Loch Kemp Storage - EIA Report

Appendix 3.1: Design & Sustainability Statement

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1. Introduction

1.1 The Proposed Development

1.1.1 Loch Kemp Storage Ltd (the Applicant), a wholly owned subsidiary of Statera Energy (UK) Limited (SEL) (the Developer), is proposing to construct a Pumped Storage Scheme (the Proposed Development) on the east side of Loch Ness on the Dell Estate near Whitebridge, approximately 13 kilometres (km) to the northeast of Fort Augustus, in the Highlands of Scotland.

1.1.2 The primary function of the Proposed Development is to extract, store and release water to and from the electricity transmission system as required, to help balance supply and demand for power at a national scale.

1.1.3 Hydro power is a very flexible method of electricity generation due to its ability to rapidly start and stop without constraint. Pumped storage plants add to this the ability to consume and store large quantities of energy, making them the most flexible of all electricity generation technologies. The role which pumped storage has traditionally played in power network management is primarily in managing relatively short-term differences between electricity supply and demand (consumption). As the proportion of electricity generated from less flexible renewable sources (such as wind and solar) rises, this role will become increasingly important.

1.1.4 The Proposed Development would operate by transferring water between Loch Ness (the lower reservoir) and the enlarged Loch Kemp (the upper reservoir) through the tailrace tunnel, powerhouse, high pressure tunnel and headrace tunnel. During periods of high electricity demand, water would be transferred from the upper to lower reservoir, thereby generating hydroelectricity. However, during periods of low demand the scheme would utilise surplus energy in the grid to pump water back up to the upper reservoir, thus ensuring that the scheme is available to meet the periods of highest demand.

1.2 Design Development

1.2.1 In terms of aesthetic appeal, the key areas of the Proposed Development are the above ground structures comprising those located at the upper and lower reservoir works and the permanent access tracks to these areas. In arriving at the preferred design option, consideration has been given to a range of factors including technological constraints, environmental constraints, economic factors, sustainability and health and safety.

1.2.2 The design process for the Proposed Development has involved the following key stages:

- Strategic design: An initial working layout of a pumped storage scheme was developed to allow environmental surveys to be undertaken;
- Development of preferred layout: Following site surveys for environmental and heritage features and initial landscape appraisal, the Proposed Development was further refined to take account of potential constraints and opportunities to achieve an optimum balance between technical efficiency whilst minimising adverse environmental effects. The proximity and sensitivity of the Ness Woods SAC became a key design constraint from an early stage in the design process. Key stakeholders comprising Energy Consents Unit (ECU), The Highland Council (THC), Scottish Environment Protection Agency (SEPA), and NatureScot, were

consulted during a series of workshops attended by the Developer, the client engineers, the project architects (HRI Munro), and project landscape architects (ASH design+ assessment Ltd), as well as other specialist members of the project environmental team;

- Design Refinement: Once the preferred layout for the Proposed Development had been agreed, input from the project architects and project landscape architects was applied to refine the design and suggest appropriate massing, finishes, detailed layout and mitigation measures to minimise adverse impact. The design of the above ground elements of the lower reservoir works, with the greatest potential for visibility in the wider area, (comprising the surface powerhouse, and associated platform, rock cuts, and access tracks), were a particular focus of attention, being the main elements of the scheme visible to the wider public, as well as being the main scheme components potentially impacting the Ness Woods SAC; and
- Detailed Design: Post consent and pre-construction phase, the indicative design would be further developed to a detailed level suitable for construction.

1.3 The Design Statement

1.3.1 This Design Statement provides a presentation of the proposed layout of the Proposed Development, and in particular, the thoughts and concepts that have led to the preferred indicative design of the various key elements of the scheme. The Design Statement is intended to be read in conjunction with other parts of the EIA Report and the accompanying Figures and Appendices, and it comprises six sections as follows:

- **1. Introduction** – This section introduces the Proposed Development and describes the Design Development stages and the structure of the Design Statement;
- **2. Background Studies** - This section describes the operational characteristics and design solutions of the various schemes and projects that have been referred to in the development of the indicative preferred design, and analyses the key influences and opportunities which can be transferred and utilised for the Proposed Development. Case studies referred to include existing pumped storage schemes in the UK, and the rich heritage of hydroelectric design within the Highlands of Scotland, as well as experience obtained by the Applicant and consultants on other relevant recent projects;
- **3. The Proposed Development** - This section describes the site context and the key visible features of the Proposed Development, located at both the upper reservoir works and the lower reservoir works. It also describes the key landscape mitigation measures proposed;
- **4. Powerhouse Design Concept** – This section looks at the design process, precedent buildings and materials, site influences, emerging concepts and design development;
- **5. Access Statement** – The Access Statement provides a brief overview of access during both the construction and operational phases; and
- **6. Sustainability Statement** – A Sustainability Statement is provided in Section 6 (see also Annex A).

2. Background Studies

2.1.1 In order to understand and address the key issues arising from the construction of the Proposed Development, studies have been undertaken for a variety of existing developments.

Scotland's Hydroelectric Heritage.

2.1.2 Scotland has a rich heritage of hydroelectric development which provides a notable and distinctive architectural resource, particularly within the Highland area. Beginning with a number of small privately owned schemes in the late Victorian era, the technology was first developed in the Highlands on an industrial scale through the works of the British Aluminium Company (BAC). Between the company's formation in 1894 and 1943, BAC developed three large scale schemes at Foyers, Kinlochleven and Lochaber to supply electricity to its aluminium smelters. On the back of the successes of BAC, further schemes were developed in the early 1920s and '30s but the major development of hydroelectric within the Highlands began with the nationalisation of hydroelectric development during the Second World War and the formation of the North of Scotland Hydro Electric Board (NoSHEB). During a period of around 30 years NoSHEB was responsible for transforming the Highlands into an area recognised for its prolific and distinctive hydroelectric architecture.

2.1.3 The formation of NoSHEB was originally led by a drive towards social and economic improvement of rural communities, bolstered by a post-war optimism. However, early opposition and threats to the independence of NoSHEB led to a situation whereby design and the setting of the schemes within the highland landscape became increasingly important. NoSHEB saw this as an opportunity to promote itself as an independent and modernising force through the development of a new industrial architectural style. Three architects became instrumental in the identification of the characteristic style associated with hydroelectric architecture: Harold Ogle Tarbolton, Reginald Fairlie, and James Shearer. Rather than opting for non-controversial vernacular buildings, the architects chose bold, modern designs believing that their honesty and simplicity could contribute positively to the sensitive landscape setting and reflect the aspirations of NoSHEB.

2.1.4 The earliest schemes, designed by Tarbolton, are of a bold, and modern design using precast concrete with large-scale volumes, stark rooflines and abstract classical detail, which created simple, unfussy shapes set against the backdrop of the highland landscape. Examples are the power stations at Sloy (1943 – 1950) and Pitlochry (1947 – 1951).

Sloy Power Station

Sloy, completed in 1950, was the first of the NoSHEB power stations to be built and emphasises the bold modern approach. Tarbolton used modern materials such as precast concrete panels with exposed aggregate and a clear simplicity of design. Four penstocks on the hillside to the rear of the building logically appear to connect to the generators, visible through massive multi-paned windows displaying an identity and honesty as to the building's use.

Pitlochry Power Station

The Pitlochry power station, completed in 1951, is a further example of Tarbolton's modernist style. The building marries together functionality, through a clear and honest structure, with a bold and modern form of design. The dam is seen as an integral part of the structure and incorporates a bridge and viewing gallery for members of the public.

2.1.5 After the death of Tarbolton in 1947 and Fairlie in 1952, the majority of hydroelectric power stations were designed by James Shearer. Although continuing to design in the modern style with large volumes and simple shapes and structure, Shearer had a greater sensitivity to the vernacular landscape setting of the buildings and employed the use of local stone to reflect the tones and colours of the landscape, creating a large variety of buildings, all uniquely tying into their immediate and wider landscape setting. Examples of Shearer's work include the power stations at Errochty and Shin. Shearer also introduced the use of carved decorative panels and features, often depicting Celtic and mythological beasts and symbols to relate the buildings to the social heritage of the area, such as at the Fasnakyle Power Station.

Errochty Power Station

Errochty power station is a classic example of a building designed by James Shearer. Whilst continuing to follow the recognisable architectural style of the earlier hydroelectric schemes by Tarbolton, the use of local stone helps to set the building within the muted tones of the landscape and ties into the exposed rock of the tailrace.

Shin Power Station

Shin power station is constructed from the local red sandstone and is of a slightly more vernacular style than some of the other buildings, with the inclusion of a pitched roof. The building incorporates an example of the sculptured and stylised stone name plates found on various elements of many of the schemes

Fasnakyle Power Station

Fasnakyle power station was one of James Shearer's earlier power stations. The design displays how the use of local stone creates a distinctive building, uniquely tied to its landscape setting. The building incorporates carved panels emphasising it's unique design, although the building is still recognisable as following the hydroelectric style.

2.1.6 The architectural design of the NoSHEB hydroelectric schemes was not limited to the power station buildings, but took on board the schemes as a whole, including features such as dams, tunnel portals, ancillary buildings and gates. This involved a similarity of architecture and materials and use of features such as crests, sculptured panels and sculptural stone name plates. This provided a sense of continuity and identity to all the features, and introduced an attention to detail which presented a positive impression.

2.1.7 More recent hydroelectric development of note includes the 100 MW Glendoe hydroelectric scheme constructed between 2006-2009. Glendoe is a storage scheme comprising: a cavern power station, a 1 km long dam and associated reservoir, and 17 intakes and associated tracks. It is located in the Monadhliath Mountains, and has a high pressure power tunnel connecting to the tailrace structures located on the eastern shore of Loch Ness, just north east of Fort Augustus, approximately 10 km to the south of the Proposed Development. During construction of the scheme, large rock cuttings were necessary in the banks of Loch Ness, to facilitate construction of the tailrace, tunnel portals, and associated access tracks. However, as a result of landscape mitigation earthworks and planting, the tailrace and associated tracks are now barely perceptible in views from the surrounding views, even in close proximity.

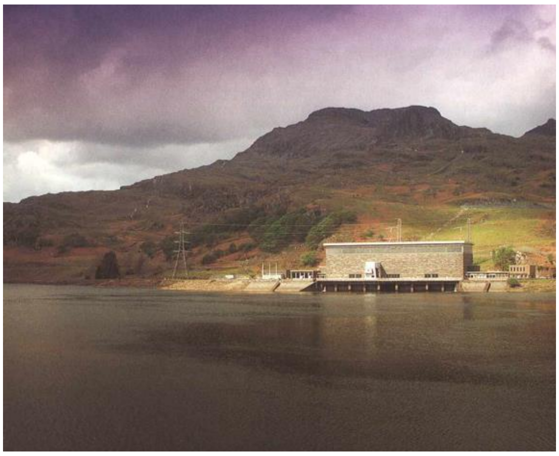
Existing Pumped Storage Schemes in the United Kingdom

2.1.8 Pumped storage is already a recognised technique for the generation and storage of energy in the UK. To date, there are four pumped storage schemes in operation, located in north Wales and Scotland. Because of the requirements of the technology, these schemes are generally located within rural and mountainous landscapes, valued for their scenic quality, and their design and appearance is considered an important issue.

2.1.9 The earliest of these developments were the Ffestiniog and Cruachan schemes, constructed in the early 1960s. Visually, these are similar schemes, both utilising elegant concrete buttress style dams at the upper reservoirs, which form simple, striking features within the large scale upland landscapes. However, different options are used for the two power stations. The Ffestiniog scheme, opened in 1963, operates a large power station on the shore of the lower reservoir, using a simple structure and stone cladding to tie it into the local vernacular. The Cruachan scheme near Oban, opened in 1965, has an underground cavern power station, minimising the scale of development required adjacent to Loch Awe, the lower reservoir. Nevertheless, above ground structures and facilities have also been developed, including offices, a visitor centre and parking which can appear somewhat cluttered and unplanned.

Cruachan Dam

The Cruachan dam is an example of how a large man-made structure may be designed to sit well within an otherwise largely undeveloped upland landscape. The clean, simple lines and lack of small scale detail, reflect the large scale and simple characteristics of the landscape setting. The concrete has weathered over time creating a muted colour and tone consistent with that of the surrounding mountains.



Ffestiniog Power Station

The designers have chosen a large, simple facade for the Ffestiniog power station, and have used local stone to reflect the colours of the landscape and the vernacular architecture of the area. However, various other buildings have grown up around the power station which can disrupt the simple structure and emphasise the scale of the main building.

