EARBA STORAGE

A GILKES ENERGY COMPANY

Earba Pumped Storage Hydro Scheme

CAR Licence Application Report

Main Report

December 2024

Executive Summary

Introduction

The Proposed Development involves the construction and operation of a new Pumped Storage Hydro (PSH) scheme with an installed capacity of up to 1,800 megawatts (MW) along with 22 hours of storage at maximum power equating to nearly 40 gigawatt hours of energy. The Proposed Development utilises the existing Loch a' Bhealaich Leamhain (Loch Leamhain) as the upper storage reservoir and the existing Lochan na H Earba, (Loch Earba) reservoir, as the lower reservoir. To create the reservoir storage capacity, Loch Leamhain would be raised by approximately 75m from its existing 635 m AOD elevation to approximately 710m AOD and in the lower reservoir, Loch Earba would be raised by approximately 25 m from its existing average level of 350 m AOD to approximately 376m AOD.

Significant additional electrical energy storage and dispatchable power capacity is required to make a meaningful difference to the UK energy system as it moves towards net zero. The Proposed Development delivers on both of these requirements, confirming that there is both a need for the project and that it is a scheme of national significance. The Earba project is presently the biggest PSH scheme proposed in the UK.

For details of the Proposed Development including references to plans and detailed drawings refer to Chapter 3: The Proposed Development.

Water Management

The reservoir water level in Loch Earba is currently controlled by two dams, one at the link between Earba east and west and one at the loch outflow at the head of the Allt Labhrach. All of the water in Loch Earba, excluding spill, is currently reserved for hydro operations.

Two new dams would be required to raise Loch Earba and these would be built at the northern and southern ends of the loch and named Shios and Shuas respectively. The Proposed Development would introduce compensation flow from the foot of the Shios Dam into the Allt Labhrach downstream as a positive improvement to this watercourse, since currently no compensation flow is provided into the Allt Labhrach. A proposed Q95 compensation flow of 190l/s would be agreed with SEPA as part of the CAR licence. During the initial period of construction, before filling, the construction works at the proposed Shios dam would maintain the natural outflow from Loch Earba into the Allt Labhrach. This flow would then be abstracted for hydro power at the existing generating station until the filling process starts.

At the upper reservoir, only one dam would be required on Loch Leamhain. The Proposed Development would not release compensation flow at the Leamhain Dam. Instead, water would flow from the upper Loch Leamhain catchment via diversion channels. As part of the proposed INNS mitigation, no releases would be made directly from the Leamhain reservoir. The natural run off from upper Loch Leamhain catchment via the diversion channels will replicate the natural flow spectrum.

During construction of the Leamhain dam, the natural outflow from Loch Leamhain into the Allt Loch a'Bhealaich Leamhain would be maintained via the catchment diversion ditches and the proposed Leamhain temporary works drainage measures.

The Proposed Development requires the diversion of the Allt Pitridh and Chlachair watercourses that flow into the south of Loch Earba. These watercourses would be diverted above the proposed Shuas dam and into the Earba reservoir.

The hydro-morphological character of key waterbodies has been assessed through a combination of spatial data analysis and site walkover survey, with a focus on channel forming processes. The impact of diminished flows in the watercourses impacted by the Proposed Development will be mitigated, for instance through the provision of compensatory flows. Furthermore, consideration has been given to potential options for mitigating spawning habitat displacement on both the Moy Burn and the Pitridh Diversion channel, with the formation of shallower-gradient secondary channels on both watercourses above the proposed maximum inundation level.

Water from the Earba catchment area will be required to fill the lower reservoir prior to operation, which will take a number of years. A hydrological model has been prepared to simulate filling the lower Loch Earba reservoir according to a range of inflows and outflows. It is estimated that filling Loch Earba reservoir would take 2 to 5 years of flow capture. This filling would temporarily impact the downstream hydroelectric schemes at Ardverikie and Lochaber. Discussion with the operators of these hydro-electric schemes is underway to form an operating agreement.

The Proposed Development would only operate between agreed minimum and maximum levels at both the upper and lower reservoirs. A stop generating level is proposed at Loch Earba to protect against overspill into the Allt Labhrach. A stop pumping level is proposed at Loch Leamhain to protect against overspill into the Allt Loch a'Bhealaich Leamhain.

A stop pumping level is also proposed to prevent pumping operations in Loch Earba during extreme low loch events and to protect against the reduction of the buffer storage provided for the existing hydro and for compensation flow.

