VOLUME 2: CHAPTER 3 - THE SITE SELECTION PROCESS AND ALTERNATIVES

Figures and Visualisations (Volume 3a and 3b of this EIA Report)

Appendices (Volume 4 of this EIA Report)

3. THE SITE SELECTION PROCESS AND ALTERNATIVES

3.1 Introduction

The need for the project and the work undertaken by SSEN Transmission to assess the strategic electricity transmission infrastructure requirements to identify the most appropriate, viable, and long term, enduring technical design solution is explained in **Volume 2 Chapter 1** Introduction and Background**.**

This chapter describes the site selection process and consideration of alternatives that have been undertaken following identification of the Proposed Option (Option 3). These processes have enabled the consideration of reasonable alternatives, in accordance with Regulation 5(2)(d) and Schedule 4, paragraph 2 of the EIA Regulations.

The following stages are described in this chapter, along with their respective outcomes:

- Stage 0: Strategic Options assessment;
- Stage 1: Initial site screening; and
- Stage 2: Detailed site selection.

3.2 Development Considerations

The study of alternatives involves of a balance of considerations. Firstly, SSEN Transmission has obligations under section 9 of the 1989 Act to 'develop and maintain an efficient, co-ordinated and economical system of electricity transmission'. Secondly, the Applicant has duties under Schedule 9, para. 3(1) (*Preservation of amenity and fisheries: Scotland*) when formulating proposals that would involve the execution of work in connection with the transmission of electricity (Schedule 9, paras. 1(3) and 3(4)). Furthermore, the requirements of the Construction (Design and Management) Regulations 2015[1] (CDM Regulations) require that the project design aims to minimise hazards and reduces risks during construction.

Taking account of this framework of obligations, SSEN Transmission has considered technical, economic and environmental factors in evaluating the reasonable alternatives for the Proposed Development, with the objective of identifying a Proposed Option which is technically feasible and economically viable, and which causes the least disturbance to the environment and to the people who live, work, visit and enjoy recreation within it.

3.3 Design Solutions

This chapter describes the different technical system design solutions and options that were considered for the purposes of delivering the Carnaig 400 kV Substation within the necessary timescales to meet the need for the reinforcement. The particular characteristics of the design solution have to take into account compliance with the Applicant's statutory and licence obligations, and the delivery strategy that is designed to ensure that the drivers for the project can be met.

Following identification of the Proposed Option (Option 3), the site selection stages of the project gave consideration to different design solutions that could mitigate likely significant environmental effects, or provide another benefit, for example rationalisation of the electricity network in a particular area.

3.4 Approach to Site Selection

The approach to site selection has been informed by SSEN Transmission's Substation Site Selection Procedures for Voltages at or above 132 kV guidance document[2] (hereafter referred to as SSEN Transmission's Substation Guidance). This guidance document considers the approach to identification and selection of new electricity transmission substation sites and also covers requirements to extend existing substations. The guidance document sets out a consistent approach to the selection.

[1] http://www.legislation.gov.uk/uksi/2015/51/contents/made (accessed 23/02/2022)

[2] Scottish and Southern Electricity Networks (November 2020). PR-NET-ENV-502. Substation Site Selection Procedures for Voltages at or above 132 kV

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 that are carried out can vary depending on the type, nature of and size of a project and consultation is carried out at each stage of the process.

In accordance with the steps outlined in the Holford Rules (Supplementary Notes on the Siting of Substations) and SSEN Transmission guidance[3], the following principles have been taken into account during the site selection stages of the Carnaig 400 kV Substation:

- 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 substations may also be considered, e.g., 'enclosed', rather than 'open', where additional cost can be justified.
- Consider the relationship of towers and substation structures with background and foreground features, to reduce the prominence of structures from main viewpoints.
- When siting substations take account of the effects of line connections that will need to be made

3.5 Strategic Options Assessment (Stage 0)

A strategic options assessment was undertaken by SSEN Transmission. The outcome of this strategic options assessment identified the following key requirements for the new sites:

- Proximity to the existing 275 kV substation to minimise the amount of cabling required to connect to the network.
- Large enough to accommodate the proposed substation footprint, together with associated landscaping, contractor compounds, access and new connection routes.
- Capacity for future connections.
- In areas which do not contain environmental designations and minimise impacts on local environmental receptors.
- Enables connection.
- The outcome of the strategic options assessment informed the identification of sites to take forward as part of the Stage 1: Initial Site Screening Stage.

