	Organic Rich Soil (<0.5m)	No	Drained Artificial	0.19	Absent	No	N/A	None	None	Hard	Dry	Low Evidence	High Evidence	None	Absent	Locally Abundant	Dominant	None	Nearby	None	None

Strongly Negative Indicator	Negative Indicator	Neutral	Positive Indicator	Strongly Positive Indicator

Annex B Figures

Strathy South Wind Farm Grid Connection

Volume 4: Appendix V1-9.4: Detailed Peatland Condition Assessment

SSEN Transmission

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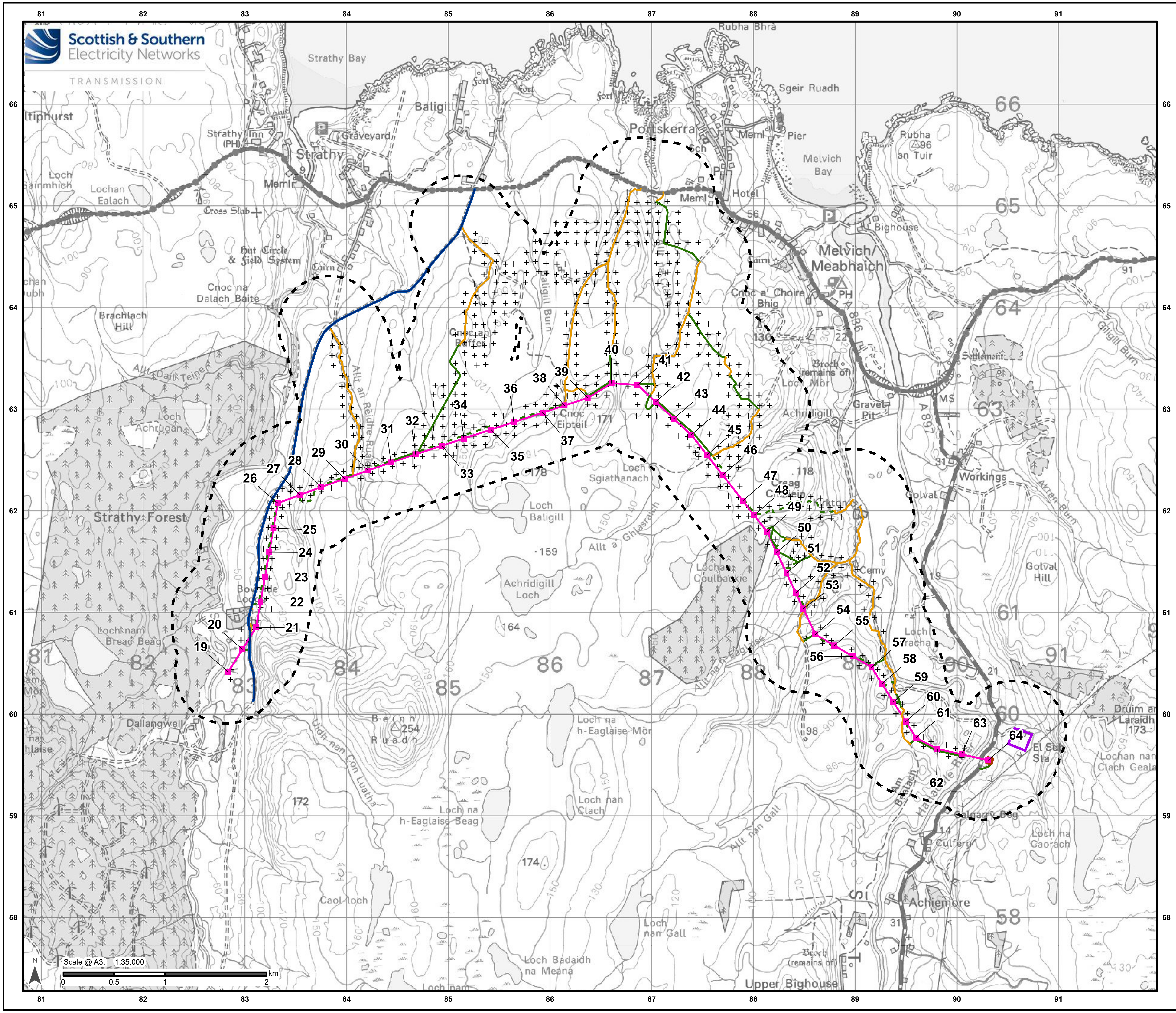
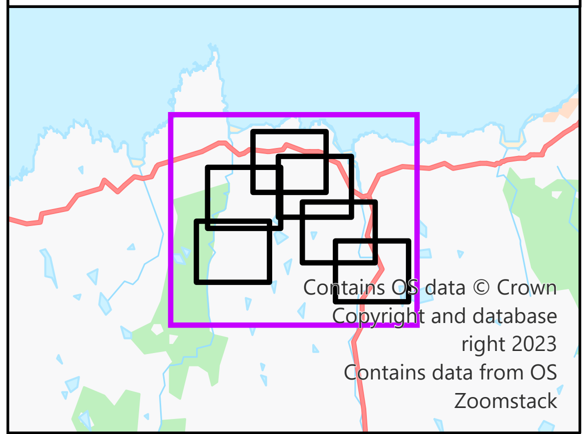


Legend

- Study Area
- Proposed Steel Lattice Tower
- Proposed OHL Alignment
- Proposed Cable Sealing End (CSE) Compound
- Existing Access Track
- Existing Access Track (to be upgraded)
- Proposed Permanent Access Track
- Proposed Temporary Access Track
- Connagill 275/132 kV Substation
- + PCA Survey Locations



Project No: LT560

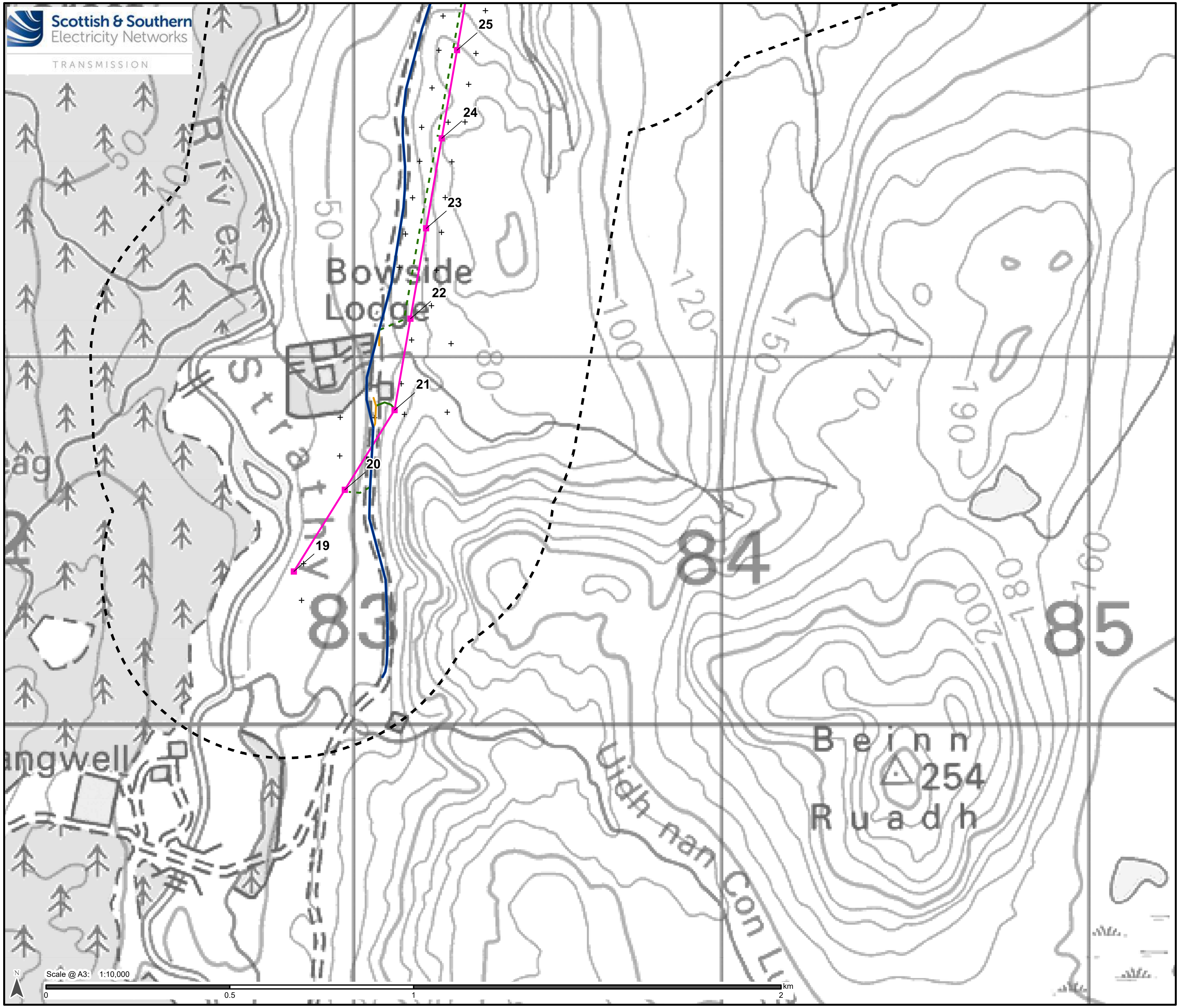
Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.1 - Site Layout Overview