In a full duration cycle, with pumping of the full storage volume at maximum rate, the Earba reservoir level would fall from the Top Water Level (TWL) to Bottom Water Level (BWL) in 30 hours. This would draw down at an average rate of approximately 0.6m per hour. In a long duration full storage generating cycle the Earba reservoir would rise from the BWL to TWL in 22 hrs at an average rate of 0.8m per hour.

Considering the same long duration cycle scenarios as outlined above at the Loch Leamhain reservoir would mean that the level rises from the BWL to the TWL in 30 hours at an average rate of approximately 2.4m per hour in a full pumping cycle. In a long duration full volume generating cycle the Leamhain reservoir would fall from BWL to TWL in 22 hrs at an average rate of approximately 3m per hour.

Once the Proposed Development is operational, the fluctuations in reservoir levels will be a function of the UK electricity supply and demand and this may vary significantly from day to day. However it is considered that a continuous full generating cycle (or full pumping cycle) will be a rare event.

Effect on Biodiversity – Aquatic

This report considers the likely effects of the Earba Pumped Storage Hydro scheme on the water environment for the purposes of Controlled Activity Regulations. The scope includes the impact on the water environment only, encompassing waterbodies, watercourses, fish fauna, fish

habitat, macroinvertebrates and macrophytes, where a direct impact is likely to occur during the operation of the Proposed Development because of the controlled activity.

A total of 17 likely effects were identified. Three of these were scoped out in Section 3.2 due to predicted negligible impacts, which included ingress and entrainment, impingement, and noise and vibration.

Assessment of magnitude, importance and significance of the14 remaining factors concluded:

A total of eleven negative effects:

- **Very Low** (fish attraction to intake and water temperature changes from water transfer),
- **Low** (reduction in macrophyte cover),
- **Moderate** (loss of spawning habitat (watercourse), reduction in food availability for fish, fish stranding, water quality reduction and reduction in macroinvertebrate abundance),
- **Moderate-High** (loss of spawning habitat (waterbody), reduction in egg viability, and hatch success, and fragmentation of habitat (including access to spawning habitat) and
- **High** (fluctuations in water level).

A total of two positive effects:

- **Very Low** (water changes from proposed compensation flow), and
- **Moderate-High** (additional flow to watercourses).

Water temperature changes from water transfer were predicted to have no impact, therefore significance effect was Very Low (likely negligible).

Mitigation of the negative effects on spawning and habitat loss within the watercourses and around the shoreline of the reservoirs will be provided by the proposed new spawning reaches of the Moy Burn and the upper sections of the Pitridh Diversion which are both above the top water level of the Earba reservoir.

Mitigation of spawning and habitat loss around the shoreline of the reservoirs will be provided by installing and maintaining spawning substrate located just below the minimum water level of the Earba reservoir. Furthermore floating habitats, which replicate shoreline margins, will be installed. These floating habitats have wider benefits including littoral habitat for flora and invertebrates as well as providing continuously wetted spawning beds, beneath the reservoir level, even under fluctuating water levels.

Effect on Terrestrial Ecology

The potential effects of the Proposed Development on designated sites (selected for non-avian, terrestrial ecology features), terrestrial habitats, and non-avian terrestrial species, during construction and operation have been assessed.

A locally significant effect was identified for the loss to inundation of a 5.35 ha strip of habitat mapped on the Ancient Woodland Inventory (AWI), which was found to support scattered mature trees on purple-moor grass dominated vegetation, comprising remnant ancient woodland in poor condition.

Significant adverse residual effects from habitat loss have been identified during construction for: blanket bog and modified bog including montane bog (at the County to national level); montane willow scrub (at the national level); unimproved calcareous grassland, base-rich

marshy grassland, upland species-rich ledges, montane heath / dwarf herb, basic flush and bryophyte-dominated spring (at the County level); semi-natural woodland, wet and dry dwarf shrub heath, unimproved acid grassland, acid / neutral flushes and watercourses (at the local level).

Significant adverse residual effects have been identified at the local level upon invertebrates and reptiles, due to habitat loss during construction. Once embedded and best practice mitigation has been applied, including protected species licensing where required, non-significant residual adverse effects have also been identified upon water vole, otter, bats, red squirrel and pine marten.

All of the effects during construction would be compensated for through habitat works and species-specific habitat features, delivered via a Biodiversity Environmental Management Plan (BEMP). Additional to the compensation proposed, further significant environmental enhancement would be implemented with the woodland restoration / creation, montane willow scrub and other montane habitat restoration, heathland enhancement and positive management of a range of other upland habitats via deer control, as well as the provision of bat, red squirrel and pine marten boxes, which would be delivered via the BEMP.

