

FEARNA STORAGE

Fearna Pumped Storage Hydro Scheme - EIA Report

Appendix 2.1 – Sustainable Design Statement Part 1 of 2

February 2025



Quality Information

Prepared by

Steven Leask

Checked by

Peter McLaughlan

Approved by

Ross Barrett

Revision History

Revision

01

Revision Date

February 2025

Details

Issue to ECU

Authorised

Fraser Allison

© 2025 HLM Ltd. All Rights Reserved

Fearna Pumped Storage Hydro Project
Sustainable Design Statement

FEARNA-HLM-XX-XX-RP-00001

Revision 04
13 February 2025

HLM
Architects

Notes

The designs shown within this report are sketch only and subject to design development. Unless stated otherwise, the designs shown are subject to detailed site survey, investigations, and legal definition, the CDM Regulations, and the comments and/or approval of the various relevant Local Authority Officers, Statutory Undertakers, Fire Officers, Engineers and the like. They are copyright, project specific and confidential and no part is to be used or copied in any way without the express prior consent of HLM Architects.

Reference Number: FEARNA-HLM-XX-XX-RP-00001

Job Name: Loch Fearna PSH

Job Number: 13-1185-01

Document: Report

Revision:

Rev.04: for Planning Application – 13 February 2025

Produced by: HLM

Checked by: RB / PM

Applicant
Fearna PSH Ltd.
No. 1 Forbury Place
43 Forbury Road
Reading, RG1 3JH

Planning Agent
Gilkes Energy Ltd
Festival House
177 West George Street,
Glasgow, G2 2LB

Landscape and Visual Consultant
ASH Design + Assessment Limited
Suite 2/3, Queens House
19 St Vincent Place,
Glasgow, G1 2DT

Architect
HLM Architects
Ailsa Court
121 West Regent Street,
Glasgow, G2 2SD



Contents

01: Introduction
02: Secure + Clean Energy
03: Existing Hydro Electric Sites
04: The Fearna Pumped Storage Hydro Project
05: Proposed Development
06: Best Practice + Sustainability
xx: Appendices

01 Introduction

01: Introduction

1.1 The Proposed Development

- 1.1.1 Fearna PSH Ltd. (The Applicant) is proposing to construct a pumped storage hydro facility approximately 23km west of Invergarry. The proposed facility would be co-located with the existing Quoich Hydro scheme, which was built by the North of Scotland Hydro Electric Board in the 1950s and continues to operate and which provides key aesthetic references to the design of the Proposed Development.
- 1.1.2 The function of the Proposed Development would be to create a nationally significant large-scale long duration electricity storage (LDES) scheme which would store and release energy to or from the electricity transmission system to balance supply and demand for electric power at a national scale. This would facilitate the further deployment of intermittent renewable generation, reduce fossil fuel energy production, provide key grid balancing services and improve the UK's energy security.
- 1.1.3 The Proposed Development would operate by transferring water between the existing Quoich reservoir and an upper reservoir created by raising the level of Loch Fearna. The reservoirs would be connected by a system of underground waterways, with the reversible pump-turbines located in shafts within a powerhouse structure by the shore of Loch Quoich.

1.2 Aim of the Design Statement

- 1.2.1 This Sustainable Design Statement sets out the methods by which the design has been developed to take account of the site's landscape characteristics, current use and sense of setting. Furthermore, the Design Statement sets out the sustainable design features that would be implemented in different parts of the project and how different Government targets would be met.
- 1.2.2 This document differs to the EIA Report Chapter 2 – The Proposed Development and Chapter 3 – Consideration of Alternatives and Design Evolution as follows:
- 1.2.3 Chapter 2 describes the technical parameters of the pumped storage project and provides the reader with an understanding of the dimensions and levels of each part of the project along with construction methods proposed and the outline programme. It is intended that the Description of Development chapter is read in advance of this Design Statement.
- 1.2.4 Chapter 3 describes the options considered and the process of refining the design to its current form. This process begins with high-level screening process and then then analyses more closely those that have potential for pumped hydro power generation against technical, environmental, regulatory and logistical criteria. The evolution of the design through the EIAR process is also documented in this chapter.
- 1.2.5 The measures outlined in this Sustainable Design Statement have been considered within the Landscape and Visual Impact Assessment (LVIA) (Chapter 7 of the EIA Report) and incorporated into photomontages which support the LVIA where relevant. The Design Statement should be read in conjunction with mitigation measures which are outlined in the LVIA.



OS Map - Location Plan
Copyright OS (Ordnance Survey)

1.3 Scoping Input into the Design Statement

- 1.3.1 The Highland Council’s (THC) Scoping Response states that a Sustainable Design Statement is required.
- 1.3.2 In writing this Sustainable Design Statement the Applicant has referred to THC’s Sustainable Design Guide which provides advice and guidance on a range of sustainability topics, including design, building materials and minimising environmental impacts of development. In Appendix B to this document a checklist as required by THC has been completed.
- 1.3.3 To meet the requirements of the Scoping Responses this Sustainable Design Statement aims to outline the design principles and concepts that have been applied to the Proposed Development by including the following:
- I. describing the policies and approach that have influenced the design;
 - II. describing the steps taken to appraise the context of the development;
 - III. demonstrating how the design takes the development context into account in relation to its proposed use;
 - IV. describing the consultations relating to the design principles and concepts that have been applied to the development; and to what extent these consultations have influenced the design;
 - V. demonstrating that the development in its entirety aligns with the three pillars of sustainable development. In addition, a Sustainable Design Checklist has also been completed and this is included in Appendix B
 - VI. demonstrating that the construction and operation of the development aligns with the ambitions of a decarbonised Scotland and in turn provides the Highlands with secure and clean electricity supplies. Sustainability will therefore be reflected in all stages of the project and most prominently in the powerhouse design. This topic will also be discussed in detail within the EIA Report at Chapter 5 – Planning and Policy Context of the EIA Report ; and
 - VII. Finally, this document will include details on how the development is likely to contribute to the Scottish Government Energy Efficient Scotland Roadmap relating to building design.

1.4 Design Development

- 1.4.1 The elements of the Proposed Development that create a change to the landscape would primarily be the above ground structures, access works and landscape mitigation measures. These are located at the upper reservoir works, the powerhouse and switchyard, tunnel adit and the permanent access routes to these areas. The design development process has considered a range of factors including technological constraints, environmental constraints, current site uses and context, economic factors, sustainability and health and safety.
- 1.4.2 The design development process for the Proposed Development can be broken down into the following key stages:
- Strategic design and optioneering: high level site review and development of potential arrangements of a pumped storage scheme, looking principally at site location, topography, geology and potential energy storage;
 - Refinement of options and development of preferred layout: initial technical and environmental surveys, identification of constraints, review of heritage features and initial landscape appraisal to further develop options and allow assessment to determine a preferred layout. In the case of the Proposed Development, the feasibility of the potential co-location with the existing Quoich Hydro station required to be analysed.
 - Architectural and landscape input: once the preferred layout for the Proposed Development had been agreed, input from architects (HLM) and landscape architects (ASH design + assessment) was applied to assess the current site characteristics, develop a design narrative, refine the design, suggest appropriate finishes, provide detailed layout and mitigation measures to minimise adverse impact; and
 - Detailed design: should the Proposed Development be consented, the indicative design would be further developed to a detailed level suitable for construction.



View from Quoich Dam westward towards Quoich control building

02

Secure + Clean Energy

02: Secure + Clean Energy

2.1 Providing Secure and Clean Energy Supplies to the Highlands

2.1.1 The Proposed Development would provide not just the Highlands, but Scotland and the rest of the UK with secure and clean long duration electricity storage, which facilitates the further rollout of renewable energy generation. At Scoping stage the developer was requested to provide narrative on how this would be achieved within the Design and Access Statement. This is set out below:

2.1.2 Pumped Storage Hydro (PSH) is sustainable proven, mature, long-lifespan (100yr+) technology. PSH has the ability to deliver large capacities of energy storage for long durations. Global PSH installed capacity is currently over 135GW and provides around 95% of global energy storage.

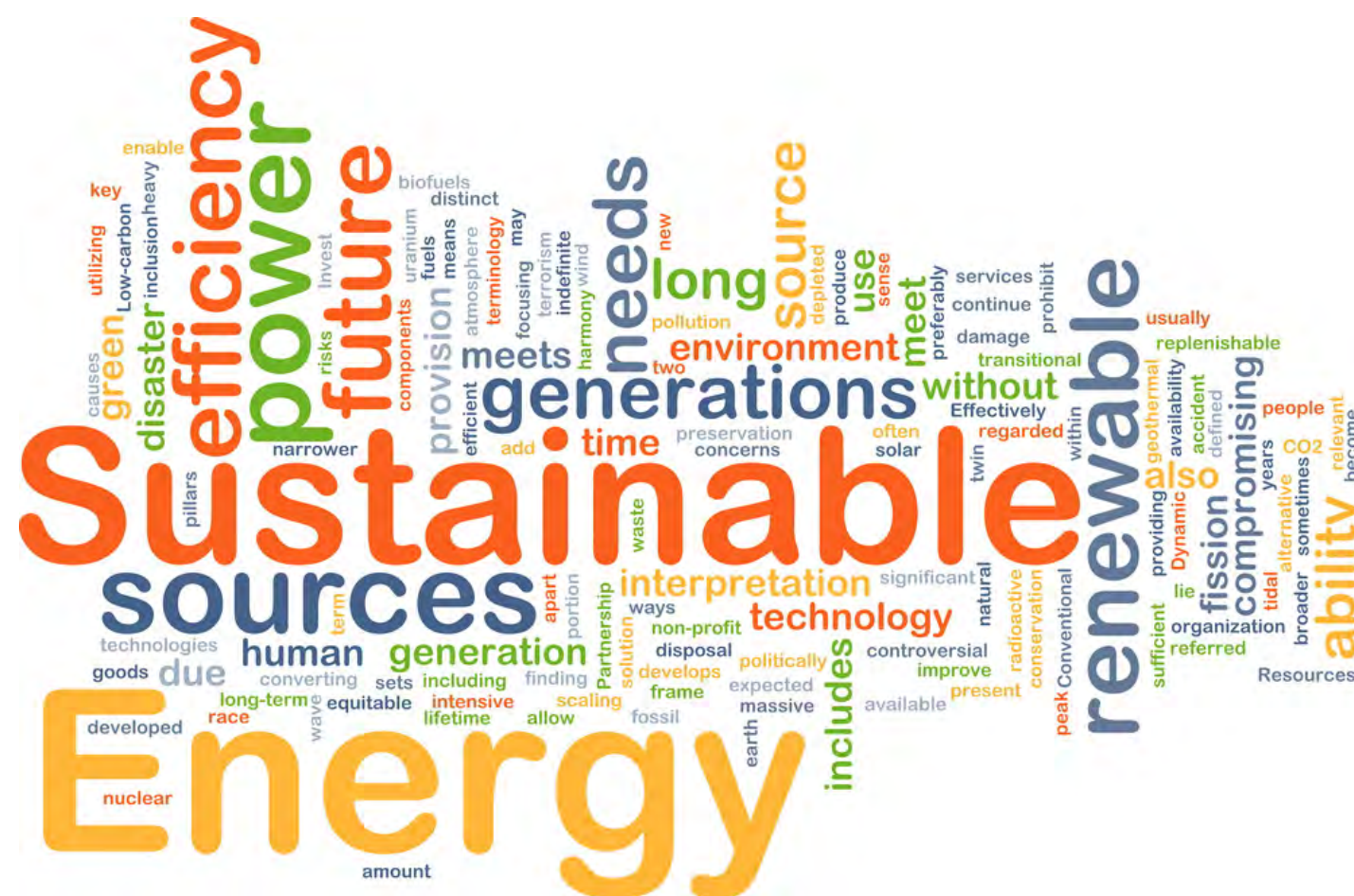
2.1.3 PSH reduces fossil fuel reliance by dispatching previously stored wind and solar energy to meet demand during periods of low renewable energy generation. This reduces the need for fossil fuel generation to provide backup during these deficits and therefore PSH provides a clean power generation source. Furthermore, this reduces reliance on volatile global gas supply and pricing, ultimately making our energy supply more secure.

