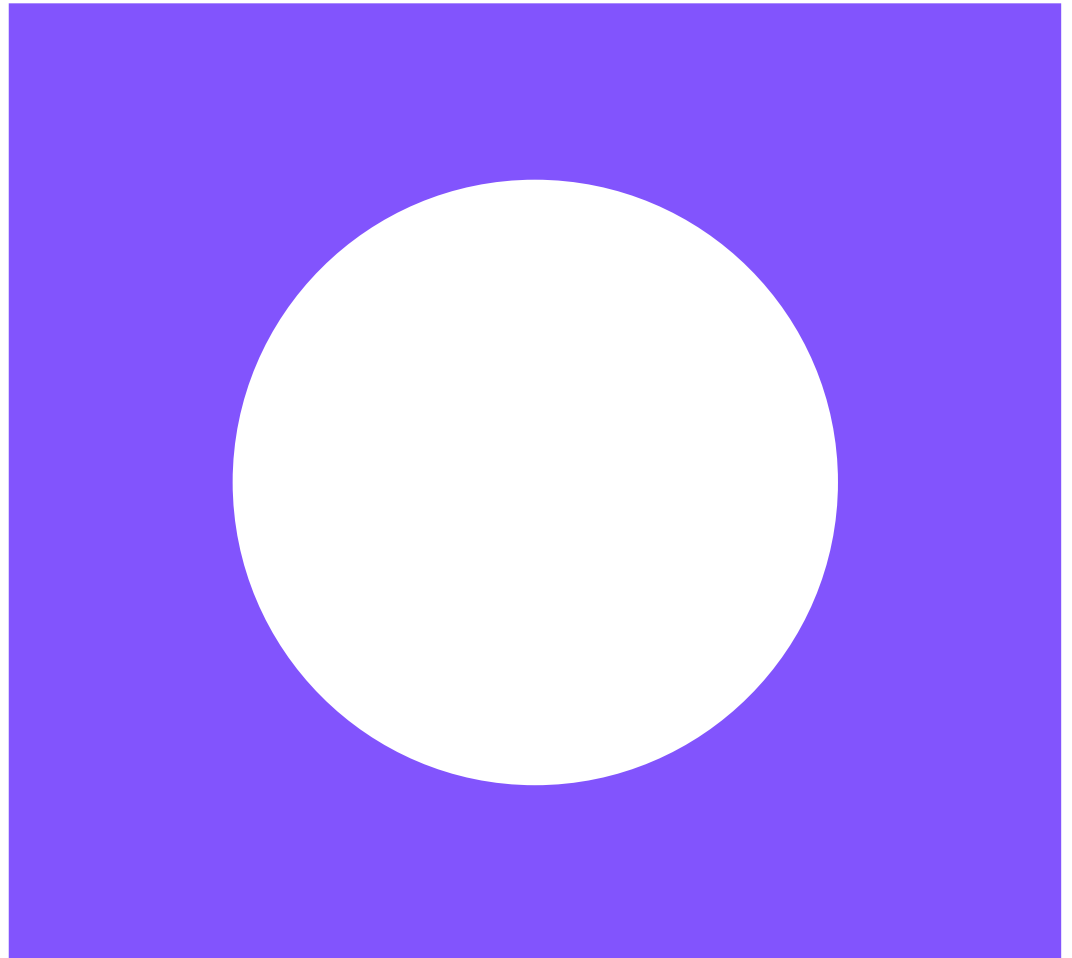




SSEN Coire Mashie Substation

Engineering Appraisal – Additional Site Option 6
& 7

October 2025

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SSEN Coire Mashie Substation

**Engineering Appraisal – Additional Site Option
6 & 7**

October 2025

Issue and Revision Record

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1 Introduction

Scottish and Southern Electricity Networks (SSEN) Transmission has identified the need to construct a 400kV Coire Mashie substation near Kinloch Laggan in the Scottish Highlands, on the western edge of the Cairngorms National Park.

Initially, a shortlist of five site location options was identified by the SSEN project team, then additional two sites were identified through a public consultation process.

This document focuses on the two additional sites and evaluates them based on a range of key criteria, comparing shortlisted locations. The aim of this report is to identify the preferred site(s) for further development, balancing stakeholder needs and considering a range of criteria, including technical, engineering, and cost factors.

This document should be read in conjunction with the initial site selection report, (Doc. No. 116030-MMD-00-XX-RP-ZZ-0001) which evaluated the 5 initially identified site locations. A general plan of all site options is shown in Figure 2.1.

SSEN Transmission is also undertaking an overhead line (OHL) and cable route assessment for connection to 400kV Coire Mashie substation. The OHL and cable route assessment exercise is outside of Mott MacDonald scope.

2 Option Evaluation and Selection Narrative

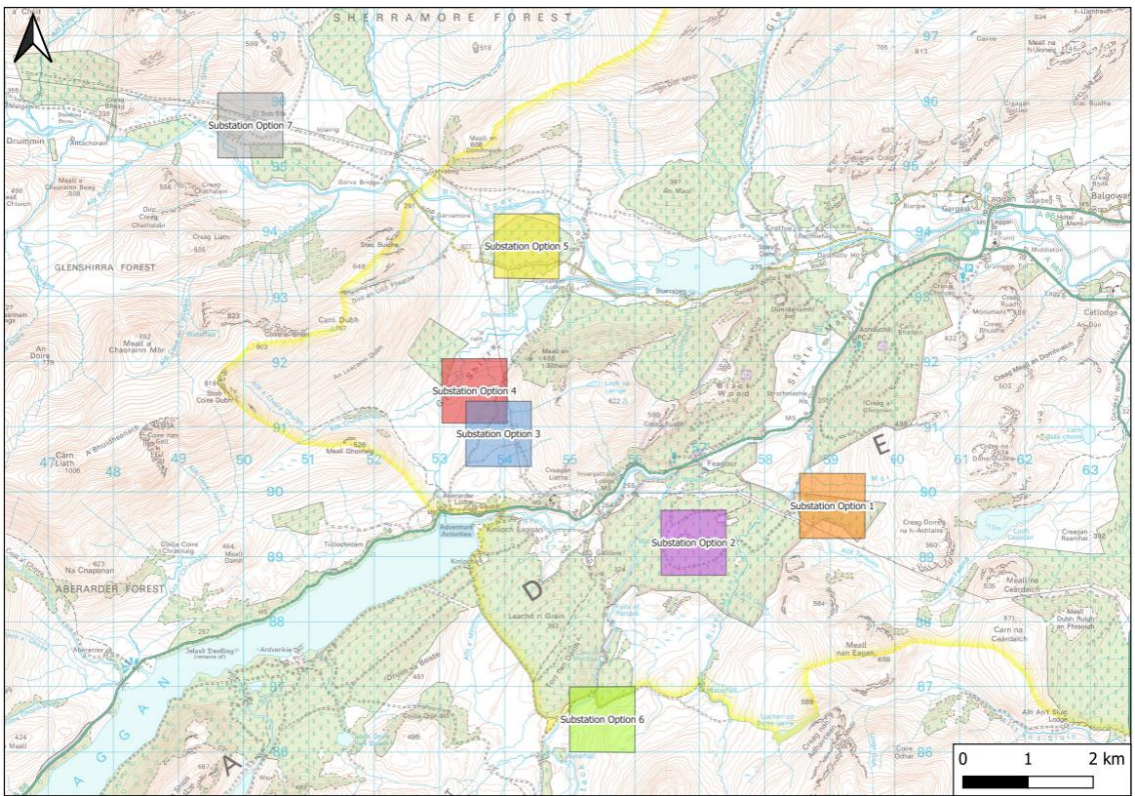
This section outlines the main options considered for the 400kV substation selection and records the assessment of key criteria relevant to the selection of a preferred solution.

