Appendix 4.1: Sloy Pumped Hydro Storage Scheme: Design Statement

Sloy Pumped Hydro Storage Scheme

Design Statement

SSE Renewables Services (UK) Limited
Sloy Pumped Hydro Storage Scheme
Final Issue: Design Statement: 16.12.2024

sse Renewables

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Note:

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1
Introduction

1. Introduction

1.1 Introduction

SSE Renewables Services (UK) Limited (SSER) is proposing to convert its existing Sloy Hydroelectric Scheme to Pumped Hydro Storage, "The Proposed Development". The Proposed Development is located within the grounds of the existing Category A listed Sloy Power Station (LB43188), that sits at Inveruglas on the westerly shores of Loch Lomond

This Design Statement documents the project context and ambition as well as the design development process, outlining the proposed approach to the design including reference to materials and sustainability.

The proposals outlined in this Design Statement have been considered within Chapter 12: Landscape and Visual Impact Assessment (LVIA) of the EIA Report and incorporated into photomontages. The Design Statement should be read in conjunction with mitigation measures which are outlined in the LVIA.

1.2 The applicant

SSE Renewables Services (UK) Limited (SSER Ltd.) "the Developer" as agent for SSE Generation Limited "the Applicant" is applying for consent to convert the current Sloy Hydroelectric Power Station into a pumped hydro storage scheme.

For the purposes of this document both entities will hereafter be referred to as SSE.

SSE is a leading developer, owner and operator of energy generation across the UK and Ireland including onshore and offshore wind farms, hydro, battery and solar. They have an operational renewable portfolio of approximately 4.5GW, a secured future project pipeline of almost 15GW in development and plans to increase installed renewable energy capacity to 9GW by 2027, and over 16GW by 2032. SSE is well placed to provide the future renewable power needed to power a green economy.

1.3 Sloy Hydroelectric Scheme

The Sloy Hydroelectric Scheme came into operation in 1950 and was a hugely ambitious engineering project at the time. The operational scheme has been recognised for its engineering and architectural importance and as a result is Category A-Listed.

In the 70 years since construction was completed, the above ground elements of the development have largely been absorbed into the surrounding landscape, and the main features of the lower works appear as distinctive structures.

The scheme generates electricity by passing water from Loch Sloy to Loch Lomond. Sloy Dam has a spillway crest level at 285m above sea level whereas Loch Lomond's surface sits at around 10m above sea level. From Loch Sloy the water is carried by a 3km long tunnel through Ben Vorlich to four steel pipelines (penstocks) which carry it to the power station at Inveruglas Bay. This difference in height within the small horizontal distance offered ideal hydraulic conditions for the development of the original scheme.

Sloy is the UK's largest conventional hydroelectric scheme, inside the power station there are four turbines with a combined generating capacity of 152.5MW. Energy is exported to the grid via overhead lines connected to the nearby Sloy Substation. In a year of average rainfall, Sloy Hydroelectric Power Station generates around 130GWh.

Sloy Hydroelectric Power Station. Credit: Richard F. Ebert

1.4 Proposed development

The Proposed Development would convert the existing Sloy Hydroelectric Power Scheme at Inveruglas, into a pumped hydro storage scheme by the construction of a separate pumphouse within the grounds of the existing hydroelectric station, immediately north of the power station, adjacent to Inveruglas Visitor Centre.

The pumphouse would be connected hydraulically and electrically the existing power station to enable water to be pumped from Loch Lomond through (up to) three of the existing four penstocks then via the tunnel to Loch Sloy during times of low demand (typically overnight) or oversupply (when there is too much renewable energy being generated from wind farms, run-of-river hydro schemes, marine devices etc).

The Proposed Development would enable the load factor at the Sloy Hydroelectric Power Station to increase from 10% to (up to) 20% and would help to reduce the likelihood of renewable energy from other sources being constrained off the grid during times of low demand.

It should be noted that it is not envisioned that there would be works required at Loch Sloy to enable the Proposed Development.
The principal components of the Proposed Development would comprise the following (refer EIA Volume 2, Figure 4.1):

- A new surface building to house electrical switchgear, pump infrastructure and gantry crane(s);
- New multi-stage pumps, located within a new underground pump hall;
- New pump motors located within a large open plan hall;
- A small new transformer compound containing the switchgear and transformers required to power the pumps;
- A new section of intake structure, located on the north side of the existing Sloy Hydroelectric Power Station tailrace to enable water to be conveyed to the pumps. The intake will be screened to protect fish and prevent floating debris from entering the pumps;
- New buried pipeline(s) to take the water from the pumps to connect into (up to) three of the existing four penstocks (the high pressure steel pipelines which convey water to the existing power station);
- A large reinforced concrete anchor block at the point of connection into the existing penstocks. This will require modifications to be made to the existing listed drystone wall to the rear of the power station;
- Reconfiguration of Sloy Hydroelectric Power Station internal road for vehicular access;
- Reinstatement of areas affected by construction of the Proposed Development with new profiled earthworks, and planting;
- Dismantling (to enable construction access) and reinstatement of Sloy Hydroelectric Power Station's listed northern entrance gates, gate pillars and a short section of walling;
- Creation of a site establishment area in the woodland to the north of the existing Sloy Hydroelectric Power Station and an area for on-site storage of excavated rock spoil;
- Regrading of the main construction compound / site establishment area and the reinstatement of the area to an improved condition to the existing, in order to achieve SSE's biodiversity net gain (BNG) targets of a minimum 10% net gain; and
- Creation of a secondary construction compound / site establishment area and vehicle holding area in the overflow car park (owned by SSE) to the north of the Inveruglas Visitor Centre car park, including permanent upgrades to the access junction and reinstatement post-construction.

Sloy Hydro Scheme viewed from the south east as existing. Image Credit SSER

1.5 The building brief

A new surface building would be required to house electrical switchgear, pump infrastructure and a gantry crane to enable removal of heavy components for maintenance and repair. SSE commissioned the services of award-winning, Glasgow based architects, Page \ Park to undertake the design concepts of the proposed above ground elements.

A high-quality contemporary building is proposed (as was the case for the previously consented pumped hydro storage scheme). The building would be positioned perpendicularly to the existing Sloy Hydroelectric Power Station and would comprise a main hall with vehicular access and laydown areas with space to house transformers, electrical switchgear and control systems. The main hall would house an overhead travelling gantry crane, to accommodate this the building is likely to be up to 18m in height.

Sloy Hydroelectric Power Station, on the banks of Loch Lomond was the first hydro scheme to be developed under the North of Scotland Hydroelectric Board. With an installed capacity of 152.5 MW, Sloy is the UK's largest conventional hydroelectric power station. It currently generates around 130 GWh per year of average rainfall. It can operate at full load within five minutes of a standing start and it is this almost instant availability that makes it ideal for use during times of peak demand.

Sloy Hydro Scheme. Credit SSER

2

Site History & Context

2.1 Heritage overview

Sloy was the first hydroelectric development to be delivered following the formation of the North of Scotland Hydroelectric Board (NoSHEB) in 1943. The purpose of the Board was to implement the Hydroelectric Development (Scotland) Act of 1943 and to generate, transmit and distribute electricity in the North. This was in response to the challenge of Highlanders returning from war being forced to find work in the central belt of Scotland, where electric power was enabling industry to grow.

Designed by architect Harold Ogle Tarbolton (1869-1947), Sloy Hydroelectric Power Station is a fine example of industrial architecture located within a landscape setting. Appointed to a panel of architectural advisors to the board of NoSHEB, H.O Tarbolton's role initially was to adjudicate on competition entries for designs for new developments and to minimise objections by parliament on the grounds of scenic amenity. Tarbolton's role was subsequently expanded and by 1947 he had become one of the designers. The prominent power station building on the shores of Loch Lomond at Inveruglas, is defined by his confident use of modern classicism and the bold application of pre-cast concrete panels.

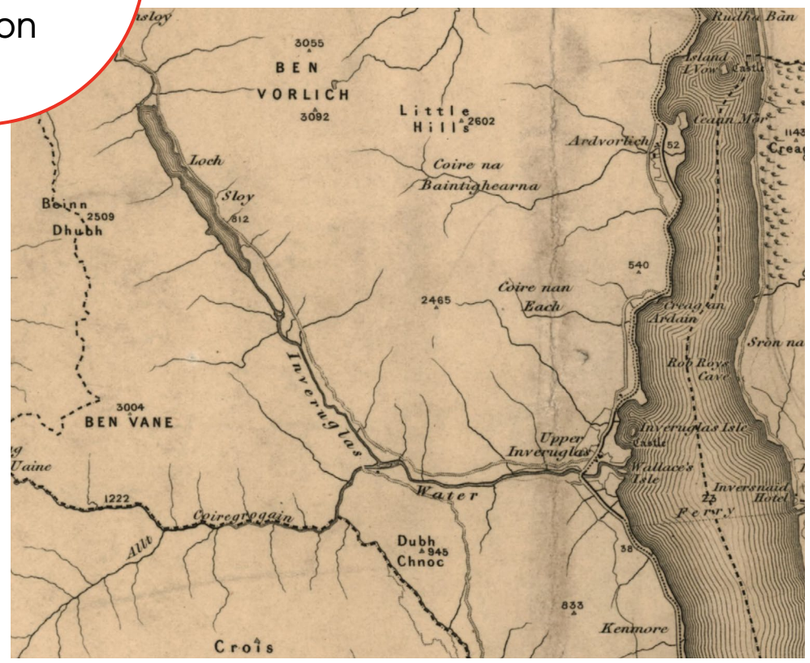
The power station building is an expression of the dynamism of the industry at the time. NoSHEB aspired to create a new prosperity in the Highlands, and the bold design of Sloy Hydroelectric Power Station was a conscious commitment to shaping the wider agenda in the energy sector and an attempt to characterise through architectural ambition, the aims and ideas embedded in the the change NoSHEB felt it was bringing to Scotland. The general massing of the station expressed the dynamism of the industry, with large primary volumes and stark rooflines set against the backdrop of crags and trees.

Today the Category A listing is recognition of the architectural importance of the building and it's setting. The built form, while distinctive in the landscape, has been absorbed into its surroundings.

Sloy Hydroelectric Power Station. Image Credit: SSER

2.2 Historical timeline for development of Loch Sloy Hydroelectric Power Station

1860
Pre-Loch Sloy Hydroelectric Station



Map of Sloy Hydroelectric Power Station site before works had commenced; NLS, 1867

Site early 1900's

Loch Sloy was a small shallow loch, lying 238m above sea level in a valley overshadowed by the Munro peaks of Ben Vane and Ben Vorlich.

The area around Loch Sloy was identified at this time as being suitable for hydroelectric development due to its high rainfall, the position of an existing loch that could provide high level storage, existing watercourses that could be diverted to increase the storage of water, a rocky gorge providing a suitable site for a dam and level ground nearby on the shore of Loch Lomond, viable for the construction of a generating station. Of particular interest was the close proximity of the site to the industrial Clydeside area - a high consumer of electrical energy.

As early as 1906, designs for a small hydroelectric scheme were outlined at Sloy that could potentially have produced around 15 million GWh annually. The scheme proposed that water was directed from Loch Sloy via an open canal and a pipeline to a generating station at the foot of the glen. The area was surveyed prior to the first world war, and again in 1925 but no development undertaken at this time.

In 1935 a different design was explored, based on the use of a reversible generating station. The scheme comprised eight turbo-alternator pump units with a total capacity of 360MW, with the turbines discharging water into Loch Lomond as well as pumping water back to Loch Sloy.

A further proposal was explored in 1937, with the idea of capturing additional water from the surrounding hills and halving the number of pumps in the hydroelectric station, which would have had a capacity of 225MW. For various reasons none of these schemes were developed further.[1]

[1] Arrochar, Tarbet & Ardlui Heritage; The Loch Sloy Hydroelectric Scheme

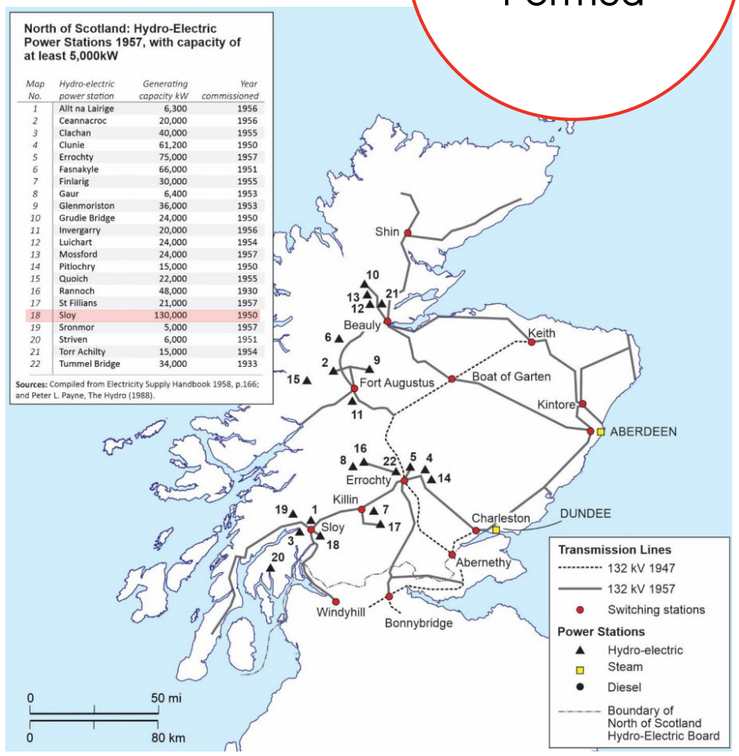
1943
NoSHEB Formed

NoSHEB

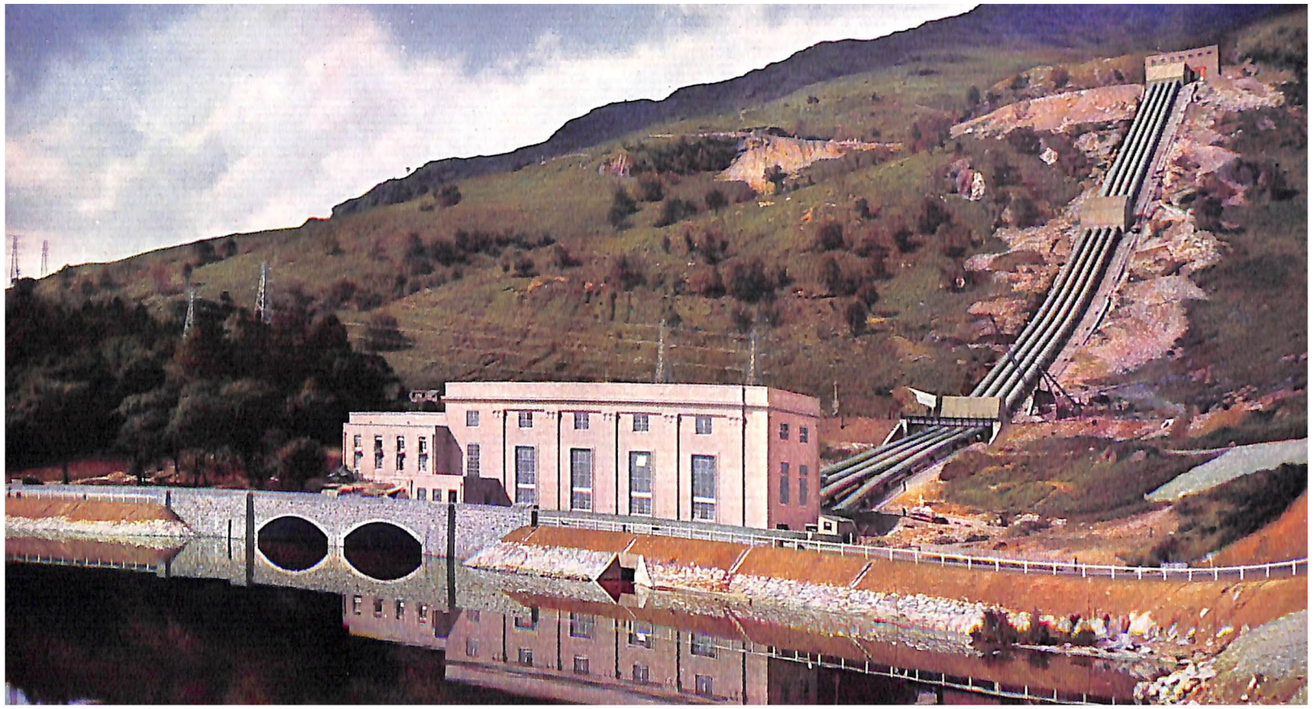
The North of Scotland Hydroelectric Board (NoSHEB) was formed with the Hydroelectric Development (Scotland) Act in 1943. Its formation was led by a drive towards social and economic improvement of rural communities, bolstered by a post-war optimism. Their aim was to provide affordable electricity for Scotland's rural communities, and to export excess power to the south through the design, construction and management of hydroelectric projects in the Highlands of Scotland. Profits were used to subsidise electricity distribution to remote areas. By the mid 1960's, Scotland had 56 dams connected by over 600km of rock tunnels, aqueducts, and pipelines.

SSE plc has its origins in NoSHEB and the former Southern Electricity Board which was formed in 1948 to distribute electricity in southern England. Both organisations were privatised in the early 1990s with the deregulation of the energy sector. They merged in 1998, creating one of the largest energy businesses in Great Britain with millions of domestic energy customers alongside operating the electricity networks across both regions.[2]

[2] "Our History - SSE." | (www.sse.com. https://www.sse.com/who-we-are/our-heritage/)



Map of NoSHEB Power Stations 1957 (accessed wpmucdn.com)



Sloy Hydroelectric Power Station, date unknown Image Credit: SSER

1944
Harold Tarbolton

Development of proposals for Sloy

Early opposition and threats to the independence of NoSHEB, led to a situation whereby design and the setting of the schemes within rural landscapes became increasingly important. NoSHEB recognised 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 evolution of the modern, contextual, style associated with hydroelectric architecture: Harold Ogle Tarbolton, Reginald Fairlie and James Shearer. Rather than opting for familiar, 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 the board.

Harold Ogle Tarbolton made significant contributions to hydroelectric infrastructure design for NoSHEB. He was responsible for the architectural panel of NoSHEB, and he designed the Sloy Hydroelectric Power Station.

A merger with his former junior colleague Matthew Ochterlony led to the formation of Tarbolton & Ochterlony in 1932, (although they collaborated on projects from as early as 1924). In 1944, Tarbolton & Ochterlony took on the role of architectural advisors to the NoSHEB, and contributed to schemes for Loch Sloy, Pitlochry, Loch Faskally, and Tummel-Garry. While Ochterlony passed away before the projects' commencement, Tarbolton oversaw their completion, although he did not live to witness their commissioning.[3]

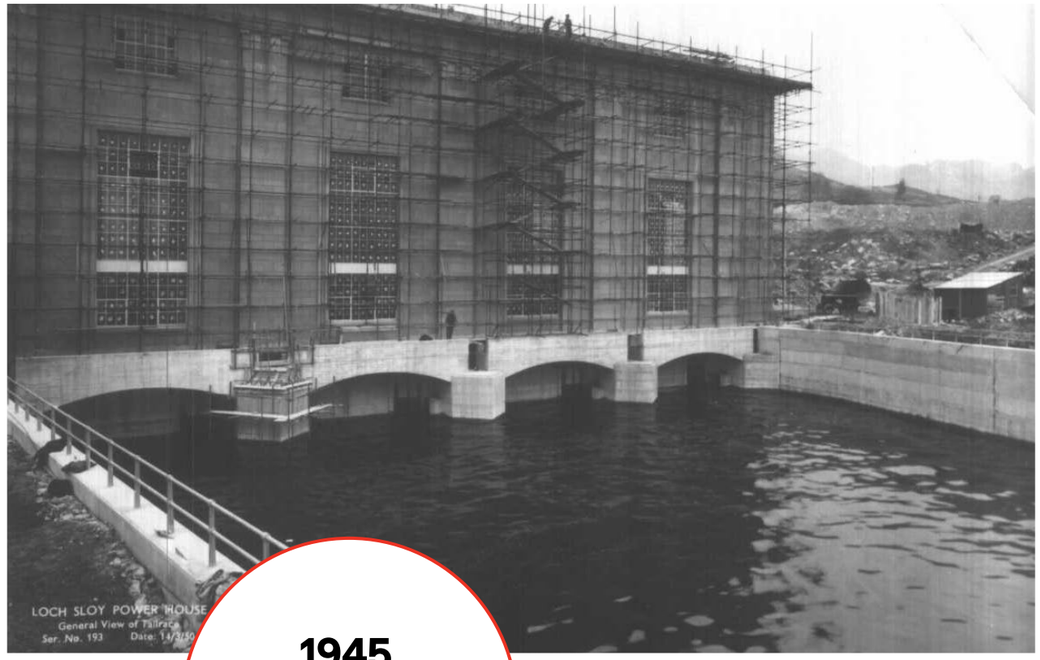
[3] "Harold Ogle Tarbolton" | https://www.royalscottishacademy.org/artists/540-harold-ogle-tarbolton-rsa/overview/

Sloy Hydroelectric Power Station, view from Loch Lomond; Image Credit: SSER

Architectural innovation

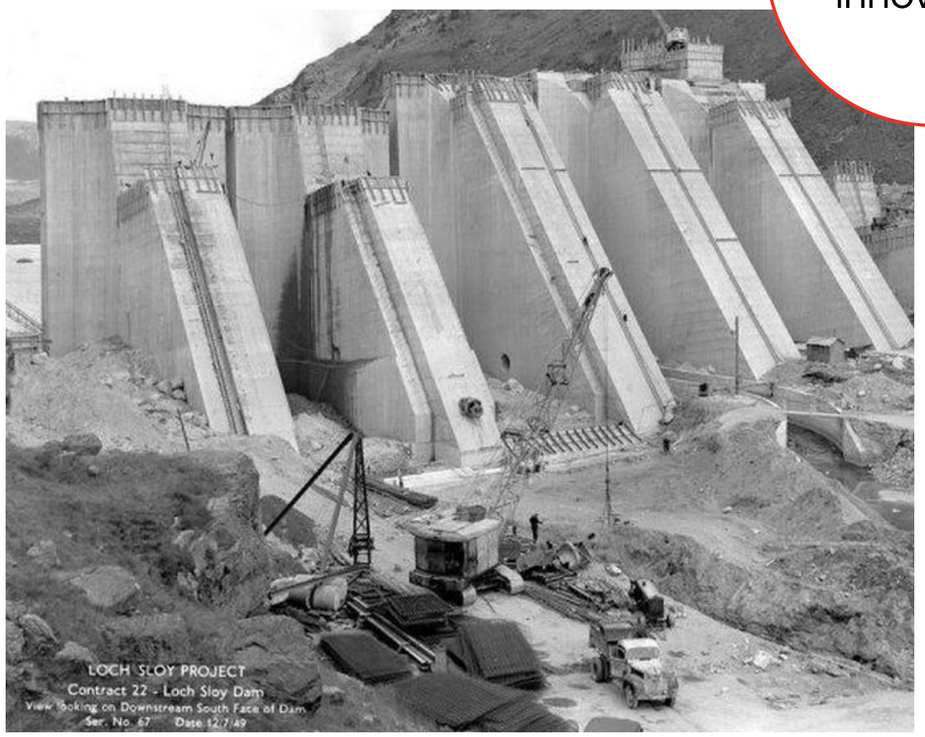
The Sloy Hydroelectric Power Station is Category A listed, in part, due to its role as the earliest example of NoSHEB's work in hydroelectric development in Scotland. The design at Sloy set the benchmark for future hydroelectric projects, while also presenting a face for the Board, reinforcing its position as a dynamic and modernising force. The hydroelectric station building was tasked with mediating the ambition for a modern architectural design with the need to integrate the building with its landscape context.