2.1.4 During wind curtailment, wind generators are currently paid to switch off, with the costs borne by UK consumers to avoid overloading the transmission network. PSH can reduce this curtailment by absorbing the excess wind energy (by pumping water uphill) and re-supplying it to the network when renewable generation sources are unable to run, for example during low wind or in the case of solar, in the hours of darkness.

2.1.5 The transmission network also experiences constraints during periods of high renewable generation, with most of the UK wind generation being in Scotland and need to be transferred to the main demand centres in the south. When the generation exceeds the capacity of the network, generation again needs to be switched off and fossil fuel generation in the south is ramped up. PSH in Scotland can serve to store the excess energy until it there is sufficient network capacity to send the electricity to the point of demand.

2.1.6 The Fearna PSH project will store up to 36,000MWh – so the equivalent of approximately 360 typical commercial battery projects, but with a much longer lifespan and using natural resources.

2.1.7 Adding PSH projects to the UK energy mix will therefore facilitate the increased rollout of renewable electricity generation, reduce the reliance on fossil fuels and improve energy security..



03

Existing Hydro Electric Sites

03: Existing Hydro Electric Sites
Ffestiniog PSH

3.1 What can be learned from existing Hydro Electric sites

3.1.1 As a background exercise a number of similar operating conventional and pumped storage hydroelectric projects have been reviewed to understand the challenges of constructing a development of this scale. Two sites in particular are considered to provide valuable discussion points. These are the Ffestiniog and Foyers operational Pumped Storage Hydro Stations.

3.2 Ffestiniog PSH

3.2.1 Commissioned in 1963, Ffestiniog PSH in Gwynedd, North-west Wales was the UK’s first major pumped storage facility. Albeit on a smaller scale to the Proposed Development, the project has visually similar elements and topographical setting. The upper reservoir and surrounding landscape sits within a rugged mountain landscape at an elevation of 500m. The powerhouse superstructure is stone-clad and located on the shore of the lower reservoir. The use of stone cladding reflects the colours and tones within the local landscape, helping to reduce the perceived scale and prominence of this very large building.



Figure 01
Ffestiniog Upper Reservoir



Figure 02
Ffestiniog dam and upper reservoir



Figure 03
Ffestiniog powerhouse and lower reservoir



Figure 04
Ffestiniog PSH project

all Ffestiniog images courtesy of Getty Images (purchased from Pixabay)

03: Existing Hydro Electric Sites

Foyers PSH

3.3 Foyers PSH

3.3.1 Located on the banks of Loch Ness the Foyers Pumped Storage project was completed in 1974. The Foyers site comprises a powerhouse with deep shafts that extend well below the surface level of Loch Ness. The Proposed Development would also require deep shafts, with the pump-turbine units situated below the minimum level of Loch Quoich.

3.3.2 On both the Foyers PSH and the Proposed Development a large superstructure is required at ground level, covering the shafts and housing a crane to lift and move equipment. The structure will also provide administration, welfare and maintenance facilities. This building has a loch side position and therefore could be a prominent feature, the Foyers powerhouse is considered to be a visible structure on the side of Loch Ness.

3.3.3 The setting behind the Foyers building of rock, trees and steep slope contrasts starkly with the light colour of the building cladding. The differing textures and colours draw the eye to the building from many locations around Loch Ness. The Fearna powerhouse aims to sit within the landscape with colours and finish of similar tones, plus local planting minimising contrast and blend with the surrounding natural features. This would be more reflective of the use of local stone for the Ffestiniog powerhouse



Figure 05
Foyers PSH from Loch Ness

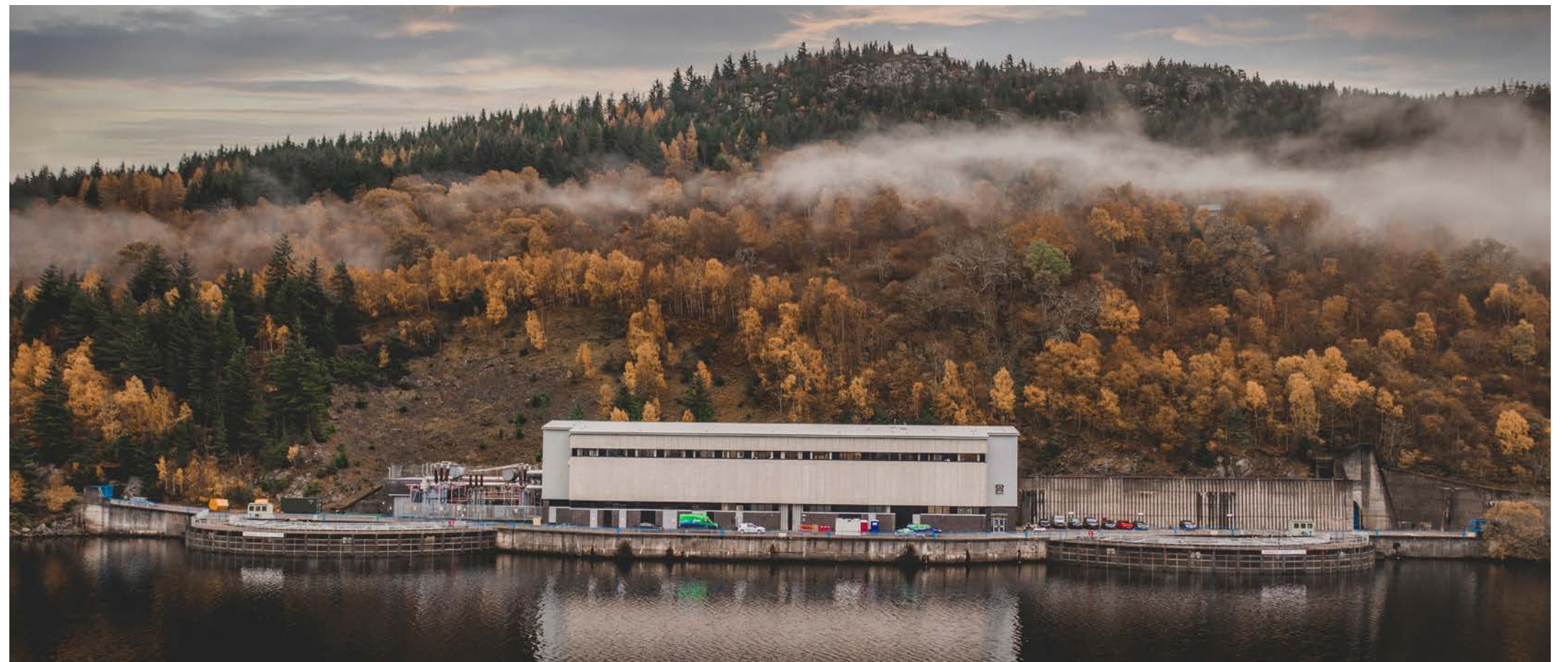


Figure 06
The Foyers PSH from the opposite side of Loch Ness

03: Existing Hydro Electric Sites

Quoich Hydro

3.4 The existing Quoich Hydro site

3.4.1 The 18MW Quoich Hydro scheme was one of the final hydro schemes commissioned by the North of Scotland Hydro Board in 1959 and forms part of the 'Great Glen Cluster' of conventional hydro storage projects.

3.4.2 The projects represent engineering excellence from the original heyday of Scottish hydropower and continue to operate to their full potential. They were transformational at the time of commissioning, in bringing electricity to the area for the first time.

3.4.3 The thousands of people employed to design and build the projects were affectionately known as 'The Hydro Boys'. Many came from Scotland and Ireland and some prisoners of war from eastern Europe were also used, as many had tunnelling expertise.

3.4.4 The Quoich dam is a 39 m high Concrete Faced Rockfill Dam and at the time was the largest rockfill dam in Scotland. This dam created the largest storage reservoir in the UK, storing around 360 billion litres of water.

3.4.5 The Quoich dam is of the same form as those to be used in the Proposed Development, albeit they would be larger. The rock used to construct the Quoich Dam was extracted from the quarry immediately adjacent to the Proposed Development powerhouse. This now disused quarry would house the switchyard and tunnel access adit for the Proposed Development

3.4.6 Over time the rockfill face of the dam has become weathered and mosses and lichens have established. The weathering process and the growth of the moss and lichen communities have helped the dam reflect the tones and textures within the surrounding landscape, which reduces the prominence and contrast of the dam face.

3.4.7 The secondary structures around the Quoich dam, for example the intake building, parapet walls and downstream valve house are all clad in locally-won stone, which again has weathered over time and has been demonstrated to be very robust over the 65 year life of the scheme.

3.4.8 The Proposed Development aims to carry across the aesthetic of the Quoich dam and other structures into the design. Refer to section 4 for further details.



Figure 07 - North of Scotland Hydro-Electric Board
Early stage of Quoich Dam construction - "The Hydro Boys" (1953)



Figure 08 - North of Scotland Hydro-Electric Board
Quoich Dam during construction (1956)



Figure 09 - North of Scotland Hydro-Electric Board
Quoich Dam construction looking south (1955)



Figure 10 - North of Scotland Hydro-Electric Board
Quoich Dam control building under construction (1956)



Figure 11
Quoich Dam control building, stone walls and existing rock face



Figure 12
Quoich Dam - view from above



Figure 13
Quoich Dam - view from the east

04 The Fearna Pumped Storage Hydro Project

04: The Fearna Pumped Storage Hydro Project

A new, nationally significant pumped storage project is being planned, tapping into Scotland's deep hydro heritage to equip her for the challenges of the future – the Fearna pumped storage project.



4.1 Site Context

- 4.1.1 The Proposed Development lies approximately 14 miles to the west of Invergarry and mid-way along a 22-mile long single track public road leading to Kinlochhourn. The site lies within a mountainous context, near the eastern end of Loch Quoich. This is a remote landscape with limited habitation but is popular for outdoor recreation.
- 4.1.2 Despite its remote location, the site has been used for hydropower generation since the 1950s, when the Great Glen Cluster of hydro projects was built.
- 4.1.3 The privately-owned estates continue to run sporting activities and Loch Quoich is a renowned fishing area for trout.
- 4.1.4 The HV transmission line between Fort Augustus and Broadford, Skye also bisects the site. This has been in place since the 1960s and is expected to be replaced in the coming years.
- 4.1.5 The 27km Southern Access Route lies primarily within commercial forestry plantation, with a new section across open hillside at the western end.
- 4.1.6 The Beinneun and Millenium Wind Farms are visible to the east from the upper end of the site.
- 4.1.7 The site lies within the Upper Garry catchment, which ultimately flows into Loch Ness and out to sea. The whole Garry catchment has been heavily modified by the construction of dams and run-of river hydro projects. The Proposed Development would not transfer water out of the existing catchment, instead it would simply transfer water between the upper and lower reservoirs.
- 4.1.8 The Proposed Development would operate within the existing operational range of Loch Quoich and therefore not cause any flooding or drought conditions within the Loch. Loch Quoich is sufficiently large for the existing Quoich Hydro scheme and the Proposed Development to co-exist.