2.1 Options considered for selection of 400kV substation

Table 2.1: Site Options

Option	Description
6 (Green)	Proposed substation site is located on the Cairngorms National Park Boundary, on the southern border.
7 (Grey)	Proposed substation site is located outside of the Cairngorms National Park Boundary. In the Southwest corner of the site there is a watercourse, in the centre of the site there is the existing Melgarve 400kV substation.

Figure 2.1: 400kV Coire Mashie substation options



Source: SSEN Coire Mashie Area Substation Site Options (Drawing Reference: 250528)

2.2 Connectivity

2.2.1 Existing circuits / network

Coire Mashie substation Site Option 7 has existing 275kV and 400kV Beauldy-Denny OHL, with its associated towers, crossing over the site. The OHL scope is related to the development and

is being assessed by others. It can be assumed that the requirement for temporary diversion of the OHL and/or a staged connection from the OHL to the new 400kV substation may affect the duration of the construction programme, preferred substation orientation and overall project program. Identification of the optimum position/arrangement for the substation in relation to the OHL routes being developed by Others is ongoing. An existing 132 kV line is located within the proposed site.

Within Site Options 6, the proposed site is located approximately 3.5km away from the existing Beaully-Denny OHL lines allowing the complete substation to be constructed offline, independent of connection stages.

Site Option 6 is proposed within the National Park area and utilisation shall be subject to approval from the relevant Authorities.

Table 2.2: Existing circuits / network RAG Rating

Option	RAG rating
6 (Green)	AMBER
7 (Grey)	AMBER

2.2.2 Future development possibilities

For this criterion, both site options have been assessed as equal, with the main driving factor for the given score being the desired switchgear technology.

In the case of AIS technology, any future expansion would be challenging as it would require a larger area due to the large footprint of additional AIS bays, and because of the nature of the surrounding area.

The proposed layouts for AIS include four fully equipped spare bays.

Table 2.3: Future needs RAG Rating

Option	RAG rating
6 (Green)	RED
7 (Grey)	RED

2.2.3 Interface with SSE Distribution and Generation

Review of available Scottish Hydro Electric Power Distribution (SHEPD) LTDS Geographic Map and publicly available Open Infrastructure maps has been done. Based on available information the only existing Distribution and Generation asset in proximity of all proposed sites is Loch Laggan tunnel which connects Loch Crunachdan with Loch Laggan. It has no impact to Site Options 6 or 7 locations.

Table 2.4: Interface with SSE Distribution and Generation RAG Rating

Option	RAG rating
6 (Green)	GREEN
7 (Grey)	GREEN

2.2.4 DNO Connection

Based on review of Scottish Hydro Electric Power Distribution (SHEPD) LTDS Geographic Map the closest belongs to SHEPD(DNO). Subject 33kV power line is originally fed from Boat of Garten SS (2x60MVA). Available capacity has not been assessed. It is unknown can this SS bare one more T-off to supply Coire Mashie Auxiliary loads. DNO should be approached via application to determine exact point of connection.

Site Option 6 is less than 1km away from the mentioned 33kV power line.

Review of publicly available open infrastructure maps has revealed a 11kV power line passing through the site for Site Option 7 for which DNO would again require approaching to determine point of connection.

Table 2.5: DNO Connection RAG Rating

Option	RAG rating
6 (Green)	GREEN
7 (Grey)	GREEN

2.3 Footprint Requirements

2.3.1 Technology

Air Insulated Switchgear (AIS) is considered for both site options. Pros and cons of this technology are summarised in Table 2.6.

Table 2.6: AIS Pros and Cons

Technology	Pros	Cons
AIS	Reliable and well-known technology. Familiar maintenance Lower equipment capital cost	Larger substation footprint. Both available sites are more than 200m above sea level and with calculated wind speed around 58m/s. These conditions favour enclosed substations rather than outdoor AIS according to SSEN specifications

Table 2.7: Technology RAG Rating

Option	RAG rating
6 (Green)	RED
7 (Grey)	RED

2.3.2 Adjacent Land use

A high-level assessment of Temporary Construction Compound (TCC) positions has been carried out.

A preliminary 200 x 200 metre TCC area is anticipated for the construction of the AIS Substation for both options, which will provide parking, welfare facilities, site cabins, and a laydown area. Three potential options have been considered are as follows:

1. Inside the AIS Substation boundary
2. Near the AIS substation
3. Off the haul road for main access

Note that the TCC footprint would be refined based on the project requirements and after consultation with contractors.

For Site Option 7, additional space around compound should be available with possible constraints including additional earthworks. Site Option 6 is constrained by two watercourses and an existing floodplain. Therefore, Site Option 6 has received a RED RAG rating and Site Option 7 has received an AMBER RAG rating.

Table 2.8: Adjacent Land use RAG Rating

Option	RAG rating
6 (Green)	RED
7 (Grey)	AMBER

2.3.3 Space Availability

Site Option 6 is characterised by steep topography, with the relatively flat land situated to the west, adjacent to the River Pattack and in the eastern extents within the Site Option 6 boundary.

In the western extents this flat area is indicated to be located in the area subjected to High, Medium and Low risk of flooding according to SEPA Flood Maps, indicating an active floodplain.

In the eastern extents, these flat areas are allocated at the top of the hill, however areas of peat are present according to BGS mapping.