Drawn by: BN

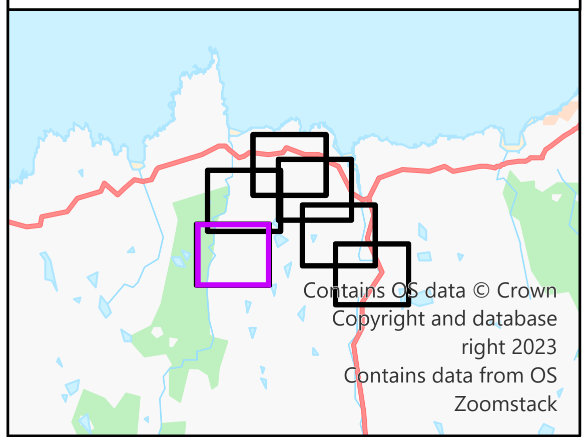
Date: 05/02/2025

Drawing: 428.013137.00001



Legend

- Study Area
- Proposed Steel Lattice Tower
- Proposed OHL Alignment
- Proposed Cable Sealing End (CSE) Compound
- Existing Access Track
- Existing Access Track (to be upgraded)
- Proposed Permanent Access Track
- Proposed Temporary Access Track
- Connagill 275/132 kV Substation
- PCA Survey Locations



Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

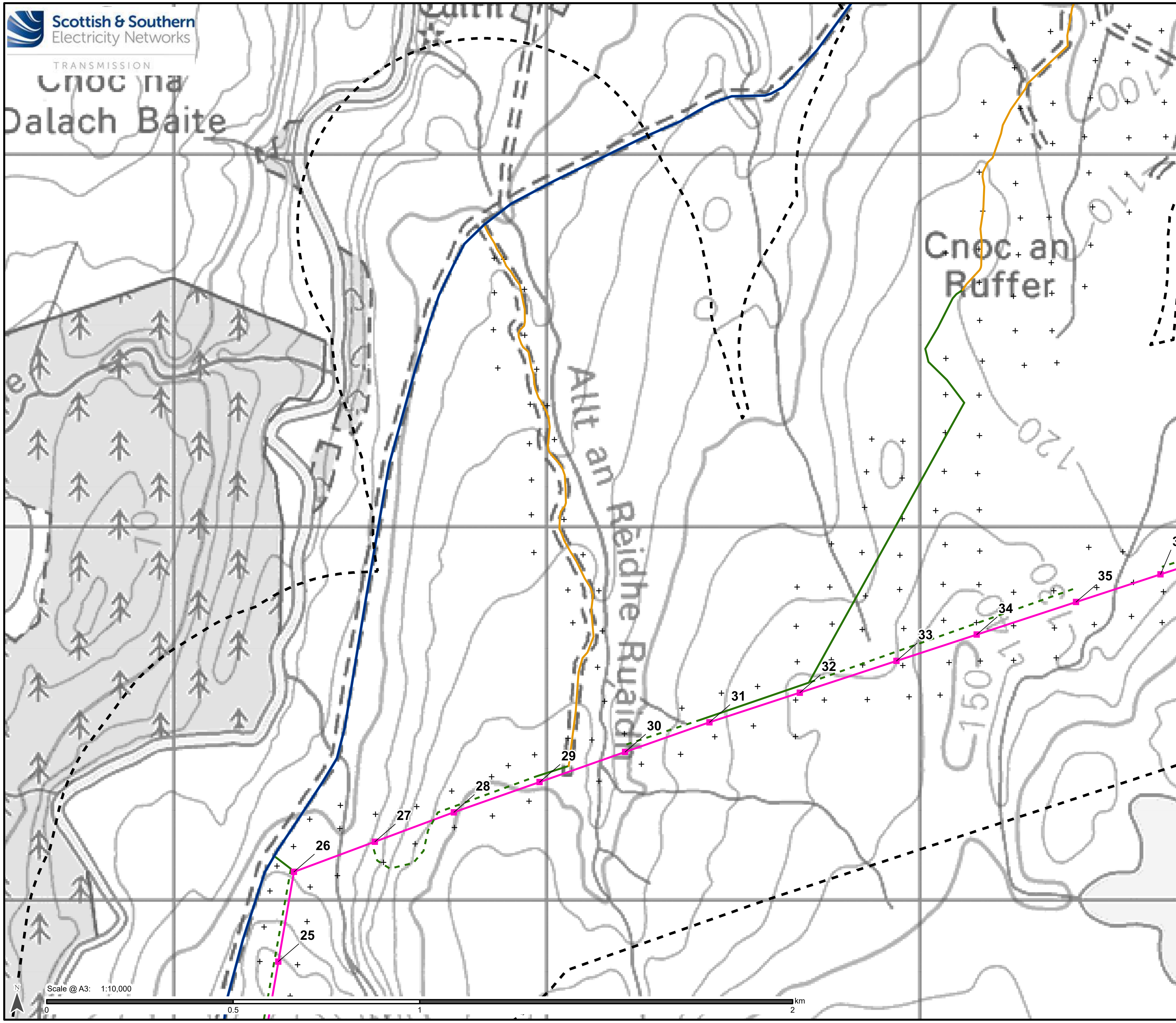
Title: Figure V1-9.4.1 - Site Layout Map 1

Drawn by: BN

Date: 05/02/2025

Drawing: 428.013137.00001

Scottish & Southern Electricity Networks
TRANSMISSION



Legend

- Study Area
- Proposed Steel Lattice Tower
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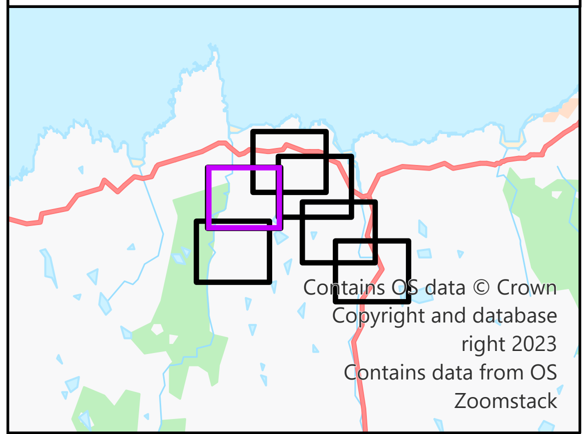
- Proposed Temporary Access Track
- Connagill 275/132 kV Substation
- PCA Survey Locations



Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.1 - Site Layout Map 2

Drawn by: BN

Date: 05/02/2025

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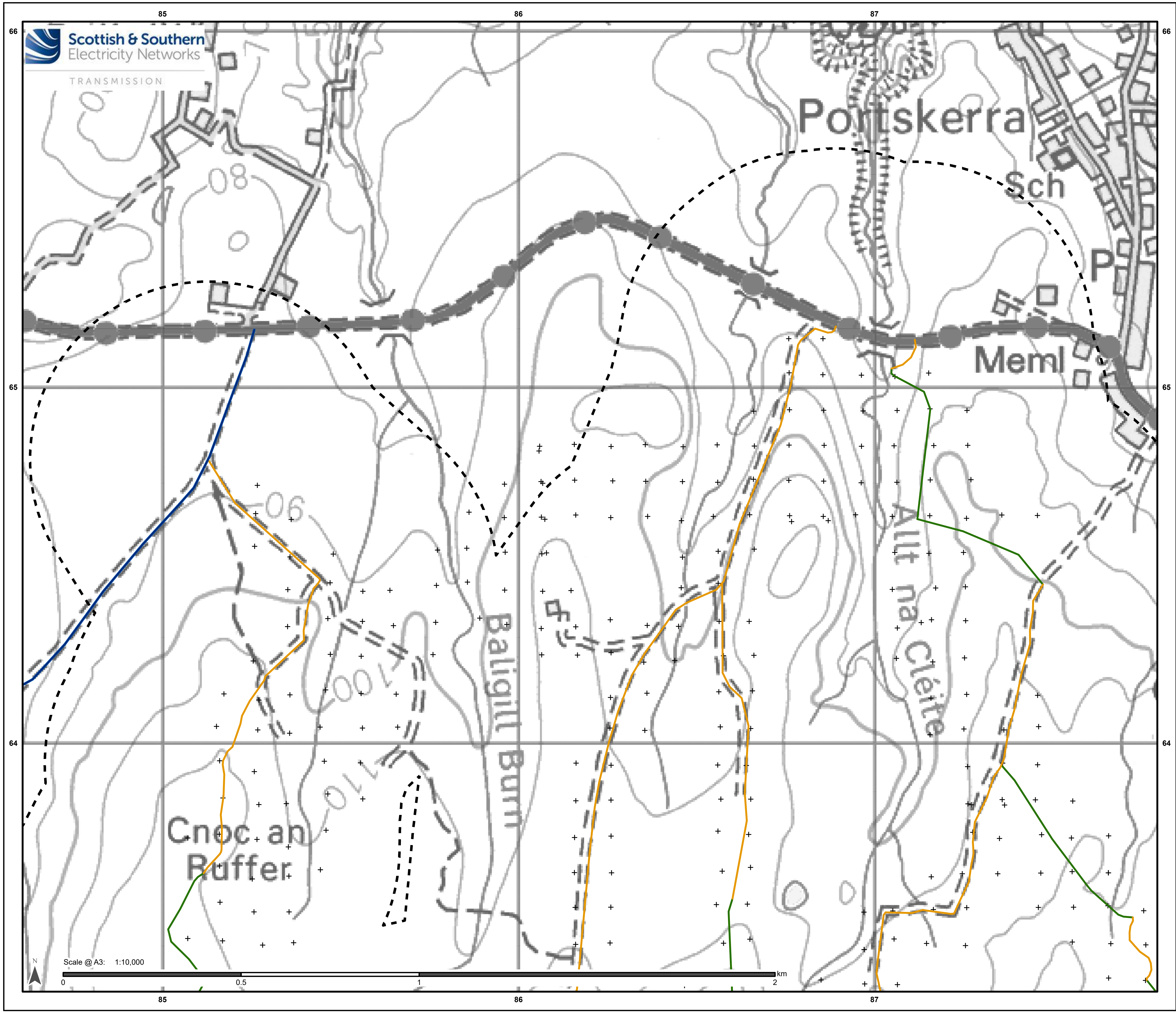