The use of pre-cast concrete blocks in the Sloy hydroelectric scheme reflects the industry's vibrancy and materials innovation during that time. The design was intended to encapsulate the revolutionary energy transformation NoSHEB aimed to bring to Scotland.

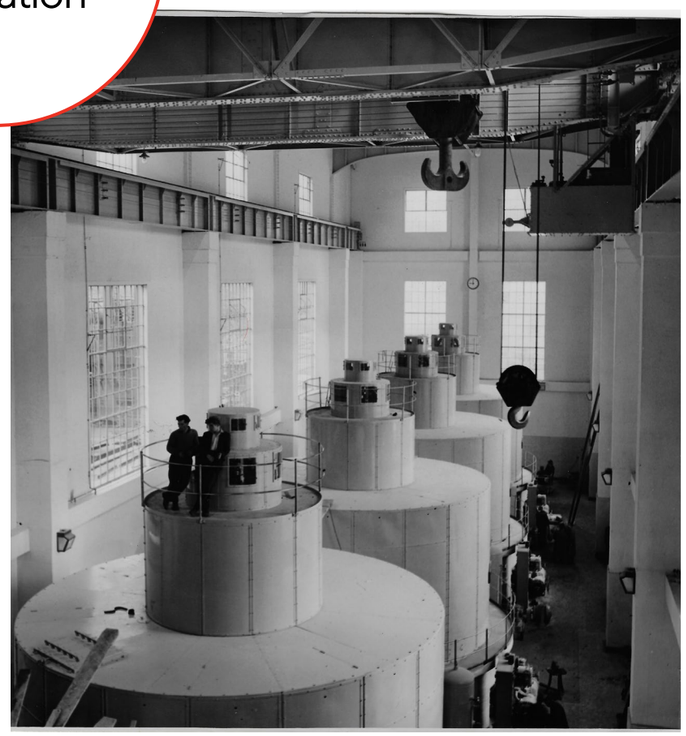


Loch Sloy Hydroelectric Power Station looking over the tailrace during construction; Image Credit: SSER

1945
Design innovation



Sloy Dam under construction, 1949 (https://www.bbc.co.uk/news/uk-scotland-22447168)



Interior of Sloy Hydroelectric Power Station. Image Credit: SSER

The power station boasts a modern design with distinctive features. The southeast facing turbine hall stands out with its full-height pre-cast pilasters. Constructed using a steel frame clad in precast concrete panels (or reconstituted stone) which have been fabricated using granite aggregate from the Aberdeenshire Quarries of Rubieslaw (grey) and Corennie (pink). The building features a banded corniced eaves course and a prominent blocking course.

The main facade comprises a 6-bay turbine hall and a lower office range, separated by decorative pilasters. The ground floor's rectangular windows have moulded concrete surrounds, while smaller windows above feature narrow moulds. The entrance side of the building showcases a 3-bay block with a balcony featuring the NoSHEB coat of arms. Inside, polished marble columns and tiles adorn the entrance foyer, leading to offices, storage, and a main control room on the first floor, which retains its original panels. The functional turbine hall features a trussed steel roof structure and a large crane.[4]

[4] http://portal.historicenvironment.scot/designation/LB43188

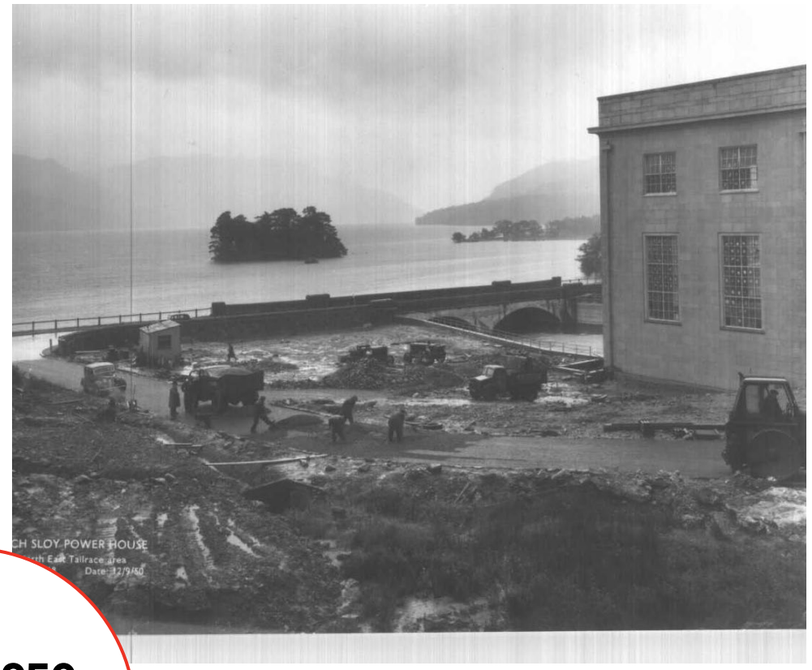
Construction phase

Starting construction towards the end of WW2, this project was, and remains a highly ambitious and successful technical achievement. Thousands of men worked on the project coming from all over the world, including German prisoners of war, and specialist miners from Cornwall. Works commenced in 1944 and the hydroelectric scheme, was completed in 1950. Over a million tons of concrete were mixed and poured on site to build the dam, tunnel linings and associated structures.

A quarry face was opened up 2km south of the dam site to provide the aggregate, which was crushed on site and mixed with sand excavated from a site on the southern edge of Loch Lomond.

Over a span of five years, more than 2,200 workers were employed in a range of tasks, including road building, foundation excavation, concrete pouring, tunnel construction, and machinery installation. On its completion, Sloy was the largest hydroelectric station in the UK.

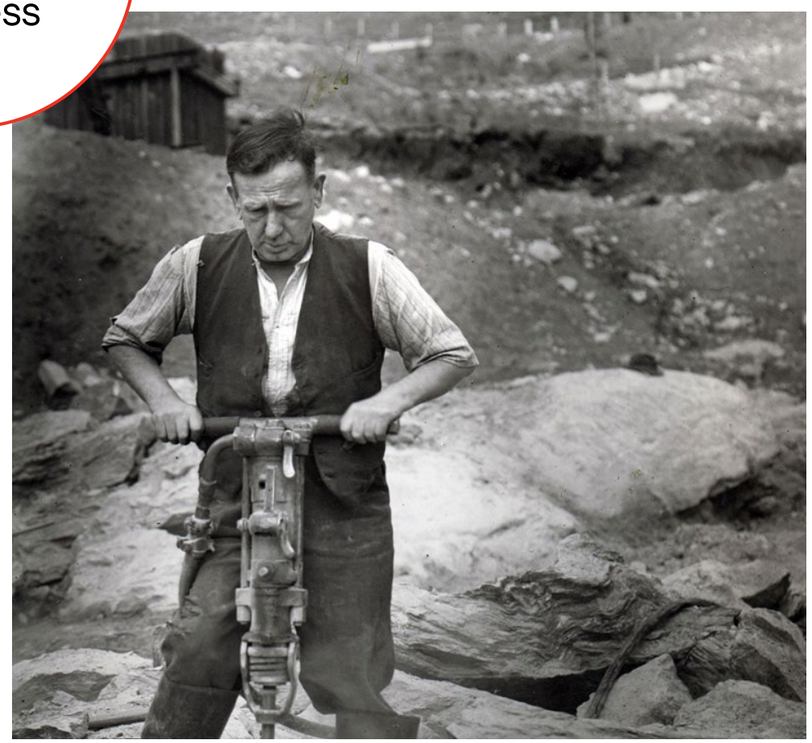
Recognising their historical significance, Historic Scotland (now Historic Environment Scotland), granted listed status to the hydroelectric station building and the dam, categorising them as Category A and Category B listed respectively.



Sloy Hydroelectric Power Station in construction; Image Credit: SSER

1944 - 1950
Construction process

View of the penstocks during constrution; Image Credit: SSER

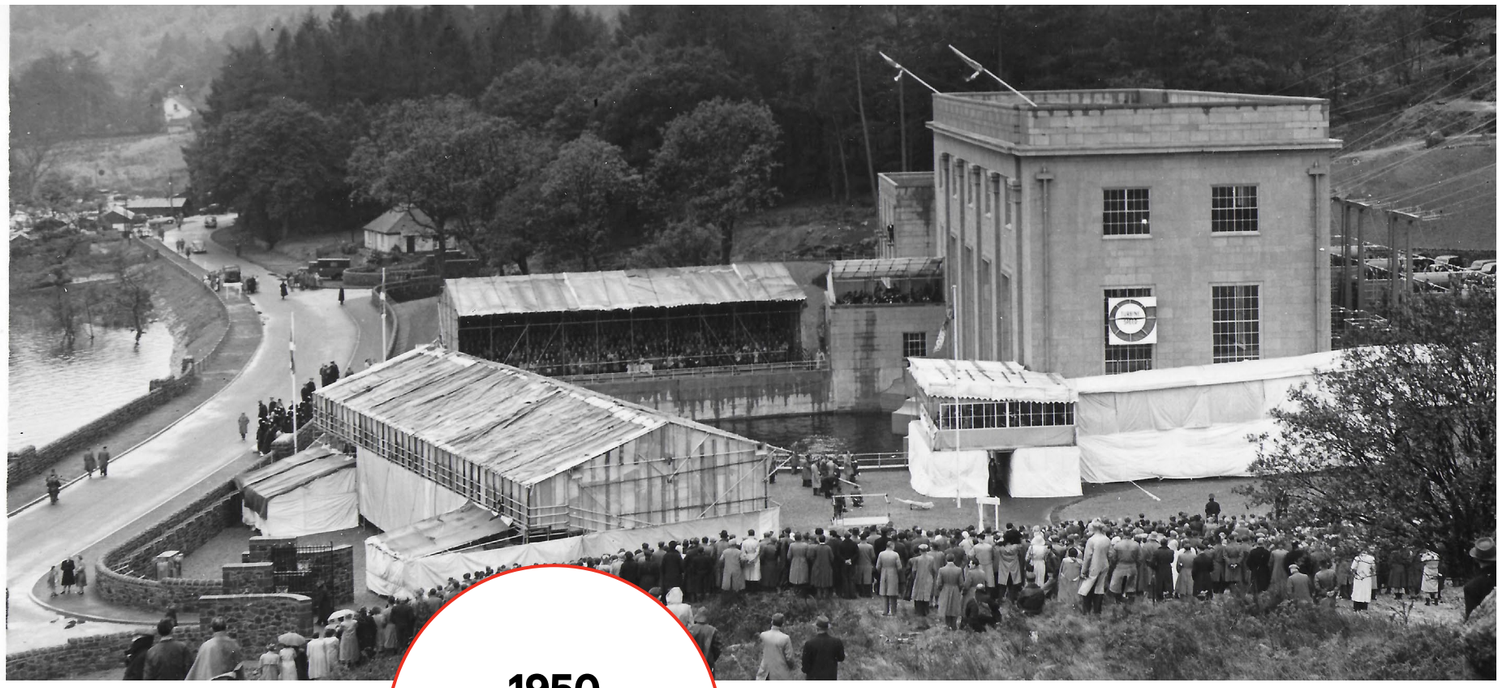


Worker on site during construction; Credit: SSER

Official opening

On 18th February 1950, Sir Edward MacColl, who had recently received the honour of knighthood, activated the inaugural generator set at Sloy Hydroelectric Power Station at precisely 3:15 pm, with the initial welcome speech given by Tom Johnston. He said: 'Here at Loch Lomond Side, in the most besung area in the world, our engineers, contractors, and workmen, have performed marvellous feats of skill and endurance'.

The whole facility was formally 'switched on' by the Queen Mother (then Her Majesty the Queen) on 18th October 1950. Part of the Queen Mother's speech has been archived; she said: 'Everyone will I know join with me in expressing the warmest admiration of those whose vision, tenacity and technical skill have welded together in facing and conquering so formidable a task'.



SSE Loch Sloy Grand Opening, 1950. Image Credit: SSER

1950
Official opening

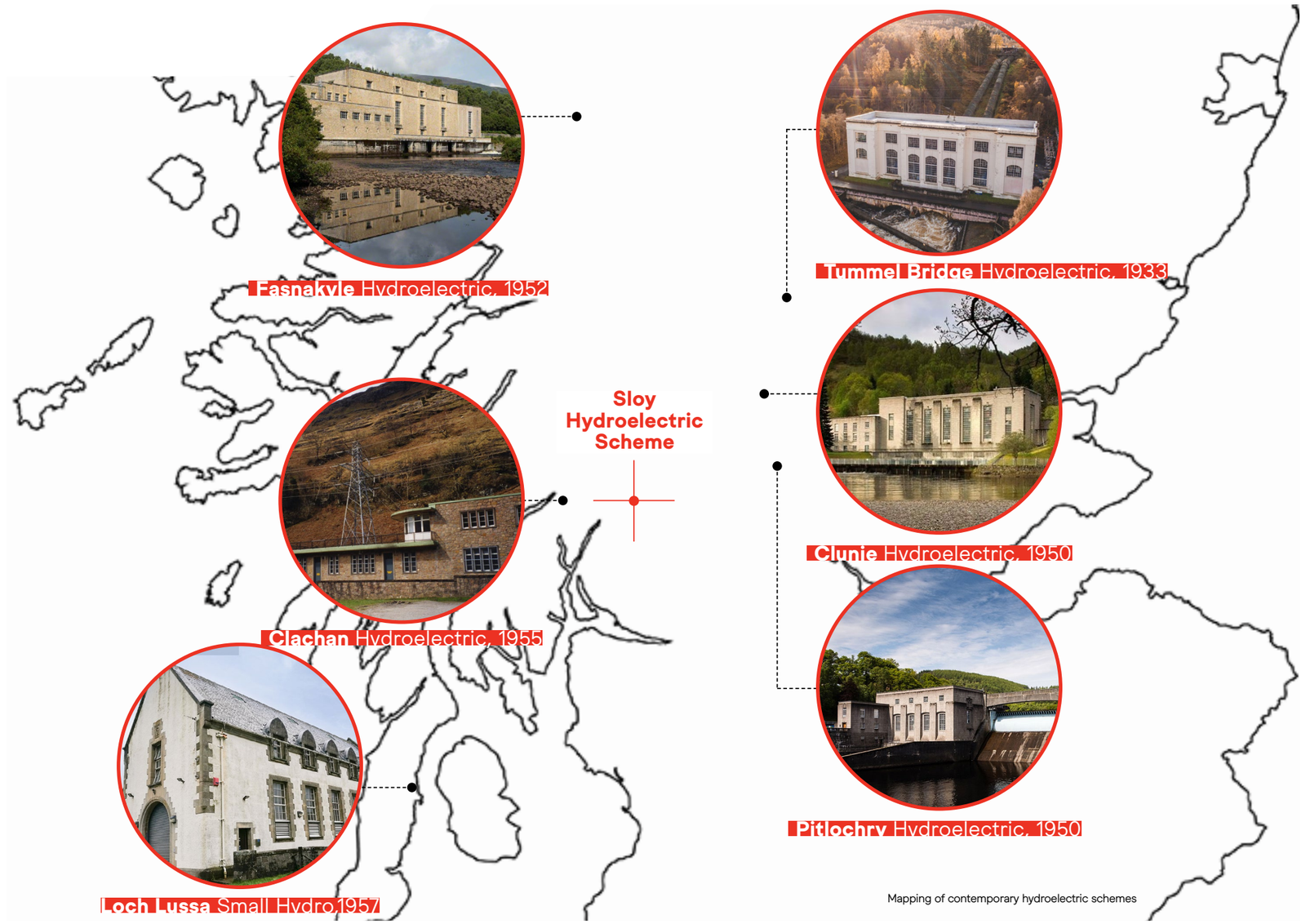
SSE Loch Sloy Grand Opening, 1950. Image Credit: SSER

Residents of Tarbet, situated further south on Loch Lomond, and those at Arrochar on Loch Long, had been receiving electricity from a temporary diesel generating station since April 1948, this was replaced by supply from Sloy Hydroelectric Power Station once operational. The initiation of this supply was marked by Miss Mary MacFarlane, then the oldest resident of the village at 96 years old, who performed the switch-on ceremony.

[6] https://www.sse.com/news-and-views/2020/10/a-platinum-celebration-for-sloy-power-station/

2.3 Examples of other hydroelectric schemes across central Scotland

The image below illustrates the broader context for the development of the hydroelectric scheme at Sloy. This includes reference to a number of comparator hydroelectric schemes that are contemporary with Sloy. These images illustrate the shift from a bold, modern-classical approach whereby NoSHEB sought to make an authoritative mark through their new hydro schemes, to an approach defined by the integration of building and landscape as led by James Sherar. Sherar promoted the use of stone cladding over concrete to root the buildings deeply in their setting.



Mapping of contemporary hydroelectric schemes

2.4 Buildings of scale on the shores of Loch Lomond

Through review of the built environment around Loch Lomond a better understanding of how buildings have been introduced into the landscape setting is gained. Of note are a number of large scale, historic, private residences on the edges of the loch. The buoyant tourist economy around the loch has led to the conversion of many of these private homes into hotels and tourist destinations. The architectural approach varies from articulated picturesque buildings to contemporary interventions and loch access infrastructure such as piers and jetties.

Sloy Hydroelectric Power Station is one of the most northerly large-scale buildings on the loch.

The diagram opposite identifies and locates the most significant large-scale structures on the edges of the loch.

1 Sloy Hydroelectric Power Station 1950

6 Lomond Castle c.1860

11 Ross Priory 1693

2 Tarbet Hotel 1850

7 Auchendennan House 1866

12 High Wards Estate

3 Luss Pier 1846

8 Cameron House c.1750

13 Old Manse 1750's

4 Loch Lomond Golf Club 1773

9 Loch Lomond Aquarium Centre

14 Inversnaid Hotel 1790

5 Arden House 1860

10 Balloch Castle 1808

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3
Proposed Development

3.1 Proposed development

The Proposed Development involves the conversion of the existing hydroelectric power scheme through the introduction of new pumps located in the grounds of the existing power station at Inveruglas on the shore of Loch Lomond.

The new pumps would enable water to be pumped through (up to three) of the existing four penstocks and the tunnel from Loch Lomond to Loch Sloy during times of low electricty demand (typically overnight) or oversupply (when there is too much renewable energy being generated).

The Proposed Development would enable Sloy Hydroelectric Power Station to operate for longer periods of time, and would minimise the likelihood of renewable energy from other sources being constrained off the grid during times of low demand.

The development of pumped hydro storage at Sloy Hydroelectric Power Station would only require construction work to be carried out in the vicinity of the existing Category A listed power station.

It is proposed that the pumps would be housed within the underground pump hall and surface building situated on the north-eastern landscaped area of the site. The pumping hall would be connected to the existing tailrace via a new intake structure. The pumped water would travel through a buried pipeline to the north of the new building and would join into the existing penstocks to the rear of the existing generating station where it would be transferred to Loch Sloy using the existing tunnel system.

The main pump hall would house an overhead travelling gantry crane, to accommodate the crane the building is likely to be up to 18m in height. The overall clear height between the lowest internal level of the new pumping hall and underside of roof level, requires a 34m clear distance. This is to accommodate the pumps, motors and provide clearance for the removal and replacement of components for maintenance.

Understanding the relative scale of the existing intervention in the landscape is critical in the context of conversion. The existing hydroelectric scheme includes a 357m length dam at Loch Sloy, which is up to 55 metres in height. A tunnel in excess of 4m diameter has been cored through Ben Vorlich to meet the four penstocks which are approximately 2.4m in diameter. These then descend the hillside to the power station. The existing power station building consists of a 58m length turbine hall and 28m length adjoining office building, is therefore relatively modest, when considered against the engineering scheme as a whole.

Previously Consented Scheme

In September 2010, Scottish Government Ministers granted consent for a pumping station within the grounds of the existing power station with subsequent extension to the Section 36 consent granted until December 2018. However, due to a perceived lack of market at the time, the scheme was never built. In recent years, there has been an increase in the development of flexible, renewable schemes (principally wind farms) and as a result there is now a recognised, clear, and urgent need for the development of pumped hydro storage, to support the integration of renewable energy and maintain security of supply. SSE have reviewed their operational assets and still believe that the existing Sloy Hydroelectric Power Station is ideally placed for conversion into a pumped hydro storage scheme.

3.2 Extent of engagement through the design development process

Through concept development, design proposals have been presented to, and discussed with, The Loch Lomond and Trossachs National Park (LLTNP) and Historic Environment Scotland (HES).

Design review meetings were held online on 23rd August 2023 and 7th November 2023 with LLTNP and on 13th September 2023 with HES. A further design progress discussion was held on 28th September 2023 with HES.

There were 2 main issues raised:
1. How to ensure the new building is subservient to the existing building.
2. How to maximise exposure of the machinery within the building, without dominating the Category A listed setting.

Concept designs were presented to both LLTNP and HES with feedback noting the positive impact that the Proposed Development could have to draw attention to the existing building and increase its prominence. There was notable support for maximising the visibility of the internal machinery and an acknowledgement of the need to balance the exposing of the building function and contributing to the cultural heritage, while not dominating the Category A listed building and setting. At follow-up meetings with LLTNP and HES a revised approach was presented in response to the initial feedback shared. These proposals reduced the scale of the rear section of the building while maximising the height of the new pumping hall. Feedback noted the improvement to the design, the proportions of the proposal, and the positive relationship with the context.