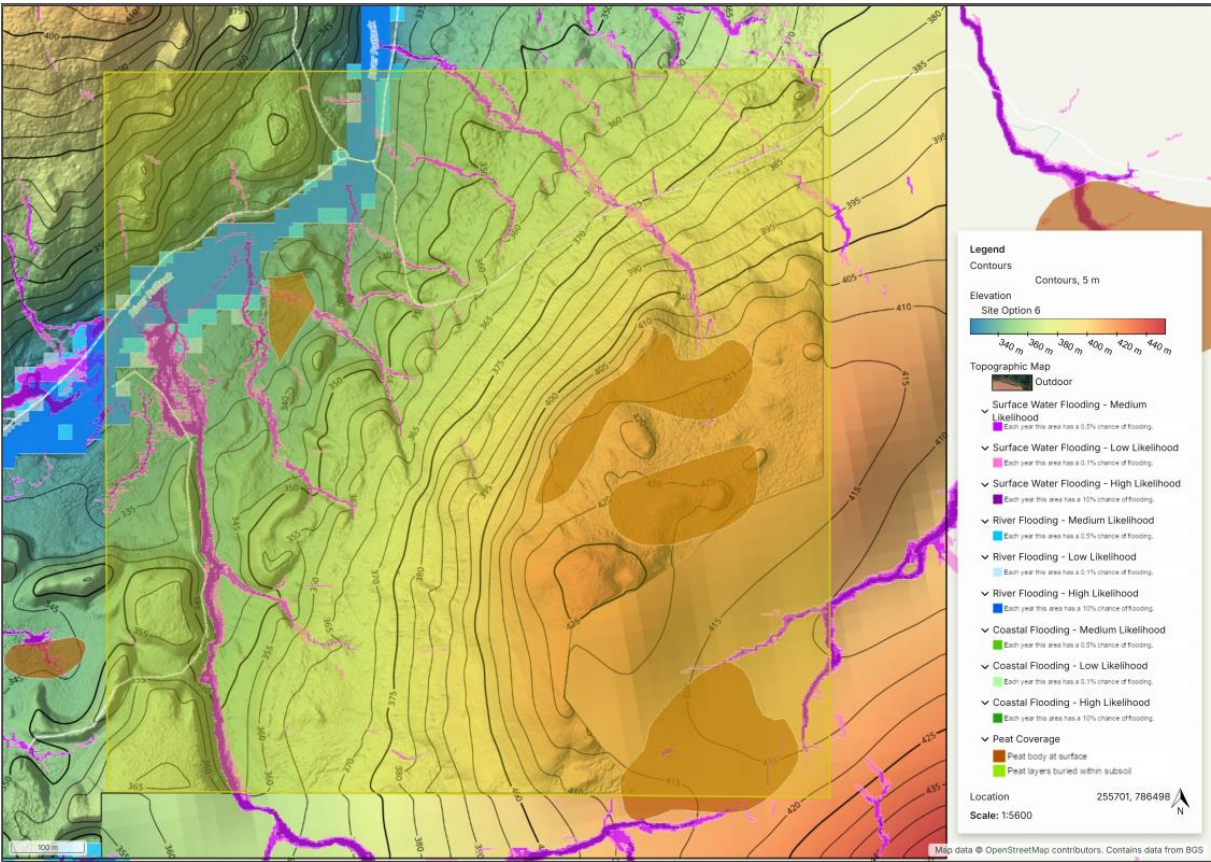
For the Site Option 7 site there is space available to the west of the Melgarve Substation for potential development. However, the site boundary, is constrained by the presence of the existing HV overhead line crossing the site from east to west, as well as the footprint of the existing Melgarve Substation. As a result, the primary area available for new substation construction is likely to the north of the existing HV OHL, where the slopes are moderately steep (approximately 9.2%).

While earthworks could be optimised if the platform is positioned parallel to the topographical contours, the eastern extents outside the Site Option 7 boundary contain flatter areas, which may be preferred to optimise earthworks balance.

Table 2.9: Space Availability RAG Rating

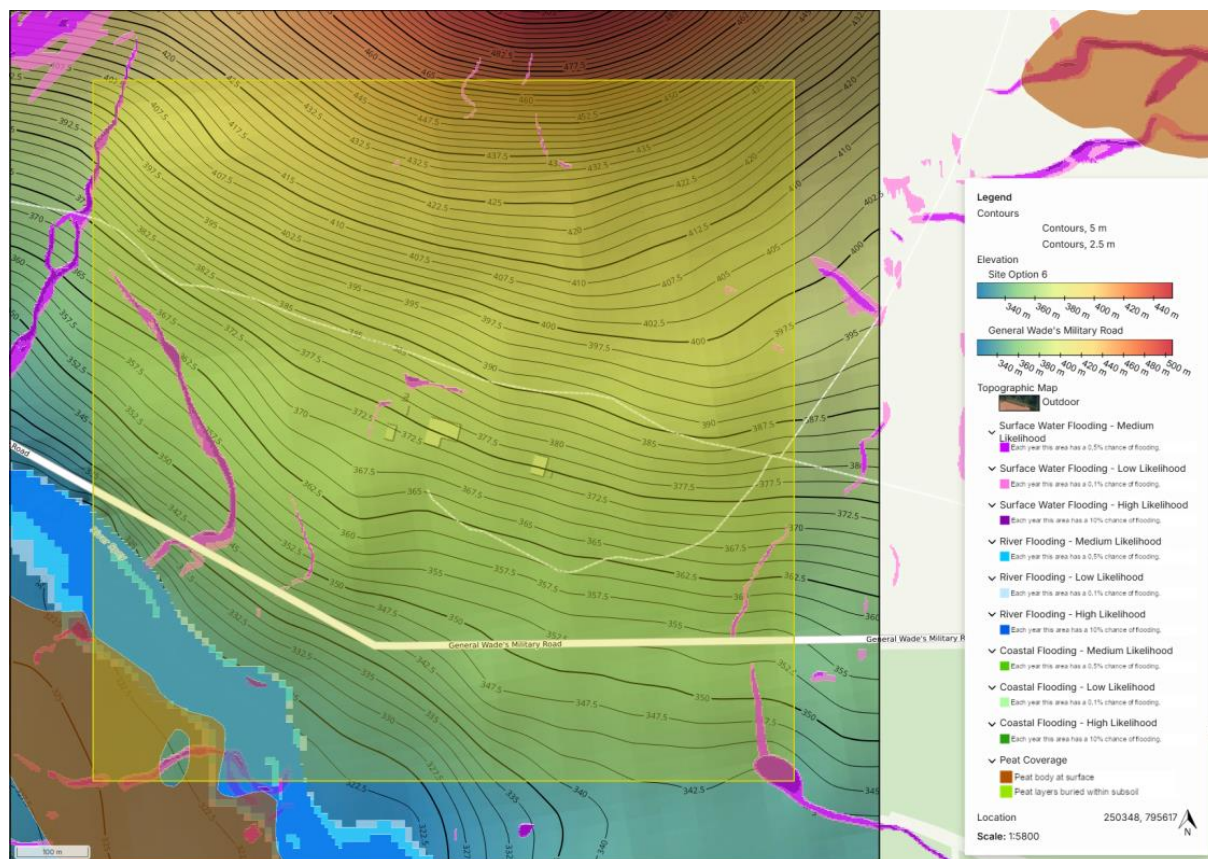
Option	RAG rating
6 (Green)	RED
7 (Grey)	AMBER

Figure 2.2: Site Option 6 Topography, including Flood and Peat Extents



Source: Scalgo (2025)

Figure 2.3: Site Option 7 Topography, including Flood and Peat Extents



Source: Scalgo (2025)

2.4 Hazards

2.4.1 Unique Hazards

For both site options areas of peat have been identified in BGS 1:50,000 scale.

For Site Option 6 superficial deposits are located in the eastern extent of the site, with an additional smaller deposit in the west.