With the implementation of continued best practice measures, no significant negative effects are predicted during the operational phase.

No potentially significant cumulative effects were identified.

Effect on Biodiversity - Ornithology

This assessment addresses impacts on ornithological biodiversity associated with the Proposed Development's effects on waterbodies and watercourses.

Three protected species, common sandpiper, black throated divers and red throated divers would be impacted by the effects of the Proposed Development on waterbodies and watercourses.

Effect on Economy

The economic effect of the proposed Earba Pumped Storage Hydro scheme (the Proposed Development) has been assessed in accordance with the SEPA Guidance Note WAT-SG-67.

The assessment has determined that the significance of the effect on the economy as a consequence of the Proposed Development is **Positive High to Very High**.

Effect on Health & Safety

The likely effects of the Proposed Development on the population in terms of human health and human safety has been assessed under the following categories:

- the risk of ill-health or disease;
- the risk of injury; or
- human well-being more generally.

The assessment concludes that the following effects would give rise to effects with the significances tabulated below.

Effect	Type of Effect	Magnitude of Effect	Importance of Effect	Significance of Effect
Ill Health or Disease				
Private water supplies	Negative	Very Small - Small	Medium	Very Low - Low
Hydrocarbon pollution	Negative	Very Small - Small	Medium	Very Low - Low
Risk of Injury				
Public / Construction interface	Negative	Small	Very High	Moderate - High
Water Hazards	Negative	Very Small	Very High	Low
Road Traffic Accidents	Negative	Very Small - Small	Very High	Low - Moderate
Human Well Being				
Disturbance to recreational access	Negative	Very Small	Medium	Low

Effects on Recreation

The assessment addresses only direct impacts on recreation and access, with those associated with visual amenity assessed in Chapter 11 on Visual Amenity and Landscapes.

The forms of public recreation known to take place within and around the site of the Proposed Development, and which have been assessed are as follows:

- Canoeing;
- Swimming;
- Angling; and
- Land based recreation including walking and running, mountaineering, rock climbing, cycling, backpacking, horse riding and caving.

The Proposed Development has the potential to impact upon recreational use and access within the proposed site and surrounding area. Most effects relate to construction disturbance and modifications to water discharges. Construction and operational disturbance would be managed by provision of the measures outlined in the EIAR Appendix 15.1 – Draft Access Management Plan, which has been prepared in consultation with the Highland Council.

The most significant impacts on recreation and access during both construction and operation have been assessed as Low (for swimming) and Low (for canoeing the river Spean during filling of the Earba Reservoir only).

Effect on Well Being – Visual Amenity and Landscapes

The LVIA has identified that there would be localised significant landscape and visual effects occurring during the construction of the Proposed Development within an area around the

Proposed Development up to around 3 – 4 km also affecting the Ben Alder, Laggan and Glen Banchor SLA and WLA 14: Rannoch – Nevis – Mamores – Alder. However, during operation, these effects would reduce and significant effects would become more localised, associated with the main permanent structures of the Proposed Development at the upper and lower reservoirs. Over time, and after 15 years, mitigation measures, including woodland planting proposed as part of the Proposed Development would lead to significant effects becoming further localised, mostly focussed around the Leamhain Dam and proposed upper reservoir, with some very localised effects to wild land characteristics around the Shuas Dam and powerhouse. Although other elements of the Proposed Development, including operational drawdown would be perceptible, and in some cases more noticeable in the wider landscape, the overriding qualities of the surrounding landscape would remain present and these effects are not predicted to significantly change the existing characteristics of the landscape or lead to significant visual effects being experienced in the wider area.

By 15 years post construction, with the growth of proposed planting and other vegetation, the effect on the Ben Alder, Laggan and Glen Banchor SLA is predicted to be not significant. Whist localised significant effects are predicted for Wild Land Area 14; this is not predicted to lead to a significant effect on the Wild Land Area overall. No significant effects are predicted to the Special Landscape Qualities of the Cairngorms National Park.

Economic Opportunities for Disadvantage Groups

The effect of the Earba Pumped Storage Hydro (the Proposed Development) on economic opportunities of disadvantaged groups has been assessed in accordance with the SEPA Guidance Note WAT-SG-67.

The Construction stage of the project will provide around 500 employment opportunities for semi-skilled and skilled workers. The 6-year construction period is the focus of the assessment on opportunities for disadvantaged groups.

