Chapter 2: Design Evolution and Alternatives - Contents

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There are no Appendices associated with this Chapter.

2. Design Evolution and Alternatives

2.1 Introduction

2.1.1 In accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, this Chapter outlines the reasons for site selection and provides a description of the environmental and technical factors that have been considered by the Applicant during the site selection and design evolution process for the Proposed Development. These processes have enabled the consideration of reasonable alternatives.

2.1.2 The Proposed Development has evolved through an iterative design process which has been influenced by engineering feasibility design works, economic considerations, environmental survey data and from responses received through the consultation process (see **Chapter 5: Scoping and Consultation**).

2.1.3 A Design and Sustainability Statement has been prepared for the Proposed Development which sets out the principles and design objectives that were aspired to during the design process. The Design and Sustainability Statement is included in **Volume 4, Appendix 3.1.**

2.2 Site Selection

2.2.1 One of the main challenges associated with pumped storage hydro (PSH) is in the identification of a site comprising suitable topography and water availability. There are very few sites within the UK which could be considered to have potential for the development of a technically, economically, and environmentally feasible pumped storage facility of this size. PSH projects are well suited to northern Scotland given its topography and environment, and in order to store 'excess' energy generated from onshore wind farm developments in this region. Beyond this, in general, PSH projects require the following:

- Sufficient land to provide the capacity to realise necessary economies of scale (300 MW minimum);
- Paired water bodies where the lower reservoir has a large enough body of water to avoid excessive changes in the water level, and the upper reservoir has a natural bowl to minimise the capital costs and potential environmental effects of large new dam structures;
- Sufficient vertical distance ('Head') between the two reservoirs (at least 100m, or, ideally more, to minimise costs/Megawatts (MW);
- A short horizontal distance between the two reservoirs (to minimise the capital cost of additional tunnel length).
- Proximity to and capacity within the grid, to allow a grid connection at a viable cost and within a sensible timescale;
- No major geological faults; and
- Good access both to the site and around the site for construction.

2.2.2 These criteria significantly limit the number of viable locations for PSH projects. However, the Loch Kemp Scheme (atypically) meets these requirements. The existing reservoirs being within 1 km of

one another and a minimum head of >160 m support favourable capital expenditure per megawatt (Cap Ex/MW) for energy generation and storage. Short waterways would also allow high round-trip (circulating the entire storage capacity of the upper reservoir) efficiency figures of at least 78%.

2.2.3 The Applicant commissioned an engineering feasibility study (undertaken by Gilkes Energy Ltd) of paired water bodies in the Highlands to identify potentially viable sites for PSH projects. The study identified a number of locations where an upper reservoir (loch) was within 3 km of a lower reservoir, with more than 200 m of Head, and less than 20 km from a 132-275 kV grid connection point. However, a more detailed review of these locations suggested that, even before environmental or landowner factors had been considered, there were a very limited number of potential candidate sites that where financially viable.

2.2.4 These challenges are verified by the fact that, despite the increasingly favourable economic landscape over the last 10 years for renewable deployment (see **Chapter 6: Planning**), no PSH scheme has been built in the UK since 1984 (Dinorwig) and in Scotland since 1969 (Foyers).

2.3 Preliminary Design Considerations

Ness Woods SAC / Easter Ness Forest SSSI

2.3.1 A key design consideration for this site was minimising the impact of the Proposed Development on the Ness Woods Special Area of Conservation (SAC), which is part of the UK National Site Network and is afforded protection under the Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations). The Ness Woods SAC is designated for:

- Tilio-Acerion forests of slopes, screes and ravines (common name: mixed woodland on base-rich soils associated with rocky slopes). This habitat is the primary qualifying feature of the SAC;
- Old sessile oak woods with Ilex and Blechnum in the British Isles (common name: western acidic oak woodland); and
- Otter (Lutra lutra).

2.3.2 The Ness Woods SAC is composed of three Sites of Special Scientific Interest (SSSI); Easter Ness Forest, Inverfarigaig and Glen Tarff SSSIs, which in their own right are afforded legal protection at a national level under the Nature Conservation (Scotland) Act. (2004). The section of the Ness Woods SAC within Dell Estate (and therefore the Site) is part of the Easter Ness Forest SSSI, which is designated for:

- Upland oak woodland; and
- Upland mixed ash woodlands.

2.3.3 The Ness Woods SAC / Easter Ness Woods SSSI within the Site extends along the eastern shoreline of Loch Ness, as shown on **Volume 2, Figure 3.1: Proposed Development**. Both qualifying woodland features associated with the Ness Woods SAC and the Easter Ness Woods SSSI have been classified by NatureScot as being in 'unfavourable condition'. It is considered that the poor condition of the site and its lack of regeneration, is largely influenced by a combination of being heavily grazed by feral goats and deer, and due to the ground flora being dominated by dense bracken. For simplicity, where the Ness Woods SAC is referred to in this Chapter, unless otherwise specified, this would also apply to the Easter Ness Forest SSSI, which occupies the same geographic area within the Site.

2.3.4 Although it is not considered possible to construct the lower reservoir works of the Proposed Development without having direct impacts on Ness Woods SAC, numerous measures have been identified, to minimise the impact of the Proposed Development on the SAC, as summarised in **Section 2.9** of this Chapter. Throughout this process, considerable consultation has taken place with key stakeholders to discuss these mitigation measures, and also to ensure that measures to restore and enhance the Ness Woods within Dell Estate are committed to as part of the Proposed Development.

2.3.5 An assessment of the impacts on the Ness Woods SAC following the implementation of these design measures are assessed in **Chapter 10: Terrestrial Ecology** and the Shadow Habitats Regulation Assessment (HRA) submitted in support of the section 36 application for the Proposed Development. The restoration and enhancement measures proposed for the Ness Woods SAC are described in the Compensatory Measures Package, included in the standalone Derogation Report and also submitted in support of the section 36 application for the Proposed Development.

Annex 1 Habitats

2.3.6 Annex 1 habitats are present in the Site, including blanket bog located adjacent to Loch Kemp in the area proposed for inundation to form the upper reservoir. Although it is not considered possible to avoid impacts on the Annex 1 habitats located within the maximum inundation area, through design, the impact of the Proposed Development on Annex 1 habitats outside of the maximum inundation have been minimised, as described in this Chapter and **Chapter 10: Terrestrial Ecology.**

Peat

2.3.7 Similar to Annex 1 habitats, it is not considered possible to avoid impacts on peat located within the maximum inundation area, although the carbon held in this peat would continue to be captured by these peatlands even once inundated. Measures that have been undertaken to minimise the impact of the Proposed Development on peat outside of the maximum inundation are described in this Chapter and **Chapter 14: Geology, Soils and Water**.

Sensitive Visual Receptors

2.3.8 The Proposed Development is located on the shores of Loch Ness, which is a popular tourist destination. Potential sensitive visual receptors include users of Loch Ness (part of the Caledonian Canal), users of the A82 (a busy tourist road), users of the Great Glen Way (located along the western edge of Loch Ness), and those accessing local summits in the surrounding area (such as Meall Fuar-mhonaidh on the opposite side of Loch Ness from the Proposed Development and the Suidhe Viewpoint off the B862). Measures that have been undertaken to minimise the visual impact of the Proposed Development on sensitive visual receptors are described in this Chapter and **Chapter 8: Landscape and Visual Impact Assessment**.

Migratory Fish

2.3.9 There have been few detailed studies on the potential impact of PSH schemes on migratory fish, such as migratory salmonids. In the absence of this knowledge, it is considered important to design the scheme to minimise any impacts on adult and juvenile migratory fish species, where possible. This is particularly important for the Proposed Development which is located on the opposite side of Loch Ness to the mouth of the River Morison, which forms part of the River Morison SAC, which is designated for freshwater pearl mussel (*Margaritifera margaritifera*) and Atlantic salmon (*Salmo salar*).

2.3.10 Like Ness Woods SAC, the River Moriston SAC is given legal protection at a European level under the Habitats Regulations. Design measures that have been undertaken to minimise the impact of the Proposed Development on migratory fish are described in this Chapter, **Chapter 13: Fish** and the Shadow HRA submitted in support of the section 36 application for the Proposed Development.

2.4 Design Evolution – Upper Reservoir Works

2.4.1 Given the complexity of PSH design, there are many elements of the Proposed Development that are necessarily technically and economically driven in order to achieve a viable project. These include the size and location of the dams, the location of the surge shafts and the tunnelling. However, within these technical and economic parameters, there remain design and environmental opportunities and constraints to be factored in, during the iterative design and EIA process.

2.4.2 The following sections explain how the various above ground elements of the Proposed Development have evolved through the iterative EIA and design process. Construction and operational access associated with the upper reservoir works is covered separately in **Section 2.6.**

Dams and Upper Reservoir

2.4.3 The location and height of the dams is technically driven, determined in part by the amount of water required to be stored within the upper reservoir to provide a scheme with the capacity to offer up to almost 9 GWh of energy storage potential.

2.4.4 In selecting the most appropriate type of dam, a number of factors were considered including technical factors (such as topography, foundation conditions and construction materials), local factors (such as climate, environment and availability of expertise) and economic factors (such as buildability, capital cost and maintenance cost). A summary of each dam type selected for the Proposed Development is provided in **Table 3.1: Preliminary Dam Descriptions** in **Chapter 3: Description of Development.** Generally concrete faced rockfill dams (CFRD) were considered the preferred dam type, as material excavated from the tunnels and shafts could be used to create the rockfill for these dams. However, in some instances a roller compacted concrete (RCC) dam or a hybrid RCC / CFRD dam was considered a more appropriate design solution. Further detail on the decision to choose a RCC or hybrid dam type for Dams 1, 4 and 5, as well as design decisions with respect to Dam 3, are described below.

Dam 1 Design

2.4.5 Dam 1 was initially proposed to be a CFRD, however this dam is located within the Ness Woods SAC. Moving the dam outside the SAC would require moving it a considerable distance into Loch Kemp. This was not considered desirable because it would involve large temporary works to establish a dry location within Loch Kemp to build the dam. This option was considered to have a larger overall impact on the local environment and be more technically complex to construct. A RCC dam, with a much smaller footprint, is therefore proposed to minimise the land take and reduce the impact of the structure on the qualifying habitats of the SAC (by approximately 50%; compared to a CFRD dam).

2.4.6 As the outflow of Loch Kemp into the Allt an t-Sluichd watercourse would be blocked by a dam in this location, Dam 1 has also been designed to allow a compensatory flow to be released into the Allt an t-Sluichd and overflow should the turbines not be available to evacuate flood water from the upper reservoir. The RCC dam has the advantage that compensation and overflow arrangements can be integrated into the main body of the dam. The CFRD would require these to be constructed

on the flanks of the dam further increasing its footprint. Further detail on the management of this watercourse is included in **Chapter 7: Water Management.**

Dam 3 Design

2.4.7 Dam 3 was originally located at a more westerly location, as shown in **Plates 2.6-2.10** and described in **Section 2.8.** However, peat probing determined that the peat at this location was up to 6 m deep in areas. The re-use of this quantity and condition of peat was considered extremely challenging for the project. The location of Dam 3 was therefore moved further east to the current position to avoid this area of exceptionally deep peat as shown in **Plate 2.11: Design Layout by Fichtner (April 2023)**. Consequently, the maximum inundation area of the Proposed Development increased from 122.74 ha to 127.866 ha.