Cruachan Tailrace

Although the Cruachan power station is housed in an underground cavern, various other buildings associated with the scheme have been built up around the tailrace outfall over time. The disparate nature of development can lead to a cluttered and unplanned appearance. However, the retention of shoreline vegetation helps to minimise the visual extent of this.

2.1.10 The Foyers pumped storage scheme near Loch Ness which began operating in 1974, was created through the redevelopment of an existing hydroelectric scheme. This scheme includes a large power station building on the eastern shore of Loch Ness which is a prominent feature within the landscape. Unlike the Ffestiniog scheme, where local stone was used to help set the building in the local landscape, the Foyers power station was finished in coloured metal cladding. The scale and bright reflective colour of the building creates a strong visual feature on the largely uniform, wooded shoreline and is prominent and sometimes obtrusive within views.

Foyers Power Station

Although a simple structure with very few peripheral features, the bright reflective colours of the Foyers Power Station cause it to be very prominent against the dark backdrop of the trees and hillside. The building can be a distracting feature in open and extensive views across Loch Ness.

2.1.11 The largest and most recent pumped storage scheme to be constructed in the UK, is the Dinorwig scheme in North Wales which became operational in 1984. This scheme is located on the edge of the Snowdonia National Park and its visual and landscape impact was therefore considered of high importance. An underground cavern power station was chosen to minimise the extent of built development required at the lower reservoir. A rock fill dam was chosen for the upper reservoir with the front face covered with earth and sowed with locally sourced grasses and heather. An access track winds up the front face of the dam but has very little visual prominence due to the construction of turf bunds on the lower side. Another notable feature which helps to tie the dam into the landscape is a dry-stone wall which has been reinstated to run down the front face of the dam.

Dinorwig Dam: Front face

The road across the face of the dam is visible only as a slight ripple in the slope due to the use of grassed bunding on the lower side, whilst the dry-stone wall down the face of the dam helps to provide continuity to the appearance of the structure within the landscape.

Dinorwig Dam: Crest

The crest of the Dinorwig dam is kept very simple with a concrete wave wall to the upstream side and a stone bund providing protection on the downstream side. This removes the need for railings which would add an obvious man-made element and disrupt the linearity of the dam.

Construction Practices and Techniques

2.1.12 The Loch Kemp Storage specialist team have previously been involved in other large scale infrastructure projects and hydroelectric schemes in sensitive landscape settings in the Highlands of Scotland, including the Glendoe Hydroelectric Scheme, and various overhead lines and wind farms. As such, they have developed a level of experience and understanding of design principles which can help reduce landscape impact and assimilate permanent features within the landscape setting. This includes the following principles:

- The use of subtle landform and tree planting to help minimise the visual extent of built features and tracks;
- Careful consideration of strategic and detailed design to 'design out' peripheral features where possible (such as railings, peripheral buildings and other structures or duplicate access tracks), as such features can introduce a human scale and complexity which can draw the eye and conflict with the large scale of the landscape; and
- Well managed and structured construction practices to ensure that areas disturbed during construction are successfully reinstated, particularly around tracks and site establishment areas.

Glendoe Dam, Intake Tower and Spillway

Maintaining simple structures in the landscape helps to minimise their impact. The surfaces of the intake tower have been broken by textured panels to try to reduce its prominence and light reflecting properties

Access Track: Glendoe Tailrace

Landform and planting has been used to soften cut slopes and help to tie in the new access track to the tailrace.

Use of Local Stone for Culverts and Drains

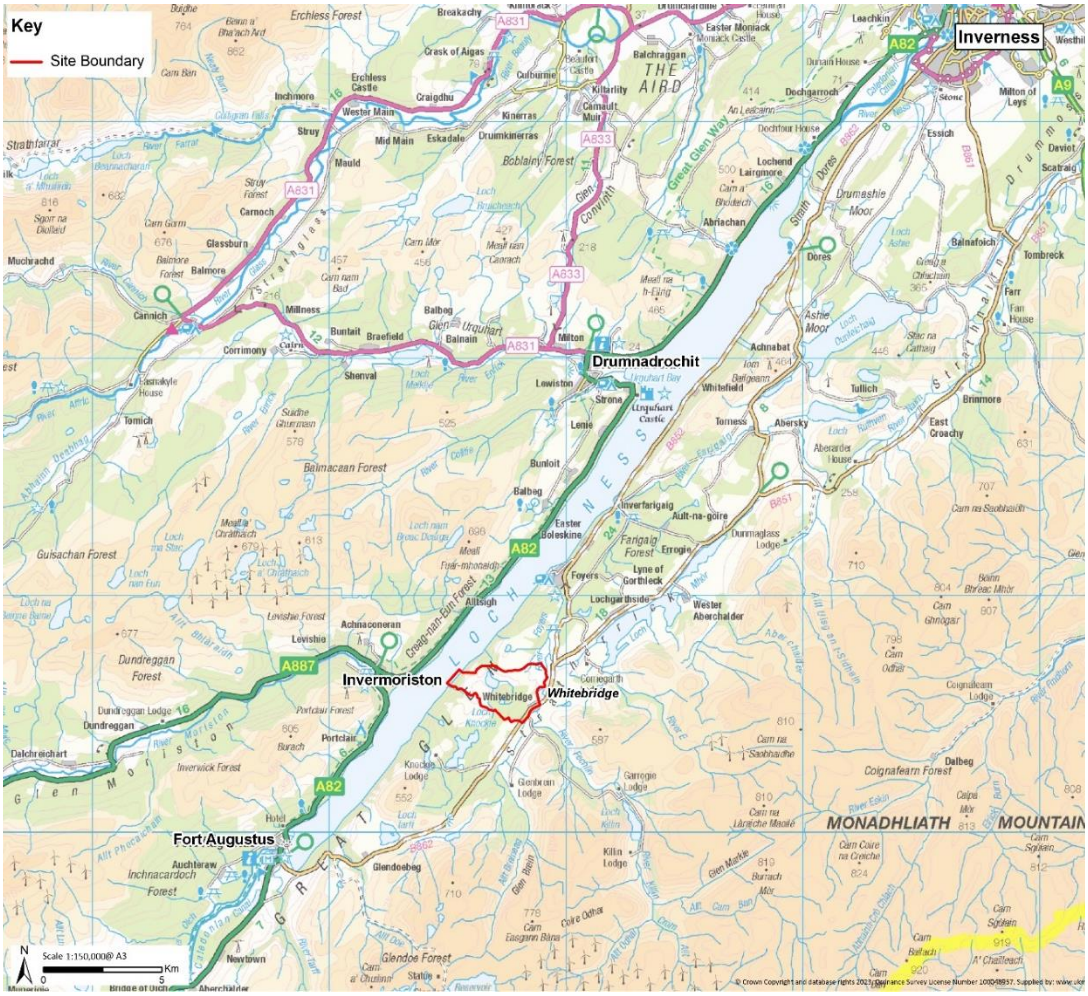
Use of corrugated arched culverts enable the river bed to be reinstated allowing free passage of water and animals. The use of local stone helps to set new features in the landscape, minimising their impact.

3. The Proposed Development

3.1 The Site Context

3.1.1 The site of the Proposed Development is located on the south-eastern side of the Great Glen approximately 13 km to the northeast of Fort Augustus. This is an area dominated by rocky hills, moorland and native woodland, managed in part for estate sporting activities. The most notable feature of the Proposed Development would be the siting of the powerhouse and associated structures on the eastern shore of Loch Ness, a world-class site and tourist destination. The Great Glen Way long distance walking and cycling route is located on the opposite shore of Loch Ness, but due to the existing forestry plantation and other vegetation, it has only intermittent vistas of Loch Ness and the site. The A82 trunk road is also situated on the western shore of Loch Ness and again the trees and vegetation ensure there are very limited opportunities to view the site from the road. There are a small number of properties on the western shore that have partial views of the site, most of which are located in the vicinity of Alltsigh or form part of the village of Invermoriston.

Site Location



3.1.2 The eastern side of Loch Ness and the site is a comparatively less travelled route and is served by the B862 between Inverness and Fort Augustus. The village of Whitebridge to the east of the site is situated in Stratherrick.

3.2 The Proposed Site

3.2.1 There are two key areas that would be affected by the Proposed Development; the area surrounding the upper reservoir works at Loch Kemp, and the area of the lower reservoir works at Loch Ness. The whole site is located on privately owned Dell Estate ground.

Upper Reservoir Works

3.2.2 The upper reservoir works area principally around Loch Kemp, comprise elevated rocky moorland with a series of low rocky hills including Creag Mhor to the north of the site, and Torr Paiteag between the site and the village of Whitebridge. The site is also visually separated from Whitebridge to the east and south by forestry planation and other woodland. Views into and out from the upper reservoir area are largely contained by a combination of landform and woodland. Existing estate tracks through the site are used informally by local walkers.

Upper Reservoir Works

Shore of Loch Kemp

View over Dell Estate

3.2.3 Access to this area is currently by means of existing tracks from the B862 at the village of Whitebridge. A new junction and associated tracks would be created off the B862 to minimise any disturbance to the local community. Existing access tracks within the estate would be upgraded and extended as necessary to a standard suitable for construction traffic, and reduced in size where feasible for operational use.

Lower Reservoir Works

3.2.4 The powerhouse building would be situated on the east shore of Loch Ness, opposite the village of Invermoriston. The site includes tailrace structures, and a pier with berthing facilities, associated access tracks, an access tunnel adit, and limited parking for staff and service vehicles. To the east of the tailrace site the hillside rises steeply, covered by the designated Ness Woods SAC, largely deciduous woodland and scrub. Rocky outcrops are also visible. There is no existing built development on this part of the loch-shore. Existing estate tracks mainly occur above the steeply sloping hillside, although there is some limited existing vehicular access down to the Loch Ness shore and these tracks would be extended and improved where possible, to provide vehicular access to the proposed powerhouse and tailrace site during construction and operation. Due to the steep nature of the hillside, the proposed tracks would need to be sinuous with several hairpin bends, and would be constructed to a width of approximately 6 m on straight sections and 7 m on bends within the SAC (whereas the tracks would have a running with up to 8 m elsewhere, during construction and would be reinstated (where feasible) to 4 m with passing places during operation). The track would feature a 4 m running surface (with passing places) with a 1 m drainage trench and 1 m safety barrier on opposing sides of the running surface. At tight cornering radii within the access track, the running surface width would be widened to 5 m to the allow safe operation of both fixed axle and articulated HGVs for construction and tunnel spoil transportation. Due to the extremely steep topography of the of 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. Rock cutting and benching would be necessary to accommodate the powerhouse platform area and associated works.

3.2.5 Although Invermoriston is situated opposite the lower reservoir site, due to the mature woodland and the layout of the village around the River Moriston, there are a limited number of buildings that have a visual connection with the site.