The Operational stage of the project will require around 20 skilled workers. The Authorised Person continues to explore training and educational opportunities for these skilled workers such that there would be a benefit to disadvantaged groups but this is ongoing and as such has been omitted from this assessment.

The assessment set out below has determined that the Proposed Development has a Positive effect of very low Significance relating to economic opportunities to disadvantaged groups.

Effects on Climate Change

The effect of the Earba Pumped Storage Hydro (the Proposed Development) on climate change has been assessed in accordance with the SEPA Guidance Note WAT-SG-67.

The assessment set out below has determined that the Proposed Development has a Positive effect of Very High Significance on Climate Change.

Invasive Non Native Species (INNS)

The increased risk of the transfer of INNS has been assessed by SEPA and classed as high risk. Mitigation to substantially reduce this risk will be provided by preventing discharge from the upper reservoir into the downstream water course, the Allt Loch a' Bhealaich Leamhain.

Any rainfall within the Loch Leamhain catchment area will be collected by a catchment transfer channel which will direct run off to the Allt Loch a' Bhealaich Leamhain which is immediately downstream of the Leamhain dam. This will ensure a continuous flow of water in the Allt Loch a' Bhealaich Leamhain without introducing an INNS transfer risk.

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1 Introduction

1.1 Background Information

1.1.1 Earba Ltd. (hereafter referred to as "the Authorised Person") is proposing to construct the Earba Pumped Storage scheme, located within Ardverikie Estate as shown in **Figure 2.1 – Location Plan**. The proposals, for which a Water Environment (Controlled Activities) (Scotland) Regulations 2011 Licence (or CAR Licence) is being sought by the Authorised Person, are referred to in this report as 'the Proposed Development'.

1.1.2 The application for a CAR Licence is being prepared on behalf of the Authorised Person by Gilkes Energy Ltd, (hereafter referred to as "the Applicant") with support from a number of specialist consultants.

1.1.3 Consent under Section 36 of the Electricity Act 1989[1] has also been sought by the Authorised Person and the documents associated with this application are available here:

1.1.4 https://www.energyconsents.scot/ApplicationDetails.aspx?cr=ECU00005062

1.1.5 The function of the Proposed Development would be to create a large-scale long duration electricity storage (LDES) scheme with up to 1,800MW generation capacity to store and release energy to or from the electricity transmission system. The Proposed Development would help to balance supply and demand for grid power at a national scale. The electricity storage capacity of the Proposed Development will be up to 40 gigawatt hours (GWhr), which equates to 22 hours of generation at 1,800 MW. This would make it the largest energy storage facility in the UK, providing a very significant contribution towards meeting the Scottish Government's commitment to pumped storage hydro, as set out in the Scottish Energy Strategy[2] .

1.2 The Authorised Person

1.2.1 The Authorised Person, Earba Ltd, is a subsidiary of the Applicant, Gilkes Energy Ltd (GEL). GEL specialises in the development of hydro power projects in the UK and comprises a multi-disciplined development team which includes engineering, consenting, project management, operations, commercial, financial and legal expertise. GEL is supported by an industry-leading team of specialist technical consultants. Over the last 14 years, GEL has successfully developed and built 17 conventional hydro projects. In 2018 GEL moved their focus from conventional smaller-scale hydro to larger Pumped Storage Hydro (PSH), with the aim of delivering increased flexibility for the UK electricity system to assist in the transition to a low carbon economy. As well as the Earba PSH, the Proposed Development under this application, GEL has one other PSH scheme in development. Both projects have been identified following a detailed screening process.

[1] The Electricity Act 1989. Available at: https://www.legislation.gov.uk/ukpga/1989/29/contents [Last Accessed December 2023].
[2] Scottish Government, 2017. The Scottish Energy Strategy. Available at: https://www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/ [Last Accessed December 2023].

1.3 The Need for the Project

1.3.1 As the UK transitions away from a system dominated by large on-demand fossil fuelled thermal generation to one dominated by intermittent renewables it becomes increasingly challenging to balance the grid. Weather patterns, especially wind, rather than the daily changes in demand, become the dominant factor. To balance longer consecutive periods of low wind as well as low winter solar output (which can last many hours, or even days), Long Duration Electricity Storage (LDES) is required.

1.3.2 LDES is typically understood to mean any technology that can store energy or release electricity for a continuous duration of 6 hours or more. This length of continuous generation cannot be delivered by short duration battery storage. Indeed, analysis by the Authorised Person and other industry specialists suggests at least 12hrs of storage is required in order to provide optimum balancing services to the grid.