2.4.8 Dam 3 is the largest dam and would also be the most visible from visitors and residents on Dell Estate, as well as for users of the recognised recreational routes located to the east of the Development Area. Dam 3 would be a CFRD dam. The dry side of the dam would be landscaped to reduce the steepness of the slope, using material excavated from the tunnels and shafts, and then soiled and planted to help mitigate the visual impact of the dam. Further detail is provided in **Chapter 8: Landscape and Visual Impact Assessment.** A visualisation of the landscaping 10-years post construction is included in **Volume 3a, Figure V3a-3g - Visualisation Location 3: Core Path IN25.01 near Whitebridge - Photomontage - Year 10 post completion** and **Volume 3b, Figure V3b-3n - Visualisation Location 3: Core Path IN25.01 near Whitebridge - Photomontage - Year 10 post completion.**

Dam 4 Design

2.4.9 Dam 4 is required to avoid inundation of the neighbouring land at the maximum inundation level. Dam 4 was initially proposed to be a CFRD but was changed to a RCC dam due to the additional structural stability required due to the potential impounding on both sides of the dam from the upstream burn entering Loch Kemp This would result in a small area of catchment uphill (i.e. on the 'dry side' of Dam 4) and it is anticipated that a small pond area would accumulate on the uphill face of the dam. For this reason a RCC dam is required with the structural stability to withstand water pressure on both sides. The accumulated water would be syphoned or pumped into Loch Kemp at intervals before being turbined down to Loch Ness.

Dam 5 Design

2.4.10 Dam 5 is the only L-shaped dam proposed. The shape of the dam has been designed primarily to avoid an area of deep peat located immediately west of the dam location. Dam 5 is proposed to be a hybrid RCC / CFRD dam design, to utilise the stability of RCC style dams given the more complex right-angled structure, ensure waterproofing of the joint between RCC and CFRD elements, and to minimise footprint of the dam to reduce impacts on deep peat.

Inlet/Outlet Structure Design

2.4.11 The location of the Inlet/Outlet structure on Loch Kemp has been chosen to minimise the length of the waterways connecting the loch to the powerhouse and found the structure in suitable geology. To avoid entraining air into the waterways, the structure must be located well beneath loch surface level, requiring an excavation on the shores of Loch Kemp. The structure is also sized to achieve SEPA best practice guidance on approach velocities to minimise impact on fish within Loch Kemp. Impact on Loch Kemp during construction would be managed by the installation of a temporary cofferdam.

Borrow Pits

2.4.12 To facilitate early access to the upper and lower reservoir works, site access tracks would be constructed using locally won graded rock extracted from borrow pits located within the Site as much as possible. Where feasible, borrow pit sites are identified within the maximum inundation area to reduce the temporary land take of the Proposed Development, although at least one borrow pit would be required near the proposed site access junction with the B862 to enable the construction of the initial length of access track into the site. Initially ten potential borrow pit sites were identified following a desk based study, however, following further assessment (see **Volume 4, Appendix 3.5: Draft Borrow Pit Screening Assessment**), three borrow pit locations were discounted from further consideration as ground conditions were not considered suitable in these locations.

Surge Shafts

2.4.13 There is the potential requirement for two surge shafts. The location of the surge shafts is technically driven; the optimum location being on the hillside between Loch Kemp and Loch Ness. The location must have sufficient elevation to avoid overtopping of water during operation which restricts the location to only a few options. The access tracks to the surge shafts were carefully aligned to avoid any areas of deep peat and minimise visual impact from receptors across Loch Ness.

2.5 Design Evolution – Lower Reservoir Works

2.5.1 The lower reservoir works at Loch Ness comprise all works associated with the lower reservoir, including the surface powerhouse building, quayside and pier, access tunnel portals, and the lower control works (as shown in **Volume 2, Figure 3.1: Proposed Development**). Construction and operational access associated with the lower reservoir works is covered separately in **Section 2.6.**

Type of Powerhouse

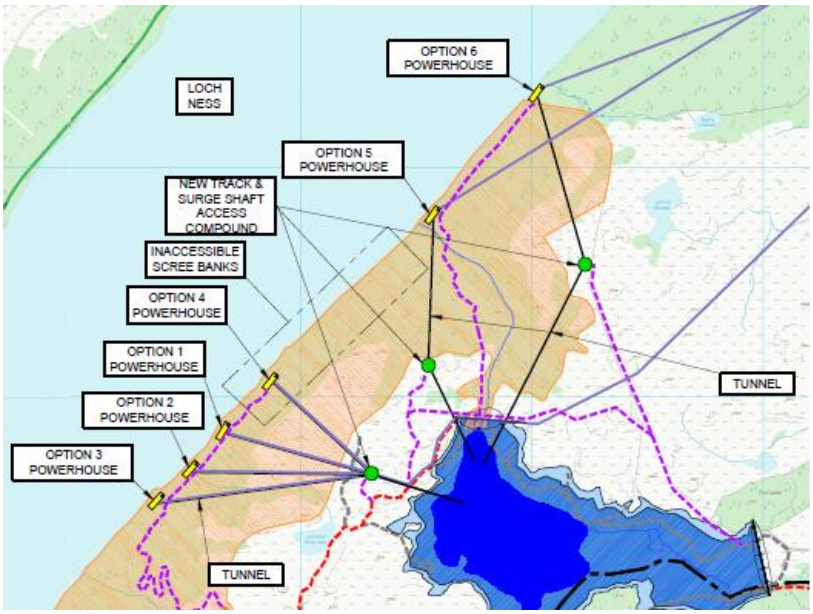
2.5.2 The use of a cavern for the powerhouse which, in theory, could reduce the land take within the Ness Woods SAC by approximately 0.5 ha compared to a shaft type powerhouse (by locating the powerhouse underground) was considered. However, it was not considered to be economically viable and therefore a shaft type powerhouse has been taken forward as part of the Proposed Development.

Powerhouse Site Selection Exercise

2.5.3 The lower reservoir works need to be situated on the shore of the lower reservoir (Loch Ness), whilst minimising the distance from the upper reservoir (Loch Kemp). The bedrock must also be suitable for the excavation of the powerhouse shafts and the tunnel works. In the case of the Proposed Development, the impact of the lower reservoir works (and associated access) on the Ness Woods SAC also needed to be minimised as far as practical.

2.5.4 Given the above, the location of the lower reservoir works is highly restricted and largely technically and economically driven. However, an early optioneering appraisal was undertaken for the powerhouse building in January 2022, along a 2.5 km section of the eastern shoreline of Loch Ness within Dell Estate, downslope from Loch Kemp. This appraisal considered six powerhouse locations as shown in **Plate 2.1** below.

Plate 2.1: Powerhouse Site Options



2.5.5 For the purposes of this appraisal, it was assumed that the shaft type powerhouse building would be approximately 100 m in length and would consist of two vertical shafts, below ground, excavated into the bedrock. As illustrated on **Plate 2.1,** no site options were included between Option 4 and Option 5 due to the extremely steep topography along this section of shoreline, which would be unsuitable for the construction of the powerhouse building. This appraisal was informed by desk studies and site visits undertaken by the project engineers and the project ecologist.

2.5.6 Following the appraisal of the six site options, Site Option 2 was considered the preferred location for the powerhouse, given that this area was a sufficient size to construct the proposed platform and shaft arrangement and the impact on the Ness Woods SAC from the access track would be reduced compared to other options. This location also allowed for a shorter waterway connection to Loch Kemp than most alternative options. Site Option 2 was therefore taken forward for further consideration.

Powerhouse Building Design

2.5.7 The Site is located within the designated Loch Ness and Duntelchaig Special Landscape Area (SLA). The SLA is characterised by the vast linear feature of Loch Ness and its dramatic landform. Loch Ness is edged on both sides by steep wooded slopes that lead to moorland ridges and the contrasting interior plateau comprising upland inland lochs, small woods and craggy outcrops.

2.5.8 The challenge of how to design a sizeable building in a large scale landscape that is generally viewed from a distance has to be carefully considered. During the design process, an initial concept of a 'broken façade' inspired by the landscape developed into a feasible elevational approach, resulting in a design that incorporated a strong horizontal basecourse, with wide vertical and diagonal lines and planes breaking the roof line behind to blur the defined mass of the cuboidal edge. The design of the powerhouse was developed in discussion with the key stakeholders at two design workshops, as described in **Chapter 5: Scoping and Consultation**. Further details on the design evolution of the powerhouse building are provided in **Volume 4, Appendix 3.1: Design and Sustainability Statement.**

Tailrace Design

2.5.9 The location of the tailrace structure on Loch Ness is chosen to achieve hydraulic requirements imposed by the pump/turbine units and to found the structure in suitable geology. To avoid entraining air into the waterways the structure must be located well beneath loch surface level requiring an excavation on the shores of Loch Ness. The structure is also sized to achieve SEPA best **p**ractice guidance on approach velocities to minimise impact on fish within Loch Ness. Screening is also provided in accordance with best practice guidance to avoid fish entrainment while abstracting water (see **Section 13.7** of **Chapter 13: Fish** for further details). To minimise the footprint of the structure a curved structure has been considered, to provide the maximum surface area for flow distribution through intake screens. Impact on Loch Ness during construction would be managed by the installation of a temporary cofferdam.

Lower Reservoir Works Landscaping

2.5.10 Following construction, areas of temporary hardstanding around the perimeter of the powerhouse building would be replaced with mitigation landform and native woodland planting, as illustrated in **Volume 2, Figure 3.5: Indicative Layout of Lower Reservoir Works - During Operation**. The strategic placement of soils and planting with native woodland and scrub understorey species, reflective of those within the surrounding landscape, would be used to enhance the setting of the powerhouse. In addition to this, in order to soften the appearance of the rock cuts, mounding of stored soils would be placed at the base of the cuttings, supplemented by planting and the encouragement of vegetation regeneration on cutting 'benches', where possible. These landscaping works are described and illustrated in **Volume 4, Appendix 3.1: Design and Sustainability Statement**, as well being illustrated in **Volume 2, Figure 3.5: Indicative Layout of Lower Reservoir Works - During Operation**, **Volume 3a, Figure V3a-1g - Visualisation Location 1: In the vicinity of the A82 north of Invermoriston - Photomontage - Year 10 post completion Photomontage - Year 10 post completion** and **Volume 3b, Figure V3b-1n - Visualisation Location 1: In the vicinity of the A82 north of Invermoriston - Photomontage - Year 10 post completion.**

2.6 Design Evolution – Access Tracks

2.6.1 Construction and operational tracks would be required for accessing the upper reservoir works and lower reservoir works. The preference for providing access within the Site is to first utilise the existing estate tracks where practicable, some of which would require upgrading. There would also be a requirement for the creation of new tracks. This section describes the alternative access options considered for each element of the works.

Access to Upper Reservoir Works

2.6.2 Access to the upper reservoir works would be taken off a new junction from the B862 to the south of Whitebridge. The main estate access track, taken from a junction with the B862 to the north of Whitebridge, which passes several properties on the estate would not be utilised by construction traffic. A high-level appraisal was undertaken to determine a safe and suitable option for access into the site from the B862 to the south of Whitebridge, as described in **paragraphs 2.6.6-2.6.8**.

2.6.3 Use of existing forestry tracks within the Whitebridge Plantation and around Loch Kemp would be utilised as far as practical. Existing tracks would require widening to approximately 8 m during construction, and would require the removal of some coniferous forestry. Following construction, tracks would be reinstated to a width of approximately 4 m to facilitate operational and maintenance activities.

