# Balliemeanoch Pumped Storage Hydro

## Environmental Impact Assessment Report

## Volume 2: Main Report
## Chapter 2: Project and Site Description

ILI (Borders PSH) Ltd

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## Quality information

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# 2. Project and Site Description

## 2.1 Introduction

This chapter provides a description of the Development (submitted design) and its surrounding environment. It also provides an overview of the likely construction methods, an indicative construction programme, including enabling pre-construction works, and an overview of the operational and decommissioning phases of the Development. A description of the generation and reuse of excavated material is also included.

This chapter is organised as follows:

- Site description (*Section 2.2: Site Description*);
- Development description (*Section 2.3: Development Description*) and summary of key development characteristics (*Sections 2.4: Description of Headpond – 2.14: Grid Connection*) - these sections provide a description of the submitted design for which consent under Section 36 of the Electricity Act 1989 ("Section 36 Consent") is sought;
- The construction programme (*Section 2.15: Construction Programme*); and
- Development phases (*Sections 2.16: Pre-Construction – 2.20: Decommissioning*) - these sections provide a description of each phase of the development: pre-construction, construction, operation and decommissioning.

## 2.2 Site Description

The Development Site is located in the Argyll and Bute region, centred on national grid reference NN 03615 17578, approximately 4.4 km to the south of the village of Portsonachan and 9 km northwest of Inveraray, with the red line boundary shown on *Figure 1.1: Location Plan (Volume 3 Figures)*. The Development Site is generally characterised by upland moorland plateau grazing land. The Headpond location at Lochan Airigh sits at approximately 360 m above ordnance datum (AOD) and 3 km to the east of Balliemeanoch Farm Steading. The proposed Marine Facility is located south of Inveraray off the A83.

There is no woodland within the main area of the Development Site, with woodland pockets restricted to those located along proposed Access Tracks. These woodlands include plantation woodland along the existing, to be upgraded, Access Track from the A819 at the north; along the proposed new and upgraded existing tracks proposed to the west of Inveraray; and along the upgraded access to the north of Inveraray Castle. Degraded woodland is present in the vicinity of the Tailpond inlet / outlet.

The Development is predominantly located within the catchment of the Allt Beochlich watercourse. The catchment consists of a number of small streams, which ultimately flow into Loch Awe, these originate from smaller lochs (Airigh, Dubh and Romach).

*Figure 2.1: Constraints (Volume 3 Figures*) shows environmental and recreational constraints within the site and surrounding area. *Figure 2.2: Utilities (Volume 3 Figures)* shows utilities within the red line boundary.

### 2.2.1 Water Features

The Development Site is consisted of two main catchment areas: the Loch Awe catchment and the Loch Fyne catchment. The Loch Awe catchment covers the Headpond area and the inlet / outlet structure. While the Loch Fyne catchment includes the Inveraray bypass route and the Loch Fyne Marine Facility. The majority of watercourses within the Loch Awe catchment flow directly into Loch Awe. However, there are three sub-catchments, including Allt Beochlich, that has a number of tributaries and lochans within its catchment, and Allt Mor which has some unnamed lochans and Claddich River catchment.

*Table 2.1: Water Features*, below lists each of the water features within each catchment and sub catchment, these features are also identified in *Figure 11.1: Surface Water and Groundwater Receptors and Attributes – Wider Context (Volume 3 Figures).*

**Table 2.1: Water Features**

| Sub Catchment | Water Features |
|---|---|
| **Loch Awe** | |
| Loch Awe | Allt na Cuile Riabhaiche and tributaries |
| | Allt a Chrosaid and small (unnamed) lochan |
| | Allt na Dail Ferna |
| | Allt na Fainge |
| | Allt a' Ghreataidh |
| | Allt Blarghour and tributaries |
| Allt Beochlich and tributaries | Loch Breac-liath |
| | Lochan Airigh |
| | Beochlich Lochan |
| | Lochan Dubh |
| | Lochan Romach |
| Alt Mor and tributaries | Unnamed Lochs |
| Claddich River | Keppochan River and tributaries |
| | Archan River and tributaries |
| **Loch Fyne** | |
| Loch Fyne | Crom Allt and tributaries |
| River Aray and tributaries | Allt Riabhachan |
| | Allt Bail' a' Ghobhainn |
| | Erallich Water |
| | Allt Phàruig |

Refer to *Chapter 11: Water Environment* for further details.

## 2.2.2 Topography

The main Development Site slopes from the summit of Cruach na Gearr-choise (571 m AOD), along the eastern boundary of the Development Site, towards Loch Awe in the west.

The proposed Headpond is located at Lochan Airigh (360 m AOD), which sits in the valley between Cruach na Gearr-Choise (571 m AOD) to the east and an unnamed summit (470 m AOD) to the west. The topography around the Headpond area is generally flat around Lochan Airigh (centre of the basin) and slopes up at approximately 12 % and 9 % from the centre of the basin to the northwest and the southeast, respectively.

The Tailpond inlet / outlet is located on Loch Awe, south of Balliemeanoch Farm. The top level of the structure is at an elevation of 38.6 m AOD and extends approximately 50 m into Loch Awe. The existing ground slopes steeply to the southeast at a gradient of approximately 14 % to the existing track, where it levels out and slopes steadily upwards to the proposed Headpond location in the east. The Balliemeanoch farmhouse is located approximately 400 m away from the proposed Tailpond inlet / outlet location. *Figure 10.1: Topography (Volume 3 Figures)* shows the topography of the Development Site based upon a 5 m digital terrain model (DTM).

## 2.2.3 Geology

The bedrock geology at the main Development Site is dominated by Metabasaltic rock of the Tayvallich Volcanic formation. The Tayvallich Volcanic formation is of the Tayvallich Subgroup, which is defined onby the British Geological Survey (BGS) as: "*Dominated by calcitic limestone, in part slumped, resedimented; however, east of mid-Deeside the limestone is replaced by psammite and quartzite with thin beds of calcsilicate rock; lavas, hyaloclastites and graphitic pelites present in Tayvallich area; Banffshire Coast – thick semipelite and calc sequence in upper part*."

This formation covers the majority of the proposed Headpond and the sloping ground to the west, towards Loch Awe.

At the tail pond inlet / outlet structure (on Loch Awe), the bedrock geology is shown to be psammitic in nature, of the Loch Avich Grit Formation. The Loch Avich Grit Formation is of the Southern Highland Group, which is defined by the BGS as: " *A thick pile of psammitic and pelitic greywackes and associated rocks, some volcanic*."

The bedrock geology is made up of Tayvallich Volcanic Formation – Metalava and Metatuff and the Tayvallich Slate and Limestone Formation – Pelite, Graphitic to the north and south of the Headpond, respectively. Both of these formations are of the Tayvallich Subgroup, described above.

As shown on *Figure 10.3: Superficial Geology (Volume 3 Figures),* no superficial deposits are identified across the majority of the main Development Site. This is an indication that bedrock is at, or near, the surface. Where superficial deposits are identified, they are generally till deposits, alluvium and peat.

A review of the BGS Faults layer (1:625,000 scale) on the BGS Onshore GeoIndex (citation) indicated the presence of a fault trending southwest – northeast through the proposed Embankment 1, terminating to the east of the Headpond..

### 2.2.4 Peat

A review of the Carbon and Peatland 2016 map on Scotland's Soils online map viewer (Scottish Government, 2016) shows the area surrounding the Headpond is a mixture of peat soils, mostly peaty gleys with semi-confined peat, peaty gleyed pozdols with peaty gleys with distrophic semi-confined peat and peaty gleys with peaty rankers.

The areas along the banks of Loch Awe and to the east towards the Headpond is described as brown earths with humic gleys.

An onsite peat depth survey was undertaken using peat probes, the results from the surveys are listed below:

- 38 % of the area surveyed recorded a depth of peat below 0.5 m
- 24 % of the area surveyed recorded a depth of peat between 0.5 m and 1.0 m
- 12 % of the area surveyed recorded a depth of peat between 1.0 m and 1.5 m
- 10 % of the area surveyed recorded a depth of peat between 1.5 m and 2.0 m
- 9 % of the area surveyed recorded a depth of peat between 2.0 m and 3.0 m
- 7 % of the area surveyed has depths of peat ranging between over 3.0 m and up to 7.30 m,, however, it is mostly located on the outer eastern edges of the survey extents.

The results of the peat probing surveys undertaken at the site were used to create a map of the varying depths of the peat surface across the Development – shown on *Figure 10.5: Peat Depth Interpolation (Volume 3 Figures).*

### 2.2.5 Land Use

The Development Site is generally characterised by upland moorland plateau grazing land. The wider landscape includes a rocky coastland, upland glens and steep ridges and mountains. The Headpond location at Lochan Airigh sits at approximately 360 m AOD and 3 km to the east of the village of Balliemeanoch. Loch Awe lies immediately to the northwest of the Development Site and Loch Fyne lies immediately to the south, where the proposed Marine Facility is located south of Inveraray, off the A83. Beyond these lochs there are areas of higher ground, which are characterised by mountains and Wild Land Areas.

The land around the area of the proposed Headpond within the Development Site comprises an upland plateau moorland with craggy outcrops, used mainly for sheep grazing. The land capability for agriculture is class 6.3, "*capable of only rough grazing due to intractable physical limitations; semi-natural vegetation provides grazing of low value*" (Hutton Institute).

There is no woodland within the main area of the Development Site, with woodland pockets restricted to those located along proposed Access Tracks and a small area near the Tailpond inlet / outlet. These woodlands include plantation woodland along the existing, to be upgraded, Access Track from the A819 at the north; along the proposed new and upgraded existing tracks proposed to the west of Inveraray; and along the upgraded access to the north of Inveraray Castle, and as noted near the Tailpond inlet / outlet on Loch Awe.

### 2.2.6 Designations

There are no statutory environmental designations within the main area of the Development Site. Inveraray Castle Garden and Designed Landscape is located within the red line boundary, along the existing Access Track north of Inveraray Castle (*Figure 2.1 Constraints (Volume 3 Figures*)). However, the proposed Marine Facility would be situated within the Upper Loch Fyne and Loch Goil Marine Protected Area (MPA), which is located to the west of Inveraray.

Within the wider area, Glen Etive and Glen Fyne Special Protected Area (SPA) is located approximately 5 km to the east of the proposed Headpond and is designated for breeding golden eagle (*Aquila chrysaetos*).

Non-statutory long established (of plantation origin) woodland is located to the north and south of stretches of the proposed access route to the north of Inveraray Castle, in addition to a number of scattered category A and B Listed Buildings. There is one Scheduled Monument within the main Development Site – Balliemeanoch chapel and burial ground, which is located approximately 500 m north of the proposed tailrace tunnel.

### 2.2.7 Access

There are no classified roads or tracks within the Development Site at the Headpond or Tailpond location. However, at Inveraray there is a <1 km section of classified road (A83) at the proposed Marine Facility location.

Site access is proposed from the A819, which links the strategic trunk roads: A85 to the north at Dalmally and A83 to the south at Inveraray. It is anticipated the general construction access will come from the north and south along the A819. Construction access from the south will bypass Inveraray, via a section of unclassified existing track (to be upgraded) north of Inveraray Castle, which will connect the A83 to the A819.

Larger construction traffic, such as abnormal loads, will be delivered by boat to the proposed Marine Facility jetty, where they will be then transported to site via the A819. Access to the A819 will be via an upgraded existing Access Track that runs to the north and then east, from the A83, around the north of Inveraray. There are proposed upgrades to the existing unclassified road “Upper Avenue” at Inveraray and a new track linking this to the A83 at the proposed Marine Facility jetty location.

