Scottish & Southern Electricity Networks

TRANSMISSION

Alignment Stage Consultation Document

Connagill Cluster Grid Connections

May 2024

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Scottish & Southern Electricity Networks
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Term	Definition
Alignment	A centre line of an overhead line, along with location of key angle structures.
Alignment Option	A distinct alignment option through an identified optimal route.
Alignment (optimal)	An alignment for the overhead line taken forward to stakeholder consultation following a comparative appraisal of alignment options.
Alignment (proposed)	An alignment taken forward to consent application. It comprises a defined centre line for the overhead line and includes an indicative support structure (tower or pole) schedule, also specifying access arrangements and any associated construction facilities.
Alignment Variant	An alternative section of an alignment where there are different ways to avoid a localised constraint(s).
Amenity	The natural environment, cultural heritage, landscape and visual quality. Also includes the impact of SSEN Transmission's works on communities, such as the effects of noise and disturbance from construction activities.
Area of Search	The area within which the appraisal of the switching station site options takes place.
Ancient Woodland Inventory (AWI)	The Ancient Woodland Inventory (AWI) is a provisional guide to the location of Ancient Woodland. It contains three main categories of woodland, all of which are likely to be of value for their biodiversity and cultural value by virtue of their antiquity: Ancient Woodland (1a and 2a); Long-established woodlands of plantation origin (LEPO) (1b and 2b); and other woodlands on 'Roy' woodland sites (3).
Biodiversity Net Gain (BNG)	A process intended to leave nature in a better state than it started using good practice principles established by the Business and Biodiversity Offset Programme (BBOP) and organisations including Construction Industry Research and Information Association (CIRIA), The Chartered Institute of Ecology and Environmental Management (CIEEM) and the Institute of Environmental Management and Assessment (IEMA).
Conductor	A metallic wire strung from structure to structure, to carry electric current.
Consultation	The dynamic process of dialogue between individuals or groups, based on a genuine exchange of views and, normally, with the objective of influencing decisions, policies or programmes of action.
Corridor	A linear area which allows a continuous connection between the defined connection points. The Corridor may vary in width along its length; in unconstrained areas it may be many kilometres wide.
DNO Crossings	The crossing of distribution lines also known as Distribution Network Operators (DNO) crossings.
Environmental Impact Assessment (EIA)	Environmental Impact Assessment. A formal process codified by EU directive 2011/92/EU, and subsequently amended by Directive 2014/52/EU. The national regulations are set out in The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. The EIA process is set out in Regulation 4(1) of the regulations and includes the preparation of an EIA Report by the developer to systematically identify, predict, assess and report on the likely significant environmental effects of a proposed project or development.
Habitat	Term most accurately meaning the place in which a species lives, but also used to describe plant communities or agglomerations of plant communities.
Kilovolt (kV)	One thousand volts.

Listed Building	Building included on the list of buildings of special architectural or historic interest and afforded statutory protection under the 'Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997' and other planning legislation. Classified categories A – C(s).
Micrositing	The process of positioning infrastructure to avoid localised environmental or technical constraints.
Mitigation	Term used to indicate avoidance, remediation or alleviation of adverse impacts.
Overhead line (OHL)	An electric line installed above ground, usually supported by steel lattice towers or wood poles.
Plantation Woodland	Woodland of any age that obviously originated from planting.
Route	A linear area of approximately 1 km width (although this may be narrower/wider in specific locations in response to identified pinch points / constraints), which provides a continuous connection between defined connection points.
Route (optimal)	A route for the overhead line taken forward to stakeholder consultation following a comparative appraisal of route options.
Route (proposed)	A route taken forward following stakeholder consultation to the alignment selection stage of the overhead line routeing process.
Routeing	The work undertaken which leads to the selection of a proposed alignment, capable of being taken forward into the consenting process under Section 37 of the Electricity Act 1989.
Scheduled Monument	A monument which has been scheduled by the Scottish Ministers as being of national importance under the terms of the 'Ancient Monuments and Archaeological Areas Act 1979'.
Sites of Special Scientific Interest (SSSI)	Areas of national importance. The aim of the SSSI network is to maintain an adequate representation of all natural and semi-natural habitats and native species across Britain.
Span	The section of overhead line between two structures.
Special Area of Conservation (SAC)	An area designated under the EC Habitats Directive to ensure that rare, endangered or vulnerable habitats or species of community interest are either maintained at or restored to a favourable conservation status.
Special Landscape Area (SLA)	Landscapes designated by the Highland Council which are considered to be of regional/local importance for their scenic qualities.
Special Protection Area (SPA)	An area designated under the Wild Birds Directive (Directive 74/409/EEC) to protect important bird habitats. Implemented under the Wildlife and Countryside Act 1981.
Stakeholders	Organisations and individuals who can affect or are affected by SSEN Transmission works.
Study Area	The area within which the route and alignment study takes place.
Switching Station	A node on the network to allow safe control of the electricity network. This could include convergence of multiple circuits, transformation of voltage or other functions to maintain and operate the electricity network.
The National Grid	The electricity transmission network in Great Britain.
Underground Cable (UGC)	An electric cable installed below ground, protected by insulating layers and marked closer to the surface to prevent accidental damage through later earthworks.
Volts	The international unit of electric potential and electromotive force.

Executive Summary

This Consultation Document invites comments from all interested parties on the proposals by Scottish and Southern Electricity Networks Transmission (SSEN Transmission) to construct new transmission infrastructure required to connect five consented and/or proposed wind farms, all located in proximity to each other, to the existing transmission network at Connagill 275/132 kV substation. Together the projects are known as the 'Connagill Cluster Grid Connections'.

The five grid connections under consideration are the consented Strathy South and Strathy Wood wind farms and the proposed Armadale, Melvich and Kirkton wind farms. The connection projects are all recognised as National Development under National Planning Framework 4.

To facilitate the five grid connections, a new switching station, known as Strathy Switching Station, would also be required to collect all incoming circuits onto a double busbar before taking these through a 132 kV OHL supported by a steel structure to Connagill 275/132 kV substation.

SSEN Transmission has aimed to streamline the pre-application consultation and alignment process of each connection to allow stakeholders the opportunity to review the Cluster as a whole, allowing the opportunity to consider the consolidation of infrastructure and construction practices where practicable.

In December 2023, a Consultation Document[1] was prepared to set out the project need and describe the five individual connections that make up the 'Connagill Cluster Grid Connections'. It sought comments from stakeholders and members of the public on route option studies undertaken for each connection, and the rationale for, and approach to, the selection of the optimal routes. A consultation event was also held on 30th November 2023 in Strathy Village Hall. Comments received were documented in a Report on Consultation[2] which set out the consultation process for the project during the route option stage of the project. The Report on Consultation confirmed that the optimal routes presented for the Strathy South and Strathy Wood Grid Connections (northern and southern sections) were being taken forward as the proposed routes for the consideration of alignment options. For the Armadale Grid Connection, further consultation was carried out with Historic Environment Scotland (HES) due to concerns they had in relation to the optimal route in proximity to the Armadale Broch scheduled monument. Further explanation was presented in the Report on Consultation as to the engineering and environmental challenges of progressing an alternative route option for this connection, and the document concluded that the optimal route was being taken forward for the consideration of alignment options. Nevertheless, SSEN Transmission acknowledge HES' concerns in relation to the Armadale Grid Connection and will endeavour to work with HES to minimise impacts on the monument, as far as is practicable.

Potential alignment options were identified within each Proposed Route. Due to the short length of the Kirkton connection, this progressed directly to alignment optioneering stage. Analysis of the alignment options within each Proposed Route has considered the environmental and technical constraints, to determine an optimal alignment for each connection. A summary of this analysis is provided within this Consultation Document, and overall optimal alignments are included for the purposes of

consultation. In addition, analysis of potential site options for the proposed Strathy Switching Station has also been undertaken, with an optimal site identified and presented within this Consultation Document.

Comments are sought from stakeholders on the alignment options (and switching station site options) considered, and the optimal alignment (and site) identified. Following a review of the consultation responses received, SSEN Transmission will confirm a proposed alignment for each connection, and proposed site for the switching station, which will be taken forward to EA/EIA and consenting stage.

When providing comments and feedback on this Consultation Document, SSEN Transmission would be grateful for your consideration of the questions below:

- Have we explained the need for this Project adequately?
- Have we explained the approach taken to select the optimal alignments / optimal site adequately?
- Are there any factors, or environmental features, that you consider may have been overlooked during the optimal alignment / site selection process?
- Do you feel, on balance, that the optimal alignments / optimal site selected is the most appropriate for further consideration at the EA/EIA and Consenting stage?

1 Introduction

1.1.1 This document has been prepared by ASH design+assessment Ltd. (ASH) on behalf of Scottish and Southern Electricity Networks Transmission (SSEN Transmission). SSEN Transmission, operating under licence held by Scottish Hydro Electric Transmission plc, owns, operates and develops the high voltage electricity transmission system in the north of Scotland and remote islands. This document invites comments from all interested parties on the optimal alignments of new transmission infrastructure in the Strathy area of Sutherland, in the north of Scotland, that is required to connect five consented and/or proposed wind farms to the existing transmission network at Connagill 275/132 kV substation. Together the projects are known as the 'Connagill Cluster Grid Connections'.

1.1.2 In addition, this document also invites comments on the selection of an optimal site for a switching station in proximity to the grid connections.

1.1.3 This Consultation Document is structured as follows:

- Section 1: Introduction - setting out the purpose of the Consultation Document;
- Section 2: Project Background and Need – outlines the background to the project and describes the need. Also provides a description of the key elements, access requirements and programme;
- Section 3: Project Overview – sets out the proposed approach for each connection;
- Section 4: Alignment and Site Selection Procedures – describes the SSEN Transmission Route Selection Guidance and the methodology used for the route and alignment selection process. It also describes the SSEN Site Selection Guidance and methodology used for the switching station site selection process.
- Section 5: Consultation to Date - summarises the range of responses and key comments and issues arising through the consultation process;
- Sections 6 - 9: Comparative appraisal of the alignment options considered for each connection, concluding in an optimal alignment;
- Section 10: Strathy Switching Station – description and comparative appraisal of the site options considered, concluding in an optimal site; and
- Section 11: Summary and Next Steps – provides a summary of the conclusions reached and actions going forward.

1.1.4 This consultation exercise provides stakeholders and members of the public with the opportunity to provide feedback on the optimal alignments and site selected. Further information in relation to public consultation events can be accessed on the project website:

www.ssen-transmission.co.uk/projects/project-map/Connagill-Cluster/

2 Project Background and Need

2.1.1 SSEN Transmission has a statutory duty under Schedule 9 of the Electricity Act 1989 to develop and maintain an efficient, co-ordinated and economical transmission system in its licenced areas. SSEN Transmission has obligations to offer non-discriminatory terms for connection to the transmission system.

2.1.2 SSEN Transmission are required to provide grid connections for five wind farms, all located within proximity to each other, in the Strathy area of Sutherland, in the Highlands of Scotland. They all require connection to the transmission network at the Connagill 275/132 kV substation. The wind farms are set out below and illustrated on **Plate 2.1**:

- Consented Strathy South Wind Farm (comprising 39 turbines with 208 MW capacity);
- Consented Strathy Wood Wind Farm (comprising 11 turbines with 62.4 MW capacity);
- Proposed Armadale Wind Farm and Battery Energy Storage System (BESS) (comprising 9 turbines with 85.4 MW capacity);
- Proposed Melvich Wind Farm and BESS (comprising 12 turbines with 99.6 MW capacity); and
- Proposed Kirkton Energy Park (comprising 11 turbines and BESS with 72.8 MW capacity).

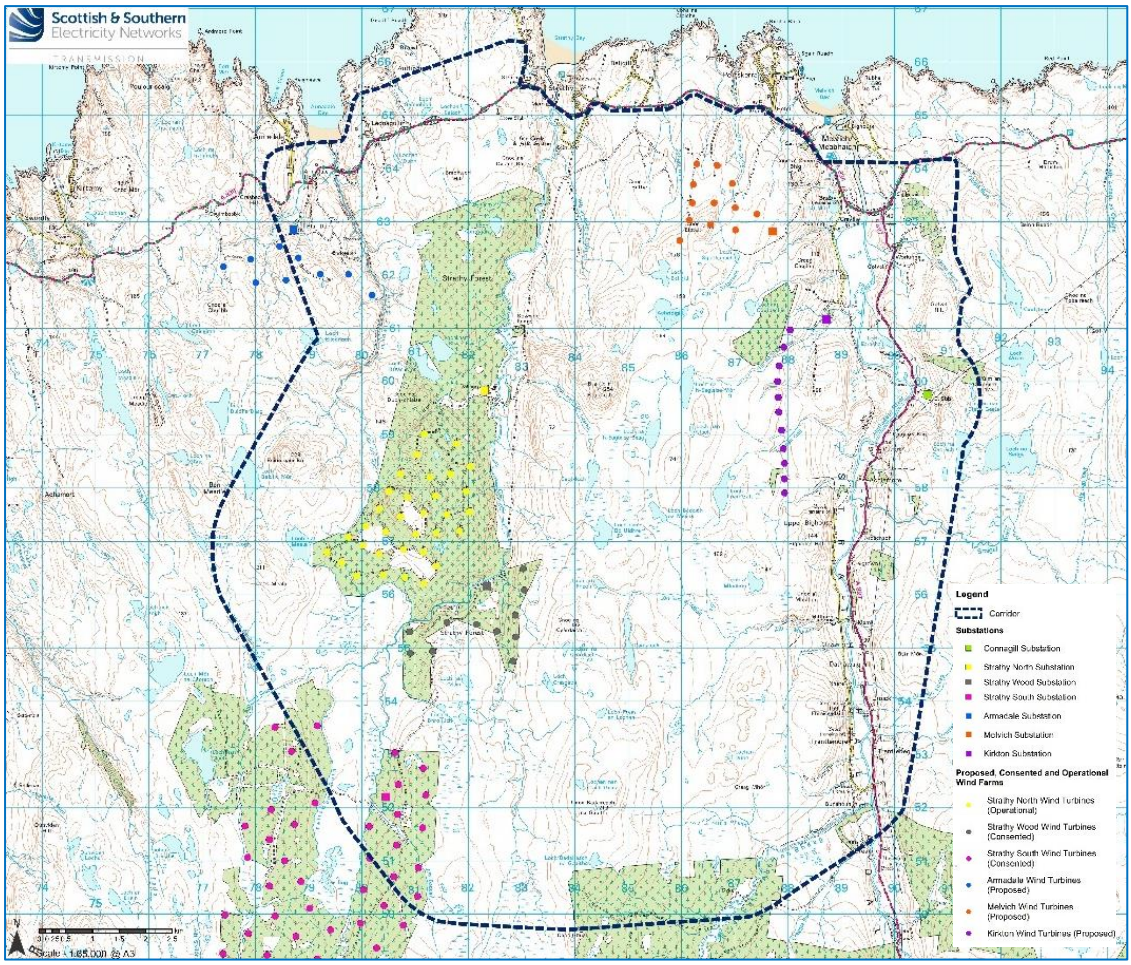
2.1.3 To facilitate the five grid connections, a new switching station, known as Strathy Switching Station, would also be required.