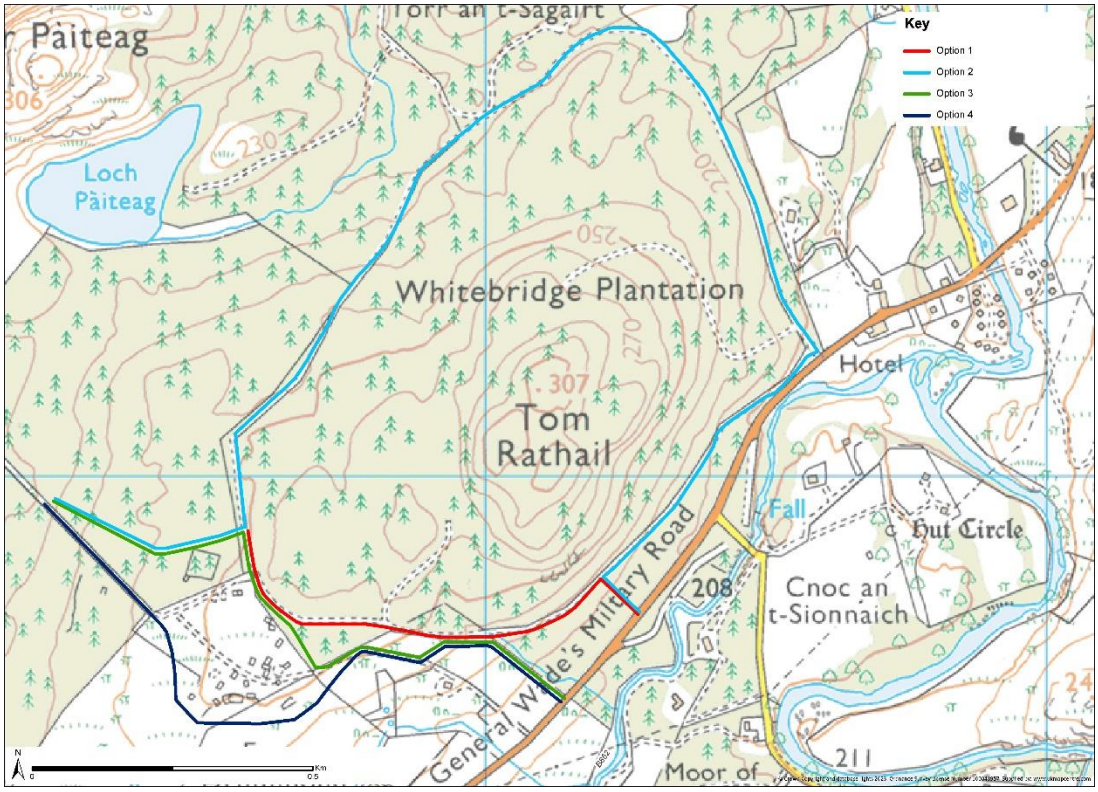
2.6.4 New access tracks would also be required around Loch Kemp to access the upper reservoir works, including the dams, the inlet/outlet structure, borrow pits, the cable shaft and the surge shafts. As some of the existing estate access tracks would be lost to the inundation area of the upper reservoir, new access tracks would be provided around Loch Kemp to replace these, to enable access for maintenance purposes and for ongoing Estate activities around the inundated area. New tracks would be constructed at approximately 8 m wide and reduced to approximately 4 m wide for operational and maintenance activities, with the exception of tracks that are being constructed predominantly for operational use (to replace the tracks that would be lost to the inundation area), which would be constructed and retained at 4 m wide.

2.6.5 The access tracks around the upper reservoir works have been through a number of design and alignment iterations throughout the design process, in discussion with key consultees. The key constraints have included avoidance of deep peat, avoidance of Annex 1 habitats (including blanket bog), avoidance of cultural heritage features and proximity to watercourses. Further details are provided in **Section 2.7.**

Access Junction Options

2.6.6 Four options were considered for a new junction into the Site from the B862 to the south of Whitebridge and the associated track to the upper reservoir works, as illustrated in **Plate 2.2** below:

Plate 2.2: Site Access Junction Options



2.6.7 The access junction options appraisal was informed by desk studies and site visits undertaken by the project engineers, the project archaeologist and the project ecologist. The access options identified were as follows:

- **Option 1**– Access would be taken from a new junction from the B862 leading into the Whitebridge Plantation on Dell Estate. From the new junction, the access track would be routed in a northwest direction until it connects to an existing estate forestry track, which it would follow the tracks in a westerly direction. A new access track would diverge from the access track at a location to the south of Loch Paiteag, leading to the proposed location of the main site welfare compound before connecting to the existing estate tracks, to reach the upper reservoir works. Option 1 would be the shortest route and would largely follow an existing access track, although this section of track is overgrown and would require upgrading, which would involve the felling of mature Scots Pine.
- **Option 2** – The new junction would be located at the same location as Option 1 but would initially follow the existing forestry track in an easterly direction, before circling around the Whitebridge Plantation to connect to the same point of divergence as Option 1, where a new track would be constructed to the location of the main site welfare compound and onwards to connect to the existing estate tracks, to reach the upper reservoir works. Option 2 would be the longest route, but it would largely follow an existing access track which is in good condition. However, widening this track to 8 m for the construction of the Proposed Development would require substantial felling of commercial forestry within the plantation, particularly as the wind firm edge of the forestry block would be lost.
- **Option 3** - Access would be taken from a new junction from the B862 located slightly further south than the junction proposed for Options 1 and 2. This junction would be located on land owned by the property at Easter Drummond. It would follow the site boundary between Dell Estate and Easter Drummond before entering the Whitebridge plantation to connect to the same point of divergence as Option 1, where a new track would be constructed to the location of the main site welfare compound and onwards to connect to the existing estate tracks, to reach the upper reservoir works. This option would limit felling but would bring the main site access very close to the property at Easter Drummond.
- **Option 4** – This option would initially follow the same route as Option 4 from the proposed junction with the B862 but would continue further westwards instead of diverging into the Whitebridge Plantation. It would then be routed around the Easter Drummond township archaeological feature (MHG2643) before entering the Whitebridge plantation at a more northerly location near the location of the main site welfare compound before continuing onwards to the existing estate tracks, to reach the upper reservoir works. As with Option 3 this option would limit felling but would bring the main site access very close to the property at Easter Drummond. Although site track has been routed around the Easter Drummond township, uncovering buried or unrecorded archaeology would remain a possibility at this site.

2.6.8 On balance, it was determined by the project team Option 1 was the preferred access option from the B862 into the Site to reach the upper reservoir works.

Access to Lower Reservoir Works

2.6.9 It was recognised that providing access to the lower reservoir works would be challenging, as these works are situated on the eastern shoreline of Loch Ness, with the loch to the west and steep slopes to the east. There are no roads located in the vicinity of the lower reservoir works, however, a 4x4 track is currently routed down to the Loch Ness shoreline from Dell Estate. The lower reservoir works are located in the Ness Woods SAC, so measures to reduce land take within this designated site as far as possible is a key consideration.

2.6.10 In addition to the above ground works at the lower reservoir area, excavation of most of the underground works would commence at the lower reservoir works on the shore of Loch Ness, with

the majority of excavated spoil being removed via tunnel portals. It is anticipated that the spoil generated at the lower reservoir works, would be reused on site, in the vicinity of the upper works. The transportation of excavated spoil material from the lower works to the upper works is therefore a key consideration in the development of the access to the lower works.

Options Considered for Access to Lower Reservoir Works

2.6.11 Several options have been considered for access to the lower reservoir works, as set out in this section.

Use of Existing Estate 4x4 Track

2.6.12 This option would involve using the existing estate 4x4 track to access the lower reservoir works.

2.6.13 In its current form, this existing track has a gradient of 1 to 3 in places (33%) and is only suitable for occasional 4x4 use. The Health and Safety Executive's Control of Major Accident Hazards (HSE COMAH) guidance for roadways and site traffic[1] states that gradients should not exceed a maximum of 1 in 12 (8.33%). While a 10% gradient is considered to be acceptable for the plant, equipment and HGVs that would use the access track in this case, it should not be exceeded for safety reasons (with contractors raising concerns over access and haul roads with 12% gradients). A further constraint is at "corners" where the turning capabilities of construction vehicles and articulated HGVs is limited, requiring a minimum corner radius of 15 m.

2.6.14 Widening the existing track would not provide suitable construction access, as its gradient would be too steep. Even with upgrades, this existing track would still have a +12% gradient and both safety and manoeuvrability would be compromised. Therefore, use of the existing track, even if upgraded, is not a technically feasible option for access to the lower reservoir works.

New Access Track between Lower Reservoir Works and Upper Reservoir Works

2.6.15 This option would involve the construction of a new access track between the upper and lower reservoir works, which would increase the land take within the Ness Woods SAC compared to other options considered. Due to the steep topography in this area, a new access track would need to include several hairpin bends in order to not exceed a 10% gradient, which is deemed safe for the plant, equipment and HGVs that would use the access track during construction.

Barge Shuttle and Public Roads

2.6.16 This option would involve establishing a compound off the A82 and using a barge shuttle across Loch Ness. The existing estate track leading to the shores of Loch Ness would be upgraded and used by 4x4s rather than creating a new access track within the Ness Woods SAC.

2.6.17 In terms of its technical feasibility, this option would introduce logistical challenges regarding storage and double handling of spoil, and would potentially add a considerable increase to the overall construction programme. The use of a barge shuttle service across Loch Ness to the A82 would also have significant water borne traffic implications on Loch Ness. There would also be road haulage traffic implications on the A82 and B862, by adding a significant number of HGV movements to the wider area, most of which would be associated with the >500,000 m^3 of excavated rock from

[1] Available at: https://www.hse.gov.uk/comah/sragtech/techmeastraffic.htm[Last Accessed 12/11/23]

the tunnels and forming the powerhouse platform that would need to be transported by road, through the village of Fort Augustus, to the upper reservoir area to be reused in rockfill dam structures. Or, if a suitable local use for the spoil could be found, considerable additional borrow pits would be required within the Site, for construction of the eight dam structures and associated tracks.

2.6.18 In addition, a suitable vehicular access track would still be required during the operational phase of the Proposed Development to provide direct access to the powerhouse building for emergency services' vehicles (such as fire engines) and as an evacuation route in the event of an emergency. Hence, the potential benefit of this alternative would not actually be realised.

2.6.19 The increased costs associated with the delay to the programme for this option, on top of other committed costs, would be prohibitive and render the scheme not financially viable.

Underground Access Tunnel

2.6.20 This option would involve constructing an underground access tunnel from outwith the Ness Woods SAC to the powerhouse building for use in both the construction and operational phases of the Proposed Development. Access to the lower reservoir works would be via a roadway that would run through the tunnel, removing the footprint of the access track from the SAC. The tunnel would need to ramp down from an elevation of 180 m AOD to 20 m AOD, which would require a minimum distance of approximately 1.6 km to achieve a safe gradient for vehicle movements (of less than 10%).

2.6.21 In terms of the impact of this option on project feasibility overall, the tunnel is estimated to require approximately two years to construct and, because it would be required for access to commence excavation of the powerhouse shafts and waterways, it would need to be completed before the main works could commence. This would have the effect of increasing the construction schedule to over six and a half years. Underground works also have a higher risk profile in terms of unforeseen delays and cost overruns. Any issues with the tunnelling would directly impact on the overall construction schedule and budget of the Proposed Development, with little scope for mitigation due its position on the critical path.

2.6.22 The significant volume of additional excavated rock spoil from the construction of an access tunnel, would also generate a surplus in the mass balance of the Proposed Development and the additional rock would require barging or trucking off-site for disposal, with implications outside of the Proposed Development area.

2.6.23 In terms of financial feasibility, the increased costs associated with constructing a 6 m tunnel of this length would be prohibitive on top of other committed costs, threatening the viability of the Proposed Development.

Tunnel Spoil Conveyor System

2.6.24 This option would involve the use of a conveyor system along the route of the existing estate track leading to the eastern shore of Loch Ness, to transport the tunnel spoil from the lower reservoir works to the upper reservoir works. It is estimated that this option would reduce the land take in the Ness Woods SAC by approximately 1 ha. However, even if the conveyor system dealt with the transportation of spoil material from the lower to upper reservoir works, the existing 4x4 estate access track (even if upgraded), would not be suitable for other construction vehicles to access the lower reservoir works or for emergency vehicle access to the powerhouse building. Hence, this

option was not considered technically feasible in isolation, as a new access track to the lower reservoir works would still be required.