3.6 Initial Site Selection (Stage 1)

Stage 1 of the SSEN Transmission Site Selection process requires a comprehensive list of feasible site options to be identified. The proposed Carnaig Substation had five options identified during the initial Site Selection Process. The first step of this process was to undertake a multi-criteria analysis (MCA) using publicly available Geographic Information Systems (GIS) datasets to provide a high-level environmental constraints map within 10 km. In addition, the site selection exercise undertaken in 2011 for the existing Loch Buidhe 275 kV Substation was reviewed to ascertain if this could yield potential site options or provide further background.

Using the data from the MCA, and assessing the 2011 site selection process, five initial site options were identified for the size of the proposed substation, and the challenging and remote nature of the terrain.

Assessment of the five options was undertaken against the key requirements and using the Red, Amber, Green (RAG) matrix[3]. This resulted in two of the options being discounted from further assessment based on access

[3] Scottish and Southern Energy Networks (SSEN) Transmission. (September 2022). *Substation Site Selection Guidelines for Voltages at or Above 132kV. PR-NET-ENV-502.*

constraints, land use impacts and environmental sensitivities. **Table 3.1** shows the location of each option and a summary of the key reasons why that option was / was not taken forward to Stage 2.

Table 3.1 Initial Site Screening of the five substation options

Option 1

Environment

- Potential for visual screening with forest plantation surrounding the site.
- Out with Strath Carnaig and Strath Fleet Moors SPA / SSSI.

Engineering

- Relatively level site.
- The existing track is steep and may require assessment and upgrades.
- Access to site from the A386 from an existing forest track.

Option 2

Environment

- Out with Strath Carnaig and Strath Fleet Moors SPA / SSSI.

Engineering

- Relatively level site.
- Access to site from existing track upgraded for the existing substation.

Option 3

Environment

- More favourable from a landscape and visual perspective as adjacent to the existing Loch Buidhe Substation.
- Although within the Strath Carnaig and Strath Fleet Moors SPA / SSSI out with the preferred habitat for hen harrier (qualifying feature of the SPA / SSSI).
- Likely to have an impact on plantation forestry.

Engineering

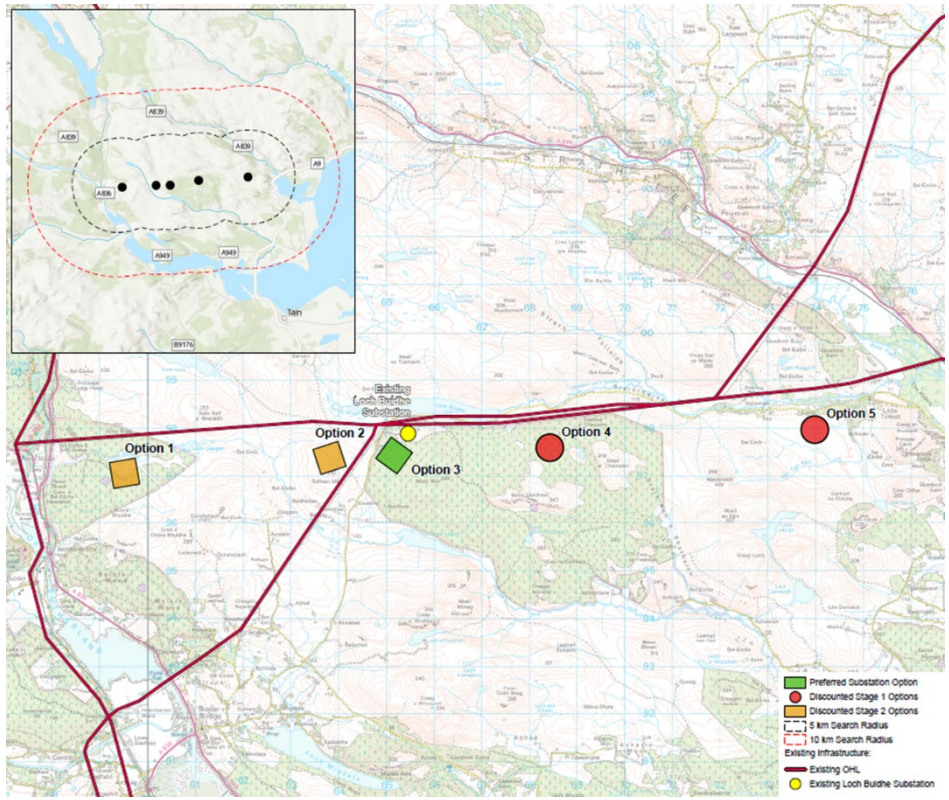
- Immediately adjacent to the existing Loch Buidhe Substation and with direct access from the road upgraded for the existing Loch Buidhe Substation.
- Shortest cable connection (c.600 m) between the proposed 400 kV substation and the existing 275 kV substation.