The preferred approach developed in liaison with LLTNP and HES has been developed further, and forms the basis of the proposals presented in this Design Statement.

3.2 Bold interventions in landscape

The architect Harold Tarbolton evolved a distinctive modern classical approach to the visionary hydro interventions in the landscape. Sloy Hydroelectric Power Station was the first of three new hydro stations he designed. His designs for both Clunie and Pitlochry, which came later, show how his confidence grew with an increasingly refined modernist approach.

There are clues in the simplicity of the approach; the play with light and shade through the articulation of the interlocking geometric volumes.

Sloy Hydroelectric Power Station; Image Credit: SSER

Sloy Penstocks; Image Credit: SSER

Sloy dam during construction; Image Credit: SSER

3.3 Engineering led design

The confidence in architectural approach adopted by Harold Tarbolton is rooted in understanding of the engineering required to enable hydro generation.

The individually impressive component parts have now settled into their landscape context. The articulation of the dam buttresses, the bold expression of the penstocks on the hillside and the vibrancy of the brightly coloured interior components set the tone for the Proposed Development to respond to.

Sloy Dam; Image Credit: Page\Park Architects

Sloy Penstocks; Image Credit: Page\Park Architects

Sloy Turbine Hall; Image Credit: Page\Park Architects

3.4 Understanding the setting

LLTNP is a geological landscape. It "was formed when glaciers flowed north to south during the last ice age between about 2 million and 10,000 years ago." The bedrock "faulted and folded" and was subjected to low grade metamorphism. This geology created a unique landscape. The Sloy Hydroelectric Power Station sits within this landscape as an extraordinary, man-made piece of infrastructure. The scale and form of the power infrastructure responds to the scale and form of this geological landscape.

The Proposed Development looks to interpret this landscape creating a visual, architectural representation of the faulted and folded geology. By looking at maps of the landscape we build up an understanding of how it has been interpreted and represented previously. The aerial view shows the surface of the land; the darkness and depth of the loch, tones graduate from the coloured vegetation to the exposed rock at the top of the hills. Roy's military map of the 1750s shows the undulating, rounded form of the landscape shaped by the glacier. The geological map of the early 20th century shows the layers of rock made up in seams and strata represented by different colours.

To the north of Loch Sloy sits Garabal Hill, "of the highest importance because of the variety of igneous rocks outcropping in a fairly small area."[7] The hill is generally believed to be lower old red sandstone. A description of the geology in the Quarterly Journal of the Geological Society of London in February 1940 notes "pink in hand specimen instead of grey".[8]

Historical Maps - Geology Analysis; Image Source: National Libraries of Scotland

[7] (No date) Balmaha. Available at: https://www.lochlomond-trossachs.org/wp-content/uploads/2016/07/Outdoor-learning-resource-Balmaha_geology_Trail.pdf (Accessed: 04 April 2024).
[8] Geology of Loch Lomond and The Trossachs National Park (2024) Wikipedia. Available at: https://en.wikipedia.org/ (Accessed: 04 April 2024).

With seasonal variations in tone and texture of its context, the Sloy Hydroelectric Power Station stands boldly against the changing National Park backdrop. Any new interventions must respond to this context and understanding of the landscape.

Sloy Hydroelectric Power Station viewed from the South as existing. Image Credit SSER

3.5 Adding to the existing composition

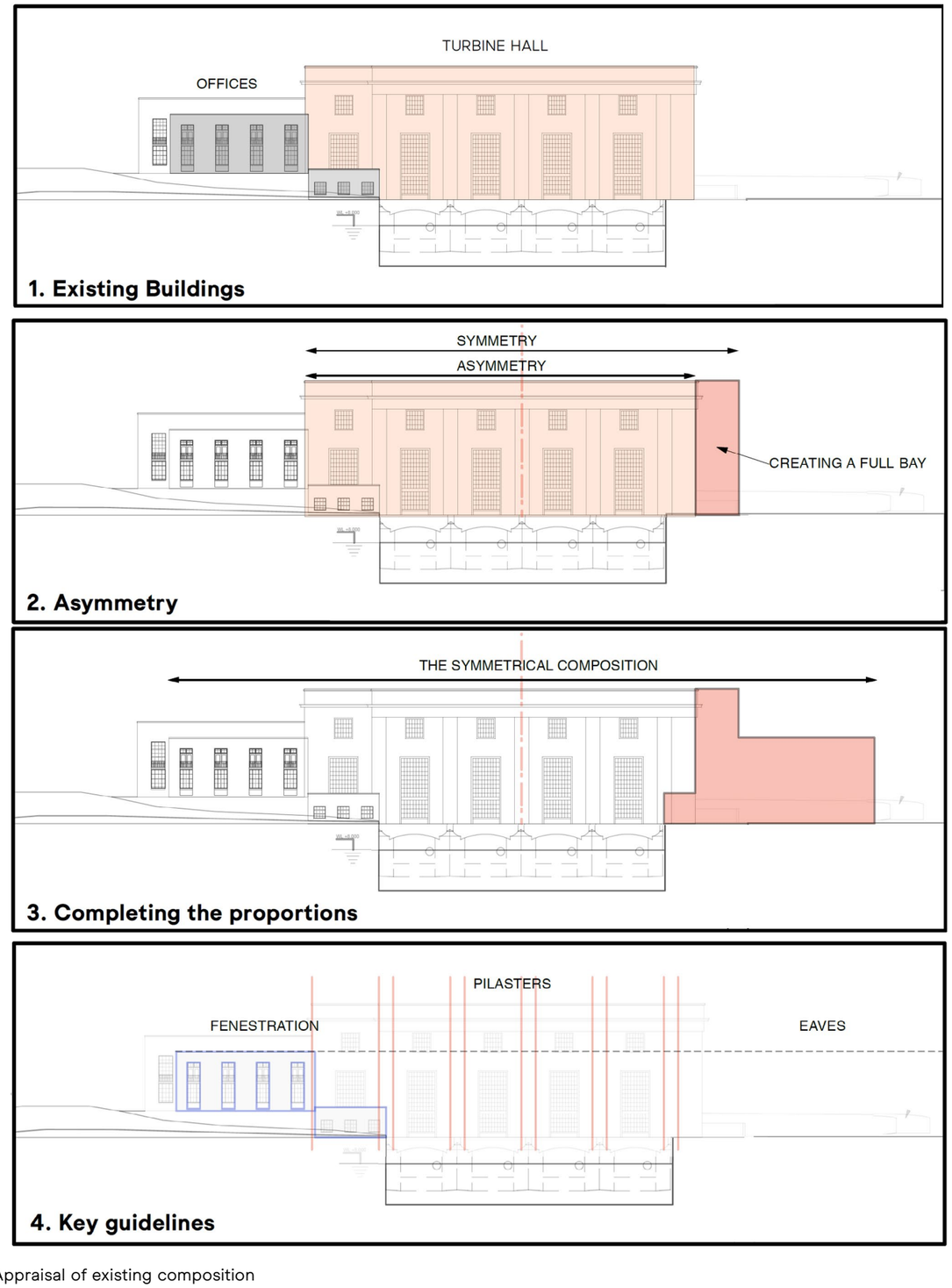
Over our 40 years in practice Page\Park have become trusted architects working in heritage settings across the UK; we have delivered complex building projects in listed settings and scheduled monuments across the UK. We believe deeply in celebrating the exemplar heritage in our unique towns, cities and landscapes; and using heritage as an agent for local change and regeneration.

Our first step is to develop a deep understanding of what exists. In the case of Sloy Hydroelectric Power Station and the existing composition, we recognise that whatever is added needs to be respectful of what exists. It should be referential, not deferential to the existing building.

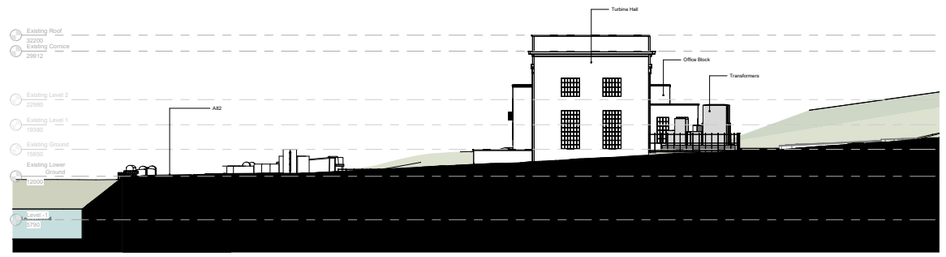
The existing turbine hall is of a modern classical style. As it is typically viewed from a passing vehicle or an oblique angle from the Visitor Centre, it is not immediately obvious that the turbine hall with its impressive pilastered façade, is in fact asymmetric. The most northerly bay has been shortened.

One of the reasons for this is that the southern side of the building is partially embedded into, and set back from, the office block which has a more plain composition of wall and window. By undertaking an exercise in recreating, firstly, the missing portion of bayed wall and, secondly, completing the absolute symmetrical composition of all the components we can set up a series of geometric rules that can inform how we design and position the new building. Eaves lines are taken through, pilaster patterns are extended and window patterns are superimposed.

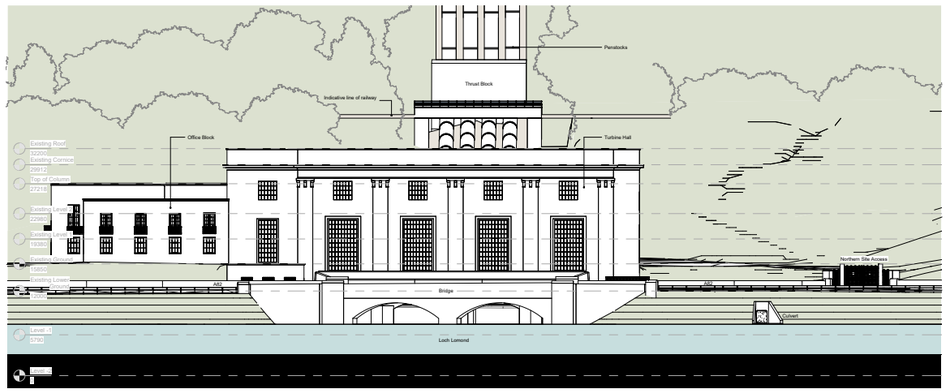
Our proposed design approach is outlined on the pages that follow.



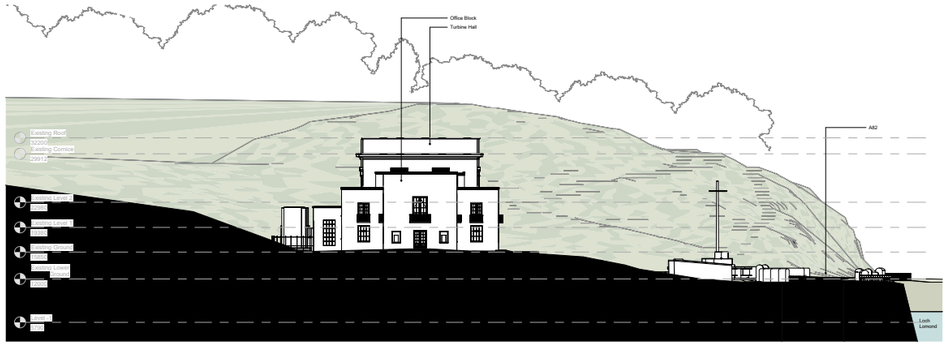
Appraisal of existing composition



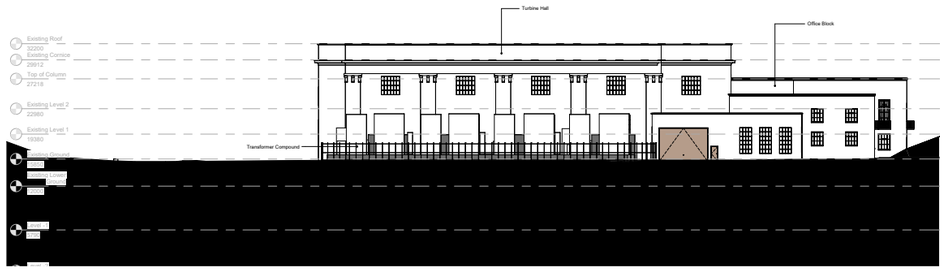
Existing North Elevation



Existing East Elevation

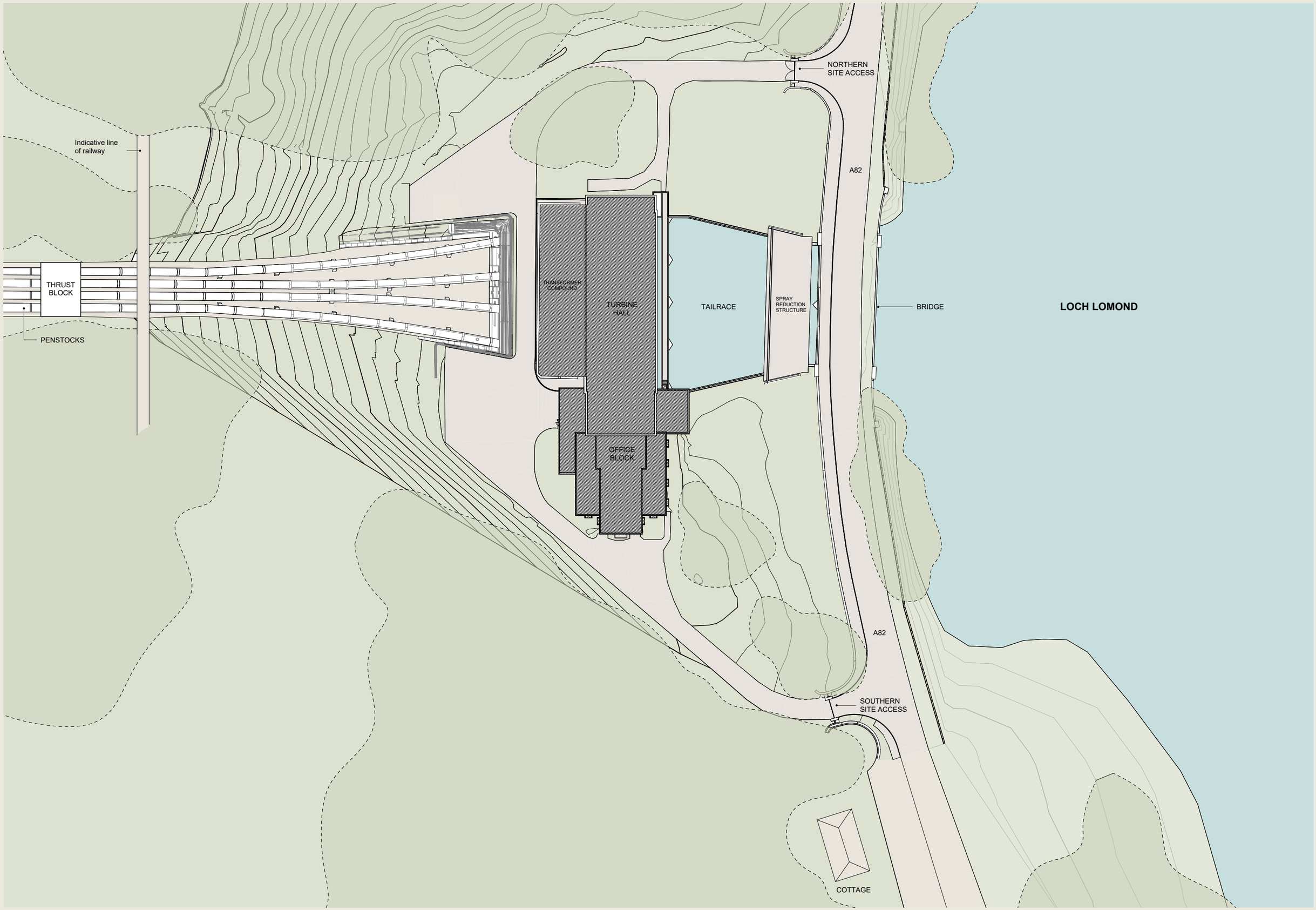


Existing South Elevation

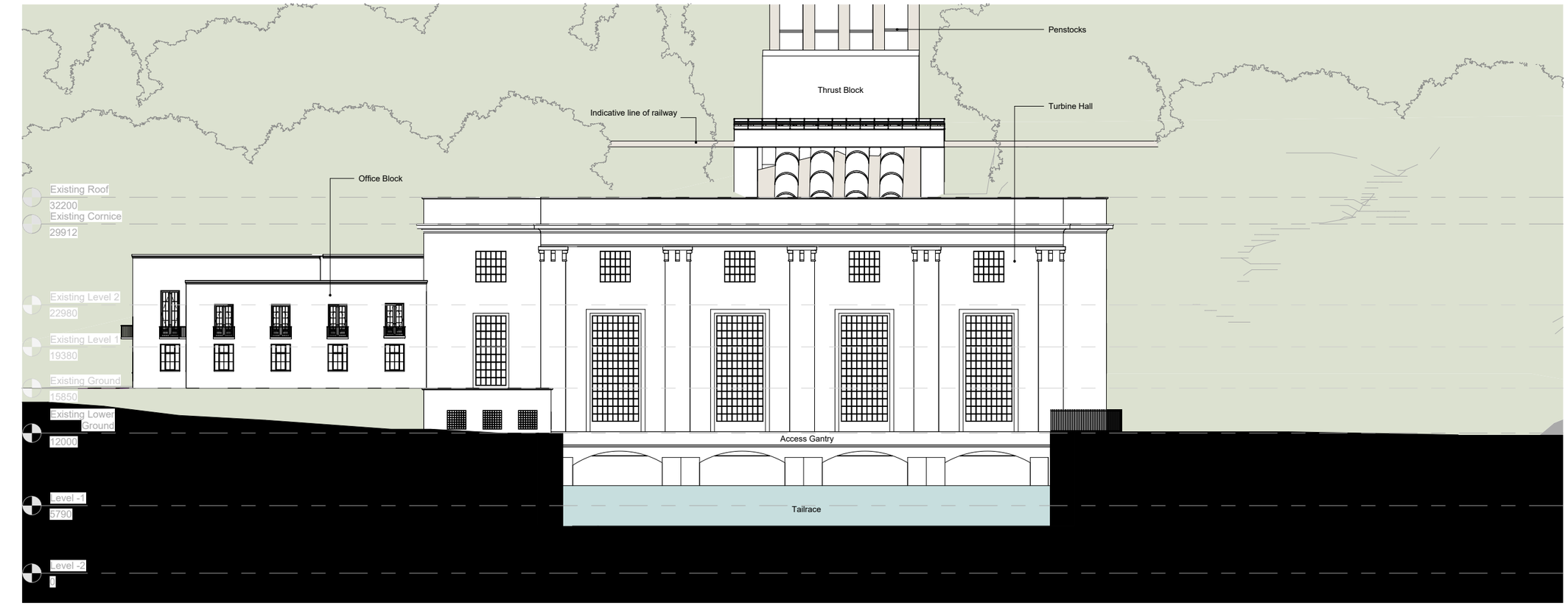


Existing West Elevation

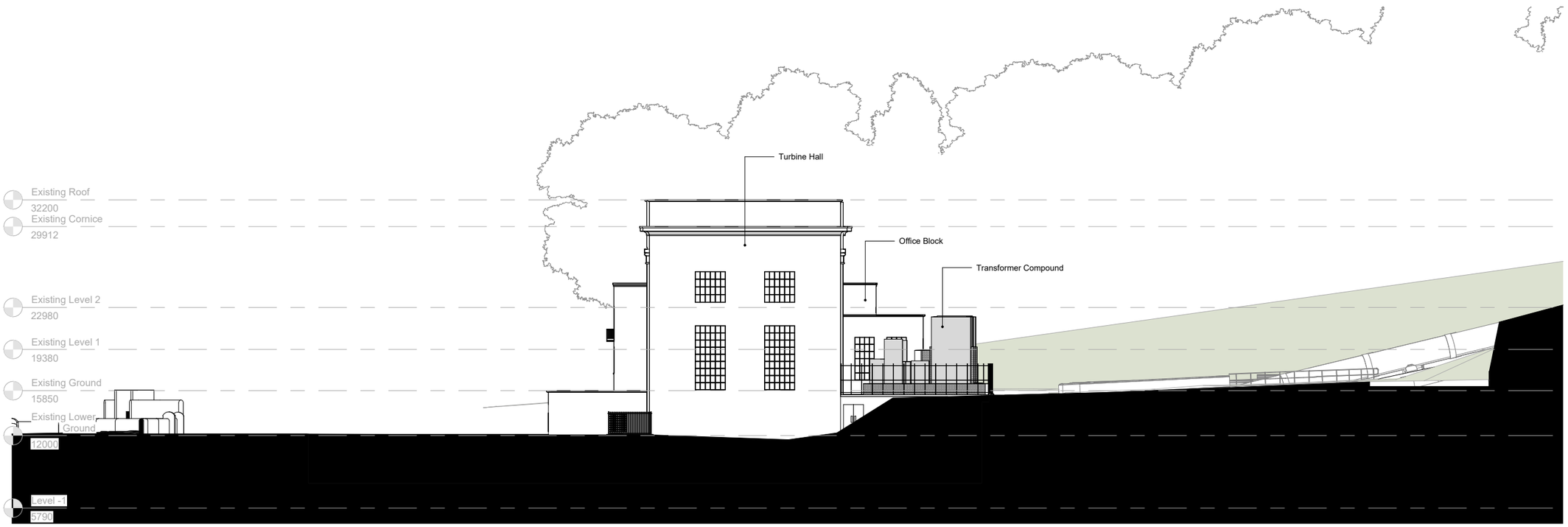
Existing Elevations



Existing Site Plan



Existing Cross Section



Existing Long Section

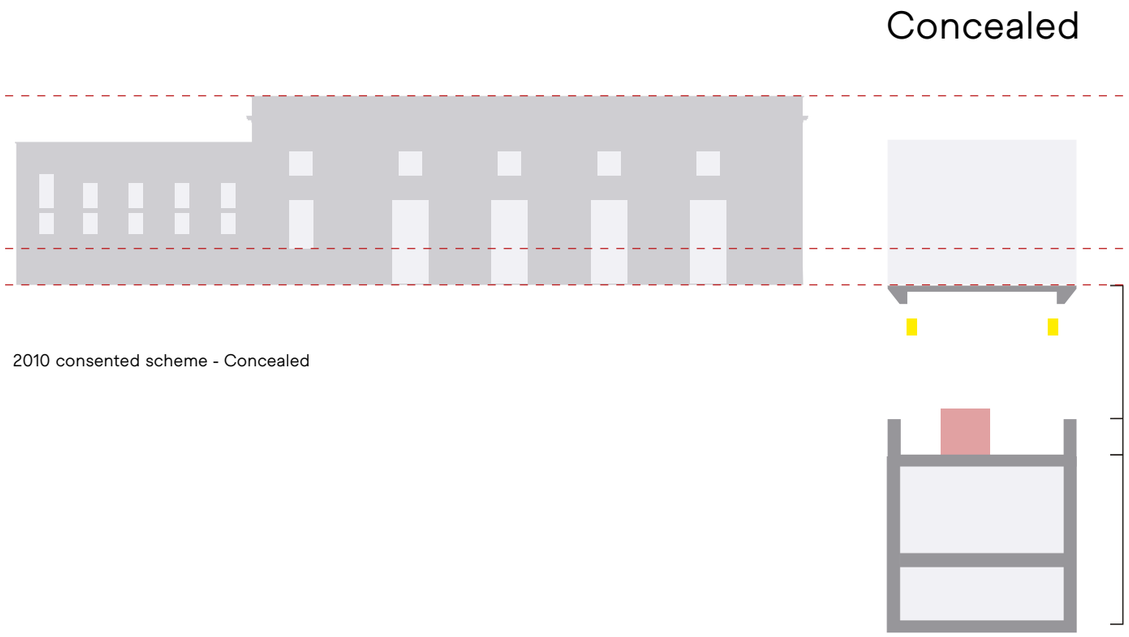
3.6 Design approach

Our design approach is described through the four steps outlined on the pages that follow.