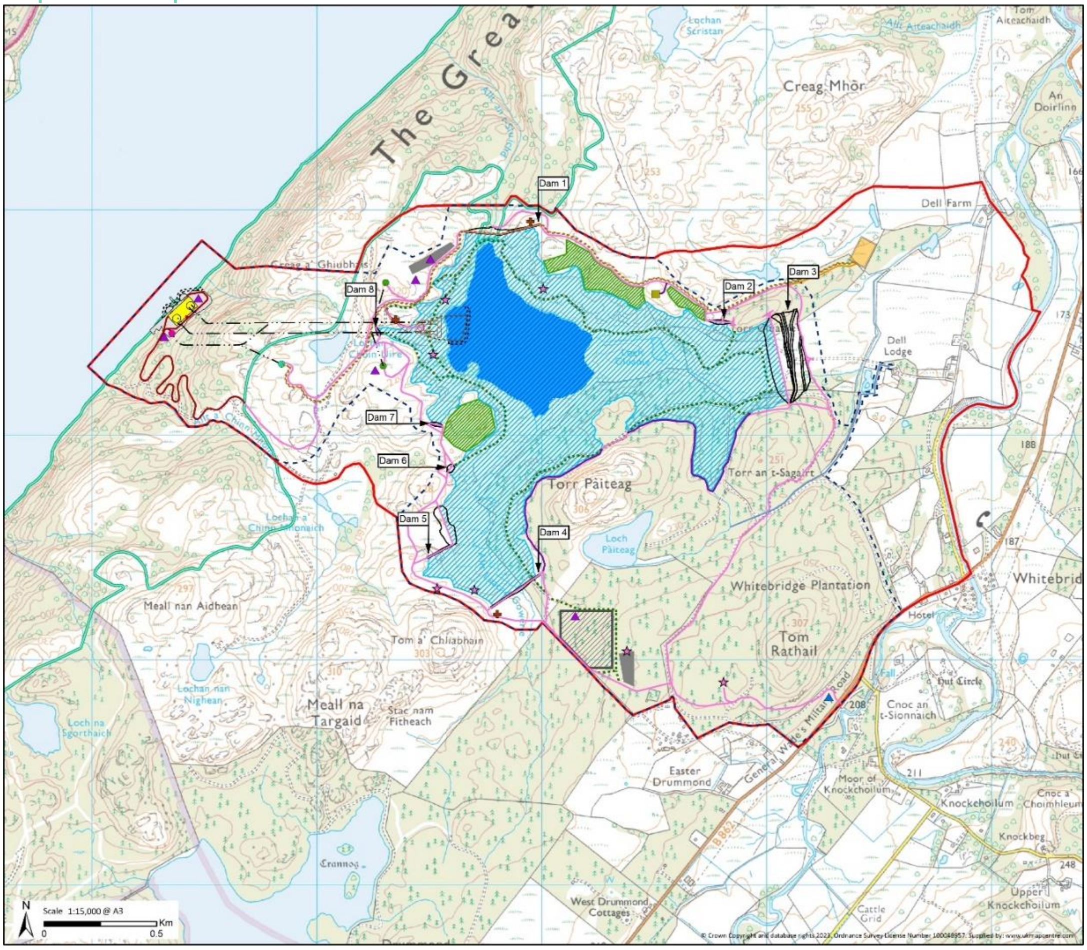
3.2.6 Local buildings are largely vernacular in appearance, built of local stone. Key sensitivities in this area include:

- The recreational use of Loch Ness which includes, boating (including canal boats traveling along the Caledonian Canal), sailing, canoeing, and tour boats, principally between Inverness and Urquhart Castle and between Inverness and Fort Augustus, as well as some commercial vessels such as small trawlers;
- Recreational use of paths and tracks on the western side of Loch Ness using the Great Glen Way; and
- Visual receptors on the western shore of Loch Ness including residential and tourist properties, local outdoor locations, and travellers on the A82.

3.2.7 Access during the construction and operation of the Proposed Development would utilise the existing B862 public road and Dell Estate forestry tracks (to be upgraded and extended) and would involve a new access onto the B862, and the creation of other new access tracks around the site, including a new access track to the lower reservoir works on the shore of Loch Ness. The Caledonian Canal would be used for the delivery of abnormal load components of Electrical and Mechanical (E&M) equipment associated with the lower reservoir works of the Proposed Development, removing a large number of potential Abnormal Indivisible Load (AIL) movements from the road network. The use of the canal for the delivery of further equipment and materials associated with the construction of the lower reservoir works would also be explored by the appointed Principal Contractor (in consultation with THC and other relevant stakeholders.

3.3 Proposed Development Layout

Proposed Development



3.3.1 The optimum design layout for the Proposed Development has been developed in order to achieve the most efficient technical performance, whilst keeping any environmental impacts to a reasonable minimum. This has involved the development of an indicative scheme design which has been refined and adjusted following site survey and discussion with technical specialists and key consultees.

3.3.2 The scheme as proposed would involve eight new dams and an associated upper reservoir located around Loch Kemp. A sub-surface intake would extract water, which would be transferred, via two high pressure tunnels to the powerhouse, where up to 600 MW turbines would generate electricity and pump water back up to the upper reservoir. A surface powerhouse with associated shafts was considered the best technical solution for the site. The tailrace structures would extract or return water via the tunnels, depending on whether the scheme was generating or pumping. Careful consideration has been given to the location of the features adjacent to Loch Kemp and Loch Ness, with the location being chosen to minimise tunnel lengths, and minimise land take in the Ness Woods SAC. Surge and ventilation shafts from the below-ground works are likely to be required, and would surface further up the hill near Lochan a Choin Uire.

3.3.3 A third tunnel would comprise an access tunnel for construction and maintenance. The tunnel adit would be located within the vicinity of the powerhouse building.

3.3.4 In order to provide a route for the grid connection cable from the 275 kV GIS substation located within the powerhouse building, without creating additional impacts in the Ness Woods SAC, it is proposed that the 275 kV cable would also be routed through the access tunnel. A short section of additional cable tunnel would diverge from the access tunnel and connect to a vertical cable shaft outwith the Ness Woods SAC in the vicinity of Lochan a Choin Uire. After exiting the cable shaft, the cable would be undergrounded and as far as practical, would follow the route of the access tracks that would be constructed as part of the Proposed Development, to connect to a new 275 kV switching station to the northeast of Loch Kemp near Dell Farm. The cable tunnel and the vertical cable shaft form part of the section 36 application, but the cable, and associated 275 kV switching station would be the subject of a separate consenting process and are considered as 'Associated Works' to the Proposed Development.

3.3.5 The existing estate fishing lodge sits on the banks of Loch Kemp and would be relocated[1] above the maximum inundation level of the new upper reservoir.

3.3.6 Details of the proposed design for each of the key scheme components are described on the following pages:

- Dam Designs;
- Lower Reservoir Works including the Powerhouse;
- Landscape Reinstatement and Mitigation;
- Access Tracks; and
- Rock Cuttings.

3.4 Dam Designs

3.4.1 The indicative dam designs have been developed to minimise any adverse impacts as far as possible. It is anticipated that they would comprise either roller compacted concrete dams (RCC), or concrete faced rockfill dams (CFRD). Dam 1 would likely be RCC to minimise the dam footprint within the Ness Woods SAC, whereas Dam 3 would likely be CFRD with additional earthworks and landscape mitigation on the dry face, to reduce the visual scale and bulk of the new structure in the surrounding landscape.

[1] 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.

Visualisation taken from Core Path IN25.01 near Whitebridge showing view of Dam 3 at 10 years after completion

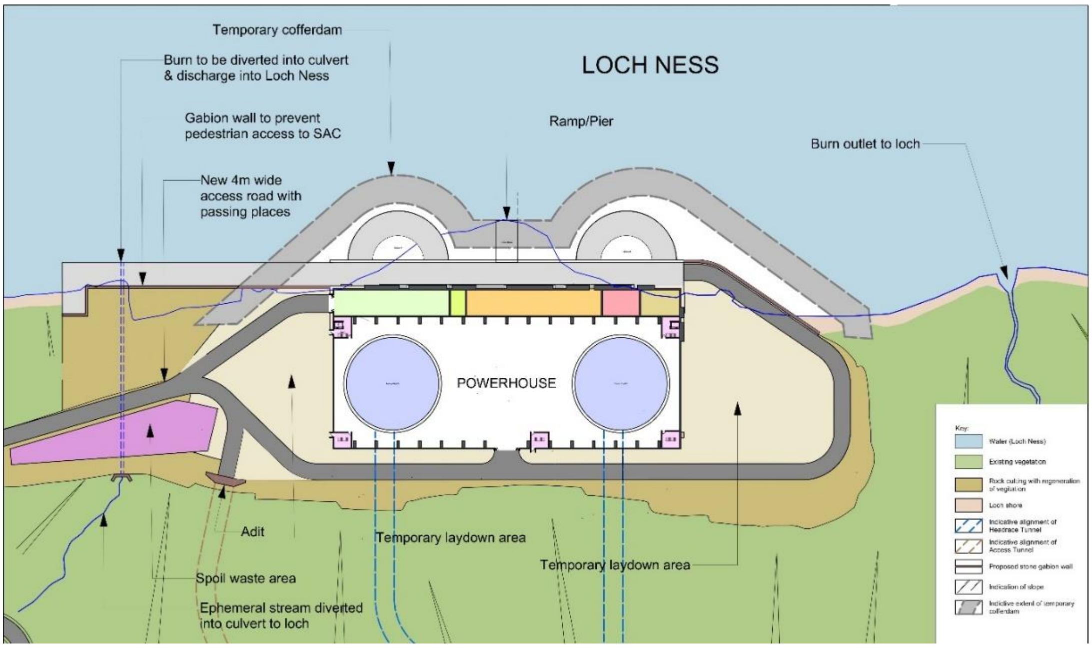
Example of a RCC Dam - Photo of Pitlochry Dam with Spillway (taken 2022)

Example of a CFRD Dam - Photo of 'dryside' of Glendoe Dam (taken 2023)

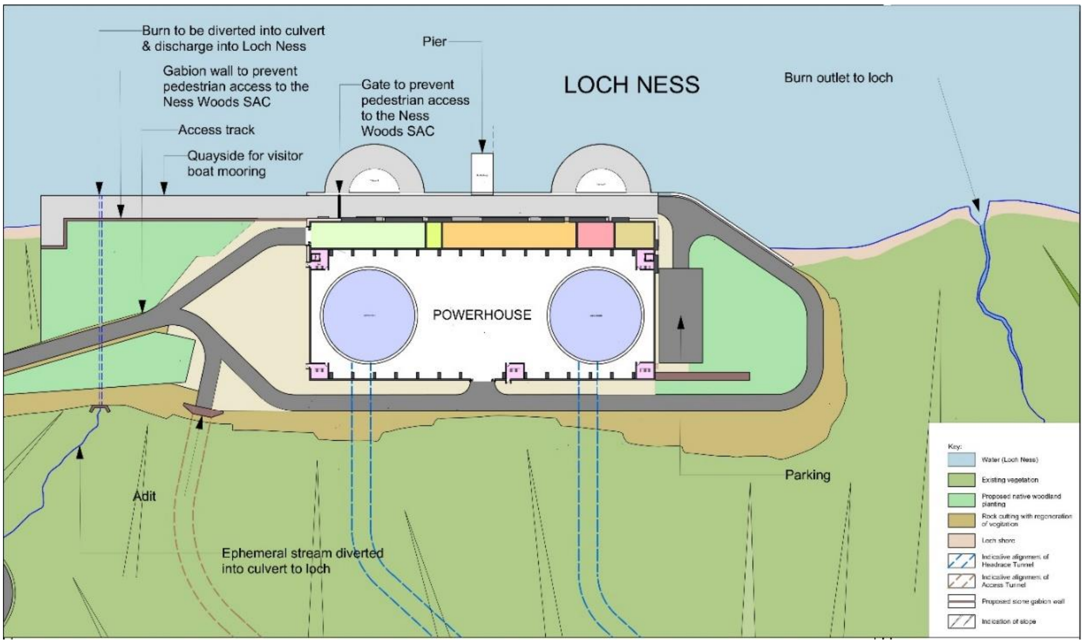
3.5 Lower Reservoir Works including the Powerhouse

3.5.1 The lower works comprise the powerhouse platform area, powerhouse tailrace structures, a pier, lower control works, parking, the access tunnel adit and associated access track. The turbines would be located in shafts within the powerhouse building. To facilitate the lower works, it would be necessary to locally excavate the rock of the steep hillside to create a working platform for the powerhouse and the tailrace structures. The mean top water level of Loch Ness is circa 16.0 m AOD. The lower level of the powerhouse building and pier would be approximately 3 m above mean water level (19.0 m AOD). The powerhouse building would be multi-layered to accommodate the turbine shafts, the transformers and switchgear, the workshop, stores, firefighting, administration and operations offices and visitor facilities.