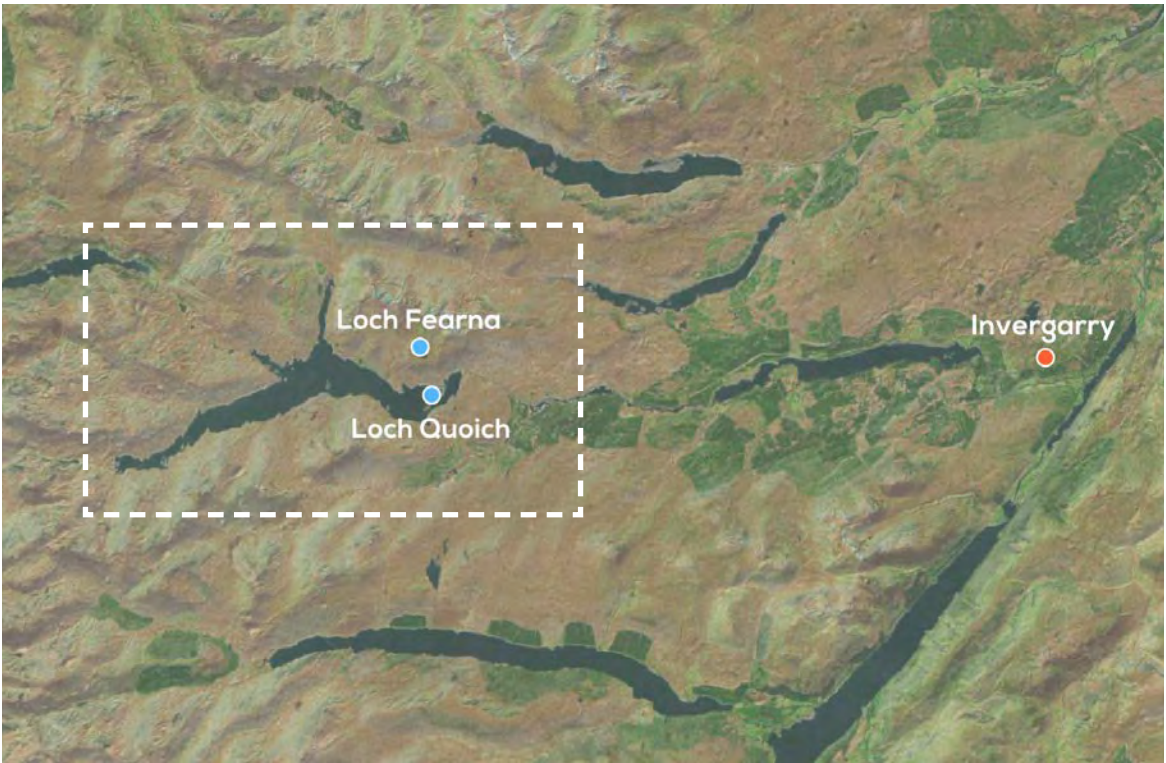
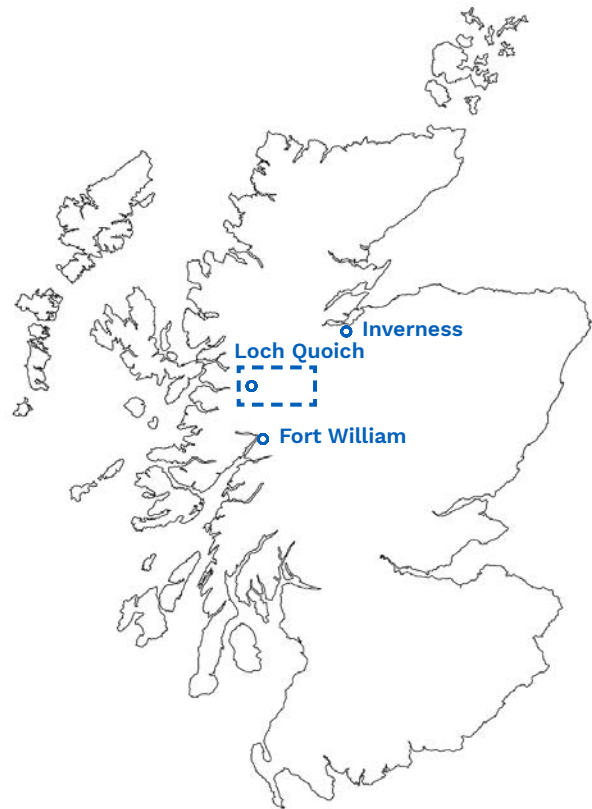


Figure 14
Location Plan



Figure 15
The proposed site looking east

04: The Fearna Pumped Storage Hydro Project

4.2 Site Setting

4.2.1 The Proposed Development would be situated within a mountainous context, near the eastern end of Loch Quoich, a long, linear valley flanked by a series of mountains to north and south which rise steeply from the loch-shore. The area is situated at the eastern edge of a wider mountainous area, with a strong east/west pattern of mountain ridges and deep, sweeping valleys to the north and south, and a more remote and intricate landscape of many peaks lying to the west. The eastern end of Loch Quoich where the Proposed Development would be located, marks a change in character, with a generally lower lying landscape of moorland hills, extensive forest plantation and scattered settlement lying to the east.

4.2.2 The area has a generally strong sense of remoteness with mountains surrounding Loch Quoich forming part of the Kinlochhourn – Knoydart – Morar Wild Land Area which extends to the north, south and west. However, Loch Quoich, which would comprise the lower reservoir, is already operated as a hydro reservoir with a dam situated at its eastern end and a visible area of drawdown present around its shoreline. The existing narrow road and steel lattice tower transmission line following the northern side of the loch also form existing infrastructural influences. From Loch Quoich there are open views across and along the loch towards the western mountains.

4.2.3 The proposed upper reservoir would utilise Loch Fearna and Coire Dubh situated within an elevated natural bowl contained by the steep, rocky slopes of the mountains Gleouraich and Spidean Mialach and their adjoining ridge. These, and other surrounding mountains are popular for recreation.

4.2.4 Key views towards the Proposed Development site, are obtained from the surrounding mountains on the northern and western side of the loch, as well as the minor road which follows the northern shore of Loch Quoich.



Figure 16
Site from the summit of Spidean Mialach, looking south with Loch Fearna in the foreground and Quoich beyond



Figure 18
Looking east from Spidean Mialach along Glengarry and the proposed southern access route



Figure 17
Quoich Dam with Loch Quoich behind, looking west. HV transmission line to the right hand side of Loch Quoich. The proposed development lies 1km beyond the dam on the right hand bank



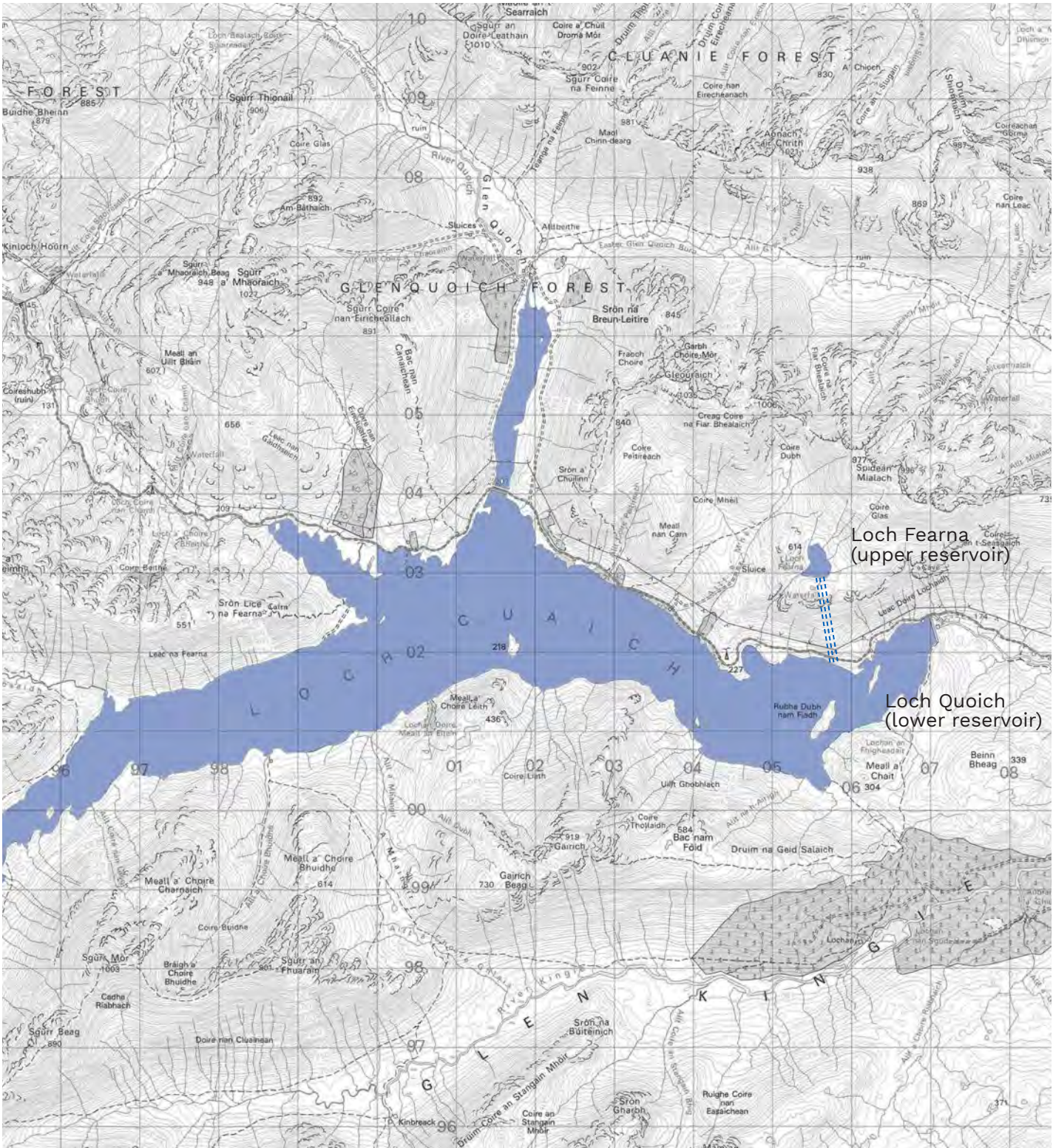
Figure 19
Existing Quoich Reservoir and HV transmission line from the proposed powerhouse site

05 Proposed Development

05: Proposed Development
Overview

5.1 Overview

- 5.1.1 The Proposed Development has been through an iterative design and optimisation to reach its current stage. This process has included feedback from stakeholders and also from the environmental surveys, architects and landscape architects, in order to minimise the impacts of the scheme and maximise its performance.
- 5.1.2 The principal components of the Proposed Development would be:
- Loch Fearna – the upper reservoir;
 - The underground waterway system;
 - Loch Quoich – the lower reservoir;
 - The powerhouse and switchyard;
 - Access tracks and footpaths;
 - Temporary construction facilities and borrow pits; and
 - Areas of habitat compensation and enhancement.
- 5.1.3 The lower reservoir of the scheme already exists, having been dammed in the 1950s and thereby re-using existing hydropower infrastructure.
- 5.1.4 During construction, the site would be accessed via the Southern Access Route, which mainly uses existing forest roads offline from public roads. The track would be extended to reach the main site.
- 5.1.5 Once complete, operational access would be taken via the C1144 public road. However, if very large or heavy items of equipment are required to be transported to or from the site in future, the Southern Access Route would be used.
- 5.1.6 Details of the proposed design for each of the scheme components are provided below:



OS Map - Location Plan
Copyright OS (Ordnance Survey)



05: Proposed Development
Overview

5.2 The Powerhouse and Switchyard

- 5.2.1 The powerhouse, located on a terrace on the shore of Loch Quoich and adjacent to the disused quarry used to construct Quoich dam would comprise a series of up to six shafts approximately 90m deep. The shafts would sit beneath a surface building which would contain an overhead crane and other facilities including offices, storage, transformers and other equipment.
- 5.2.2 The area for the powerhouse will be excavated to a level platform at +205m, which is sufficiently above the Loch Quoich maximum flood level of +203m. This area is mainly in rock and the material will be placed in the base of the disused quarry immediately adjacent to the powerhouse. This will raise this area also to +205m and create the temporary working area for the construction of the scheme, which will ultimately become the HV switchyard.
- 5.2.3 The excavation around the powerhouse will therefore have a similar appearance to the adjacent quarry face and will weather over time.
- 5.2.4 The HV switchyard will house the electrical equipment to connect the project to the transmission network. This is the point of interface between the project and the national grid. The switchyard will require a building which will house the project’s switchgear and it is proposed to follow a similar design concept to the powerhouse, albeit on a smaller scale.
- 5.2.5 External electrical switchgear is also likely to be required at the switchyard. The final arrangement of this equipment is in development.
- 5.2.6 The powerhouse area is already industrialised, with the presence of the disused quarry and a large laydown area. However, a series of measures are proposed to provide visual mitigation around the powerhouse and switchyard, primarily from the public road which runs to the north of this area.
- 5.2.7 A landform created at the eastern end of the switchyard area using the excavated material from the powerhouse will provide visual screening and will be formed to replicate the sloping hillsides which characterise this area. The landform will be topped with soil, peat and boulders and planted with native woodland.

- 5.2.8 Woodland planting will also be provided between the powerhouse area and public road, at the eastern gable and around the switchyard to provide further visual screening and softening, and to help accommodate the site into the wider loch-shore landscape. Woodland planting will comprise a mix of upland native species reflecting those already present around Loch Quoich, including Scots pine, birch, rowan and willows.
- 5.2.9 The shoreline of the powerhouse area is currently influenced by historic hydro operations, which has created an area of shingle and exposed rock. The shoreline varies in height depending on the level of Loch Quoich. In order to provide protection to the powerhouse and also to provide landscape mitigation, vegetated rock armour is proposed along the shoreline. This will comprise rock armour with the gaps between the rocks infilled with peat and turf and also planted with shrubs and small trees.

Building Design Concepts

- 5.2.10 Design Development
- 5.2.11 The powerhouse building and surrounding landform would be further developed through detailed design stage with the aim of reducing the overall influence and prominence of the building in the landscape as far as possible and achieving a design which would contribute a positive feature as part of the wider landscape context.
- 5.2.12 The following pages set out the site analysis, initial design concept and the subsequent approach to the design development of the powerhouse which would be developed further during detailed design of the building.



Figure 20
Existing woodland to the west of the powerhouse site



Figure 21 - The proposed powerhouse site, adjacent to the disused quarry, looking north from Loch Quoich



Figure 22 - North of Scotland Hydro-Electric Board
Quoich quarry (1954)



Figure 23
Quoich quarry (2024)



Figure 24
The proposed HV switchyard area, in use for transmission works



Figure 25
The disused quarry, looking east and partially infilled with 2018 landslide spoil (landslide visible in top left of image)

Site Context

Constraints + Opportunities

“A new, nationally significant pumped storage project is being planned, tapping into Scotland’s deep hydro heritage to equip her for the challenges of the future – the Fearna pumped storage project.”



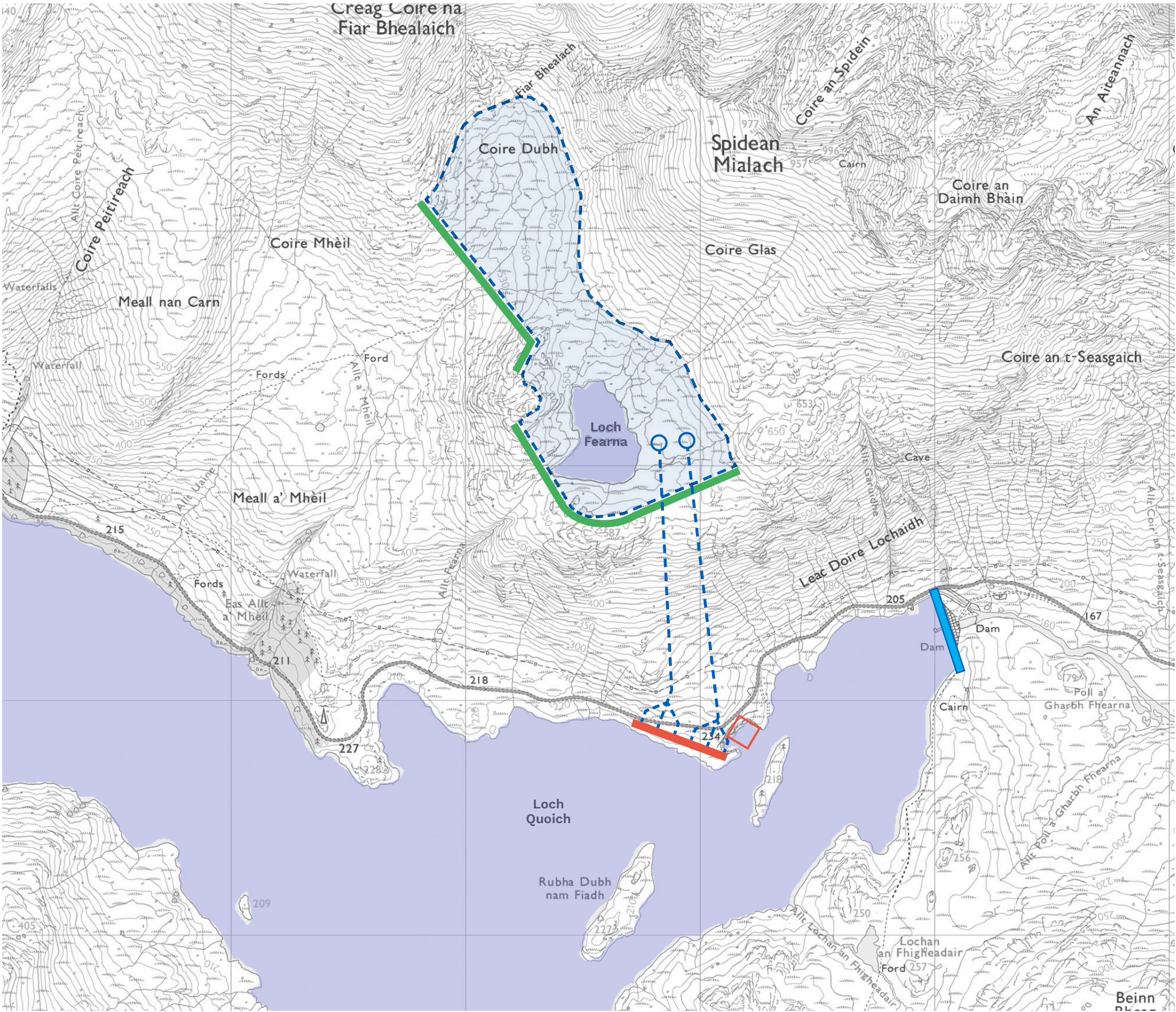
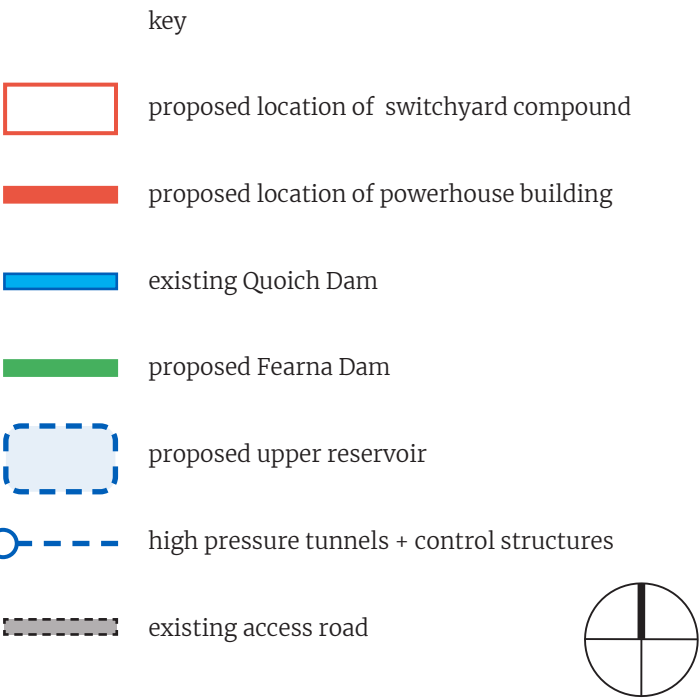
05: Proposed Development
Site Context

Location

Loch Fearn & Loch Quoich are located approximately 25km West of Invergarry, with the proposed development located towards the western end of Glengarry.

The site for the proposed powerhouse building is located on the north eastern edge of Loch Quoich, (just 1 km west of the nearby Quoich Dam).

Loch Quoich will form the lower reservoir for the new pumped storage hydro project, with Loch Fearn used as the upper reservoir. The topography around Loch Fearn and Coire Dubh is well suited to allow the creation of an upper reservoir by building two new dams to store approximately 41 billion litres of water.



OS Map - Location Plan
Copyright OS (Ordnance Survey)

05: Proposed Development
Site Context

Location
Site Photographs



Aerial OS Photograph - Site Photo Markers
Copyright OS (Ordnance Survey)

05: Proposed Development
Site Context

Location
Site Photographs



OS Map - Location Plan
Copyright OS (Ordnance Survey)



01
Approach from Invergarry to Quoich Dam



02
Looking back to Quoich Dam from public road



03
Looking towards disused quarry



04
Looking down on disused quarry from public road



05
View towards Quoich Dam from disused quarry



06
View looking south towards the proposed site



07
High view looking south across Loch Quoich



08
Loch Fearn

05: Proposed Development
Site Context

Location
Site Photographs



view 01 - Loch Fearn
Panoramic view of proposed location of new dam



view 02 - Disused Quarry
Panoramic view of disused quarry (proposed site of powerhouse)

05: Proposed Development
Site Context

Munros

There are Munros located on the loch.