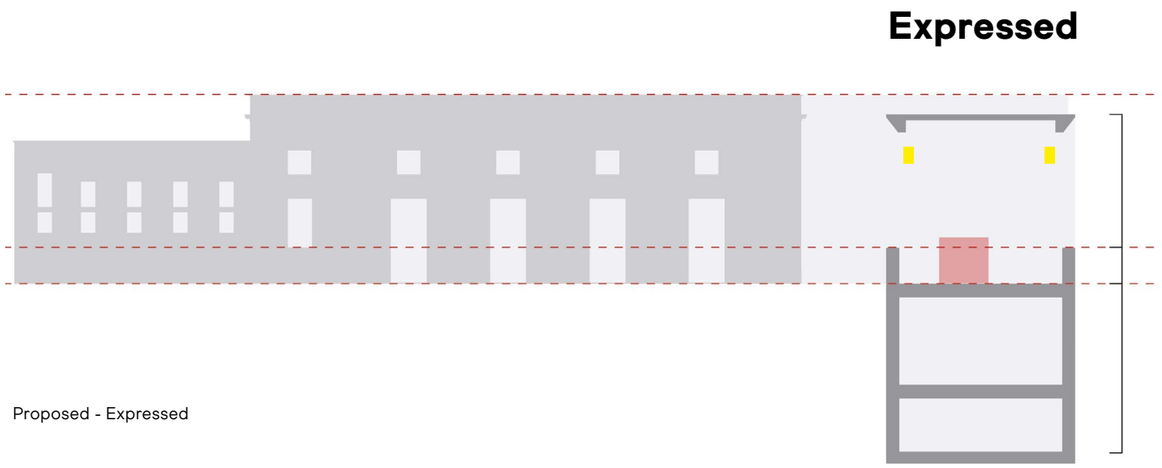
1. Celebrating rather than concealing
One approach, as was proposed in the 2010 consented option, would be to attempt to conceal the mass of the pump hall by submerging it fully in the landscape. This approach would allow views to the existing building to remain undisturbed, but in turn requires excavation of a larger volume of spoil when compared with a visible surface building. Submerging the new pumping hall fully was therefore not technically viable in this scheme.

Instead, an opportunity was presented to celebrate the change that is proposed within the site, for local and national benefit. We believe that the mass of the proposed pump hall should be acknowledged and celebrated. The proposed approach has been to seek to do that, by evolving an architectural language that is in dialogue with the existing building, that appears subservient to it, and that celebrates the engineering process that it encapsulates.

The design proposals therefore take a conscious decision not to conceal the new building, rather to acknowledge its mass and scale and to work carefully to refine it relative to its context.



2010 consented scheme - Concealed



Proposed - Expressed

2. Building massing
The massing of the new building has been driven by the engineering requirements of the pumps, the equipment and safe working space it required to encapsulate them. The engineering demands have been carefully balanced with the need to evolve a cohesive and responsive approach across the existing site.

Initial concept responses sought to balance the asymmetrical existing composition, with the new building mirroring the massing of the front section of the southerly office block. The impact of this height limit was an increase in the excavations required to achieve the minimum clear internal heights needed to service the facility.

As the height of the new building increased it was recognised that, while reducing the level of excavations required, the pumps could also be made visible from the building exterior. This is in contrast to the façade of the existing turbine hall which conceals the inner workings of the power station.

Through explorations of the building massing, a maximum height datum was identified that aligns with the lower cornice of the existing building parapet. This datum has defined the extent of excavations and has provided a framework for explorations into the articulation of the new building.

3. Open not closed
Critical to the concept of expansion of the existing composition through the addition of a new pumping hall that runs perpendicular to the existing, is that a high degree of transparency is achieved to ensure that the existing building remains visible.

In contrast with the existing building, the new piece has therefore been developed as a structure that is open rather than closed. A bold, transparent volume that sits on the edge of the loch, celebrating the future energy generation for the nation. This is in a similar vein to the bold, modern classicism of the Tarbolton building which signalled and celebrated the electrification of rural Scottish communities.

The massing of the new piece has therefore been broken down to form a frame structure which offers a clear sightlines through to the Category A listed existing building. This approach builds on the existing building massing, the abstracted classical details and the use of giant-order pilasters to articulate the bays of the turbine hall, and also draws inspiration from the Clunie and Pitlochry schemes. The organisation of the elevations of the proposed new building becomes an exercise in modulation, that relates to the rhythmic articulation of the historic façade.

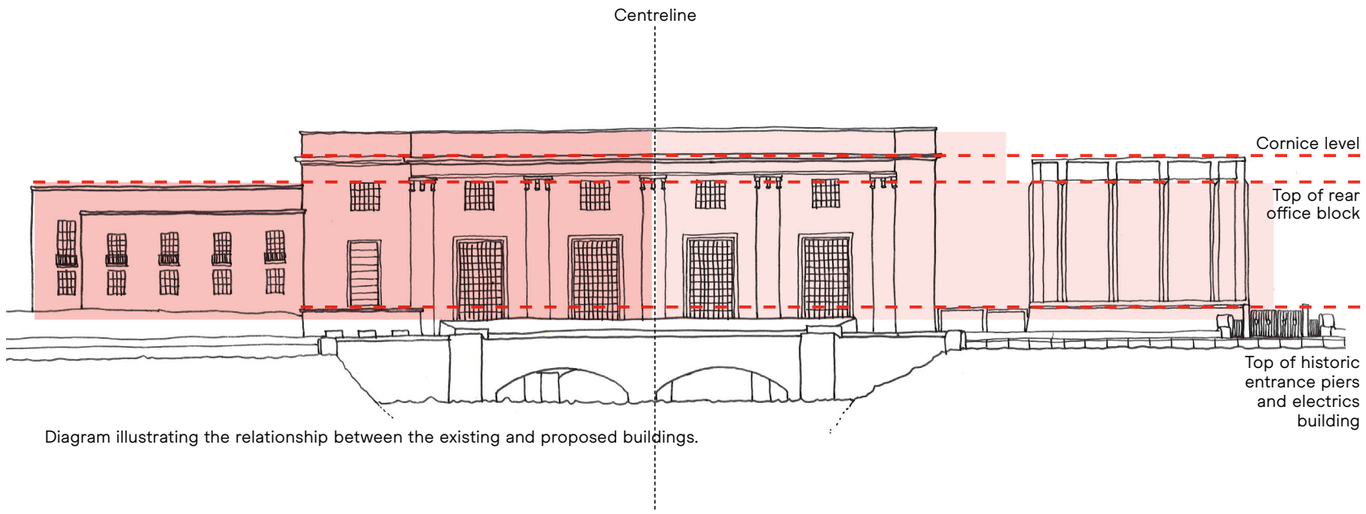
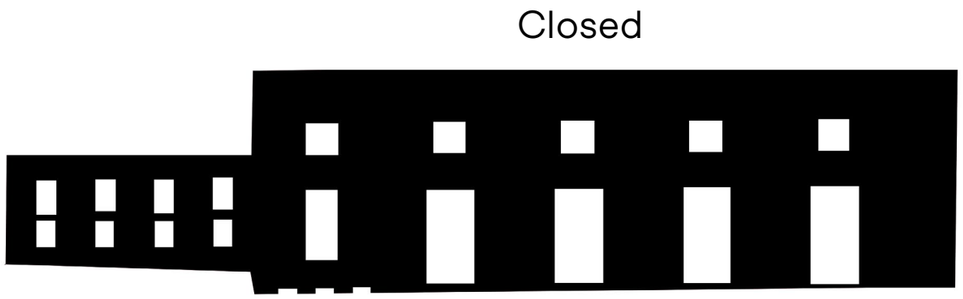


Diagram illustrating the relationship between the existing and proposed buildings.



Existing - Closed

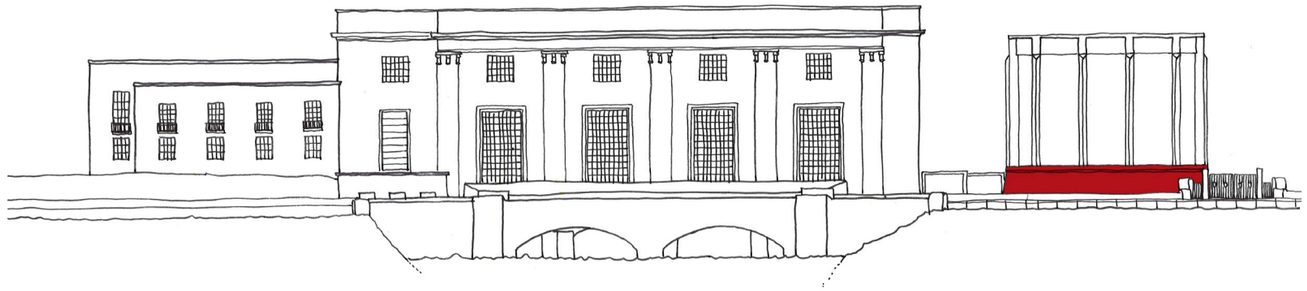
Proposed - Open

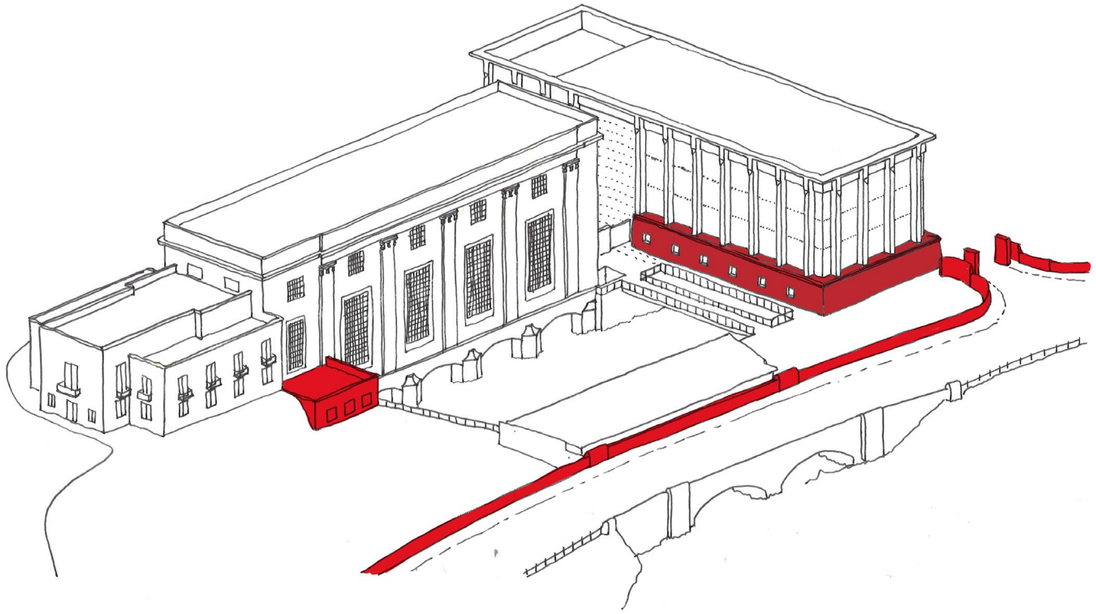
4. A temple on the Loch
By dissecting the existing building we have grown to understand its classical references, with plinth, columns (or pilasters) and entablature with frieze as it rises from ground to roof level. The new pumping hall form has been similarly articulated to reference a classical order. This is appropriate because it is in the tradition of the neo-classical power stations of the north of Scotland.

The proposed contemporary version, observes the sparse use of detail used to embellish these buildings. It recognises the power of its scale, and seeks to draw inspiration from the faults and folds of the geological landscape of the National Park to introduce subtle shifts in form to enrich the composition and key in to the articulation of the principal (southeast) façade of the existing turbine hall. In simple terms, the new building is imagined as a contemporary temple on the loch. It is a new monument that is in dialogue with the existing building; is subservient to it through articulation of mass, scale, and transparency; and is also differentiated as a contemporary addition.

The articulation of the proposed temple can be described in three parts:

i. Rustic plinth
With fine capping – the base of the temple is formed by a weighty plinth. This plinth is canted to root the building in the land in which it sits. It draws inspiration from the distinctive dry stone walls that edge Loch Lomond.



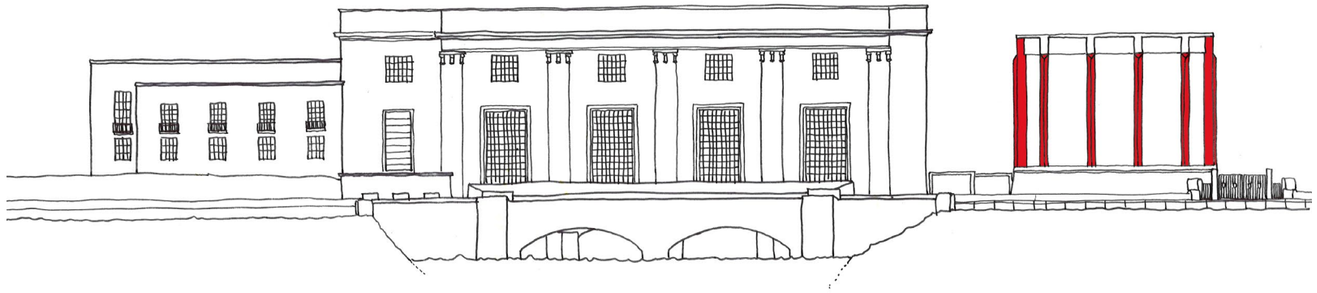


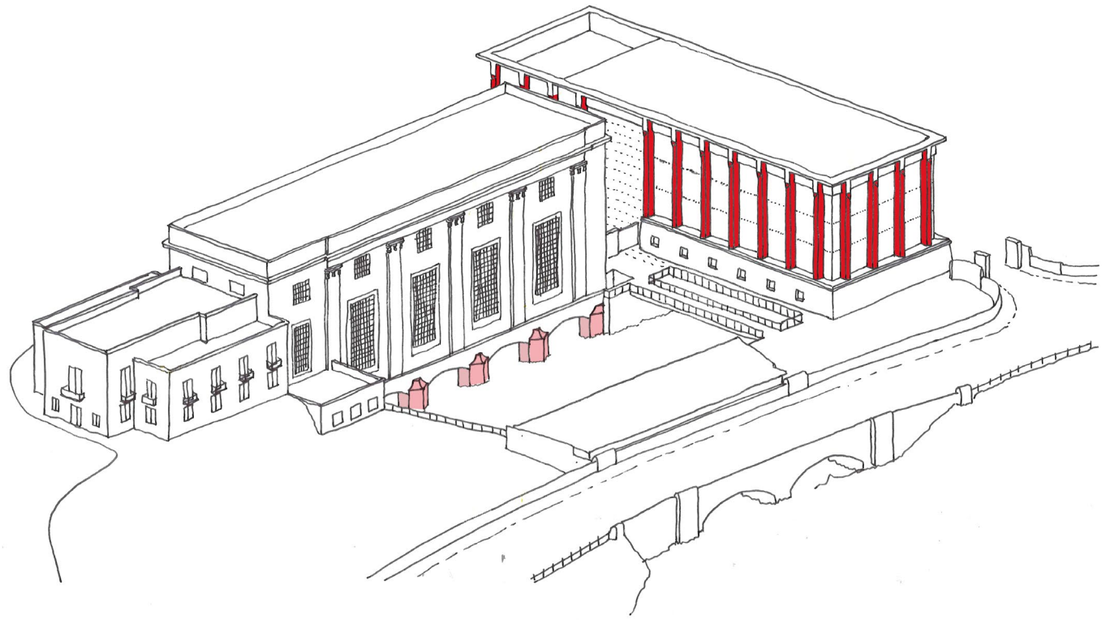
Material

Plinth: Local, dark, extracted stone constructed in a dry stone wall arrangement.

ii. Refined columns
Atop the fine capping of the plinth rise delicate columns. The columns are finished in a honed stone with solid stone cappings to the outer face. A shaping piece, in the form of an angled articulation to the front face of the column, elongates the column as it rises. The form of the canted cappings is derived from the shape of columns in the undercroft of the existing turbine hall as the water is released into the tailrace.

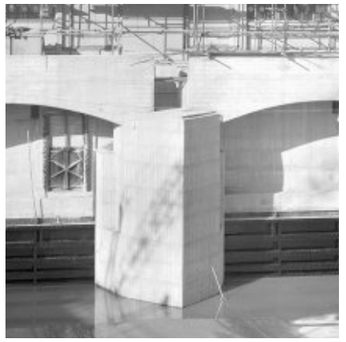
At the point where the columns align with the frieze, the canted column frontage terminates, allowing the expression of the emblematic trabeated beam arrangement.





Material

Columns: Natural stone

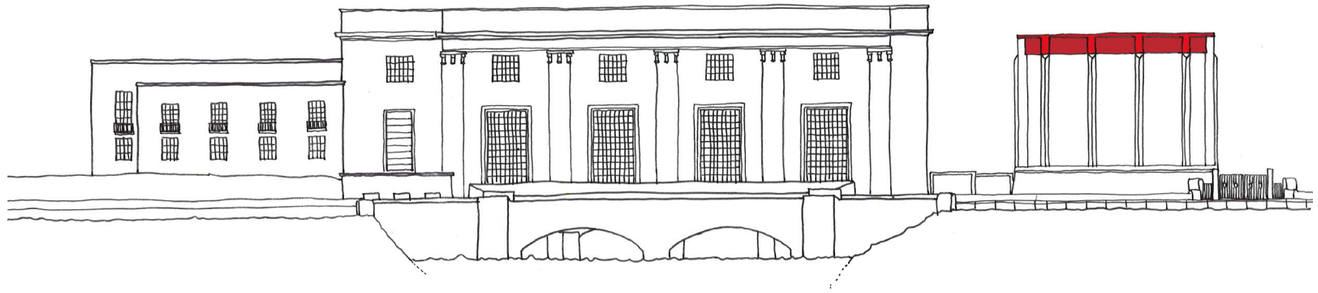


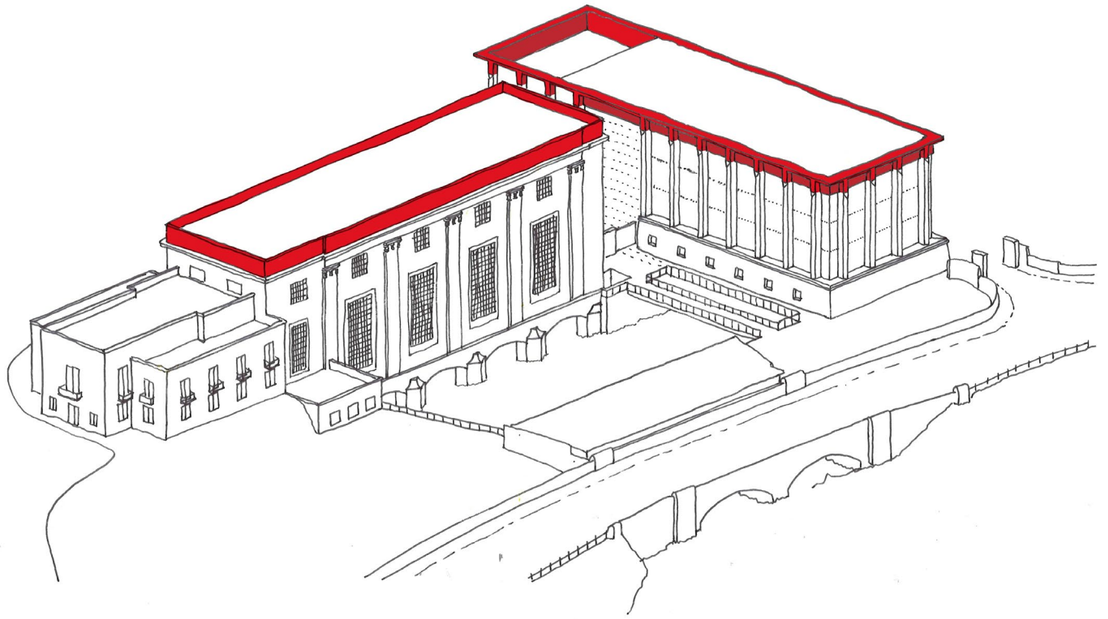
iii. Recessed frieze
The frieze is inset between the columns to align with the architrave and cornice on the existing building.

The articulation of the top of the columns at the base of the frieze aligns with the mouldings at the head of the pilasters on the principal elevation of the existing building.

The pink granite to the freize is proposed to be a split-face finish, this is to introduce texture, in contrast to the slender, honed columns.

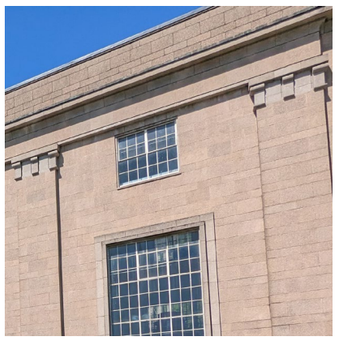
There is an opportunity for subtle artistic expression in the finish of the freize. This will be explored through the detail design phase.