2.1.4 The proposed connections are in accordance with agreements between SSEN Transmission, National Grid Electricity System Operator (as operator of the National Grid), and each wind farm developer.

2.1.5 Although the connections are under separate connection agreements, SSEN Transmission has decided to streamline the pre-application consultation and routeing process in order to allow stakeholders to review the connections that make up the Cluster as a whole. This also provides the opportunity to consider the consolidation of infrastructure and construction practices where practicable.

2.1.6 All connections are to be provided at 132 Kilovolts (kV) (132,0000 volts) accommodated on a combination of overhead lines (OHLs) and underground cable.

Plate 2.1: Locations of Wind Farms in the Strathy area



2.1.7 In December 2023, a Routeing Stage Consultation Document[1] was prepared to set out the project need and seek comments from stakeholders and members of the public on the route option studies undertaken, and the rationale for, and approach to, the selection of the optimal routes for the consented Strathy South and Strathy Wood wind farms and the proposed Armadale wind farm. Due to the short length of connection, the grid connections for the proposed Melvich and Kirkton wind farms did not undergo routeing stage studies and progressed directly to alignment optioneering.

2.1.8 Comments received were documented in a Report on Consultation (April 2024)[2] which set out the consultation process for Connagill Cluster Grid Connections during the route option stage. The Report on Consultation confirmed that the optimal routes selected for the grid connections would be taken forward as the proposed routes for the consideration of alignment options.

2.1.9 Work has since been carried out to identify and appraise alignment options within the proposed routes for each grid connection. The results of this work are summarised in this Consultation Document.

[1] Connagill Cluster Grid Connections: Consultation Document (Route Options), December 2023, produced by SSEN Transmission
[2] Connagill Cluster Grid Connections: Report on Consultation (Route Options), April 2024, produced by SSEN Transmission

3 Project Overview

Proposed Approach

3.1.1 Following a review of the various technology options available, SSEN Transmission concluded that a rationalised approach would be most appropriate across the five connection projects. The table below sets out the proposed approach for each connection and the consenting approach.

Table 3.1: Optimal Technology Solutions and Consenting Approach

Project	Technology Solution	Description	Consenting Approach
Strathy South and Strathy Wood Wind Farms	132 kV underground cable	From Strathy South Wind Farm on-site substation to a point in the vicinity of Strathy Wood Wind Farm on-site substation.	Anticipated to be Permitted Development Submission of a Habitat Regulations Appraisal (HRA) Screening. (Requirement for a cable sealing end (CSE) compound would fall under ancillary development of the section 37 submission for Strathy Wood Grid Connection)
	132 kV OHL supported by steel structure	From Strathy Wood substation, a new 4.25 km double circuit 132 kV OHL supported by steel structures would be constructed to a 'T' on to the existing Strathy North 132 kV trident H-wood pole OHL near Dallangwell. This would transport electricity generated by Strathy Wood wind farm initially. This arrangement of T-ing onto the existing wood pole OHL would be a temporary arrangement until the next section of connection (as described below) is constructed, at which point electricity generated by Strathy South wind farm would also utilise the OHL.	Section 37 of the Electricity Act (1989)
	132 kV OHL supported by steel structure	A new 12 km double circuit 132 kV OHL supported by steel structures would be constructed to continue the connection between the Strathy North 'T' (at Dallangwell) to Connagill 275/132 kV substation. The structures would be capable of operating at 275 kV in the future, if required. Following completion of this section, Strathy Wood and Strathy North would be transferred over to the new structure and redundant parts of the existing trident H-wood pole OHL removed.	Section 37 of the Electricity Act (1989)
Armadale Wind Farm	132 kV trident wood pole OHL	The works would include a single circuit 6 km 132 kV trident H-wood pole OHL between Armadale wind farm substation to a 'T' onto the proposed double circuit 132 kV OHL. The proposed 132 kV OHL (set out above) would	Section 37 of the Electricity Act (1989)

Project	Technology Solution	Description	Consenting Approach
		complete the connection into Connagill 275/132 kV substation.	
Melvich Wind Farm	132 kV underground cable	From Melvich wind farm on-site substation to the existing Strathy North 132 kV trident H-wood pole OHL.	Anticipated to be Permitted Development (Requirement for a CSE compound would fall under ancillary development of the section 37 submission for Strathy South Grid Connection)
Kirkton Wind Farm	132 kV trident wood pole OHL	The works would include a short span (<1 km) of single circuit 132 kV trident wood pole OHL between Kirkton wind farm substation and a 'T' on the existing Strathy North 132 kV trident H-wood pole OHL.	Section 37 of the Electricity Act (1989)
Existing Strathy North OHL	132 kV trident wood pole OHL	Once the 132 kV double circuit OHL is constructed, to further rationalise the project, the existing Strathy North 132 kV trident H-wood pole OHL would be removed between Strathy North substation, to a point, yet to be determined, but likely in proximity of Melvich substation. The section of wood pole OHL that would remain in place would be re-purposed for use by the Melvich and Kirkton connections into Connagill 275/132 kV substation.	This would fall under ancillary development of the section 37 submission for the Strathy South Grid Connection
Strathy Switching Station	Switching station	To facilitate the five connections, a new switching station would also be required to collect all incoming circuits onto a double busbar before taking these through the double circuit 132 kV OHL supported by steel structure	Town and Country Planning (Scotland) 1997

Steel Structures

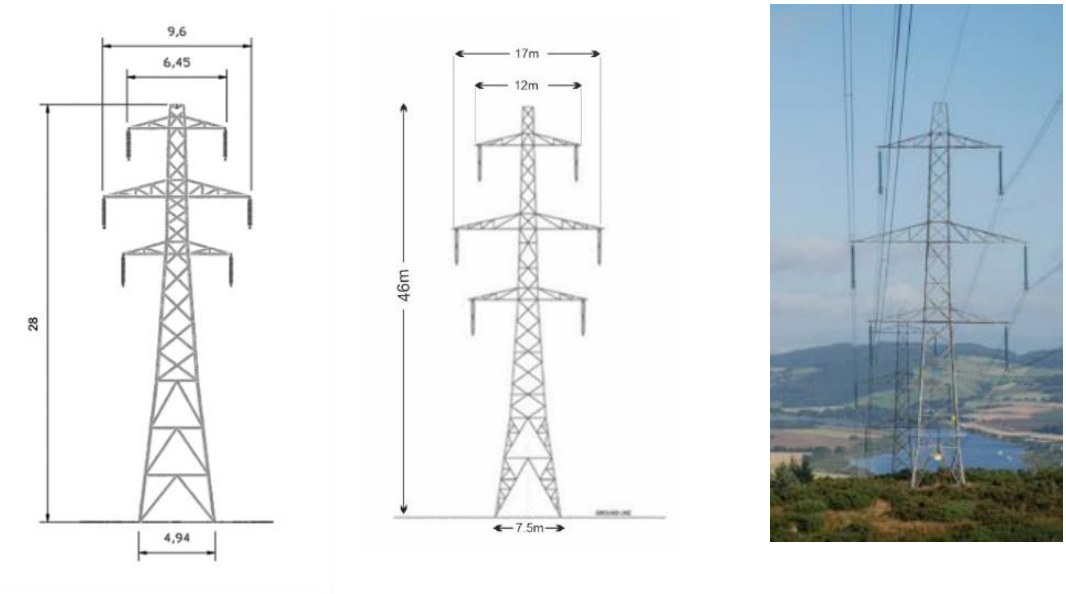
3.1.2 Steel structures would comprise a lattice design from the SSEN Transmission 'L7' series or 'L8' series of steel lattice tower. The span length (distance between towers) would vary slightly depending on topography and land usage. For an L7 series of tower the span lengths would be between approximately 200 - 280 m whereas for an L8 series of tower it would be approximately 250 m.

3.1.3 Tower heights would also vary, depending on local topography, but would typically be 28 m in height for an L7 series of tower and 46 m in height for an L8 series of tower. Exact heights of and the distances between towers would be determined after a detailed line survey and confirmed prior to submission of an application for consent. The towers would carry two circuits, each with three conductors supported from either glass, porcelain, or composite insulators attached to the horizontal

cross arms on both sides of each steel lattice tower. An Optical Ground Wire (OPGW)[3] would be suspended between tower peaks, above the conductors.

3.1.4 A schematic of the proposed L7 and L8 series of steel lattice towers is shown in **Plate 3.1** below.

Plate 3.1: Proposed L7 and L8 Steel Lattice Tower Typical Schematic and Example Photograph



Trident H-wood Pole

3.1.5 The trident wood poles would have a height of approximately 16 m (including insulators and support). The proposed trident wood pole would support three conductors in a horizontal flat formation. The spacing between poles would vary depending on topography and altitude. The specific distances would be determined after a detailed line survey but would be approximately 100 m apart. A photograph showing a typical wood pole trident line is shown in **Plate 3.2** below.

Plate 3.2: Proposed Trident H-wood poles Typical Schematic and Example Photograph

[3] Optical Ground Wire is a dual functioning cable, providing a 'shield' to conductors from lightning, whilst also comprising optical cables for telecommunication purposes.

Underground Cable

3.1.6 As stated in **Table 3.1**, a section of UGC would be required for the Strathy South Wind Farm Grid Connection, this is primarily to avoid impacts to sensitive bird species, as discussed with NatureScot during consultation.

Forestry Removal

3.1.7 Felling of commercial forestry may be required to enable construction of the proposed grid connections although this will be avoided or minimised where possible. If required, this would be undertaken in consultation with affected landowners. Scottish Forestry would also be consulted throughout the development of the grid connections and each development would adhere to Scottish Government's Control of Woodland Removal Policy[4].

3.1.8 An operational corridor may be required to enable the safe operation and maintenance of the OHL. This would vary depending on the type of woodland (based on species present) in proximity to the OHL, and the height of support structures used within each woodland area.

Access Strategy

3.1.9 Vehicle access is required to each tower or pole location during construction to allow for excavation and placing of concrete foundations and tower / pole installation.

3.1.10 In general, proposed construction access would be taken via the existing public road network and utilise existing forest and estate tracks, as far as practicable, upgraded as required. Installation of new tracks, both temporary and permanent would likely be required, depending on the technology solution. Floating stone road or trackway panel construction (typically a short-term solution) may be installed in sensitive areas such as over deeper areas of peat. Alternatively, helicopters may be used to deliver and construct poles and/or towers in areas where access presents a significant challenge. Using helicopters in this way can minimise the environmental impact on sensitive habitats and reduces the need for temporary access tracks. However, helicopter delivery is a high-risk activity and presents some limitations. Feasibility is currently being assessed for the best method of access.

3.1.11 For underground cable sections, a temporary track is typically constructed along the length of the cable during the construction phase.

3.1.12 Access for operation and general maintenance must also be considered. For steel lattice towers, the preferred access is a permanent track, between 2.5 – 3.0 m wide. For wood pole lines, a route suitable for off-road vehicles is acceptable, therefore eliminating the need for a permanent access track.

[4] Forestry Commission Scotland (2009) Control of Woodland Removal Policy

3.1.13 There is an opportunity to utilise the Strathy South wind farm access track for construction and maintenance access and deliveries, which could significantly reduce new access requirements within this part of the project.

Programme

3.1.14 It is anticipated that construction of the cluster as a whole would take place in a phased approach over a four year period, following the granting of consents, although detailed programming of each of the connection works would be the responsibility of the Contractor in agreement with SSEN Transmission.

Biodiversity Net Gain

3.1.15 Biodiversity Net Gain (BNG) is a process which leaves nature in a better state than it started. SSEN Transmission has developed a BNG toolkit based upon the Natural England metric[5], which aims to quantify biodiversity based upon the value of habitats for nature. It is an efficient and effective method for demonstrating whether development projects have been able to maintain or increase the biodiversity value of a development site after construction works.

3.1.16 The BNG toolkit would be applied across the cluster to quantify the overall potential biodiversity impacts; this includes a biodiversity baseline assessment, analysis of habitat losses due to temporary works and permanent structures during construction works, and analysis of biodiversity gains following reinstatement of habitats in areas of temporary construction work.

SSEN Transmission's Biodiversity Ambition

3.1.17 SSEN Transmission is committed to protecting and enhancing the environment by minimising the potential impacts from their construction and operational activities. As part of this approach, SSEN Transmission plc has made commitments within its Sustainability Strategy (2018)[6] , Sustainability Plan (2019)[7] and RIIO-T2 Business Plan, for new infrastructure projects to:

- Ensure natural environment considerations are included in decision making at each stage of a project's development;
- Utilise the mitigation hierarchy to avoid impacts by consideration of biodiversity in project design;
- Positively contribute to the UN and Scottish Government Biodiversity strategies by achieving an overall 'No Net Loss' on new infrastructure projects gaining consent in 2020 onwards and achieving Net Gain on projects gaining consent in 2023 onwards; and

[5] Natural England Biodiversity Metric 2.0 http://publications.naturalengland.org.uk/publication/5850908674228224
[6] Delivering a smart, sustainable energy future: The Scottish Hydro Electric Transmission Sustainability Strategy (2018) https://www.ssen-transmission.co.uk/media/2701/sustainability-strategy.pdf
[7] Our Sustainability Plan: Turning Ambition into Action. (2019) SHE Transmission. https://www.ssen-transmission.co.uk/media/3215/our-sustainability-plan-consultation-report.pdf

- Work with their supply chain to gain the maximum benefit during asset replacement and upgrades.

3.1.18 The design and evolution of these grid connection projects will be carried out in line with these commitments.

4 Alignment and Site Selection Procedures

4.1 Alignment Selection Procedure

Overview

4.1.1 The approach to alignment selection was informed by SSEN Transmission's guidance '*Procedures for Routeing Overhead Lines and Underground Cables of 132 kV and above*'[8] which provides a framework to ensure environmental, technical and economic considerations are identified and appraised at each stage of the routeing process.

4.1.2 The guidance splits a project into five stages, as follows:

- Stage 0: Routeing Strategy Development;
- Stage 1: Corridor Selection;
- Stage 2: Route Selection;
- Stage 3: Alignment Selection; and
- Stage 4: EIA and consenting.