These upgrades are proposed to ease traffic and to avoid sensitive bridges within the area of Inveraray.

In summary:

- There is a proposed heavy goods vehicle (HGV) construction traffic bypass route between the A83 east of Inveraray and the A819 to the north of Inveraray. This utilises a combination of existing construction Access Track and new Access Tracks to the north of Inveraray Castle.
- A proposed abnormal indivisible load (AIL) route, utilising Upper Avenue, between the A83 south of Inveraray and the A819 north of Inveraray would facilitate the movement of AIL deliveries from the proposed Marine Facility jetty facility.
- HGV construction traffic will avoid the B840. It is unlikely that this route would be required for construction traffic, as a route will be available directly from Access Tracks from the A819 at Craig nan Sassanach to the Development site.
- The proposed HGV construction traffic routes would avoid Inveraray Town Centre, as well as the historic Aray Bridge on the A83.

### 2.2.8 Utilities

Utility searches were commissioned for three key areas of the Development. The three search areas were selected given the size of the Development and the aim to limit the search areas to those receptors within proximity to residential areas where such services are most likely to be affected. These can be seen on *Figure 2.2: Utilities (Volume 3 Figures).*

The report identified the following receptors potentially affected by the Development:

- Water & Sewerage – Scottish Water (SW).
- Electricity Distribution – Scottish and Southern Energy Networks (SSEN).
- Telecoms & Cables – BT Openreach.

#### 2.2.8.1 Water and Sewerage

SW plans only show the public mains in the area. Any connections / supply pipes are classed as private and are usually not recorded by SW.

Water utilities are present within the area of the proposed Marine Facility. Raw water supply is present along the southern corner section of Upper Avenue, at the residential dwelling and water treatment works.

Adopted public water mains are present at temporary compound 23 as shown on *Figure 2.3 Above Ground Infrastructure Sheet 2 of 2 (Volume 3 Figures*) at South Cromalt, within the area of the proposed temporary Access Track to connect the proposed Marine Facility to Upper Avenue, and along the southern corner section of Upper Avenue.

Given the temporary nature of the proposed access routes at these locations, it is considered that, at the detailed design stage, measures will be put in place to effectively mitigate against disturbance. Consultation with SW at Gate Check was undertaken. Refer to *Chapter 3 Evolution of Design and Alternatives* for further information on Gate Check and the design process. SW advised that they must be consulted during the detailed design stage and provided with timescales for construction start dates, in order to discuss the possibility to avoid or mitigate coinciding with SSEN pylon works scheduled in this area.

In addition, 3 months in advance of any works commencing on site, SW should be notified at protectdwsources@scottishwater.co.uk. to ensure SW are aware of activities in the catchment. If it is required, a site meeting with the relevant member of SW Sustainable Land Management team can take place to discuss the construction programme.

During the detailed design, arrangements will be required for surface water, for reasons of sustainability and to protect SW customers from potential future sewer flooding. SW will not accept any surface water connections into their combined sewer system.

#### 2.2.8.2 Electricity Distribution

There is an existing run-of-river hydro scheme on Allt Beochlich, with an associated private generator and low voltage (LV) cable routes. These have been taken into consideration throughout the Development design process.

Where the proposed Temporary B840 Realignment begins at Barr Beithe, there is an LV mains and 16 kVA cable. LV cables are typically dug at a maximum of 1 m underground for agricultural land, 0.6 m at road crossings, and 0.45 m at footpaths / unmade land. It is considered that these cables will be avoidable within the detailed design.

A 33 kV overhead line (OHL) runs from north to south over the west of the Development Site, to the east of the proposed Temporary B840 Realignment from the northeast of Balliemeanoch Farm southwest to Cruach Bheac, and crosses the proposed temporary road diversion. At the northern section of the proposed Temporary B840 Realignment there is a 22 kV OHL between Oaklea and Balliemeanoch Farm. This OHL crosses the existing farm access that is proposed to be upgraded for the Temporary B840 Realignment. The detailed design stage will take into consideration the OHLs and any interactions from the Development during construction.

South of Inveraray near the proposed Marine Facility, LV mains cross Upper Avenue at the water treatment facility, with the 11kV and 33kV OHLs crossing the alignment of the proposed temporary access from the Marine Facility to Upper Avenue. It is likely that these will require realignment to enable the Development to proceed. This will be determined at the detailed design stage.

#### 2.2.8.3 Telecoms and Cables

BT Openreach telecommunications are present along the existing B840, via overhead cables on poles. Underground cables are also present north of Barr Beiche to the north of Allt Beochlich, connecting to the existing run of river hydro scheme.

There are underground cables that follow the A819 and, at Inveraray, there are overhead cables on poles that follow Upper Avenue from the A83.

Consultation with BT Openreach was undertaken at Gate Check and BT Openreach advised that the project should not cause interference to BT Openreach's current and presently planned radio network.

The Emapsite Report also identified that gas distribution network (Scotia Gas Network (SGN)) is not considered to be affected by the Development.

### 2.2.9 Local Community and Economy

The main Development Site is located in a rural area. Isolated static caravans are situated at the west of the site on the banks of Loch Awe in proximity to the proposed Tailpond inlet / outlet. There are two houses in the area close to the proposed western Access Track, linking the Headpond and Tailpond; these are identified as a detached bungalow and Balliemeanoch farm.

The Development Site lies within the Argyll and Bute Council area, where it is noted that 47.2 % of the area's population live in areas classified by the Scottish Government as 'rural' (Argyll and Bute Council (2020[1])). Surrounding the Development Site lie the settlements of Ardchonnell, Ballimeanoch, Drimfern, Ladyfield, Portsonachan and Taynafead. Inveraray is the largest nearby settlement to the Development Site with an estimated population of 560 (Argyll and Bute Council (2020)).

### 2.2.10 Future Baseline

If the Development were not to be built, the characteristics and land use within the Development Site boundary would remain as currently existing. Therefore, the future baseline is not anticipated to differ significantly from the Site Description provided in *Section 2.2: Site Description*, above.

## 2.3 Development Description

*Table 2.2: Description of Development Component Parts* introduces the terminology and component parts of a typical pumped storage hydro (PSH) scheme and describes these components for the Development.

The above and below ground infrastructure can be seen separately on *Figures 2.3: Above Ground Infrastructure and Figure 2.4: Below Ground Infrastructure (Volume 3 Figures)* respectively. This project description is summarised below.

[1] Argyll and Bute Council (2020). Population: Where we live [Online]. Available at: https://www.argyll-bute.gov.uk/my-community/population-where-we-live

## Table 2.2: Description of Development Component Parts

| Arrangement | Component | Description |
|---|---|---|
| Above Ground (as shown on **Figure 2.3 (Volume 3)**) | Headpond | The Headpond is the upper reservoir with associated Embankments. The Headpond will be constructed through a combination of excavation and creation of two new Embankments. The existing topography is utilised in the design to reduce the number of Embankments, Embankment size and length as far as practically possible.<br><br>Component parts of the Headpond include:<br>• Headpond reservoir – referring to the waterbody containing approximately 59,580,500 m³ of water, with a working volume of 53,397,000 m³ located at NN 04594 16411;<br>• Embankment 1 – the largest of the two Embankment structures retaining the waterbody approximately 1,635 m long, approximately 485 m wide and approximately 95m high<br>• Embankment 2 – the smaller of the two Embankment structures retaining the waterbody approximately 279 m long, approximately 85 m wide and approximately 13 m high.<br>• Headpond inlet / outlet structure – where the Waterways exit the Headpond, the structure will predominantly sit within Embankment 1.<br>• Upper Gate House (permanent) – The upper gate house location east of the Headpond and accessed via the Embankment 1 and will be 35 m x 25 m x 10 m [L x B x H].<br>• The Headpond will include one borrow pit within its interior. This borrow pit (BP01) is required to excavate the required material for the construction of the Embankments and reduce the reliance on delivery of additional material to site via public roads. BP01 could yield up to approximately 9,600,000 m³ of stone. The borrow pit floor measures approximately 825 m x 445 m and is around 37 m in depth. |
| | Tailpond | The Tailpond is the lower reservoir, and in the case of this Development, will be the existing body of Loch Awe.<br><br>The permanent and temporary components of the Development located within the Tailpond include:<br>• Lower Gate House (permanent) – the lower gate house location approximately 90 m south east of the Tailpond inlet / outlet structure and will be 8 m x 7 m x 5 m [L x B x H].<br>• Cofferdam (temporary) – a water-tight, temporary structure that will encircle the area required for Tailpond works. The area within the cofferdam will be pumped dry to facilitate the construction of the Tailpond inlet / outlet structure. |
| | Construction Compounds | Temporary compounds (TC) and permanent compounds (PC) will be required across the Development. Some will be used for construction related activities such as laydown areas, work yards and for general site activities. Others will be used for office space, parking areas, welfare areas, and accommodation. These may include electric charging points for electric shuttle cars / buses.<br>• There will be 11 temporary compounds and 11 permanent compounds at various locations across the Development Site to facilitate different construction works. |
| | Development Site Access | • The Development Site access via the public road network is from the A819 near Craig nan Sassanach. The A819 runs to the east of the Development Site from north to south.<br>• There is potential to access the Development Site further south down the A819 at Three Bridges utilising the proposed access for the Blarghour Wind Farm should this be constructed, and the necessary land rights secured.<br>• The Marine Facility located on the coast south of Inveraray will act as Development Site access for certain deliveries via water from Loch Fyne. The marine structure will be a jetty structure that will extend into Loch Fyne. The jetty will extend south-east from the shore perpendicular to the A83 and will be approximately 180 m from the shoreline and 10 m in width. |