<u>Material</u>

Freize: Split-face natural stone



3.7 Materials

Historic buildings in the National Park often include a pink textured sandstone with a finer blonde stone for quoins and details, see image right. The pinkish hue is picked up in other west coast of Scotland buildings in granite, for example at St.Columba's Cathedral in Oban, for which Harold Tarbolton was Consultant Architect. Here, the robust granite is used alongside the sandstone to express scale and power.

Part of this project includes a large excavation of stone. We propose to reuse this local stone where feasible, particularly in the construction of the plinth. This would key in to the language of local drystone walls, synonymous with the loch side setting.

Atop this plinth would sit our new 'temple' assuming the formal, ordered architectural language of the original power station. This formal architectural language would then be overlaid with a softer articulation to represent the geological landscape.

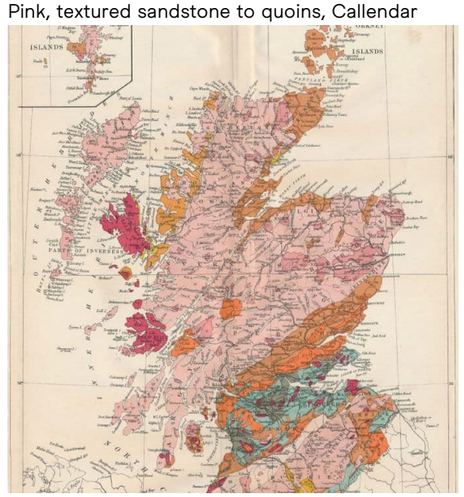
A restrained material palette is proposed, referencing the restrained palette used to express the scale and importance of the existing building. A natural stone with a honed finish is envisaged for the columns with a textured, split-face stone for the frieze. The use of a pink hue stone is anticipated to relate to the existing building, with subtle variations in finish from honed to split-faced used to define the component parts of the new temple. Stone is proposed to complete the upper order of the temple, with the introduction of a fine cornice.

A transparent glazed finish is proposed with concealed structural frames integrated within the new stone columns to support the large, structural glass panels between the columns. Ventilation openings in the plinth of the building could be edged in honed stone, with corresponding, integrated roof vents incorporated a high level to enable a passive stack ventilation approach.

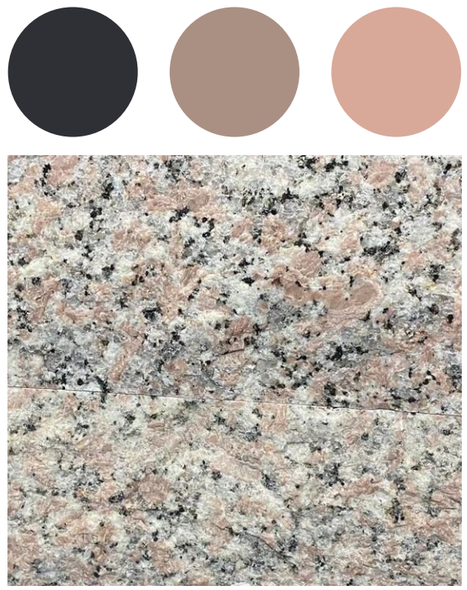
The tone of the granite proposed is directly derived from the existing building, with its distinctive pinkish hue of the reconstituted stone facade, infused with decorative pink granite chips.

St.Columba's Cathedral Oban with mix of granite and honed sandstone interior

Pink, textured sandstone to quoins, Callendar



Geological map (Source: National Libraries of Scotland)



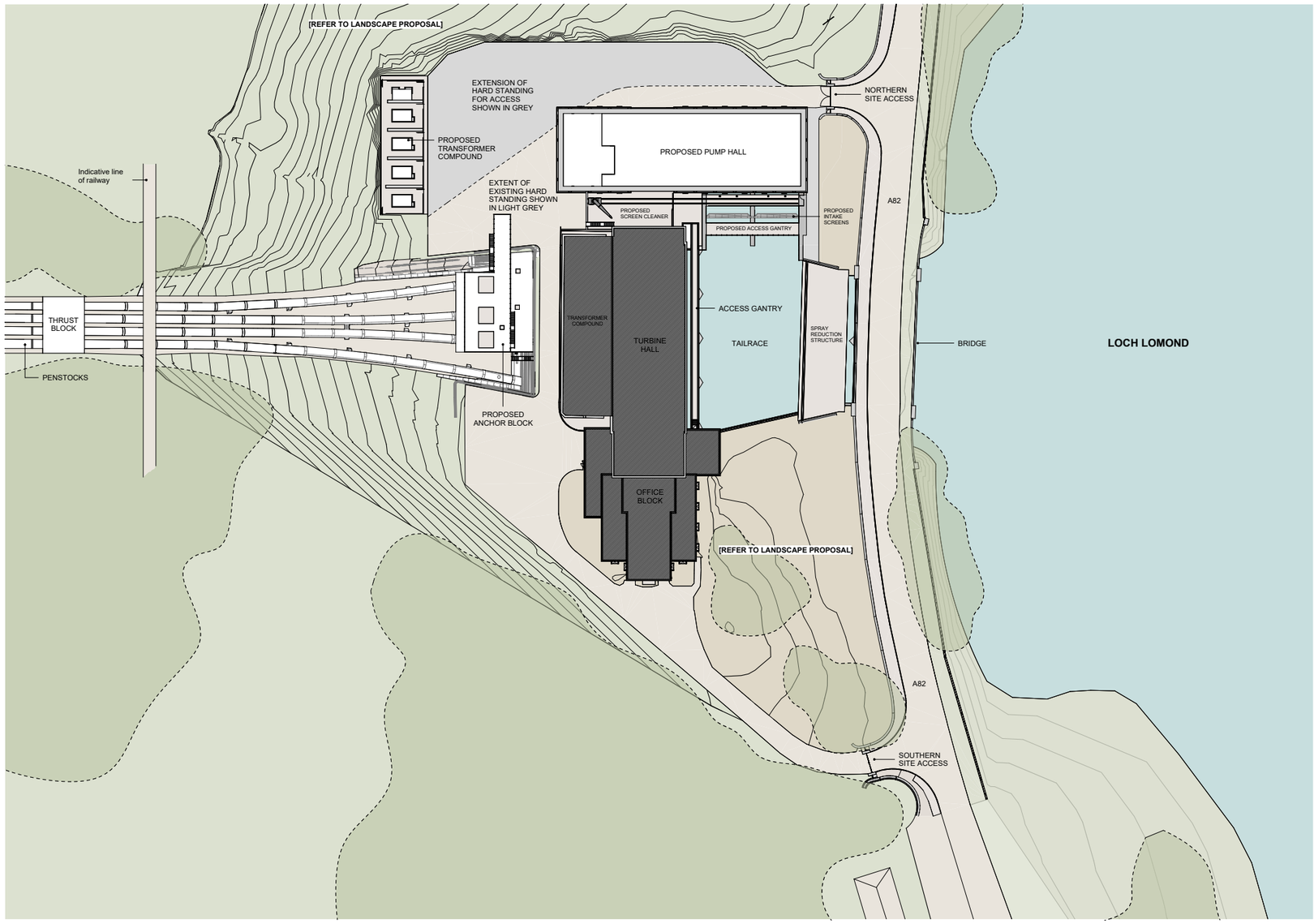
Honed and split face pink-hue stone

3.8 Proposed Pump Hall

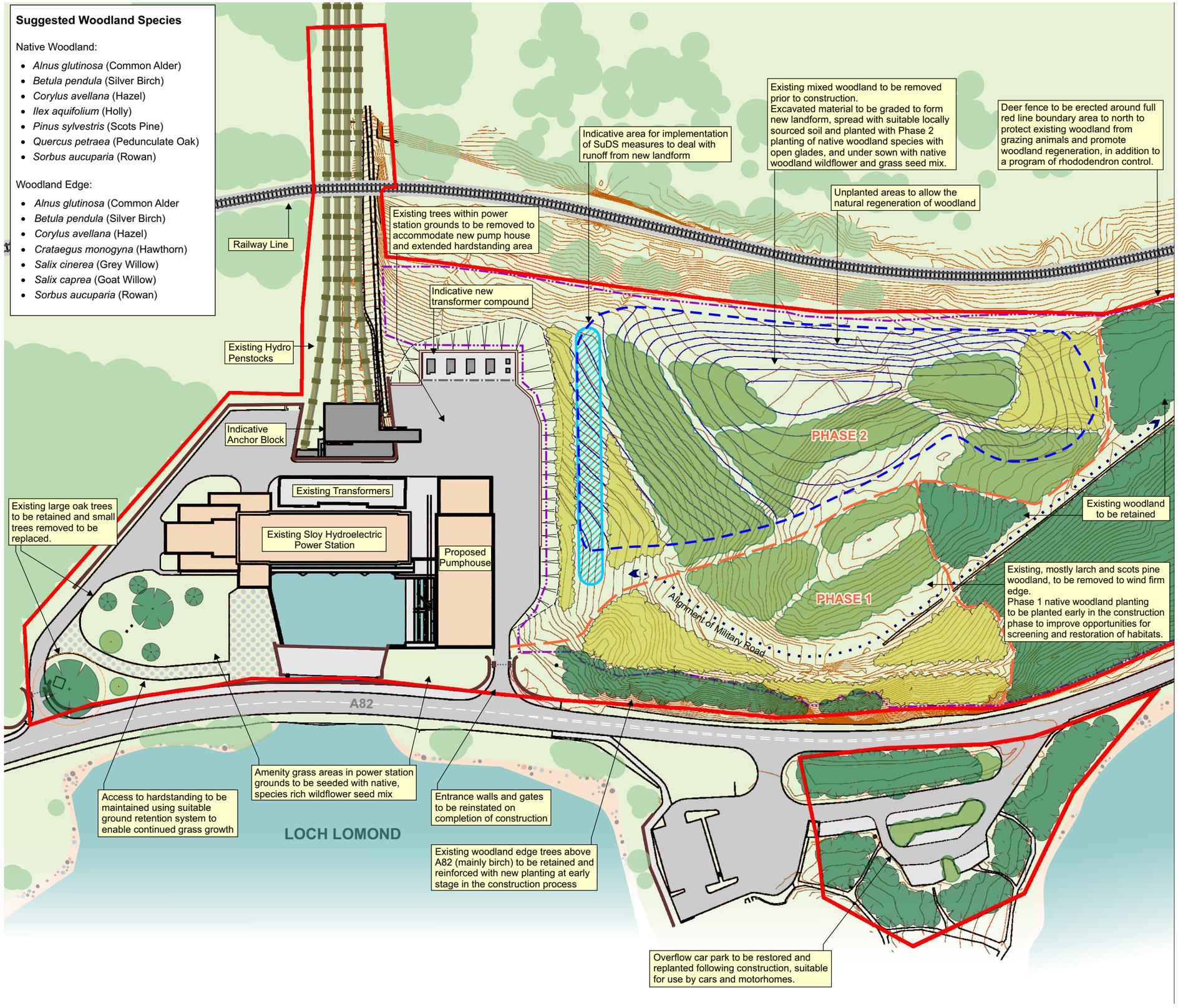
Drawings of the Proposed Development are contained on the pages that follow.

As described on earlier pages, the proposed building materials reference the tones and textures of the existing building and landscape.

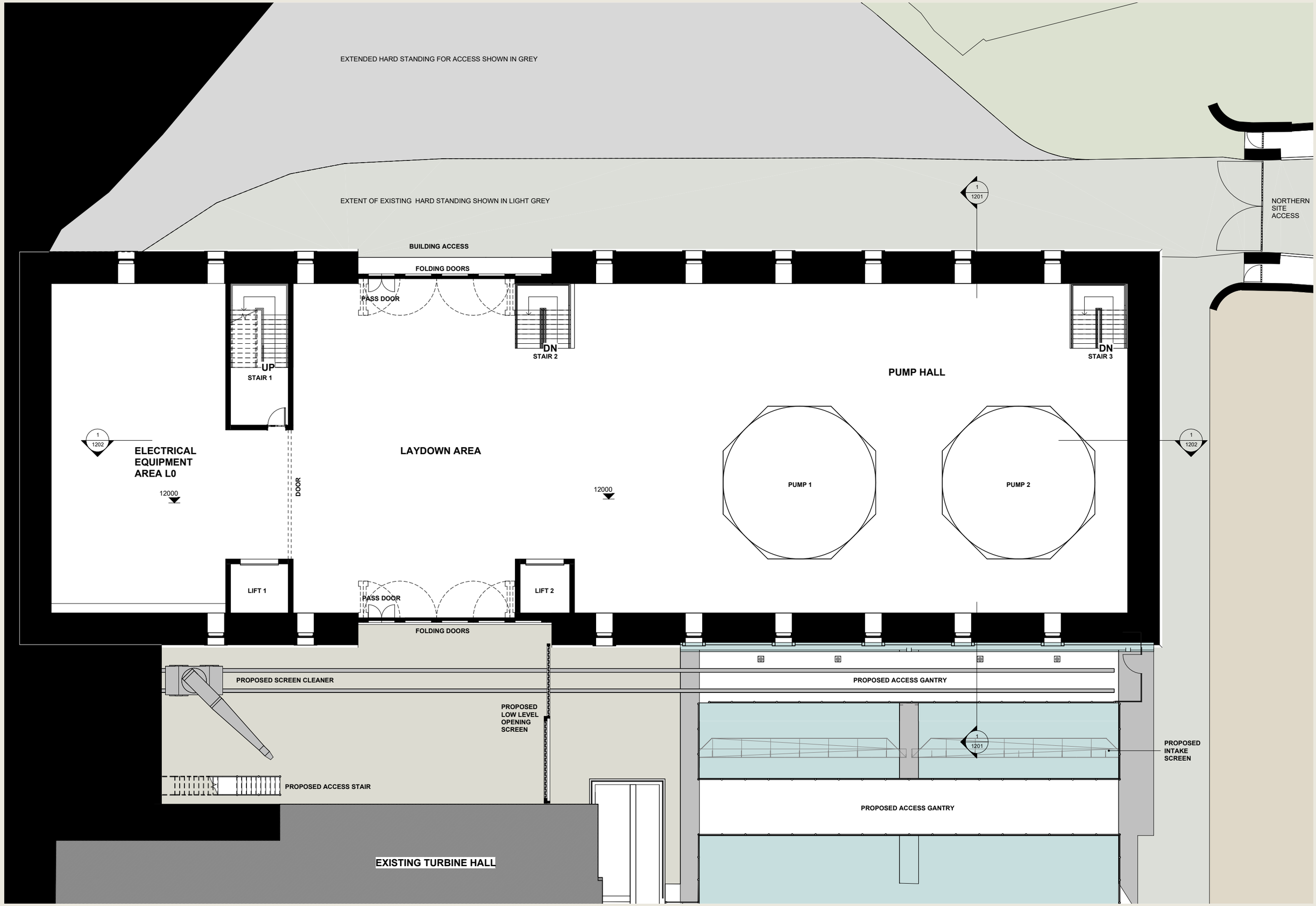
Refer *Volume 2: Figure 12.7: Outline Landscape Proposals* of the EIA for details of the proposals for the landscape surrounding the buildings. This includes proposals for excavated materials.



Proposed Site Plan



Landscape Plan - Outline Landscape Proposals (see Volume 2, Figure 12.7 of the EIA)

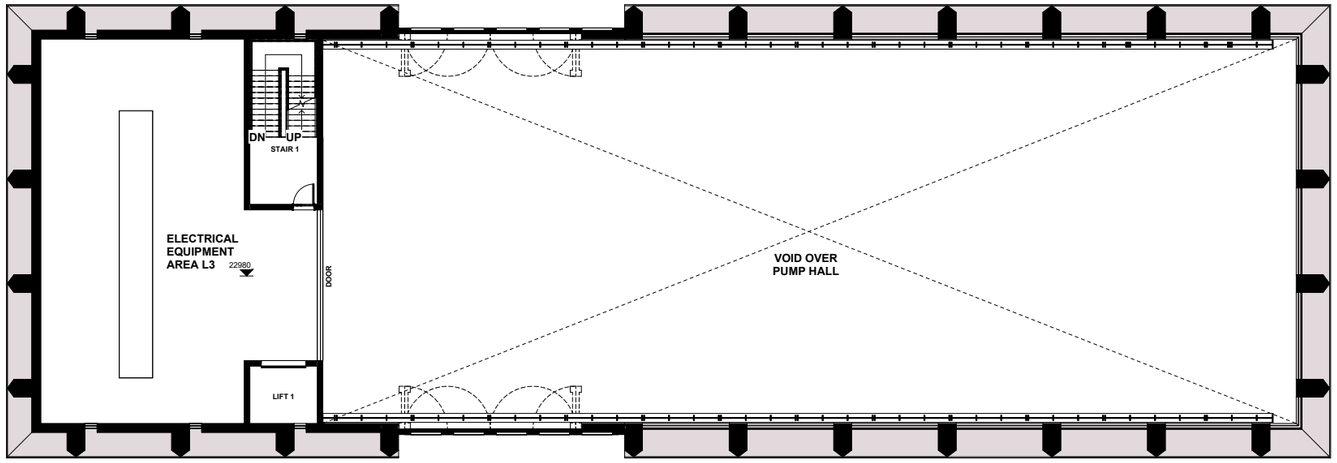


Proposed Ground Floor Plan

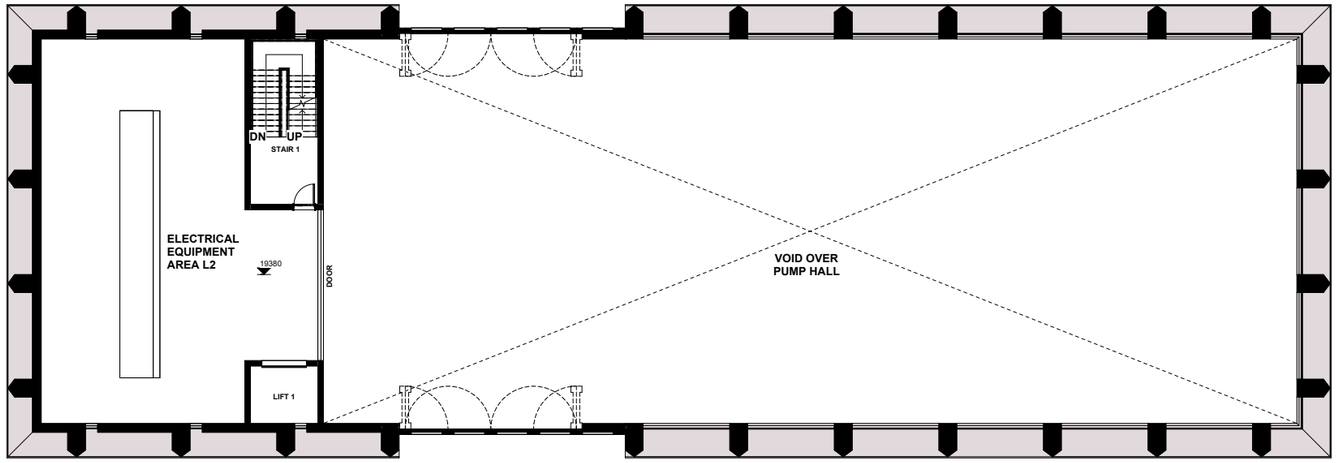
Plans of Pump Hall

The proposed pump hall is a functional enclosure for the pumps. The internal floor area accommodates a laydown area for access and egress by vehicles to service and maintain the equipment and machinery. To the west of the building is an electric building consisting of stacked floors for supporting electrical infrastructure. These floors are to be served by both a lift and staircase. To the east of the laydown area is the new pump hall. Accessed by lift or stair, the base of the pump hall sits approximately 18m below the existing ground level with some localised areas up to 20m deep.

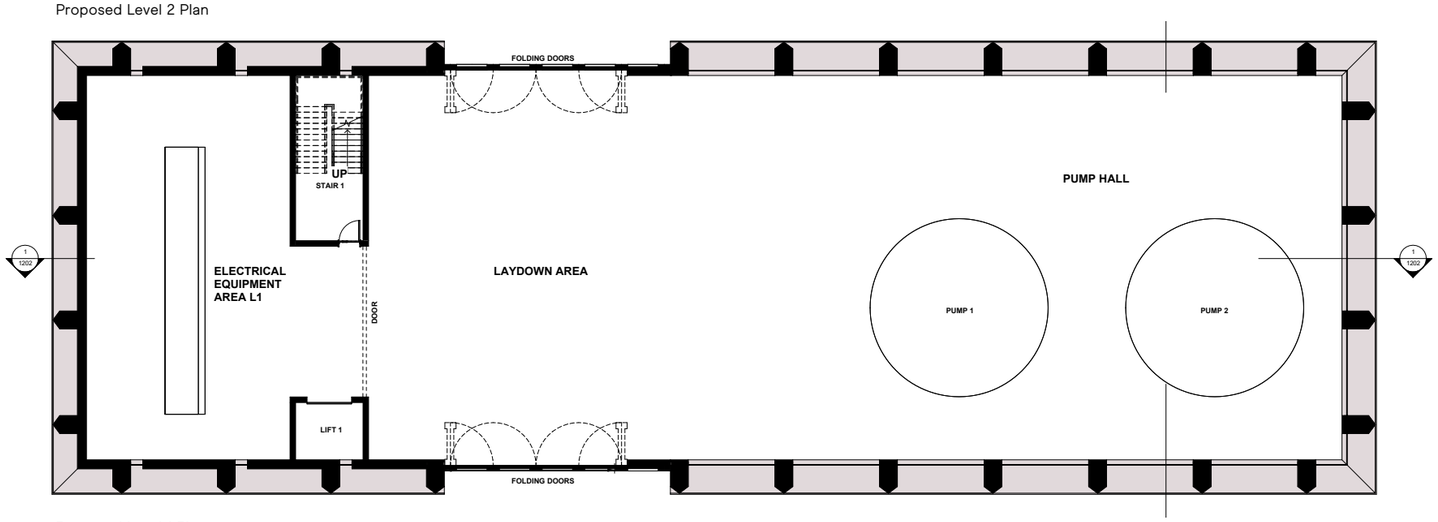
New access gantries are required to service the intake screens. A small, mobile crane is used as part of the operational maintenance. This is to be stowed within the operational space between the existing and new buildings.