4.1.3 Each stage is an iterative process and involves an increasing level of detail and resolution, bringing cost, technical and environmental considerations together in a way which seeks to achieve the best balance at each stage. The stages can vary depending on the type, nature and size of a project and consultation is carried out at each stage of the process as appropriate.

4.1.4 The Connagill Cluster Grid Connections are currently at Stage 3: Alignment Selection, the objective of which is to identify an optimal alignment to be taken forward for consultation prior to commencing the EIA and consenting stage.

4.1.5 In consideration of the principles outlined in the guidance document, the method of identifying an optimal alignment in this study has involved the following four key tasks:

- Review and update, where required, of the baseline situation established at Stage 2;
- Identification of alignment options;
- Environmental and engineering analysis of alignment options and alignment variants; and
- Identification of an optimal alignment.

4.1.6 Desk-based studies were supplemented by high-level walkover assessments by specialist consultants and OHL engineers. These walkover surveys obtained further site data and observations of localised constraints.

[8] SSEN Transmission (2020) Procedures for Routeing Overhead Lines and Underground Cables of 132 kV and more

Alignment Identification and Selection Methods

4.1.7 Alignment options (or alignment variants) have been identified for each connection, aiming to minimise interaction with the environmental constraints identified within the proposed routes based on the key environmental and engineering constraints identified during Stage 2: Route Selection.

4.1.8 The steps outlined in the Holford Rules[9] and SSEN Transmission's internal guidance have been taken into account as far as is practicable in establishing the alignment options. In particular, alignments have sought to:

- Avoid if possible major areas of highest amenity value (including those covered by national and international designations and other sensitive landscapes);
- Avoid by deviation, smaller areas of high amenity value;
- Try to avoid sharp changes of direction and reduce the number of larger angle towers required;
- Avoid skylining the route in key views and where necessary, cross ridges obliquely where a dip in the ridge provides an opportunity;
- Target the alignment towards open valleys and woods where the scale of towers / poles will be reduced and views broken by trees (avoid slicing through landscape types and try to keep to edges and landscape transitions);
- Consider the appearance of other lines in the landscape to avoid a dominating or confusing wirescape effect; and
- Approach urban areas through industrial zones and consider the use of undergrounding in residential and valued recreational areas.

Appraisal Method

4.1.9 Appraisal of alignment options has involved systematic consideration against the environmental and engineering topic areas included in **Table 4.1**.

Table 4.1: Environmental and Engineering Topic Areas Considered

	Category	Sub-Topic
Environmental	**Natural Heritage**	Designations
		Protected Species
		Habitats
		Ornithology
		Geology, Hydrology and Hydrogeology
	Cultural Heritage	Designations
		Cultural Heritage Assets

[9] Scottish Hydro Electric Transmission Limited (SHETL). (October 2004). The Holford Rules: Guidelines for the Routeing of New High Voltage Overhead Transmission Lines with NGC 1992 and SHETL 2003 Notes; Revision 1.01

	People	Proximity to Dwellings
	Landscape and Visual	Designations
		Character
		Visual
	Land Use	Agriculture
		Forestry
		Recreation
	Planning	Policy
		Proposals
Engineering	**Infrastructure Crossings**	Major Crossings (132kV, 275kV, Rail, 200+m wide river, navigable canal, gas or hydro pipeline)
		Road Crossings
	Environmental Design	Elevation
	Ground Conditions	Terrain
		Peat
	Construction / Maintenance	Access
		Angle Structure
	Proximity	Clearance Distance
	Other Considerations	DNO Crossings

Identification of an Optimal Alignment

4.1.10 Following review of all of the potential alignment options, the environmental and engineering considerations have been considered in combination to arrive at an optimal alignment for each grid connection.

4.2 Site Selection Procedure

Overview

4.2.1 The approach to site selection for Strathy Switching Station was informed by SSEN Transmission's guidance '*Substation Site Selection Procedures for Voltages at or above 132 kV*'[10] which provides a framework to ensure environmental, technical and economic considerations are identified and appraised at each stage of the site selection process.

4.2.2 The guidance splits a project into four stages, as follows:

- Stage 0: Pre-Site Selection Activities – Strategic Connections Options Appraisal;
- Stage 1: Initial Site Screening;
- Stage 2: Detailed Site Selection; and

[10] SSEN Transmission (2022): Substation Site Selection Guidelines for Voltages At or Above 132kV [PR-NET-ENV-502]

- Post Site Selection Activities – Consenting Process.

4.2.3 The stages that are carried out can vary depending on the type, nature and size of a project and consultation is carried out at each stage of the process as appropriate. This project is currently at Stage 1: Initial Site Screening, the objective of which is to identify technically feasible, economically viable and environmentally acceptable site option within a defined area.

4.2.4 In consideration of the principles outlined in the guidance document, the method of identifying an optimal switching station site involved the following four key tasks:

- Identification of the baseline situation;
- Identification of switching station site options;
- High level environmental appraisal of switching station site options; and
- Identification of an optimal switching station site.

4.2.5 Desk-based studies were supplemented by high-level walkover assessments by specialist consultants and OHL engineers. These walkover surveys obtained further site data and observations of localised constraints.

Site Identification and Selection Methods

4.2.6 Seven switching station site options were identified following desk-based review and site appraisals undertaken in 2023. However, on further consideration by SSEN Transmission, two of these site options were discounted on engineering grounds and were not progressed further.

4.2.7 In accordance with the steps outlined in SSEN Transmission's approach to switching station site selection, the following considerations have been taken into account as far as is practicable at this stage and will be considered in more detail during subsequent assessments:

- Respect areas of high amenity value and take advantage of the containment of natural features such as woodland, fitting in with the landscape character of the area);
- Take advantage of ground form with the appropriate use of site layout and levels to avoid intrusion into surrounding areas;
- Use space effectively to limit the area required for development, minimising the effects on existing land use and rights of way;
- Alternative designs of switching stations may also be considered, e.g. 'enclosed', rather than 'open', where additional cost can be justified;
- Consider the relationship of towers and switching station structures with background and foreground features, to reduce the prominence of structures from main viewpoints; and
- When siting switching stations take account of the effects of line connections that will need to be made.

Appraisal Method

4.2.8 Appraisal of switching station site options has involved systematic consideration against the environmental and engineering topic areas listed in **Table 4.2**.

Table 4.2: Environmental and Engineering Topic Areas Considered

	Category	Sub-Topic
Environmental	**Natural Heritage**	Designations
		Protected Species
		Habitats
		Ornithology
		Geology, Hydrology and Hydrogeology
	Cultural Heritage	Designations
		Cultural Heritage Assets
	People	Proximity to Dwellings
	Landscape and Visual	Designations
		Character
		Visual
	Land Use	Agriculture
		Forestry
		Recreation
	Planning	Policy
		Proposals
Engineering	**Connectivity**	Existing Circuits / Networks
		Future Development Possibilities
		Interface with SSEN Distribution and Generation
		DNO connection
	Footprint Requirements	Technology
		Adjacent Land Use
		Space Availability
	Hazards	Unique Hazards
		Existing Hazards
	Ground Conditions	Topography
		Geology
	Environmental Conditions	Elevation
		Salt Pollution
		Flooding
		Carbon Footprint
		SF6
		Contaminated Land
		Noise
	Construction Access	Substation Access Road (from public road)
		Transformer Delivery Route

	Operation and Maintenance	Access

4.2.9 Appraisal of the site options was undertaken against a number of environmental, engineering and cost criteria set out within SSEN Transmission guidance[Error! Bookmark not defined.] using the Red, Amber, Green (RAG) matrix which is provided as **Plate 4** below. A selection of feasible sites will then be selected to take forward to Stage 2.

Plate 4: RAG Ratings

Performance	Comparative Appraisal
Most Preferred	Low potential for the development to be constrained
	Intermediate potential for the development to be constrained
Least Preferred	High potential for the development to be constrained

5 Consultation to Date

5.1 Introduction

5.1.1 Formal consultation was carried out during Stage 2 (Routeing Stage) of the project in order to obtain comments from statutory and non-statutory consultees, including members of the public. A consultation event was held in November 2023 to present the route options to members of the public local to the area and invite questions and comments.

5.2 Route Stage Consultation Summary

5.2.1 A summary of key consultation responses at route selection stage is described in the following paragraphs.

Strathy South and Strathy Wood Grid Connection 'Southern Section'

5.2.2 Comments received from NatureScot and RSPB Scotland noted a preference for Route Option SS-SN 3 (which was the environmental preference documented in the Consultation Document[1]) as it largely avoids the Caithness and Sutherland Peatlands Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site, compared to the optimal route (Route Options SS-SN 2a and SS-SN2b), as it would be least damaging thereby helping to maintain the SAC and SPA conservation objectives. However, from a technical and safety perspective, Route Option SS-SN 3 is not considered to be viable as it would be challenging to construct through an operational wind farm due to the proximity of existing wind turbine underground cables and would require third party permission for future maintenance and operations access. Whilst the optimal route does pass through the designated sites, it is considered that there would be opportunities to minimise or avoid adverse effects on the qualifying features of these sites by closely following disturbed ground alongside an existing access track.

5.2.3 Further review and consideration of the impacts on the qualifying habitats and species of the designated sites (including the candidate WHS) will be undertaken as the project progresses.

5.2.4 On balance, it is considered that the optimal route for this section is taken forward as the proposed route which will comprise a combination of 132 kV underground cable and 132 kV double circuit OHL supported by steel lattice towers.

Strathy South and Strathy Wood Grid Connection 'Northern Section'

5.2.5 Responses received from statutory and non-statutory consultees provided general support for the optimal route identified for this section. No specific comments were received on preference of route options from the local community.

5.2.6 Whilst the environmental sensitivities were noted and considered further during the alignment selection stage of the project, on balance it was considered the optimal route for this section (as per 2014 section 37 consent for Strathy South Grid Connection (which runs parallel to the existing Strathy

North 132 kV wood pole OHL)) is taken forward as the proposed route, comprising a 132 kV double circuit OHL supported by steel lattice tower (and capable of operating at 275 kV in the future, if required).

Strathy South and Strathy Wood Grid Connection 'Northern Alternative Section'

5.2.7 Responses received from statutory and non-statutory consultees provided general support for the optimal alternative route (Route Option SN-C ALT 1).

5.2.8 The Highland Council (THC) suggested considering an iteration of the optimal alternative route utilising underground cable in the northern part of the route, where it runs closest to the A836 and settlements. SSEN acknowledged that the use of UGC can be considered to mitigate likely significant effects where appropriate but noted that an underground cable does not come without its own constraints. These constraints include the additional land take required for an underground cable and working corridor, and the potential for environmental effects particularly on habitats and hydrology; the requirement for additional infrastructure (in the form of cable sealing end compounds and joint bays); and challenges in maintenance and power restoration. Given these constraints and SSEN Transmission's responsibility for an economical and efficient transmission network, it is considered that OHL is the most appropriate choice of technology for this connection. Nevertheless, further environmental and engineering studies have been undertaken to seek to find an acceptable alignment.

5.2.9 RSPB raised concerns that all route options span an important area used by qualifying species of the Caithness and Sutherland Peatlands SPA (located to the south) to access feeding at sea (to the north). Where high risks of collision are predicted, RSPB Scotland suggested that the use of underground cable should be considered to reduce impacts. Ornithological surveys completed across the cluster, along with data collected from surveys for other developments in the area, have been drawn upon during alignment selection to minimise this risk, where possible.

5.2.10 Comments received from the local community queried the need for this connection, should Melvich wind farm not receive planning consent. No specific comments were received on the route options.

5.2.11 Whilst the environmental sensitivities are noted and have been considered during alignment selection, on balance it was considered the optimal alternative route (Route Option SN-C ALT1) be taken forward as the proposed alternative route, comprising a 132 kV double circuit OHL supported by steel lattice tower (and capable of operating at 275 kV in the future, if required).

Armadale Grid Connection

5.2.12 Responses received from the majority of statutory and non-statutory consultees provided general support for the optimal route identified for this section, with the exception of Historic Environment Scotland (HES), who raised concerns with the proximity of the western extent of the optimal route in relation to the Armadale broch scheduled monument and advised they may object.

5.2.13 RSPB Scotland raised concerns that all route options considered would span an area that connects the Flow Country breeding grounds to the sea with potential for collision and barrier effects to the Caithness and Sutherland Peatlands SPA species. Similarly, all route options would cross the Armadale Gorge Site of Special Scientific Interest (SSSI). Results from habitat and ornithological surveys (along with data collected from surveys for other developments in the area), have been drawn upon to inform the alignment selection and minimise risk of impact, where possible. Overall RSPB Scotland agreed that Route Option A-3a was least optimal.

5.2.14 No specific comments were received from the local community on route options.

5.2.15 Whilst the heritage sensitivities are noted and were discussed further with HES during a meeting in March 2024, the technical challenges associated with crossing the Armadale gorge elsewhere limits SSEN Transmission ability to progress an alternative option, unless the use of steel lattice tower technology is employed; and this could result in other environmental constraints, notably increased risk of collision to some bird species and would be visually more prominent. As such, it was considered that the optimal route (Route Option A-4) for this connection be taken forward as the proposed route, comprising a 132 kV OHL supported by trident H-wood pole. SSEN Transmission will continue to engage with HES to identify a mutually acceptable alignment; keeping development as far from the broch as is technically feasible, while recognising the technical challenges of the gorge.

5.3 Project Responses

5.3.1 To address these points, the following actions have been or are being undertaken in relation to all aspects of the project:

- Further environmental survey and assessment work to identify acceptable alignment and design solutions through the sensitive landscapes and environment.
- Further targeted consultation will be undertaken as the designs progress.

5.3.2 All comments and considerations will be taken forward into assessments which will be carried out for all relevant environmental aspects. This process will remain inclusive, seeking further consultation where appropriate.

5.4 Routeing Stage Consultation Conclusions

5.4.1 The programme of consultation undertaken for the project between August 2023 and February 2024 was designed to engage with stakeholders including statutory and non-statutory consultees, local communities, landowners and individual residents in order to invite feedback on the rationale for and approach to, the selection of the optimal route options.

5.4.2 The consultation process confirmed that the optimal routes identified within the Connagill Cluster Grid Connections Consultation Document[1], selected on the basis that they are considered to provide an optimum balance of environmental and technical factors, will all be taken forward as the proposed routes to the next stage of the routeing process (alignment stage).