| Arrangement | Component | Description |
|---|---|---|
| | Access Tracks | There will be both temporary and permanent internal Access Tracks required to be constructed. The alignment of existing Access Tracks has been utilised as far as possible. Any existing Access Track will be upgraded to accommodate the size and number of vehicles required to travel to, from and around the Development.<br>• Existing tracks to be upgraded - 12.8 km length and up to 10 m wide, which will be restored to 5 m wide post-construction with the exception of Upper Avenue and the Inveraray Castle Garden access route. Upper Avenue will be maintained at approximately 3 m wide, with local temporary widening where necessary, avoiding tree felling along the route. Inveraray Castle Gardens access will have limited widening and will be no more than 3 m wide, with local passing places installed where necessary. Post construction the road will be restored to pre-construction state.<br>• New Access Tracks - 10.3 km (5.3 km excavated and 5.0 km floated) and up to10 m wide.<br>• Temporary construction tracks - 5.8 km and up to 10 m wide.<br>• Blarghour Wind Farm access - 8.6 km which would not be built as part of the Development and only utilised should the wind farm be constructed and in operation, and the necessary land rights secured. |
| | Temporary B840 Realignment | Temporary realignment of a section of the public road network.<br>• To allow for construction of the Tailpond inlet / outlet structure a 1.5 km section of the B840 requires to be diverted. This will be temporary, with the B840 reinstated post construction. The newly built sections of the temporary diversion will be returned to its original condition, with the upgraded sections of the existing farm access retained. |
| | Walking Routes | Sections of existing informal Walking Routes within the site boundary will be temporarily diverted during construction. These routes will be fully reinstated on completion of construction. In addition, sections of the Access Tracks required to be constructed for the Development will be signposted and included as new Walking Routes for use by the public post construction. A public right of way (PRoW) crosses the internal Access Track into the site at the north. This PRoW is listed as a Heritage Path, it is not listed on HER, or CANMORE, or visible on aerial imagery; however, access will be maintained at all times with additional signage provided to warn any walkers of construction traffic that may be present on the intersecting road. An Outline Access Management Plan is located within *Appendix 16.1: Outline Access Management Plan (Volume 5 Appendices).* |
| | Switching Station | The Switching Station (NN 05087 17754) will consist of two secure electrical compounds (one controlled by the project and one controlled by the Distribution Network Operator (DNO)), in which electrical equipment will be housed. In addition to the external switchgear, a number of parking spaces and permanent welfare facilities will be present. |
| | Marine Facility | A temporary jetty will be constructed within Loch Fyne (NN 08500 07100). The jetty will be used for delivery of AILs of materials and equipment during construction, removed post construction and reassembled during operation for maintenance when required. The jetty will be used for delivery of a maximum of 10 shipments, estimated based on a combination of the number of AILs and units that can be carried on a barge appropriate for the size of the Marine Facility), and only at high tide due to the tidal nature of the loch and the design of the jetty.<br><br>Key jetty parameters are:<br>• Approximately 180 m in length from the shoreline.<br>• 10 m wide.<br>• Deck top level: 3.3 m AOD (1.6 m above Mean High Tide Level (MHTL)) and approximately 600 mm deep.<br>• Supported by vibro-driven piles into the seabed.<br>• The jetty will be temporary and will be in place for the duration of construction with the jetty platform being removed during demobilisation. The piles will remain in-situ. |
| | Temporary Workers' Accommodation | Temporary Workers' Accommodation will be required to house construction workers during the development phase. A housing strategy is located within *Appendix 16.2 Outline Housing Strategy (Volume 5 Appendices),* which will set out options including onsite accommodation, offsite accommodation, and park and ride options. The aim will be to have a mix of accommodation / travel options to ensure no significant adverse impacts on local accommodation for tourists and / or residents. The final locations have yet to be identified with the relevant studies currently being undertaken with discussions ongoing with Argyll and Bute Council. Any workers accommodation requiring planning consent will be subject to its own studies and assessments as part of separate planning application(s) under the Town and Country Planning (Scotland) Act 1997, as required. |
| Below Ground (as | Waterways | Waterway tunnels will transfer water between the Headpond and Tailpond and consist of:<br>Headrace - High pressure tunnel connecting the Headpond to the pump turbines within the Power Cavern Complex, approximately 670 m in length. |

| Arrangement | Component | Description |
|---|---|---|
| shown on **Figure 2.4 (Volume 3)**) | | Tailrace - Low pressure tunnel connecting the pump turbines to the Tailpond inlet / outlet, approximately 2.3 km in length.<br>The spillway - an open cut trench from the top of Embankment 1 used to drain any excess water from the Headpond. The spillway is approximately 580m and drains into an unnamed river that drains into Allt Beochlich.<br>The scour pipe - a pipe within the trench at the bottom of the Headpond that joins the spillway pipe within a chamber below the Headpond. Along with the spillway, the scour is used for the scouring and draining down of the Headpond.<br>Surge shafts associated with the high and low pressure tunnels. Located along the Waterways to contain pressure fluctuations within the hydraulic system. The low-pressure tunnel surge shaft will be underground. The high-pressure tunnel surge shaft will be underground and will extend to ground level (top of surge shaft to be covered by steel grate and contained within a permanent compound) but may have section cut / filled into the hillside and fenced which will be determined at the detailed design stage. |
| | Power Cavern Complex | Split into three sections:<br>1. Powerhouse cavern (contains the combined pump turbines),<br>2. Transformer cavern (contains the transformers) and,<br>3. Main inlet valve (MIV) cavern (contains the MIV), all three connected by galleries.<br>The powerhouse cavern will be the largest section, measuring approximately 200 m long, 25 m wide and 50 m high. The Power Cavern Complex is located approximately 460 m below ground level. There is a ventilation tunnel from the Power Cavern Complex, the ventilation shaft does not have a tunnel portal but does comes to ground level. At ground level the shafts will be housed in a permanent compound and cordoned off by adequate safety measures. |
| | Access Tunnels | Tunnels for access, construction and power which will also be used in operation.<br>• Construction and emergency egress tunnel, approximately 2.2 km in length. Also used in operation to provide access to the Power Cavern Complex (NN 01222 15828).<br>• Access tunnel, approximately 2.4 km in length (NN 01528 15624).<br>• Power cable tunnel, approximately 3.2 km in length (NN 050931 8511).<br>• Ventilation tunnel, approximately 240 m in length (NN 03526 16819). |
| Grid Connection | | The grid connection will not form part of the Section 36 Application and will be subject to its own separate consents. The Development will connect into the grid at Creag Dhubh substation via the Switching Station within the Development. |

A detailed description of each component part of the Development is provided in the following sections. There is some information that is unconfirmed at present and will only be determined at a later design stage or and / or post detailed site investigation (SI) works, which will occur once Section 36 Consent is granted.

However, a 'Rochdale Envelope' has been applied to all built features, including those that are temporary, and establishes the maximum (or worst case) dimensions of that component part of the Development (such as the maximum height of a building or maximum noise limit of a construction vehicle) or the Limits of Deviation (LoD). LoD allow for geographical flexibility during the construction phase, such as the maximum buffer strip within which construction access will be located to allow for any unexpected ground conditions. The LoD are outlined in **Chapter 4: Approach to EIA** in further detail.

# 2.4 Description of the Headpond

The Headpond is located within the south of the main Development Site at Lochan Airigh centred on NN 04594 16411. The Headpond consists of a body of water, two Embankments, a Headpond inlet / outlet structure, which will be embedded into the hillside, a spillway, Access Tracks for construction, operation and maintenance and a temporary Construction Compound. A Switching Station is proposed to the north east of the Headpond, in addition to a tunnel portal and PC15. Three additional small permanent Compounds are proposed to the north west of the Headpond (PC17, PC18 and PC19). There is no fencing proposed around the Headpond.

## 2.4.1 Headpond Waterbody

The Headpond is designed to hold approximately 59.6 million meters cubed ($Mm^3$) of water with approximately 53.4 $Mm^3$ of it being used as the working volume during operation. *Figure 2.5 Headpond – Indicative Arrangement (Volume 3 Figures)* provides a general arrangement of the Headpond.

The working bottom water level (BWL) will be 374 m AOD, and the working top water level (TWL) will be 420 m AOD. The water levels can be viewed on *Figure 2.6 Headpond Cross Sections (Volume 3 Figures).*

## 2.4.2 Embankments

Two Embankments will retain the Headpond waterbody: Embankment 1, which is the largest of the two Embankment structures and will be located to the western side of the waterbody, and Embankment 2, which is the smaller of the two Embankment structures and will be located to the north-eastern side of the waterbody.

The Embankments can be viewed on *Figure 2.6: Headpond Cross-Sections and Figure 2.7: Headpond Embankments (Volume 3 Figures).*

The Embankments will be a built-up earth and / or rockfill structure.

### 2.4.2.1 Embankment 1

Embankment 1 will be up to 1,635 m long, approximately 482 m wide and approximately 95 m high. It will have a maximum top bank level of 425 m AOD, providing a minimum 5 m freeboard from the TWL of 420 m AOD.

The crest of the Embankment will typically be a maximum of 10 m wide and will include a 5 m wide Access Track with low kerb on the external side. Details of the Embankment can be viewed on *Figure 2.6 Headpond Cross Section (Volume 3 Figures*), *Figure 2.7: Headpond Embankments and Figure 2.8: Headpond Borrow Pit (Volume 3 Figures.*

The inner slope of the Embankment will be approximately 1 in 2.5 (V:H) and the external slope will be 1 in 2.5 (V:H) with 5 m horizontal benches at 10 m vertical increments. The external slope will be finished with soil and turf.

The inner slopes of the Embankment will be lined, however, the rest of the Headpond will not be lined. The lining will be a waterproof system that would be either an asphalt or concrete lining (or equivalent).

### 2.4.2.2 Embankment 2

Embankment 2 will be up to 279m long, approximately 85 m wide and approximately 13 m high. It will have a maximum top bank level of 425 m AOD providing a minimum 5 m freeboard from the TWL of 420 m AOD.

The crest of the Embankment will typically be a maximum of 10 m wide. There will be no Access Track along the top of Embankment 2. Details of the Embankment can be viewed on *Figure 2.6 Headpond Cross Section (Volume 3 Figures*), *Figure 2.7: Headpond Embankments and Figure 2.8: Headpond Borrow Pit (Volume 3 Figures).*

The inner slope of the Embankment will be approximately 1 in 2.5 (V:H) and the external slope will be 1 in 2.5 (V:H). The external slope will be finished with soil and turf.

The inner slopes of the Embankment will be lined. However, as stated in paragraph 2.4.2.1, the rest of the Headpond will not be lined. The lining will be a waterproof system that would be either an asphalt or concrete lining (or equivalent).

### 2.4.3 Headpond Inlet / Outlet Structure

The Headpond inlet / outlet structure is where the Waterways exit the Headpond through the headrace. The structure will predominantly sit within the base of the Headpond at existing ground level directly behind the main Embankment as shown on *Figure 2.9: Indicative Headpond Inlet / Outlet Structure (Volume 3 Figures).*

This structure will incorporate the inlet / outlet for the high-pressure headrace tunnel and will predominately site below the bottom water level of the Headpond. The structure will comprise a trashrack (debris screen), stoplog (to control water level / discharge), deck area with parapet wall around the deck with a manhole for maintenance. The structure will be approximately 90 m in length, 20 m in height and 30 m wide, at its widest point. Rock armour will be located either side of the trashrack behind the deck.

The related mechanical equipment for operating the scour valve along with the gates will be housed within a timber clad frame on top of the Embankment, which will be a maximum of 10 m tall, 25 m wide and 35 m long. This building will also denote the subsurface location of the Headpond inlet / outlet structure as shown on *Figure 2.9: Indicative Headpond Inlet / Outlet Structure (Volume 3 Figures).*

### 2.4.4 Borrow Pit

The Headpond will include one borrow pit (BP01) within its footprint. This borrow pit is required to excavate the required material for the construction of the Headpond Embankments and compounds and reduce the reliance on delivery of additional material to site. BP01 could yield approximately 9,600,000 m³ of stone. The borrow pit floor measures approximately 825 m x 445 m and has a maximum cut height of 37 m.

## 2.5 Description of the Waterways

The Waterways create a connection between the Tailpond and the Headpond. The Waterways comprise of the high-pressure tunnel, low-pressure tunnel, the spillway, the scour pipe and the surge shafts. This is shown on *Figure 2.10: Waterways and Tunnels Section (Volume 3 Figures).*

### 2.5.1 High and Low Pressure Tunnels

The high-pressure tunnel, also known as the headrace, connects the Headpond inlet / outlet to the pump turbines within the Power Cavern Complex, and is controlled via the main inlet valve (MIV) located within the Power Cavern Complex. This tunnel will be approximately 670 m in length.

The high-pressure tunnel will have a maximum internal diameter of up to 13 m and will be lined with reinforced shotcrete. The specification of lining and stabilisation will depend on the underlying geology. This will be confirmed during further site investigation to be undertaken post-consent.