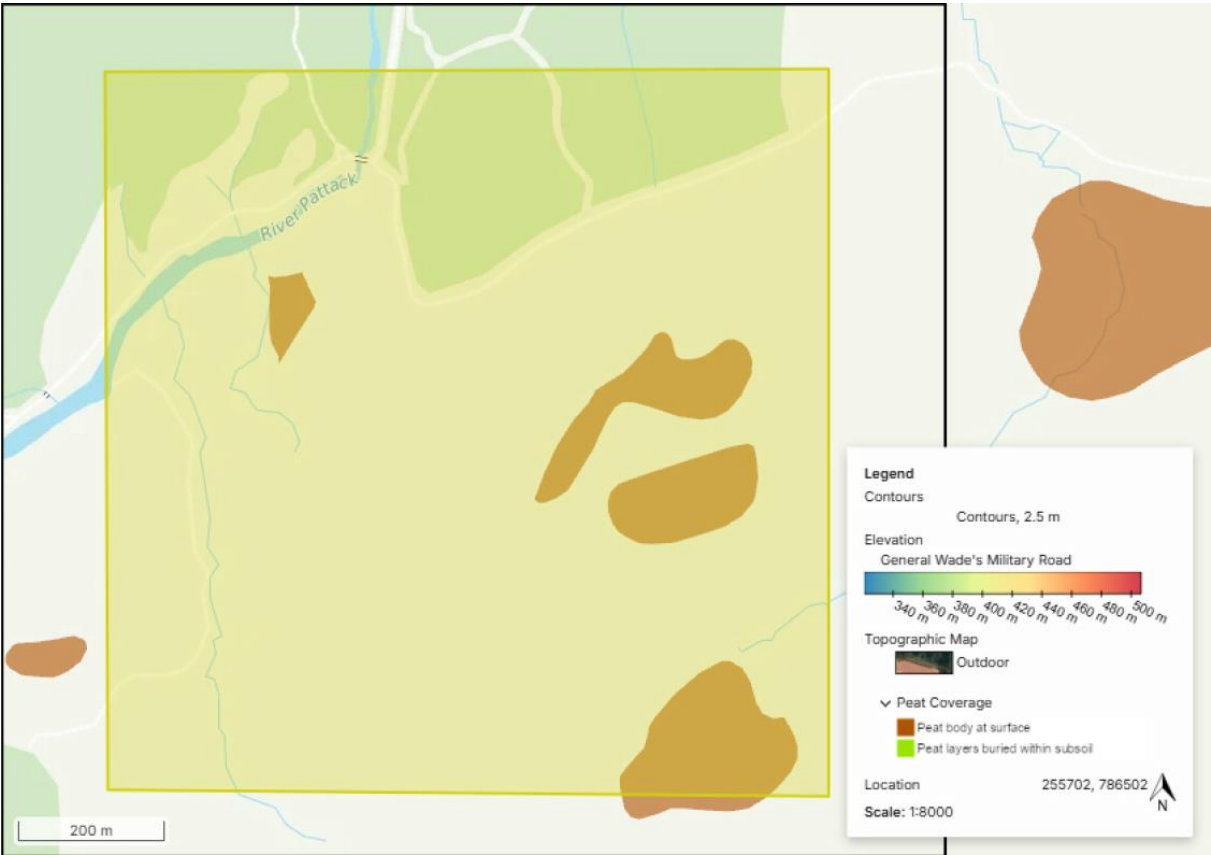
For Site Option 7, superficial deposits are located in the south-west corner of the site with an additional deposit in the north-east extent, outside the site boundary.

Table 2.10: Unique Hazards RAG Rating

Option	RAG rating
6 (Green)	RED
7 (Grey)	AMBER

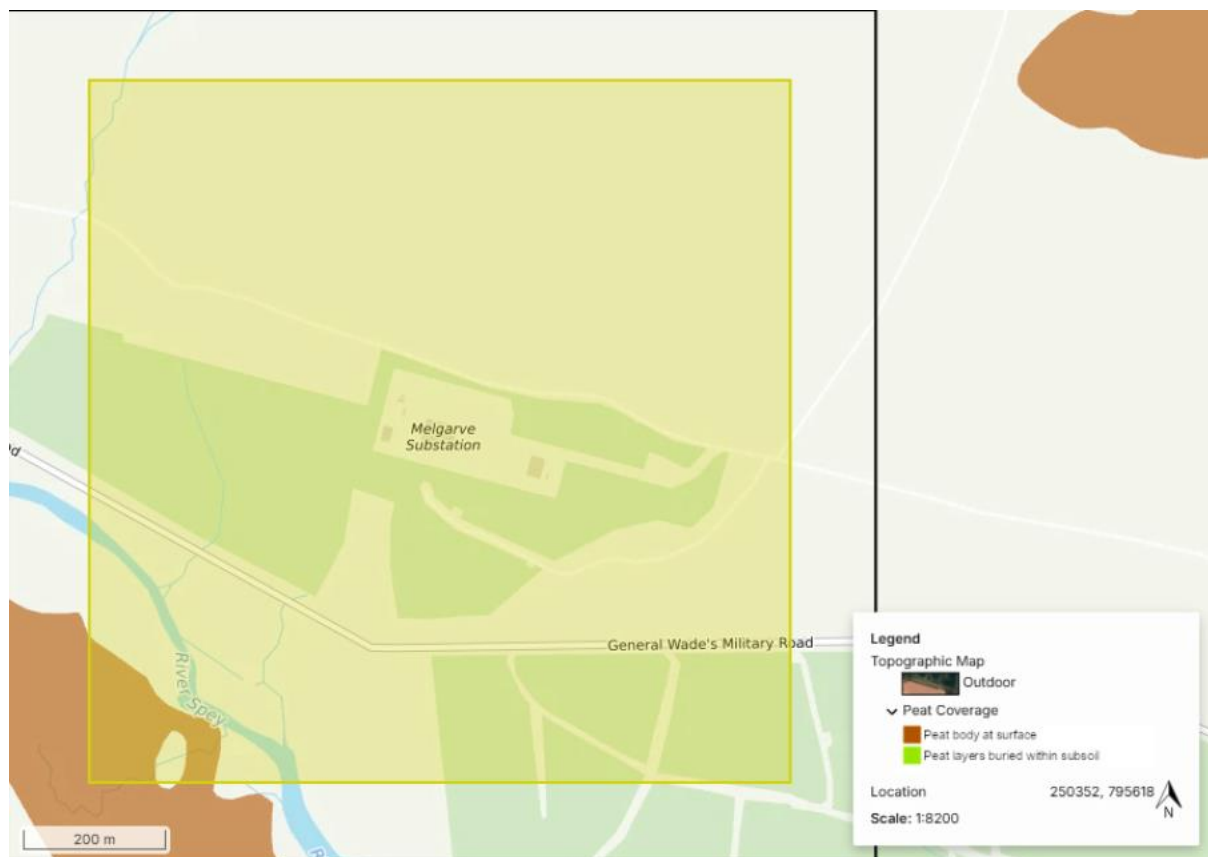
Development of any option will require further assessment of potential hazards such as construction traffic, potential below ground services (electrical, communications, water, gas) work near existing OHLs, construction work on steep slopes.

Figure 2.4: Site Option 6 Peat Deposits



Source: Scalgo (2025)

Figure 2.5: Site Option 7 Peat Deposits



Source: Scalgo (2025)

2.4.2 Existing Utilities

For Site Option 6, a 33kV overhead line (OHL) crosses the access road from east to west. There is a potential risk of construction traffic coming into contact with the wires. A clearance check will be required to be conducted at the next stage of the project and a GPR survey completed prior to any intrusive works.

For Site Option 7, the existing Beauty-Denny HV OHL runs east to west along General Wade's Military Road, directly through the Site Option 7 boundary. Safety clearances will require to be maintained, and exclusion zones applied.

Table 2.11: Existing Utilities RAG Rating

Option	RAG rating
6 (Green)	GREEN
7 (Grey)	AMBER

2.5 Ground Conditions

2.5.1 Topography

The anticipated topographic profile of the proposed site areas has been reviewed and interpreted from available Ordnance Survey mapping and aerial images. A site walkover has not

been undertaken for any of the proposed sites, and as such the topographical profile slope gradients are subject to updates following further surveys and site visits.

A summary of the pertinent topography and associated geotechnical risks pertaining to the proposed site options and the respective strengths, weaknesses and opportunities is presented in Table 2.12.