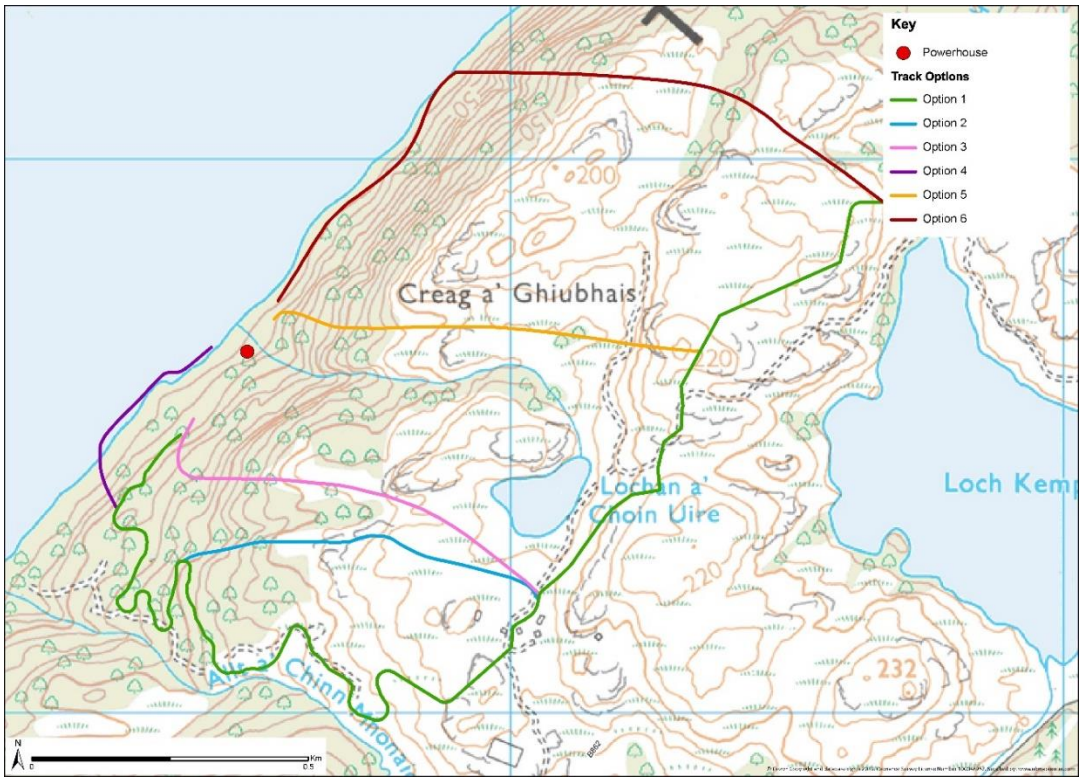
Preferred Option for Access to Lower Reservoir Works

2.6.25 On balance, it was determined by the project team that of the options considered for access between the lower and upper reservoir works, the construction of a new access was the only feasible option, although opportunities to incorporate sections of the existing 4x4 access track would be identified where practical. The creation of a new access track would increase the land take within the Ness Woods SAC compared to other options considered but the access track route would be optimised to minimise this land take as far as possible.

Track Route Selection

2.6.26 An appraisal was undertaken in January 2022 to determine the preferred access track route to the preferred powerhouse site from the upper reservoir works. This appraisal was informed by desk studies and site visits undertaken by the project engineers and the project ecologist. Six track options were considered, as illustrated on **Plate 2.3: Access Track Options to Lower Reservoir Works**.

Plate 2.3: Access Track Options to Lower Reservoir



2.6.27 Following the appraisal of the six access track options leading to the preferred powerhouse site, Track Option 1 was identified as the preferred track option and was taken forward post scoping.

2.6.28 However, during 2023, various further design iterations were made to the access track to the lower reservoir works to avoid qualifying habitat of the Ness Wood SAC, to reduce overall tree loss and to

increase the distance between the access track and watercourses. Further details are provided in **Sections 2.8 and 2.9.** Some of the key design changes that were made to the access track within the Ness Woods SAC to reduce the impact on this designated site are described below.

Design Measures to Reduce Impacts of the Access Track on the Ness Woods SAC

2.6.29 It is proposed that most access tracks that would be constructed or upgraded for the Proposed Development would have a running width of 8 m during construction. However, within the Ness Woods SAC, the access track would have a running width of approximately 6 m on straight sections and 7 m on bends. Further details are provided in **Section 3.5** of **Chapter 3: Description of Development.** A tight working corridor has also been applied to the access track within the Ness Woods SAC, with only a 3 m working area proposed around the maximum extent of the access track[2]. No site compounds are proposed within the Ness Woods SAC outside of the footprint of the powerhouse platform, to avoid additional land take in the SAC.

2.6.30 To accommodate the reduced running width of the access track within the Ness Woods SAC, it is proposed to transport some of the larger pieces of plant and equipment associated with the lower reservoir works (such as Electrical and Mechanical (E&M) equipment) from Loch Ness by barge, either from Corpach or Inverness (via the Caledonian Canal). For the purposes of the EIA Report, delivery of the larger items to the lower reservoir works are assumed to be via Loch Ness.

2.7 Switching Station and Grid Connection

2.7.1 In order to connect the Proposed Development to the National Grid, a switching station is required which demarcates the ownership boundary of the connection between the operator of the Proposed Development to Scottish and Southern Electricity Networks (SSEN Transmission). The switching station would contain conductors to connect the incoming and outgoing circuits. As it forms the barrier of ownership between the Proposed Development and the transmission operator certain equipment is required. There would be circuit breakers and disconnectors which would isolate the outgoing circuit in the event of a fault or maintenance being required. Metering would also be installed to measure the amount of energy imported or exported by the switching station for the purposes of billing. Protection relays would also be included, which would detect any faults on the circuit and operate the circuit breakers to isolate the line.

2.7.2 Initially the proposal was to construct a 275 kilovolt (kV) gas insulated switchgear (GIS) switching station as part of the lower reservoir works, next to the powerhouse building. Under this proposal, the exterior of the main switching station building would have been designed to mirror the exterior of the powerhouse building and would form part of the Proposed Development.

2.7.3 The inclusion of the switching station as part of the lower reservoir works led to an exercise to consider how the grid connection could be routed away from the switching station, up or along the steep slopes of the eastern shoreline of Loch Ness, whilst minimising further impacts to the Ness Woods SAC. Although the grid connection does not from part of the Proposed Development and would be the responsibility of SSEN Transmission to consent, the Applicant understands that the Proposed Development could not be constructed if the associated grid connection is not consented due to additional impacts on the Ness Woods SAC or is not considered technically feasible to

[2] The maximum extent of the access track includes the track running surface, safety barrier, track drainage and cut and fill requirements so would be wider than the 6-7 m running surface.

construct due to the challenging terrain surrounding the lower reservoir works. An exercise was undertaken to understand whether the grid connection would lead to any additional impacts on the Ness Woods SAC, and to identify means of avoiding or reducing these impacts, and to determine the most technically feasible means of delivering the grid connection from the lower reservoir works.

Grid Connections Options within the Ness Woods SAC

2.7.4 This section describes the options that were considered to create a grid connection from the lower reservoir works to a location outside to the Ness Woods SAC.

Underground Cable

2.7.5 A buried cable from the proposed switching station at the lower reservoir works to a location outwith the Ness Woods SAC would be technically challenging due to the width of corridor required for cables and steep hillside gradient but would reduce any long-term impacts on sensitive visual receptors in the surrounding area. However, this would lead to approximately 3-4 ha of additional land take within the SAC, depending on the cable route selected.

Underground Cable under the Access Track

2.7.6 An alternative cable option was considered to avoid further impacts on the Ness Woods SAC that involved routeing the cable underneath the proposed new access track to the lower reservoir works. This option would be challenging but technically feasible and could theoretically reduce the land take in the Ness Woods SAC by up to 1.98 ha compared to a buried cable outwith the access track footprint. However, there would be a requirement to widen the track route to achieve this. The proposed track would also have extremely tight hairpin bends. It would therefore not be technically feasible to route a cable around the tight radius of these bends and the cable route would either need to 'cut corners' or be extended beyond the outer radius of the track, which would lead to additional land take within the Ness Woods SAC. This means that a reduction in land take within the Ness Woods SAC would not be realised. Laying the cable under the access track would also be very disruptive during the construction phase when the track would be in constant use by vehicles travelling between upper and lower reservoirs. This would result in an extension of the project construction programme within the Ness Woods SAC. It would also present issues during the operation phase where the track would need to be excavated for maintenance, making access to the powerhouse building for operations staff challenging.

Overhead Line

2.7.7 Connecting to the grid via an overhead line (OHL) would be challenging but technically feasible and could reduce the land take in the Ness Woods SAC by up to 2.7 ha compared to a buried cable.

2.7.8 A potential OHL route was identified, which could transport a 275 kV grid connection from the proposed switching station at the lower reservoir works to a location outwith the Ness Woods SAC, with only one steel lattice tower located within the SAC boundary, as shown indicatively in **Plate 2.4**. The location of the tower within the SAC was based on span length. Whilst the standard maximum span between 275 kV steel lattice tower could be up to approximately 350 m, the steep height increase between the lower and upper reservoir works would mean that the maximum span length would be approximately 270 m. The shortest distance between the proposed switching station location and the boundary of the SAC would be 368 m, meaning at least one steel lattice tower would be required within the Ness Woods SAC.

Plate 2.4: Indicative OHL Route from the Lower Reservoir Works out of the Ness Woods SAC

2.7.9 Although the tower would need to be located within the Ness Woods SAC, it could be positioned in an area with a scarcity of trees. A temporary access track to the tower location could also potentially be routed to avoid the felling of trees. However, the area below the OHL would likely require a wayleave cut, or tree pruning, leading to further adverse impacts on the Ness Woods SAC. An OHL option would also be visible from several sensitive receptors, including Loch Ness, the A82, the Great and Glen Way.

Sub-loch Cable

2.7.10 Laying a sub-loch cable from the lower reservoir works through Loch Ness, would result in no additional land take within the Ness Woods SAC from the grid connection, assuming the cable would resurface at a location outside of the SAC. However, this option was not considered technically feasible to achieve due to the significant depth of Loch Ness (>200 m), access restrictions (including issues associated with accessibility for the marine cable installation equipment), and the high risk of delay to project delivery.

Underground Tunnel

2.7.11 A further option that was considered involved routeing the 275 kV cable through the access tunnel, then creating a spur from this tunnel so the cable can exit the tunnel system through a cable shaft located outside the Ness Woods SAC. This option would be technically feasible and would avoid any additional land take within the SAC. It would also be unlikely to result in any significant effects on sensitive visual receptors in the surrounding area. However, it would add circa £10 M of costs to the Proposed Development, thereby reducing viability.

Conclusion

2.7.12 Following the consideration of options identified for a grid connection from the lower reservoir works to a location outwith the Ness Woods SAC, routeing a 275 kV cable through the access tunnel and through a vertical cable shaft located outside the Ness Woods SAC was considered the only technically feasible option that would result in no additional land take within the SAC. This option

was therefore taken forward as the preferred cable option, despite the significant additional cost to the project.

Switching Station Site Selection Exercise

2.7.13 Following the identification of the routeing of a cable through the access tunnel and through a vertical cable shaft located outside the Ness Woods SAC, it was advised by SSEN Transmission that their internal health and safety policies prevent them from owning and/or operating a cable enclosed within a tunnel. The Applicant would therefore need to install and operate the cable within the tunnel. Consequently, the location of the switching station location, where the ownership of the connection would 'switch' from the operator of the Proposed Development to SSEN Transmission, would need to be relocated to the upper reservoir works, so it would connect to the cable after it exited the tunnel via a vertical cable shaft. For the purposes of site selection and assessment an air insulated switchgear (AIS) switching station design has been considered for most site options following advice from SSEN Transmission on their likely requirements. An AIS switching station would also require a larger footprint than a gas insulated switchgear (GIS) switching station, so better represents a worst-case scenario situation for the purposes of the assessment.