Legend

- Study Area
- Proposed Steel Lattice Tower
- Proposed OHL Alignment
- Proposed Cable Sealing End (CSE) Compound
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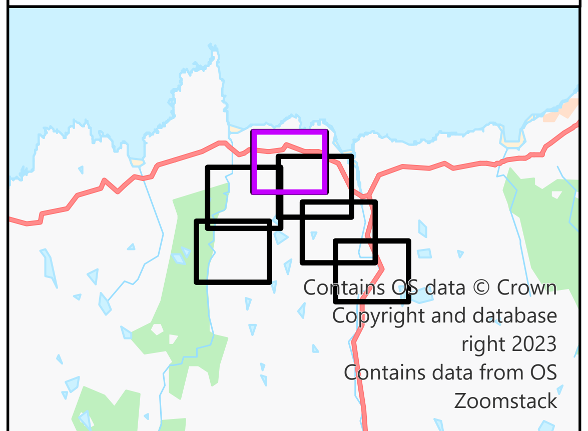
- Existing Access Track (to be upgraded)
- Proposed Permanent Access Track
- Proposed Temporary Access Track
- Connagill 275/132 kV Substation
- PCA Survey Locations



Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.1 - Site Layout Map 3

Drawn by: BN

Date: 05/02/2025

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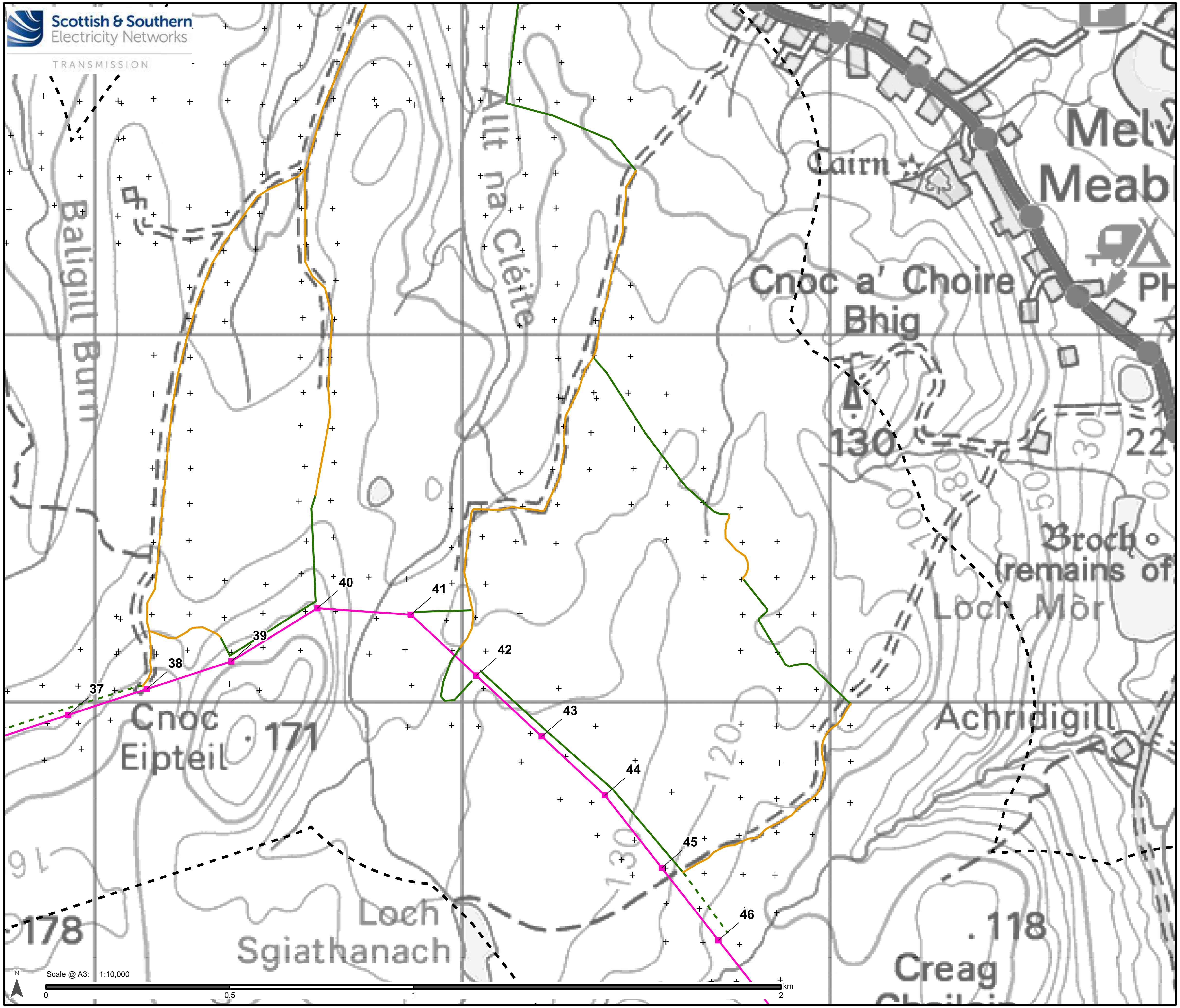

Legend

- Study Area
- Proposed Steel Lattice Tower
- Proposed OHL Alignment
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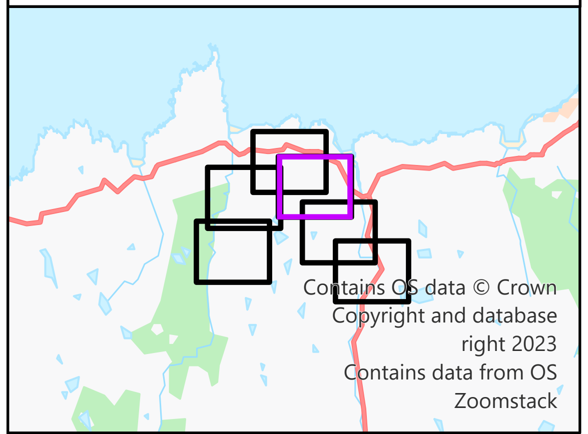
- Proposed Temporary Access Track
- Connagill 275/132 kV Substation
- PCA Survey Locations



Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.1 - Site Layout Map 4

Drawn by: BN

Date: 05/02/2025

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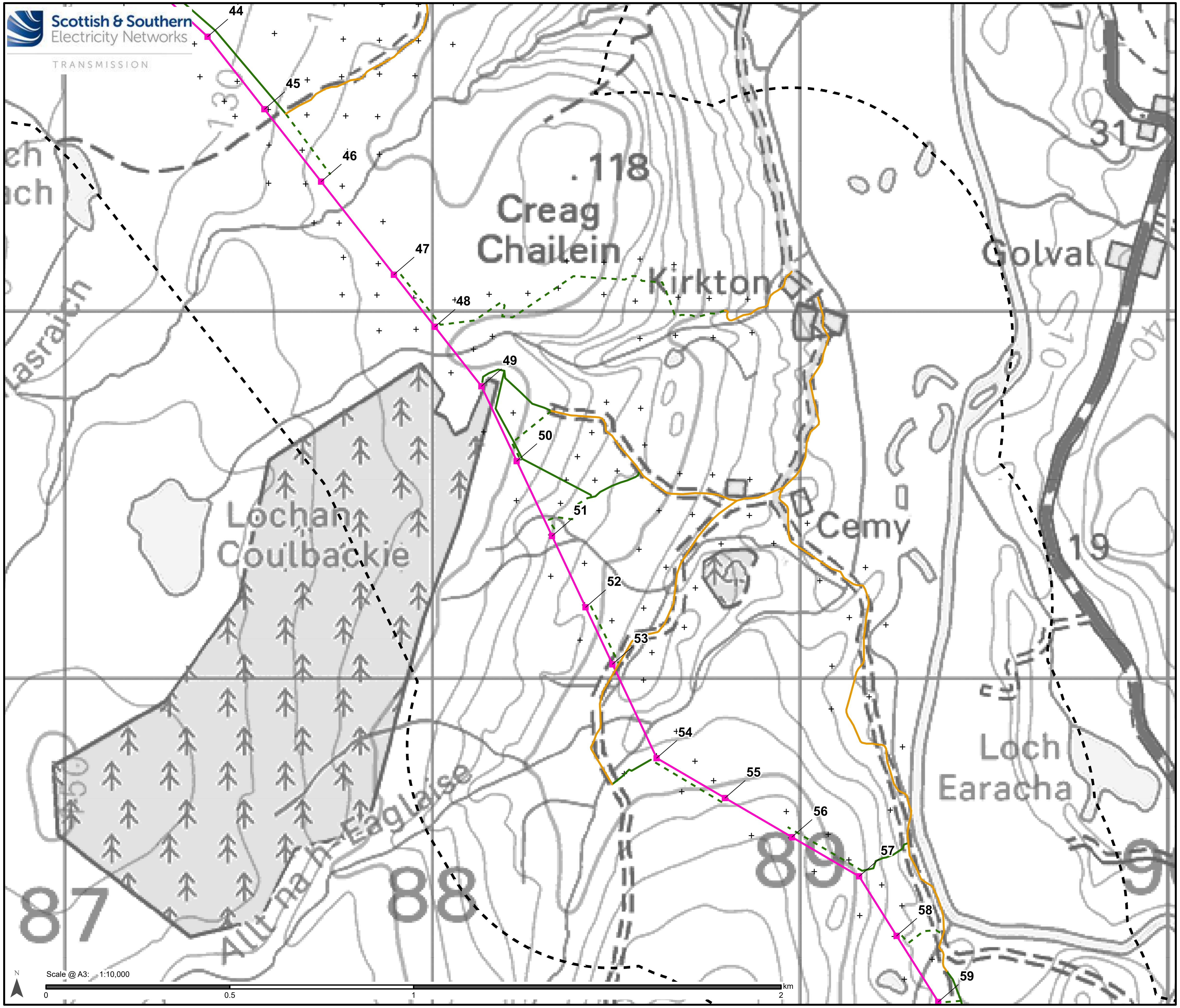