Indicative Plan of Lower Works - During Construction

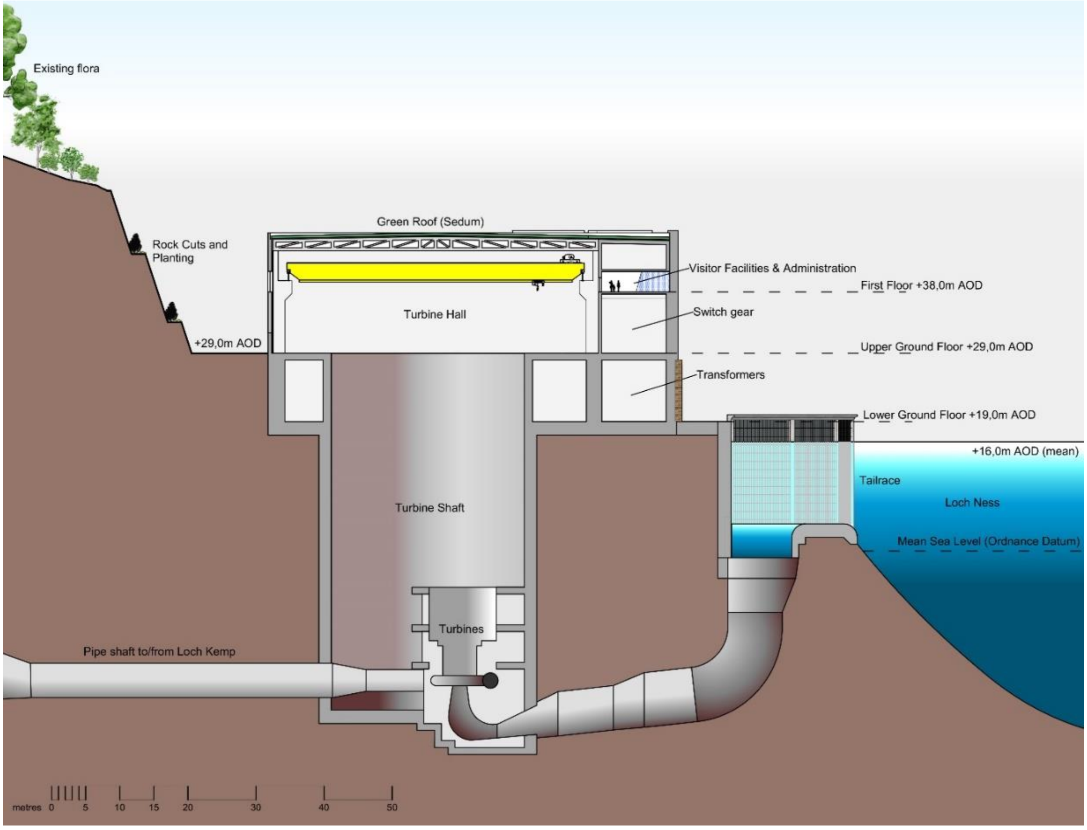


Indicative Plan of Lower Works - During Operation



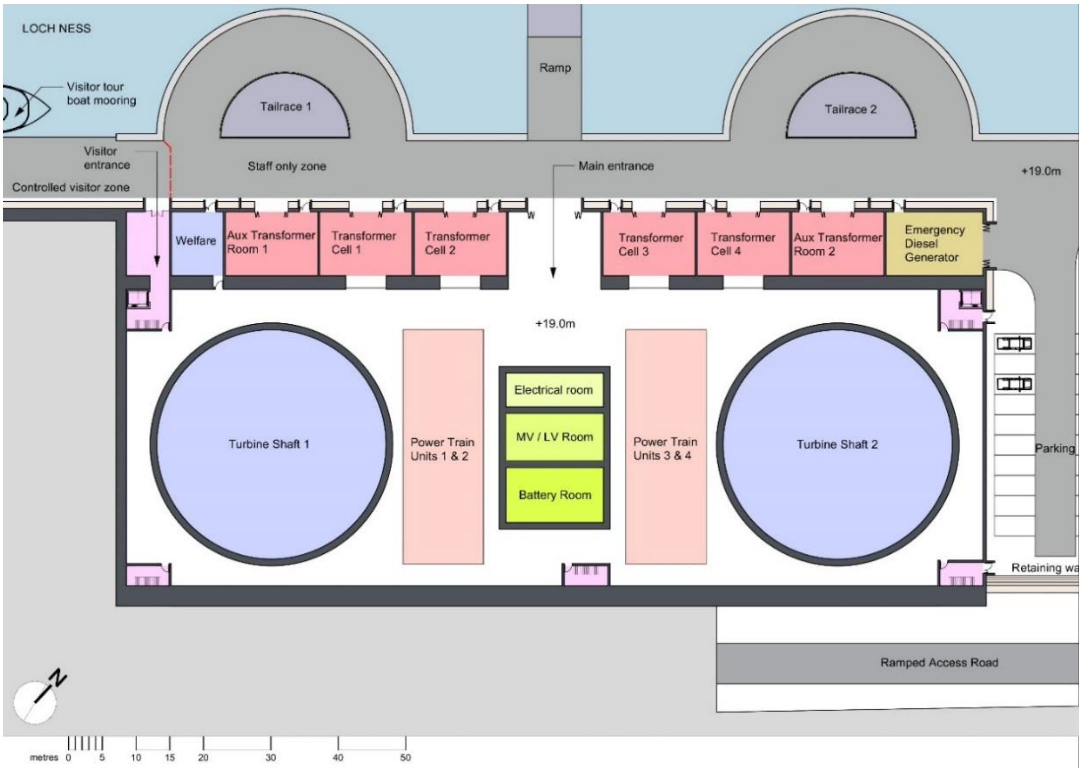
3.5.2 Around the powerhouse building there would be circulation areas for vehicles, parking for operational staff, and maintenance vehicles/equipment. These areas would be screened from principal views from the loch. The plans above illustrate the indicative layout of the lower reservoir works during the construction phase (indicating the temporary cofferdam and site establishment), and also the indicative layout at completion, with temporary works removed and mitigation earthworks and planting. The section and floor plans below illustrate the necessary relative floor levels and required spatial arrangements of each of these levels.

Indicative site section – Powerhouse and Turbine Shaft

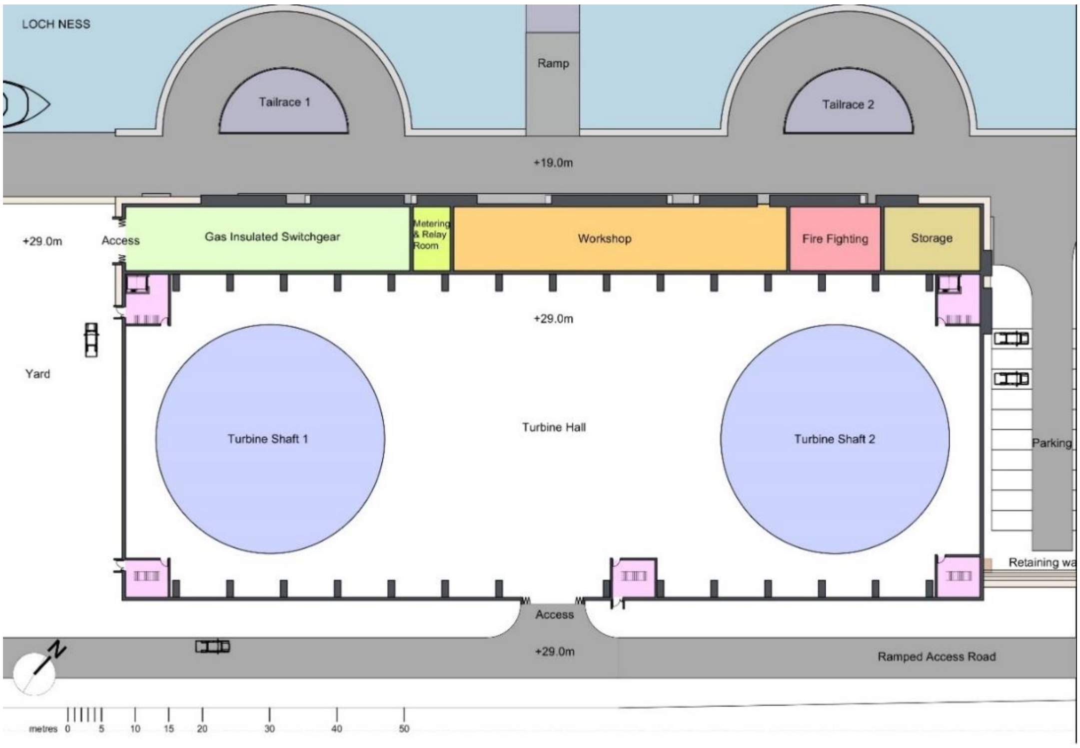


3.5.3 The overall size of the powerhouse building is determined by function. Although the final structure would be subject to detailed design, it is considered that this would require a building in the region of approximately 130 m x 60 m and would be approximately 30 m in height, excluding the underground turbine shafts. In addition, working space is necessary around the building to facilitate the construction and operational phases. It is expected that this would require an area of land approximately 300 m long x 110 m wide (not including tracks). Upon completion, landscaping would be carried out comprising earthworks and native planting to reflect the Ness Woods SAC species.

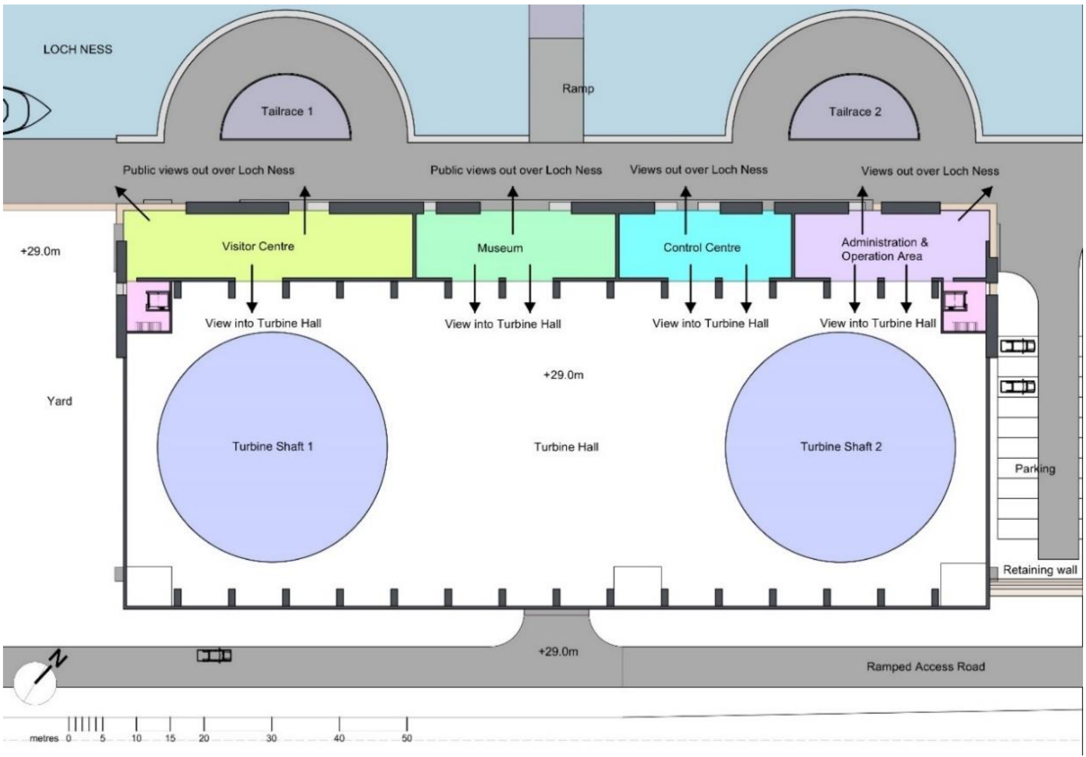
Indicative Powerhouse Lower Ground Floor Plan



Indicative Powerhouse Upper Ground Floor Plan



Indicative Powerhouse First Floor Plan



3.6 Landscape Reinstatement and Mitigation

3.6.1 Reinstatement proposals for the lower reservoir works on the shore of Loch Ness would concentrate on trying to minimise the visual impact of the rock cuttings, maintaining a simple frontage and structure, and screening the movement and activity associated with operation and maintenance of the scheme as far as possible. This would be achieved through adherence to the following principles:

- Retaining the shoreline vegetation as far as possible to maintain a consistent frontage along the shore of the loch, and limit gaps which would have the potential to draw the eye;
- Planting of native woodland species to restore gaps in the shoreline vegetation and soften the appearance of rock cuttings; and
- Allowing the growth of vegetation on benches and in crevices of higher parts of the rock cutting where practicable / safe;
- Retention of a simple frontage along the shore of the loch, using walls and the building to screen the movement and clutter of everyday activity, and minimising the need for features such as railings.

3.6.2 Upon completion of construction works, the shape of the rock face could be softened, where possible, to reduce hard vertical and horizontal edges and corners. Depending on the nature of the rock faces revealed once cut, it is likely that these would have to be faced or sealed for the safety of those working below. This may require the use of shotcrete (concrete sprayed at high velocity on the rock face). The utilisation of local stone may be considered on the lower part of the cuttings, to give the appearance of retaining walls and would have the following advantages:

- Local stone would reflect the tones and colours of the landscape context, particularly when seen from distance; and
- Use of stone on the lower sections of the cutting would present a more finished and high quality appearance at a human scale to those walking by.