1.3.3 Other energy storage technologies that have been suggested include: hydrogen, liquid air storage and thermal storage but many of these are yet to be developed at any feasible economic scale. PSH is a long established, clean, large scale, LDES technology which has been successfully deployed in the UK for decades and it is being increasingly used for grid scale energy storage in the push to net zero around the world.

1.3.4 PSH can absorb excess energy on the grid and use it to pump water to an upper reservoir, storing this energy until times of high demand. At these times of peak demand, the water stored in the upper reservoir is sent through a turbine converting the stored energy back into electricity.

1.3.5 PSH installations are highly flexible and can deliver large quantities of power very quickly as they have the ability to rapidly start and stop.

1.3.6 By storing energy from renewable sources and then releasing it at high demand PSH can reduce our reliance on expensive carbon emitting gas generation which currently supports the grid. The Proposed Development can store up to 40GWh of energy, meaning it could save around 2 million tonnes of CO2 emissions a year, which would be a large step towards meeting Scotland's climate change target of net zero by 2045. In April 2024 the Scottish Government accepted that their flagship target of reducing greenhouse gas emissions by 75% by 2030 could not be achieved. This only highlights further the challenge ahead to reach net zero by 2045.

1.3.7 In summary, significant additional electrical energy storage and dispatchable power capacity is required (LDES), to make a meaningful difference to the UK energy system as it moves towards net zero. The Proposed Development delivers on both of these requirements confirming that there is both a need for the project and that it is a scheme of national significance.

1.3.8 Policy and Planning

1.3.9 A number of energy legislation and policy documents provide the context for the development of pumped storage hydro, including:

- Climate Change (Scotland) Act 2009 and Climate Change (Emissions Reduction Targets) (Scotland) Act 2019;

- The Climate Change (Scotland) Act 2009 (Interim Target) Amendment Regulations 2023;
- Scottish Emissions Targets - First Five-yearly Review & Progress in Reducing Emissions in Scotland – 2022 Report to Parliament (2022);
- Equality, Opportunity, Community - Our Programme for Government September 2023 (2023);
- Update to the Climate Change Plan 2018 - 2032: Securing a Green Recovery on a Path to Net Zero (2020); and
- Scottish Energy Strategy (2017) and Draft Energy Strategy & Just Transition Plan (2023).
- The Energy Security Act 2023;
- Climate Change Act 2008 (as amended);
- Climate Change Committee – Progress in Reducing Emissions – 2023 Progress Report to Parliament;
- British Energy Security Strategy – Secure, Clean and Affordable British Energy for the Long Term;
- Committee on Climate Change – The Sixth Carbon Budget, the UK's path to Net Zero;
- National Planning Framework 4 (NPF4);
- Highland Wide Local Development Plan (HwLDP) (2012);
- West Highland and Island Local Development Plan (WestPlan) (2019);
- Supplementary Guidance; and
- Other Development Plans (Cairngorms National Park Authority, Perth and Kinross Council, both neighbouring planning authorities).

1.3.10 Some key elements of the Scottish Energy Strategy and Planning Framework which directly relate to this Proposed Development are noted in the Planning and Energy Policy Context chapter of the Section 36 Application EIA Report, and are summarised below:

- While the **Scottish Energy Strategy (2017) and Draft Energy Strategy & Just Transition Plan (2023)** acknowledges that all renewable energy technologies will have a role to play in the future energy system, it notes the importance of pumped storage hydro (PSH) developments, stating that "investment in new PSH capacity in Scotland could greatly enhance the flexibility and resilience of our electricity network and power supplies. These are major infrastructure projects, with considerable economic and industrial value attached".
- **Climate Change Committee – Progress in Reducing Emissions – 2023 Progress Report to Parliament** : On Planning, the report notes that the planning system must have an "overarching requirement that all planning decisions must be taken giving full regard to the imperative of net zero". In Scotland, these principles are now set by National Planning Framework 4 (NPF4), discussed below.
- **National Planning Framework 4** notes that "a large and rapid increase in electricity generation from renewable sources will be essential for Scotland to meet its net zero emissions targets". NPF 4, Part 2 National Developments 'Pumped Hydro Storage' sets out a list of developments that have National Development Status including "new and/ or expanded and/or upgraded water holding reservoir and dam" and "new and/or expanded and/or upgraded water inlet and outlet pipework…" and where the scheme is classified as a 'major' development (20 MegaWatts and above). The Proposed Development with a generating capacity of up to 1,800 MW significantly exceeds this threshold and falls within this National Development category.