Legend

- Study Area
- Proposed Steel Lattice Tower
- Proposed OHL Alignment
- Proposed Cable Sealing End (CSE) Compound
- Existing Access Track
- Existing Access Track (to be upgraded)
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- Proposed Temporary Access Track
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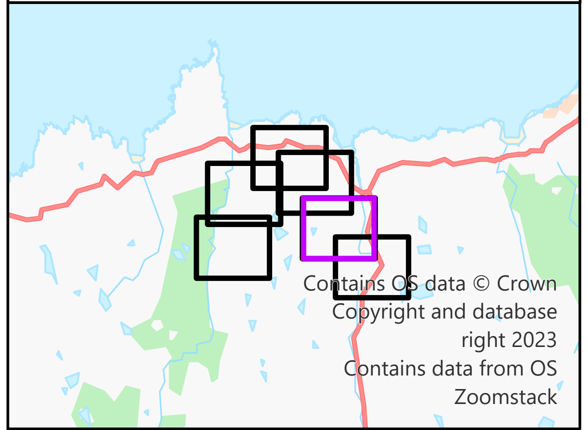

Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.1 - Site Layout Map 5

Drawn by: BN

Date: 05/02/2025

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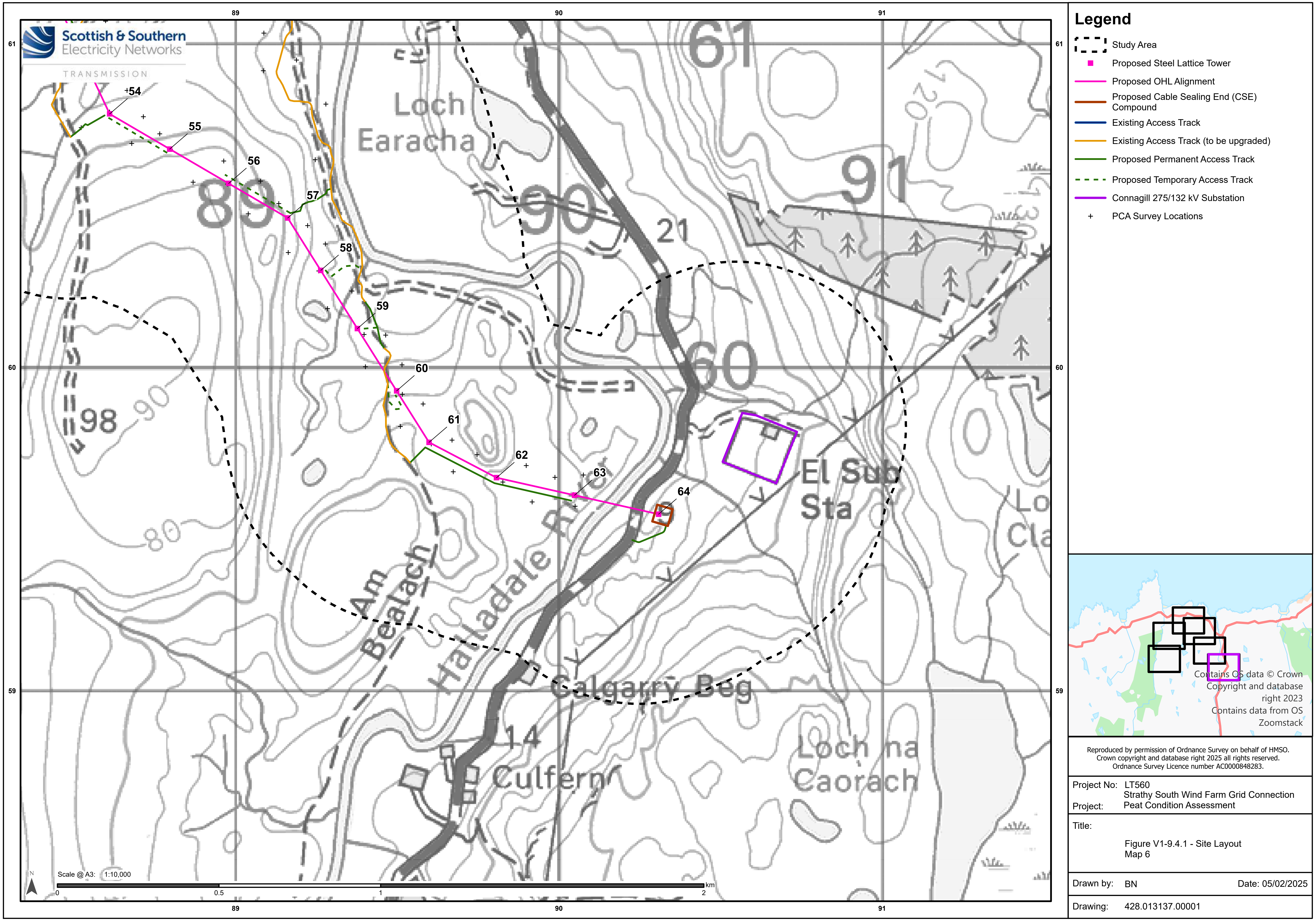

Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.1 - Site Layout Map 6

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Date: 05/02/2025

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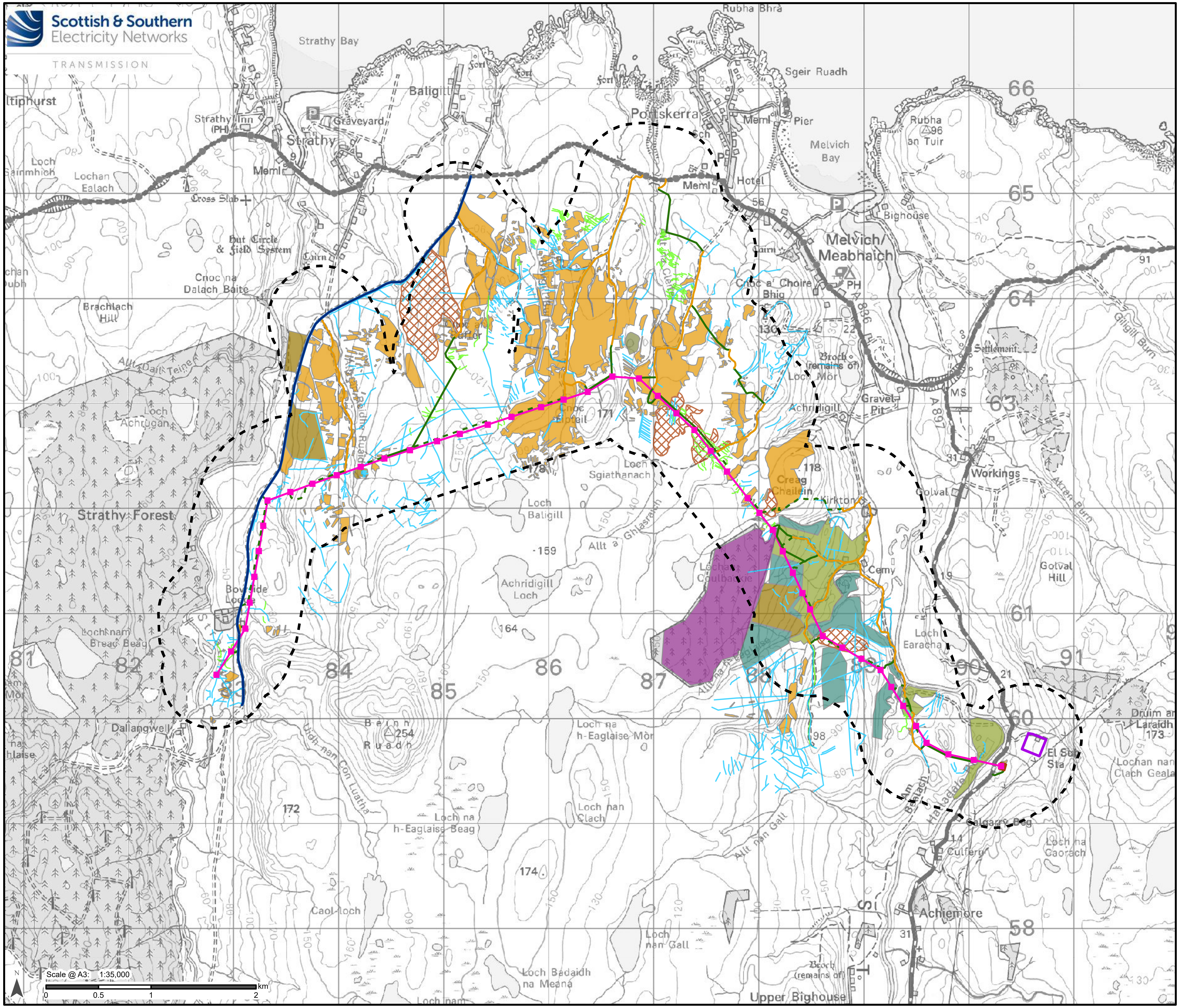

Legend

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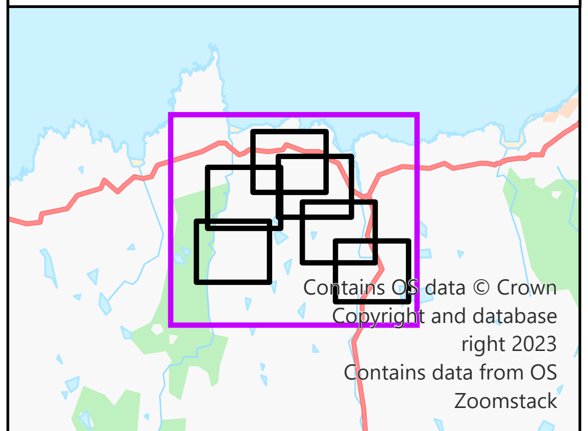
- Vegetated Gully
- Microerosion
- Peat Cutting
- Pool System
- Rough Grazing
- Improved Pasture
- Plantation Forestry
- Native Forestry