- 01

Gairich, Loch Cuaich
- 02

Gleouraich
- 03

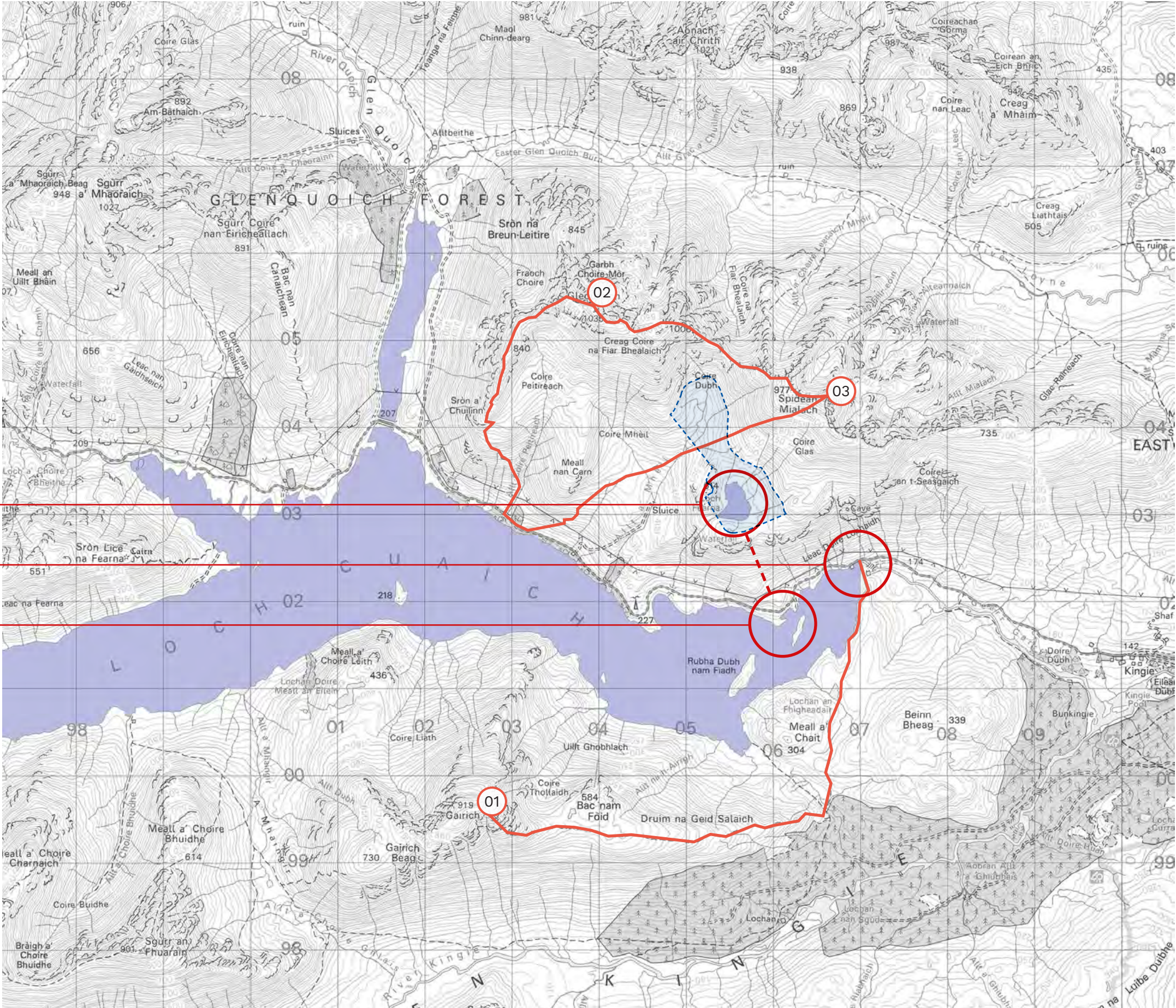
Spidean Mialach
- walking routes
- proposed upper reservoir

The walking routes to the Munros at Loch Fearna will be adjusted to maintain access around the upper reservoir.

Loch Fearna

Quoich Dam

proposed site



OS Map - Location Plan
Copyright OS (Ordnance Survey)

05: Proposed Development
Constraints + Opportunities

Constraints

Public Road:

The existing public road to the north of the site effectively provides a boundary and restricts the extent of the site, as the road will largely be maintained in its current form. - - -

Proximity to Loch Fearna:

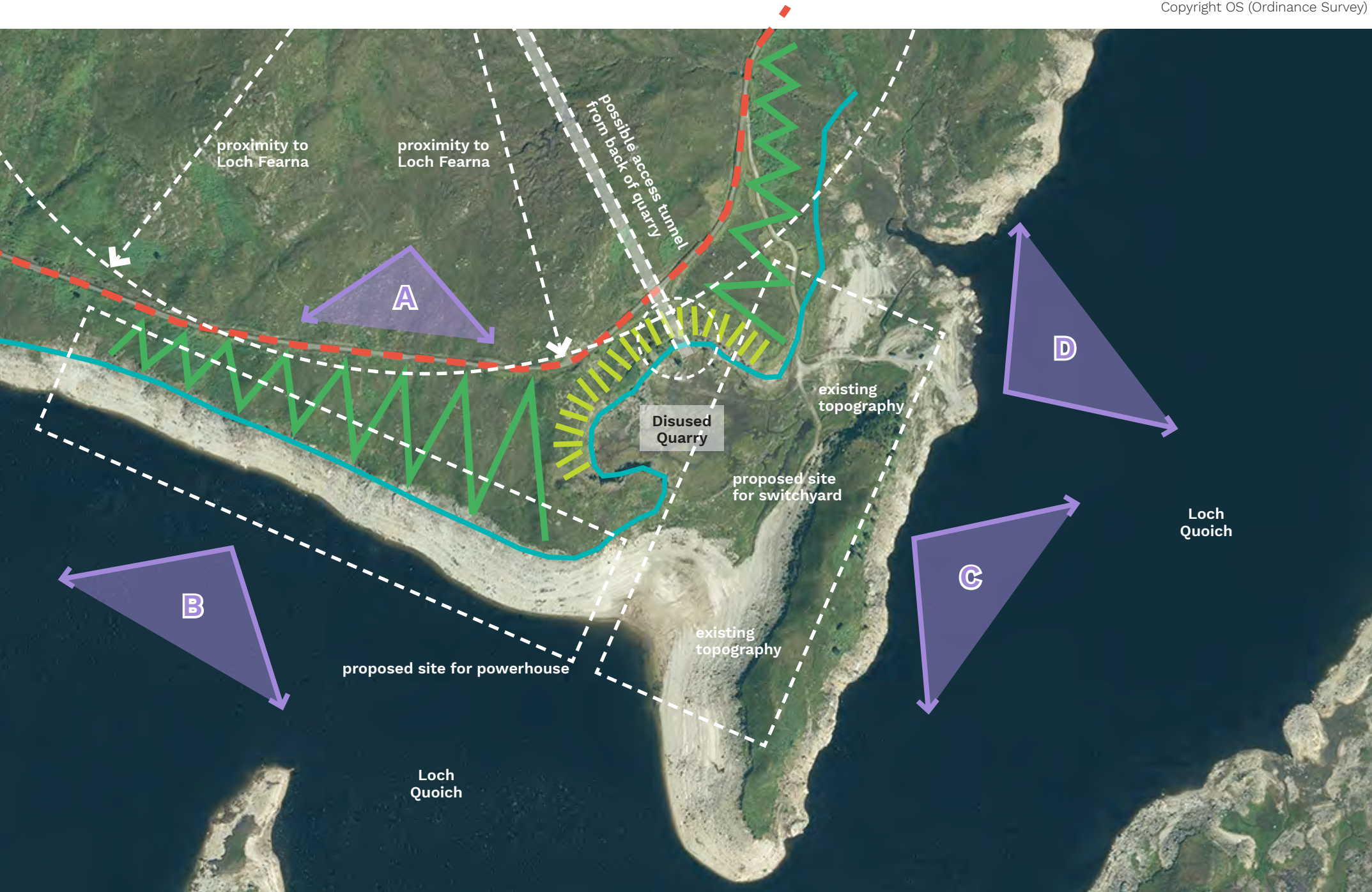
The site for the powerhouse needs to be close to the shore of Loch Quoich to deliver the required hydraulic performance, with the pump turbines set below the minimum operating level of Loch Quoich. The site for the proposed powerhouse also needs to be within close proximity to Loch Fearna to minimise the length of the headrace tunnels linking Loch Fearna and Loch Quoich.

Proposed High Water Line:

The maximum flood level of the lower reservoir (Loch Quoich) will dictate the “base” level of the powerhouse compound which will sit above this (plus contingency).

Visual Impact:

Impact of views from Gairich (to the south), and from the existing access road to the north, above the site, will need to be considered. Also the visual impact on approach from Quoich Dam to the east.



Opportunities

Disused Quarry:

The existing quarry adjacent the site has a relatively large, flat base cut into the landscape, and offers an opportunity to re-use this area for the powerhouse and switchyard development, and minimise any new excavation as far as possible. The ground level of the existing quarry could be raised above the “high water” level of the existing reservoir, to provide a suitable “dry” base for the development, whilst still sitting lower in the landscape (below the access road to the north).

The location of the quarry also provides an opportunity for an access tunnel portal off the back face of the quarry to provide access to the underground tunnel system.

Topography

The existing topography provides an opportunity to screen the building.

Site Excavation Materials:

Given the large volume of excavated rock anticipated to form the pumped hydro storage facility and associated civil engineering works, there is an opportunity to use the excavated rock in the building construction, and help integrate the building into the landscape.

key	
- - -	Public Road (unclassified)
 	Exposed rock face of disused quarry
—	Proposed high water level (+201.5m)
^ ^ ^ ^ ^	Sloping topography
A	Visual impact from existing access road
B	Visual impact from Gairich Summit (Munro)
C	Visual impact from path ascending Gairich Summit (Munro)
D	Visual impact on approach from Quoich Dam

Site Response + Concept

05: Proposed Development
Site Response + Concept

Character

Loch Quoich is located towards the western end of Glengarry, sitting in a predominantly green and mountainous landscape. However the character of the shoreline itself has a linear quality, with exposed rock forming an outline around the lochside, as a consequence from the changing water levels of the Quoich reservoir.

The Loch Quoich dam at the eastern end of Loch Quoich is also low and linear, extending the rocky outline of the shoreline across a natural dip in the landscape, to create the reservoir.

There are other linear forms that punctuate the landscape, (some man-made, some natural) such as cuttings to form the lochside access road, or landslips that have exposed the rockface below the green landscape.