2.7.14 A positive of moving the switching station from the lower to upper reservoir works is that the footprint of the powerhouse platform could be further optimised, leading to a reduction of the land take of the Proposed Development within the Ness Woods SAC. However, a suitable location for the switching station needed to be identified.

2.7.15 It was agreed with SSEN Transmission that the Applicant would consent and construct the platform for the switching station at the upper reservoir works. The Applicant therefore completed a site selection exercise to identify a suitable location for the switching station platform, based on the standard dimensions of a SSEN Transmission AIS switching station, advised to be approximately 110 m x 70 m, with switching gear being up to 11 m in height. The eight switching station options considered in this appraisal are described below and illustrated in **Volume 2, Figure 2.1: Switching Station Site Selection**. This appraisal was informed by desk studies, existing habitat data, a peat probing exercise, input from the project's architect and landscape architect and site visits undertaken by the project engineers, project forestry consultant and project ecologist.

- **Switching Station Site Option 1 –** This site would be located immediately adjacent to the proposed location of the vertical cable shaft, minimising the cable length required between the cable shaft and the switching station. However, only a GIS style switching station could be accommodated at this site, as the footprint of an AIS style switching station would be too large. SSEN have advised that a GIS switching station would not be in line with their internal policies on the use of greenhouse gases in their infrastructure. This site would also be highly visible from sensitive receptors on the opposite side of Loch Ness, such as the Great Glen Way and the summit of Meall Fuar-mhonaidh. An extensive excavation was considered to reduce the platform level of a switching station at this location, to reduce its visibility from these receptors. However, such an excavation would generate spoil requiring relocation elsewhere on the site and could result in drainage issues, which would be challenging to deal with without impacting the Ness Woods SAC, which is located immediately downslope of this site.
- **Switching Station Site Option 2 –** A switching station in this location could potentially result in the loss of blanket bog habitat. However, with a small modification to the northern corner this could be avoided, as illustrated in **Volume 2, Figure 2.1: Switching Station Site Selection**. However, the site would be located with 30 m of the Lochan a'Choin Uire watercourse. An 0.1 km underground cable would be required between the cable shaft and the switching station

and the switching station, although this could be routed underneath the access track leading to the cable shaft.

- **Switching Station Site Option 3 -** A switching station in this location would be well screened both from the Estate properties and tracks and from sensitive receptors on the opposite side of Loch Ness. However, regardless of the orientation of the platform, the site would be partially located within the Ness Woods SAC, albeit in an area with very little woodland cover. An 0.3 km underground cable would be required between the cable shaft and the switching station and the switching station. Due to its location an additional section of access track would be required, however the cables could be routed underneath to reduce additional impact.
- **Switching Station Site Option 4 -** A switching station at this location would be constructed in an area that would be used as a laydown area during construction, so it would minimise additional land take. However, to avoid deep peat in this area, a substation excavation into the hillside would be required, which could lead to the switching station becoming visible from sensitive receptors on the opposite side of Loch Ness, such as the Great Glen Way and the summit of Meall Fuar-mhonaidh. It would also be highly visible from the estate tracks and the estate fishing lodge, including across Loch Kemp. An 0.6 km underground cable would be required between the cable shaft and the switching station, although this could be routed underneath the access track. The cable access into the switching station would be more technically challenging at this site compared to other sites, due to the presence of deep peat, the trench footprint required, the cable bend radii and thermal separation.
- **Switching Station Site Option 5 –** A switching station in this location would be well screened both from the estate properties and tracks and from sensitive receptors on the opposite side of Loch Ness. However, peat probing results indicated that peat depth at this location was up to 6 m. A 2.1 km underground cable would be required between the cable shaft and the switching station, although this could be routed underneath the access track.
- **Switching Station Site Option 6 –** A switching station at this site would be closer to the properties on Dell Estate than other options, including Dell Lodge and the farmhouse at Dell Farm, but would be relatively well screened by surrounding topography and vegetation and there would be opportunities for landscaping. The site is relatively flat, so cut and fill requirements for a switching station platform in this location would be minimal. There is a small pocket of deep peat located at the at the eastern corner of the site, but this could be avoided through micrositing the location and/or the orientation of the switching station or by modifying the shape of the platform (i.e., to remove the corner). A minor watercourse is located 20 m north of this site option. A 2.6 km underground cable would be required between the cable shaft and the switching, although this could be routed underneath the access track.
- **Switching Station Site Option 7 -** A switching station at this site would be closer to the properties on Dell Estate than site options 1-5 but would be relatively well screened by surrounding topography and vegetation. Although there would be opportunities for landscaping, construction a switching station platform at this site would require felling within the adjacent woodland to a windfirm edge, which could increase the visibility of the switching station. Ecology surveys have also indicated that there could be badger (*Meles meles*) present within this woodland, so this felling could cause disturbance and/or habitat loss to this species. A minor watercourse is located 40 m northwest of this site option. A degree of cut is required to form the substation platform at this location which provides screening from the hillside within the woodland. A 2.7 km underground cable would be required between the cable shaft and the switching, although this could be routed underneath the access track.
- **Switching Station Site Option 8 –** This site would be located on fields used for livestock grazing land associated with the nearby Dell Farm. A switching station at this site would be in close

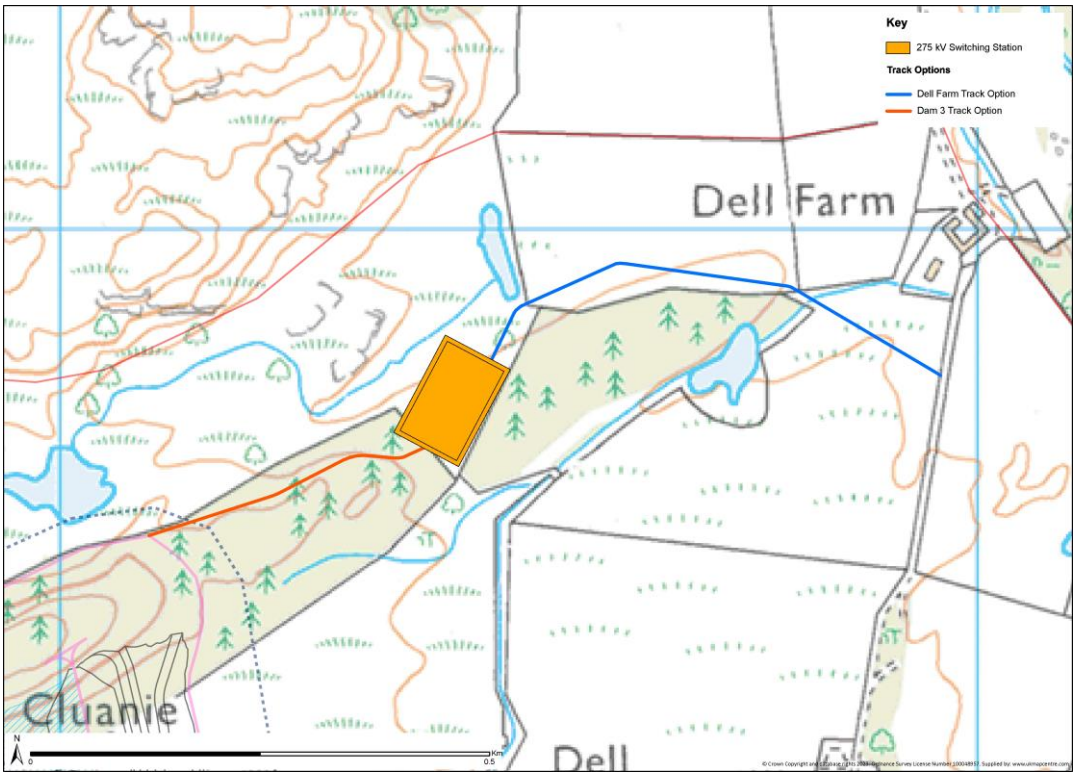
proximity to the property at Dell Farm and could result in residential visual amenity and noise issues at this property. It would also be visible for a section of the Core Path. Landscaping opportunities at this site would be limited due to the flat, exposed nature of the site. A minor watercourse is located 30 m southeast of this site option. The site is also relatively flat, so cut and fill requirements for a switching station platform in this location would be minimal. A 2.9 km underground cable would be required between the cable shaft and the switching, although this could be routed underneath the access track.

2.7.16 Following the appraisal of switching station site options identified, Site Option 6 was considered to be the preferred option for the switching station site, due to the screening and landscaping opportunities at this site. A switching station platform at this location would need to be microsited to avoid areas of deep peat and avoid impacts on the minor watercourse to the north of the site. However, as described in **Section 3.7** of **Chapter 3: Description of Development**, the switching station platform is considered as Associated Works to the Proposed Development and is subject to separate consent. This level of design detail for the platform is therefore not included as part of this EIA Report or the wider Section 36 Application.

Access to Switching Station

2.7.17 The existing access track leading to Dell Farm was initially considered for access to the preferred switching station location, as illustrated by the Dell Farm Track Option in Plate 2.5. However, this option would result in construction traffic passing in close proximity to the properties on Dell Estate. It would also require access to be taken from the existing estate access junction with the B862 to the north of Whitebridge, which is not proposed to be upgraded as part of the Proposed Development. Therefore, a new access track to the switching station to the north of Dam 3 is proposed (as illustrated by the Dam 3 Track Option in Plate 2.5) but would form part of the Associated Works which would be subject to separate consent as part of the planning application for the switching station platform, as described in **Section 3.7** of **Chapter 3: Description of Development**.

Plate 2.5: Track Options to Preferred Switching Station Site (Associated Works)



Cable Route to Switching Station

2.7.18 After exiting the underground tunnel through the vertical cable shaft, it is proposed to route the cable beside the operational access tracks for the Proposed Development, to minimise the additional land take from the cable. Initially the cable would be routed beside the access track leading to the cable shaft. However, where this track meets the main site access track, it could follow the track either northbound or southbound around Loch Kemp. The northbound route would require a substantially shorter cable length than the southbound route, however, when the track reaches Dam 1, the cable would either need to be routed through the inundation area, over the dam or through part of the Ness Woods SAC.

2.7.19 Further engineering studies have determined that it would be technically feasible to route the cable over Dam 1. The cable would be run in conduits or trenches beneath the dam crest road. Therefore it is proposed to use the shorter northbound route, as shown by the 'Associated Works' in **Volume 2, Figure 3.1: Proposed Development.** No additional land take within the Ness Woods SAC would therefore be required by routeing the cable underneath the northbound track around Loch Kemp. After crossing Dam 1, the cable would continue to follow alongside the access track around Loch Kemp, until it reaches the north of Dam 3, where it would follow the proposed access track to the switching station as described in **paragraph 2.7.18** above. This new cable would form part of the separate application for the switching station platform, as described in **Section 3.7** of **Chapter 3: Description of Development**.