6 Strathy South and Strathy Wood Grid Connections – Southern Section

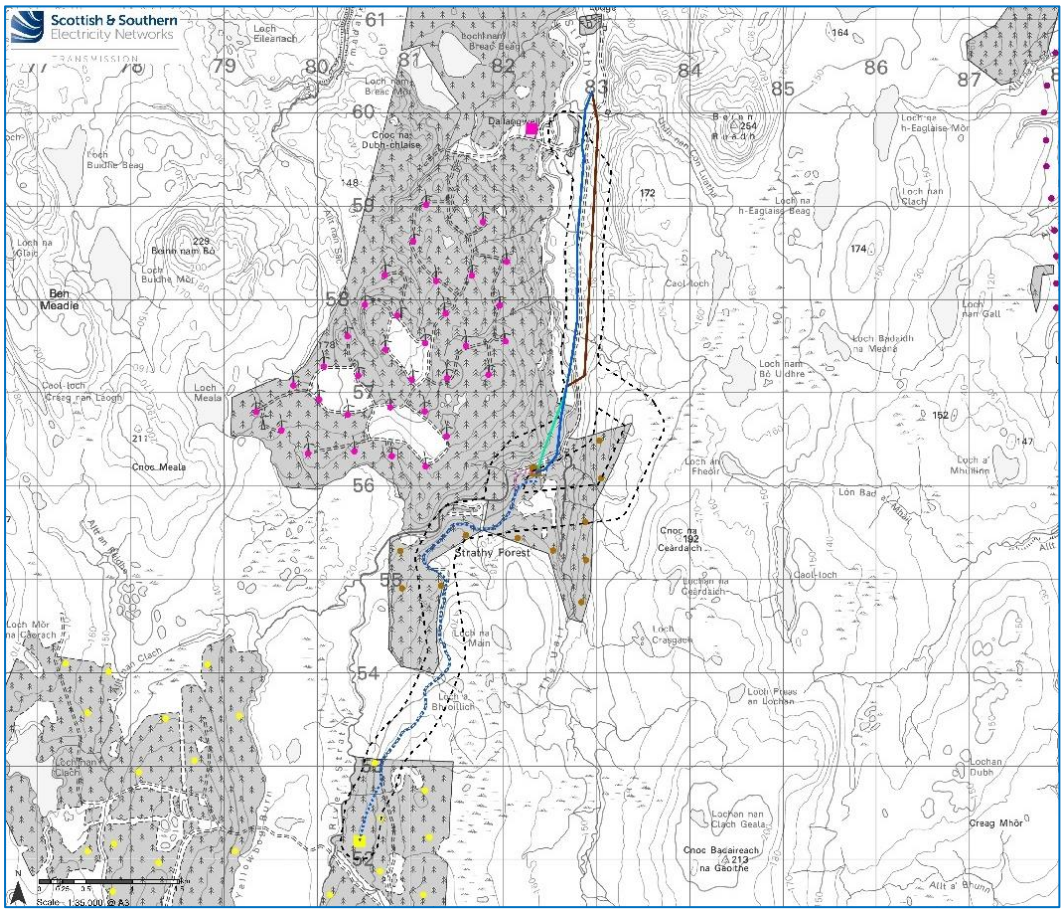
6.1 Introduction

6.1.1 This section of the report sets out a description and comparative appraisal of the alignment options that were considered for the 'southern section' of the combined Strathy South and Strathy Wood grid connection. The southern section covers the area from the consented Strathy South wind farm substation to (within the vicinity of) the operational Strathy North substation. Section 7 of this report describes the 'northern section' to complete the connection to Connagill 275/132 kV substation.

6.2 Description of Alignment Options

6.2.1 SSEN Transmission identified one Baseline Alignment and three alignment variants between the Strathy South substation to Strathy North substation within the Proposed Route, as displayed on **Plate 6.1** and **Figure 1.1**.

Plate 6.1: Strathy South and Strathy Wood Grid Connection 'Southern Section' Alignment Options



6.3 Comparative Appraisal of Alignment Options

Overview

6.3.1 An appraisal of the Baseline Alignment and alignment variants has been undertaken, considering the environmental and technical constraints of each prior to arriving at an optimal alignment. A summary of this appraisal is provided below, and **Appendix 1** contains a more detailed breakdown of the environmental appraisal of these options.

Environmental

6.3.2 In selecting the optimal alignment on environmental grounds, consideration has been given to a number of environmental factors and topic areas, with the majority concluding that the alignment options are broadly comparable. Given the location of this connection within the Caithness and Sutherland Peatlands SAC, SPA, Ramsar site and associated West Halladale SSSI, impacts on these statutory designated sites are considered to be the over-riding factor on selection of the optimal alignment.

6.3.3 Alignment Option 1 (UGC and OHL) and Alignment Variant 2 (OHL) pass directly through the SAC, SPA, Ramsar site, and associated SSSI. Due to nearby sensitive diver species, the technology solution for the southern section of Alignment Option 1 only considered the use of UGC, as agreed with NatureScot during earlier consultation. The UGC alignment was informed by ecological survey work that mapped the boundary of the qualifying habitats of the surrounding SAC and those which had been previously disturbed through historical construction activities. The aim was to target the alignment within the degraded, non-qualifying habitats of the SAC to limit impacts.

6.3.4 The OHL section of Alignment Option 1 and Alignment Variant 2 would enter the designated sites upon crossing the River Strathy (at the northern most crossing point) and would each traverse either side of the existing track; Alignment Option 1 (OHL) on the western side and Alignment Variant 2 (OHL) on the eastern side. It is considered that by locating infrastructure adjacent to the track, within an area of previously disturbed ground, would reduce impacts on the sensitive habitats of the SAC. The area to the east of the access track (Alignment Variant 2 (OHL)) comprises sloping ground and is dominated by poorer quality habitats on shallow peats, while the area to the west of the track (Alignment Option 1 (OHL)) is likely to include higher quality bog habitats and areas of deeper peat. Alignment Option 1 (OHL) would cross more of the River Strathy floodplain (between the crossing points), compared to Alignment Variant 2 (OHL), and by having a greater separation distance from the River Strathy and woodland edge (by being located on the eastern side of the track), Alignment Variant 2 (OHL) would also be further from good quality otter (along with other protected species) habitats. However, it should be noted that Alignment Variant 2 (OHL) is closer to some SPA breeding bird territories, notably hen harrier and golden plover, which could increase disturbance and displacement during construction, albeit this would only be marginal compared to the impacts of Alignment Option 1 (OHL). Overall, between Alignment Option 1 (OHL) and Alignment Variant 2

(OHL), it is considered that Alignment Variant 2 (OHL) is optimal given the reduced impact on the qualifying habitats and species of the designated sites.

6.3.5 Alignment Variant 1 (UGC) would consider an alternative approach to Strathy Wood substation (specifically the CSE compound / structure) compared to Alignment Option 1 (UGC). Alignment Variant 1 (UGC) would keep infrastructure outwith an area of native woodland, unlike the comparable section of Alignment Option 1 (UGC) in the vicinity of Strathy Wood substation. However, Alignment Variant 1 (UGC) would bring development in closer proximity to a meandering section of the River Strathy, which could have greater connectivity to the designated sites via the River Strathy (despite the variant not overlapping any designated site). By ensuring permanent structures are set back from watercourse channels, with appropriate controls in place during construction, this is not considered a constraint to development. Overall, between Alignment Variant 1 (UGC) and Alignment Option 1 (UGC), it is considered the benefit of avoiding the native woodland is preferable and Alignment Variant 1 (UGC) is considered optimal.

6.3.6 Alignment Variant 3 (OHL) would consider an alternative crossing of the River Strathy compared to Alignment Option 1 (OHL). Alignment Variant 3 (OHL) would move construction further from the River Strathy (upon crossing) compared to the comparable section of Alignment Option 1 (OHL), and would reduce potential disturbance to the riparian corridor and otters (a designated feature of the SAC) that use it. It would also cross less of the floodplain compared to Alignment Option 1 (OHL). However, it would bring development in closer proximity to visible structures of a Regionally significant heritage asset, although with sensitive placement of towers and application of mitigation measures (such as asset marking) during construction, this should be adequate to ensure no accidental damage. Overall, between Alignment Option 1 (OHL) and Alignment Variant 3 (OHL), it is considered that by keeping development further from the river, outwith the floodplain and with reduced disturbance to the qualifying species of the SAC, Alignment Variant 3 (OHL) is considered optimal.

6.3.7 In consideration of other environmental topics, the area between the two connection points is remote and distant from residential and route receptors, with the nearest properties; at Braerathy Lodge and Dallangwell, both unoccupied, and either planned for demolition or the future use is unknown. As such, the visual impacts of the OHL section of all alignment options would be limited to recreational users of Scottish Hill Track 344: Strath Halladale (Trantlebeg) to Strathy, and while an OHL alongside the northern section of this track may be intrusive for users, measures can be put in place during construction to ensure no severance of the public rights of way. Furthermore, there are no designated heritage sites that would be directly impacted, or located within the near vicinity of any of the alignment options that could compromise their setting.

6.3.8 On balance the overall environmentally optimal alignment would be Alignment Option 1 (UGC) in combination with all three alignment variants.

Engineering

6.3.9 Given the similarities between the alignment options, many of the engineering constraints are comparable. For the engineering topic areas of major crossings, pollution areas, contaminated land, access, clearance distance and proximity to wind farms there is no real preference between Alignment Option 1 (UGC and OHL) and any of the alignment variants.

6.3.10 The below engineering topic areas relate to constraints where there are some differences between Alignment Option 1 (UGC and OHL) and the alignment variants.

- Road Crossings: Alignment Variant 1 (UGC) is considered less optimal to the comparable section of Alignment Option 1 (UGC) as it would require a crossing of the existing access track. All other alignment options are comparable.
- Elevation: The overall elevation of Alignment Option 1 (UGC) is under 200 m, whereas the comparable section of Alignment Variant 1 (UGC) is less than 100m, making it preferable. For all other alignment options, elevation constraints are considered comparable.
- Flooding: Upon leaving Strathy Wood substation, approximately 25% of Alignment Option 1 (OHL) would pass through a mapped flood zone. The comparable section of Alignment Variant 2 passes through approximately 20% and Alignment Variant 3 passes through 8% and are both therefore considered preferable to the comparable sections of Alignment Option 1 (OHL). Alignment Option 1 (UGC) and Alignment Variant 1 (UGC) are considered comparable in terms of flooding.
- Terrain: The terrain along Alignment Option 1 (UGC) is open and nearly flat to gently undulating with no narrow pinch points, whereas there is a greater slope along the comparable section of Alignment Variant 1 (UGC) making it slightly more challenging to construct and less optimal. All other alignment options are comparable.
- Peat: For the engineering topic area of peat, Alignment Option 1 (OHL) and Alignment Variant 3 (OHL) are comparable as they cross a similar extent (approximately 45-50 %) of Class 1 peatland, whereas Alignment Variant 2 crosses approximately 45-50% of Class 2 priority peatland and is therefore optimal than the comparable section of Alignment Option 1 (OHL). Alignment Option 1 (UGC) is optimal compared to Alignment Variant 1 (UGC) which passes through slightly deeper peat.
- Angle structures/deviations: The exact number of angle towers that would be required can only be determined accurately once at the detailed design stage. However, a high-level assessment of the potential number of angle towers has concluded that Alignment Option 1 (OHL) and Alignment Variant 3 (OHL) would have comparable number of angle structures (approximately 8), whereas the comparable section of Alignment Variant 2 (OHL) would require fewer angle structures (approximately 4) and would therefore be optimal. Alignment Option1 (UGC) is preferable to the comparable section of Alignment Variant 1 (UGC) due to fewer angle deviations, resulting in installation being less challenging.

6.3.11 On balance from an engineering perspective, Alignment Option 1 (UGC) is optimal compared to Alignment Variant 1 (UGC) due to the terrain and elevation being flatter and straighter, and therefore less challenging to construct.

6.3.12 Alignment Variant 2 (OHL) is optimal compared to the comparable section of Alignment Option 1 (OHL) as it runs through less of the mapped flood zone, less priority peatland and has fewer angle structures, resulting in less challenging conditions for construction and maintenance.

6.3.13 Alignment Variant 3 (OHL) is optimal compared to the comparable section of Alignment Option 1 (OHL) as it runs through less of the mapped flood zone.

6.4 Optimal 'Southern' Alignment

6.4.1 The various constraints have been taken into account to reach an optimal alignment across environmental and technical considerations.

6.4.2 Alignment Variant 1 (UGC) has been identified as the optimal option; despite crossing slightly more elevated terrain which may result in installation being slightly more challenging, it would allow infrastructure to be outwith an area of native woodland, unlike the comparable section of Alignment Option 1 (UGC) in proximity to Strathy Wood substation, and is therefore considered favourable.

6.4.3 Alignment Variants 2 and 3 are considered optimal from both an environmental and engineering perspective over the comparable sections of Alignment Option 1 (OHL). The area east of the existing track, through which Alignment Variant 2 (OHL) would traverse, is considered dominated by poorer quality habitats of the Caithness and Sutherland Peatlands SAC and consists of shallower peat. Being further from the River Strathy means that both alignment variants would cross less of the mapped floodplain, and while Alignment Variant 3 (OHL) may bring development closer to regionally significant heritage assets, through careful placement of towers and application of measures during construction, this is not considered a constraint to development.

6.4.4 The overall Optimal 'Southern' Alignment is, therefore, **Alignment Option 1 (UGC), Alignment Variant 1 (UGC), Alignment Variant 3 (OHL) and Alignment Variant 2 (OHL)**, as shown on **Figure 1.2**.

6.4.5 An indicative visualisation of the Optimal 'Southern' Alignment is included within this Consultation Document from Bowside Lodge (see VP1 contained in **Figure 7.1 (a-b)**).

7 Strathy South and Strathy Wood Grid Connection – Northern Section

7.1 Background

7.1.1 This section of the report considers the 'northern section' of the Strathy South and Strathy Wood grid connections, which covers the area from within the vicinity of Strathy North substation to Connagill 275/132 kV substation.