- **NPF4** states that these schemes will help the transition to a net zero economy "through the ability of pumped storage hydro schemes to optimise electricity generated from renewables by storing and releasing it when it is required". It clarifies that the National Development status applies to new PSH sites as well as increasing the capacity at existing sites.
- **NPF4 Policy 11**: Energy, is particularly relevant to the Proposed Development. Its objective is to "encourage, promote and facilitate all forms of renewable energy development onshore and offshore. This includes energy generation, storage, new and replacement transmission and distribution infrastructure and emerging low carbon and zero emissions technologies including hydrogen and carbon capture utilisation and storage (CCUS)". It confirms that all forms of renewable, low carbon and zero emission technology will be supported. These include "energy storage such as battery storage and pumped storage hydro…". Policy 11 also states that inter alia "development proposals will only be supported where they maximise net economic impact, including local and community socio-economic benefits such as employment, associated business and supply chain opportunities".

1.4 Selection of the Optimum PSH Development Site

1.4.1 PSH requires a suitable location combining several key factors:

- Suitable topography and geology to be able to create substantial upper and lower reservoirs and a waterway system to provide meaningful LDES at scale.
- Practicable access to the electricity transmission network;
- Practicable access to the site; and
- The minimum footprint and impact on the natural environment from construction and operation of the scheme.

1.4.2 Several alternative sites were considered within a nationwide screening exercise. Relatively few locations satisfy the key criteria that are listed above. The Highlands of Scotland do provide opportunities for PSH; however many potential sites were found to have existing infrastructure or other stakeholder interest in the reservoirs. Furthermore, some potential sites were located within sensitive and designated natural areas or they were not found to provide significant energy storage for a given footprint.

1.4.3 The 1,800MW Earba PSH scheme is well located to satisfy the above criteria, being close to existing grid infrastructure, clear of migratory fish and other existing water interests and being located away from designated natural habitat areas.

1.4.4 The Proposed Development at Earba provides both significant quantities of dispatchable power generation (up to 1,800MW) and stored energy (up to 40GWh). When compared with other PSH projects it scores very highly and is one of the best potential stores of grid scale energy in the UK for a relatively modest development footprint.

1.4.5 The graph below, Plate 1-1 PSH Projects Compared, shows the power and stored energy ratings of Earba compared with the four existing operational PSH projects in the UK and any known PSH projects, either in development, in the planning system or consented but not constructed.

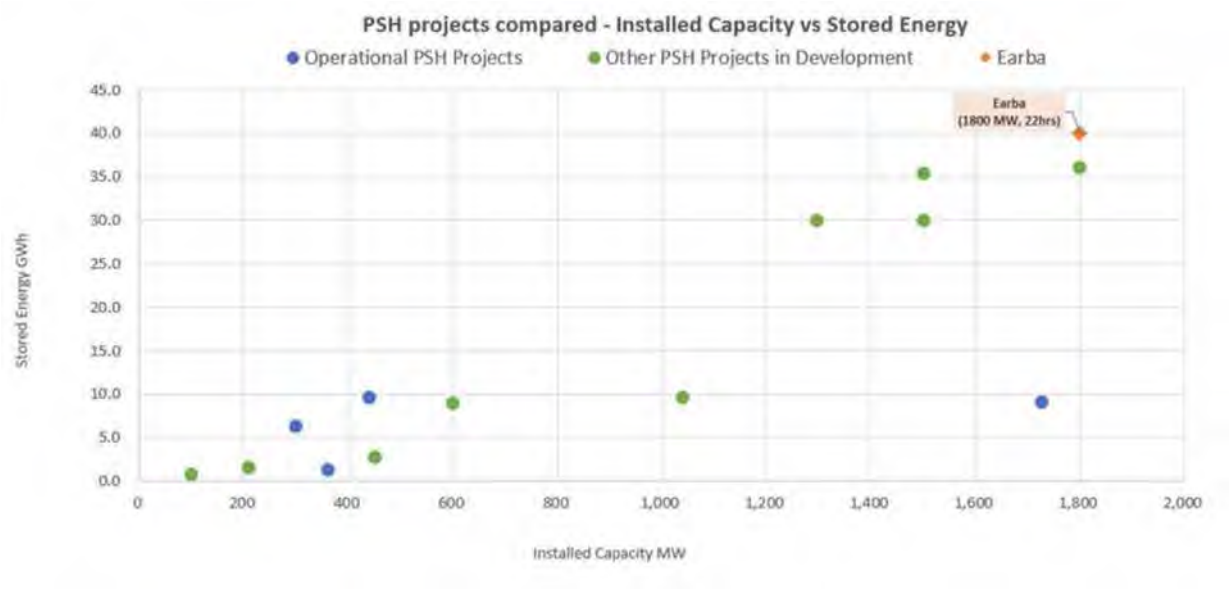


Plate 1-1 PSH Projects Compared

1.4.6 The scheme design has been developed to minimise its environmental footprint and its extent would be confined mainly to the footprint of the reservoirs, the powerhouse and access tracks.