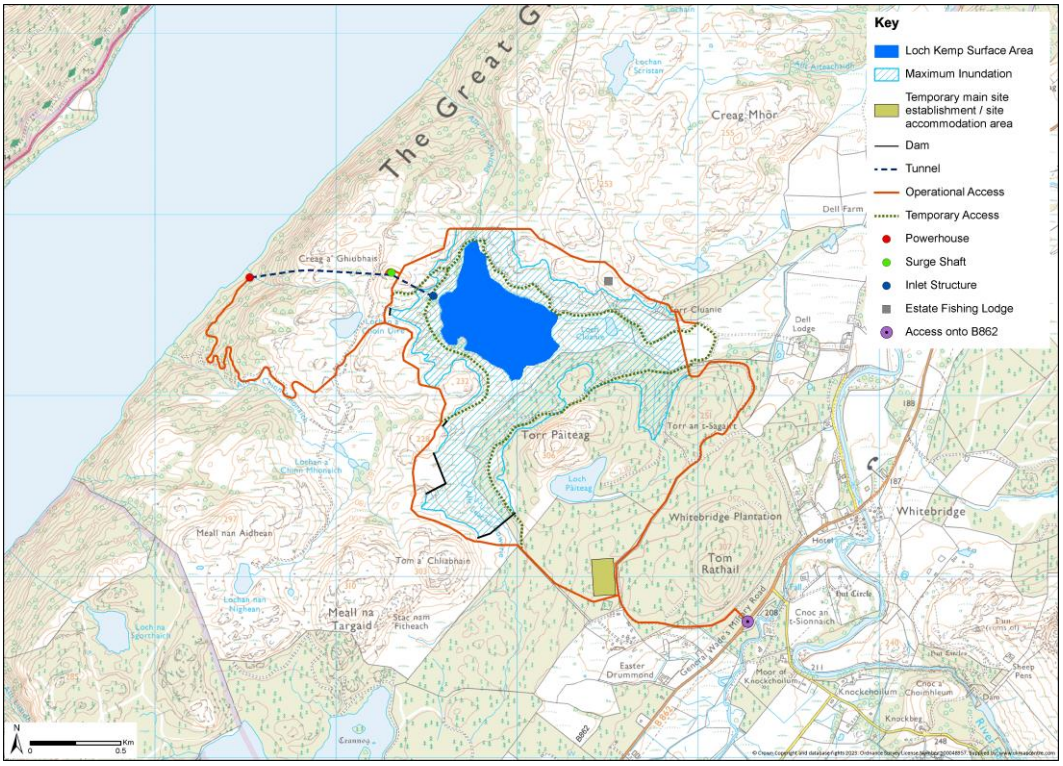
2.8 Key Design Iterations

2.8.1 This section describes the key design iterations for the project between the initial scoping design in November 2021, and the final design layout (August 2023) assessed within this EIA Report.

Iteration 1. Scoping Layout (November 2021)

2.8.2 The indicative site layout included in the Scoping Report, which accompanied the request for a scoping opinion summitted to the Scottish Government's Energy Consents Unit (ECU) in November 2021, is shown in **Plate 2.6: November 2021 - Scoping Layout**.

Plate 2.6: November 2021 - Scoping Layout



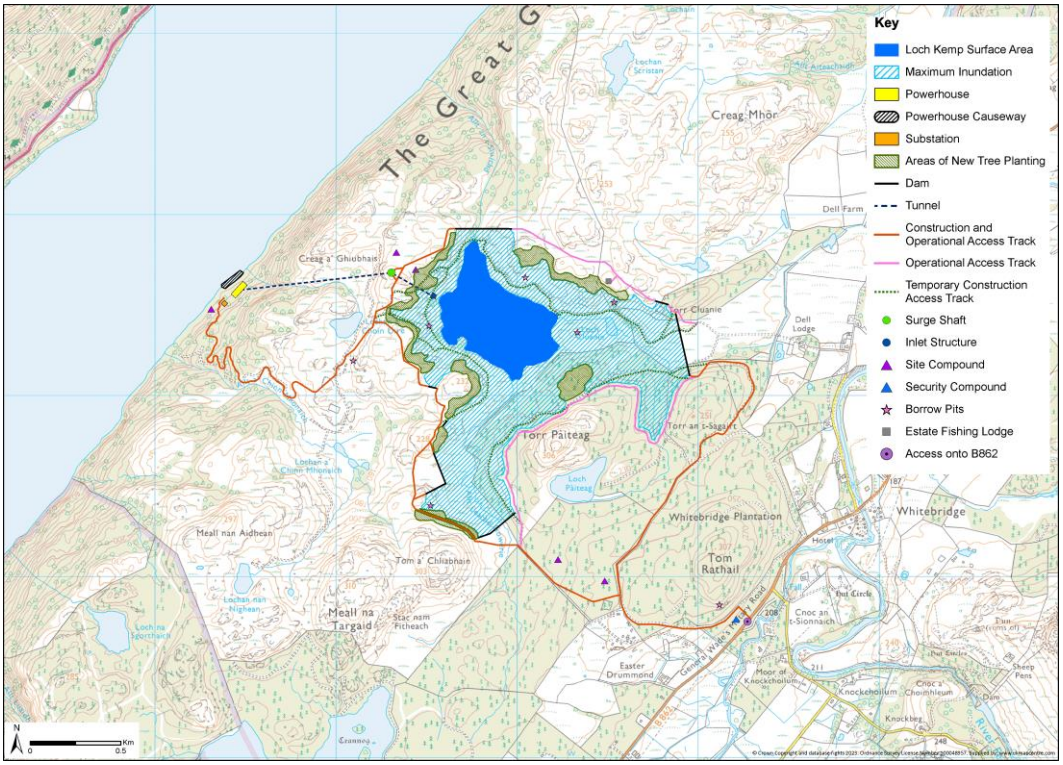
2.8.3 At this stage in the project the Proposed Development was proposed to be a 300 MW PSH with a single tunnel and surge shaft, and eight dams required to create the upper reservoir. Access to the site was proposed to be taken from a new junction on the B862 at a location south of Whitebridge. Existing access tracks were utilised where possible, but it was recognised that many of the estate access tracks would be lost to the inundation area once the Proposed Development was operational, so a new permanent access track was proposed around the new inundation level at Loch Kemp to maintain estate and maintenance access around the loch. Temporary construction tracks were located below the proposed maximum inundation level, where possible. It was recognised that as the existing estate fishing lodge on Loch Kemp would be below the new top water level, the estate

fishing lodge would need to be relocated[3] outside the maximum inundation level. At this stage the powerhouse location was indicative only. The scoping report indicated that the Applicant had accepted a grid connection from National Grid and a buried cable had been requested, but the route was yet to be confirmed. It also indicated that the grid connection would be a separate application.

Iteration 2. Pre - application Consultation Layout (May 2022)

2.8.4 The site layout presented at the pre- application consultation meeting held on 11th May 2022, attended by ECU, THC, NatureScot and SEPA, is shown in **Plate 2.7: Pre – Application Consultation Layout**.

Plate 2.7: November 2021 - Pre – Application Consultation Layout.



2.8.5 The updated design comprised an increase in megawatts from 300 MW to 600 MW. However, the increase resulted in larger tunnels and an increase in excavated spoil, rather than resulting in any material above ground changes to the scheme. The design included a separate substation building to the south of the powerhouse, but at this stage, any details of the connection between the Proposed Development and the National Grid (at Foyers) were unknown. At this stage a number of environmental surveys had taken place, including terrestrial ecology surveys, tagging of trees potentially disturbed by the construction works within Ness Woods SAC, and peat depths in key areas including potential dam locations and tracks. A number of powerhouse locations had been considered, post scoping, as well as the associated tracks, in order to minimise disturbance within the Ness Woods SAC. The loss of woodland at the upper reservoir had been reviewed, and proposals

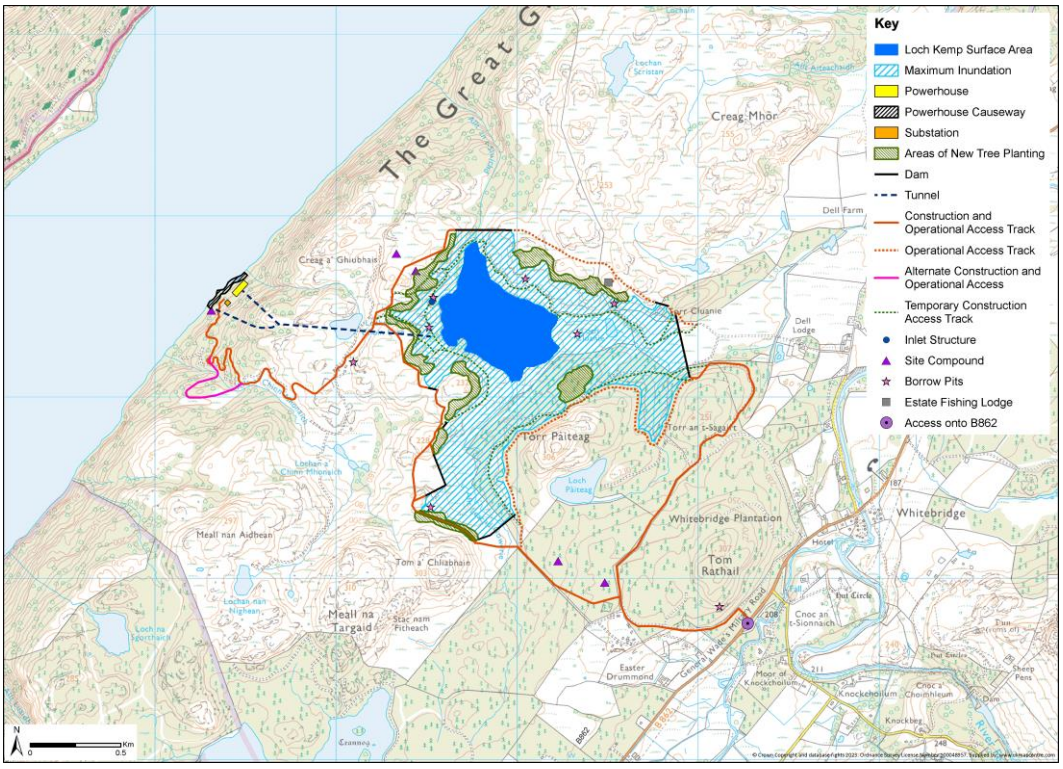
[3] The location of the fishing lodge would be relocated outside of the maximum inundation area as illustrated on **Volume 4, Figure 3.1: Proposed Development** but it is anticipated that a new fishing lodge building would be constructed rather than relocating the existing lodge.

to replace the loss by extensive woodland habitat creation, was included as part of the Proposed Development. Recommendations were made by consultees for further terrestrial ecology surveys to be undertaken, as well as additional peat probing, and these were taken on board where possible in advance of the first design workshop on 24th May 2022.

Iteration 3. Design Workshop One Layout (May 2022)

2.8.6 The site layout presented at the first Design Workshop held on 24th May 2022 attended by ECU, THC, NatureScot and SEPA, is shown in **Plate 2.8: Design Workshop One Layout.**

Plate 2.8: Design Workshop One Layout



2.8.7 The changes to the previous pre- application layout comprised the following:

- Consideration of a concrete dam design for Dam 1, to minimise potential impacts on the SAC;
- Consideration of an alternative access track alignment within the SAC; and
- Addition of a causeway along the shore of Loch Ness.

2.8.8 There was consideration of a concrete dam at Dam 1, rather than a RCC dam, to reduce the impact of the Ness Woods SAC.

2.8.9 The proposed access track and access junction were largely the same as the Scoping layout. However, a potential alternative access track through the upper section of the Ness Woods SAC was presented. This option would increase the total length of the track within the SAC but would be routed over less qualifying habitat. However, the alternative access track was later discounted, as it would be technically challenging to construct and would cross the Allt a Chinn Mhonaich watercourse twice. This watercourse is ecologically sensitive as it runs through the Ness Woods SAC

and it is also located within a steep gorge, which would make the watercourse crossings challenging to construct.

2.8.10 The causeway was proposed along the shoreline of Loch Ness to provide a construction compound and laydown area at the lower reservoir works, without having additional land take within the Ness Woods SAC.

2.8.11 It had also been identified that the private water supply which supplies the properties on Dell Estate may need to be rerouted as a result of the Proposed Development, so these works were included as part of the site layout. Eight potential borrow pits and five potential site compounds had also been identified at this stage of the design evolution.