The low-pressure tunnel, also known as the tailrace, connects the pump turbines within the Power Cavern Complex to the outlet / inlet in the Tailpond. This tunnel will be approximately 2.3 km in length. The low-pressure tunnel will have a maximum internal diameter of up to 13 m. The low-pressure tunnel may also be lined in a similar manner to the high-pressure tunnel and is subject to further site investigation.

### 2.5.2 Spillway and Scour Pipes

Adjacent to the Headpond inlet / outlet are the spillway and scour pipes. At the top of Embankment 1, the spillway is used to drain any excess water from the Headpond. The spillway is approximately 580 m long and drains into an unnamed river that drains into Allt Beochlich.

Within the trench at the bottom of the Headpond will be the scour pipe. This pipe joins the spillway within a chamber below the Headpond. Along with the spillway, the scour is used for the scouring and draining down of the Headpond.

The spillway inlet will be situated above the top water level of the Headpond with a 0.5 m freeboard.

### 2.5.3 Surge Shafts

Surge shafts are associated with the high-pressure and low-pressure tunnels and will be located along the Waterways to contain pressure fluctuations within the hydraulic system. The low-pressure tunnel surge shaft will be underground. The high-pressure tunnel surge shaft will be underground and will extend to ground level.t The top of the surge shaft will be covered by a steel grate and contained within a permanent compound (PC18) cut into the hillside and fenced.

## 2.6 Fencing

Fencing will be required across the Development. It will be restricted to all permanent compounds and is assumed to be palisade fencing up to 2.4 m in height.

## 2.7 Switching Station

There will be high voltage Switching Station within the Development located within the footprint of PC15 at central NN 05087 17754. This will be approximately 225 m in length and 100 m in width and may have equipment up to 14 m in height. The Switching Station is a switchyard that is partly the responsibility of the grid operator (SSEN Transmission) and partly the responsibility of the scheme developer and so the switchyard is divided into two sections of roughly equal area separated by a common boundary. The two parties own and operate their sections of the switchyard (with associated equipment), separately from the other party. The two areas will be fenced off from one another and have separate and private accesses.

In addition to the switchgear, there will be parking, welfare and offices located within both sides of the Switching Station.

## 2.8 Description of the Power Cavern

The Power Cavern Complex is the main underground component of the Development, split into three sections:

1. Powerhouse (contains the combined pump / turbines),
2. Transformer cavern (contains the transformers), and
3. MIV cavern (contains the MIV), connected by galleries.

Refer to *Figure 2.11: Cross-section of the Development,* with and indicative arrangement shown on *Figure 2.12: Indicative Power Cavern Section (Volume 3 Figures).*

The Power Cavern Complex is located approximately 460 m below ground level. There is a ventilation tunnel from the cavern, the ventilation shaft does not have a tunnel portal but does comes to ground level. At ground level the shafts will be housed in a permanent compound (PC 19) and cordoned off by adequate safety measures.

The precise arrangement of the Power Cavern Complex will be subject to detailed design.

### 2.8.1 Powerhouse

The powerhouse will be the largest section of the Power Cavern Complex, measuring approximately 200 m long, 25 m wide and 50 m high, and will contain the pumphouse, generator, switchgear, compressors, gantry crane, cable gallery, offices, and the control room. The powerhouse can be accessed via the Access Tunnel portal (tunnel portal 2).

### 2.8.2 Transformer Cavern

The transformer cavern will be approximately 70 m from the powerhouse and will be approximately 200 m long, 20 m wide and 35 m tall. The transformers will be housed within the transformer cavern, along with a gantry crane and the draft tube gate. The transformer cavern can be accessed via the power tunnel portal (tunnel portal 3).

### 2.8.3 Main Inlet Valve Cavern

The main inlet valve cavern is the smallest section of the Power Cavern Complex, measuring approximately 200 m long, 15 m wide and 15 m high and will contain the gantry crane, sump and main inlet valve with counterweight.

# 2.9 Description of the Access Tunnels

The Access Tunnels comprise of the construction and emergency egress tunnel, Access Tunnel, power cable tunnel and vent tunnel. The indicative routes and sections of the construction and emergency egress tunnel and Access Tunnel can be viewed on *Figure 2.13: Access and Construction Tunnel Section (Volume 3 Figures).*

## 2.9.1 Construction and Emergency Egress Tunnel

The construction and emergency egress tunnel will be approximately 2.2 km long, 5 m wide and 5 m high as shown on *Figure 2.13: Access and Construction Tunnel Section (Volume 3 Figures*). It is accessed via tunnel portal 1 within PC05 and provides access to / from the Power Cavern Complex.

Post-construction, the construction and emergency egress tunnel will also be utilised for the operational phase for maintenance, plant/equipment movements and an emergency exit.

## 2.9.2 Access Tunnel

The Access Tunnel will be approximately 2.4 km long, 9 m wide and 10.5 m high as shown on *Figure 2.13: Access and Construction Tunnel Section (Volume 3 Figures).* It provides access to the Power Cavern Complex via tunnel portal 2 within PC06.

It will be used for both the construction and operation phases and therefore is a permanent feature of the Development. During operation, the Access Tunnel will be utilised for operational workers travelling to the Power Cavern Complex.

## 2.9.3 Power Cable Tunnel

The power cable tunnel will be approximately 3.2 km in length, 10 m wide and 13 m high as shown on *Figure 2.14: Power Tunnel Section (Volume 3 Figures).* The power cable tunnel provides access to the transformer cavern via tunnel portal 3 within PC14.

## 2.9.4 Vent Tunnel

The heat and moisture environment can directly affect the operation safety of electrical equipment and the health of workers, as such a vent tunnel is required. The ventilation tunnel is approximately 240 m in length and 5 m in diameter, as shown on *Figure 2.13: Access and Construction Tunnel Section (Volume 3 Figures).* The tunnel provides ventilation into the Power Cavern Complex, via tunnel portal 2 within PC14.

# 2.10 Description of Tailpond Structures

## 2.10.1 Tailpond Inlet / Outlet Structure

The Waterways will terminate at the Tailpond inlet / outlet structure situated on the eastern bank of Loch Awe at approximately NN 00900 16200 and can be viewed on *Figure 2.15: Indicative Tailpond Inlet / Outlet Structure (Operational) (Volume 3 Figures).*

The bed of Loch Awe will be reprofiled to a new level of 18.2 m AOD. The inlet / outlet structure will be a maximum of 20 m deep (within the bank of Loch Awe) and extend approximately 80 m into Loch Awe from the lower gatehouse. The majority of the structure is either sub-surface within the bank of Loch Awe or beneath the water level of the loch as shown on *Figure 2.16: Indicative Tailpond Inlet / Outlet Cross Section (Volume 3 Figures).* The inlet / outlet structure consists of an inclined screen, stoplog and rock armour.

The inclined screen extends into Loch Awe and will be up to 150 m in width. To avoid fish and debris entrainment, the screens will be designed according to SEPA best practice guidance. The screen also acts and an energy dissipation measure to reduce the velocity of the water discharging from the Development. The screen is protected on each side by rock armour and is covered over its entire width by the roof of the Tailpond inlet / outlet structure. There will be a removable safety handrail on the edge of the inlet / outlet structure at Loch Awe's water's edge.

During operation, when the Development is pumping water up to the Headpond, water passes through the screen into the low-pressure tailrace tunnel, which connects to the lower gate shaft below the lower gatehouse.

The water levels within Loch Awe are variable, but on average there is approximately 1 m of freeboard between the removable roof of the Tailpond inlet / outlet structure and the top water level of Loch Awe. Due to design / position of the roof and the inclined slope of the screen, the screen will not be visible.

There are two gatehouses along with a permanent plant and equipment storage area, car parking and permanent office and welfare facilities, which will be surrounded by security fencing to the east of the Tailpond inlet / outlet structure. The gatehouses will contain the mechanical equipment for operating the gate within the low-pressure tailrace tunnel. The gatehouse will be 5 m in height (above ground level), 8 m wide and 8 m long and will be clad in natural wood or a suitable finish to be agreed with Argyle and Bute Council.

The B840 existing road will be temporarily diverted during construction to allow for the construction of the Tailpond inlet / outlet structure which will sit below the road once reinstated. More information on the Temporary B840 Realignment can be found in *Section 2.13.2: Temporary B840 Realignment*.

Areas of permanent landscaped hardstanding and planting are incorporated into the design within the area of the Tailpond inlet / outlet structure.

### 2.10.2 Temporary Cofferdam in Loch Awe

A temporary cofferdam will be built out into Loch Awe up to 170 m from the shoreline and 270 m in width around the location of the Tailpond inlet / outlet structure. The exact type of cofferdam will be determined at a later design stage. A temporary silt curtain will be installed around the cofferdam for the duration of any works in the Loch Awe.

The cofferdam is a temporary structure that will be removed at the end of the construction phase of the Development, as will the silt curtain. This can be viewed on *Figure 2.17: Indicative Tailpond Inlet / Outlet Structure (Construction) (Volume 3 Figures).*

## 2.11 Description of Inveraray Temporary Marine Facility

A temporary Marine Facility will be required within Loch Fyne to allow for the delivery of large AILs. The Marine Facility will be located at NN 08510 07158 with the start of a jetty will adjacent to the A83, with the middle of the jetty at NN 08581 07089. The Marine Facility will take circa 12 months to construct, with the vibro-driven piles (or hammer where vibro-piles not feasible) installed from a jack-up barge. No dredging will be required for construction of the Marine Facility .

The Marine Facility will comprise 600 mm (D) piles in a 5 m x 5 m arrangement on a 600 mm deep pre-fabricated steel bridge deck, which will be 180 m long and 10 m wide.

The Marine Facility has been designed to accommodate the following vessel types:

- Deck Cargo Barge - 50 m x 14 m with a 2 m draft - deck load 6 t/m$^2$, deadweight tonnage 1,300 tonnes. Only for use during mean tide and above.
- Vessel - based crane - floating sheerleg. 45.1 m x 20.1 m with a 1.6 m draft, 400 tonne lift capacity.

The jetty is proposed to be accessed from a deep water load out quay, such as King George V Dock in Glasgow.

The Marine Facility is designed to be temporary for delivery of AILs and will be removed after delivery of the last AIL. For the purposes of the assessment, we assume the worst-case time-period is the entire construction period.

At the end of construction, the Marine Facility will be removed, however the piles will remain in-situ. The piles will remain in place should the pier be required for replacement components during the PSH's lifetime. *Figure 2.18: Indicative Temporary Marine Facility (Volume 3 Figures)* shows the indicative layout and composition of the proposed Marine Facility .

## 2.12 Description of the Compounds

There will be both temporary and permanent Compounds required for the Development. Temporary Compounds will be required to facilitate the construction of the Development, as shown on *Figure 2.3: Above Ground Infrastructure (Volume 3 Figures).*

The compounds are anticipated to be unsealed (stone, aggregate or gravel surface) in nature and will be either floated (over peat) or built into the hillside depending on the site conditions and anticipated loads.