3.6.3 To further soften the appearance of rock cuttings, landform would be introduced at the base, allowing native woodland planting to take place. Vegetation would also be encouraged to establish on benches and in crevices to soften the higher parts of the rockface. To maintain the simple frontage along the shore of the loch, it is proposed that much of the movement and activity which could catch the eye would be screened. Whilst the powerhouse building itself would act as a screen to activity associated with it, it is proposed that a low wall be located along the front of the lower reservoir works. This would also act as a safety barrier, eliminating need for railings along the front of the structure. The wall could be constructed to create a simple continuity with the powerhouse building.

3.7 Access Tracks

Upper Reservoir Works

3.7.1 Access to the upper reservoir works would follow existing tracks where possible, for construction works. However, as some of the existing estate access tracks would be lost to the inundation once the Proposed Development is operational, new sections of operational and estate access tracks would need to be constructed around Loch Kemp. Where existing tracks are utilised, these would require widening to approximately 8 m prior to commencement of the major construction works and reduced in width on completion where feasible. The vertical and horizontal alignment of widening works would be designed to minimise adverse impacts on local features that contribute to the character of the area, such as trees, walls, and local landform, where possible.

3.7.2 New tracks would be designed using robust design principles sympathetic to the environment. It is envisaged that tracks outwith the SAC would require widening to approximately 8 m during construction. Tracks that would be lost within the inundation area of the upper reservoir once the Proposed Development is operational would not be reinstated. Any upgraded tracks that are outwith the inundation area following construction would be reinstated to a width of approximately 4 m (with passing places), where feasible to facilitate operational and maintenance activities. The alignment of tracks has been carefully considered, based on information available, to follow the contours of the landscape where possible, and minimise obtrusive switchbacks. This would be further developed at detailed design stage utilising local landform to further minimise impact. Careful removal and storage of the vegetated peat layer prior to construction, would be important to enable reuse in reinstatement works, ensuring that vegetation along the edges of the new tracks would re-establish and marry in with adjacent undisturbed areas. Cut and fill slopes would be carefully graded to tie into the surrounding landform, and reinstated with vegetated peat.

Lower Reservoir Works

3.7.3 Access to the lower reservoir works would follow existing tracks where possible. However, to maintain safe gradients for vehicular access and haulage along the steep terrain leading down to the lower access works, the track alignment would be required to deviate from existing track alignment particularly at steeply sloped areas. Where the existing track is utilised it would require widening prior to commencement of the major construction works and reduced in width on completion, where practicable. The vertical and horizontal alignment of widening works would be designed to minimise adverse impacts on local features that contribute to the character of the area, such as trees, walls and local landform, where possible, and to minimise impacts on the Ness Woods SAC.

3.7.4 Where the existing track cannot be utilised, new tracks would be constructed where necessary, to a high standard of design and reduced in width on completion of construction works, where practicable. Within the Ness Woods SAC, new tracks would be constructed to a width of approximately 6 m, on straight sections and 7 m on bends rather than 8 m, in order to minimise land take within the Ness Woods SAC. It is anticipated that the track would feature a 4 m running surface (with passing places) with a 1 m drainage trench and 1 m safety barrier on opposing sides of the running surface. At tight cornering radii within the access track, the running surface width would be widened to 5 m to the allow safe operation of both fixed axle and articulated HGVs for construction and tunnel spoil transportation. The alignment of tracks has been carefully considered, based on information available, to follow the contours of the landscape and minimise obtrusive switchbacks. This would be further developed at detailed design stage utilising local landform to further minimise impact. Cut and fill slopes would be carefully graded to tie into the surrounding landscape and reinstated with vegetated soils.

3.7.5 It is anticipated that tracks and surfaces in key areas requiring the most frequent access and footfall (such as the powerhouse building) may comprise a sealed road surface. This would enable locally steeper gradients which may limit cut and fill in some areas and reduce the potential for erosion and the need for maintenance. The dark colour may also be less visually prominent in the landscape. Other tracks and areas would be surfaced with local crushed stone which is anticipated to have a similar colour and tone to existing exposed rock in the landscape.

3.8 Rock Cuttings

3.8.1 There would be considerable rock cuttings present at the lower reservoir works to the rear of the powerhouse building and lower reservoir works. Treatment of rock cuttings would depend on the nature of the rock revealed once cut. Where sufficient room was available and where practical, an uneven face would be formed to encourage long term re-establishment of vegetation on small ledges and crevices. Where space was more limited vegetation would be encouraged where possible to establish on benches through the placement of topsoil or peat. It is envisaged that these measures would help soften the appearance of these areas of cut and once weathered, the long-term appearance would not be dissimilar to areas of bare rock within the wider upland landscape.

Rock Cuttings on the A830 near Arisaig

The cut slope has been given a very irregular surface resulting in many small ledges and crevices. The placement of soils and hydro-seeding has encouraged vegetation to re-establish giving a more naturalised cliff-like appearance. Techniques such as this may help reduce the effects of rock cuttings.

A82 near Tarbet

Restricted space has resulted in a very high, steep cutting with little opportunity to break up the face of the rock. However, scrub vegetation has been allowed to establish along benches and other vegetation has colonised small crevices, helping to filter and soften the appearance. This type of technique could be used to soften the appearance of rock cuttings to the rear of the lower reservoir works.

Visualisation of the Proposed Lower Reservoir Works from the west. This visualisation shows how the lower control works might look with the encouragement of vegetation growth along the benches of rock cuttings.

4. Powerhouse Design Concept

4.1 Site Influences

4.1.1 The site is located within the designated Loch Ness and Duntelchaig Special Landscape Area (SLA). The SLA is dominated by the vast linear feature of Loch Ness and its dramatic landform. The waterbody trench is edged on both sides by steep towering wooded slopes that leads to moorland ridges and the contrasting interior plateau comprising of upland inland lochs, small woods and craggy outcrops. The loch and its setting are typical of the Great Glen as a whole, one of Scotland's most important routeways of striking uniqueness. The geological divide of the fault line, the major landforms of the Great Glen and the contrast between inclined and horizontal intersecting plains, form a powerful vista.

Seasonal changes in the rich colours of the landscape.


Juxtaposition of the loch and the hillside – sand, stone & rock. Scree slopes and boulders displaced to the shore.


Hillside mixture of trees, bracken, grass etc. Changes in colour through the seasons.

Pattern of vertical and near vertical elements within the landscape – visible tree trunks.

4.2 Precedent Power Station Images

Fasnakyle Hydro Power Station, Glen Affric.

4.2.1 Fasnakyle Power Station is an example of a well-designed large volume early post-war industrial building in an attractive setting. The design was contemporary at the time it was designed and built, and it sits proudly and unashamedly into the landscape. Its architectural quality is acknowledged by its Category A listing and is cited as being 'an outstanding example of a large station with an archetypal vernacular modernist design by James Shearer'.

Small Hydro Power Station, Ovre Forsland, Norway.

4.2.2 An example of a modern contemporary design for a hydro power station, sitting in a mountainous area with a vertical orientation contrasting with a horizontal overall form, is located at Ovre Forsland, Norway. It comprises a palette of timber cladding, transparent material such as glass or polycarbonate, composite steel cladding to the rear and expressed fenestration using concrete.

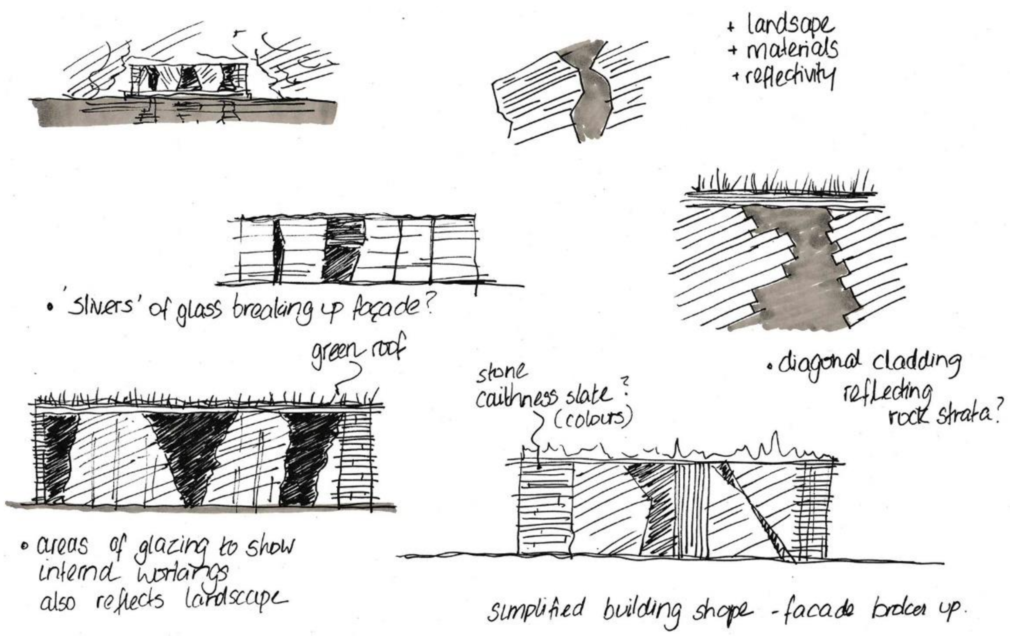
4.3 Design – Sketch Ideas and Design Development

Initial Concept Ideas

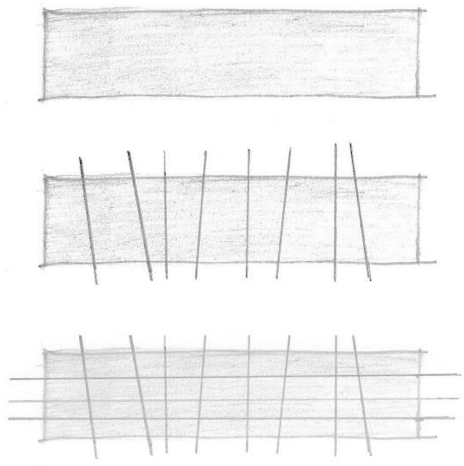
4.3.1 The challenge of how to design a sizeable, sustainable building in a large scale landscape that is generally viewed from a distance, has to be carefully considered. Firstly, the design has to reflect the landscape character: horizons, slopes, scale, colour, tones and materials.

4.3.2 The site palette of water, steep slopes, trees, rocks and sky dominate the vista. The ever-changing light varies how these elements are perceived. Looking closely at the landscape reveals a mixture of dominant and secondary elements that can influence the design solution. These are illustrated in the sketches below.

Concept Sketches

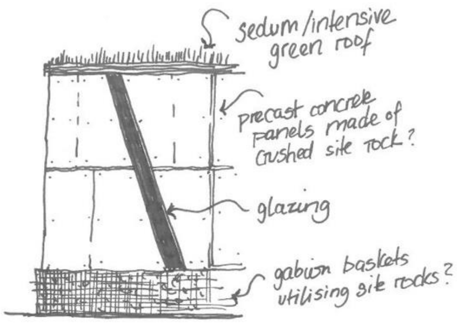


Design development sketches



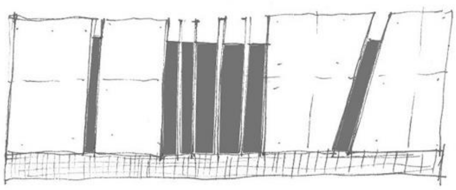
- A basic horizontal rectangular form following the horizontal nature of the loch and the skyline of the hillside.
- The mass broken with vertical or near vertical elements reflecting secondary visual elements such as tree trunks.
- The horizontal elements strengthened as a strata.

Design Development Study



- A 'green' or sedum roof links the building to the landscape.
- Cladding panels to the walls punctuated by glazed elements create breaks in the mass.
- A base course of stone from the site, perhaps in gabions, grounds the building with the rock of the landscape.