The proposed powerhouse building will look to reflect these forms and materiality that are part of the character of the area.



view of the loch shoreline



aerial view of the loch shoreline

Aerial OS Photograph
Copyright OS (Ordnance Survey)



view of road cutting along the shoreline



long view looking eastwards towards Quoich Dam and the loch shoreline

05: Proposed Development
Site Response + Concept

Character

Loch Quoich Dam is faced in coursed random rubble, won from the excavations during the construction of the Hydro-electric infrastructure in the 1950's, as are the dam control building and downstream valve house. The proposed new powerhouse will look to continue this architectural language and materiality, using rock excavated from the new Hydro project construction works, so that it is perceived as part of the same “family” of structures.



view of Quoich Dam and downstream valve house



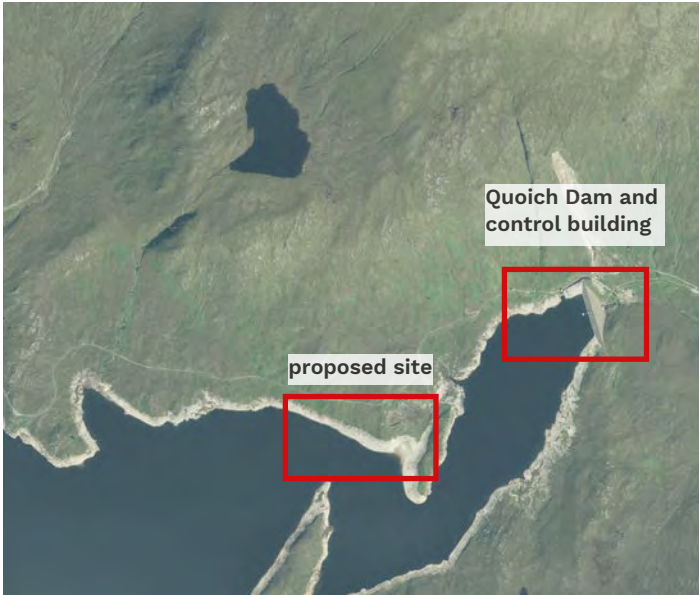
Loch Quoich Dam - east face



Quoich dam control building



view of Quoich dam control building with proposed powerhouse site beyond



aerial view of site

Aerial OS Photograph
Copyright OS (Ordnance Survey)

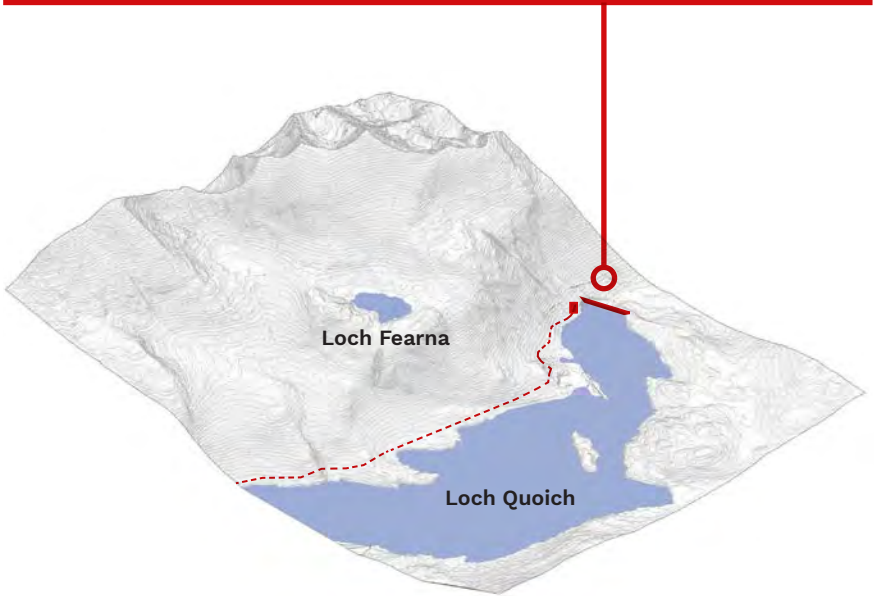


view of the proposed site

05: Proposed Development
Site Response + Concept

Existing Hydro Infrastructure

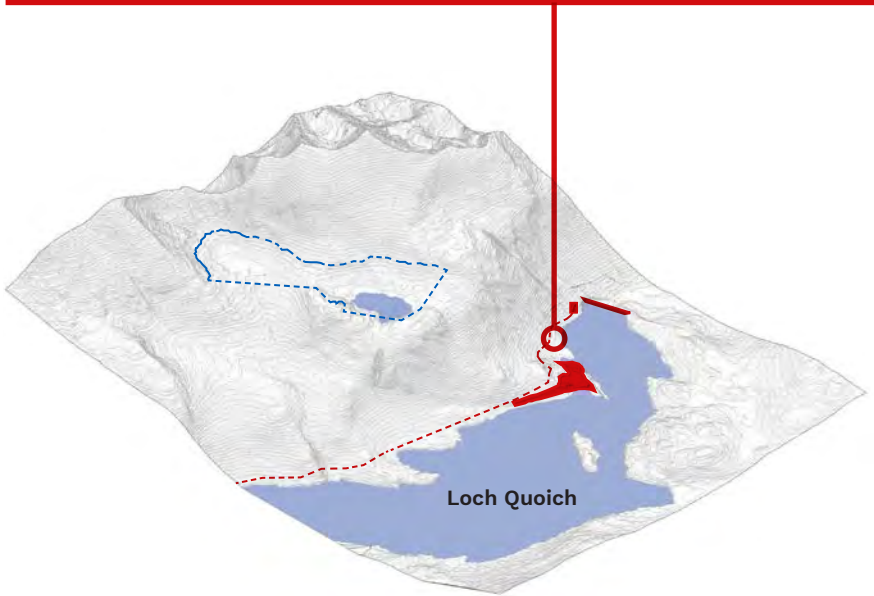
Loch Quoich Dam is faced in coursed random rubble, won from the excavations during the construction of the Hydro-electric infrastructure in the 1950's, as are the 2 gatehouse intake towers.



Existing Quoich Dam + Gatehouses

Powerhouse

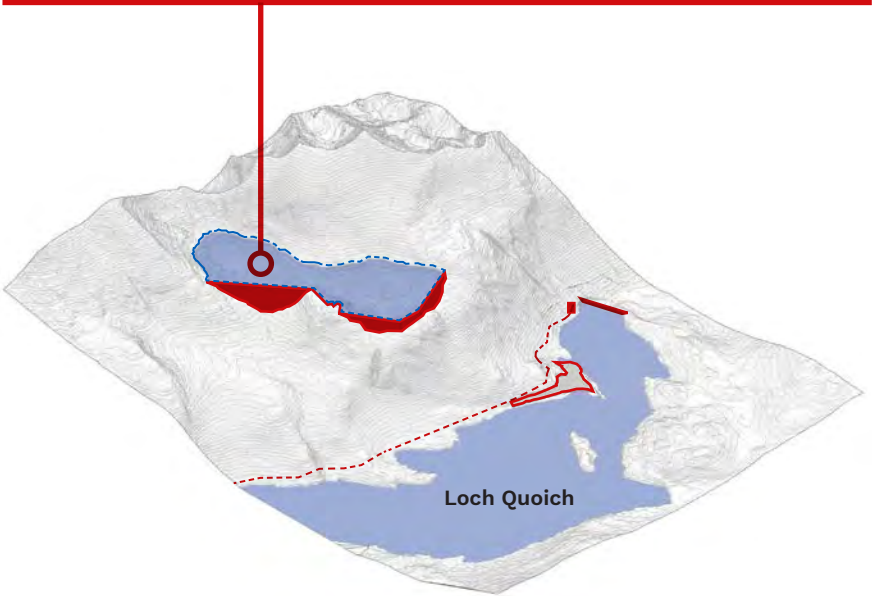
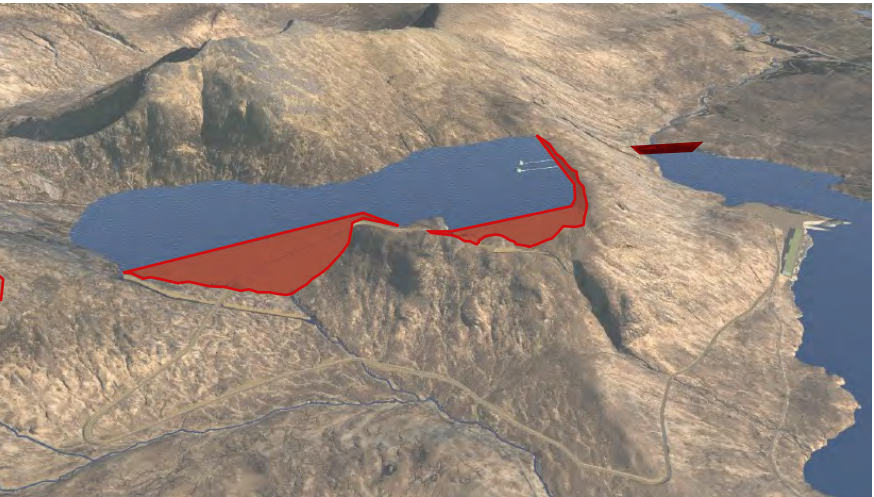
The proposed new powerhouse will look to continue this architectural language and materiality, using rock excavated from the new Hydro project construction works, so that it is perceived as part of the same “family” of structures.



Proposed Powerhouse

Fearna Dam

The proposed new Fearna and Coire Dubh Dams will also be faced using rock excavated from the new Hydro project construction works, extending the family of hydro structures.



Proposed Fearna Dam

05: Proposed Development
Site Response + Concept

A Landscape Driven Response

The initial concept and design approach for the site and the building has evolved from 3 primary influences:

Topography + Geology:

A contextual response that is integrated, low lying, using the natural topography, and which speaks to the undulating hills, ridges, rugged peaks & the Munros beyond, the grassy slopes, crests, precipitous craggy drops, and contours.

An architectural response that references the natural geology and evolution of the site, it’s rock folds, fissures, fault lines and landslips, and responds to the linear, layered character of the lochside.

Hydro Engineering History on site:

There are a number of existing “Hydro” interventions around the site dating back to the 1950’s, including the Quoich Dam, control buildings and valve houses, and Loch Quoich Power Station. Loch Quoich Dam is faced in coursed random rubble, as are the control buildings and valve houses, and the proposed new powerhouse will look to continue this architectural language, so that it is perceived as part of the same “family” of structures. In addition, the Quoich Dam is approx. 320m long, and sits low along the eastern edge of Loch Quoich. The proposed powerhouse will look to reflect this long, linear low-lying form in the landscape, echoing the colours, materials and the layered horizontal character of the lochside.

Materiality:

The design approach will pursue a sustainable response using found materials, such as locally excavated rock in gabions, stone, and a grass roof, which are low carbon, low impact, renewable, biodiverse, and considers whole life carbon.



long view looking eastwards to Quoich Dam and the loch shoreline



view looking eastwards to Quoich Dam



existing quarry adjacent to the site

05: Proposed Development
Site Response + Concept

Concept

The initial concept and design approach for the building looks to reference the linear character of the shoreline and the Quoich Dam at a macro level, as well as the site geology at a micro level. It further looks to reference the existing original 1950's hydro-electric structures around the site, and in particular the Quoich Dam, and develop a simple architectural language that is also informed by the site context and one which will provide an overarching conceptual framework for the design.