## 2.12.1 Temporary Compounds During Construction Phase

Eleven temporary Compounds are anticipated to be required for the construction period. The proposed location, use and approximated size of each of the compounds are detailed in *Table 2.3: Proposed Construction Compound Location and Size*, below. TC08 is representative of compounds that will be used during construction and the outline design follows design guidance. Its indicative arrangement is shown on *Figure 2.19: Compound TC08 Indicative Layout Construction Phase (Volume 3 Figures).*

**Table 2.3: Proposed Construction Compound Location and Size**

| Compound No. | Use | Approximate Location | Approximate Max Size of Working Area ($m^2$) |
|---|---|---|---|
| TC01 | Temp. Construction Compound<br>Material storage, plant and equipment | NN 01083 16691 | 5,460 |
| TC02 | Temp. Construction Compound<br>Material storage, plant and equipment | NN 01006 16188 | 50,460 |
| TC04 | Temp. Construction Compound<br>Material storage, plant and equipment | NN 01142 15953 | 10,940 |
| TC07 | Temp. Construction Compound<br>Material storage, plant and equipment | NN 02877 15461 | 4,000 |
| TC08 | Temp. Construction Compound<br>Material storage, plant and equipment, site offices and welfare, car parking and SuDS | NN 03314 15882 | 7,500 |
| TC10 | Temp. Construction Compound<br>Material storage, plant and equipment | NN 04156 15386 | 5,000 |
| TC11 | Temp. Construction Compound<br>Material storage, plant and equipment | NN 05365 16728 | 5,400 |
| TC12 | Temp. laydown area for construction/upgrade of access | NN 06567 19357 | 9,800 |
| TC16 | Temp. Construction Compound<br>Material storage, plant and equipment | NN 04020 16488 | 10,000 |
| TC22 | Temp. laydown area for construction/upgrade of access | NN 08801 08464 | 4,000 |
| TC23 | Temp. laydown area for vehicle turning and loading. Welfare Facilities. | NN 08452 07151 | 3,025 |

*Note: The size is in relation to the boundary of each compound and not in relation to the size of any hardstanding areas.*

## 2.12.2 Permanent Compounds

Following the completion of the construction period, all temporary Compounds will be removed and the ground fully reinstated.

Eleven permanent Compounds are required to remain for the lifespan of the Development. These are detailed in *Table 2.4: Proposed Permanent Compound Location and Size*, below. PC03 is representative of a permanent compound that will be used during operational phase of the Development. The outline design shows an indicative arrangement on *Figure 2.15: Indicative Tailpond Inlet / Outlet Structure (Operational) (Volume 3 Figures).*

**Table 2.4: Proposed Permanent Compound Location and Size**

| Compound No. | Usage | Approximate Location | Approximate Max Size of Working Area ($m^2$) |
|---|---|---|---|
| PC03 | Lower gate houses, permanent welfare, parking, stores, site office and landscaping. | NN 00982 16225 | 5,010 |
| PC05 | Tunnel portal 1 compound | NN 01191 15804 | 3,900 |
| PC06 | Tunnel portal 2 compound | NN 01476 15601 | 5,000 |

| Compound No. | Usage | Approximate Location | Approximate Max Size of Working Area ($m^2$) |
|---|---|---|---|
| PC09 | Permanent compound housing flow control building | NN 03816 15871 | 5,520 |
| PC14 | Tunnel portal 3 compound | NN 04904 17954 | 7,880 |
| PC15 | Switching Station | NN 05079 17758 | 22,500 |
| PC17 | Upper Gate House compound | NN 03809 16644 | 2,450 |
| PC18 | Surge shaft compound | NN 03678 16748 | 1,250 |
| PC19 | Ventilation shaft compound | NN 03646 16875 | 1,250 |
| PC20 | Ventilation shaft compound | NN 02855 15912 | 750 |
| PC21 | Ventilation shaft compound | NN 02503 16299 | 1,250 |

# 2.13 Description of the Permanent and Temporary Access

## 2.13.1 Development Site Access

Site access is proposed off the A819, which links the strategic trunk roads A85 to the north at Dalmally and A83 to the south at Inveraray. It is anticipated the general construction access will come from the north and south along the A819. Construction access from the south will bypass Inveraray via a section of unclassified existing track (to be upgraded) north of Inveraray Castle which will connect the A83 to the A819. This access uses the existing Maltlands bridge, however there may be a need for a temporary bridge constructed adjacent to this bridge should the existing bridge not be deemed suitable following detailed structural surveys. At this point, it has been assumed that the existing bridge will be suitable for construction traffic.

Larger construction traffic, such as AILs, will be delivered by boat to the proposed Marine Facility, where they would be transported to site via the A819. Access to the A819 will be via an upgraded existing Access Track that runs to the north, then east, from the A83, around the north of Inveraray. There are proposed upgrades to the existing unclassified road “Upper Avenue” at Inveraray and a new track linking this to the A83 at the proposed Marine Facility location.

These roads can be viewed on *Figure 1.1: Location Plan (Volume 3 Figures).* Local improvements may be required along these routes, such as local widening, and additional passing places, this is outlined in more detail in *Chapter 14: Access, Traffic and Transport.*

## 2.13.2 Temporary B840 Realignment

A section of the B840 is located at the Tailpond inlet / outlet structure at Loch Awe. A temporary realigned route for the B840 has been proposed and can be viewed on *Figure 2.20: B840 Temporary Realignment - Indicative Arrangement (Volume 3 Figures).*

The realigned section of the B840 will be located to the east of the existing alignment and will start from Balliemeanoch Farm at approximately NN 01131 16598 and route southwards before rejoining to the north of the bridge over Allt Boechlich at approximately NN 00581 15357. The temporary realigned portion of road will, for approximately half its length, utilise an existing farm track which will be upgraded, and will be approximately 1.45 km in length and 5 m wide.

Access along the B840 will be maintained at all times with the temporary section constructed prior to closure of the existing road section. Post-construction, the B840 will be reinstated to its former route and the new sections of the road, which are not currently part of the existing farm track, removed and the ground reinstated to its former use. The upgraded existing farm track section will remain permanently.

## 2.13.3 Permanent Access Tracks

Access into the site will be off the A819 at approximately NN 10060 19965 into Keppochan Forest to the proposed Switching Station as shown on *Figure 2.3: Above Ground Infrastructure (Volume 3 Figures).* The alignment will follow existing forestry access which will be upgraded to 10 m wide, plus 0.7 m for swales and 4 m peat / topsoil

mounds requiring a total working width of approximately 15 m. Sections of new Access Track will be required to join the existing forestry tracks within the plantation. New sections will be either excavated or floating depending on ground conditions. These are shown on *Figure 2.21: Excavated Access Track Typical Detail and Figure 2.22: Floating & Widening Access Track Typical Details (Volume 3 Figures).*

From the Switching Station, the Access Track is routed south around the eastern side of the Headpond before routing west past Embankment 1 to the farmers track / Temporary B840 Realignment. There will also be a permanent Access Track along the top of the Headpond and connecting to three permanent Compounds (PC17, PC18, and PC19), in addition to another branch off to two permanent Compounds (PC 20 and PC21), west of the Headpond.

## 2.13.4 Temporary Access Tracks

Four sections of temporary Access Tracks will be required during construction as shown on *Figure 2.3 Above Ground Infrastructure (Volume 3 Figures).* The temporary Access Tracks are as follows:

- From the existing B840 to the Compound at tunnel portal 1 to allow for construction traffic to access the Tailpond inlet / outlet working area. The temporary Access rack is required to restrict impact on public traffic along the B840 diversion.
- From the proposed Switching Station into the Headpond to access the proposed temporary Compound within the Headpond (TC16). The Access Track within the Headpond will be left in-situ for access to the inlet / outlet structure.
- Branches off the section above and is routed around the northern side of the proposed Headpond to the proposed permanent access along the western Embankment and permanent Compounds.
- From the temporary Marine Facility to Upper Avenue to allow for movement of vehicles transporting AILs from the Marine Facility to the main site.

The construction corridor required for temporary Access Tracks will be a maximum of 30 m to allow for two-way vehicular traffic, drainage and peat mounds.

The temporary Access Tracks will typically be unsealed in nature and will be removed following the completion of the construction phase.

Tree protection measures, dust screens and fencing to separate working areas from trees will be implemented along the temporary Access Track within the Ancient Woodland Inventory (AWI) listed woodland area.

## 2.13.5 Public Road Crossing

During construction, the Temporary B840 Realignment will be crossed by a temporary Access Track at approximately NN 00948 15655 (the “Crossing”). During the construction phase, it is intended that the Crossing will consist of semi-permanent traffic two-way signalling system given the duration of construction. The Crossing will be a conventional crossroads that will cross the public road where grade and visibility is optimal to reduce the impact on the public roads as far as practicable. The crossroads will have temporary signage and line markings warning drivers of road layout ahead. Priority will be given to the public road users.

The Crossing will be removed following the end of the construction phase when the temporary Access Track and Temporary B840 Realignment are removed and B840 reinstated to its former alignment.

## 2.13.6 Public Paths

To maintain public safety during the construction phase, temporary safety signage will be required. Core paths and forestry paths will largely remain open and accessible to all users during construction. To maintain public health and safety, diversions to certain forestry paths, such as the SA128, may be necessary. It is not expected that diversions to recreation routes will be required during operation.

A full description of the local path network within the Development Site and the surrounding area is provided within *Chapter 16: Socio-Economics and Tourism* and can be viewed within the *Appendix 16.1: Outline Access Management Plan (Volume 5 Appendices).*

# 2.14 Grid Connection

The grid connection route is anticipated to be to Creag Dhubh substation, which is located to the north-east of the Development Site. Within the Development Site, the high voltage (HV) cable will be routed from the underground transformer gallery, through the power tunnel to PC15, from here the cable will be undergrounded to the Switching Station.

The exact route of the grid connection from the Development Site to Creag Dhubh is currently unconfirmed, the connection may be via an underground cable however for the purposes of the assessment it has been assessed on a "worst case" scenario that it will be via an overhead line. The grid connection location at Creag Dhubh is at NN08739 19509, approximately 4.0 km north-east of the Development Site.

A grid connection agreement has been accepted for Development between the Applicant and SSEN. The grid connection will be subject to its own separate consents under the Act and does not form part of this S36 Application.

# 2.15 Construction Programme

The lifespan of the Development has been broken into four distinct phases:

1. Pre-Construction – initial works that enable the construction of the Development;
2. Construction – the building and commissioning of the Development;
3. Operation – the period when the Development is active and has the potential to generate electricity; and
4. Decommissioning – the end of operational use and the removal and / or making safe of the Development.

*Sections 2.16: Pre-Construction to 2.19: Decommissioning* set out the different phases of the Development and the works required by each component part.

A more detailed construction methodology will be produced by the Construction Contractor for the Development post-consent.

## 2.15.1 Timescales

Construction is expected to last up to 7 years, including the pre-construction works. The construction work is anticipated to peak within years 2 and 3 as the tunnelling construction and the Headpond construction are the two largest operations, and they are likely to be sequenced in parallel. It is expected that the tunnelling work will be a 24-hour operation. *Table 2.5: Indicative Construction Programme* below shows an indicative programme of the construction phase.