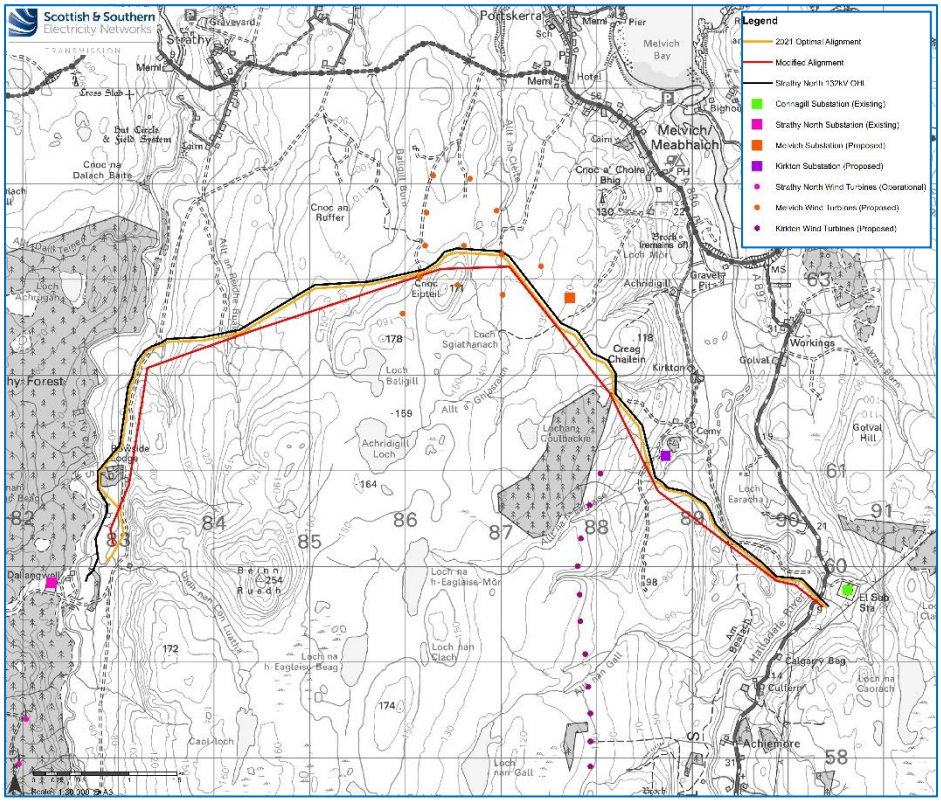
7.1.2 SSEN Transmission gained consent in 2014 for two parallel 132 kV trident H-wood pole OHLs to connect the consented Strathy North wind farm and (at the time) proposed Strathy South wind farm. Construction of one of the OHLs (to connect Strathy North wind farm) was completed in 2015 but the second OHL was not constructed due to delays in Strathy South wind farm receiving its consent. The consent for the OHL connection for Strathy South wind farm has now lapsed.

7.1.3 In 2021, SSEN Transmission carried out an exercise to review the route and alignment previously consented for the Strathy South wind farm. At this time the connection continued to consider an OHL supported by trident H-wood pole (as per the 2014 consent). The 2021 review concluded that the alignment previously identified, which follows alongside the existing Strathy North 132 kV OHL, remained optimal.

7.1.4 As part of the assessment to rationalise the cluster, SSEN Transmission carried out a further engineering review to consider an OHL supported by steel lattice tower which resulted in some minor modifications to the 2021 Optimal Alignment to ensure sufficient clearance from the existing Strathy North 132 kV OHL by the larger steel tower structure. This is referred to as the 'Modified Alignment'.

7.1.5 The '2021 Optimal Alignment' and 'Modified Alignment' are illustrated on **Plate 7.1** below and on **Figure 2.1**.

Plate 7.1: Strathy South and Strathy Wood Grid Connection 'Northern Section' 2021 Optimal Alignment and Modified Alignment



7.2 Optimal 'Northern' Alignment

7.2.1 An environmental review of the Modified Alignment was carried out which is detailed within **Appendix 2** and summarised below.

7.2.2 It was considered that the increased height of the steel lattice tower of the Modified Alignment could appear more intrusive both to sensitive bird species and to the open character of the landscape and visual receptors, compared to what was considered for the 2021 Optimal Alignment (wood pole). In comparison to wood poles, steel lattice towers will require a longer construction period, which could increase the potential for disturbance to protected species and breeding birds for a longer period, as well as requiring a larger footprint, increased working areas (around the towers) and requirement for additional infrastructure (i.e. access tracks), which may also lead to greater direct habitat loss and further loss, damage or fragmentation of habitats including peatland.

7.2.3 The Modified Alignment would require the careful placement of towers, particularly in relation to targeting the avoidance of sensitive qualifying habitats of the Caithness and Sutherland Peatlands SAC, Ramsar and West Halladale SSSI, and regionally significant heritage assets, but would also require the application of further mitigation, at both construction and operational stages, to avoid and reduce potential effects on the qualifying interests of the designated sites.

7.2.4 Whilst the potential for constraints and mitigation was recognised for the Modified Alignment, the review concluded that there were no particular constraints that would preclude this alignment from

being taken forward. The Modified Alignment is hereafter referred to as the Optimal 'Northern' Alignment (see Section 7.7).

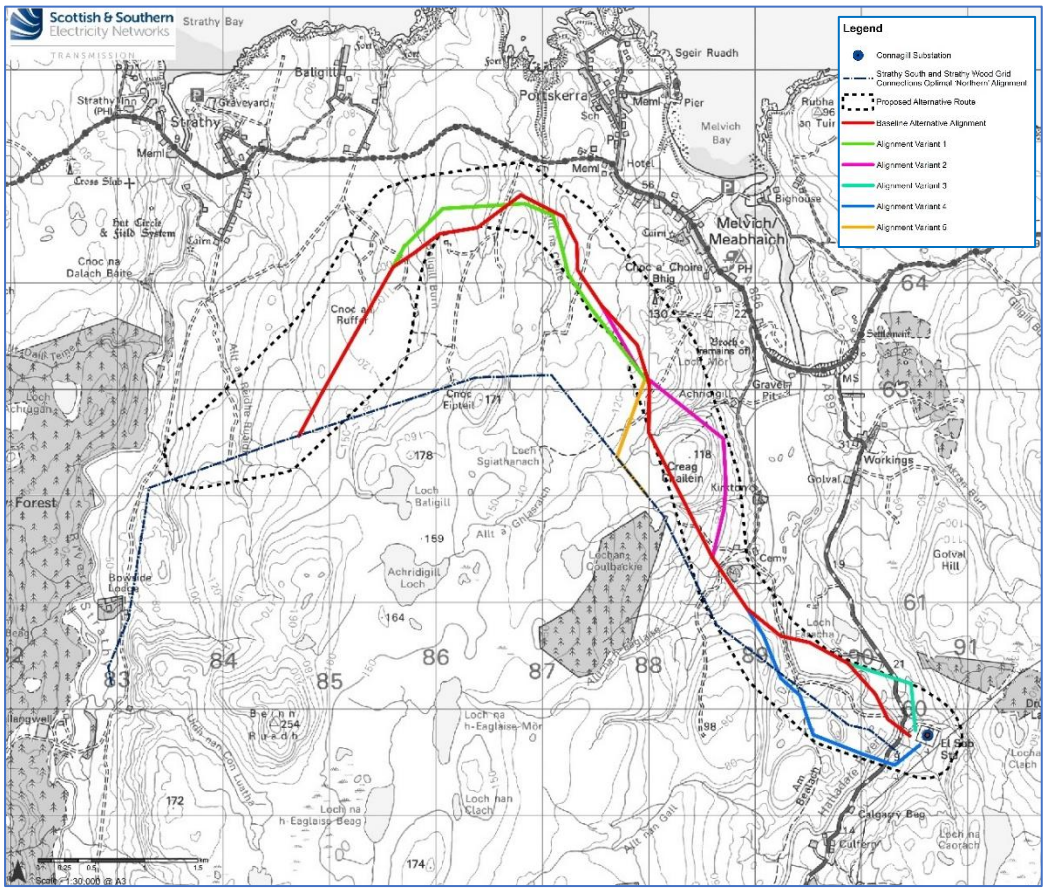
7.3 Requirement to Consider Alternative Alignment Options

7.3.1 Whilst the Optimal 'Northern' Alignment is SSEN Transmission's preference, there has been a requirement to consider an alternative connection due to the Optimal 'Northern' Alignment passing through the proposed Melvich wind farm. The minimum distance required between the proposed wind turbines and a 132 kV OHL supported by steel towers could not be maintained along the Optimal 'Northern' Alignment and, therefore, should Melvich wind farm be granted planning consent, an alternative alignment would need to be considered.

7.3.2 To address this constraint, an optioneering exercise for an alternative alignment within the Proposed Alternative Route has been carried out.

7.4 Description of Alternative Alignment Options

7.4.1 SSEN Transmission identified a Baseline Alternative Alignment and five alignment variants within the Proposed Alternative Route, as displayed on **Plate 7.2** and **Figure 2.2**.



7.5 Comparative Appraisal of Alternative Alignment Options

Overview

7.5.1 An appraisal of the Baseline Alternative Alignment and alignment variants has been undertaken, considering the environmental and technical constraints of each prior to arriving at an optimal alternative alignment. A summary of this appraisal is provided below, and **Appendix 3** contains a more detailed breakdown of the environmental appraisal of these options.

Environmental

7.5.2 In selecting the optimal alternative alignment on environmental grounds, consideration has been given to a number of environmental factors and topic areas as summarised below. The appraisal has described the connection in three defined sections 'western', 'central' and 'eastern', as defined on **Figure 2.2**.

Western Section

7.5.3 Alignment Variant 1 was developed to reduce the prominence of an OHL from receptors to the north and east compared to the Baseline Alternative Alignment, by avoiding passing directly over localised higher ground. Alignment Variant 1 is therefore considered to slightly reduce the prominence of closest towers in views from the A836 (which also forms part of key tourist routes; the North Coast 500 and National Cycle Route 1) and from the settlement of Melvich compared to the Baseline Alternative Alignment. Although, it is acknowledged that it would continue to be prominent in inland views from these receptors. Both alignment options are a similar distance to the Caithness and Sutherland Peatlands SPA, and while Alignment Variant 1 would bring infrastructure in slightly closer proximity to recorded golden plover territories (which are designated features of the SPA), this would only be marginal compared to the Baseline Alternative Alignment and both would require similar mitigation. Overall, between the Baseline Alternative Alignment and Alignment Variant 1, there is a slight preference for Alignment Variant 1 in this section.

Central Section

7.5.4 Alignment Variant 2 would bring development off the ridge of Strath Halladale compared to the Baseline Alternative Alignment, flanking the hilltop at a lower elevation and thereby allowing an OHL to potentially appear less skylined due to backclothing, in views across the strath, albeit continuing to be prominent. This variant would however bring development much closer to properties within the strath (particularly at Kirkton and Achridgill) and would potentially appear more imposing within some views and have more notable effects on amenity compared to the Baseline Alternative Alignment or Alignment Variant 5 and is therefore least optimal.

7.5.5 Alignment Variant 5 was developed to consider connecting onto the Optimal 'Northern' Alignment immediately after navigating the turbines of the proposed Melvich wind farm. While it would be located in closer proximity to the Caithness and Sutherland Peatlands SAC, SPA, Ramsar and West Halladale SSSI compared to the Baseline Alternative Alignment, it remains downstream of the

designations, and potential effects on qualifying features are likely to be of a similar magnitude, with similar mitigation required to avoid and reduce potential impacts on these features. Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) would interact with the edge of a conifer plantation and would cross a similar extent of sensitive habitats and priority peatland, albeit peat depths of >3 m depth were recorded in discrete areas along the Baseline Alternative Alignment. Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) would allow the OHL to be pulled back from Strath Halladale, and as it would follow the existing Strathy North 132 kV OHL more closely, would appear less skylined, thereby reducing impacts on visual and recreational receptors within the strath.

7.5.6 Overall, between the Baseline Alternative Alignment and Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment), it is considered that the benefits of pulling the alignment further from Strath Halladale to reduce impacts on receptors within the strath, is marginally optimal. in this section.

Eastern Section

7.5.7 On approach to Connagill substation, the Baseline Alternative Alignment would cross the Halladale River five times and would be located within the floodplain of the Halladale River for a longer stretch compared to Alignment Variants 3, 4 and 5 (in combination with the Optimal 'Northern' Alignment), that would each only require one crossing over the river. As such, the Baseline Alternative Alignment is considered the least optimal in this section.

7.5.8 Alignment Variant 4 would cross a larger area of Class 2 priority peatland and would bring development in closer proximity to recorded protected species including a main badger sett and two otter holts compared to Alignment Variant 3. However, it would cross the strath further to the south, and away from the more open valley area, and would make better use of the local landform, helping it to appear less prominent from the strath and sensitive nearby properties. Alignment Variant 3 on the other hand would cross the strath at higher and more open ground and would potentially be more prominent, particularly to the property at Loch Earacha and the A897. Alignment Variant 3 would also pass through an extensive non-designated heritage asset; Deasphollag Township, immediately east of the A897 public road and north of Connagill substation. This Early Modern settlement consists of at least eleven recorded heritage assets and is considered to be of Regional significance. It would be difficult to avoid these assets even with careful placement of towers.

7.5.9 Overall, it is considered that Alignment Variant 4 is optimal within this section, but it is acknowledged that appropriate mitigation would need to be employed during construction to avoid impacts on terrestrial protected species.

Conclusion

7.5.10 From an environmental perspective, the Optimal 'Northern Alternative' Alignment is considered to be a combination of Alignment Variant 1 (in the western section), Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) (in the central section) and Alignment Variant 4 (in the eastern section).

Engineering

7.5.11 Given the similarities between the alignment options, many of the engineering constraints are comparable. For the engineering topic areas of road crossings, elevation, pollution areas, contaminated land, clearance distance, proximity to wind farms, communication masts, urban areas, DNO crossings there is no real preference between the Baseline Alternative Alignment and any of the alignment variants.

7.5.12 The below engineering topic areas relate to constraints where there are some differences between the Baseline Alternative Alignment and the alignment variants.

- Major Crossings: The Baseline Alternative Alignment has no major crossings, except that it crosses the Halladale River at five separate locations, which are all spannable. Both Alignment Variant 4 and Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) would cross the river once. Alignment Variant 4 and Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) would cross the existing Strathy North 132 kV OHL. However, at the point of crossing for Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment), the existing Strathy North 132 kV OHL is already planned to be undergrounded to accommodate the grid connection for the separately proposed Melvich wind farm. As such, Alignment Variant 4 is considered less optimal. All other alignment variants are considered similar to the comparable section of the Baseline Alternative Alignment.
- Flooding: The Baseline Alternative Alignment crosses the Halladale River at five separate locations on approach to Connagill 275/132 kV substation and falls within the mapped flood zone for a greater length compared to the comparable sections of Alignment Variants 3, 4 or 5 (in combination with the Optimal 'Northern' Alignment). Overall, there is a preference for Alignment Variant 4 in terms of flooding constraints, compared to other alignment options in the eastern extent, as it is further from the Halladale River and falls within less of the flood zone.
- Terrain: The terrain along the Baseline Alternative Alignment and Alignment Variants 1 to 4 are comparable, consisting of undulating conditions and slopes. Whereas Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) is slightly more challenging and is less optimal.
- Peat: For the engineering topic area of peat, all alignment options pass through similar extents of Class 1 and Class 2 priority peatland, although Alignment Variant 2 falls within slightly less Class 1 priority peatland and is therefore considered optimal to the Baseline Alternative Alignment. All other alignment variants are considered comparable with the Baseline Alternative Alignment with no preference.
- Access: Access would be limited for the majority of the Baseline Alternative Alignment, with no existing tracks available within the western extent, until it is in proximity to the public road

near Kirkton Farm. Access is less challenging for Alignment Variant 2, as it is within closer proximity to the public road at Kirkton, and Alignment Variant 3 on approach to Connagill 275/132 kV substation, and therefore these two alignments are considered optimal. In the eastern extent, access for Alignment Variant 4 is considered most challenging than the comparable sections of the Baseline Alternative Alignment, Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) or Alignment Variant 3.