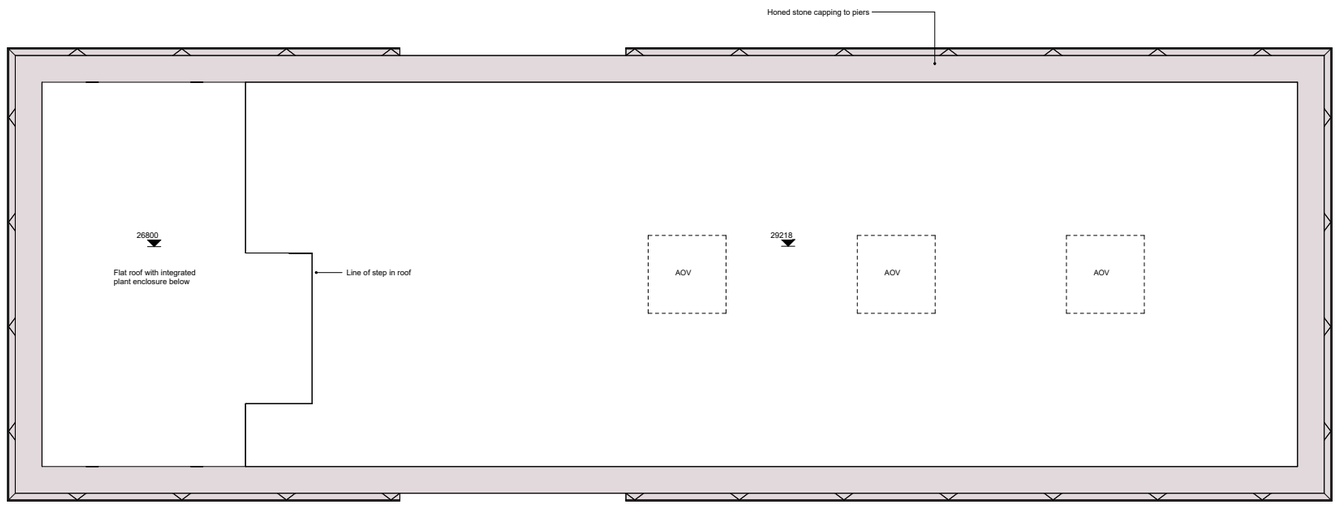
Proposed Level 3 Plan



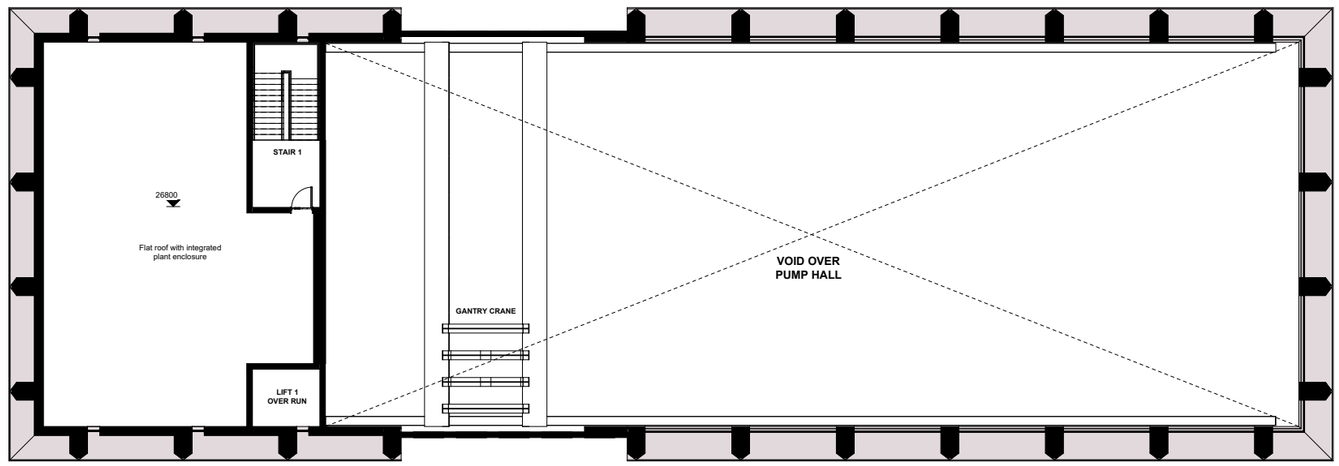
Proposed Level 2 Plan



Proposed Level 1 Plan

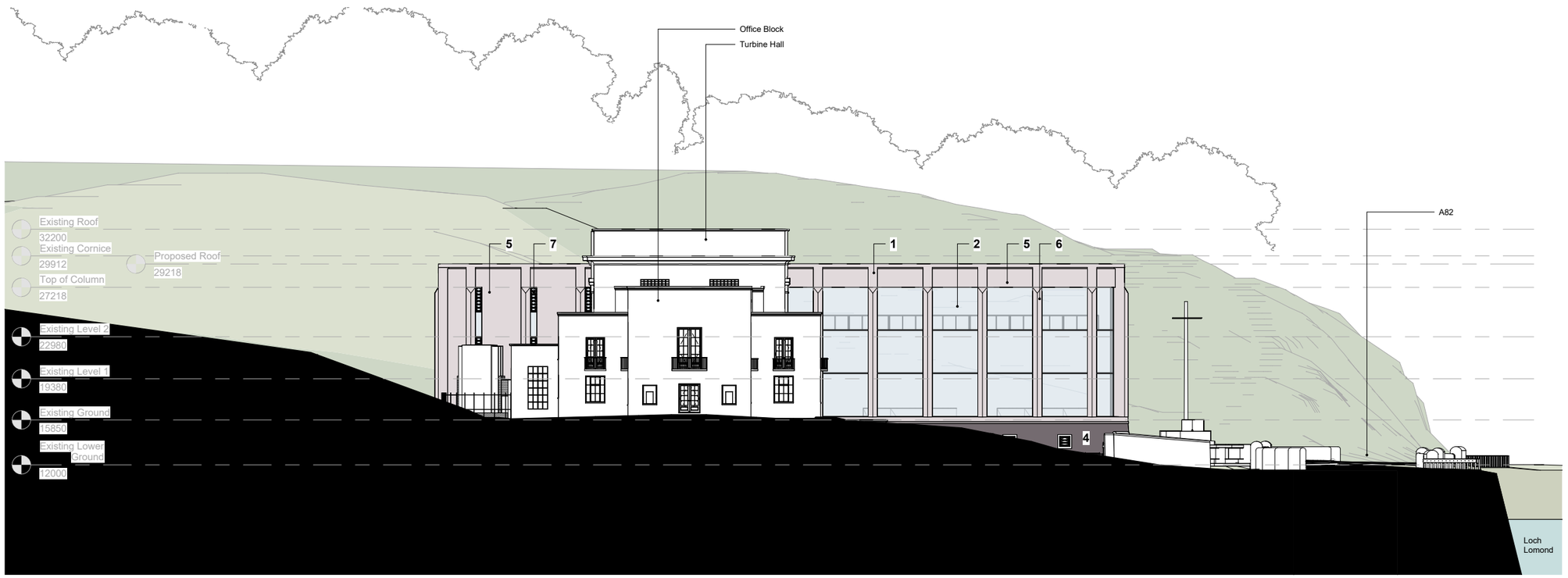


Proposed Roof Plan



Proposed Level 4 Plan

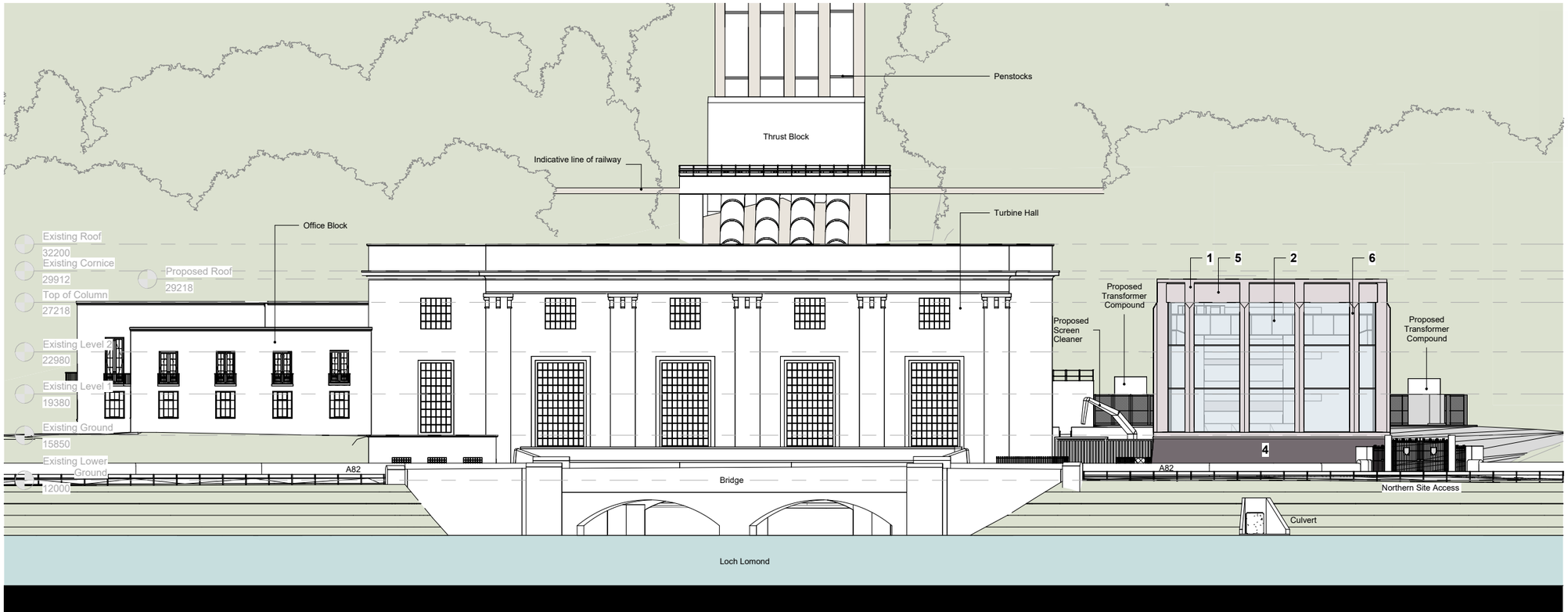
Proposed North Elevation



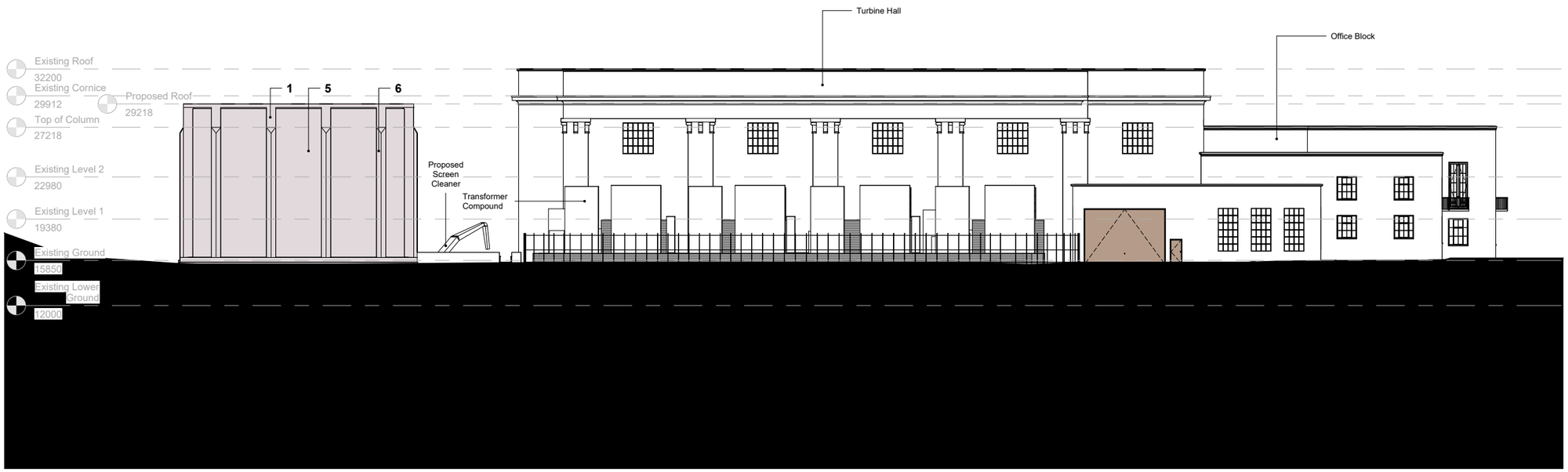
Proposed South Elevation

Materials Key

1. Natural Stone: Honed Finish
2. Structural Glazing
3. Folding door screen with integrated pass door
4. Extracted local stone re-used to form dry stone wall cladding
5. Natural Stone: Split Face Finish
6. Solid honed natural stone to form angular column fronts



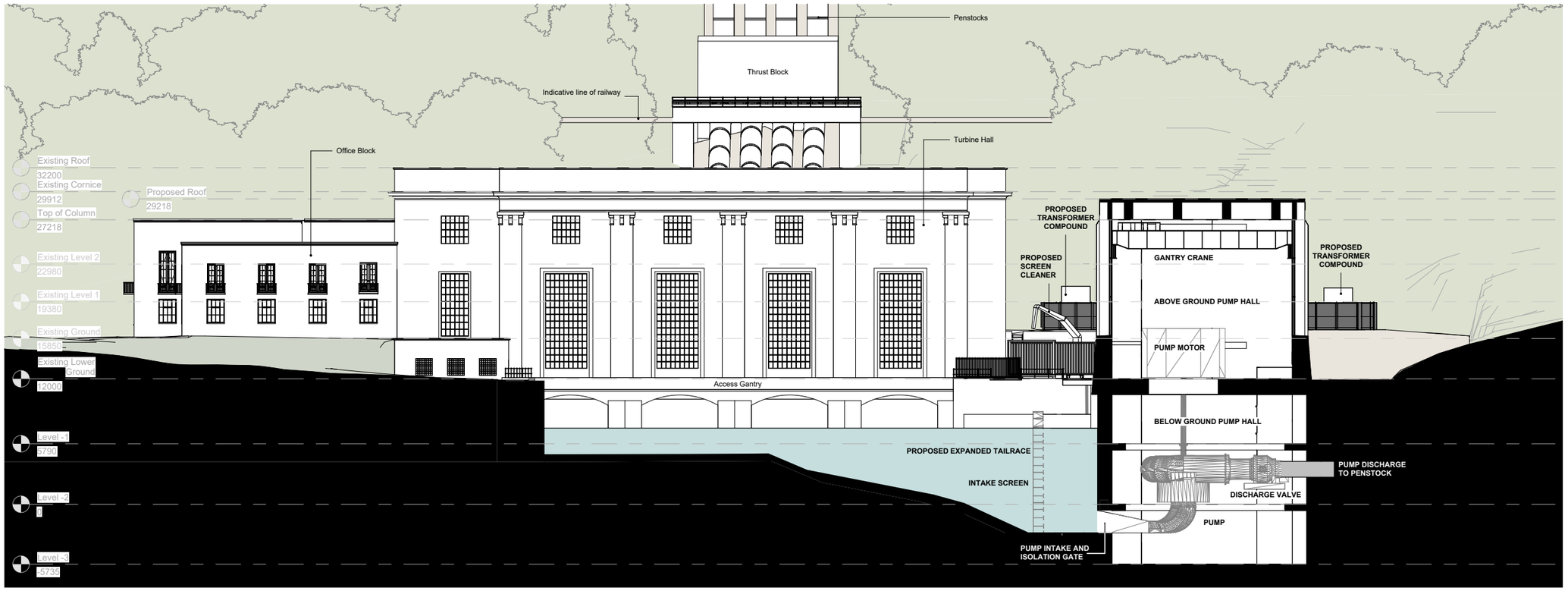
Proposed East Elevation



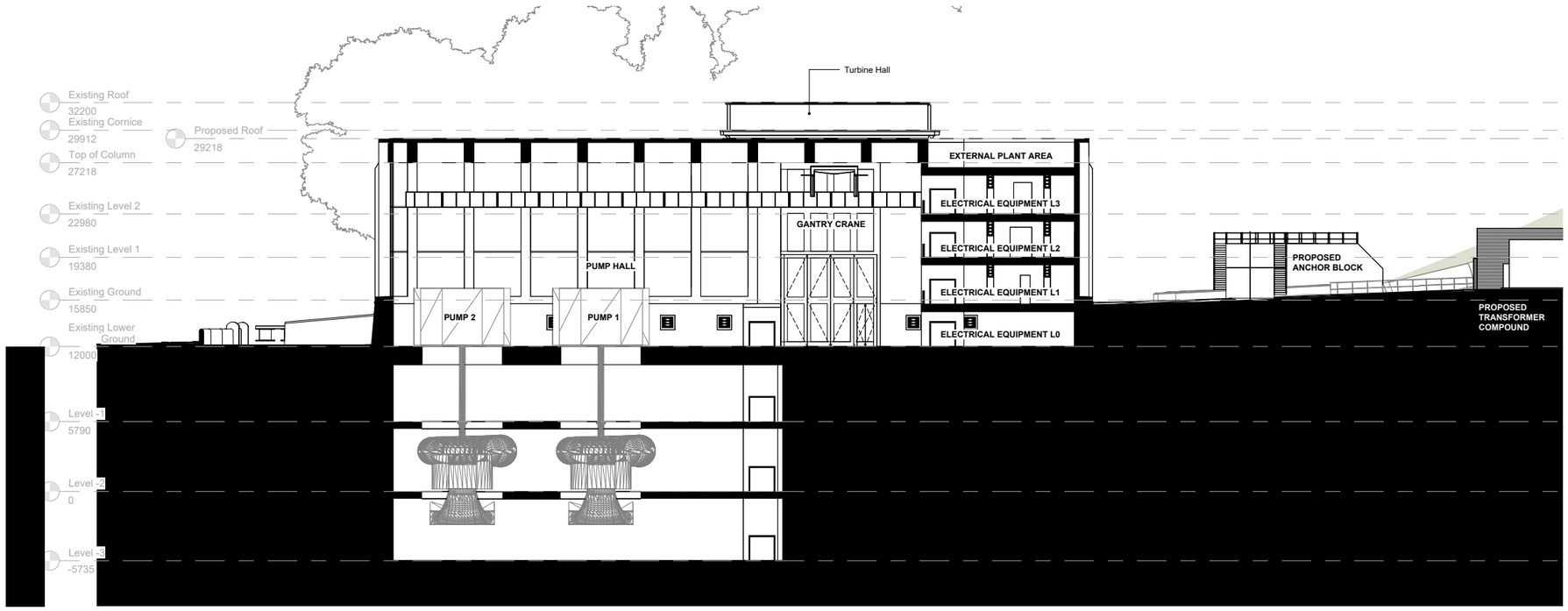
Proposed West Elevation

Materials Key

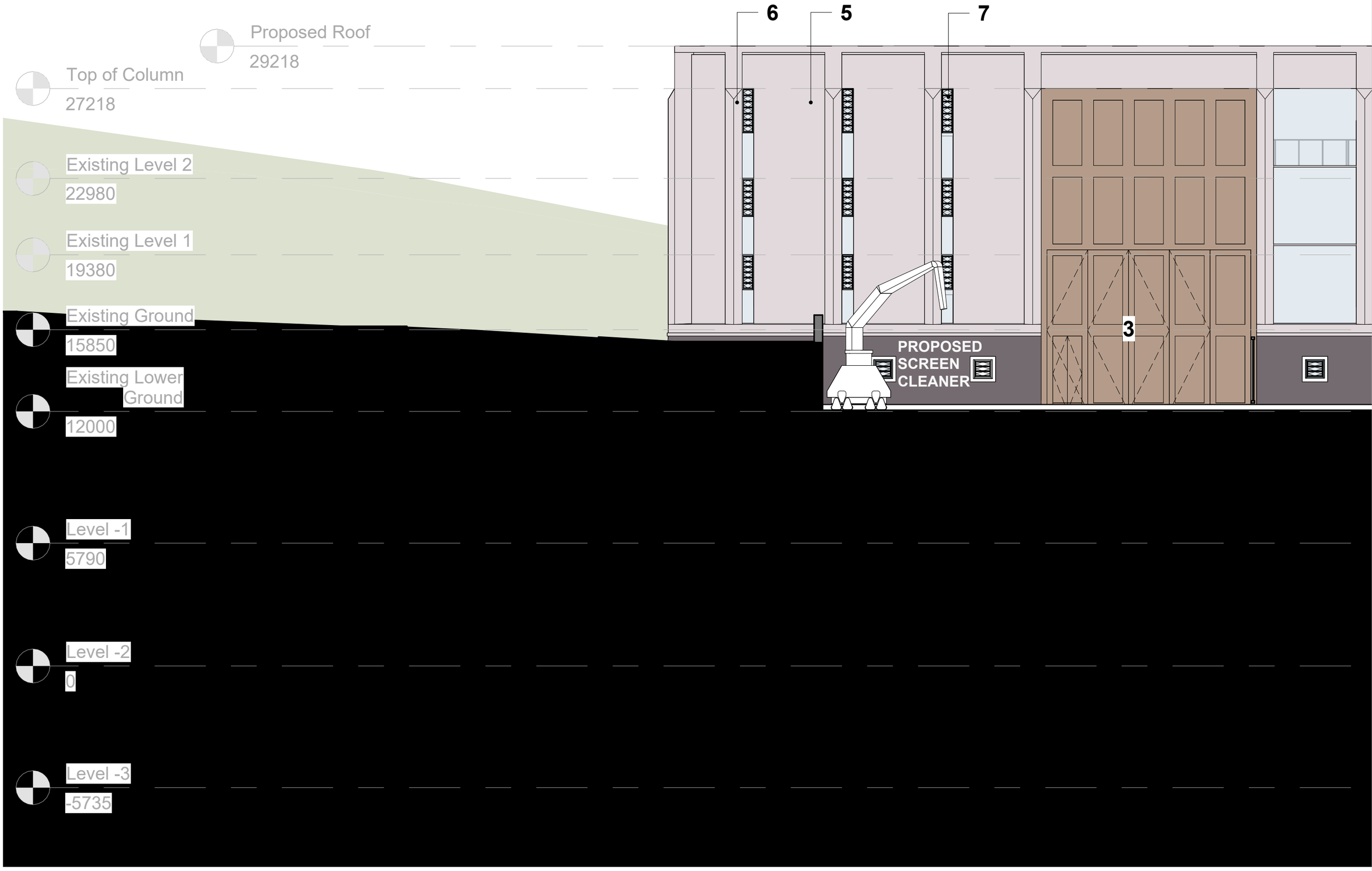
1. Natural Stone: Honed Finish
2. Structural Glazing
3. Folding door screen with integrated pass door
4. Extracted local stone re-used to form dry stone wall cladding
5. Natural Stone: Split Face Finish
6. Solid honed natural stone to form angular column fronts