Project No: LT560

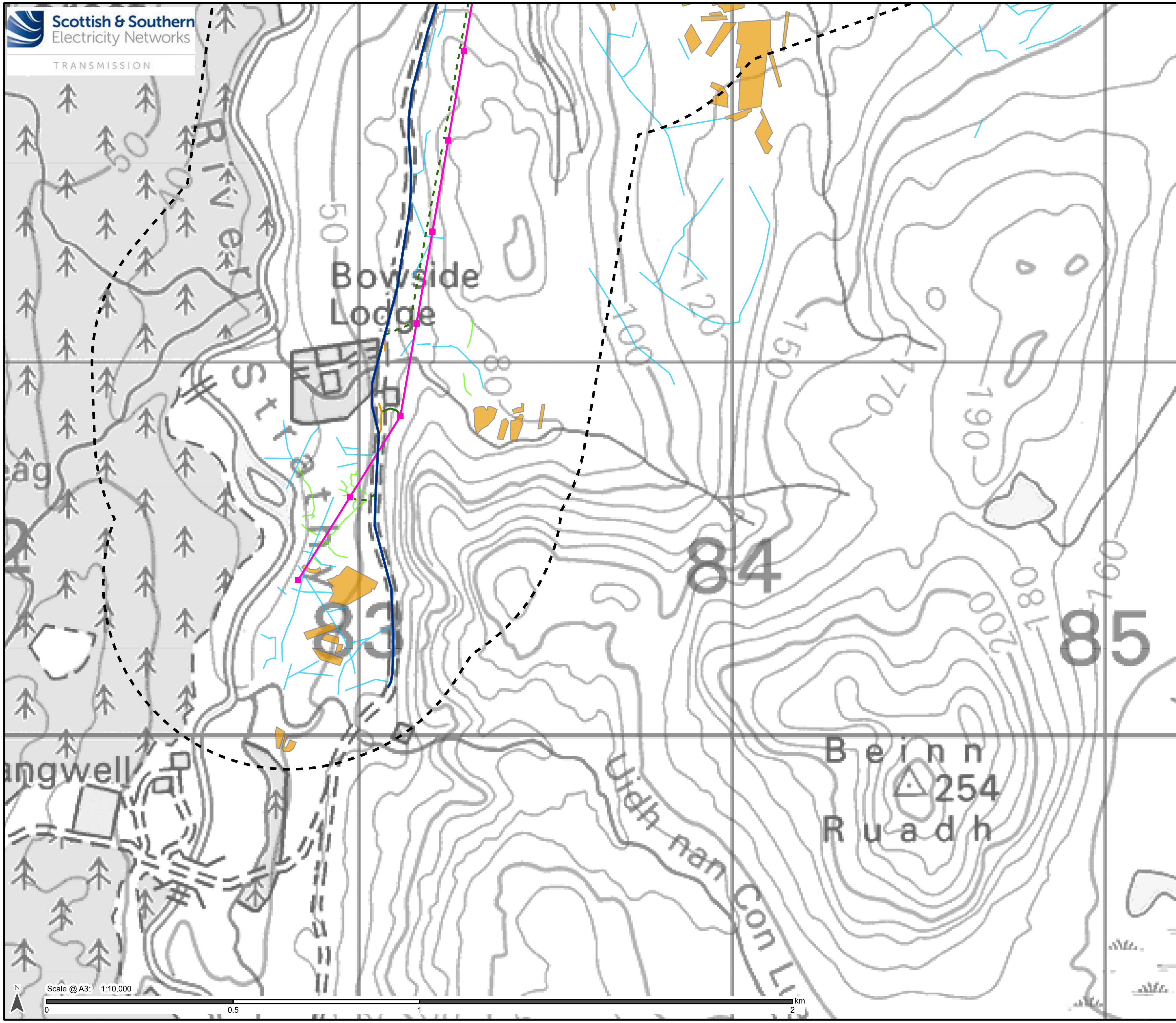
Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.2- Erosion and Landuse Features Overview

Drawn by: BN

Date: 05/02/2025

Drawing: 428.013137.00001



Legend

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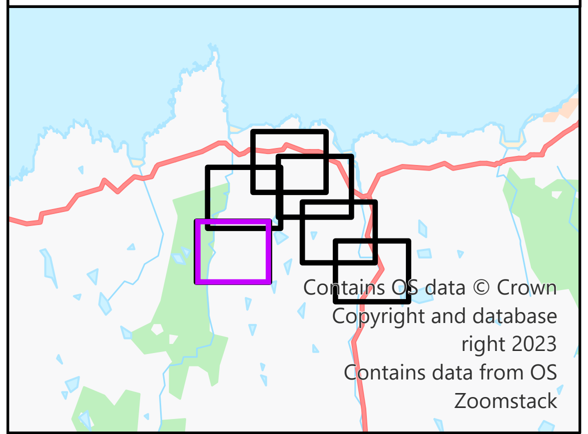


Project No: LT560

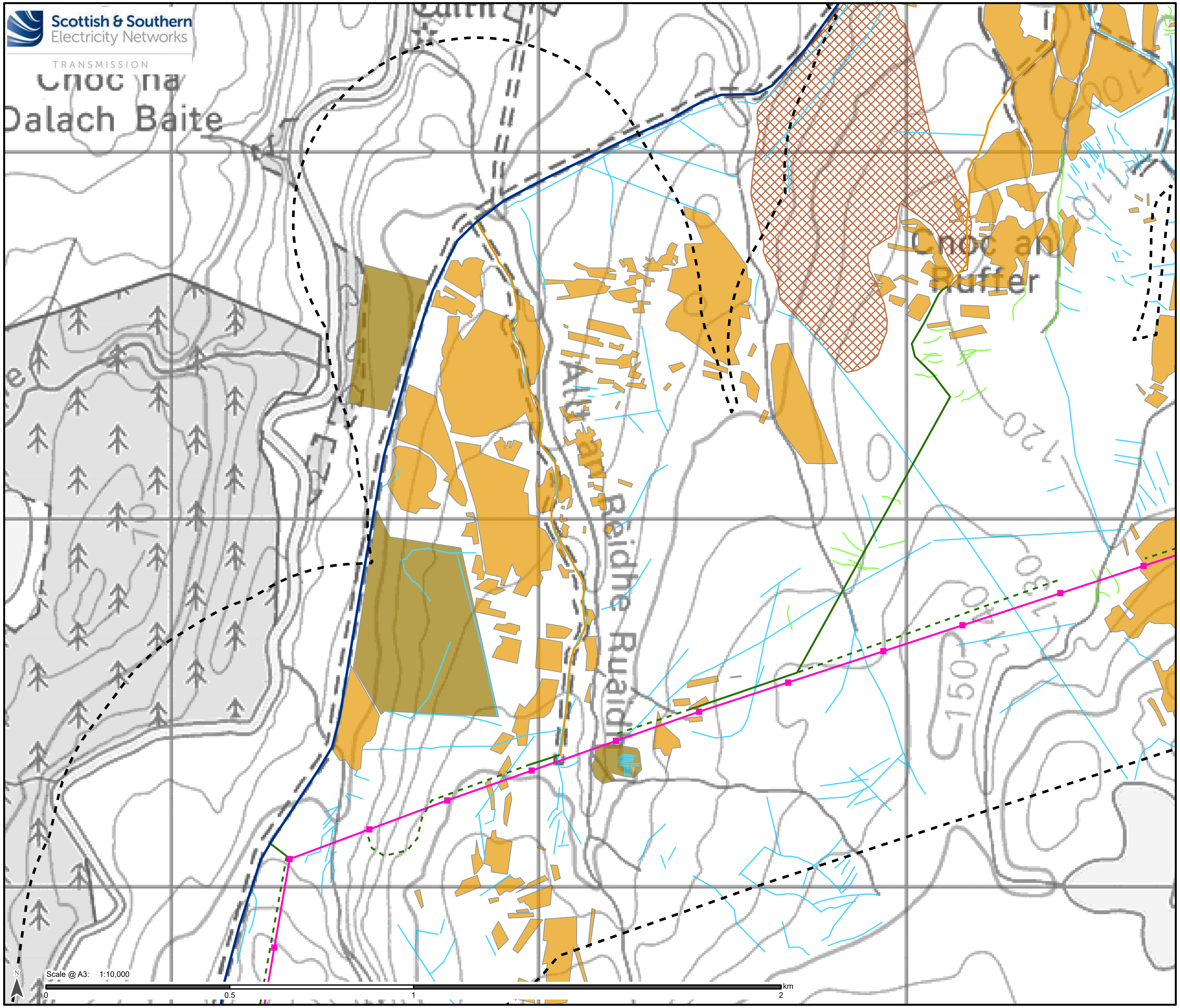
Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.2- Erosion and Landuse Features Map 1

Drawn by: BN

Date: 05/02/2025

Drawing: 428.013137.00001



Legend

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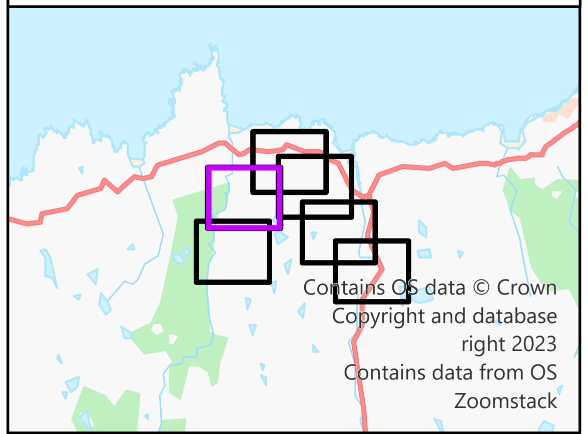

Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.2- Erosion and Landuse Features Map 2

Drawn by: BN

Date: 05/02/2025

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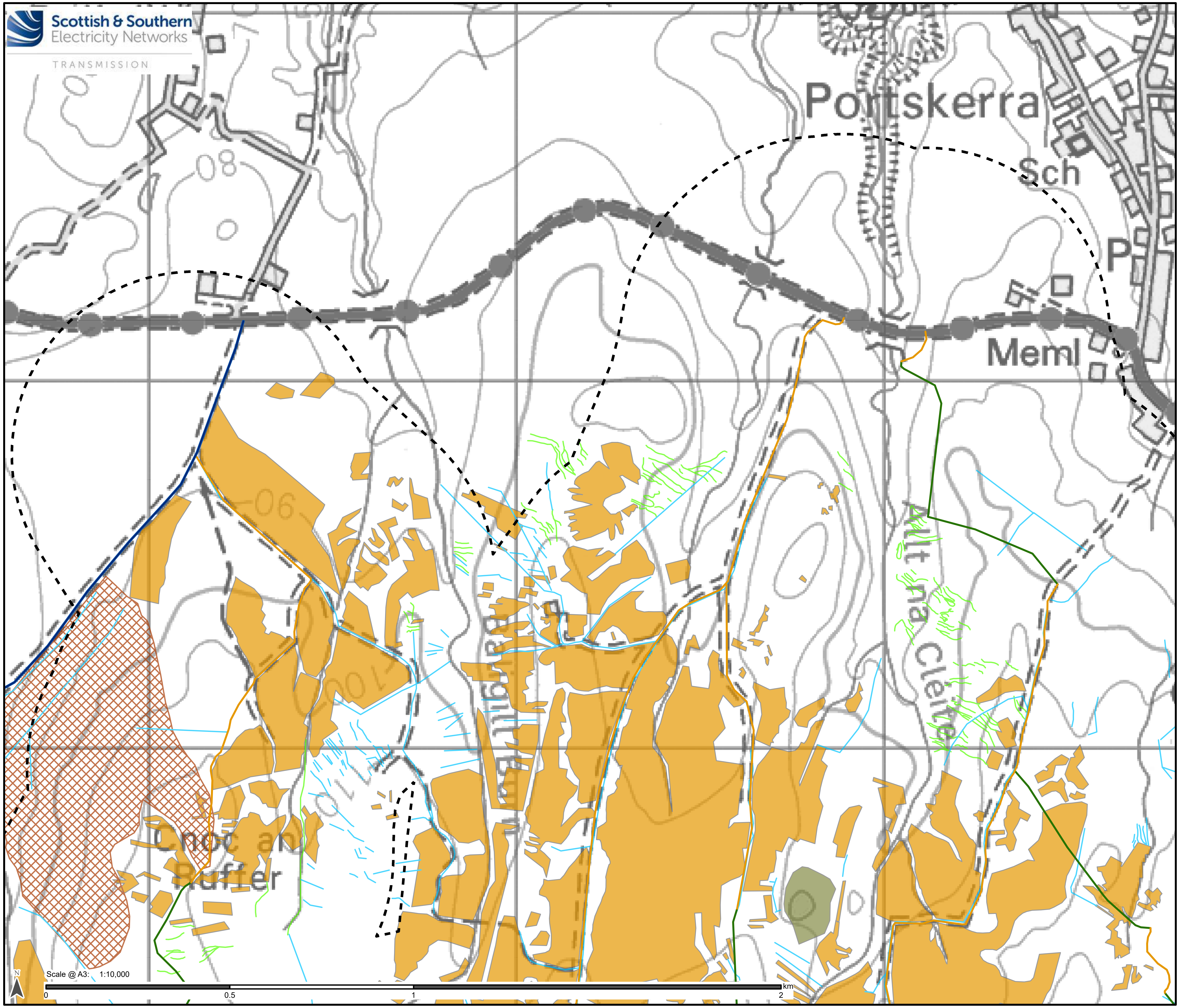

Legend

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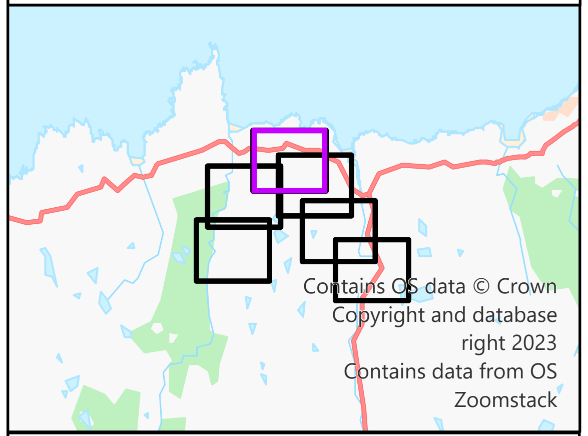
- Native Forestry



Project No: LT560

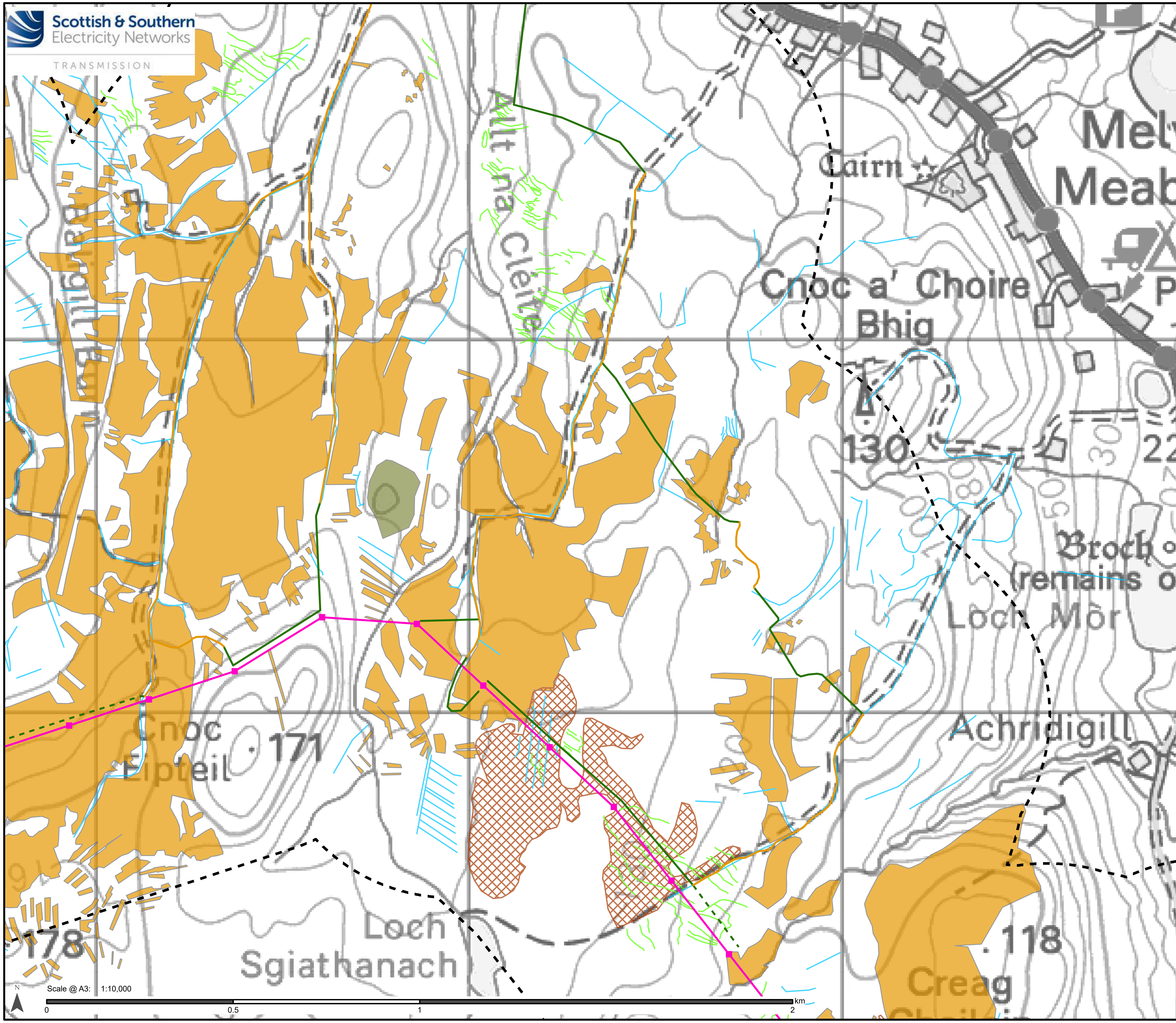
Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.2- Erosion and Landuse Features Map 3

Drawn by: BN

Date: 05/02/2025

Drawing: 428.013137.00001



Legend

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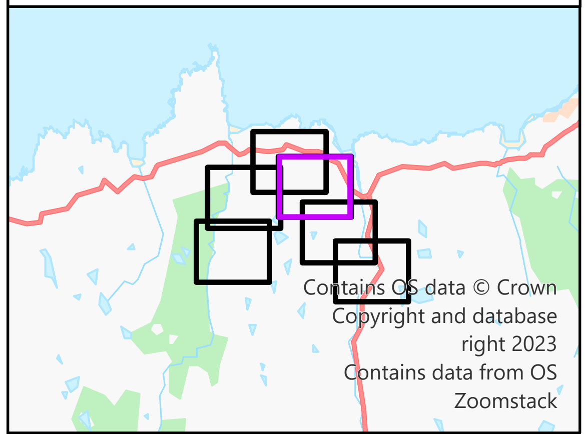

Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.2- Erosion and Landuse Features Map 4