- Angle structures: The exact number of angle towers that would be required can only be determined accurately once at the detailed design stage. However, a high-level assessment of the potential number of angle towers has concluded that all alignment options would require a similar number of structures, with Alignment Variant 1 requiring fewer structures than the comparable section of the Baseline Alternative Alignment and therefore being optimal.
- Metallic Pipes: The Baseline Alternative Alignment has more crossing of water pipelines (six in total) than the comparable sections of Alignment Variants 1, 2, 3, 4 or 5 (in combination with the Optimal 'Northern' Alignment) and is therefore less optimal. Overall, Alignment Variant 3 has the fewest pipeline crossings.

7.5.13 On balance, from an engineering perspective, Alignment Variant 1 is considered optimal to the comparable section of the Baseline Alternative Alignment as it would require fewer angle structures and cross fewer metallic pipes, and therefore would be less challenging to construct.

7.5.14 Alignment Variant 2 is considered optimal to the Baseline Alternative Alignment as it would cross less of Class 1 priority peatland and is within closer proximity to existing access thereby resulting in less challenging construction conditions.

7.5.15 In the eastern extent, while Alignment Variant 4 is further from the Halladale River and falls within a shorter extent of the mapped flood zone, it would require crossing the existing Strathy North 132 kV OHL making it less optimal. Alignment Variant 3 is closer to existing access and the terrain along the Baseline Alternative Alignment is considered less undulating to the comparable section of Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment).

7.6 Optimal 'Alternative Northern' Alignment

7.6.1 The various constraints have been taken into account to reach an Optimal 'Alternative Northern' Alignment across environmental and technical considerations.

7.6.2 Alignment Variant 1 was considered optimal for both environmental and engineering as it would slightly reduce the prominence of an OHL from the A836 and settlement of Melvich to the north, although noting that an OHL would still form a prominent feature in views, however, it would also require fewer angle structures and fewer crossing of metallic pipes (water pipelines) and therefore be less challenging to construct.

7.6.3 While engineering preferred Alignment Variant 2 as it would cross less Class 1 priority peatland and be closer to existing access, making it less challenging to construct, from an environmental perspective this option was considered the least optimal, as it would bring development close to properties within Strath Halladale and would appear imposing in views and have a more notable effect on amenity. Overall, it was considered not appropriate to progress this option. Instead, Alignment Variant 5 (in combination with Optimal 'Northern' Alignment) would allow development to be further from the strath and follow the existing OHL thereby keeping development together. However, it would bring development closer to the natural heritage designated sites to the west, although the potential effects on qualifying features are expected to be of similar magnitude should other options be progressed. Another advantage of Alignment Variant 5 (in combination with Optimal 'Northern' Alignment) is that although it would require a section of the existing Strathy North 132 kV OHL to be undergrounded, this would be at a point where the existing OHL would already be undergrounded to accommodate the separately proposed Melvich wind farm grid connection, thereby reducing construction challenges.

7.6.4 In the eastern extent, the optimal environmental option was Alignment Variant 4 due to the favourable crossing of Strath Halladale and A897. Being further south and away from the open valley, and its use of the local landform to appear less prominent from the strath and sensitive nearby properties, make it favourable compared to all other crossings considered. Alignment Variant 4 would be situated further from the Halladale River and outwith the mapped floodplain for a longer stretch, making it preferable from a construction and maintenance perspective. When considered in combination with Alignment Variant 5 (in combination with Optimal 'Northern' Alignment), Alignment Variant 4 would not require a crossing of the existing Strathy North 132 kV OHL (as this will already have taken place at a point further north in proximity to Melvich wind farm substation); it was for this reason this alignment variant didn't factor so favourably in the engineering appraisal.

7.6.5 The overall Optimal 'Alternative Northern' Alignment is, therefore, Baseline Alternative Alignment, Alignment Variant 1, Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) and Alignment Variant 4.

7.7 Alignment Modifications

Optimal 'Northern' Alignment

7.7.1 Following the appraisal of the Alternative 'Northern' Alignment, SSEN Transmission considered that the benefits of Alignment Variant 4, on approach to Connagill 275/132 kV substation from the south, was preferred over the comparable section of the Optimal 'Northern' Alignment.

7.7.2 Alignment Variant 4 would cross Strath Halladale away from the more open valley area, and would make better use of the local landform, helping it to appear less prominent from the strath and sensitive nearby properties.

7.7.3 As such, it was determined that the Optimal 'Northern' Alignment would be modified to capture Alignment Variant 4, as illustrated on **Figure 2.3.**

7.7.4 Indicative visualisations of the Optimal 'Northern' Alignment are included within this Consultation Document from Strathy Cemetery (see VP2 contained in **Figure 7.2 (a-b)**) and the A897 near Golval (see VP3 contained in **Figure 7.3 (a-b)**).

Optimal 'Alternative Northern' Alignment

7.7.5 Further engineering studies proposed a slight realignment at the point where Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment) would join Alignment Variant 4, to navigate topographical constraints.

7.7.6 The proposed re-alignment was reviewed from an environmental perspective, and it was noted that the realignment would benefit in pulling infrastructure further from Havaig Fort, a regionally significant heritage asset and while it would move the OHL in closer proximity to suitable otter habitat at Loch a'Bhealaich, it would be slightly further from a golden plover territory recorded in 2022 to the east of Loch a'Bhealaich. It would also reduce the number of crossings of Core Path SU19.03. Overall, it was considered that no significant environmental risks would occur as a result of this slight re-alignment.

7.7.7 This realignment would apply to both the Optimal 'Northern' Alignment and the Optimal 'Alternative Northern' Alignment, as illustrated on **Figure 2.3.**

8 Armadale Grid Connection

8.1 Introduction

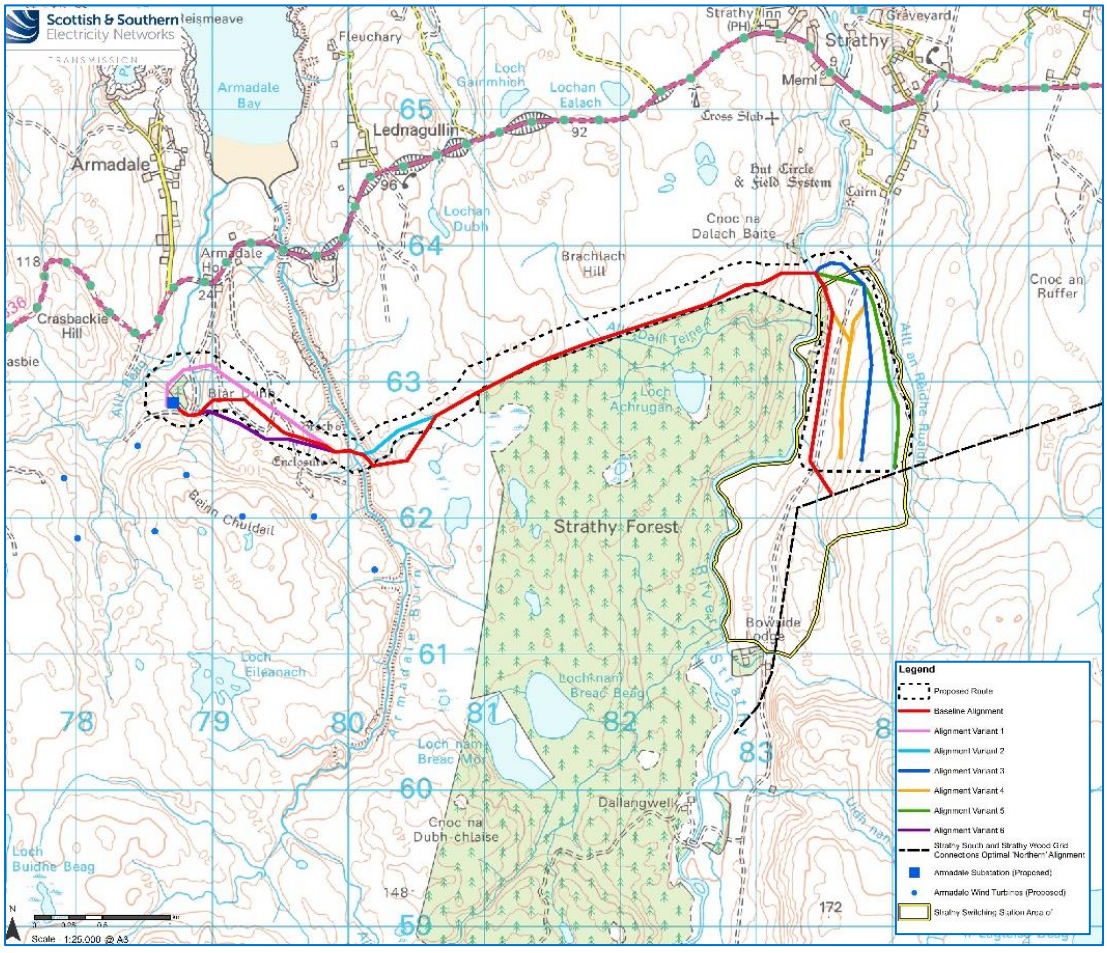
8.1.1 This section of the report provides an overview of the alignment options selected for the 132 kV OHL connection between the proposed Armadale wind farm on-site substation to a tee-in point on the Optimal 'Northern' Alignment of the Strathy North to Connagill 132 kV OHL (see Section 7). The tee-in point is still to be confirmed but would likely to be in the vicinity of the optimal site of the Strathy Switching Station (see Section 9). This is followed by a summary of the potential environmental and technical constraints identified for each alignment option.

8.1.2 As noted in **Table 3.1**, trident H-wood poles are the optimal technology option for this connection and the appraisal has assumed that OHL options will feature this technology.

8.2 Description of Alignment Options

8.2.1 SSEN Transmission identified one Baseline Alignment and six alignment variants within the Proposed Route. A summary of the alignment options is outlined below and illustrated on **Plate 8.1** and **Figure 3.1**.

Plate 8.1: Armadale Grid Connection Alignment Options



8.3 Appraisal of Alignment Options

Overview

8.3.1 An appraisal of the Baseline Alignment and alignment variants has been undertaken, considering the environmental and technical constraints of each prior to arriving at an optimal alignment. A summary of this appraisal is provided below, and **Appendix 4** contains a more detailed breakdown of the environmental appraisal of these options.

Environmental

8.3.2 In selecting the optimal alignment on environmental grounds, consideration has been given to a number of environmental factors and topic areas as summarised below. The appraisal has described the connection in three defined sections 'western, central and eastern', as indicated on **Figure 3.1**.

Western Extent

8.3.3 Alignment Variant 1 was developed to explore a northern exit out of the Armadale wind farm on-site substation. However, it is considered the least optimal as it would bring development in closer proximity to settlement and the A836 (which forms part of the North Coast 500) to the north, whereas both the Baseline Alignment and Alignment Variant 6 would exit the substation to the south, allowing a small forest plantation to provide an element of screening.

8.3.4 Alignment Variant 1 would also increase the extent of OHL by approximately 300 m, thereby increasing the overall habitat loss (albeit minimal for a wood pole structure) and potential for collision risk to bird species. Whereas Alignment Variant 6, due to its reduced overall length, would result in reduced habitat loss compared to the Baseline Alignment or Alignment Variant 1.

8.3.5 Alignment Variant 6 was developed to avoid areas of deeper peat that had been recorded across both the Baseline Alignment and Alignment Variant 1 and would therefore be preferred in this regard. Traversing a more south-westerly approach to the Armadale gorge crossing would allow Alignment Variant 6 to cross open ground slightly further from the Armadale Broch scheduled monument compared to the Baseline Alignment or Alignment Variant 1, however it would pass the broch at the same distance as the Baseline Alignment and would therefore have a similar potential for visual impact and alteration to the setting of the monument as the Baseline Alignment.

8.3.6 Overall, on balance, it is considered that Alignment Variant 6 is most optimal in the western extent due to the benefits of being further from residential and recreational receptors in the north and crossing shallower peat.

Central Section

8.3.7 The Baseline Alignment would traverse a stretch of 500 m within the designated sites of Caithness and Sutherland Peatlands SAC, SPA and Ramsar and the underlying Lochan Buidhe Mires SSSI, whereas Alignment Variant 2 is considered optimal as it would bring development outwith the boundary of these designated sites, thereby reducing the impact on the qualifying blanket bog of the SAC.

8.3.8 Alignment Variant 2 would continue to cross the Armadale Gorge SSSI (as would the comparable section of the Baseline Alignment), which is designated for its scrub and subalpine dry heath habitats that it supports, along with traversing a slightly longer stretch of native woodland at the gorge crossing. As such, consideration of the placement of poles would need to be given so as to limit impacts to the designating features of the site.

8.3.9 Alignment Variant 2 is also considered less likely to cause direct damage to cultural heritage assets within the area around the gorge crossing compared to the Baseline Alignment.

8.3.10 Overall, Alignment Variant 2 is considered most optimal crossing point of the Armadale gorge. Thereafter the Baseline Alignment would run along the northern edge of Strathy Forest until the crossing of the River Strathy.

Eastern Section

8.3.11 Alignment Variants 3 and 5 are considered least optimal as they would traverse slightly more elevated terrain and thereby likely to appear more visible in inland views from coastal settlement and the A836 to the north. Alignment Variant 5 in particular would bring development closer to the settlement of Strathy with potential to appear more noticeable in views and have potential for greater impact on the setting of designated heritage assets.

8.3.12 Whereas, the Baseline Alignment and Alignment Variant 4 would be set at a lower elevation, within the Strathy Valley and therefore appear less prominent, particularly in inland views from the north. Being located on the eastern side of the existing track, Alignment Variant 4 would be set slightly further from the River Strathy and woodland edge, which is anticipated to support protected species associated with the wider Caithness and Sutherland Peatlands SAC, and would therefore be slightly more optimal to the Baseline Alignment.