1.4.7 The scheme would re-use the majority of earthworks arisings for construction of the works including the dam structures and maintain a balance of materials within each of the upper and lower parts of the site. This would avoid impacts on local road infrastructure and also avoid long haul routes for earthworks materials within the site, a key feature of the sustainable aims for the Proposed Development.

1.4.8 In summary, the Proposed Development has been selected as one of the best located and most significantly sized PSH developments in the UK.

1.5 The Proposed Development

1.5.1 The layout of the Proposed Development is shown in Drawing No. **EAR-GEL-002-P1 Figure 2.2 Scheme Arrangement**. The Proposed Development would operate by transferring water between a lower reservoir, Lochan na h-Earba (Loch Earba) and an upper reservoir, Loch a' Bhealaich Leamhain (Loch Leamhain). The maximum water level of these existing lochs would be raised by constructing dams to increase their natural storage capacity. The reservoirs would be connected to each other via the powerhouse by an underground waterway system including up to three headrace tunnels.

1.5.2 The Proposed Development would also include a very significant package of habitat compensation and enhancement works which would demonstrably and significantly contribute to the enhancement of biodiversity, including restoring degraded habitats and building and strengthening nature networks and the connections between them.

1.5.3 Details of the Proposed Development are included in **Chapter 3 Scheme Description**.

1.6 Associated Works

1.6.1 A grid connection, comprising a buried 400 kV cable and a sub-station adjacent to the Beauly to Denny overhead transmission line, is required to connect the Proposed Development to the national electricity grid. For regulatory reasons, this will be subject to a separate consenting process with Scottish and Southern Electricity Networks Transmission ("SSEN Transmission") as the Applicant. It is unlikely that the grid connection works will require any significant controlled activities.

1.7 Site Context

1.7.1 The site comprises predominantly wet heath, with some smaller areas of blanket bog, dry heath, mire, woodland and scrub. There is a small area of scheduled ancient woodland along the shore of Loch Earba. The Estate is used for highland sports, outdoor recreation, commercial forestry, hydroelectric generation (there are two existing reservoir storage hydro schemes), holiday accommodation and as a film location.

1.7.2 The site is within the river Spean catchment upstream of Loch Laggan. Lochan na h-Earba drains to Loch Laggan via the Allt Labhrach and Loch a' Bhealaich Leamhain also drains to Loch Laggan via the Allt Loch a' Bhealaich Leamhain, the Allt Cam and the River Pattack. The catchment is already heavily modified by the operation of the existing Ardverikie, Pattack and Lochaber Hydro Schemes.

1.8 Structure of the Earba CAR Licence Submission

1.8.1 The following information sets out the Structure of the CAR Licence submission:

- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 Licence Application Form A
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 Licence Application Form D
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 Licence Application Form E
- Earba PSH CAR Licence Application Report :
    - Chapter 1 Introduction & Need for Project
    - Chapter 2 Assessment Methodology - Assessing Significance of Impacts ref (WAT-SG-67)
    - Chapter 3 Scheme Description
    - Chapter 4 Water Management
    - Chapter 5 Effects on Biodiversity - Aquatic
    - Chapter 6 Effects on Biodiversity - Terrestrial
    - Chapter 7 Effects on Biodiversity - Ornithology
    - Chapter 8 Effects on the Economy
    - Chapter 9 Effect on Well Being – H&S
    - Chapter 10 Effect on Well Being – Recreation
    - Chapter 11 Effect on Well Being – Visual Amenity and Landscapes
    - Chapter 12 Economic opportunities for disadvantage groups
    - Chapter 13 Effect on natural resource use/climate change
    - Chapter 14 Invasive Non Native Species (INNS)
    - Chapter 15 Shadow (Draft) Balancing Test