Option 4

- Poor access to site, which would require upgrade of c.4 km of public road.
- Likely to have an impact on plantation forestry.

Option 5

- Access track would require upgrade.
- Located within Strath Carnaig and Strath Fleet Moors SPA / SSSI on peatland habitat which has potential to support hen harrier (qualifying feature of the SPA / SSSI).



Sites taken to Stage 2 Assessment

Options 1, 2 and 3 were taken forward to Stage 2 based on access constraints, land use impacts and environmental sensitivities.

3.7 Detailed Site Selection (Stage 2)

This stage seeks to identify a preferred substation site from shortlisted options, which minimises where practicable physical, environmental and amenity constraints, is likely to be acceptable to stakeholders and is viable (taking into account engineering and cost requirements). The connections into new and existing assets forms a crucial part of this assessment to reduce the need for additional new infrastructure.

Following the completion of the Stage 1 initial screening process, a total of three sites were identified and taken forward to Stage 2.

- Option 1 is located 6 km to the south west of the existing substation within an area of peatland, coniferous woodland and heathlands.
- Option 2 is located 1.5 km to the south west of the existing substation within an area of peatland.
- Option 3 is located immediately to the south west of the existing substation within an area of conifer plantation / clear-fell, peatland and open ground.

The substation site selection report (**Volume 4 Appendix 3.1**) was completed in compliance with the SSEN guidance document site selection for substation, noted above.

3.7.1 Site Identification and Appraisal

The shortlisted site options were appraised following the desk-based review and site walkovers, giving due consideration to the principles set out in the Holford Rules and SSEN Transmission guidance, as described in **Section 3.4** of this chapter.

Appraisal of options involved systematic consideration against the topic areas noted below:

Environmental

- **Natural Heritage**: Designations; Protected Species; Habitats; Ornithology; and Hydrology / Geology.
- **Cultural Heritage**: Designations; and Cultural Heritage Assets.
- **Landscape and Visual**: Designations; Landscape Character; and Visual.
- **Land Use**: Agriculture; Woodland/Forestry; and Recreation.
- **Planning:** Policy; and Proposals

Technical

- **Access and Connectivity**: Construction access; Operation and Maintenance; Existing Circuits / Networks; Future Development Possibilities; Interface with SSEN Distribution and Generation; and DNO Connection.
- **Footprint Requirements**: Technology; Adjacent Land Use; and Space Availability.
- **Hazards**: Unique Hazards; and Existing Utilities and Installations.
- **Ground Conditions**: Topography; and Geology.
- **Environmental Conditions**: Elevation; Salt Pollution; Flooding; Carbon Footprint: Sulphur hexafluoride (SF6); Contaminated Land; and Noise.

Cost

- **Capital**.

A RAG rating was applied to each topic area for each route option, indicating potential constraint to development.

3.8 Summary of Site Selection Appraisal

The following part of this chapter summarises the options appraised during Stage 2 of the site selection process. For each location, a summary of the main environmental and technical constraints identified during the appraisal have been set out.

3.8.1 Options Appraisal

There were three options appraised in the second stage of the site selection process.

Option 1

The first option is located 6 km to the south west of the existing substation within an area of peatland, coniferous woodland and heathland. Within Option 1, there are no internationally or nationally designated sites however, there is presence of peatland and therefore there may be potential to compromise the integrity of ground water dependent terrestrial ecosystems (GWDTE).

There are many more sites designated for cultural heritage within 2.5 km of Option 1 including scheduled monuments and Category A, B and C listed buildings. There is potential to compromise the designated features indirectly through changes to their setting regarding their visibility to and from the surrounding landscape. Option 1 may compromise the characteristic elements of the Rounded Hills - Caithness & Sutherland Landscape Character Type (LCT) 135. The Garvary Wind Farm is situated out with Option 1.