8.3.13 Overall, once across the River Strathy, Alignment Variant 4 is considered most optimal in the eastern extent.

Conclusion

8.3.14 On balance, the optimal environmental alignment is considered to be a combination of Alignment Variant 6 (in the western section), Alignment Variant 2 followed by the Baseline Alignment (in the central section) and Alignment Variant 4 (in the eastern section).

Engineering

8.3.15 Given the similarities between the alignment options, many of the engineering constraints are comparable. For the engineering topic areas of existing OHL infrastructure, railway, flooding, atmospheric pollution, contaminated land, clearance distance, wind farms, communication masts, urban environments and metallic pipes there is no preference between the Baseline Alignment and any of the alignment variants.

8.3.16 The below engineering topic areas relate to constraints where there are some differences between the Baseline Alignment and the alignment variants.

- Road Crossings: While none of the alignment options cross major roads, the Baseline Alignment and Alignment Variants 3, 4 and 5 would cross a local access road. Alignment Variant 1 would cross multiple tracks compared to the Baseline Alignment, with Alignment Variant 6 crossing even fewer, and thereby being preferable.
- Elevation: In the western extent, the Baseline Alignment and Alignment Variants 1, 2 and 6 are comparable, all located at an elevation below 100 m. In the eastern extent, the Baseline Alignment and Alignment Variants 3 and 4 are below 100 m in elevation, whereas Alignment Variant 5 traverses slightly more elevated terrain.
- Terrain: The Baseline Alignment crosses undulating terrain with slopes up to maximum of 20% gradient. In the western and central extents, the comparable sections of Alignment Variants 2and 6 cross gentler terrain compared to the Baseline Alignment, unlike Alignment Variant 1 which crosses steeper terrain thereby being less optimal. In the eastern extent, Alignment Variant 4 would cross gentler terrain compared to the Baseline Alignment, unlike Alignment Variants 3 and 5 which initially cross steeper terrain before levelling out, thereby being less optimal.
- Peat: For the engineering topic area of peat, Alignment Variant 6 is preferable to the comparable section of the Baseline Alignment, as it passes through less deep peatland for most of its length. All other alignment options are comparable.
- Access: Limited access is available in the central section of the connection, including to the Baseline Alignment and Alignment Variant 2. In the eastern section, Alignment Variant 3 is further from existing access tracks compared to the Baseline Alignment and Alignment Variants 4 and 5, and is therefore slightly less optimal. In the western extent, Alignment Variant 6 and the Baseline Alignment have similar existing access opportunities and are therefore comparable.
- Angle structures: In the western extent, the comparable section of Alignment Variant 1 would be optimal as it would require fewer angle poles compared to Alignment Variant 6 and the Baseline Alignment; each requiring a similar number of angle poles. In the central extent, Alignment Variant 2 would require fewer angle poles and thereby be preferred compared to the Baseline Alignment. In the eastern extent, the comparable section of Alignment Variants 3 and 5 would require more angle poles compared to the Baseline Alignment and Alignment Variant 4, thereby being less optimal.

8.3.17 From an engineering perspective the optimal alignment in the western extent is considered to be Alignment Variant 6, as it would cross shallower peat compared to the Baseline Alignment or Alignment Variant 1, and would therefore be less challenging to construct.

8.3.18 In the central section, Alignment Variant 2 is considered optimal as it would cross gentler terrain compared to the Baseline Alignment, thereby resulting in less challenging construction conditions.

Thereafter, the Baseline Alignment would continue the connection to the River Strathy crossing. Access through this section may be challenging with few existing tracks.

8.3.19 In the eastern extent, upon crossing the River Strathy, Alignment Variant 4 is considered optimal as it traverses a gentler terrain, at a lower elevation and is closer to existing access tracks.

8.3.20 On balance, the optimal engineering alignment is considered to be a combination of Alignment Variant 6 (in the western section), Alignment Variant 2 followed by the Baseline Alignment (in the central section) and Alignment Variant 4 (in the eastern section).

8.4 Optimal Alignment

8.4.1 The various constraints have been taken into account to reach an optimal alignment across environmental and technical considerations.

8.4.2 In the western extent, both environmental and engineering consider exiting the substation via the Baseline Alignment (to the south) would be optimal, thereafter joining Alignment Variant 6. This would slightly reduce the prominence of an OHL from the A836 and settlement to the north, with the forest plantation at Armadale substation offering an element of screening. This alignment variant would also cross shallower peat depths, making it less challenging to construct with a reduced environmental impact.

8.4.3 In the central section, Alignment Variant 2 was considered optimal for both environmental and engineering as the crossing point of the Armadale gorge. Once across the gorge, Alignment Variant 2 would keep development outwith the designated areas of the Caithness and Sutherland Peatlands SAC, SPA and Ramsar site, and the underlying Lochan Buidhe SSSI, thereby reducing impact on the qualifying habitats. It would nevertheless remain within the Armadale Gorge SSSI and would require careful placement of poles to reduce impact on the qualifying habitats of this designation. Alignment Variant 2 would also avoid direct impact on several heritage assets and would be located on slightly gentler terrain making it more optimal for construction. Thereafter, the Baseline Alignment would continue the connection along the edge of Strathy Forest to the River Strathy crossing. It is acknowledged however, that existing access is limited in this section of the connection.

8.4.4 In the eastern extent, engineering considered Alignment Variant 4 optimal, with environmental stating a marginal preference for Alignment Variant 4 (over the Baseline Alignment). Alignment Variant 4 would be located at a lower elevation of the Strathy valley, thereby appearing less noticeable in views from settlement and recreational routes to the north and would be less challenging to construct. Alignment Variant 4 would be set further from the River Strathy and woodland edge (compared to the Baseline Alignment), both of which are known to be used by qualifying species (i.e. otter) of the SAC. By being located on the opposite side of the existing track, would provide a slightly increased buffer for any indirect impacts to these species and it is therefore considered the optimal alignment within this section.

8.4.5 The overall Optimal Alignment, is therefore, Baseline Alignment, Alignment Variant 6, Alignment Variant 2, Baseline Alignment, Alignment Variant 4, as shown on **Figure 3.2**.

8.4.6 It should be noted that the site identified as the optimal location for the proposed Strathy Switching Station will influence the final section of alignment to its connection point onto the proposed alignment of the double circuit 132 kV OHL supported by steel towers. Should any major environmental or engineering constraints be identified that cannot be overcome through micrositing, further appraisal will be undertaken.

9 Kirkton Grid Connection

9.1 Introduction

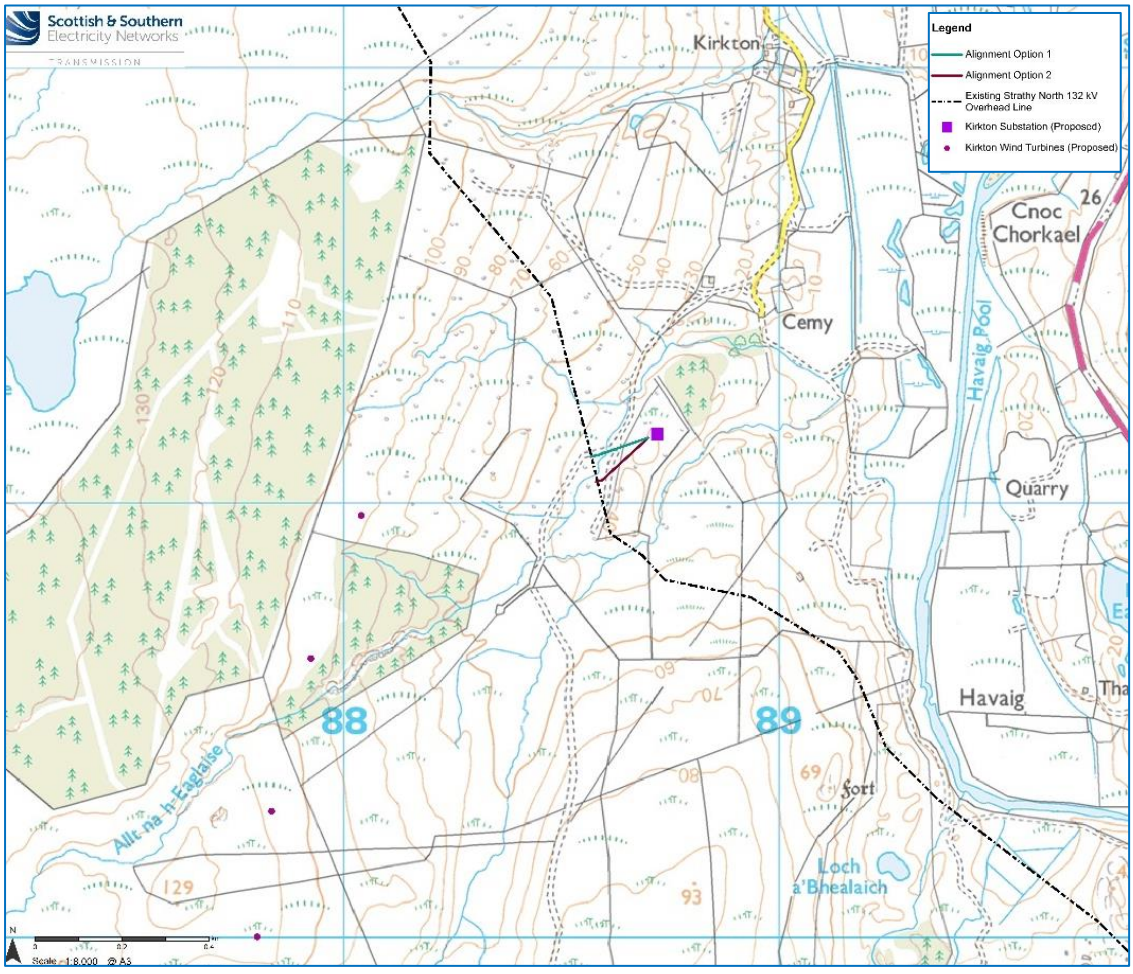
9.1.1 This section provides an overview of the alignment options selected for the 132 kV OHL connection between Kirkton wind farm substation to a tee-in point on the existing and repurposed Strathy North 132 kV trident H-wood pole OHL for onward connection to Connagill 275/132 kV substation. This is followed by a summary of the potential environmental and technical constraints identified for each alignment option.

9.1.2 As noted in **Table 3.1**, trident H-wood poles are the optimal technology option for this connection and the appraisal has assumed that OHL options will feature this technology.

9.2 Description of Alignment Options

9.2.1 SSEN Transmission identified two alignment options between the proposed Kirkton wind farm on-site substation to the existing (and repurposed) Strathy North 132 kV OHL, as displayed on **Plate 10.1** and **Figure 4.1**.

Plate 10.1: Kirkton Grid Connection Alignment Options



9.3 Appraisal of Alignment Options

Overview

9.3.1 An appraisal of the two alignment options has been undertaken, considering the environmental and technical constraints of each prior to arriving at an optimal alignment. A summary of this appraisal is provided below, and **Appendix 5** contains a more detailed breakdown of the environmental appraisal of these options.

Environmental

9.3.2 In selecting the optimal alignment on environmental grounds, consideration has been given to a number of environmental factors and topic areas. The majority of topics found the two alignment options to be comparable with the key differences associated with ecology, hydrology and peat constraints.

9.3.3 Alignment Option 1 crosses lower ecological value habitat and a shorter extent of Class 1 priority peatland compared to Alignment Option 2. It is also located in closer proximity to an existing track that could be utilised during construction and operation, reducing the associated environmental effects of having to cross a slightly longer stretch of undeveloped ground for access.

9.3.4 Alignment Option 2 would cross less of the mapped floodplain of the nearby tributary of the Allt na h-Eaglaise watercourse compared to Alignment Option 1, albeit the likely connection point (i.e. terminal pole) onto the existing Strathy North 132 kV OHL would most likely fall within the mapped floodplain. Although it appears that a greater extent of Alignment Option 1 falls within the mapped floodplain, most of this would likely be spanned by OHL conductors, and the positioning of the terminal pole structure would not pose a flooding risk.

9.3.5 Overall, from an environmental perspective, there is a marginal preference for Alignment Option 1.

Engineering

9.3.6 Given the similarities between the alignment options, many of the engineering constraints are comparable. For the engineering topic areas of existing infrastructure, elevation, atmospheric pollution, contaminated land, terrain, access, angle structures, clearance distance, wind farms, communication masts and metallic pipes there is no preference between Alignment Option 1 or Alignment Option 2.

9.3.7 The below engineering topic areas relate to constraints where there are some differences between the two alignment options.

- Flooding: Alignment Option 2 would cross less of the mapped flood zone, compared to Alignment Option 1 and is therefore considered optimal.

- Peat: For the engineering topic area of peat, it is noted that both options cross a short extent of Class 1 peatland, with Alignment Option 1 crossing slightly less, and is therefore considered optimal.

9.3.8 On balance from an engineering perspective, while both alignment options are similar, there is a slight preference towards Alignment Option 2 as it would avoid a watercourse crossing and cross a shorter extent of the mapped floodplain.

9.4 Optimal Alignment

9.4.1 Both the environmental and engineering appraisal found the alignment options were largely comparable, with the key differentiating constraints for both appraisals centred on flooding and peat.

9.4.2 The environmental appraisal noted a marginal preference for Alignment Option 1 as it would cross habitats of lower ecological value and a shorter extent of Class 1 priority peatland. However, the habitat across both alignment options were noted to be typical of the wider landscape and with careful placement of poles could look to avoid the most sensitive habitats. The engineering appraisal noted a preference for Alignment Option 2 as it would avoid a watercourse crossing and would traverse a shorter extent of mapped flood plain.

9.4.3 The overall Optimal Alignment is therefore considered to be Alignment Option 2, as shown on **Figure 4.2**. Site specific peat probing will be carried out to assess existing peat deposits and used to inform the final wood pole locations.