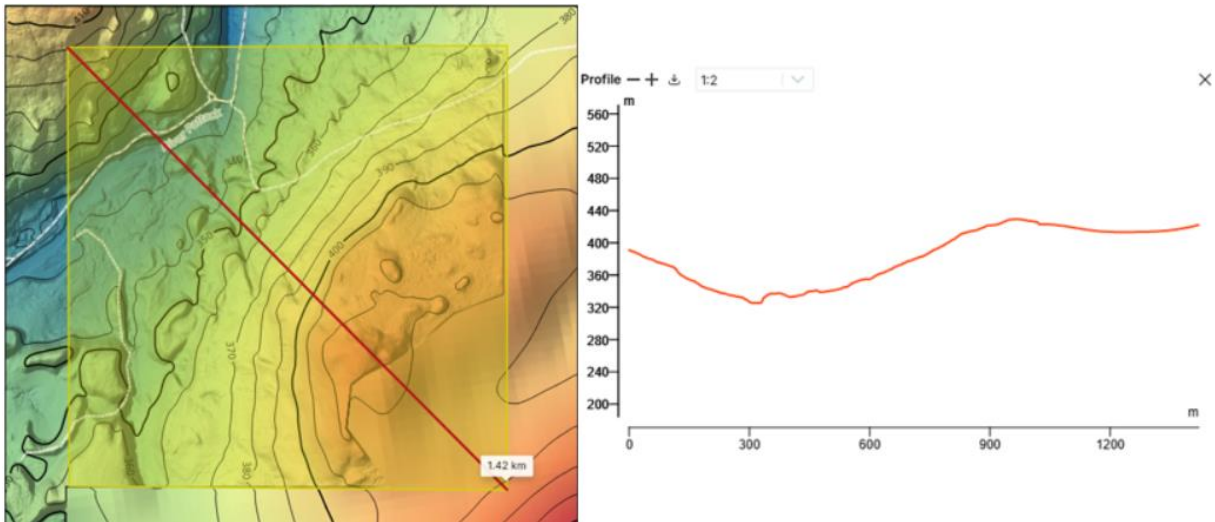
Table 2.12: Topography Summary

Option	Strengths	Weaknesses	Opportunities
6	The topography in both the northwest and southeast of the site is indicated to be relatively flat however these areas are associated with an existing floodplain to the north and peaty areas indicated on BGS mapping to the south.	The majority of the site comprises of steeply sloping land ranging from 310m to 429m AOD. Significant earthworks would be required to form a flat platform for the AIS substation and access road. The site is constrained by the presence of peat and an existing floodplain of the River Pattack.	Substation layout/location could be optimised to target areas requiring least earthworks. A detailed Topographic Survey could be undertaken to inform the design of the cut/fill earthworks platform and access roads. A peat proving survey could be carried out to determine the depth of peat deposits.
7	Topography to the east, outside the site option boundary, features smoother terrain. However, peaty areas indicated on BGS mapping suggest that further surveys would be required.	The majority of the site comprises of steeply sloping land ranging from 326m to 410m AOD. Significant earthworks would be required to form a flat platform for the AIS substation.	Substation layout/location could be optimised to target areas requiring least earthworks. A detailed Topographic Survey could be undertaken to inform the design of the cut/fill earthworks platform and access roads. A peat proving survey could be carried out to determine the depth of peat deposits.

Table 2.13: Topography RAG Rating

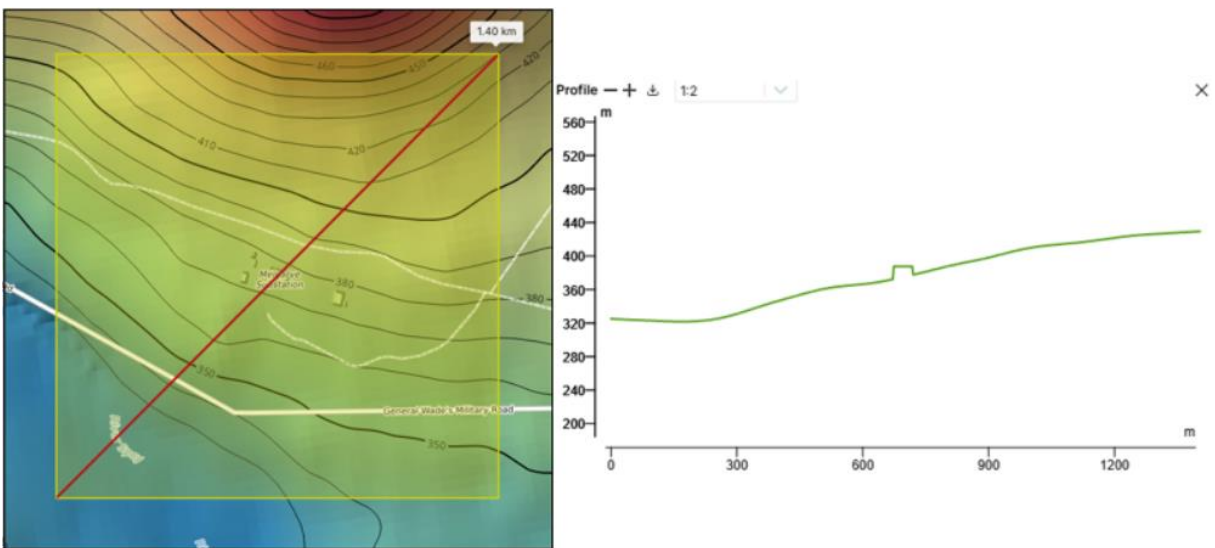
Option	RAG rating
6 (Green)	RED
7 (Grey)	RED

Figure 2.6: Site Option 6 Topography



Source: Scalgo (2025)

Figure 2.7: Site Option 7 Topography



Source: Scalgo (2025)

2.5.2 Geology

For Site Option 6, the anticipated site geology comprises Glacial Till across the majority of the site, overlying bedrock anticipated to consist of granite from the Strathspey Formation and semipelitic rocks from the Glen Banchor Sucession.

In certain areas, superficial deposits appear to be absent in some areas, with localised rock outcrops exposed at the surface.

Localised peat deposits of unknown thickness are expected, particularly in the eastern part of the site. These deposits typically exhibit very low strength and highly compressibility and may pose a risk of excessive settlement and bearing capacity failure.

Additionally, localised alluvium and river terrace deposits are indicated to be present in the NW of the site, around the River Pattack. These deposits are likely to consist of soft to loose soils, which may also present challenges for foundation design and excavation stability.

For Site Option 7, the anticipated site geology comprises Glacial Till across the majority of the site, overlying bedrock anticipated to consist of psammite from the Garva Bridge Formation.

Localised alluvium deposits and peat/peaty soils are indicated to be present in the SW of the site, around the River Spey, which are likely to consist of soft to loose soils, presenting challenges for foundation design and excavation stability.

Ground conditions are unproven and may differ from those anticipated and summarised above.

Table 2.14: Geology and Ground Conditions RAG Rating

Option	RAG rating
6 (Green)	AMBER
7 (Grey)	AMBER

2.6 Environmental Conditions

2.6.1 Elevation

The proposed Site Options are approximately 350m (between 320m – 500m) above Ordnance Datum Newlyn with high wind speed of 69.27m/s for Site Option 6 (Ref. doc. 116030-MMD-00-XX-CA-CE-0001) and 71.2538m/s for Site Option 7 (Ref. doc. 116030-MMD-00-XX-CA-CE-0002).