Sketch Elevation Study



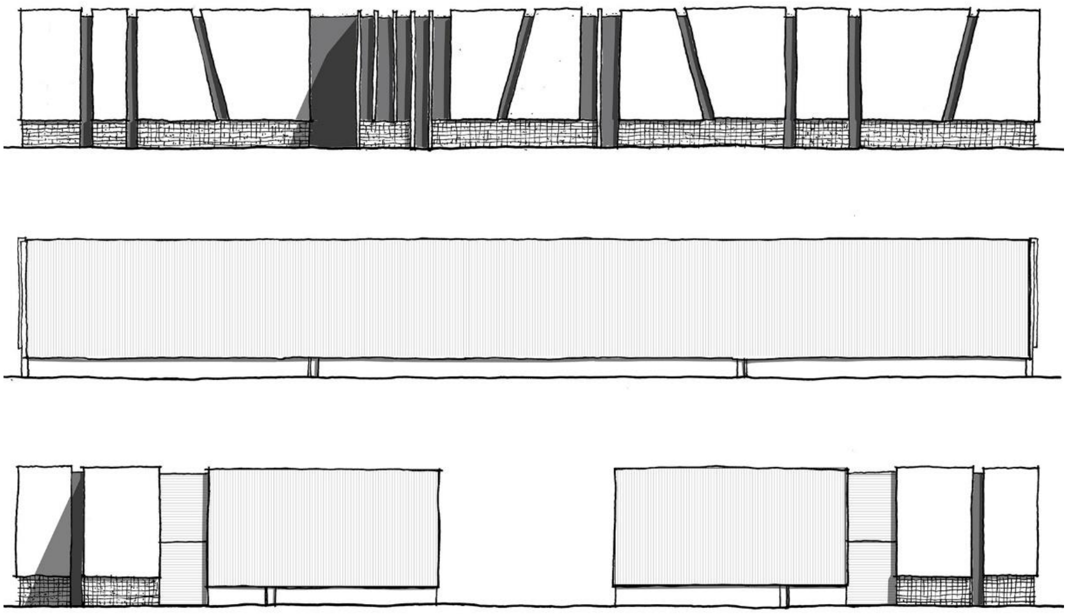
- A mixture of vertical and near vertical lines and breaks in the mass, start to reflect the random patterns of regenerating trees on the hillside.

Developed Scheme Elevations

4.3.3 The conceptual response moves from an initial reaction of a 'broken façade' and abstracted linear bisections inspired by the landscape, into a tangible elevational approach to both powerhouse and substation. A strong horizontal basecourse, with wide vertical and diagonal lines and planes break the roof line behind to blur the defined mass of the cuboidal edge. Definition is viewable from a distance.

4.3.4 The base course of gabions filled with broken rock from the excavations anchor the building with the site and its landscape. Visible rocks on the shoreline and slopes are a mixture of colours from pinks and light browns to varied greys. The gabions extend out from the building at either side and taper away with the profile of the hillside. This makes the building appear smaller and less intrusive.

Developed Scheme Elevations



Colour study

4.3.5 The eastern shore of Loch Ness is often cast into shadow as a result of the steeply rising hillside shading the site, and a mixture of dark foliage. A colour study (below) illustrates the effect of light to very dark coloured forms on the shoreline. Light colours are stark against the background and are inappropriate. Very dark (black) also sits uneasily in the landscape. Mid to dark greys however blend more effectively with the general landscape.

Colour Study

4.3.6 From this study, it is considered that the use of coloured cladding and concrete with transparent material such as tinted glass or polycarbonate would be the most appropriate approach to help the building harmonise with the landscape.

4.4 Materials

4.4.1 Following the site precedent of water, rock and flora, it is anticipated that the materials palette would focus on reconstituted stone, concrete, transparent materials such as glass or polycarbonate, and steel.

Stone

4.4.2 There would be stone available from the tunnelling / shaft formation and rock removal process to form the powerhouse platform. This stone could be crushed to suitable sizes and placed in suitable gabion baskets or similar stone facing to form a tiered basecourse around the public facing walls of the powerhouse.

Precedent Images of Buildings using Stone Filled Gabion Baskets

Concrete

4.4.3 The use of concrete is strongly associated with the design and construction of hydroelectric schemes due to its strength and durability with minimal maintenance required during its life. The use of local aggregates is also a factor in reducing cost and environmental impacts. The main structure of the powerhouse would naturally be a mixture of concrete and steelwork due to the scale, loads and spans involved.

4.4.4 The external cladding to the powerhouse on the public faces needs to fulfil a strong design aesthetic coupled with durability. Concrete, or an aesthetically similar non-combustible cladding material, could be coloured to harmonise with the landscape. It is envisaged that the concrete elements would be irregular, to reflect the vertical elements present naturally in the landscape and to create a contemporary design form. To the rear of the building, concrete could be used as the base walls below the composite cladding providing security and durability.

Precedent Images of Buildings with Concrete Walls

Steel

4.4.5 Steel would be used externally where required, principally to the rear of the building and as features around the openings.

Glass

4.4.6 Glazing would be used to provide natural light to the office and public access areas as well as views out to appreciate the panoramic views across the loch.

Roof

4.4.7 The powerhouse building would have a large flat roof. As part of the design development, roof finishes would be explored to consider the aesthetic, and bio-diversity benefits of a ‘Green’ or ‘Brown’ roof system.

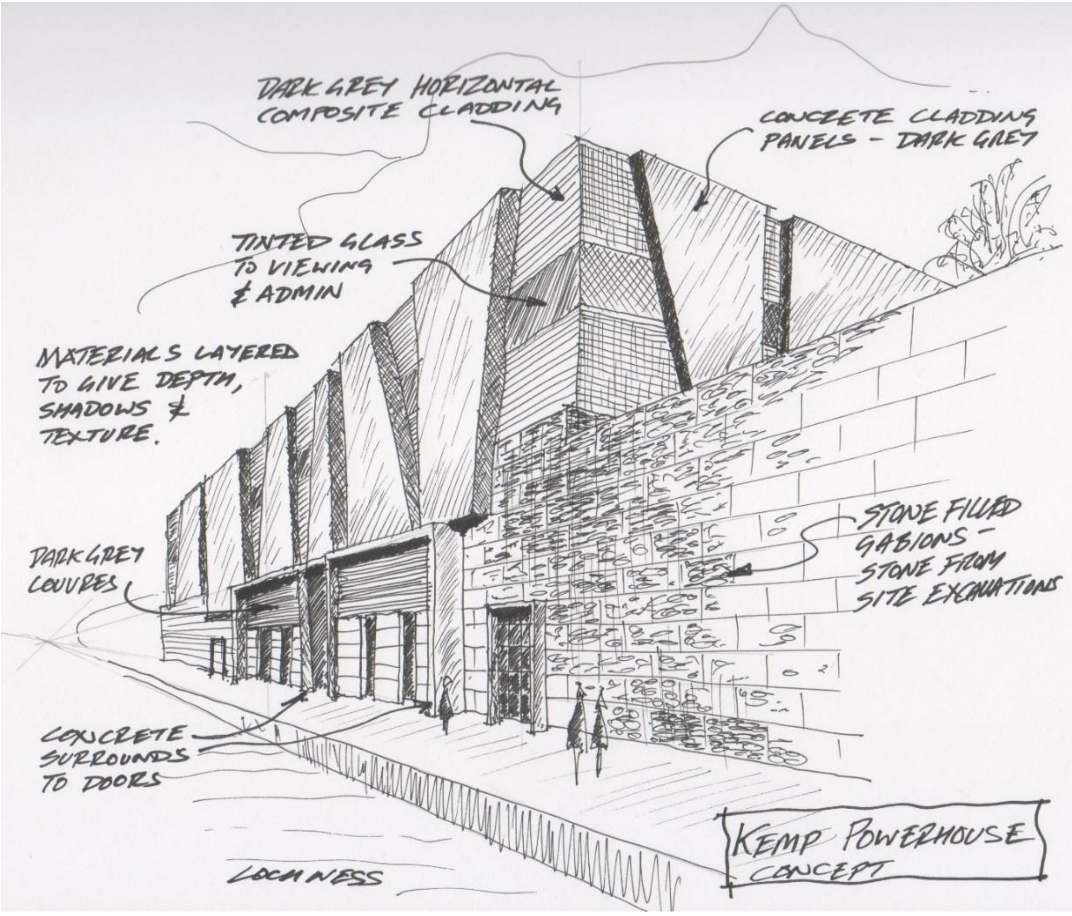
Durability

4.4.8 Due to the location of the site, and with a view to sustainable design, durable low maintenance materials would be preferred.

4.5 Design Layout and Elevational Approach

4.5.1 Using the landscape as key influences and with reference to the traditions of precedent developments, the design has evolved to take account of the functionality of the building as well as its aesthetic approach. This has resulted in a design concept as shown in the sketch below.

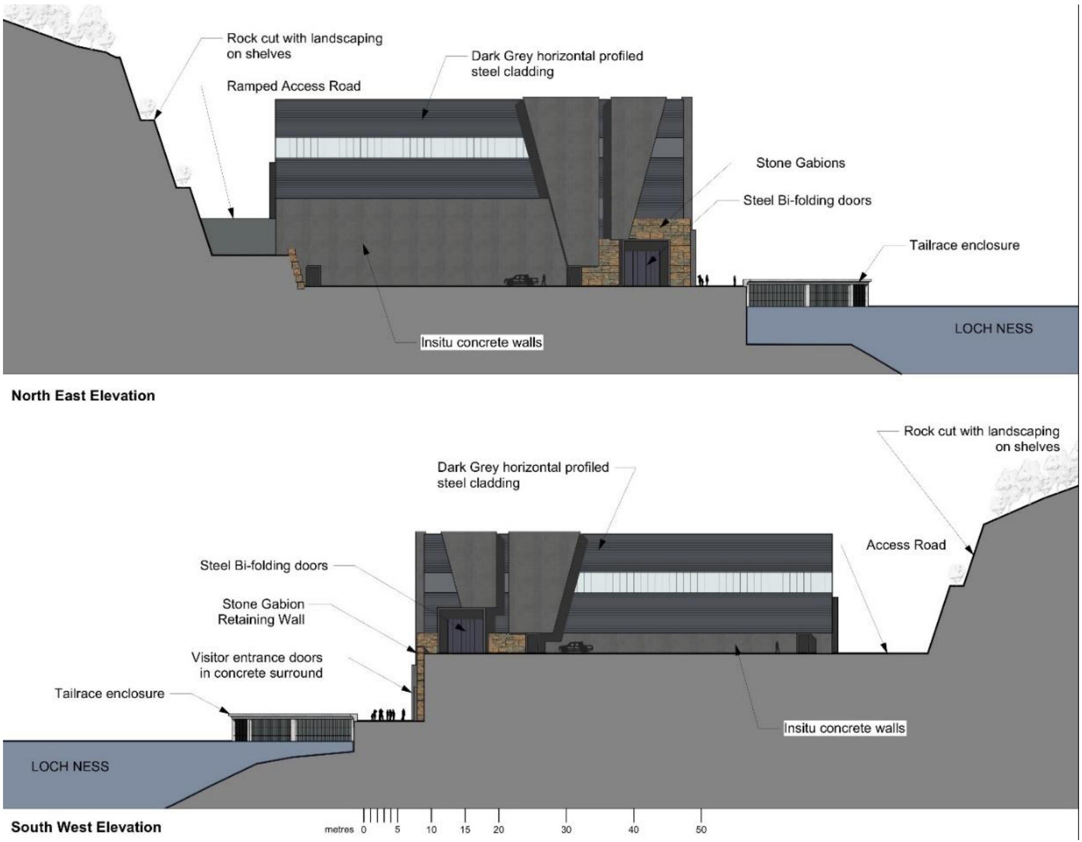
Sketch of Powerhouse Building



Visualisation of Powerhouse (once Completed)

Diagram of Powerhouse with Elevations (Northwest and Southeast Elevations)

Diagram of Powerhouse with Elevations (Northeast and Southwest Elevations)



5. Access Statement

5.1 Access for operations

5.1.1 Access to the powerhouse building and the wider development would generally be restricted to authorised powerhouse personnel involved in operations, maintenance and control of the Proposed Development, with appropriate signage and security measures in place to this effect. Vehicular movements on the hillside access track between the powerhouse building and the dam would similarly be limited to workers. There would be no public vehicular access for cars, buses, etc. to the powerhouse building.

5.2 Access for the general public – tourists and visitors

5.2.1 The powerhouse building would accommodate visitor facilities and may comprise information / interpretation exhibits about pumped storage, a viewing platform, a meeting room, and toilets. The public would be restricted to access the building via boat from the pier facility located at the loch side, to protect the adjacent Ness Woods SAC. All external publicly-accessed realms would be largely level providing a barrier free area for all. Access to and within the building would meet statutory accessibility regulations, inclusive of lift access between levels. The design of the access would ensure that the public would not be permitted beyond the powerhouse into the wider SAC, due to the sensitivity of the woodland to disturbance.

6. Sustainability Statement

6.1 The Proposed Development

6.1.1 The Proposed Development has sustainability at its very core. Its purpose is to facilitate the use of green energy to the national grid using low carbon technologies. It is therefore fundamental that the design and construction of the Proposed Development embody and demonstrate this philosophy.