Drawn by: BN

Date: 05/02/2025

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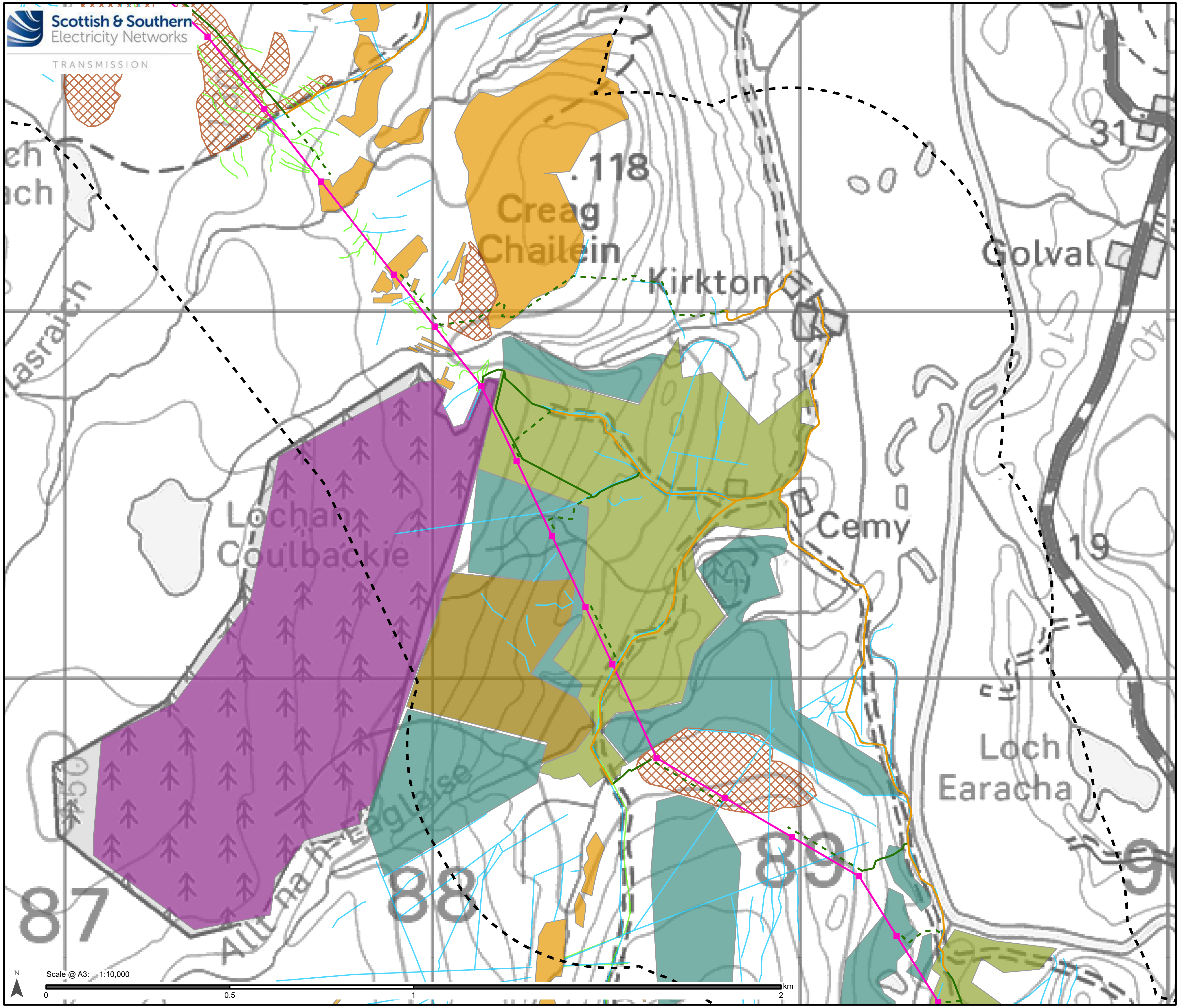

Legend

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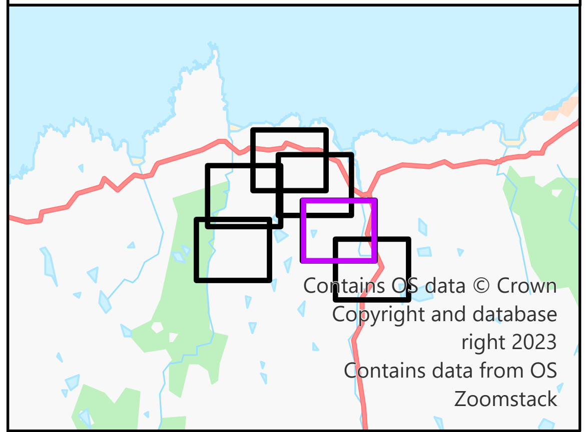


Project No: LT560

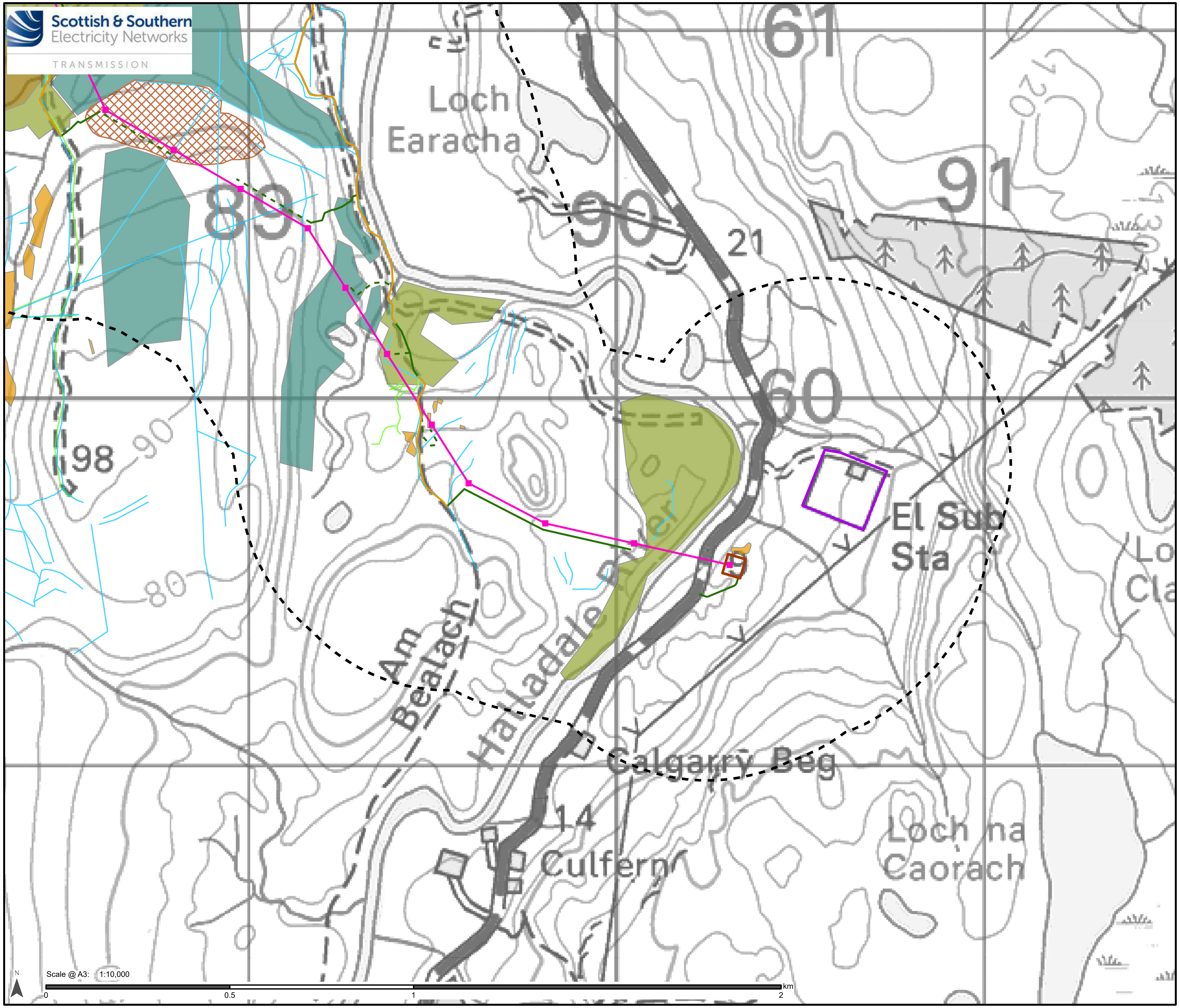
Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.2- Erosion and Landuse Features Map 5

Drawn by: BN

Date: 05/02/2025

Drawing: 428.013137.00001



Legend

- Study Area
- Proposed Steel Lattice Tower
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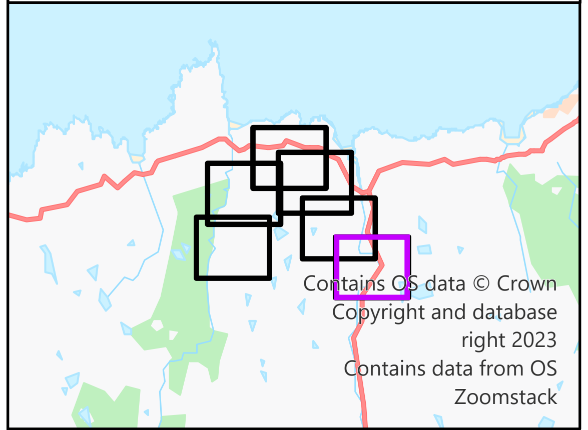
- Native Forestry



Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.2- Erosion and Landuse Features Map 6