## Table 2.5: Indicative Construction Programme

| | | | Year 1 | | | | Year 2 | | | | Year 3 | | | | Year 4 | | | | Year 5 | | | | Year 6 | | | | Year 7 | | | | Y8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase** | **Activity** | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 |
| Enabling Works | Existing Access Improvements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pre-Construction | Safety and Security Measures | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Construction Compound Set Up (Permanent and Temporary) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Borrow Pit and Associated Access | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Marine Facility | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction | Access Track Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Headpond | Embankment Lining | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Embankment 1 Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Embankment 2 Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Spillway Construction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Headpond Inlet / Outlet Works | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Tailpond | Temporary B840 Realignment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Temporary Works (in Loch Awe) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Inlet / Outlet Works and Gate House | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Rock Excavation and Armouring | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Removal of Temporary Works | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Tunnels | Access to Tunnel Portals | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Construction of Tunnel Portals | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Construction Tunnel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Emergency Egress & Access Tunnel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Power Tunnel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Ventilation Tunnel | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Waterways | Headrace Tunnel (Low Pressure) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Headrace Tunnel (High Pressure) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Surge Shaft | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Switching Station | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Power Cavern | Excavation, Lining and Support | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Power House Buildings | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Mechanical and Electrical | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Commissioning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

# 2.16 Pre-Construction

The pre-construction phase incorporates:

- Site clearance;
- Borrow pits;
- Compound set up;
- Construction of the permanent Access Tracks;
- Construction of the temporary Access Tracks;
- Sustainable drainage systems;
- Public path diversions; and
- Construction of the Marine Facility.

## 2.16.1 Site Clearance

Prior to the commencement of works, vegetation will be cleared including tree felling where necessary. Trees will be retained wherever possible. To facilitate this, the Development Site will be surveyed to determine the extent of forestry removal.

Tree felling will be conducted in accordance with the measures outlined in *Appendix 5.5 Forestry (Volume 5 Appendices*) with the timber removed from the Development Site. Some temporary timber storage will be required, and this will be located within the Construction Compounds. The tree stumps will then be removed and shredded on-site along with any remaining brash wood. This processed material will also be removed from the Development Site.

Further details on felling and timber management are available within *Appendix 5.5 Forestry (Volume 5 Appendices*).

Once trees and other vegetation are removed, soil will be excavated in a sequential manner. Turves, topsoil and subsoil will be excavated as required and stored individually. Stockpiles of soil will be compacted and sealed as far as practicably possible.

## 2.16.2 Borrow Pit

One borrow pit will be created within the Headpond to win material and minimise the requirement to import material at the start of construction. Material from the borrow pit is anticipated to be used for the construction of the Headpond Embankments and Construction Compounds . Access to the borrow pit will be via the new Access Track from the A819. Refer to *Section 2.4.4: Borrow Pit* for further details on the borrow pit.

## 2.16.3 Compound Set Up

The vegetation and topsoil that has been excavated will be temporarily stored nearby so that it can be reused to dress off the Construction Compounds areas post-construction. The Construction Compounds will be constructed with material from the borrow pit, which is located within the Headpond.

## 2.16.4 Construction of Permanent and Temporary Access, including Temporary B840 Realignment

The construction method to be used for the permanent and temporary Access Tracks and the Temporary B840 Realignment will be similar. Once the required areas are cleared, the routes of the permanent and temporary Access Tracks, and the Temporary B840 Realignment, will be marked out and the ground prepared. Drainage will be installed along the full length of the Access Tracks before stone is placed and covered with a base and wearing course. The temporary and permanent Access Tracks will be left unsealed during construction while the B840 will be surfaced as per its current condition.

Temporary and permanent Access Tracks will require a construction corridor between 30 m and 50 m.

There is the potential for sections of the permanent Access Tracks to be floated over peaty hollows. *Figure 2.3: Above Ground Infrastructure (Volume 3 Figures*) indicates the extend of sections for floating tracks, however, the exact requirement for floated sections and their detailed extent will be determined during site investigations to be undertaken post-consent.

The majority of the material for the Access Tracks is anticipated to be generated within the Development Site. This will be from the borrow pit within the Headpond in the first instance. There may be a need for materials to be sourced or imported from a nearby quarry depending on the finalised construction programme determined by the Construction Contractor – this is considered unlikely but local quarries have been identified to aid the Construction in *Chapter 14: Access, Traffic & Transportation*.

Should ancillary temporary tracks be required, those not already established or those requiring upgrading will be made up of bog mats or trackway systems. These alternate road construction materials will be employed where the ground may be saturated.

## 2.16.5 Sustainable Drainage Systems (SuDS)

During the pre-construction phase, much of the on-site SuDS will be implemented. This is anticipated to include, but is not limited to:

- SuDS ponds/settlement lagoons;
- Temporary ditches;
- Silt fences;
- Silt busters;
- Dewatering / sediment bags;
- Silt curtains; and
- Designated bunded fuelling areas.

There will be SuDS along all of the Access Tracks including downslope silt fences and temporary ditches.

Further details on extent, positions, size and filtration methods that will be used are available within *Appendix 3.1: Outline CEMP (Volume 5 Appendices)*.

## 2.16.6 Public Path Diversions

During the pre-construction works, the temporary diversions for the following core paths will be implemented:

- C200(a) - Coille Bhraghad-Queens Drive-Inveraray (Upper Avenue, connects to C203(a)).
- C203(a) - Bealach an Fhuarain, Inveraray (circular).
- C201 - Dun Na Cuaiche, Inveraray (crosses access around castle).

The proposed diversion routes for these paths are available to view in *Appendix 16.1: Outline Access Management Plan (Volume 5 Appendices).*

The path diversions will be constructed using material sourced from the on-site borrow pit.

## 2.16.7 Construction of the Marine Facility

The Marine Facility will be a fixed structure comprising decks supported by steel piles into the seabed. The Marine Facility will of 600 mm (D) piles in a 5 m x 5 m arrangement on a 600 mm deep prefabricated steel bridge deck, which will be 180 m long and 10 m wide.

No geotechnical information is available at this stage. However, based on the bathymetry, it is anticipated that the seabed would comprise a thin layer of marine deposits over shallow bed rock. This would require the piles to be socketed into pre-augured holes in the rockhead. Piles are anticipated to remain post-construction to allow for the reinstatement of the temporary jetty during the operation of the Development for the delivery of AILs for replacement components during any periods of maintenance and repair. However, if the piles are required to be removed, the socketed piles would need to be cut off by divers just above seabed leaving the feet in place.

The deck structure would be a prefabricated steel deck structure, forming a temporary platform that could be both installed and removed in modular sections. Steel corrosion is normally a concern for marine structures but should not be a major issue for a temporary structure. Post-delivery of the AILs, the deck will be removed, and the steel piles will remain in situ.

It is envisaged that the jetty deck would be located at a height of 3.30 m AOD. However, a full hindcasting study is required to confirm that this is the required level.

The Marine Facility will take circa 12 months to construct with the vibro-driven piles installed from a jack-up barge. No dredging will be required for the construction of the Marine Facility.

The following equipment will be required during construction:

- Fendering - required at the vessel berthing location. As the proposed structure will be temporary, it is envisaged that pneumatic Yokohama fenders will be utilised.
- Lighting - lighting columns will be required for operating in low-light conditions. These should especially be considered if the lifting operations have tidal restrictions. Column height will be determined by the lighting design but can be up to 10m tall.
- Security - to prevent members of the public from accessing the jetty, gates and fencing will be required at the shore access point.
- Welfare - welfare facilities including sanitary and canteen provision may be required for the Marine Facility. This would be located within TC23.
- Services – provisions will be required for activities on the jetty, which will require switch boxes, water mains and service ducts.
- Barriers - traffic barriers would typically be required at exposed deck edges along the roadway. These have a standard height of 600 mm. Pedestrian barriers would typically be required at all exposed edges. These have a standard height of 1,100 mm with an additional mid-height rail.
- Life Preservation and Firefighting Equipment - life preservation systems will be required on the deck at regular spacing. Regulations[2] require ladders from the waterline to deck level at regular spacing. Firefighting provision will need to be considered, with hydrants and reels located on the jetty.
- Navigational Aids – markers and lights will be required on the structures to indicate the location and hazards around the jetty. These must be visible by vessels in all weather conditions. Additional marker buoys may be required in the loch to indicate navigation hazards.

# 2.17 Construction Phase

## 2.17.1 Construction Vehicles, Plant and Equipment

The construction of the Development will require task-specific vehicles, plant and equipment in addition to general construction equipment. Equipment potentially required on-site includes, but is not limited to:

- Concrete – on site batching plant, concrete mixers, concrete pavers, concrete pumps, concrete wagons, planers;
- Cable reels and cabling equipment;
- Cranes – crawler cranes, dock cranes, gantry cranes, large cranes and winches;
- Crushers and screeners;
- Dozers, grader, pavers, road brush, rollers and sheep foot rollers;
- Drill and blast equipment and hydraulic breakers;
- Excavators, long reach excavators and tracked excavators;
- Rigs – loading rig, piling rig, sequential / impact drill rig;
- Scaffolding, formwork and mobile elevated working platforms (MEWPs);

[2] International Convention on the Safety of Life at Sea, 1974 and The Merchant Shipping (Special Measures to Enhance Maritime Safety) Regulations 2024

- Shotcrete spraying machine and rock bolter;
- Silt fence, pumps, bog mats, low ground pressure (LGP) equipment, wheel wash and dust suppression;
- Site set up equipment such as traffic lights, portable buildings, generators, toilets and temporary utilities (lighting, ventilation, power);
- Transporting equipment – articulated dump trucks, flatbeds, HGVs, hiabs, load haul dumpers, tracked dump trucks, tractors, trailers, tipper wagons, unimogs and conveyors;
- Tree felling and site clearance equipment such as harvesters, mulchers and logging wagons; and
- Vessels for loch transport such as jack-up rig, barges and tugs.

Specialised types of the plant listed above may be required for the construction of specific components of the Development and the most suitable equipment for the task will be identified.

## 2.17.2 Materials Management

One of the key design principles for the Development has been to minimise any surplus material by balancing the material that is generated from the cutting, drilling and excavation activities with the Development.

It is anticipated that materials generated from drill and blast activities associated with the tunnelling works will be transported by dump trucks, stored in temporary compounds near the location of tunnelling and transported to the Headpond. The material will be processed and sorted for re-use within the Headpond for the Embankment construction. If material cannot be re-used within the Embankments, then other uses will be sought so that only residual material will remain for appropriate disposal, if any remains.

Underground excavation may occur on a 24-hour basis once the works are sufficiently underground.

A Materials Management Appraisal (MMA) has been undertaken and is available in *Appendix 10.1: Materials Management Appraisal (Volume 5 Appendices).* The MMA aims to demonstrate that the material that is generated from construction operations is reused, as far as practically possible, within the Development. The MMA results are used to ensure that the best practical option is secured by:

- Determining the final volumes and likely nature of the rock that will be excavated from the different excavation operations; and
- Classification of the excavated rock to determine the use in the Development.

Estimated volumes have been based on the Rochdale Envelope presented in *Chapter 4: Approach to EIA* and are derived using bulking factors and consideration of the source of generation (blasting, excavation or drilling) as detailed in the MMA. The MMA provides details on the likely volumes excavated and reused in the Development.

It is estimated that 20,010,000 m³ of material will be excavated during construction. This material will primarily be used to construct the Headpond Embankments, with an excess excavated material of around 1,630,000 m³.

Although the MMA appraisal shows an excess volume, it is anticipated that there will be a negligible excess volume of material during construction as the borrow pit will be excavated on a needs-must basis during construction. While on site, should there be excess material, this will be used across the site for:

- Construction Compounds – reinstatement, dressing and bunding.
- Access tracks – resurfacing of existing surfaces on-site.
- Switching Station – use for construction of hardstanding / internal tracks.

The post-consent site investigation will more accurately inform the volume and quality of material generated from the construction of each of the Development components.

## 2.17.3 Power

Electrical power will be required on the Development for various aspects of construction. It may be possible for a temporary connection to be made to the local distribution network. A grid connection would reduce fuel consumption on the Development Site and reduce noise from on-site generators. However, it is anticipated that this will not be available across the whole Development Site and for the full duration of the construction phase. Therefore, it has been assumed that construction power will also be supplied by portable generators fuelled by natural gas or diesel.