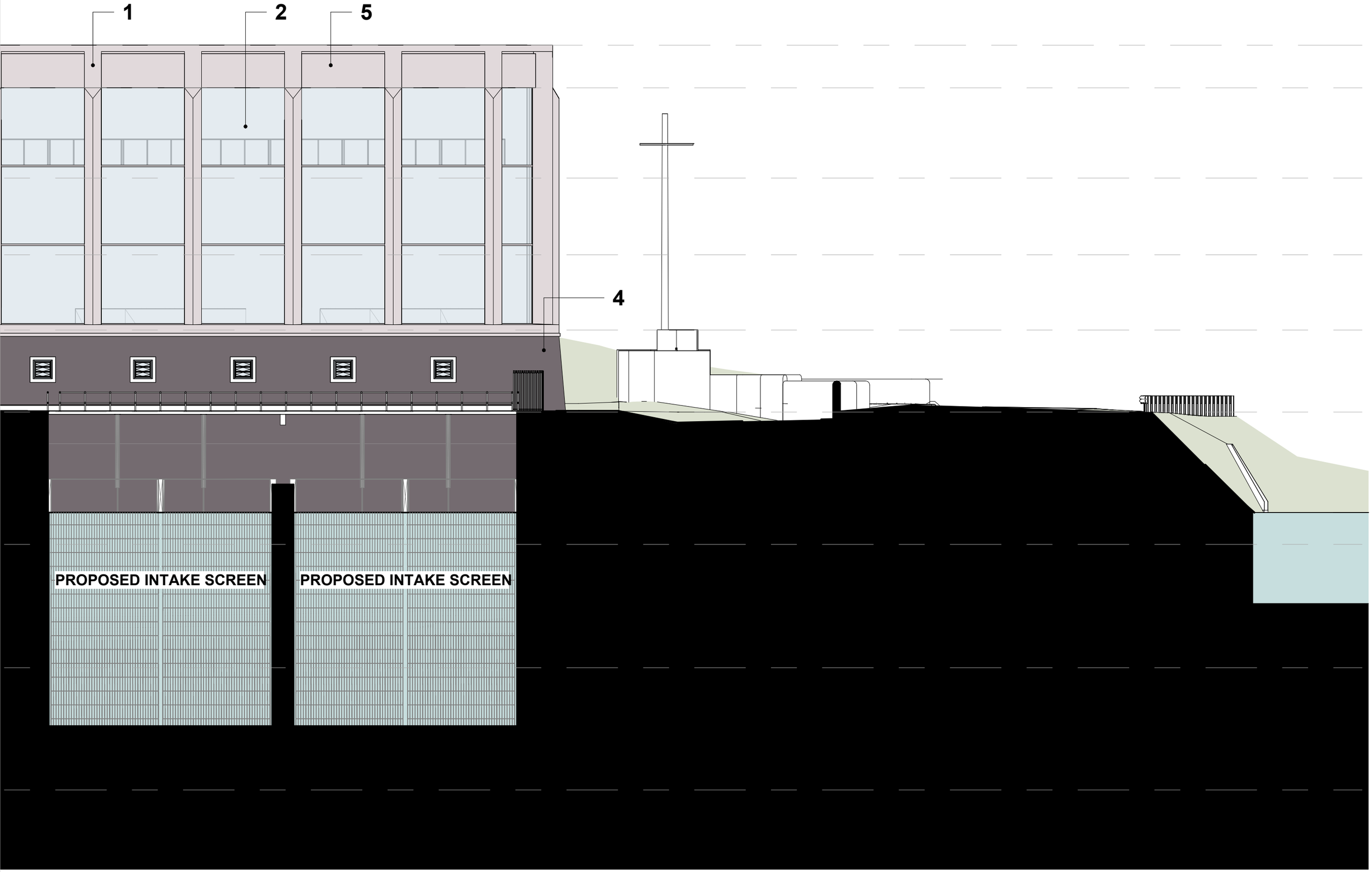
Proposed Cross Section

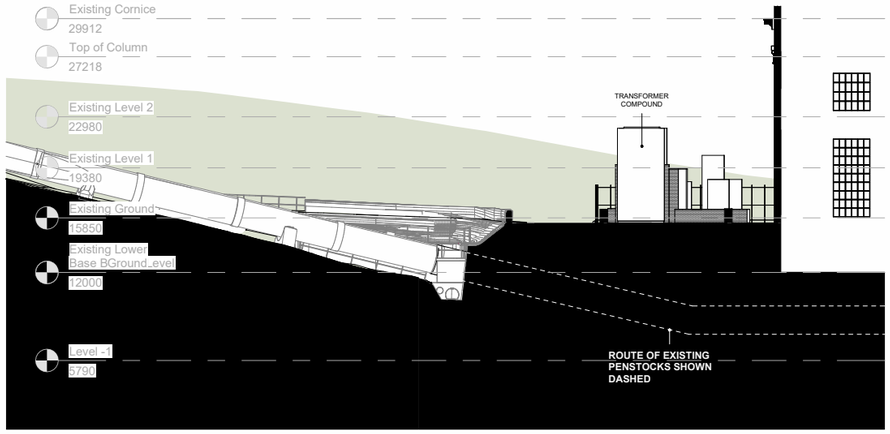


Proposed Long Section

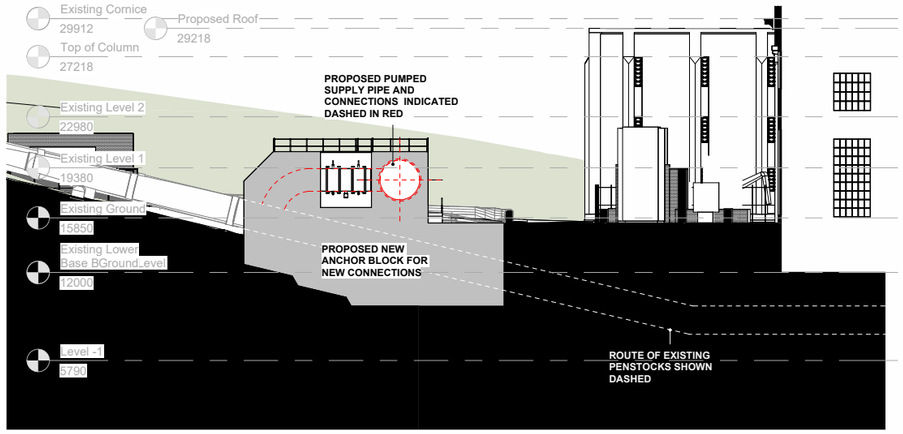


Proposed Long Section

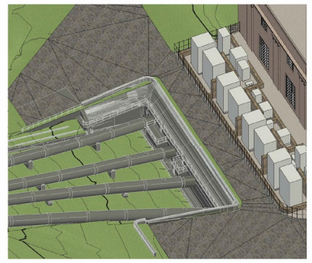

1
2
5
4
PROPOSED INTAKE SCREEN
PROPOSED INTAKE SCREEN



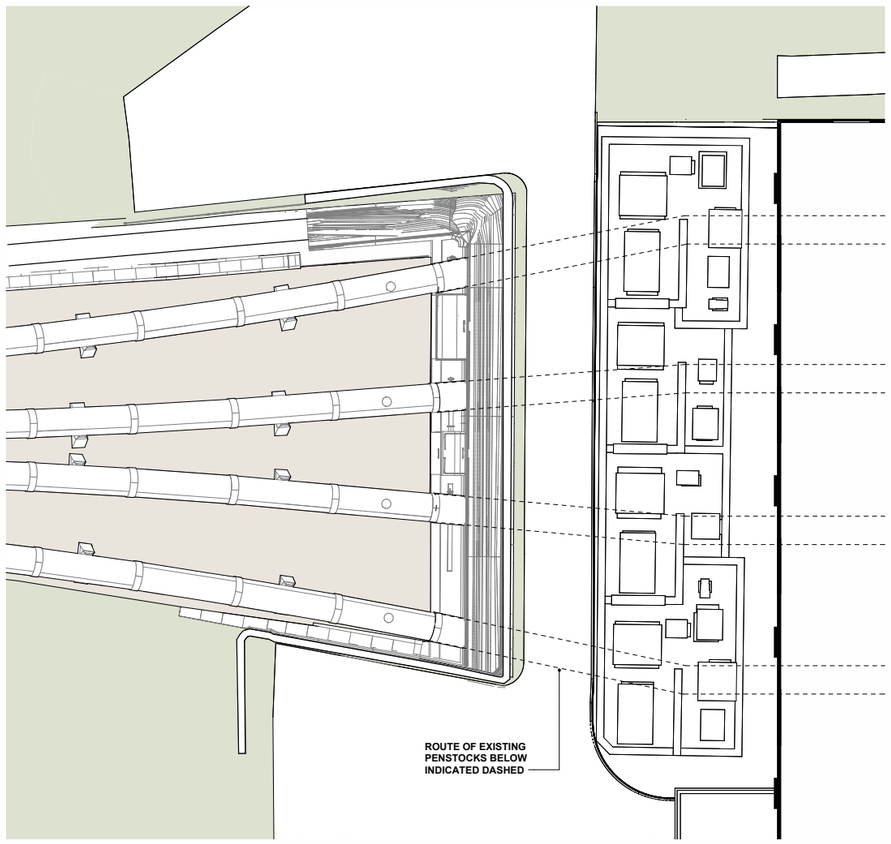
2 Section - Penstocks as Existing
1 : 200



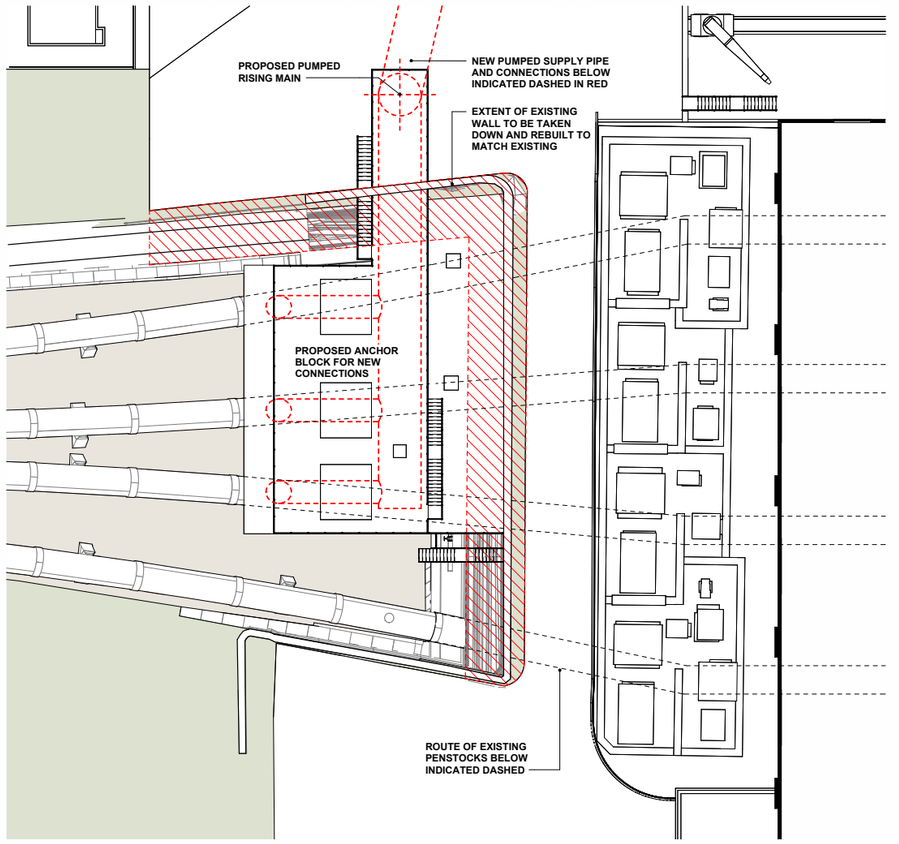
1 Section - Penstocks with Proposed Thrust Block
1 : 200



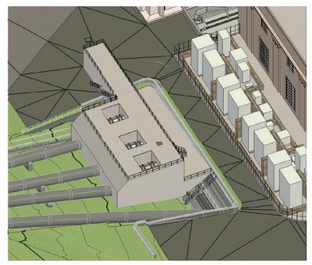
6 Penstocks as Existing



4 Plan - Penstocks as Existing
1 : 200

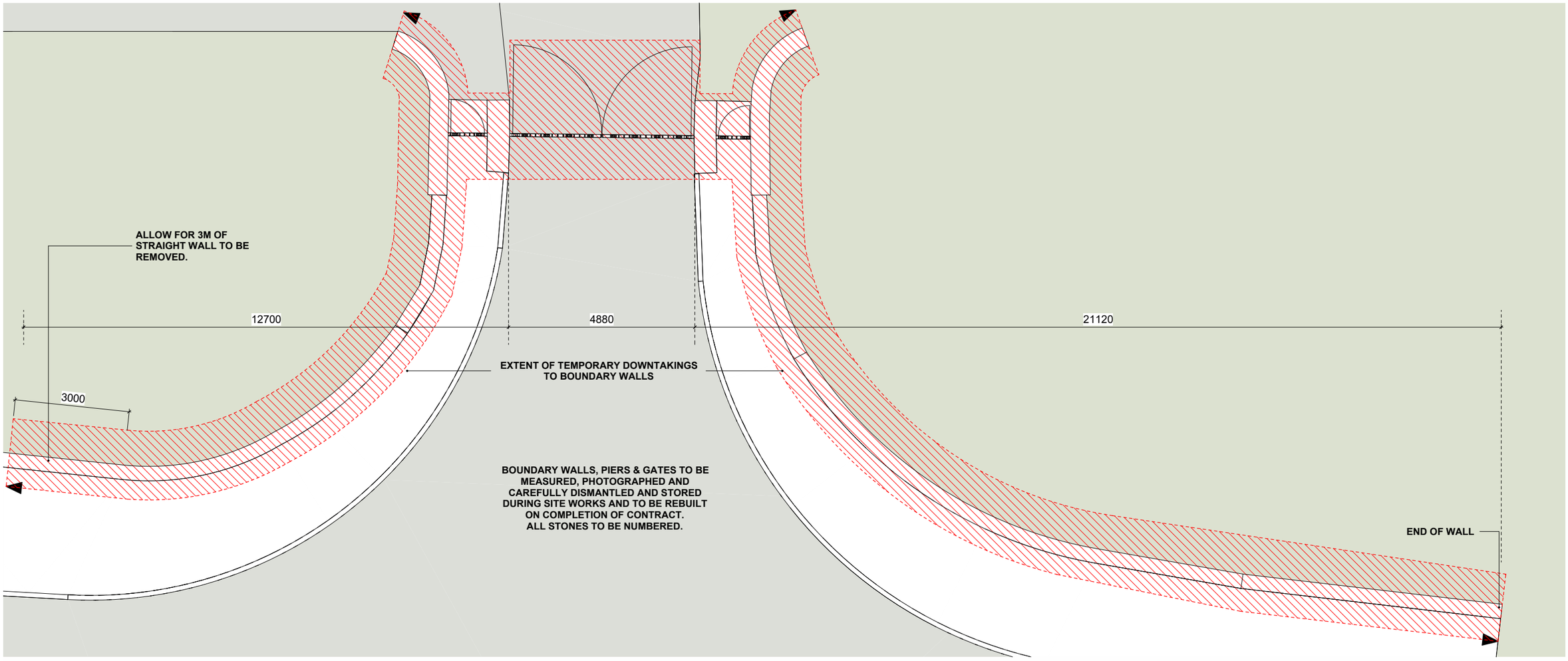


3 Plan - Penstocks with Proposed Thrust Block
1 : 200

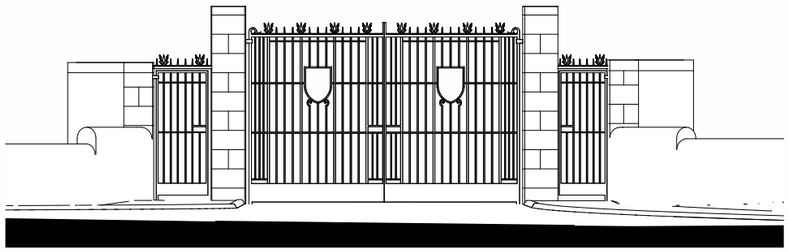


5 Proposed Thrust Block

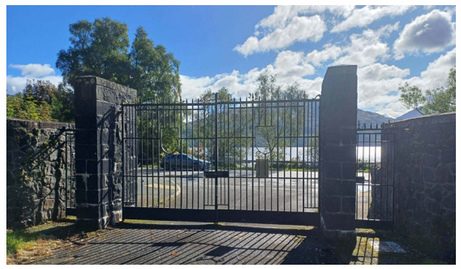
Proposed Works to Penstocks at Base



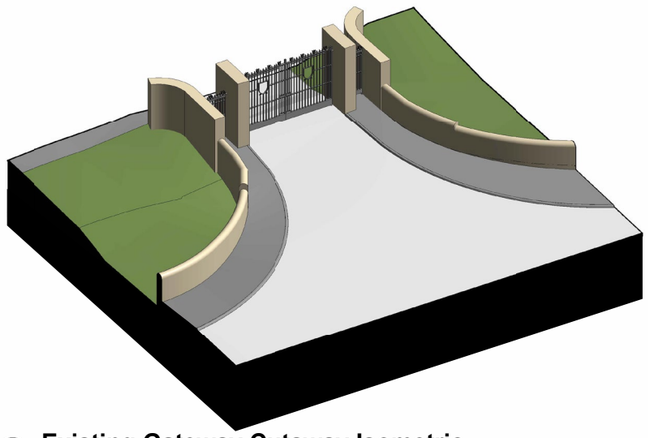
1 **Existing Gateway - Plan**
1 : 50



2 **Existing Gateway Elevation**
1 : 50



3 **Existing Gateway**
1 : 50



4 **Existing Gateway Cutaway Isometric**

Proposed Works to Existing North Entrance

Proposed view from pedestrian route from Inveruglas

Proposed view from Inveruglas point

Proposed view from the tailrace showing the relationship between the columns of the existing building and the proposed sculpted columns.

Proposed view from the south

3.9 Sustainable design

SSE are committed to environmental and sustainable building initiatives. It is imperative that a sustainable design approach is embedded in the project philosophy. Sustainability targets for the project are to be defined through the detailed design stage. What is notable about the proposed development however, is the low heating demand. Therefore an acute focus of the sustainablility approach is on the embodied carbon of the construction, rather than the operational carbon of the systems required to maintain a stable environment.

The intention is for the building to be responsive to the climatic and operational requirements, with a particular interest in the sourcing and specification of materials utilised in its construction. There is a keen interest in the re-use of the extracted stone in building construction materials, this is one aspect that is to be explored in greater detail at the next design stage. The approach to building fabric, is to consider the local sourcing of materials where feasible, with a reduction in the number of materials and variations in type.

The design is being developed to consider carefully the sustainability approach to the following areas:

- Character & setting;
- Materials;
- Energy efficency;
- Construction waste;
- Landscaping;
- Layout, scale & proportion;
- Water conservation;
- Natural heritage;
- Cultural Heritage;
- Flooding and surface water

The proposed design focuses on key areas such as:

Reducing Embodied Carbon
Use of low-carbon materials such as low-carbon steel, local or extracted rock/stone to minimise embodied carbon in construcion, reducing transport and waste. Potential for a load-bearing stone structural frame, utilising extracted material, is to be explored.

Passive Design & Ventilation
Low level air inlets are used to draw cool area in to displace high level warm air, generated by the pumps and solar gain, through roof openings.

Renewables
The building is a piece of renewable energy infrastructure.

Compliance with Building Regulations alone is not enough to drive change. Therefore, the following **Hierarchy for Embodied Carbon Reduction** is used as a framework for the development of an appropriate sustainability strategy, in combination with **Elemental Reduction Strategies** developed by Low Energy Transformation Initiative (LETI) and target **Passivhaus** criteria/principles within the constraints of the project budget and operational constraints.

Hierarchy for Embodied Carbon Reduction

1. Build Less
- Challenge the brief for spatial efficiency.
- Re-use existing where possible.
- Carryout audit of materials for circular economy purposes.

2. Build Light
- Review structural loadings, utilisation, and spans.
- Reduce material quantities.
- Consider whole life aspects.

3. Build Wise
- Know where your carbon footprint is, including ‘big ticket’ items and repeating ‘small ticket’ items.
- Explore standard modules and material efficiency.

4. Build Low Carbon
- Specify low-carbon, renewable biobased, re-used or recycled materials from responsible sources.
- Be aware of uncertainty/variability in data.

5. Build for the Future
- Design for durability, flexibility, and adaptability.
- Design for disassembly and circular economy at end of life.

6. Build Collaboratively
- Measurement, verification, and disclosure.
- Share knowledge.

Elemental Reduction Strategies

1. Structure
- Compare options at an early stage. Lighter super structure saves on substructure.
- Review loadings and rationalise or reduce structural grids.
- Test ground conditions.

2. Façade and Roof
- Compare options at an early stage, including framing elements.
- Consider the effect of replacement cycles.