Drawn by: BN Date: 05/02/2025

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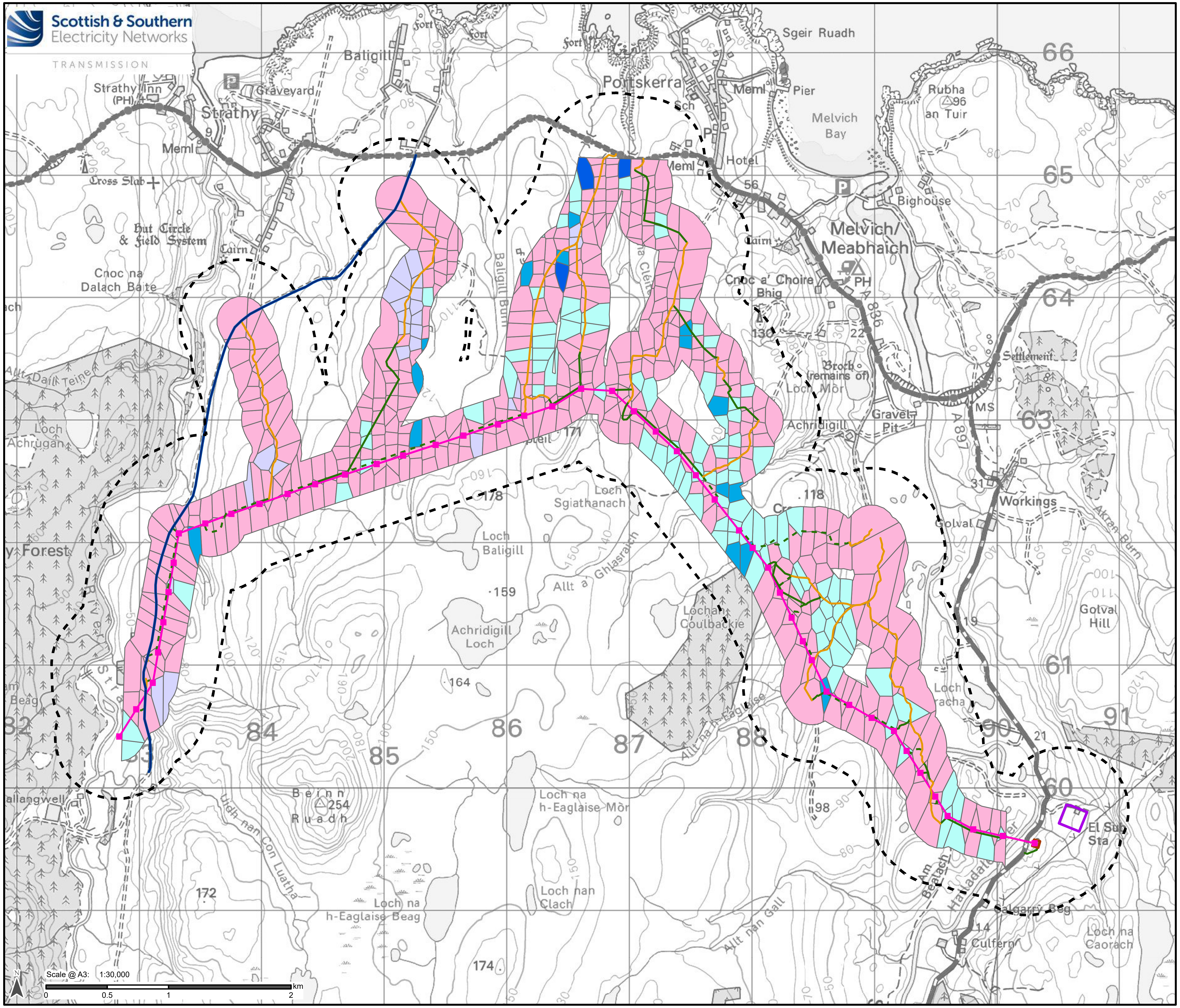

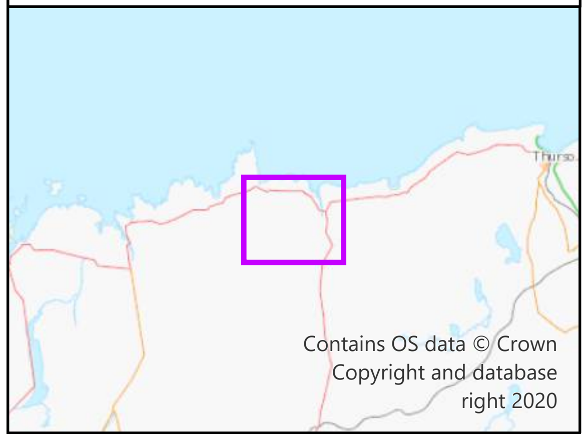

Legend

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- Proposed Temporary Access Track
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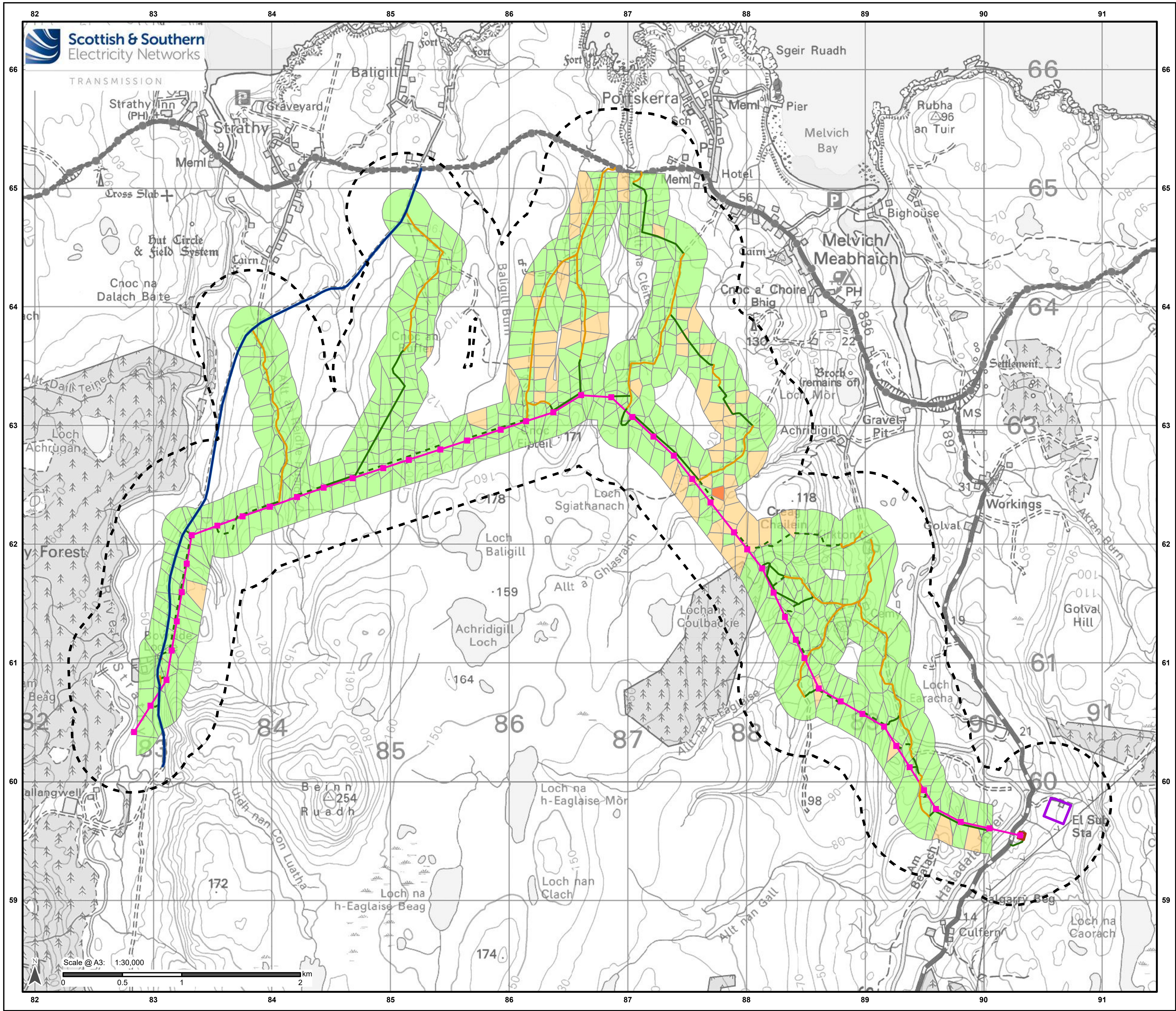
Surface Wetness

- Desiccated
- Dry
- Saturated
- Ponding
- Surface Water

Project No:	LT560
Project:	Strathy South Wind Farm Grid Connection Peat Condition Assessment
Title:	Figure V1-9.4.3 - Peat Surface Wetness
Drawn by:	BN — Date: 05/02/2025
Drawing:	428.013137.00001



Legend

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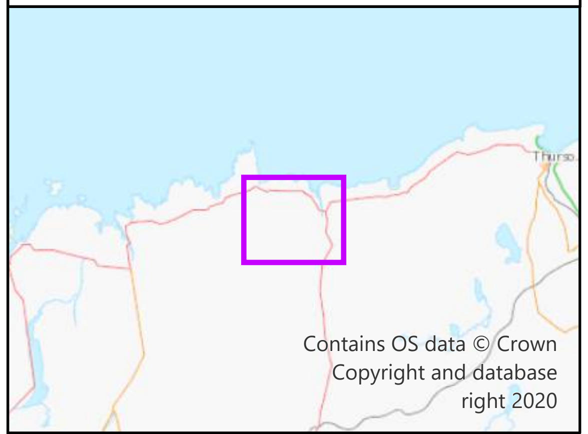
Peat Softness

- Hard
- Soft
- Quaking



Project No: LT560

Project: Strathy South Wind Farm Grid Connection Peat Condition Assessment

Title: Figure V1-9.4.4 - Peat Density

Drawn by: BN Date: 05/02/2025

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