Table 2.15: Elevation RAG Rating

Option	RAG rating
6 (Green)	RED
7 (Grey)	RED

2.6.2 Salt Pollution

Both sites are over 70km away from coastline and are not expected to be subject to salt pollution.

Table 2.16: Salt Pollution RAG Rating

Option	RAG rating
6 (Green)	GREEN
7 (Grey)	GREEN

2.6.3 Flooding

The Site Option 6 location is situated on the slopes of Beinn Eilde, the site features steep gradients that indicate rapid surface water runoff toward the development area. According to

SEPA mapping, the River Pattack traverses the site, primarily flowing from north to west, and is associated with a 1 in 10 year (HIGH) flood risk.

If the development platform is located at the hilltop, the overall flood risk is considered low due to the elevated position, with rainfall expected to be managed by the on-site drainage system (SuDS). However, should the platform be situated on the slope, overland flow from rainfall will need to be managed with drainage ditches and embankments to prevent runoff entering the site. Also, BGS mapping indicates peat areas at the top of the hill in the south-eastern corner of the Site Option 6 boundary suggesting issues within the superficial layers.

The site sits in the valley between Meall a' Ghiubhais and Creag Chathalain posing a potential risk of surface runoff towards the substation platform. However, the topography suggests flows in the upper catchment and likely moderate to low flows towards the site platform, however this will be managed via overland ditches to prevent runoff entering the site. Areas of surface water pooling are indicated within the boundary but will be addressed by the on-site drainage system (SuDS).

The River Spey flows through the south-west corner of the site posing a 1 in 10 year (HIGH) chance of flooding, according to SEPA mapping.

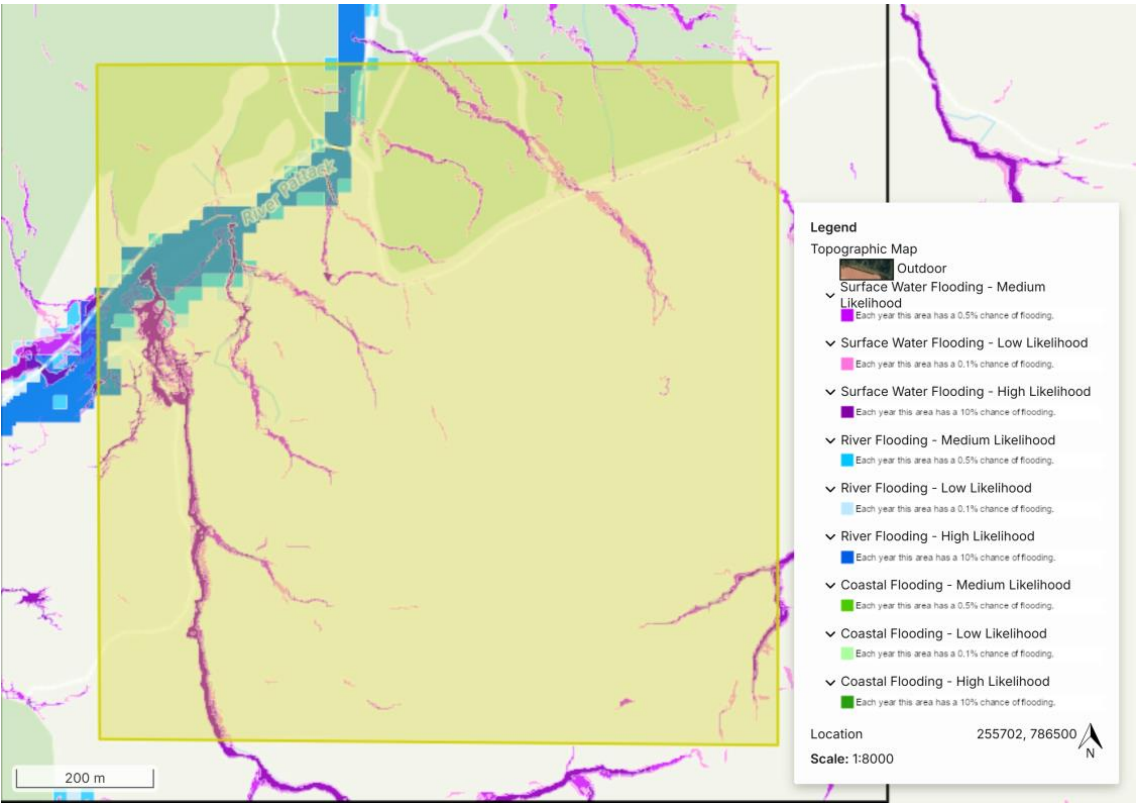
Table 2.17: Flooding RAG Rating

Option	RAG rating
6 (Green)	AMBER
7 (Grey)	AMBER

Development of any option will require further Flood Risk Assessment and suitable surface water runoff management.

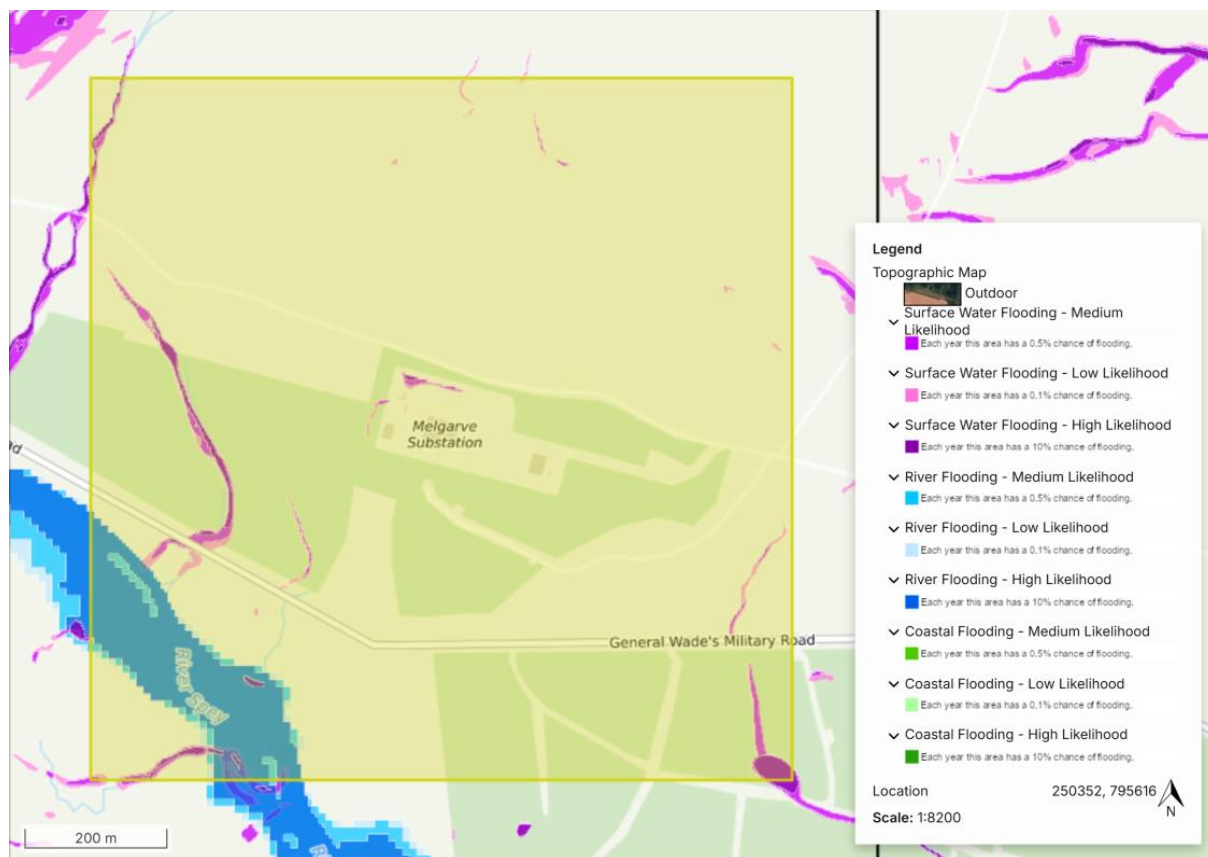
Site drainage system will be provided to manage surface water from and approaching the site. Minimum finished floor levels and minimum flood sensitive infrastructure levels will be set to manage the residual flood risk.