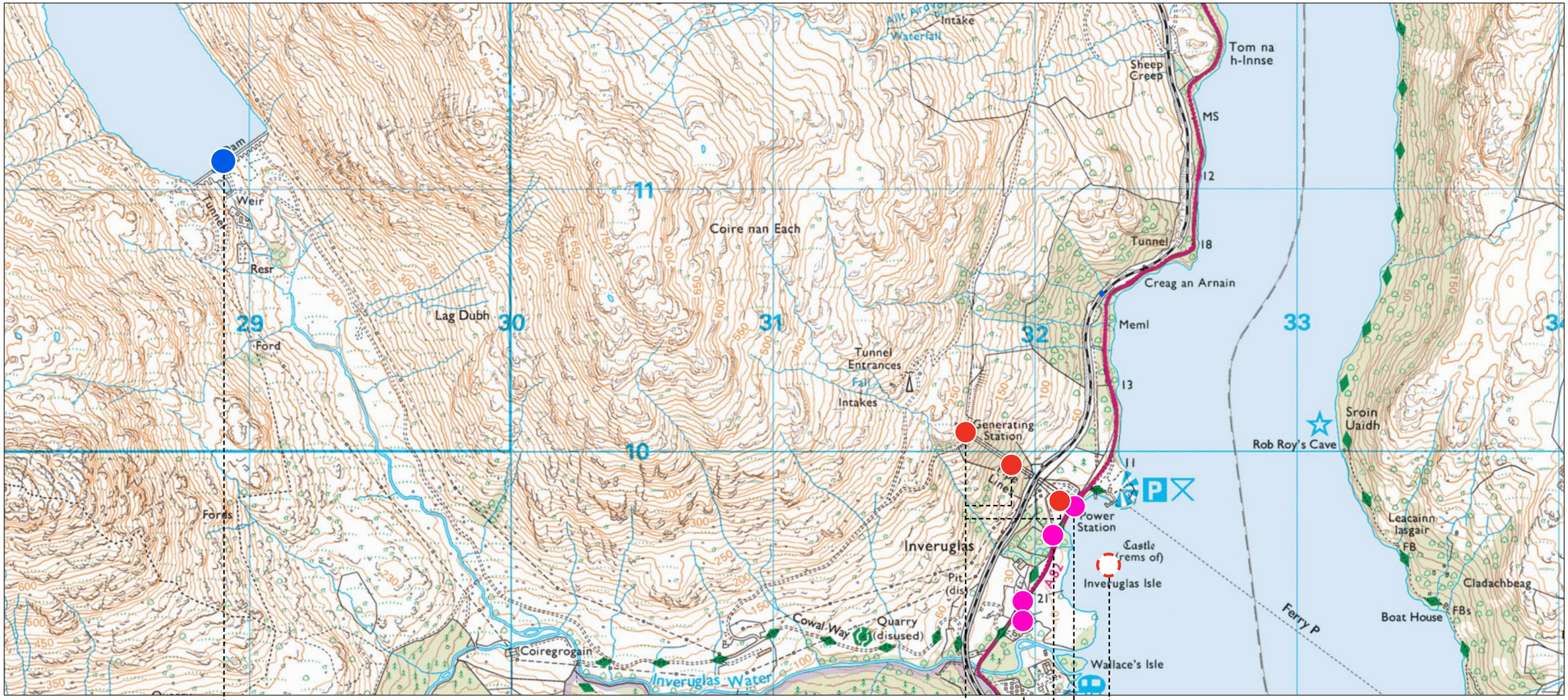
3. Mechanical, Electrical and Plumbing
- Interrogate comfort metrics.
- Avoid over-provision of plant, fewer and simpler systems are preferable.
- Reduce duct runs.
- Natural ventilation can reduce upfront carbon, maintenance burden and energy use.
- Specify refrigerants with low GW and ensure leakage is considered in analysis.
- Design for easy access through finishes, recycling, and deconstruction.

4. Finishes, Furniture and Fittings
- Eliminate materials where possible and utilise self-finishing surfaces with low maintenance.
- Ensure replacement cycles are considered, especially loose items and high footfall areas.
- Replacement cycles should be reduced where possible.

Proposed Corner Bay Detail

A

Appendix - Historic designations



Cultural Heritage Designations

Sloy Awe Hydroelectric Scheme, Loch Sloy Dam (LB51712)

Sloy Awe Hydroelectric Scheme, Sloy Power Station including boundary walls, gates and gatepiers (LB43188)

Inveruglas Castle, Inveruglas Isle, Loch Lomond (SM9264)

Sloy Power Station, Bridge (LB43189)

Sloy Power Station, Bungalow (LB43190)

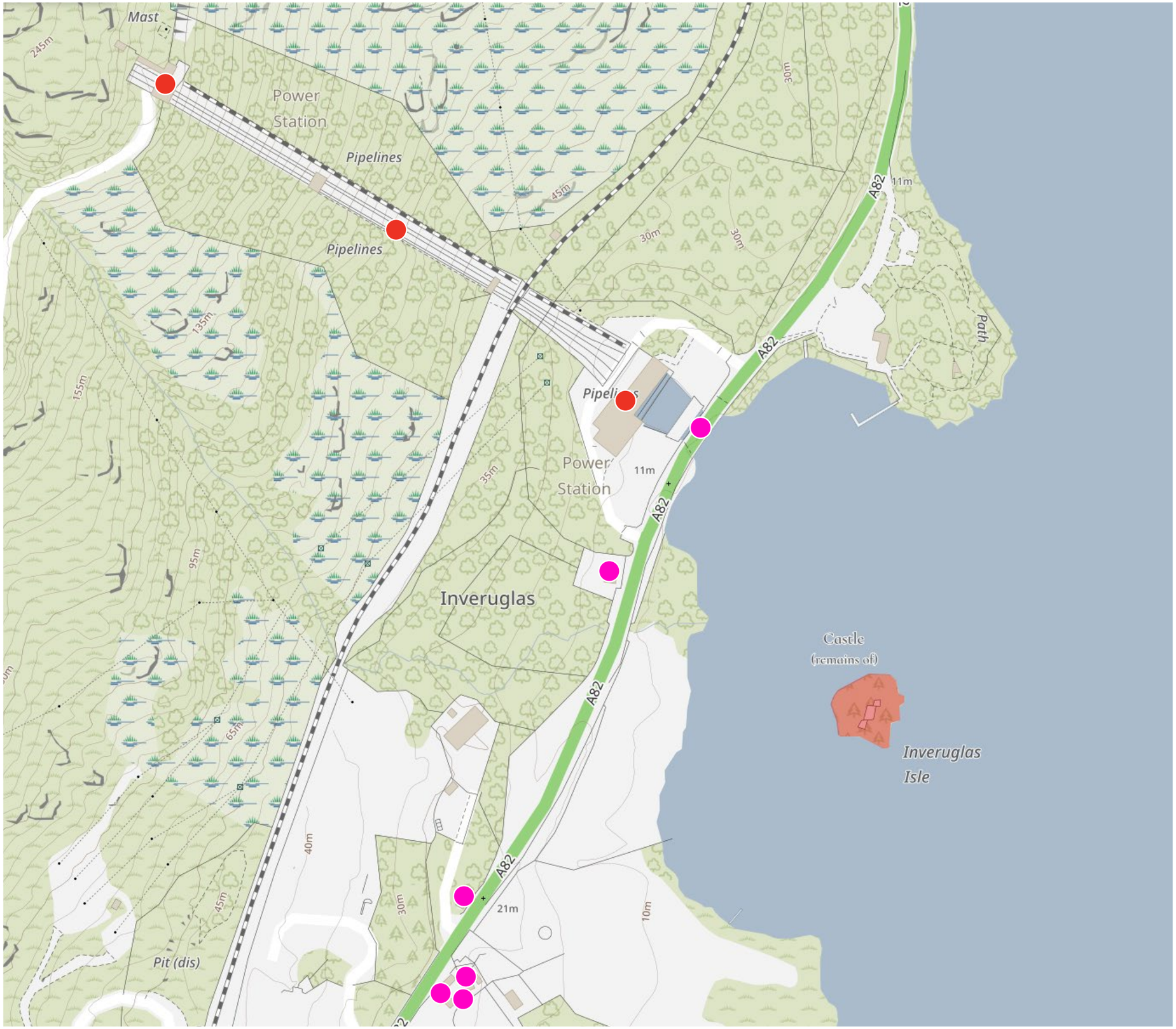
Inveruglas Barn (LB43186)

Inveruglas Steading (LB43187)

Key

- Category A Listed
- Category B Listed
- Category C Listed
- Scheduled Monuments

Cultural Heritage Designations



Key

- Category A Listed
- Category C Listed
- Scheduled Monuments

HES Listing

Sloy Awe Hydroelectric Scheme, Sloy Power Station(LB43188)

Category
A

Date Added
29/03/1996

Supplementary Information Updated
21/02/2018

Local Authority
Argyll And Bute

Planning Authority
Argyll And Bute

Parish
Arrochar

National Park
Loch Lomond And The Trossachs

NGR
NN 32091 9818

Coordinates
232091, 709818

Description
Harold Ogle Tarbolton (architect for the North of Scotland Hydroelectric Board architectural panel), 1950 (designed 1947). 2-storey, 5-bay rectangular-plan classical modern power station with additional lower office block attached to left (SW). Prominent full-height pre-cast pilasters to SE turbine hall elevation. Steel frame with pre-cast Rubislaw and Corrennie granite slabs. Banded corniced eaves course with deep blocking course above.

SOUTH EAST (PRINCIPAL) ELEVATION: roughly 11 bays with tall 6-bay turbine hall to right (NE) and lower range to left (SW) comprising offices and store. Slightly advanced 4-bay centre to turbine hall flanked by single outer bays (that to right (NE) blank) with giant order pilasters with dentilled capitals dividing bays, all oversailing tailrace on concrete piers and segmental arches. Full-height rectangular windows to ground floor in moulded concrete surrounds carried beneath banded cill course; smaller windows above in narrow moulded surrounds. 4 full-height windows to lower section at left (SE) with cantilevered concrete balconies and doorways above; similar to single bay return. Slightly taller recessed single bay to far left (SE) with similar windows.

SW (ENTRANCE) ELEVATION: 3-bay advanced entrance block flanked by single recessed bays. Advanced doorpiece flanked by rectangular windows at ground with balcony above incorporating North of Scotland Hydroelectric Board coat of arms. Tall rectangular window at 1st floor with moulded architraved surround. Similar windows and balconies to those at office block to SE elevation.

NW (REAR) ELEVATION: similar to that at SE with advanced panelled teak vehicular access door in plain surround and transformer station directly adjacent to rear of turbine hall elevation and roughly 4-bay advanced workshop to right (SW).

NE ELEVATION: 2 symmetrical bays with full height windows at ground floor and smaller rectangular windows above.

Predominantly small pane windows with some hopper top openings in painted Crittal frames. Flat platform roof, behind parapet. Cast-iron rainwater goods with decorative hoppers.

INTERIOR: full-height entrance vestibule with dog leg stair on axis with door giving access to balcony at 1st floor; octagonal section pillars all in polished marble with marble tiles to walls. Various offices and store rooms with main control room directly opposite entrance door at 1st floor retaining original control panels (2009). High quality fixtures including stair handrails and some oak doors with brass handles. Predominantly plain functional interior to turbine hall with large travelling crane to gantry at attic level and trussed steel roof structure.

Statement of Special Interest
Sloy power station forms an A-group with Sloy Dam (see separate listing). Sloy power station is the earliest example of the work of the North of Scotland Hydroelectric Board (NoSHEB) in the development of hydroelectric power in Scotland. It is a bold Modernist Classical design, sited in a prominent location on the banks of Loch Lomond adjacent to the A82 trunk road and is a fine work by one of the board's most significant architects, H.O.Tarbolton. The station is an integral component of the Sloy Hydroelectric Scheme, which also included Sloy Dam (see separate listing), and was the first major scheme to be developed by NoSHEB after its inception in 1943. The scheme was highly significant as the precedents which it set in terms of design and construction informed all of the future work by the Board on the developments of schemes throughout the rest of Highland Scotland. The scheme was highly ambitious in scale and technology and the generators had the highest capacity of any in Britain when they were installed.

Sloy power station is a prominent example of the bold modernist phase of designs by NoSHEB and the use of modern materials such as pre-cast concrete blocks expressing the dynamism of the industry at this time. The board also aspired to creating a new prosperous society in the Highlands by bringing electricity to remote communities. The station was the first to be built by the board and the bold design was part of a conscious effort to shape the wider agenda in the energy sector and to clearly characterise, through architecture, the aims and ideals of the revolution it felt it was bringing to Scotland.

The power station was designed with 4 turbines commissioned from the English Electric Company, with a combined generating capacity of 160 megawatts, at the time the largest in Britain. The station has a large head of 277 metres with water conducted via aqueduct tunnel and pressure pipeline from Sloy Dam (see separate listing). The average output of the station is 130 million units. The turbines were refurbished in 1999 as part of a wider program of redevelopment at the station costing £113 million and designed to keep it in operation for the next 30 to 40 years.

The Sloy scheme was the first of the major post-war hydroelectric developments by NoSHEB, with this second phase of development dating from the mid 1950s. The scheme played a key role in the realisation of the social agenda of NoSHEB by providing power which could be exported via the grid to the central belt, the profit from which subsidised the provision of power to remote north highland communities and stimulated economic regeneration. Under the leadership of eminent chairman Sir Tom Johnston the board undertook developments throughout Highland Scotland and his aspirations saw the development of schemes in locations such as Loch Dubh near Ullapool and Storr Lochs on Skye. Johnstone's social aspirations and wider wishes to reinvigorate the economy of the Highlands ensured that schemes in remote areas formed a key part of the NoSHEB development plan.

All of the developments carried out by NoSHEB were subject to parliamentary approval and objections on the grounds of scenic amenity were common. In order to meet these objections the board appointed a panel of architectural advisers which included Reginald Fairlie (1883-1952), James Shearer (1881-1962) and Harold Ogle Tarbolton (1869-1947), appointed in 1943. Initially the role of the panel was to adjudicate on competition entries for designs, but by 1947 it had become one of designers. The panel had little control over the functional form of the buildings, as they left this to engineers, but they did influence the appearance and the style of the designs. The design of Sloy Power Station is typical of Harold Ogle Tarbolton's bold designs for NoSHEB as can be seen in his work at Pitlochry and Clunie (see separate listings). This contrasts with the later approach of the board after Tarbolton's death in 1947, with the focus on the integration of buildings with the landscape with the use of natural stone and rubble facings.

Harold Ogle Tarbolton became involved in the design of hydroelectric infrastructure for NoSHEB late in his career (he died in 1947), but he had been a member of the Amenity Committee which considered the work carried out under the Galloway Water Power Act of 1929, acting as advisory architect for the Galloway schemes and designed the associated housing schemes. As a consequence of his experience in Galloway and his original training as a civil engineer he was appointed to the North of Scotland Hydroelectric Board alongside James Shearer and Reginald Fairlie. His two most prominent commissions for the power stations are those at Loch Sloy and Pitlochry (see separate listings). Both of these designs are characterised by confident use of modern classicism and bold application of pre-cast concrete panels.

(List description updated 2011 as part of Hydroelectric Power Thematic Survey)

HES Listing

Sloy Awe Hydroelectric Scheme, Loch Sloy Dam (LB51712)

Category
B

Group Category Details
100000019

Date Added
29/03/1996

Supplementary Information Updated
21/02/2018

Local Authority
Argyll And Bute

Planning Authority
Argyll And Bute

Parish
Arrochar

NGR
NN 28938 11120

Coordinates
228938, 711120

Description
James Williamson (engineer for North of Scotland Hydroelectric Board technical panel), Balfour Beatty and Co. (main contractors), designed 1936, built 1946 onwards. Large buttress dam with access roadway oversailing prominent arcaded buttresses with fixed spillway to centre integrated with buttress and control tower, dominating upper reaches of Inveruglas water. Shuttered concrete, with some reinforced concrete to parapet and gatehouse control tower. Battered downstream face with deep buttresses with rounded headed gaps between. Large buttress to centre forming fixed spillway with central rib integrated with dispersal valve to base and control tower to parapet. Parapet to top with small buttressed piers springing from centre of main buttresses.

TUNNEL INTAKE AND DISPERSAL VALVE GATEHOUSE: set directly adjacent to upstream face of dam on large concrete pier incorporating intakes for tunnel and dispersal valve beneath waterline. Large panelled teak vehicular access doors to SE elevation with paired narrow rectangular windows to SW and NE elevations.

Statement of Special Interest
Sloy Dam forms an A-group with Sloy Power Station (see separate listing). The dam is of a pioneering design and is an excellent example of the work of preeminent designer and engineer James Williamson. It forms a major component of the Sloy Hydroelectric Power Scheme (along with Sloy Power Station), the first to be built by the North of Scotland Hydroelectric Board (NoSHEB). The scheme is in a significant location setting a precedent in terms of design and construction, informing all future work by the Board on the developments of schemes throughout the rest of Highland Scotland. The dam dominates its setting on the upper reaches of the Inveruglas Water and the bold use of striking functional yet modern design illustrates the confidence of NoSHEB and the strength of their vision for the development of Hydropower in Scotland.

The Sloy scheme was the first of the major post-war hydroelectric developments by NoSHEB, with this second phase of development dating from the mid 1950s. The scheme played a key role in the realisation of the social agenda of NoSHEB by providing power which could be exported via the grid to the central belt (via a connection at Windyhill near Glasgow in the case of Sloy), the profit from which subsidised the provision of power to remote north highland communities and stimulated economic regeneration. Under the leadership of eminent chairman Sir Tom Johnston the board undertook developments throughout highland Scotland and his aspirations saw the development of schemes in locations such as Loch Dubh near Ulapool and Storr Lochs on Skye. Johnston's social aspirations and wider wishes to reinvigorate the economy of the Highlands ensured that schemes in remote areas formed a key part of the NoSHEB development plan.

All of the developments carried out by NoSHEB were subject to parliamentary approval and objections on the grounds of scenic amenity were common. In order to meet these objections the board appointed a panel of architectural advisers which included Reginald Fairlie (1883-1952), James Shearer (1881-1962) and Harold Ogle Tarbolton (1869-1947), appointed in 1943. Initially the role of the panel was to adjudicate on competition entries for designs, but by 1947 it had become one of designers. The panel had little control over the functional form of the buildings, as they left this to engineers, but they did influence the appearance and the style of the designs. The design of Sloy Power Station is typical of Harold Ogle Tarbolton's bold designs for NoSHEB as can be seen in his work at Pitlochry and Clunie (see separate listings). This contrasts with the later approach of the board after Tarbolton's death in 1947, with the focus on the integration of buildings with the landscape with the use of natural stone and rubble facings.

The design of Sloy Dam would go on to typify James Williamson's approach, with an innovative solution designed specifically to suit the requirements of a particular site. His design for Sloy Dam was pioneering. He had first described the principal of using buttresses instead of mass concrete in 1936 when lecturing in Washington DC. The use of this technology represented a significant cost saving for the Board with only 20,000 tons of concrete required for construction, in contrast to the 50,000 which would have been necessary for a conventional mass concrete dam. Williamson was a prominent engineer who specialised in the design of dams following his work on the Galloway Hydroelectric scheme (see separate listings) in the 1930s. He acted as one of the chief engineering advisors to NoSHEB and was the lead engineer for a number of schemes until his death in 1953. After this date his company, James Williamson and Partners, continued in the role of chief engineers to the board.

Previously listed with Sloy Power Station. Now split and category changed from A to B as part of Hydroelectric Power Thematic Survey 2011.

HES Listing

Loch Sloy Station Bridge (LB43189)

Category
C

Date Added
29/03/1996

Supplementary Information Updated
22/02/2018

Local Authority
Argyll And Bute

Planning Authority
Argyll And Bute

Parish
Arrochar

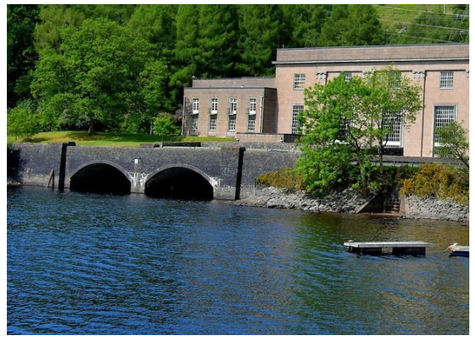
National Park
Loch Lomond And The Trossachs

NGR
NN 32150 9796

Coordinates
232150, 709796

Description
Circa 1950. Bridge carrying road over Inveruglas Stream from Sloy Power station into Loch Lomond. Squared whinstone with cement dressings. Paired semicircular arches, cement rendered soffits. Plain whinstone parapet with cement coping; slightly advanced die.

Statement of Special Interest
The bridge is part of the Sloy Power station complex.



HES Listing

Loch Sloy Station Bungalow (LB43190)

Category
C

Date Added
29/03/1996

Local Authority
Argyll And Bute

Planning Authority
Argyll And Bute

Parish
Arrochar

National Park
Loch Lomond And The Trossachs

NGR
NN 32074 9684

Coordinates
232074, 709684

Description
Circa 1950. Single storey, 3-bay, rectangular-plan bungalow. Windows directly under eaves; base course.

MAIN ELEVATION: broad, deep-set door at centre; broad flanking windows; cills.

SIDE ELEVATION: 2-bay slight storage advanced shot; boarded doors, narrow window at centre.

12-lying-pane timber sash and case windows. Grey slate piended roof.

Statement of Special Interest
The bungalow was probably built as workers, lodge accommodation for the Sloy Hydroelectric station.

HES Listing

Inveruglas Castle, Inveruglas Isle, Loch Lomond (SM9264)

Date Added
08/12/2000

Type
Secular: tower

Local Authority
Argyll And Bute

Parish
Arrochar

NGR
NN 32272 9572

Coordinates
232272, 709572

Description
The monument consists of the remains of a Z-plan tower situated on Inveruglas Isle, off the west shore of Loch Lomond. On the island there are also the remains of a substantial jetty and other buildings which may be associated with the castle.

Inveruglas Castle was the principal seat of the Clan Macfarlane. The castle is believed to have been abandoned and partial destroyed during the Commonwealth (1649-1660) by Cromwellian Troops.

The tower measures overall 12m E-W by 9.5m N-S with round towers on the NE and SW angles. The structure now only stands to first floor height. The castle is of two main phases; the original structure was a simple oblong tower to which the corner towers were later added. The alterations probably took place in the latter half of the 16th century in an attempt to modernise the castle. The castle is simply but well constructed in random rubble roughly brought to courses and with small quoins. The castle is partly built on bedrock outcrops, which have been incorporated into the walls of the castle.

Due to the destruction of the upper floors of the castle, there are few notable features. There is no evidence that the ground floor was vaulted, or that there was a ground floor entrance. At first floor level in the main block there is evidence of a fireplace midway along the S wall. The SW tower has the remains of an opening, probably a window, at first floor level. The only other features are numerous small rectangular openings that pierce the two angle towers at ground and first floor. They appear to be crude gun ports.

To the E of the tower, there are two buildings. The E of these is a rectangular stone structure orientated N to S and measuring 13m by 5.6m over walls on average 0.8m thick. An entrance, c.1m wide, is located in the E wall. By the SW corner of the building, there is a rectangular drystone structure. The overall dimensions, including the walls, are approximately 8.7m N to S by 4.4m E to W. There is a fine drystone jetty and landing stage at the SE corner of the island. The relationship of these structures to the castle cannot be determined.

The area to be scheduled corresponds to the total area of Inveruglas Isle. The area is irregular in shape and has maximum dimensions of 60m N-S and 55m transversely as marked in red on the attached map.

Statement of National Importance
The monument is of national importance as the remains of a small medieval tower house perhaps with associated structures. The addition of the angle towers to create a Z-plan tower is an interesting feature demonstrating how very simple towers could be adapted to changing fashions. The archaeology of this monument has the potential greatly to increase our knowledge about the defences, domestic life and function of such monuments.

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