strata

Plural Noun

(1) A layer, or a series of layers of rock in the ground



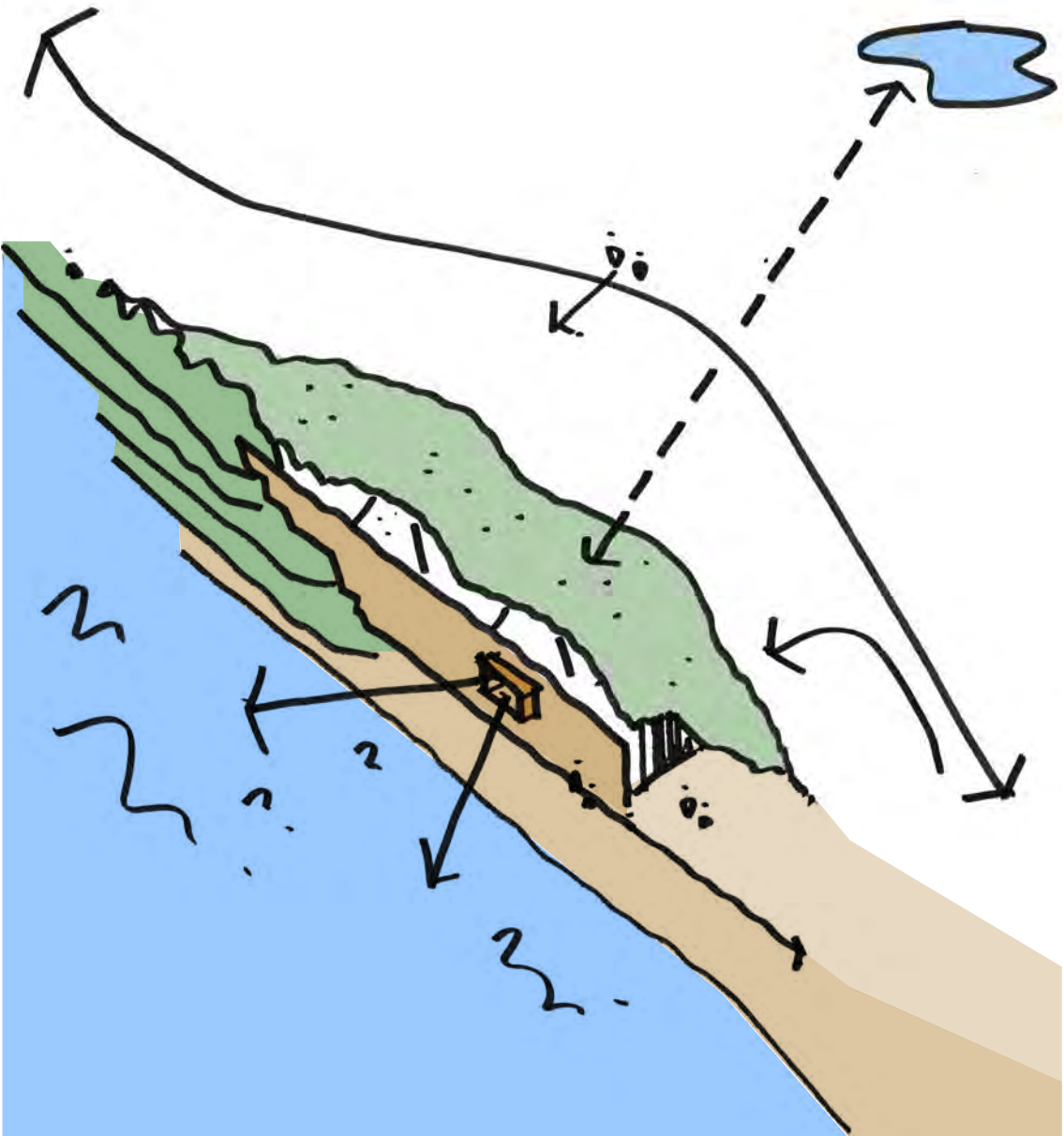
view looking eastwards to Quoich Dam



long view looking eastwards towards Quoich Dam and the loch shoreline



site geology



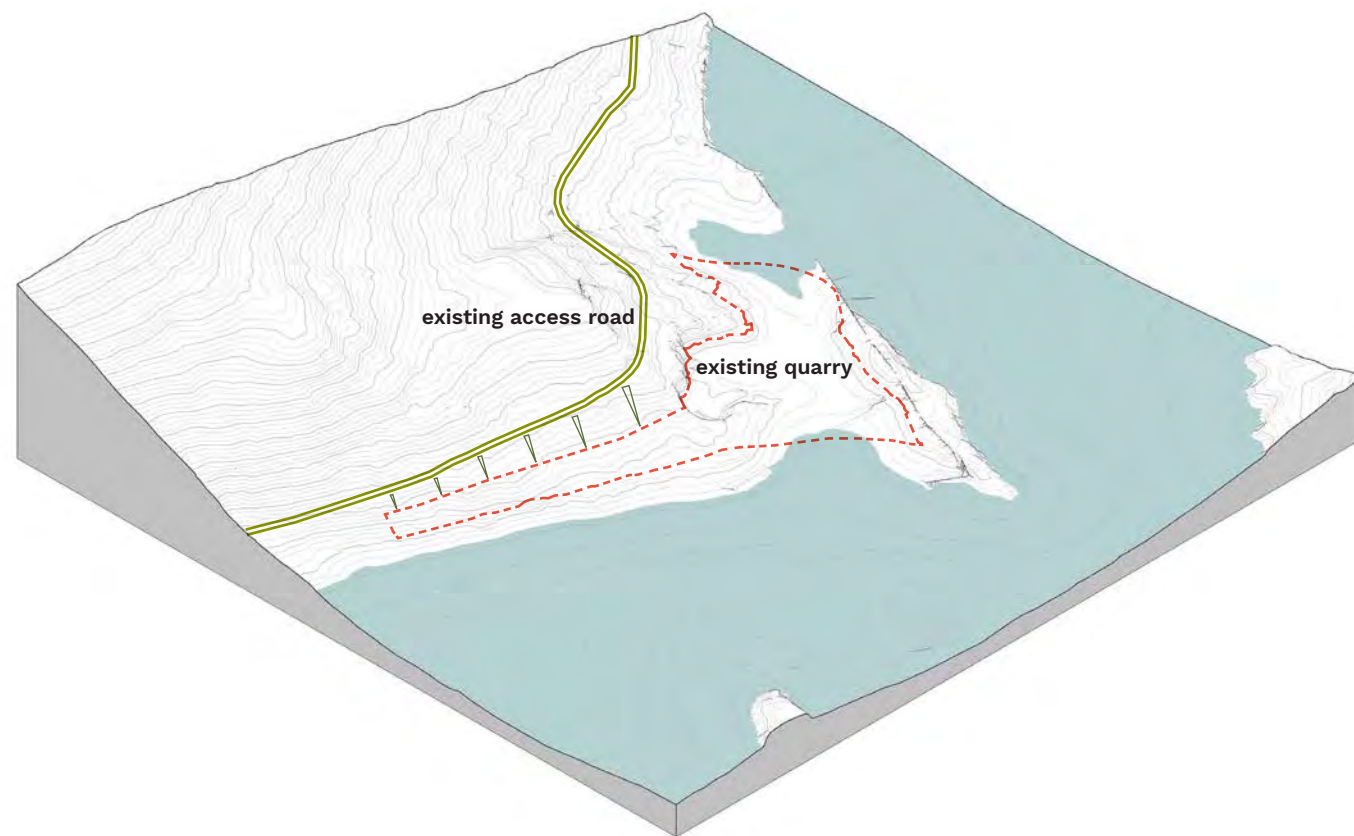
concept sketches

05: Proposed Development Site Response + Concept

01 existing site

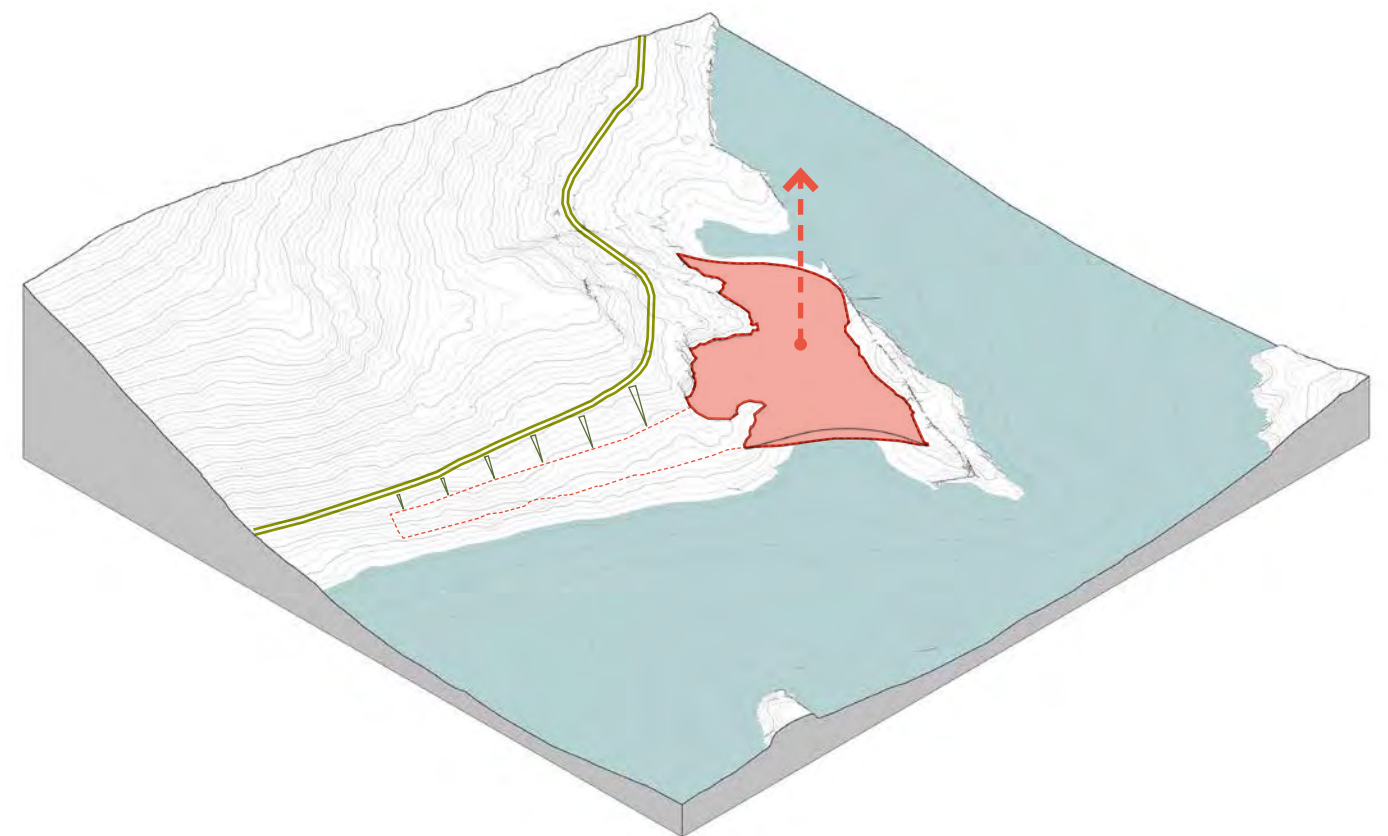
The proposed site for the new powerhouse is located within, and adjacent to an existing quarry that was used during the construction of the original 1950's hydro-electric structures located around the site, and in particular the Quoich Dam.

The excavated quarry already has a relatively large, flat base which would provide a suitable platform for the final powerhouse and switchyard development. This base would also facilitate a temporary construction compound. The intention is to minimise any new excavation as far as possible, by re-using the existing (disused) quarry, and adapting and extending the existing "base", rather than create new excavation elsewhere.



02 re-using the quarry to form the site

The ground level of the existing quarry would be raised above the "high water" level of the existing Quoich reservoir, to provide a suitable "dry" base for the final powerhouse and switchyard development, as well as facilitating use as the construction compound during the construction work itself.