Figure 2.8: Site Option 6 Flooding Map



Source: Scalgo (2025)

Figure 2.9: Site Option 7 Flooding Map



Source: Scalgo (2025)

2.6.4 Carbon Footprint

For Site Option 6, road improvements and new access road are required for substation access. The existing track is approximately 4km long. Significant earthworks are anticipated for flat platform and new access construction.

For Site Option 7, earthworks will be required to create a flat platform, however, the extent is expected to be less than for Site Option 6, as the area North of the HV OHL ranges from 440 m to 380 m above sea level with a maximum gradient of 15.0%. The necessary scale of improvements to the existing access road is currently unconfirmed, but it is anticipated that this track was previously used for AIL deliveries. Additional road improvements may be identified following a swept path analysis (SPA) and site walkover, as the current road condition is unknown.

Table 2.18: Carbon Footprint RAG Rating

Option	RAG rating
6 (Green)	RED
7 (Grey)	RED

2.6.5 SF6

Current AIS circuit breakers use SF6 technology. However, alternatives like Hitachi's EconIQ Live Tank Circuit Breaker LTA 420 kV are becoming available and could be considered. The 400kV PVT proposed as first supply is also available in SF6 free versions like Trech's Clean Air PVT.

Table 2.19: SF6 RAG Rating

Option	RAG rating
6 (Green)	GREEN
7 (Grey)	GREEN

2.6.6 Contaminated Land

Neither site is anticipated to be within contaminated land however further investigation is required to confirm.

Table 2.20: Contaminated Land RAG Rating

Option	RAG rating	Additional Note
6 (Green)	GREEN	Further investigation required
7 (Grey)	GREEN	Further investigation required

2.6.7 Noise

To do a high-level evaluation of noise substation creates the Noise selection screening tool – WP3 Excel Screening Tool has been used. Below are extracts from the tool and map of locations of Sites and relevant Noise receptors considered.

Site Option 6 is identified as “Moderate Impact” which gives it the AMBER rating. Site Option 7 is identified as “PASS” which gives it the GREEN rating.

Figure 2.10: WP3 Screening Tool - Input data

Substation equipment									Receptors							Substation location								
ID No. or name	Type	Rating	One of pair	Cooling	1 at 100% OF&F	2 at 50% ON&N	SWL	With tonal penalty	ID No. or name	Easting	Northing	Area	Noise source nearby?	Background noise	Height (m)	ID No. or name	Easting	Northing	Max SPL (dB(A))	Max excess	Nearest receptor	Distance (m)	Critical receptor	Excess
SGT 1	SGT	400/132	No	OF&F	85.1	86.4	85.1	91.1	NR 1	255302	788916	Very rural	No	20	4	SS 1	259039	789779	24.8	4.8	NR 3	1711.1	NR 3	4.8
SGT 2	SGT	400/132	No	OF&F	87.6	90.1	87.6	93.6	NR 2	257059	790288	Very rural	Yes	30	4	SS 2	256910	789214	28.7	5.2	NR 2	1084.3	NR 1	5.2
					#N/A	#N/A	#N/A	-100.0	NR 3	258704	791457	Very rural	No	20	4	SS 3	253915	790883	27.4	1.7	NR 4	1276.1	NR 1	1.7
					#N/A	#N/A	#N/A	-100.0	NR 4	253483	789890	Very rural	Yes	30	4	SS 4	253543	791543	24.0	1.7	NR 4	1854.8	NR 5	1.7
					#N/A	#N/A	#N/A	-100.0	NR 5	259042	793410	Very rural	No	30	4	SS 5	254341	793764	31.4	11.4	NR 5	785.3	NR 5	11.4
					#N/A	#N/A	#N/A	-100.0							4	SS 6	254262	786523	20.9	0.9	NR 1	2612.0	NR 1	0.9
					#N/A	#N/A	#N/A	-100.0							4	SS 7	250302	795640	13.9	-6.1	NR 5	5238.4	NR 5	-6.1
					#N/A	#N/A	#N/A	-100.0							4									

Source: SSEN Template

Figure 2.11: WP3 Screening Tool - Results

Substation location								
ID No. or name	Easting	Northing	Max SPL	Max excess	Pass?	Nearest receptor	Distance (m)	Critical receptor
SS 1	259039	789779	24.8	4.8	Moderate impact	NR 3	1711	NR 3
0								
SS 2	256910	789214	28.7	5.2	Highly constrained	NR 2	1084	NR 1
SS 3	253915	790883	27.4	1.7	Moderate impact	NR 4	1276	NR 1
SS 4	253543	791543	24.0	1.7	Moderate impact	NR 4	1855	NR 5
SS 5	254341	793764	31.4	11.4	Highly constrained	NR 5	785	NR 5
SS 6	254262	786523	20.9	0.9	Moderate impact	NR 1	2612	NR 1
SS 7	250302	795640	13.9	-6.1	Pass	NR 5	5238	NR 5