10 Strathy Switching Station

10.1 Introduction

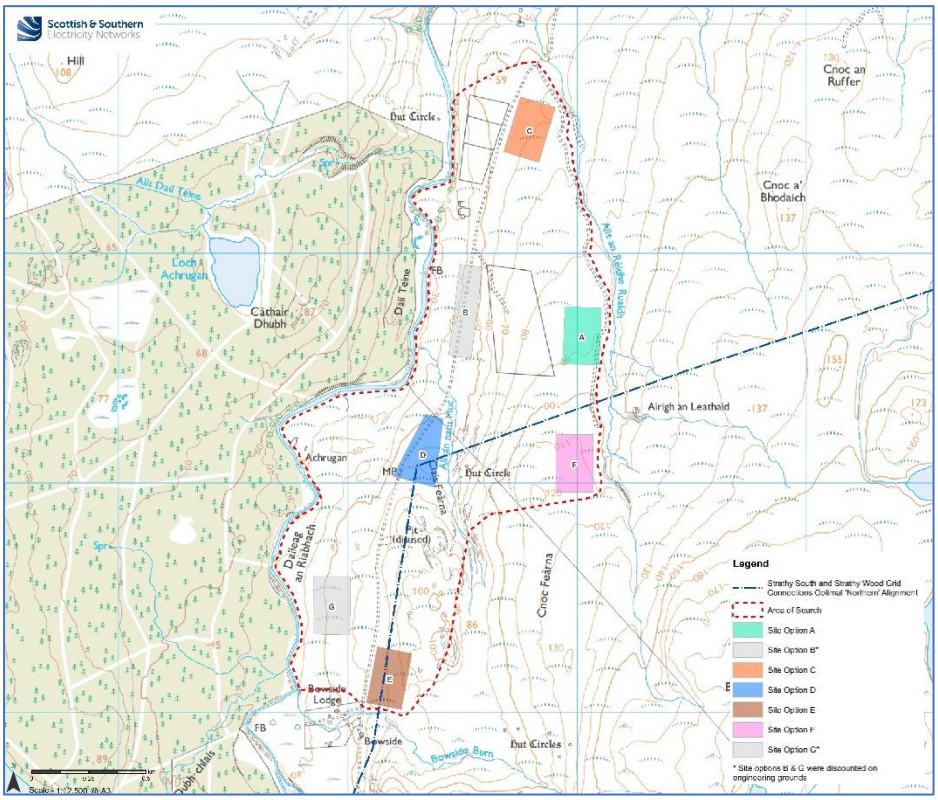
10.1.1 This section provides an overview of the site options selected for the Strathy Switching Station and a summary of the potential environmental and technical constraints identified for each site option.

10.2 Description of Site Options

10.2.1 SSEN Transmission identified seven site options based on initial desk-based review and site visits within the Area of Search, as illustrated on **Plate 10.1** and **Figure 5.1**. However, two site options (Site Options B and G) were discounted from further appraisal at an early stage on engineering grounds.

10.2.2 For the purposes of appraisal, a worst-case AIS scenario was considered, with a development footprint of 250 m x 160 m and it is roughly on these dimensions the site options are based. However, further optioneering will be carried out to determine whether AIS or GIS technology will be utilised for the switching station.

Plate 10.1: Strathy Switching Station Site Options



10.3 Appraisal of Site Options

Overview

10.3.1 An appraisal of the site options has been undertaken, considering the environmental and technical constraints of each prior to arriving at an optimal site. A summary of this appraisal is provided below, and **Appendix 6** contains a more detailed breakdown of the environmental appraisal of these options.

Environmental

10.3.2 Comparative analysis of the switching station site options has highlighted that Site Option E is considered the least optimal primarily due to being located within closest proximity of the designated sites of the Caithness and Sutherland Peatlands SAC, SPA and Ramsar and the West Halladale SSSI, at approximately 25 m to the north, while all other site options are sited over 1 km away from these designated sites. As a result, there is greater potential for indirect effects on qualifying features to occur, making it less optimal to other site options. It is also partially located within the Bowside Burn surface water catchment which is designated as a Drinking Water Protected Area (DWPA) and there is a private water supply (PWS) in close proximity associated with the Bowside Burn. This site option is also sited within 100 m of residential receptors at Bowside Lodge and Bowside Cottage and given the close proximity, these receptors would experience visual effects, particularly during construction.

10.3.3 Site Option C is also considered less optimal, located at the northern end of a shallow moorland valley and may form a prominent feature, reducing the sense of openness and exposure of the landscape locally. It would also be in closest proximity to the regionally designated Farr Bay, Strathy and Portskerra SLA with potential for localised impacts on the setting of the coastal landscape. The entirety of this site option is underlain by Class 1 priority peatland with peat depths ranging between 0 m and 2.3 m.

10.3.4 Site Options A and F, both located in proximity of the Allt an Reidhe Ruaidh watercourse and existing minor track on open moorland, are located in close proximity (less 200 m) to a recorded golden plover territory; an Annex I feature of the Caithness and Sutherland Peatlands SPA, and both options fall well within the disturbance distance of this species. The elevated position of these site options is also considered likely to lead to the potential for localised impacts on the designated landscape; Farr Bay, Strathy and Portskerra SLA, and impact the sense of openness and exposure of the landscape with limited opportunities for mitigation. Both sites are also entirely underlain by Class 1 priority peatland with peat depths ranging between 0 m and 2 m.

10.3.5 Site Option D, located to the west of the Alltan nam Muc watercourse and overlaps the main wind farm access track, is located approximately 500 m from a recorded golden plover territory (the same territory referenced in relation to Site Options A and F), sited at the very edge of the considered disturbance distance of this species. There would also be interaction with Scottish Hill Track 344 which would likely require a minor permanent diversion to accommodate this site option. However given its low position within the River Strathy valley, this site option would be well contained, maintaining the sense of openness and exposure across the wider landscape, with limited views from

receptors to the north. While this option is predominately underlain by Class 1 priority peatland, peat depth probing has recorded much shallower peat, ranging between 0.1 and 0.4 m deep.

Conclusion

10.3.6 On balance, Site Option D was identified as the optimal switching station option on environmental grounds. However, it is recommended that given its close proximity to the Alltan nam Muc watercourse, further modelling be undertaken to determine the floodplain extent prior to confirming whether this is the optimal site. Given the close proximity of the existing access track, opportunities to soften views by introducing low level planting, could be considered.

Engineering

10.3.7 Given the similarities between site options, many of the engineering constraints are comparable. For the engineering topic areas of Interface with SSE Distribution and Generation, DNO Connection, Geology, Elevation, Carbon Footprint, SF6 and Contaminated Land, there is no preference between the site options.

10.3.8 Comparative analysis of the switching station site options has highlighted that Site Option C is least optimal as its in closest proximity to the coast would mean that equipment may need to be housed indoors which could limit the technology options available. In addition, it would require an extended span of the Optimal 'Northern' Alignment of the double circuit 132 kV OHL (by approximately 4 towers) to reach the tie-in point. Despite being positioned on gently sloping ground, a dip within the footprint of the site option would require substantial earthworks to construct, and while being located adjacent to the existing wind farm access track to the west and minor track to the east would be beneficial in terms of accessing the site, this would restrict future expansion in the future, if required.

10.3.9 The footprint of Site Option D is of an irregular shape and positioned on top of the existing wind farm access track. Without modification or relocation, the footprint in its current form would be unable to accommodate all technology types, and diversion of the existing track would cause disruption to use of the track by wind farm traffic. Site Option D is positioned on undulating ground and would require significant earthworks to construct, and being adjacent to the Alltan nam Muc watercourse also presents a surface water flood risk, and limits the ability for future expansion. The 'tucked in' position of this site, may also pose issues for future tie-in connections, should these be required. Site Option D is directly on the alignment of the Optimal 'Northern' Alignment of the double circuit 132 kV OHL and would require the OHL to be temporarily diverted while a switching station is constructed at this location. Overall, Site Option D is considered less optimal.

10.3.10 Site Option E is also located directly on the alignment of the Optimal 'Northern' Alignment of the double circuit 132 kV OHL, and it too would require the OHL to be temporarily diverted while a switching station is constructed at this location, as would a BT line which the site option would be located directly upon. Site Option E is located on steep terrain and significant earthworks would be required, unless it was relocated further to the south-east (this could then have implications of being

located within natural heritage designated sites, depending on its location). It is also located approximately 150 m to a dwelling (at Bowside Lodge).

10.3.11 Site Options A and F are broadly comparable. Both are located on generally flat to gently sloping terrain and would require minimal earthworks. While located slightly further from the existing wind farm access track compared to other site options, there is an existing minor track that would lead to the eastern extent of each site option, however, would require substantial upgrade to be used during construction and operation. Overall, out of these two site options, there is a slight engineering preference towards Site Option A as it would be located on the northern side of the Optimal 'Northern' Alignment of the double circuit 132 kV OHL and therefore the Optimal Alignment for the Armadale wind farm OHL, located to the north, would not require to be undergrounded to tie-in to the switching station, as would be the case should Site Option F be progressed.

10.4 Comparative Analysis Summary

10.4.1 **Table 10.1** displays the environmental and engineering appraisal RAG ratings for the site options considered.

Table 10.1: Strathy Switching Station – RAG Ratings

	Category	Sub-Topic	A	B *	C	D	E	F	G *
Environmental	Natural Heritage	Designations							
		Protected Species							
		Habitats							
		Ornithology							
		Geology, Hydrology and Hydrogeology							
	Cultural Heritage	Designations							
		Cultural Heritage Assets							
	Landscape and Visual	Designations							
		Character							
		Visual							
	Land Use	Agriculture							
		Forestry							
		Recreation							
	Planning	Policy							
		Proposals							
Engineering	Connectivity	Existing circuits / networks							
		Future Development Possibilities							

		Interface with SSE Distribution and Generation							
		DNO Connection							
	Footprint Requirements	Technology							
		Adjacent Land Use							
		Space Availability							
	Hazards	Unique Hazards	N/A		N/A	N/A	N/A	N/A	
		Existing Utilities							
	Ground Conditions	Topography							
		Geology							
	Environmental Conditions	Elevation							
		Salt Pollution							
		Flooding							
		Carbon Footprint							
		SF6							
		Contaminated Land							
		Noise (proximity to dwellings / residential properties)							
	Construction Access	Substation Access Road (from public road)							
		Transformer Delivery Route	N/A		N/A	N/A	N/A	N/A	
	Operation and Maintenance	Access							

* Site Options discounted on engineering grounds and not taken forward to appraisal

10.5 Optimal Site

10.5.1 Taking the various constraints and site preferences into account, while Site Option D was the environmental preference due to its contained position limiting views from receptors to the north and maintaining the sense of openness and exposure across the wider landscape, along with being positioned on much shallower peat; from an engineering perspective this was a less preferred option. The irregular shape and location of this option would lead to constraint in technology type, and it's contained position could lead to future expansion and connection restrictions. In addition, it has a greater potential for flood risk due the proximity of a nearby watercourse.

10.5.2 The optimal engineering option was Site Option A due to its flat topography, minimal earthwork requirement and being located on the more favourable side of the Optimal 'Northern' Alignment double circuit 132 kV OHL for ease of connection. While environmental constraints were noted with Site Option A, such as falling with the disturbance distance of an Annex 1 species of the nearby Caithness and Sutherland Peatlands SPA, its elevated position leading to potential localised impacts

on a regionally designated landscape and the sense of openness of the landscape; in comparison to other site options, the environmental constraints were considered less unfavourable.

10.5.3 On balance it is therefore considered that Site Option A is the optimal site for Strathy Switching Station, as illustrated on **Figure 5.2**.

11 Summary and Next Steps

11.1.1 SSEN Transmission is required to construct new transmission infrastructure for five consented and/or proposed wind farms to the existing transmission network at Connagill 275/132 kV substation. The five connections under consideration are the consented Strathy South and Strathy Wood wind farms and the proposed Armadale, Melvich and Kirkton wind farms. Together the projects are known as the 'Connagill Cluster Grid Connections' and are recognised as National Development under National Planning Framework 4.

11.1.2 This Consultation Document sets out the proposed technology solutions to complete the connections and provides environmental and technical analysis of the potential alignment options, plus switching station site options, prior to arriving at an optimal solution.

11.1.3 SSEN Transmission has sought to identify a rationalised approach to complete the connection requirements. This approach, together with the analysis of the different options, has led to the following optimal solution across the connection projects:

- **Strathy Wood and Strathy South Grid Connection** ('Southern Section' between Strathy South substation and Strathy North substation): 132 kV underground cable and 132 kV double circuit steel structure OHL. The Optimal 'Southern' Alignment would be *Alignment Option 1 (UGC) – Alignment Variant 1 (UGC) – Alignment Variant 3 (OHL) – Alignment Variant 2 (OHL).*
- **Strathy Wood and Strathy South Grid Connection** ('Northern Section' between Strathy North substation and Connagill 275/132 kV substation): 132 kV double circuit steel structure OHL. The structures would be capable of operating at 275 kV in the future, if required.
    - The Optimal 'Northern' Alignment (assuming Melvich wind farm does not gain consent and is not constructed) would be as per the 2014 section 37 consent for the Strathy South Grid Connection (which has now lapsed), which runs parallel to the existing Strathy North 132 kV wood pole OHL, with some modifications, including capturing the alignment of 'Alternative Northern' Alignment Variant 4.
    - The Optimal 'Alternative Northern' Alignment (assuming Melvich wind farm does gain consent and is constructed) would be *Baseline Alternative Alignment – Alignment Variant 1 – Alignment Variant 5 (in combination with the Optimal 'Northern' Alignment – Alignment Variant 4).*
- **Armadale Grid Connection**: 132 kV trident 'H' Wood Pole OHL. The Optimal Alignment would be Baseline Alignment - *Alignment Variant 6 – Alignment Variant 2 – Baseline Alignment – Alignment Variant 4.*
- **Kirkton Grid Connection:** A short section of 132 kV trident 'H' wood pole OHL. The Optimal Alignment would be *Alignment Option 2.*

- **Strathy Switching Station:** The optimal site for the switching station would be *Site A.*

11.1.4 The optimal alignments across all projects, plus the optimal switching station site, are shown on **Figure 6**.

11.1.5 Comments are sought from stakeholders on the alignment options considered, and the optimal alignments identified.

11.1.6 A consultation event will be held on **20th May 2024** at **Strathy Village Hall** and the responses received from this event, and those sought from statutory consultees and other key stakeholders, will inform further consideration of alignment options prior to identification of proposed alignments to take forward to the next stage in the routeing process (EA / EIA consenting).

11.1.7 All comments on the alignment selection process are requested by **14th June 2024**. Following consultation events and a review of consultation responses, a Report on Consultation will be produced which will document the consultations received, and the decisions made in light of these responses to inform the selection of a proposed alignment for each section of the cluster.

11.1.8 Following the identification and confirmation of a proposed alignment, these will be taken forward into Stage 4: EA/EIA and Consenting, with the approach to consenting for each connection summarised in **Table 3.1**. However, should further site and desk-based analysis at the EA/EIA and Consenting stage identify a particular constraint, a further review of the proposed alignments may be required.