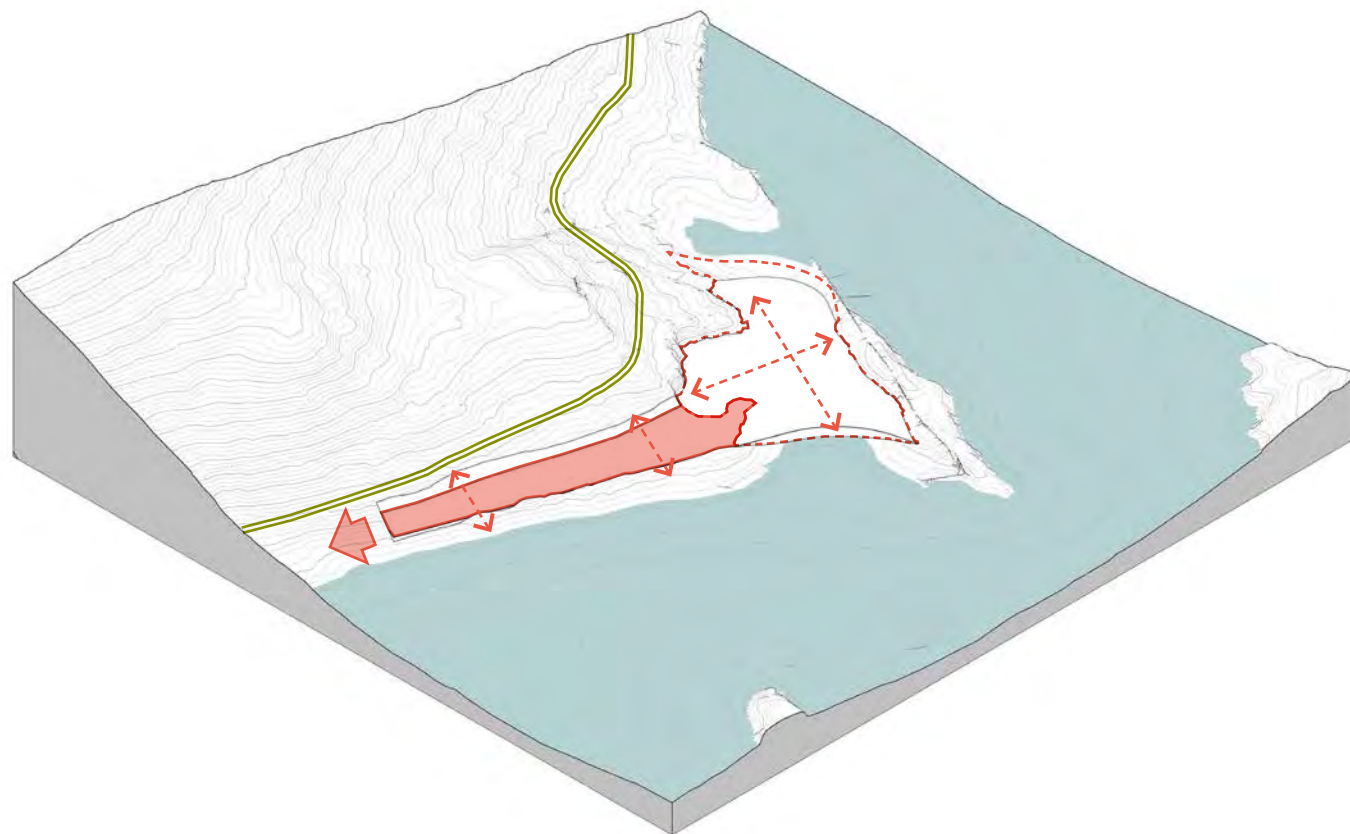


05: Proposed Development Site Response + Concept

03 extending the site

The quarry base would then be extended westwards, cutting into the site to help locate the new powerhouse building lower into the hillside to reduce the visual impact.

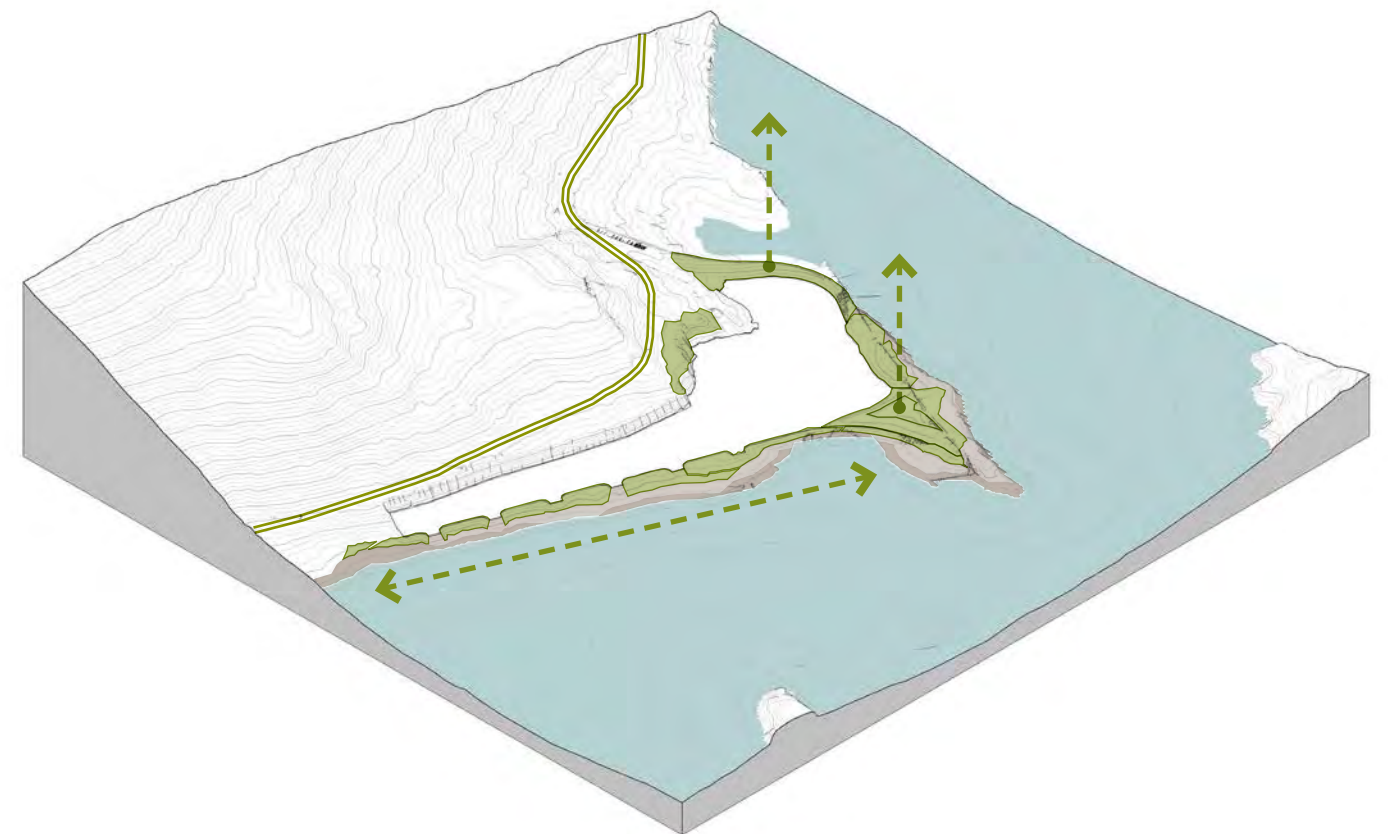
The new building would be located on the narrower “cut” site, running east - west along the lochside, with the associated electrical infrastructure located within the adjacent (wider) existing quarry base to the east.



04 earthworks / landform

New landscaped earthworks would be created, mainly to the east of the site, which would reflect the existing topography and help screen, or hide the powerhouse when viewed on approach from Quoich Dam (from the east).

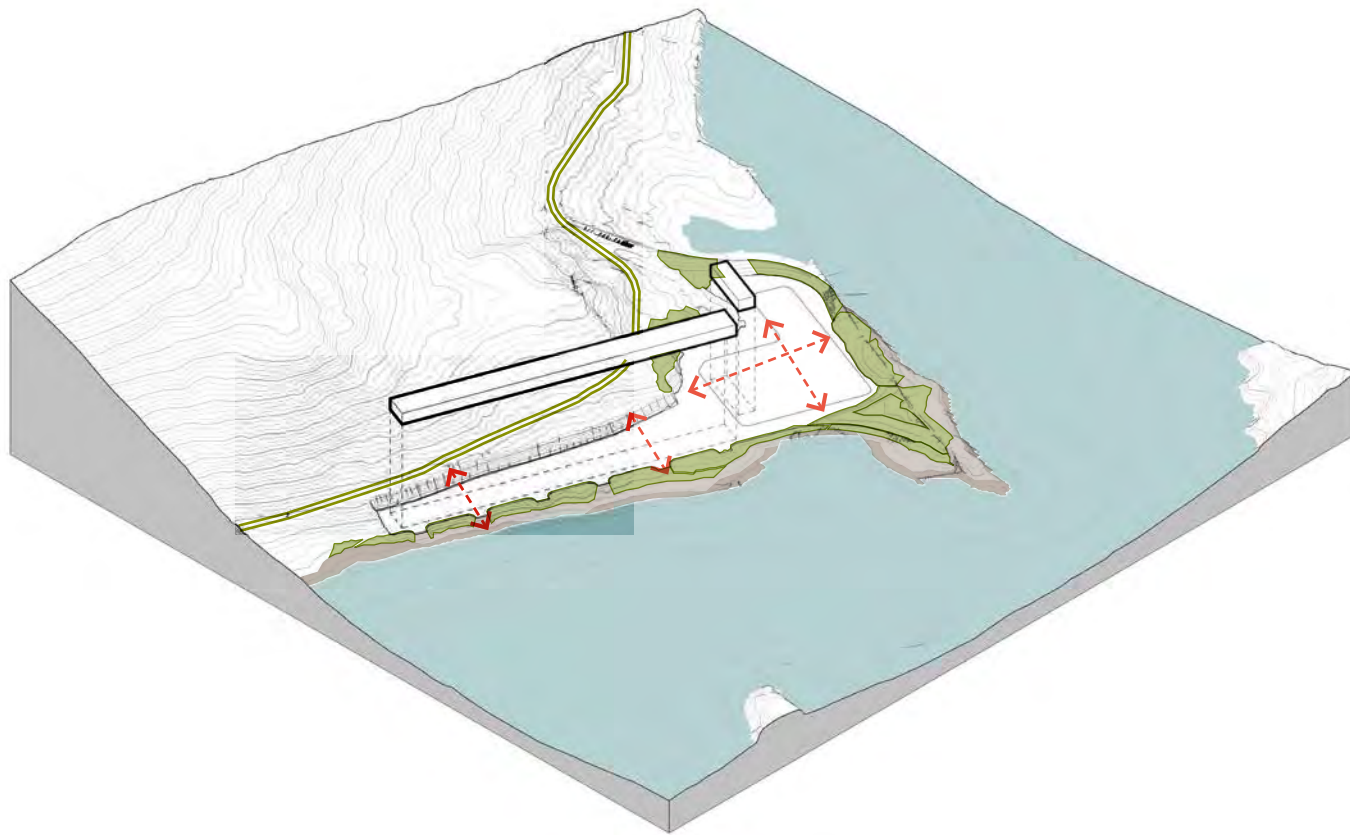
Similarly new rock armour is required along the shoreline to the south, extending from below the water line up to the “powerhouse” platform level. Vegetation should be encouraged to grow and establish itself around and through the rock armour, and together with some additional smaller earthworks, will help anchor the building more naturally into the landscape.



05: Proposed Development Site Response + Concept

05 powerhouse

The new powerhouse form is driven by the engineering requirements, the 6 turbine shafts connecting Loch Fearn and Loch Quoich, and the internal equipment crane, with the building located close to the loch, and inserted into the narrower “cut” landscape.



06 proposed site

Green roofs are proposed for the new buildings, to further anchor them into the landscape, and help screen them from the higher vantage point of the access road to the north, directly above the site.