6.1.2 The design process has looked carefully at the site, the environment and design decisions have been made to minimise impacts and enhance the environment locally. The Highland Council have produced detailed guidance[2] on how a sustainable design approach should be taken and this has been considered and incorporated. A summary of the steps taken and to be developed are shown in **Annex A**.

[2] The Highland Council. (2013) Sustainable Design Guide. Available at: file:///C:/Users/TWhite.ASH/Downloads/Highland_Council_Sustainable_Design_Guide.pdf

Loch Kemp Storage - EIA Report

Appendix 3.1: Design & Sustainability Statement

Annex A

November 2023

ash

HRI | Munro
architecture

Annex A

The Highland Council Sustainable Design Checklist

Sustainable Design Statement

Sustainable Design Issue	Minimum Standard Required	Response
1. Layout, scale, proportion, materials, construction and finishing Will the appearance of the development be visually appropriate, complementing local character whilst reinforcing local distinctiveness (e.g. materials, road pattern etc) and be clearly integrated with the wider community? A. Building materials and colour complement local character B. Site layout, building style and scale enhance local character C. Roof-scapes visually respect the local context (allowing for low carbon technologies where appropriate) D. Continuity of local building details such as simple and uncomplicated design of roofs, dormers, windows and doors E. Potential for personalisation by prospective residents F. Contemporary approach which reflects the local vernacular where appropriate.	A-C & F achieved. E not applicable to this development.	The layout of the powerhouse building and its relationship with the shoreline of Loch Ness is driven by functional requirements. These key imperatives are well established and dictate size and location to a large extent. However, to mitigate the footprint it is possible to stack a number of elements on three floors located at the loch facing side of the building which works well with the required height of the turbine hall. Floor plans: Vehicular access would be via the new access road and taken around the back of the building and dropping to the lower level with parking situated at the north end of the building. This would give access to all levels including the administration and operations areas on the first floor. The lower ground floor at tailrace level provides accommodation for the transformers and the power train units. The upper ground floor would have the turbine hall and access the turbine shafts, and would provide accommodation for the switchgear, workshops, metering and fire-fighting.

Sustainable Design Issue	Minimum Standard Required	Response
		The first floor would provide accommodation for the control centre, the administration and operation offices and the visitor centre and interpretation facility, all with views into the turbine hall and also across Loch Ness. The powerhouse building would be situated in a vast landscape, so despite its physical size, it would be dwarfed by the hillside. Materials are described in more detail in **Section 4** below, but they are envisaged to be from a simple palette of site stone, coloured concrete and dark grey profiled cladding to the walls and a sedum 'green' roof. The colours of the walls and doors would be generally mid to darker greys to help blend the building into the hillside. Due to the buildings size, the roof would be flat or have a very low pitch. This provides the opportunity to provide bio-diversity as well as reduce the visual impact of the building especially when viewed from above. This also provides the opportunity to position renewables such as PV's and solar thermal panels as required.
2. Landscaping Has a landscaping scheme been drawn up for the site which ensures that: A. Landscape forms the context for the development B. The development integrates into or enhances the present landscape character C. Green spaces are provided for public/private and site boundaries (including tree and shrub planting) D. Public open space and recreational provision is given as required E. Safeguards green networks within the site, and establishment of green network features that link into the wider green network.	Landscape scheme drawn up covering criteria A-E.	The need for the Proposed Development to 'fit' into the surrounding landscape while minimising landscape and visual impacts has been a key consideration of the design. The Proposed Development sits within an undeveloped open steep hillside with a mixture of trees, bracken, heather and low shrubs as detailed in the **Volume 1, Chapter 3: Description of Development** of the EIA Report. Any woodland / forestry removed during the formation of the Proposed Development would be compensated for (see **Volume 1, Chapter 19: Forestry** (and associated appendices) of the EIA Report). The design seeks to harmonise the built elements within the natural landscape both in terms of scale, colour and texture.

Sustainable Design Issue	Minimum Standard Required	Response
3. Cultural heritage Are the culturally and archaeologically important features on the site and their settings known, and how will these be affected by the development?	Please see Chapter 15 – Cultural Heritage	A detailed assessment of culturally and archaeologically important features within the vicinity of the site and their settings has been carried out as part of the EIA Report (see **Volume 1, Chapter 15: Cultural Heritage**). This assessment concluded that with the employment of appropriate mitigation measures there would be no significant effects on cultural heritage features as a result of the Proposed Development.
4. Materials Which materials are from secondary or recycled sources, have low-embodied energy, and are from sustainable and/or local sources? A: Roof B. External walls C. Internal walls (including separating walls) D. Upper and ground floors (including separating floors) E. Windows	The target is to achieve a Green Guide rating of A or B for the key elements of the powerhouse building construction listed in sections A to E. All timber used in the process must be from sustainable sources and FSC or PEFC certified.	The general approach to material selection is based upon a pragmatic assessment of function; sustainable sourcing; low maintenance and renewal, and end of life deconstruction. Additionally, where possible, materials would be selected which support bio-diversity. A: Roof – a sedum/green roof is preferred. The benefits are rainwater attenuation, visual harmony, expanding the bio-diversity on the site and can provide a safe sustainable environment for birds, insects etc. This roof would also attenuate noise and vibration from the turbines, as well as improve the overall roof insulation. **Green Guide rating: A** B. External walls – A mixture of concrete and steel frame is envisaged ; composite cladding with non-combustible insulation core; gabions filled with rock excavated from the site; and reinforced concrete cladding panels using crushed aggregate extracted at the site. **Green Guide rating: A or B.** C. Internal walls – Due to the structural requirements, many of the internal walls would likely be concrete. Non-load bearing walls would likely be lightweight framed with plasterboard. **Green Guide rating: A** D. Upper and Ground floors – Due to structural and fire separation requirements the floors would likely be reinforced concrete. **Green Guide rating: B**

Sustainable Design Issue	Minimum Standard Required	Response
		E. Windows – Windows to the building would likely be a combination of large glazed panels sub-dividing the concrete facade, and glazing to the admin, control, offices and visitor experience areas. Glazing is proposed to be a thermally-efficient aluminium framed, structural glass system or curtain walling system or other similar system. **Green Guide rating: B** All timber used in the building including during the construction phase (formwork, shuttering etc) would be from FSC/PEFC sources.
5. Natural heritage Has an assessment been made of the site's ecology and will the ecological value of the site be protected or recreated to equal quality and or enhanced?	An assessment has been undertaken and strategy produced by an ecologist to protect or recreate existing ecological value.	A detailed assessment of the site ecology has been carried out, the ecological value as been determined and a strategy has been produced to recreate and enhance the quality. Please see Volume 1, Chapter 10: Terrestrial Ecology, Chapter 11: Ornithology, Chapter 12: Aquatic Ecology and Chapter 13: Fish and associated appendices for further details.
6. Enhancing wildlife Will there be: A. No net loss in relation to habitats and species? B. A mixture of locally occurring species specified for planting and landscaping schemes? C. Any new links between habitats within the site or links to habitats outside the development boundary? D. An increase in important or sensitive habitats identified in the Local Biodiversity Action Plan (LBAP), either by creating or restoring ecological	A-D achieved.	Please see Volume 1, Chapter 10:Terrestrial Ecology, **Chapter 11: Ornithology**, **Chapter 12: Aquatic Ecology** and **Chapter 13: Fish** and associated appendices for further details on assessment of potential impacts on habitats, species and proposed mitigation measures. Potential impacts and proposed mitigation measures for Natura 2000 sites (i.e. European sites, including Ness Woods SAC) are contained in the standalone Habitats Regulations Appraisal (HRA) Report. Habitat and species compensation and enhancement proposals, including habitat creation and restoration, are detailed in the Outline Habitat Management Plan (OHMP) (see **Volume 4, Appendix 10.7**). Habitat compensation measures specific to Ness Woods SAC are detailed in the Derogation Report.

Sustainable Design Issue	Minimum Standard Required	Response
value (as assessed by an ecologist), or support for a species identified in the LBAP?		Landscape mitigation proposals specify the use of native locally occurring species (See **Section 2.6 of** the **Appendix 3.1: Design and Sustainability Statement** as well as **Volume 1, Chapter 8: Landscape and Visual Impact Assessment** of the EIA Report.
7. Energy efficiency What steps have been taken towards reducing CO_2 emissions through energy-efficient design for the proposed development? A. Minimising energy demand for the site through orientation and maximising passive solar gain B. Maximising the thermal efficiency of individual buildings through thermal mass, insulation, natural shelter, and appropriate glazing C. Minimising demand for water heating, space heating and cooling, lighting and power in individual dwellings through efficient equipment and controls.	A-C achieved.	At the detailed design stage the building will be assessed to ensure it can be energy efficient during its operation and design life. This will be achieved by meeting and ideally exceeding the minimum requirements for thermal performance stated in the Building (Scotland) Regulations 2004 and the Energy Performance of Buildings (Scotland) Regulations 2008. The energy performance will assess the whole building with a focus on reducing energy demand and associated greenhouse gas emissions. This will assess the requirements for 'nearly zero energy buildings'. Energy from renewable sources will be assessed and the most effective and appropriate option will be adopted based upon the outcomes of the 'Simplified Building Energy Model (SBEM)'. The building is aligned with Loch Ness due to terrain constraints and operational need. The elements of the building that require daylight for wellbeing are oriented to benefit from the views and daylight. Where needed, large panels of glazing will maximise passive solar gain. The building would benefit from heat from the turbines and the transformers. This would be used to provide heating to some or all of the building. High levels of insulation of the fabric along with good levels of air-tightness would minimise heat loss. In addition, the mass concrete structure of the walls and floors would provide thermal mass. High performance glazing would complete the energy efficiency of the structure.

Sustainable Design Issue	Minimum Standard Required	Response
		Low energy fittings, PIR control and environmental sensors would provide efficient building Management and reduce electricity usage.
8. Renewable energy Has the energy demand for the development been calculated to determine: A. The amount of low or zero carbon technology e.g. wind, solar, hydro, photovoltaic (PV), Combined Heat and Power (CHP) that is practicable to meet the extant Building Standards CO2 emissions reduction target. B. The % of total site energy demand that will be produced from on-site renewable energy technologies. C. Meeting the remaining energy demand efficiently, e.g. non-renewable or waste powered district heating and cooling.	A-C will be achieved by a combination of on-site low or zero carbon technologies (LZCT) and any other appropriate measures.	At the detail design stage the most appropriate low and zero carbon technologies appropriate to the site and the building will be determined. The objective will be to meet the Building Standards CO^2 emissions reduction target. This will be achieved by a combination of on-site low or zero carbon technologies (LZCT) and any other appropriate measures. The assessment will determine the percentage of total site energy demand that will be produced from on-site renewable energy technologies. The final design solution will meet the prevalent requirements of the 'Scottish Building Standards', the 'Climate Change (Scotland) Act', the 'Scottish Planning Policy' and 'A Low Carbon Building Standards Strategy for Scotland'.
9. Foul wastewater treatment Will the development be connected to the public sewer; if not has a sustainable waste water treatment system been designed to avoid unacceptable damage to the water environment?	Foul drainage will be treated by a suitable waste water treatment system to allow clean water to be discharged to Loch Ness.	Due to its geographic location in relation to public sewers, a private foul waste water treatment system will be required. Engineers will assess the load and design a suitable foul water treatment system in consultation with SEPA. The foul water drainage system will be regulated and authorised by SEPA.
10. Flooding What measures have been taken to ensure that the development will: A. Be free from significant risk of flooding;	Reference has been made to SEPA's flood risk maps to determine if a flood risk assessment is required.	The lower works including the powerhouse building would be located beside Loch Ness. The SEPA flood maps have been consulted and the site is not in an area designated as a flood risk area. While the top water level of Loch Ness does vary the difference between the mean top water level of 16.0 m AOD and the lower ground floor of the Powerhouse at 19.0 m AOD gives

Sustainable Design Issue	Minimum Standard Required	Response
B. Not add to the area of land that requires flood prevention measures; and C. Not affect the ability of the functional floodplain to store or move flood waters?		sufficient freeboard protection to the building. The tailraces and the quayside and pier will have a wave protection wall with a top level of 20.0 m AOD giving added protection. Please also refer to **Volume 1, Chapter 7: Water Management** and **Chapter 14: Geology, Soils and Water** of the EIA Report for further details on Flooding. The assessment also considers potential cumulative flood risk, associated with in-combination effects associated with other hydraulically connected pump storage schemes.
11. Surface water runoff Which of the following localised strategies for ensuring that runoff from the finished development does not exceed runoff from the previously undeveloped site have been proposed and designed in accordance with the SUDS Manual C697 published by CIRIA: A. Prevention of runoff at source – through simple design measures on individual buildings (e.g.; minimising paved areas) to allow water to return to the natural drainage system as near to the source as possible and not to contribute to runoff. B. Source control of runoff rate/volume - through control of the rate/volume of runoff generated close to source e.g.: rainwater harvesting systems, green roofs and individual soakaways for buildings. C. Site control of water management – water is managed from several areas e.g.: roofs and parking areas into one large soakaway or device such as an infiltration basin. This incorporates enhancing biodiversity and amenity, and is sized to allow incorporation of further developments in future.	A-C achieved	There are several natural burns and streams taking surface water runoff from the hillside into Loch Ness. The new access track and powerhouse platform would cross some of these ephemeral streams. The number of required watercourse crossings has been minimised as part of the site design. Where this occurs, the burns would be diverted or culverted as necessary into Loch Ness. Rainwater channels would collect rainfall runoff from the proposed access track and include regular discharge points to ensure existing surface water flow paths are maintained. SuDS drainage techniques have been proposed which allow for the attenuation and treatment of runoff prior to discharge. Please refer to **Volume 1, Chapter 14: Geology, Soils and Water** of the EIA Report for further details. Around the powerhouse building there would be a pattern of drainage channels that would again be directed to the loch. The roof of the powerhouse would be sedum. This will provide rainwater attenuation before the gutters direct the water to the Loch. At completion, new soft landscaping would provide some additional attenuation of rainwater.