The BNG assessment identified Option 1 as the preferred option over Option 2 and 3 however it would require micro siting and for the watercourse to be retained to avoid the loss of 5,127.80 Linear Units (LU).

From an engineering and economic perspective, the cost of the site construction across the shortlisted options is generally the same. The main variable in cost is being driven by the distance from the existing 275 kV substation; the further the new site is from the existing site the more cost that is required for the excavation and material purchase for the connection between the existing substation and the proposed substation site.

The other driving factor is a comparison of the extent of civil works required on each site. Site 1 would require substantial excavation works in order to produce a level platform.

Option 2

The second option is located 1.5 km to the south west of the existing substation within an area of peat.

Within Option 1 there are no internationally or nationally designated sites, however, there is the presence of peatland and therefore there may be potential to compromise the integrity of GWDTEs.

Option 2 may compromise the characteristic elements of the Rounded Hills - Caithness & Sutherland LCT 135. Option 2 is partially within the south east edge of the planning boundary of Garvary Wind Farm but does not impact turbine locations or access tracks.

From an engineering and economic perspective, the cost of the site construction across the shortlisted options is generally the same. The main variable in cost is being driven by the distance from the existing 275 kV substation; the further the new site is from the existing site the more cost that is required for the excavation and material purchase for the connection between the existing substation and the proposed substation site.

The other driving factor is a comparison of the extent of civil works required on each site. Site 2 consists mainly of peat and this would be required to be excavated and relocated to another location.

Option 3

The third option is located immediately to the south west of the existing substation within an area of woodland and clear-felled woodland. Option 3 is within the Strath Carnaig and Strath Fleet Moors Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI). In the absence of mitigation, the option would likely directly impact this internationally and nationally designated site and / or the conservation status of the designating

features of the site. There is the presence of peatland within Option 1 which means there may be potential to compromise the integrity of GWDTEs.

Option 3 may compromise the characteristic elements of the Rounded Hills - Caithness & Sutherland LCT 135 however it should be noted that Option 3 is within the landscape context of two existing OHLs and an existing substation.

Option 3 is within the SPA and SSSI and the SSEN Transmission Toolkit suggests that biodiversity net gain cannot be achieved. Following the SSEN Transmission Biodiversity Net Gain Toolkit User Guide, impacts to the SPA and SSSI should be avoided, mitigated and, as a last resort, compensated for, following national legislation, policy and guidelines. These areas, including any mitigation or compensation, should be removed from the biodiversity calculations. As such, no net less / net gain cannot be calculated for Option 3 within the Toolkit. No hedgerow habitats were recorded for Option 3 however linear watercourse habitats were identified. Neither blanket bog or Ancient Woodland Inventory (AWI) woodland were identified within the option.

Although Option 3 is within the Strath Carnaig and Strath Fleet Moors SPA and SSSI, historical bird surveys suggest this area is not well used by hen harrier. Option 3 is adjacent to the existing substation and is on balance considered to present the lowest potential for environmental impact. Option 3 is the environmentally preferred option.

From an engineering and economic perspective, the cost of the site construction across the shortlisted options is generally the same. Option 3 is the closest option to the existing Loch Buidhe Substation and thus the most cost-effective solution.

The other driving factor is a comparison of the extent of civil works required on each site. Site 3 will require civil works for the platform, however, this is proportionately less when compared with the other two proposed sites and, in conjunction with the reduced cable length required to connect to the existing substation, this would result in reduced cost impact by comparison.

Preferred Site

Option 3 is considered the environmentally preferred option. Clustering development adjacent to the existing substation limits the potential for landscape and visual impact in the wider area. Although within the Strath Carnaig and Strath Fleet Moors SPA and SSSI, historical bird surveys suggest this area is not well used by hen harrier.

Option 3 is considered the technically preferred option. The Option 1 access road is too steep for equipment delivery and would also need to be upgraded. Options 2 and 3 would use the access road for the existing Loch Buidhe Substation and is well away from the Garvary Wind Farm consenting area.

The preferred site from a cost perspective is Option 3 as it is closer to the existing 275 kV substation and requires a shorter cable connection and less excavation to produce a level platform.

Option 3 was therefore the identified as the Preferred Option to take forward to the design and layout stage (summarised below).

3.8.2 Consultation

Consultation on the preferred substation option and two alternative options, was undertaken jointly with the Spittal – Loch Buidhe – Beauly 400 kV OHL. The public consultation events were held across a two-week period in late February and early March 2023; the events spanned towns and villages located along the route options for the new 400 kV OHL.