It is assumed that most of the smaller works, not requiring the use of construction plant or machines, will use handheld petrol generators and equipment.

Management measures for the use of generators on-site will be set out within the *Appendix 3.1: Outline CEMP (Volume 5 Appendices).*

## 2.17.4 Construction Workforce

The number of construction staff on the Development Site will vary according to the construction activities being undertaken and will be confirmed by the Construction Contractor upon appointment. These will range from admin and transportation of staff to construction and machine operators. It is expected that up to 1,000 personnel will be employed on site during the construction phase at its peak. The average number of personnel working on the Development Site over the construction period will be up to 500. As this will be subject to the requirements of the Construction Contractor this estimate could change.

The welfare and other facilities required for the personnel will be located within TC08. For some critical path activities, where 24-hour working is required, it is anticipated that on-site accommodation facilities will be required for a small proportion of the workforce.

Given the rural location of the site, there are a number of options that have been considered to accommodate workers on or near the site, including potential for park and ride. As a result, this has been considered within *Chapter 16: Socio-economics, Recreation and Tourism*, and an Outline Workers Housing Strategy has been produced in *Appendix 16.2: Outline Housing Strategy (Volume 5 Appendices)*. The Applicant is committed to identifying and developing a detailed Workers' Housing Strategy at the appropriate time that will support the project's delivery, provide quality accommodation for the non-home-based workforce and maximising the socio-economic benefits for communities within Argyll and Bute.

It is considered that a range of feasible options and locations exist for the provision of workers' housing. These include either a single site or an appropriate mix of housing options and location, examples include:

1. Hybrid solution 1: small scale development of new homes at Inveraray (plus potentially other sites), small scale permanent in-migration of workers to existing settlements (limited to avoid significant impacts on housing supply for residents), use of some low season hotel capacity plus the development of temporary accommodation in a satellite settlement with shuttle bus service.
2. Hybrid solution 2: small scale development of new homes at Inveraray, small scale permanent in-migration of workers to existing settlements, location of workers in 60-minute towns in existing housing/accommodation with transport provided from a park and ride in same town. Park and ride can be used by those living there as well as those travelling in from further afield e.g. Glasgow.
3. Temporary Workers' Compound: A self-contained compound would allow all accommodation to be located on a single site or split between a number of sites. This option would allow housing to be located in close proximity to the Development, but would require additional facilities and local transport links, particularly if remote from surrounding settlements.
4. Additional Options: The use of very low capacity or vacant hotels, such as the Dalmally Hotel, or other suitable commercial buildings may provide an option for adaption into workers' housing. Visitor accommodation has been identified as having some capacity throughout the year. Further engagement with the visitor accommodation sector is required.

Further work is required post-consent to identify which specific workers' housing option is to be implemented to facilitate the construction of the Development. This will require more detailed investigation of specific options and their ability to accommodate workers and engagement with receiving communities and stakeholders to avoid adverse impacts on the local community or key industries, such as tourism.

## 2.17.5 Headpond Construction

The design of the Headpond means that the excavation of the Headpond and the construction of the Embankment can be sequenced together. Where possible, material excavated from the Headpond will be used to construct the Embankment. The excavated material will be supplemented by the material generated from the tunnelling activities, which will be transported to the Headpond area via dump trucks. Due to the size of the excavation and the material anticipated to be handled, the Headpond works will be constructed under the Quarries Regulations 1999 and Explosives Regulations 2014 (as amended).

The following is an indicative methodology for the construction of the Headpond and Embankments. After the pre-construction works, the Headpond area will be split into sections. The southern end of the Headpond has some of the deepest areas of cut, and it is anticipated that this area could be excavated first to generate material for the start of the Embankments. Once the first section is complete, the next section will be started so that the construction sequence is rolling until the Embankments are completed.

Some areas of hard rock are anticipated to be encountered during the excavation of the Headpond. If conventional rippers and hydraulic breakers are not effective, blasting may be implemented. The amount and rate of blasting will be informed by detailed site investigation.

At the base of the Embankments, a drainage blanket of geosynthetic or geocomposite material will be laid. Embankment fill will be placed atop the drainage blanket and rolled in accordance with the Embankment design. The Embankment fill will be made up of compacted rock and soil generated through excavation and tunnelling activities. Temporary stockpiles of excavated and tunnelled material will be processed in order to separate the different types of material. Crushers and screens will be used to screen, sort / grade, and seal, if applicable, material ready to be used as Embankment fill.

As the construction of the Embankments progresses, the outside of the Embankments will be dressed off with topsoil that was generated during excavation. This material will have a higher organic content than the makeup of the Embankments so is anticipated to regenerate faster.

Material that is unable to be used in the Headpond Embankments construction will be transported compounds to be used for reinstatement, dressing and bunding of compounds, or for the Switching Station construction.

Should lining be required within the Headpond it will require grading and rolling / compacting of the selected waterproof lining system. During the lining works, any water collected from precipitation will need to be pumped out of the Headpond to appropriately sized settlement lagoons located nearby.

The crest of the main Headpond Embankment will consist of features such as Access Tracks, walls and drains as shown on *Figure 2.6 Headpond Cross Section (Volume 3 Figures*), *Figure 2.7: Headpond Embankments and Figure 2.8: Headpond Borrow Pit (Volume 3 Figures).* These will be constructed once the works inside the Headpond are complete.

## 2.17.6 Tailpond Construction

Whilst the Tailpond will be Loch Awe, works in and around the loch will be required as set out in the following sections.

### 2.17.6.1 Temporary Works

Works at the Tailpond will be initiated with the installation of the temporary infrastructure. This includes a temporary silt curtain and the temporary cofferdam. The silt curtain will be installed prior to works commencing on the cofferdam.

Irrespective of the type of cofferdam selected by the Construction Contractor, construction will require sheet piles and / or rock armour. A piling rig may be required for installing sheet piles which is likely to take the form of a jack-up barge, manoeuvred into place by a tugboat.

The method of supporting the cofferdam will be dependent on the type of cofferdam selected. However, it is considered likely that it will require bracing or infilling. These works will involve further activity of vessels, such as tugs and barges on the loch as well as activity on the shoreline to transfer materials from TC02 to the cofferdam.

The area within the completed cofferdam will be dewatered to facilitate drill and blast activities for the construction of the low-pressure tunnel. Any water collected from precipitation will be pumped out of the area while the cofferdam is in place.

### 2.17.6.2 Construction of the Tailpond Inlet / Outlet Structure

The Tailpond inlet / outlet structure will commence once tunnelling of the tailrace has reached the Headpond. This is to enable excavated material to continue to be delivered to the Tailpond inlet / outlet structure and transported to the Headpond via dump trucks. The inlet / outlet is likely to be a piled structure, supporting a structured steel frame, within which the screen is installed. Rock armour will be placed either side of the frame. The shoreline around the Tailpond inlet / outlet structure will be landscaped and the loch bed on the approach will be re-profiled. Once there is no access requirement for the tailrace tunnel portal, the roof of the Tailpond inlet / outlet structure will be installed.

### 2.17.6.3 Removal of the Temporary Works

Once the works at the Tailpond are complete, the cofferdam will be removed. The same plant and equipment that was used during the cofferdam installation will be used during the removal works. Some localised dredging and further demobilisation work may be required following removal of the cofferdam to remove any material that has built up around the piles.

## 2.17.7 Access Tunnel Construction

The Access Tunnel portals and Access Tunnels will be one of the first components to start being constructed. The starting point for the construction tunnel will be from PC05, with the Access Tunnel from PC06 and the power cable tunnel from PC14. The construction method for Access Tunnels is anticipated to be by a conventional drill and blast method.

Excavation using the drill and blast method is sequential in nature and a more flexible tunnelling method than that of a Tunnel Boring Machine (TBM). The geology along the route of the tunnels is currently unknown and would require further site investigation works to determine the rock types in more detail.

Prior to the tunnelling works, the tunnel portal areas will be excavated and prepared for the drilling equipment. This operation will involve localised breaking, excavating and rock stabilisation.

It is anticipated that the underground tunnelling could be a 24-hour operation. The anticipated blast cycle could be up to two blasts per 24 hours.

## 2.17.8 Waterways Construction

The Waterway is divided into two main parts, the high-pressure and the low-pressure sections. These sections are often the most complex to construct, due to restricted working space and restricted access. The entire Waterway will be lined with concrete with the higher-pressure section also likely lined with steel. The steel sections will consist of a steel collar that will be fabricated off site and then transported to site where it will be welded. A cross section of the subterranean features can be seen in *Figure 2.11: Cross-section of Development (Volume 3 Figures).*

All Waterway tunnels will be excavated using a drill and blast method. Prior to the commencement of tunnelling, the tunnel portal areas will be excavated and prepared to provide a suitable surface for drill and blast to take place.

### 2.17.8.1 High-Pressure Shaft

The high-pressure shaft is the vertical component of the scheme and connects the low-pressure and high-pressure sections of the headrace. It will be exposed to existing ground level at 451 m AOD and will act as the upper surge shaft. It is expected that the shaft will either be constructed by a raising bore drill (RBD) / shaft boring machine (SBM) or by drill and blast. This will be confirmed at a later design stage. The material that is generated from these operations will be transported to the Embankment site at the Headpond.

RBD involves setting up a drilling rig above the shaft (PC18). From here, a pilot hole will be drilled down the length of the shaft until it reaches the excavation made for the high-pressure tunnel. At this point the drill will change heads and utilise a reamer head. The reamer head will be rotated and pulled back up towards the drilling unit, generating the larger shaft. Fill generated from the drill will be deposited at the bottom of the pressure shaft. As the reamer head moves up, this fill will then be transported to the top of the Headpond to be used as fill for the Embankments. Following the completion of the drilling, the shaft will then be reinforced with shotcrete and concrete, with lower-pressure and higher-pressure sections of the shaft being reinforced with steel. Following construction, PC19 will secure the top of the surge shaft.

### 2.17.8.2 Lower Surge Shaft

Unlike the high-pressure shaft, the lower surge shaft does not extend to the surface, as such it will be excavated using a drill and blast method. It will be built adjacent to the Power Cavern Complex within the low-pressure section of the Waterway tunnel, as seen in *Figure 2.11: Cross-section of Development (Volume 3 Figures).*

# 2.18 Drill and Blast (Access Tunnels and Waterways)

Drill and blast is a method of rock excavation commonly used for the construction of tunnesl. It has been chosen as the method of construction for the Development, as opposed to the use of a TBM. This is due to limited access to the site and the proposed length of the tunnels, which would make the use of a TBM financially and logistically impractical.

Drill and blast involves drilling holes on the desired rock face before loading a series of explosives in the holes to break up the rock. Following the blasting of the rock the face is then ventilated and mucked out to remove loose material. This material will then be transported to the Headpond for use in the Embankments. The excavation will then be lined and secured as per the detailed design, possibly requiring shotcrete, and / or the use of rock bolts. Following the securing of the excavation, a new set of holes will be drilled and the cycle repeated until the desired length of tunnels is reached.

The use of drill and blast for tunnel excavation could be a 24-hour operation, and the anticipated blast cycle could be up to two blasts per 24 hours.