Sustainable Design Issue	Minimum Standard Required	Response
12. Water conservation How will the development sustainably meet the required water demands including through the use of: A. Water efficient appliances such as dual flush toilets, aerating taps, and water-efficient white goods; B. Rainwater collection for re-use; C. Green roofs.	A-C achieved.	Due to the remote location of the powerhouse, water would be acquired at the site. This may be directly from rainwater harvesting, the loch or from a borehole(s), or from a bottled water source where required for potable use. The design will seek to identify and utilise water saving measures such as dual-flush WC's, aerated taps, and grey water for WC's.
13. Waste and recycling Has suitably screened space been made available for the storage of waste and recyclables in or around each building including: A. Space for sorting and storing recyclable materials; B. Space for general waste storage; C. Space for composting organic kitchen and garden waste?	A-C achieved.	Facilities for temporary storage of waste would be provided on site. During the construction phase the main contractor would be required to sign up to the Considerate Constructors Scheme to ensure responsible handling and management of waste. During the operation phase, waste would be divided into designated recycling containers and the operators would have a waste management plan and arrange for regular removal of waste to an approved recycling and waste disposal facility.
14. Site management How will development of the site be undertaken in a manner which minimises disturbance to neighbouring properties and the environment including addressing: A. Noise pollution B. Light pollution	The Considerate Contractors Scheme would be adopted and implemented to minimise noise, light and air pollution. A site waste management plan would be put in place that reflects the	A series of site investigations have identified the nature and extent of wildlife, flora and fauna on and around the site. This is detailed elsewhere within the EIA Report (see **Volume 1, Chapter 3: Description of Development, Chapter 8: Terrestrial Ecology, Chapter 14: Geology, Soils and Water, Chapter 16: Traffic, Access and Transport, Chapter 17: Noise and Vibration, Chapter 18: Air Quality** and **Chapter 19: Forestry** (and associated appendices) of the EIA Report). Protection and mitigation measures are detailed in these reports. In addition, site operations

Sustainable Design Issue	Minimum Standard Required	Response
C. Air pollution D. Construction waste E. Surface water run-off F. Soil handling G. Protection of trees H. Traffic movements I. Access	requirements of Netregs including identifying: • Types of waste removed from the site • The person who removed the waste • The site to which the waste is taken; and • Key sources of potential disturbance and pollution are identified and mitigation measures put in place.	may have impacts upon the environment and these must be addressed during the construction phase. These impacts may include but are not restricted to air, noise, light and dust pollution. At the detailed design stage, operational site lighting would be assessed and designed to minimise light pollution across the loch to receptors including those travelling on the A82, navigational users, and residents within viewing distance of the powerhouse. During the construction phase, obligations would be placed upon the site construction team to assess the risks and have in place procedures for prevention of pollution that may occur as a result of the works. Refer to **Volume 4, Appendix 3.3: Outline Construction Environment Management Plan (CEMP)** of the EIA Report**.** Construction phase waste management will be considered and systems will be in place to ensure materials being delivered to the site are stored safely and packaging and surplus materials are disposed of in a responsible manner. Also refer to Volume 4, Appendix 3.2: Schedule of Mitigation, Appendix 3.4: Spoil Management Plan, Appendix 9.1: Outline Outdoor Access Management Plan (OAMP), Appendix 10.6: Outline Habitat Management Plan (HMP), Appendix 14.1: Peat Management Plan (PMP), Appendix 14.2: Peat Landslide Hazard Risk Assessment (PLHRA), Appendix 16.1: Transport Assessment, Appendix 17.3: Outline Construction Noise and Vibration Management Plan (CNVP) and Appendix 19.2: Loch Kemp Pumped Storage Woodland Management Plan of the EIA Report.
15. Transport How does the development proposal make a positive contribution towards the improvement of the sustainable transport network by: A. Reducing car dependency; B. Promoting sustainable transport modes;	A & D achieved. B & C not applicable to this development	The Proposed Development would lead to an increase in traffic, including Heavy Goods Vehicles (HGCs) on the B862 during construction, although it is envisaged the Caledonian Canal system would be used as far as practicable in the delivery of larger items by boat, such as the electrical and mechanical (E&M) equipment for the project. As part of the rock cut and tunnel boring processes, it is anticipated that rock and crushed aggregate from the site will be available for concrete batching and for the stone filled gabions. This use of site material would reduce the potential environmental impacts as well as reduce vehicle movements on the B862. A Transport Assessment, which includes an outline Construction Traffic Management Plan (CTMP), an

Sustainable Design Issue	Minimum Standard Required	Response
C. Creating or linking to existing sustainable travel modes including the core path network, safe routes to schools and workplaces by cycle, pedestrian or public transport; D. Reducing the need to travel; demonstrated through a Transport Assessment where transport impacts are considered to be significant.		Abnormal Loads Management Plan and a Canal Management Plan, is covered elsewhere in the application (refer to **Volume 4, Appendix 16.1: Transport Assessment** of the EIA Report). The site is located on private ground within the Dell Estate and there are no public roads, cycle paths or footpaths leading to schools, workplaces or other public facilities within the site. Core Path (IN25.01 - Dell Lodge – Foyers), which forms part of the South Loch Ness Trail and the Loch Ness 360 route, runs through Dell Estate, east of the Proposed Development. Access to this Core Path would not be disrupted by the Proposed Development. See **Section 16** below for more information on access to recreational routes. The public would be able to continue to take non-motorised access to Dell Estate during the operation of the scheme and new tracks would be created around Loch Kemp to replace those lost to the inundation area. However, no public vehicle access would be provided from the B862 to the powerhouse building.
16. Pedestrians and cyclists How close is the development to existing public transport networks? What provision is made for secure cycle storage in new buildings and at associated local facilities including transport hubs?	The nearest public transport to the Proposed Development is available in Whitebridge, where there is a bus stop. No other forms of public transport are available in the vicinity of the site. The Caledonian Way Long Distance Cycle Route follows the B862 which forms the eastern edge of the site boundary and will join up with the proposed new access junction to the site.	The nearest public transport is available in Whitebridge, where there is a bus stop. The temporary work camp would be within walking distance of the nearest bus stop. The powerhouse building is remote and unlikely to be a viable option for walking from the bus stop to the building, although could be accessible by bike once operational. The site is located on private ground within the Dell Estate. The local community currently use the existing estate tracks around Loch Kemp informally for walking and horse riding. Core Path (IN25.01 - Dell Lodge – Foyers), which forms part of the South Loch Ness Trail and the Loch Ness 360 route, runs through Dell Estate, east of the Proposed Development. Access to this Core Path would not be disrupted by the Proposed Development. This Core Path and/or the existing estate tracks could be accessed from the bus stop in Whitebridge. The Caledonian Way Long Distance Cycle Route follows the B862 which forms the eastern edge of the site boundary and would pass the new access junction. A short section of the South Loch

Sustainable Design Issue	Minimum Standard Required	Response
		Ness Trail and the Loch Ness 360 route is also routed along the B862 where it forms the eastern edge of the site boundary. Although these walkways would not directly interfere with the new access junction, the Proposed Development would result in larger volumes of traffic travelling along this section of road during construction. There would therefore be an obligation on the appointed Principal Contractor to implement an Outdoor Access Management Plan during construction. A draft Outdoor Access Management Plan is included in Volume 4, Appendix 9.1 of the EIA Report. Refer to Volume 1, Chapter 9: Land Use and Recreation of the EIA Report for further information on recreational routes. The public would be able to continue to take non-motorised access to Dell Estate during the operation of the scheme and new tracks would be created around Loch Kemp to replace those lost to the inundation area. However, no public access would be provided from the B862 to the powerhouse building. Instead, public access would be limited to access by water from Loch Ness, and strictly controlled boats that would berth at the quayside and pier by appointment only. Once disembarked from the boat, the accessible area would be controlled by means of walls, gates and signage and overseen by the tour guides to protect the Ness Woods SAC.
17. Efficient use of land and existing buildings How does the design ensure that: A. Disturbance to soils is minimised for example through minimising required earthworks. B. Where appropriate demolition materials will be re-used on-site, rather than transported off-site as waste materials. C. Existing redundant and derelict buildings are sympathetically converted and/or restored where appropriate with a bat survey and mitigation plan carried out if necessary.	A and B achieved. C is not applicable. No derelict or redundant building are present on the site but an Extended Phase 1 Habitat and a National Vegetation Classification (NVC) Survey has been carried out and the results are shown in **Volume 2, Figure 10.3: Phase 1 Map with**	The engineering of an infrastructure project of this nature dictates the physical size of the building and the associated access and construction areas. However, every effort has been taken to minimise the land take especially at the lower works around the powerhouse. In addition, where possible, land occupied during the construction phase would be reinstated with landscape earthworks and planting. This would both restore some of the habitat and provide visual softening and harmony. It is intended that the rock excavated as part of the Proposed Development would be reused on site to form the dams around Loch Kemp and also for the gabions at the powerhouse building.

Sustainable Design Issue	Minimum Standard Required	Response
	Proposed Infrastructure Overlain and **Figure 10.4 NVC Map with Proposed Infrastructure Locations Overlain**	
18. Design for flexibility Has flexibility been designed into all units to provide adaptability to changing needs? A. Has design to Lifetime Homes Standards been adopted? B. Has infrastructure been installed to allow for home working, e.g. telephone / WiFi for all developments? C. Does building structure and position allow for future extension? D. Have construction techniques been used which enable internal walls to be easily removed or re-positioned to create new spaces?	A & B only required for residential developments. C & D achieved.	The functional requirements of a pumped storage scheme are well established. While every effort is taken at the concept stage to predict future requirements it is inevitable that some variation may be necessary in the future. The design of the powerhouse building provides all the necessary spatial requirements, but also flexibility for future adaptations. The upper floor provides sufficient adaptive space for visitor information, and a museum of Pumped Storage and Hydro Electric schemes. This space could provide areas for information, conference and evolving presentation opportunities.
19. **Private amenity space** Is there provision for private amenity space e.g.: private garden, balcony, roof terrace or patio, or a communal garden/courtyard which is easily accessible for occupants of designated properties, and does the size and type of area provided allow for: A. All occupants to sit outside at once; B. Safe access by those using wheelchairs or mobility aids;	A-E not applicable to this development.	The majority of the powerhouse and its immediate surroundings would be strictly controlled areas due to the sensitive nature of the facility. It is also important to limit public access to designated areas only, to ensure people do not gain easy access to the SAC. This could be achieved by a series of measures such as gabion walls and discrete fencing. Appropriate signage may also be incorporated.

Sustainable Design Issue	Minimum Standard Required	Response
C. Growing fruit or vegetables; D. Composting of kitchen and garden waste; E. Drying washing.		
20. Accessibility of community facilities How far in miles is the development from the following facilities? A. Healthy facilities such as a surgery or pharmacy; B. Education facilities such as a crèche, primary and secondary schools; C. Shop; D. Bank, Post Office or cash machine; E. Leisure facilities such as a community centre or indoor sports facility.	A-E not applicable to this development.	