The public consultation events were followed by presentations to and engagement with the statutory consultees; representatives from THC, NatureScot (NS) and Historic Environment Scotland (HES) attended a consultation session on 10th March 2023. An invite was also issued to Scottish Environment Protection Agency (SEPA).

Information materials prepared for the consultations[4] with the public and statutory authorities in March 2023 included a consultation booklet, public event banners and ArcGIS-based Storymaps that set out the context and background to the Proposed Development and its need, in addition to the process followed to assess site options and reach a short list.

3.8.3 Consultation Responses

Feedback from the consultation session with the statutory consultees on 10th March is summarised below:-

Option 1

- HES indicated this was their least preferred of the 3 site options due to presence of Scheduled Ancient Monuments (SAMs);
- NatureScot did not express any major concerns in relation to this option.

Option 2

- HES did not express any major concern in relation to this option;
- NatureScot did not express any major concerns in relation to this option.

Option 3

- HES indicated this site options was furthest from SAMs than the other site options under consideration and therefore probably likely to be least worrisome;
- NatureScot indicated that this was the most sensible site option in their view but that consideration was required of impact on hen harrier population which is the qualifying species of the SPA;
- THC indicated a preference for a consolidated site option subject to assessment of Landscape and Visual Impact and to satisfying NS comments in relation to impacts on protected species;
- THC indicated that micro-siting and cumulative landscape and visual effects should be heavily weighted in design; suggested that all configuration / layout options and technologies should be considered in order to bed the design into the landscape.

3.9 Development Location within Preferred (Option 3) Site

Following the completion of the Site Selection Study exercise and subsequent consultation, which confirmed Option 3 as the preferred location, preliminary design works were undertaken to identify the optimal location and layout for the Proposed Development from an environmental, engineering and construction perspective. As part of this exercise, particular attention was given to peat deposits and the potential for impacts on peat from the Proposed Development. An exercise was undertaken to confirm that there was no other suitable site locations which could accommodate the Proposed Development and also help reduce impacts to peatland.

Given the large dimensions of the substation platform as well as associated infrastructure, there is a very limited area within the vicinity of the preferred Site Selection Study Option that can accommodate the Proposed Development. The selection of alternative locations are not only limited by the existing substation to the south and the existing public highway to west, the area is characterised by the steeply sloping topography of Meall Mor, a hill which rises to a height of 296 m above ordnance datum (AOD) located approximately 1.3 km south of Loch Buidhe. As a result of these physical constraints, and when trying to avoid deep peat identified by peat probing, only two other potential locations to the east and south could theoretically accommodate the proposed substation footprint area.

A comparison of earthworks modelling undertaken for all feasible substation locations within the Option 3 boundary, indicated reduced volumes of peat extraction associated with the alternative sites but increased bulk excavation volumes. It is considered that whilst favourable from a peat extraction perspective, there are a

[4] SSEN Transmission project documents https://www.ssen-transmission.co.uk/projects/project-map/carnaig/

number of other environmental impacts associated with an increase in bulk excavation including extended programme of vehicular movements, prolonged risk to the water environment and greater disturbance to protected species.

Additionally, an engineering assessment of the alternative locations (**Volume 3a Figure 3.1**) confirmed that when trying to locate the platform, whilst the alternatives represent the best-case in terms of accommodating the platform size and slope gradients both options would require significant amounts of construction work within slopes above a 20-degree gradient. This angle exceeds design specification tolerances with regards to slope stability risk, i.e. there is an unacceptable health and safety risk associated with constructing a platform in these locations.

Furthermore, the two alternative locations would require major excavations for the installation of the underground cable. The further the Proposed Development is located from the existing Loch Buidhe Substation, the greater the health and safety risk associated with working in excavations within steep slopes. Consideration has also been given to the increased risk associated with blasting operations which would likely be required as part of the earthworks alternative locations as difficulties associated with rock mass excavatability has the potential to trigger the need for blasting which could result in further cut slope instability.

While the peat excavation volumes would potentially be lower at the alternative options, it has been concluded that that site location cannot be moved due to significant engineering constraints that show the alternatives are unfeasible including the exceedance of health and safety tolerances which is a direct result of the sloping topography and limited space to accommodate the proposed and necessary development infrastructure.