Source: SSEN Template

Table 2.21: Noise RAG Rating

Option	RAG rating
6 (Green)	AMBER
7 (Grey)	GREEN

2.7 Construction Access

2.7.1 Substation Access Road (from public road)

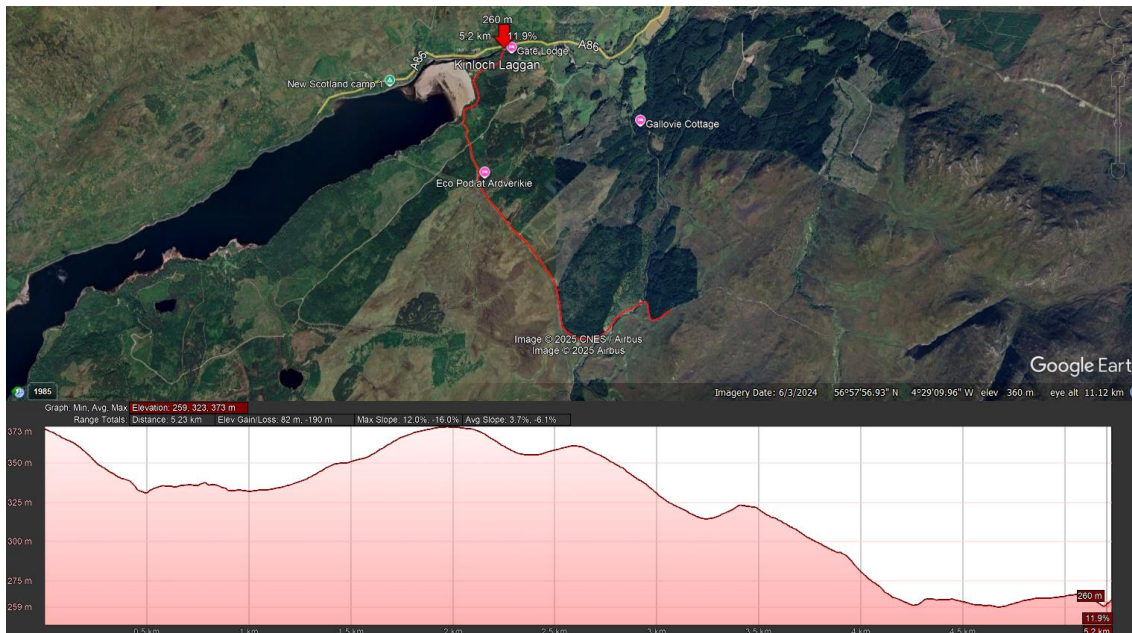
For Site Option 6, approximately 4km of road improvements from the A86 would be required to accommodate construction traffic. An assessment of suitable crossing methods for the River Pattack, Allt a' Mhuilinn, and Allt Meall Each will be necessary to confirm their suitability to carry heavy loads. In addition, LIDAR data from Google Earth indicates a maximum road slope of 12.4%, suggesting that levelling works will be required to enable safe delivery of transformers.

For Site Option 7, The magnitude of the road improvement works for existing access road is unconfirmed, however it is anticipated that the existing track was used for previous AIL delivery, however, additional road improvements may be identified following a Swept Path Analysis (SPA) and site walkover, as the current road condition is unknown. In addition, LIDAR data from Google Earth indicates road slopes exceed 10% at sections along the access road, suggesting that levelling works will be required to enable safe delivery of transformers.

Table 2.22: Substation Access Road RAG Rating

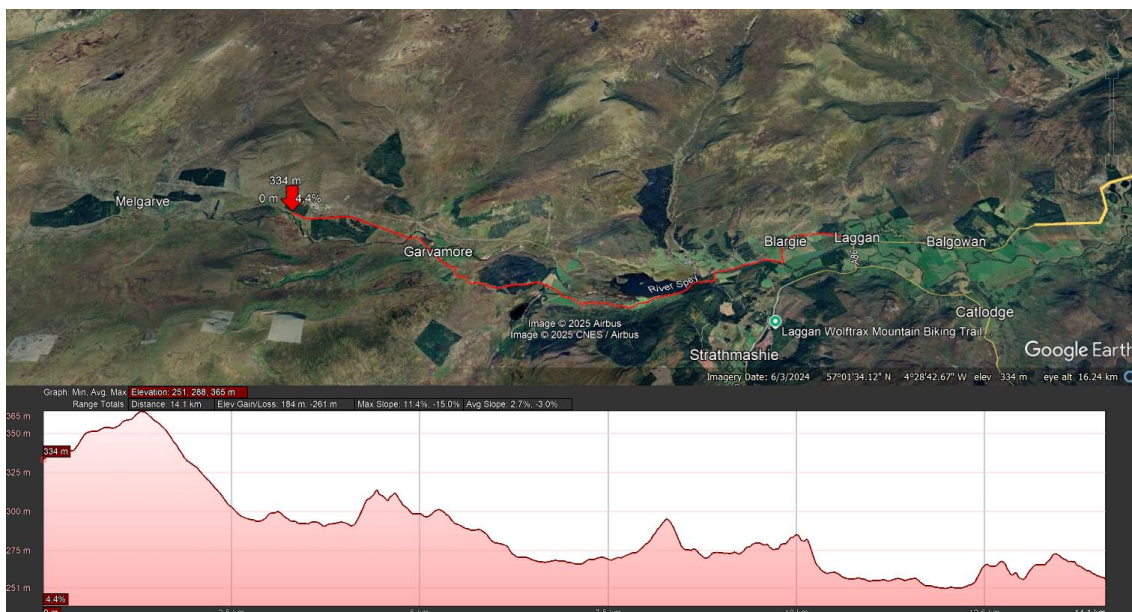
Option	RAG rating	
6 (Green)	RED	Requires Further Survey
7 (Grey)	AMBER	Requires Further Survey

Figure 2.12: Site Option 6 Access Road Profile



Source: Google Earth Pro (2025)

Figure 2.13: Site Option 7 Access Road Profile



Source: Google Earth Pro (2025)

2.7.2 Transformer Delivery Route

For Site Option 6, the site is accessed directly from the A86 via an approximately 4km long single-track road. A watercourse crossing over the River Pattack is located at the entrance off the A86 and will need to be assessed for suitability of heavy vehicle loads. Road improvement works are required to facilitate Abnormal Indivisible Load (AIL) delivery and the magnitude of the works required is TBC with the aid of swept path analysis at a later project stage.

For Site Option 7, the magnitude of the road improvement works for existing access road is unconfirmed; however, it is anticipated that the existing track was used for previous AIL delivery.

However, additional road improvements may be identified following a swept path analysis and site walkover, as the current road condition is unknown.

Table 2.23: Transformer Delivery Route RAG Rating

Option	RAG rating	
6 (Green)	RED	Requires Further Surveys
7 (Grey)	AMBER	Requires Further Surveys

Figure 2.14: A86 Access Road for both Site Options



Source: Google Maps (2025)

Figure 2.15: Single Track Road Entrance for Site Option 6



Source: Google Maps (2025)

Figure 2.16: General Wade’s Military Road for access to Site Option 7



Source: Google Maps (2025)

Figure 2.17: General Wade’s Military Road for access to Site Option 7



Source: Google Maps (2025)

2.8 Operation and Maintenance

2.8.1 Access

Proposed options have been qualitatively assessed based on the access point and associated civil works.

The proposed Site Option 6 is approximately 4km away from A86 road and road improvements are required to facilitate access. Site Option 7 is located 10km away from the nearest A86 road along the Generals Wade military road.

Table 2.24: Operational and Maintenance Access RAG Rating

Option	RAG rating
6 (Green)	RED
7 (Grey)	RED

3 Conclusion

In summary, both Site Options 6 and 7 are characterised by a RED – High Risk rating following engineering appraisal. Site Option 7 is preferred over Site Option 6; however, further surveys, including site visits, are required to confirm the findings of desktop studies.

A summary of RAG Ratings available in Table 3.1 below:

Table 3.1: RAG Rating Summary Table

ID	Engineering Topic	Engineering Criteria	Site Option 6	Site Option 7
1	Connectivity	Existing circuits / network	A	A
		Future development possibilities	R	R
		Interface with SSE	G	G
		Distribution and Generation	G	G
		DNO Connection	G	G
2	Footprint Requirements	Technology	R	R
		Adjacent Land use	R	A
		Space Availability	R	A
3	Hazards	Unique Hazards	R	A
		Existing Utilities	G	A
4	Ground Conditions	Topography	R	R
		Geology	A	A
7	Environmental Conditions	Elevation	R	R
		Salt Pollution	G	G
		Flooding	A	A
		Carbon Footprint	R	R
		SF6	G	G
		Contaminated Land	G	G
		Noise	A	G
8	Construction Access	Substation Access Road (from public road)	R	A
		Transformer Delivery Route	R	A
9	Operation and Maintenance	Access	R	R
Overall			RED - High Risk	RED - High Risk