2.8.12 The Applicant reported on additional information gathered on tree composition within the SAC, as well as additional information on lichen and bryophyte composition, in order that micrositing to minimise adverse effects could occur.

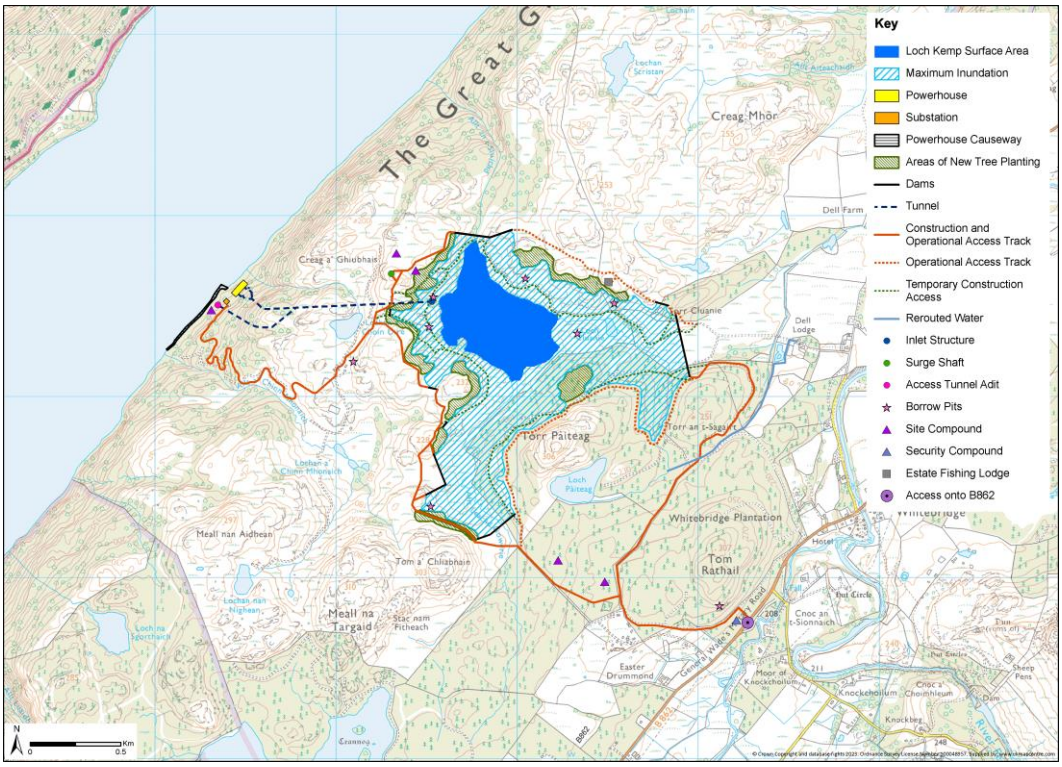
2.8.13 The Applicant also reported on additional peat probing work that had taken place within the proposed inundation area, as requested by consultees at pre- application. In addition to this, the preliminary design approach and design concepts for the powerhouse were presented by the project Architects, HRI Munro.

Iteration 4. Design Workshop Two Layout (July 2022)

2.8.14 The site layout presented at the second Design Workshop held on 27th July 2022 attended by ECU, and THC, is shown in **Plate 2.9: Design Workshop Two Layout**.

2.8.15 The workshop focussed on the powerhouse design and included the provision for visitor facilities, as requested by consultees. Mitigation at the lower works, to assimilate the built development into the landscape, focussed on design of the rock cuttings and earthworks and associated planting. A security compound was added to the layout near the entrance of the B862. In addition, the consideration of further track options within the SAC was discussed, as well as confirmation that Dam 1 would be RCC, to minimise the dam footprint within the Ness Woods SAC. The design of Dam 5 was also considered further to try to minimise impacts on peat.

Plate 2.9: Design Workshop Two Layout

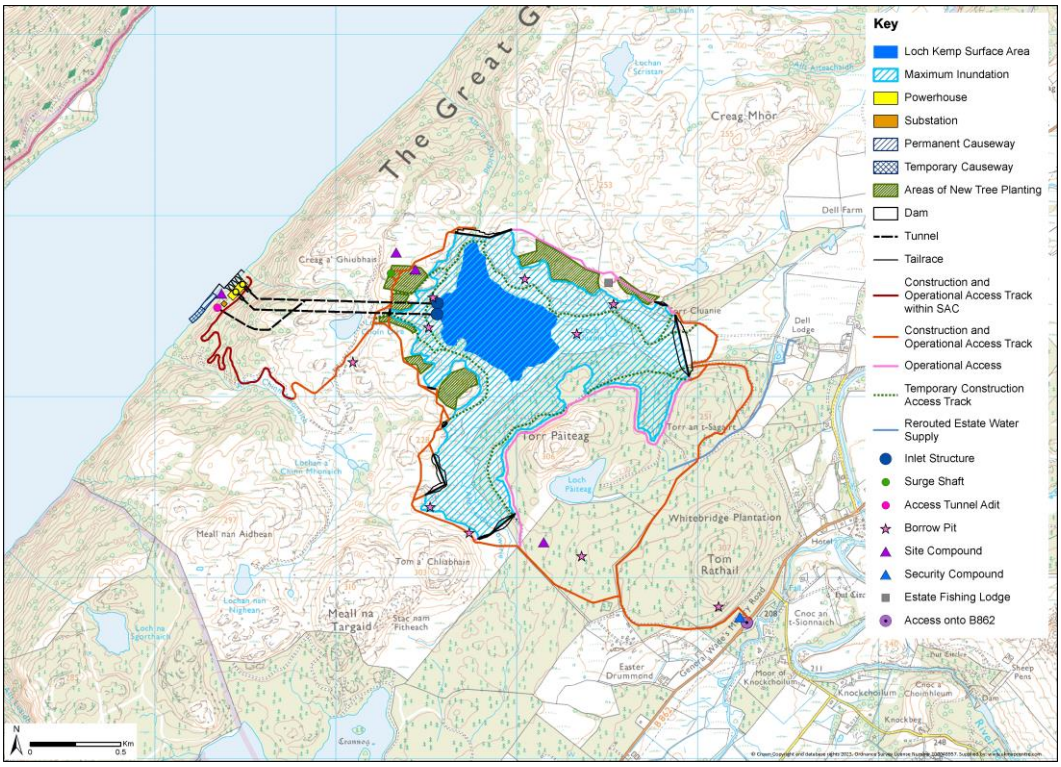


Iteration 5. Design Freeze Layout by Gilkes (November 2022)

2.8.16 The design freeze layout by the initial client engineers (Gilkes) was confirmed in November 2022, and was issued to technical specialists to base their initial EIA assessments on, as shown in **Plate 2.10: Design Freeze Layout by Gilkes**. The design included a twin tunnel configuration and two surge shafts to allow for the independent waterways. At this point the Applicant appointed Fichtner Consulting Engineers Ltd (Fichtner), to review the Gilkes design and to refine the design to take it forward for planning.

Plate 2.10: Design Freeze Layout by Gilkes

2.8.17



Iteration 6. Design Layout by Fichtner (April 2023)

2.8.18 The site layout developed by Fichtner is shown in **Plate 2.11: Design Layout by Fichtner (April 2023).** The changes to the previous design freeze layout comprised the following:

- Dam 3 moved east to avoid deep peat, and landscaped with additional landform and planting;
- The substation was moved inside the powerhouse building;
- A separate switching station building (where the ownership of the grid connection would transfer from the Developer to SSEN Transmission) was added outwith the Ness Woods SAC boundary. A cable tunnel and cable shaft were also added so that a cable could be routed between the substation inside the powerhouse building and the switching station without having additional land take within the Ness Woods SAC; and
- Main access track moved away from properties, and minor changes made to other tracks.

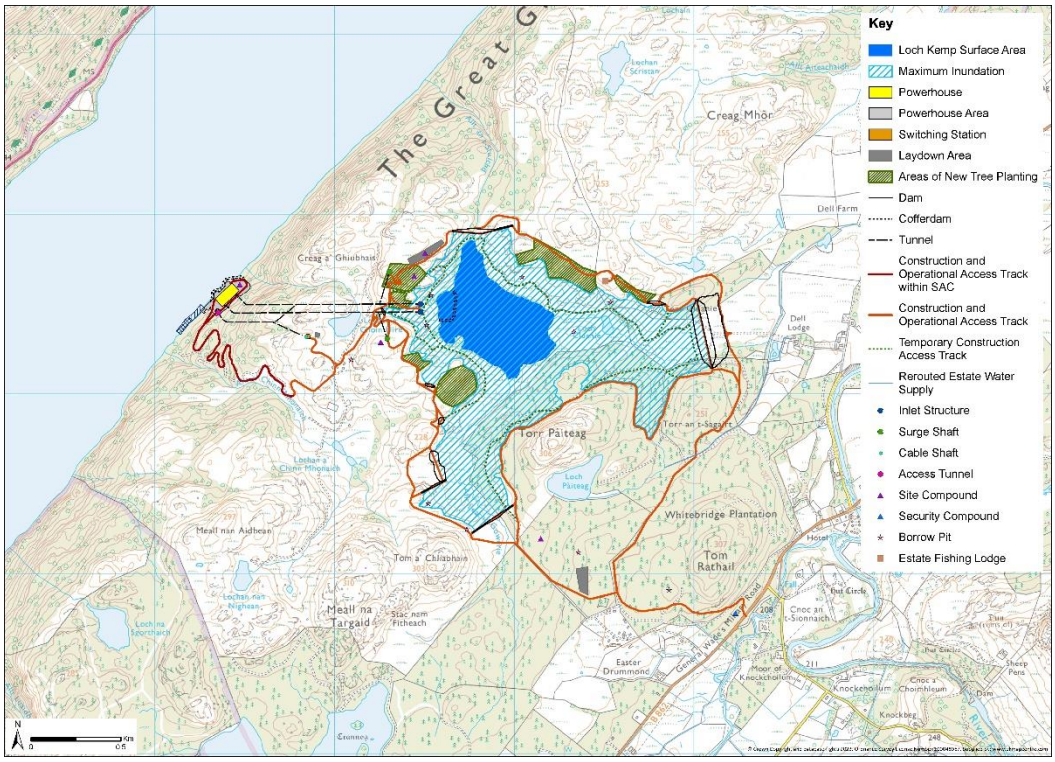
2.8.19 Re-examination of the extent and condition of deep peat that would need to be excavated at Dam 3 resulted in the movement of Dam 3 further eastwards, to avoid the deeper peat. This also increased the size of the inundation area to 127.86 ha. However, the movement of Dam 3 to the east, brought it closer to Dell Estate properties, including Dell Lodge, as well as recreational routes passing through the Site, and so mitigation to reduce the impact of the dam from these receptors included the addition of tunnel spoil to reprofile the dry side of the dam to enable landscaped landform and planting, to soften the long-term appearance to the dam structure. A visualisation of the landscaping 10-years post construction is included in **Volume 3a, Figure V3a-3g - Visualisation Location 3: Core Path IN25.01 near Whitebridge - Photomontage - Year 10 post completion** and **Volume 3b, Figure V3b-3n - Visualisation Location 3: Core Path IN25.01 near Whitebridge - Photomontage - Year 10 post completion.**

2.8.20 As a result of these changes to Dam 3, the alignment of the access tracks in this area had also been altered, including the addition of a new access track around the woodland at Torr Cluanie, which would partially follow an existing forestry track, and an access track between the dam crests of Dam 2 and Dam 3, which would be routed through the Torr Cluanie woodland. The extent of the site boundary was expanded to include the new location of Dam 3 and associated access tracks.