## 2.18.1 Switching Station Construction

The Switching Station will be constructed from PC15, which will also contain welfare facilities and offices. The location proposed for PC15 has a working area of approximately 22,500 $m^2$. The Switching Station will be approximately 225 m in length and 100 m in width and may have equipment up to 14 m height. The final equipment to be included in the Switching Station will be determined at detailed design stage, post-consent.

The construction of the Switching Station will take place in three main sections, these are: the ground works, the super structure, and the air-insulated switchgear (AIS) switchyard. The ground works will involve the preparation of the ground to be suitable for the required electrical equipment. The superstructure for the Switching Station will consist of the erection of the permanent welfare facilities, in addition to the switchyard control and metering room. The AIS switchyard section will be built following the completion of the superstructure, and the ground works, and will involve the installation of the require electrical equipment.

## 2.18.2 Power Cavern Complex Construction

The Power Cavern Complex will be accessed from PC05 via the construction tunnel, from PC06 via the Access Tunnel and from PC14 via the power tunnel. The Power Cavern Complex will be excavated using a conventional drill and blast methods.

The blasting will be carried out in a controlled sequence in accordance with a blast plan. The rate of blasting is dependent on the rock type, space, and orientation of excavation. However, it has been assumed that around four blasts could occur per day. If required, following blasting, there may be some localised scaling. This will be carried out by hydraulic breaking equipment and will ensure the size shape and position of the excavation is correct. Once it is safe to do so, the rubble that is produced from the blasting will be removed. Excavated material will be transported to the surface in dump truck via the Access Tunnels.

Exposed rock with the Power Cavern Complex will likely be lined, as a minimum, with reinforced shotcrete.

To fully form the Power Cavern Complex, horizontal galleries will be excavated, using conventional drill and blast methods, to connect the three sperate caverns.

Mechanical lifting (overhead cranes) and operating equipment will be installed in the Power Cavern Complex. These will be used for the installation of the turbines and associated mechanical equipment.

The turbines will be delivered through the construction tunnel to the powerhouse cavern where they will be lifted and installed in sections.

The generators will be fitted on top of the turbines and connected to the turbine shaft. The transformers and associated electrical wiring will be installed connecting to and in the transformer cavern. Following the wiring of the generators, the high voltage cable can then be installed out of the power tunnel at PC14.

## 2.18.3 Access Track Maintenance

During the construction phase, the temporary and permanent Access Tracks will require occasional maintenance. With the proposed construction traffic and the duration of usage, it is anticipated that local resurfacing and maintenance, such as the filling of potholes will be required. In the worst case, there may be section that will need to be re-constructed from the subgrade level.

The SuDS associated with the Access Tracks will be inspected and maintained on a regular basis and settlement ponds, silt fences and ditches will be monitored and cleaned when required.

### 2.18.4 Public Path Diversions - Construction

During the construction phase, the temporary diversions for the following core paths will be implemented:

- C200(a) - Coille Bhraghad-Queens Drive-Inveraray (Upper Avenue, connects to C203(a)).
- C203(a) - Bealach an Fhuarain, Inveraray (circular).
- C201 - Dun Na Cuaiche, Inveraray (crosses access around castle).

The proposed diversion routes for these paths are available to view in *Appendix 16.1: Outline Access Management Plan (Volume 5 Appendices)*.

Path closures will be advertised locally as well as being announced by signage at route ends. The temporary and permanent Access Tracks will be fenced along their lengths to promote safety. Crossings will be provided at designated points and will be managed to ensure public safety. Details of crossing locations and management are specified in *Appendix 16.1: Outline Access Management Plan (Volume 5 Appendices)*.

### 2.18.5 Commissioning

The Development will be commissioned in stages commencing with a period of “dry commissioning”. During this period the Development components such as Embankment leakage control, valves, motors, pumps, screens, stop-logs, gates, and electrical control systems will be tested for functionality with no water in the Headpond.

During the testing, a small reservoir of water will be created at the Headpond using a small temporary cofferdam.

Once commissioning has been completed, the Headpond will be filled with water from the Tailpond by slowly opening the gates at the Tailpond inlet / outlet and letting the water flow into the low-pressure tunnel towards the turbines which will fill with water from the Tailpond. Once filled, one of the turbines that will have already been pre-commissioned will be used to slowly pump water into the high-pressure tunnel and then the Headpond. Once the high-pressure tunnel is filled, the other pumps will assist with the pumping.

Once the Headpond is full, the “wet commissioning” of the mechanical and electrical equipment can take place. This, together with the commissioning of the grid connection will allow the Development to operate, initially in a reduced capacity, if market conditions allow until full functionality testing can occur at full operating capacity for pumping and generating electricity.

## 2.19 Operational Phase

### 2.19.1 Operational Lifetime

The expected lifetime of a PSH scheme is reported in academic literature to be around 100 years. This is considered is to be a conservative estimation as Ffestiniog Power Station and Cruachan Power Stations were commissioned in 1963 and 1965 respectively and are still in good operational condition having had some relatively minor refurbishment works. It is expected that the civil works (Access Tunnels and Embankments) will have an operational life of up to 100 years. However, throughout this period it is expected that the electrical plant will require refurbishment or major overhaul every 25 years.

### 2.19.2 Maintenance Requirements

Once commissioned, PSH schemes typically require very little maintenance. However, there will be regular inspections to ensure the safety of the Headpond. Under the Reservoirs (Scotland) Act 2011, the operator of a reservoir must appoint a Supervising Engineer from a ‘panel’ of engineers pre-approved by the Scottish Government. The Supervising Engineer will monitor the Headpond, supervise operations and conduct visual inspections. Inspection must also be conducted with a minimum frequency of every two years by an Inspecting Engineer who is an independent, panel engineer. Further details on the expected maintenance requirements and inspections of the Development are set out in Table 2.7: Likely Maintenance Requirement, below.

**Table 2.6 Likely Maintenance Requirements**

| Component | Objectives | Inspections Carried out by: | Frequency |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Headpond (Embankment) | Examine the critical safety features including, Embankment structure, spillway, screens and scour arrangements, the condition of the major elements and the operating records. | A qualified third-party Panel Engineer, Supervising Engineer and / or the Operator | • Routine and Surveillance (Operator) – Minimum once or twice weekly.<br>• Inspection (Supervising Engineer) – Annually.<br>• Inspection (Inspecting Engineer) – at a minimum of every 2 years. |
| Access Tunnels | Tunnel inspection, maintenance, and performance | Operator | 10 years |
| Pump / Turbines and Generators | Reliable operation of equipment in the service environment – achieved through planned, periodic inspection and checking of components and systems, together with replacement or rectification of parts wherever required.<br>Maximum availability of equipment and a minimum of unplanned shut-downs by using planned / periodic shutdowns to inspect all equipment | Operator / turbine supplier | As recommended by the manufacturer, likely to be daily, weekly, monthly and quarterly checks as per the maintenance schedules, with major refurbishment works not expected more frequently than five year intervals. |
| Tailpond Inlet / Outlet Structure Screen | Maintain operation of inlet / outlet structure. Cleaning screen. Inspecting structure. Replacing screen. | Operator | • Routine cleaning of the screen – Maximum daily.<br>• Inspection – 10 years.<br>• Replacing Screen – 20 years. |
| Access Tracks | General maintenance, ensure fit for purpose and replacing | Operator | General Maintenance - Annually |
| Switching Station | General maintenance, servicing, replacing | Operator / DNO | • Routine and Surveillance (Operator) – Minimum once or twice weekly.<br>• Inspection – Annually.<br>• Major Service – 20 years. |

## 2.19.3 Operational Workforce

After the initial construction of the Development, it is expected that there will be approximately 5 - 10 on-site jobs created as a result of the operation of the Development plus external contractors from time to time.

## 2.19.4 Operational Environmental Management

The Development will be subject to an Environmental Policy / Environmental Management System (EMS) that will require regular monitoring and auditing.

## 2.19.5 Operational Lighting Requirements

There will be internal lighting within the Access Tunnels and the Power Cavern Complex. Further to this, external lighting is expected to be required at the tunnel portals and at the Switching Station.

At the Headpond and Tailpond (Loch Awe), external lighting will be required for access. The lighting will only be used when needed rather than from dusk to dawn.

## 2.19.6 Operational Discharges and Abstractions

Once the Development is fully commissioned, the working water volume will pass between the Headpond and Loch Awe (Tailpond) in order to provide storage and generate electricity at peak times.

It is anticipated that the normal drawdown level of the Headpond will be between 420 and 374 m AOD.

The outflow during generation at the Tailpond inlet / outlet will be up to 520 meters cubed per second ($m^3/s$) with a velocity of approximately 0.38 metres per second (m/s). The inflow during pumping will be up to 407 $m^3/s$ with a velocity of no more than 0.3 m/s, at the Tailpond inlet / outlet screens. It should be noted that a PSH scheme will tend to operate on cycles that are dictated by the energy markets.

An application for a Controlled Activities Regulation (CAR) license will be made shortly after the submission of the Section 36 Application. The Applicant has been in consultation with SEPA over the requirement and extent of the CAR license.

### 2.19.7 Access Tracks - Operation

The permanent Access Tracks will be sealed and maintained as an asphalt road after the completion of the construction phase. During the operational phase, the permanent Access Tracks will comprise maximum 5 m wide road, plus drainage ditches, as shown on *Figure 2.21 Excavated Access Track Typical Detail and Figure 2.22 Floating & Widening Access Track Typical Details (Volume 3 Figures).* The exception is to the existing access at Inveraray Castle Park and Gardens where the permanent access will be reinstated to the existing width with local widening in places.

The temporary Access Tracks will be reinstated after the completion of the construction phase.

### 2.19.8 Public Paths - Operation

During the operational Phase access to the temporarily diverted core paths will be reinstated.

The details of the on-site path network during the operational phase are set out within *Appendix 16.1: Outline Access Management Plan (Volume 5 Appendices).*

New paths and upgrades will utilise excavated material from the construction of the Development where appropriate. All access controls will be designed in accordance with British Standard 5709:2006 “Gaps, Gates and Stiles”.

## 2.20 Decommissioning

Hydropower assets are very durable and, consequently, it is very rare for large-scale hydro projects to be decommissioned. Rather, they may be refurbished or adapted. However, if decommissioning became necessary, then it is envisaged that at the end of its operational life, the Development can be decommissioned as follows:

- Water would be drained from the Headpond and released at an agreed rate and timescale through the appropriate licensing regime into Loch Awe;
- The pump turbines and associated mechanical and electrical plant will be removed;
- The Power Cavern Complex will be stripped of equipment and the entrances blocked off;
- The Waterways and tunnel portal entrances will be blocked off with local spoil;
- The Tailpond inlet / outlet structure will be removed;
- The Switching Station will be removed;
- To prevent any incident with the Headpond filling up, the scour valves will remain open, and the spillway pipe and the Headpond inlet / outlet structure will be left in place.

Under the Reservoirs (Scotland) Act 2011, the Headpond does not need to be drained, as long as ongoing maintenance is undertaken.

Decommissioning effects would be those which would occur as a result of the dismantling and draining of the Development at the end of its operational life (as outlined above) and would typically be similar to those assessed for construction. The Development has a design life of 100 years; however, it is anticipated that rather than be decommissioned, components of the Development would be replaced to extend the Development’s operational life. Given the lifespan of the development, with the effects of decommissioning being similar to that of construction, and the requirement for a decommissioning plan at the end of its lifespan, decommissioning effects have been scoped out of assessment. Notwithstanding, where information is deemed appropriate to be included this has been outlined within the relevant specialist assessment chapter.