2.8.21 Another key change in this site layout was the layout of the lower reservoir works. The size and location of the powerhouse building was updated. As a result of the decision to route the 275 kV cable through the access tunnel to a location outside of the Ness Woods SAC as described in **Section 2.7,** a cable tunnel was added as a spur to the access tunnel, which would resurface through a vertical cable shaft located outside the SAC, near the upper reservoir works. The substation located at the lower reservoir works was relocated inside the powerhouse building (see the 'Indicative Powerhouse Upper Ground Floor Plan' included in **Volume 4, Appendix 3.1: Design and Sustainability Statement**) and a separate switching station (where the ownership of the grid connection would transfer from the Developer to SSEN Transmission) was introduced next to the vertical cable shaft at the upper reservoir works**.** At this stage it was assumed that the switching station could use GIS switchgear, and therefore it would be possible to locate the switching station next to the cable shaft to minimise the length of cable between the vertical cable shaft and the switching station. The extent of the hardstanding area around the powerhouse building was added to iteration of the site layout. The size of the final hairpin bend before reaching the powerhouse platform was also increased to allow large construction vehicles with limited turning radiuses to be able to transit the bend.

2.8.22 Other changes to this site layout included the addition of the cable tunnel spur and vertical cable shaft (and associated access track) at the upper reservoir, the addition of a second potential surge shaft and minor changes to the extent and locations of all dams. At this stage it was determined that Dam 4 would be a concrete dam and Dam 5 would be a hybrid dam, as described in **Section 2.4**. The access track to Dam 1 was changed to approach the dam from the east rather than the west. This was due to the more favourable gradient on the eastern abutment avoiding the need for hairpin bends and a longer overall route compared to the western abutment. This spur to Dam 1 was designed to avoid an area of deep peat and minimise land take within the Ness Woods SAC. Two larger laydown areas were also presented on the site layout. The causeway in Loch Ness was also split into a temporary and permanent section.

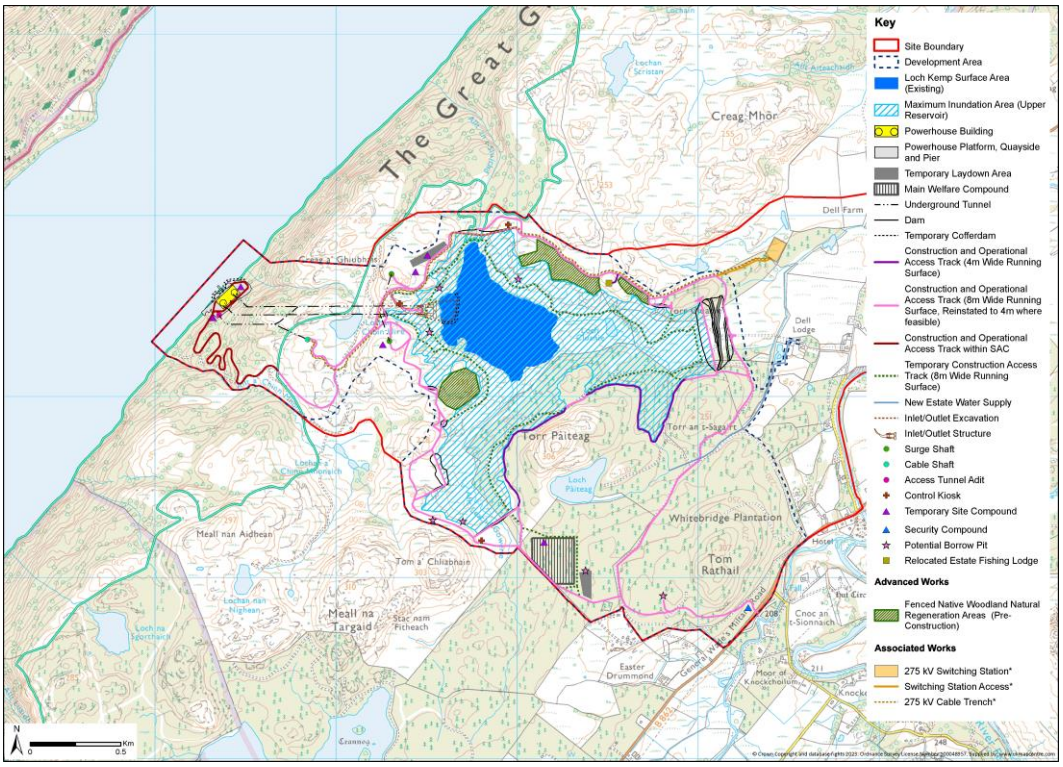
Plate 2.11: Design Layout by Fichtner (April 2023)



Iteration 7. Final Design Layout (August 2023)

2.8.23 The Final Design Layout is shown in **Plate 2.12: Final Design Layout (August 2023)** (also see **Volume 2, Figure 3.1: Proposed Development)**. The key update to this design iteration is the addition of the Advanced and Associated Works. The Advanced Works comprise the fenced native woodland natural regeneration areas, which would be fenced-off pre-construction so that the woodland would be well established by the time construction work commenced to provide screening. The areas would also replace the native woodland that would be lost within the inundation area once the Proposed Development is operational. The Associated works comprise the proposed 275 kV switching station (assumed to by an AIS switching station based on advice provided by SSEN Transmission), a 275 kV buried cable and an access track which were now proposed to be located near Dell Farm, as described in **Section 2.7.** The site boundary was extended to include the Associated Works. However, as most survey work that had been undertaken has been based on the previous site boundary and no works directly relating the Proposed Development would be located outwith this boundary, the previous iteration of the site boundary was included in the Final Design site layout but is referred to as the 'Development Area'.

Plate 2.12: Design Layout by Fichtner (April 2023)



2.8.24 Other notable changes to the Final Design Layout, compared to the April 2023 layout, include:

- The addition of the three control kiosks at Dam 1, Dam 4 and the inlet/outlet structure;
- The full extent of the inlet/outlet structure and associated excavation have been included in the site layout;
- The full extent of the welfare compound and associated access track have been included in the site layout. It was also confirmed that a 0.77 ha area of the welfare compound would be retained to as a maintenance area, following construction;
- The location of the access junction was moved slight northward to avoid having to clear fell an entire block of commercial forestry to accommodate the junction;
- An access track to the borrow pit near the access junction (BP1) was included in the site layout;
- The access tracks to the south of Dam 3 were rerouted to follow the existing forestry tracks;
- The access track between the dam crests of Dam 2 and Dam 3 was removed to avoid having to clear fell a substantial area of forestry at Torr Cluanie to accommodate the track. Turning heads would be constructed at the end of each dam crest instead;
- Landscaped landform and planting were added to the dry side of Dam 3;
- Three potential borrow pit locations (BP5, BP9 and BP10) were excluded from the final Design Freeze layout following the initial borrow pit screening exercise (see **Volume 4, Appendix 3.5: Draft Borrow Pit Screening Assessment**). The location of some of the remaining borrow pits were also revised following this screening exercise;

- At the point where the access track splits to access the cable shaft and the lower reservoir works (to the south of the Lochan a Choin Uire), the spur leading to the lower reservoir works was rerouted to follow the existing access track to minimise potential damage to a heritage asset that was identified in this area;
- The upper section of the track to the lower reservoir works within the Ness Woods SAC was rerouted to increase the distance between the track and the upper banks / upper ridge of the Allt a Chinm Mhonaich watercourse, following advice from SEPA. This access track is now at least 10 m from the top of the banks of the watercourse; and
- The proposed causeway was removed from site layout as it was considered that it would be technically challenging to construct and to later partially remove this causeway within Loch Ness. It was also considered that is would be technically feasible to use the hardstanding area within the powerhouse platform for all construction works. Instead, a quayside and pier, which both extend into Loch Ness, have been added to the powerhouse platform (see **Volume 2, Figure 3.5: Indicative Layout of Lower Reservoir Works - During Operation)**. These structures would provide access to the lower reservoir works during construction and during operation of the Proposed Development.

2.9 Summary of Design Measures to Reduce Impacts on the Ness Woods SAC

2.9.1 The following design measures have been implemented through the design evolution process to minimise impacts on the Ness Woods SAC:

- The powerhouse location has been sited on a flat area close to Loch Ness shore, which is dominated by bracken, and whilst this area is still classified as part of the woodland qualifying interest habitat, construction in this area would reduce tree loss compared to more densely wooded areas;
- Multiple access track route options have been considered to try to reduce land-take within the woodland qualifying interest habitat, as well as to reduce the level of impact on bryophyte and lichen communities of conservation value, and minimise tree loss as far as possible;
- Tracks within the Ness Woods SAC would be constructed to have a running surface[4] of approximately 4 m on straight sections (with passing places) and 5 m on bends during construction rather than 8 m, which would be the standard for most tracks outwith the SAC.
- The infrastructure footprint, and working corridor (i.e. land used for construction), has been reduced as far as is practically feasible;
- It is proposed to deliver some of the larger E&M equipment to the lower reservoir works site by boat (via the Caledonian Canal);

[4] As described in Section 3.5 of **Chapter 3: Description of Development,** it is envisaged that the total running width of track within the Ness Woods SAC would be approximately 6 m on straight sections and would comprise a 4 m running surface, with a 1 m drainage trench and 1 m safety barrier on opposing sides of the running surface (as illustrated on **Plate 3.8** in **Chapter 3: Description of Development**). At tight cornering radii within the access track, the running surface width would be widened to 5 m meaning that the total running width of track would increase 7 m on bends. Due to the extremely steep topography of the slopes leading down to the lower reservoir works, substantial cut and fill works would also be required to construct sections of the access track down to the lower reservoir works (as illustrated **in Volume 4**, **Figure 3.6: Typical Access Track Construction Details inside Ness Woods SAC)**.

- The access track through the SAC would follow the route of the existing 4x4 track as far as practical, to reduce additional land take;
- The qualifying habitats of the SAC have been mapped and the access track has been routed through areas of non-qualifying habitat as far as practical;
- The access track has been microsited to ensure it is at least 10 m away from the top of the banks of the Allt a'Chinn Mhonaich watercourse for the entirety of the route following advice from SEPA as a pollution prevention measure. No storage of material would be permitted in this buffer area;
- A cable tunnel is proposed to route the proposed grid connection, a 275 kV cable, from the powerhouse below ground and beneath the Ness Woods SAC. The cable would enter the access tunnel through the tunnel adit and exit the tunnel through a cable shaft located outside the SAC (and then continue onwards as a buried cable to connect to a 275 kV AIS switching station, as described in Section 2.2). This would ensure that there would be no additional land take in the Ness Woods SAC, as a result of the grid connection for the Proposed Development;
- No site compounds, are proposed within the Ness Woods SAC outside of the footprint of the powerhouse platform, to avoid additional land take in the SAC;
- Dam 1, which is located within the Ness Woods SAC, would be a RCC dam rather than a rockfill dam, which reduces the land-take of the dam within Ness Woods SAC by approximately 50%;
- As the cable route is proposed to follow the route of the proposed access track, where the tracks passes over Dam 1 it is also proposed to route the cable over Dam 1, again ensuring that there would be no additional land take in the Ness Woods SAC, as a result of the grid connection;
- An option previously being considered of a conveyer belt through Ness Woods SAC to transport some construction materials has been removed from the scheme; and
- Access to and from the visitor centre by the public would be via the quayside on Loch Ness only.

2.9.2 An assessment of the potential direct and indirect impacts of the Proposed Development on Ness Woods SAC following the implementation of these design measures is included in the **Chapter 10: Terrestrial Ecology**. A Shadow HRA, which includes an assessment has been prepared in support of the section 36 Application. As it is anticipated that there would be adverse impacts on the woodland qualifying habitats associated with the Ness Woods SAC as a result of the Proposed Development, a Compensatory Measures Package has also been developed for this designated site in consultation with NatureScot and is included in the Derogation Report which forms a standalone document submitted in support of the section 36 Application.