- Appendix A Hydrology Study
- Appendix B MNV final hydrology report
- Appendix C Comparison of theoretical and gauged data
- Appendix D Hydromorphological Appraisal
- Appendix E Leamhain Dam Construction – Draft Pollution Prevention Plan*
- Appendix F Outline Construction Environmental Management Document*
- Appendix G Loch Leamhain drawdown and buffer storage assessment
- Appendix H Loch Earba drawdown and buffer storage assessment
- Appendix I INNS mitigation - impact on flows
- Appendix J Aquatic Ecology Technical Appendix for the CAR Licence
- Appendix K Charr Species Protection Plan
- Appendix L Socioeconomics EIAR Chapter*
- Appendix M Figures

- Shadow Habitats Regulations Appraisal (HRA) Report (Ben Alder and Aonach Beag SAC)
- A separate Non-Technical Summary

**Please note that these documents are taken directly from the EIAR and therefore will contain references to EIAR chapters and appendices, instead of CAR Report chapters*

1.9 CAR Specialist Team

1.9.1 The Applicant recognises that the Proposed Development may give rise to some environmental effects. Specialist consultants have therefore been appointed by the Applicant to provide expert knowledge in assessing the environmental effects as follows:

- Hydrology and Water Management: Mott MacDonald Limited & MNV Consulting;
- Geomorphology: EnviroCentre Ltd;
- Aquatic Ecology:
  - Gavia Environmental Ltd plus
  - [redacted] UoG, expert in the field of freshwater ecology specialising in Arctic Charr;
- Terrestrial Ecology: SLR Consulting Ltd;
- Ornithology: [redacted]
- Landscape and Visual: ASH Design and Assessment Ltd;
- Land Use: Gilkes Energy Ltd;
- Recreation and Access: Gilkes Energy Ltd
- Socioeconomics and Tourism: MKA Economics Ltd.

1.10 Supporting Documents

1.10.1 The following supporting documents will be submitted along with the CAR Licence Application Report:

- A Non-Technical Summary (NTS) – this is a summary of the CAR Licence Application Forms, Report and Appendices in non-technical language;

- A Shadow Habitats Regulations Appraisal (HRA) Report (Stage 1 & 2) for the Ben Alder and Aonach Beag SAC – this is provided to assist the competent authority's (in this case NatureScot) Appropriate Assessment of the likely significant effects of the Proposed Development on this designated site.

2 Assessment Methodology

2.1.1 The key topics that will be assessed by SEPA as part of a CAR Licence application have been assessed in accordance with the SEPA Supporting Guidance (WAT-SG-67).

2.1.2 It is understood that this guidance (WAT-SG-67) is to be followed when determining whether or not SEPA should authorise a controlled activity that would potentially breach environmental standards. The guidance considers the significance of both positive and negative impacts across Social, Economic and Environmental issues. The Applicant has drafted a chapter on each area across the Social, Economic and Environmental sphere. This is intended to assist with SEPA's assessment and provide all the information in a concise report.

2.1.3 In some instances, the Applicant has made reference back to the Section 36 EIA report as transferring the findings to match SEPA's criteria was considered unnecessary.

2.1.4 A Shadow Balancing test has been included within this report, following the SEPA guidance, whilst acknowledging that SEPA will need to undertake this exercise following a review of the information presented within this report and the associated application forms.

3 The Proposed Development

3.1 Introduction

3.1.1 This chapter describes the principal components of the Proposed Development which includes the Controlled Activities under the CAR licence application. It also describes the expected construction methodology, together with the outline programme for its construction. An overview of the operational and decommissioning phases of the development is also provided. The location of the Proposed Development is shown in **Figure 2.1 – Location Plan** and its general arrangement is shown in **Figure 2.2 – Scheme Arrangement** and **Figure 2.3 – Scheme Arrangement (Aerial)**.

3.1.2 The function of the Proposed Development would be to create a large-scale long duration electricity storage (LDES) scheme with up to 1800MW generation capacity to store up to 40 GWhr from the electricity transmission system during periods of over supply and then and then release the energy back to the electricity transmission system when required, to help balance supply and demand for power at a national scale. The Proposed Development would operate by transferring water between a lower reservoir, Lochan na h-Earba (Loch Earba) and an upper reservoir, Loch a' Bhealaich Leamhain (Loch Leamhain). The maximum water level of these existing lochs would be raised by constructing dams to increase their natural storage capacity. The reservoirs would be connected by an underground waterway system including up to three headrace tunnels.

3.2 Site Description

3.2.1 The Proposed Development would be situated within the Ardverikie Estate "the Estate" to the south of Loch Laggan approximately mid-way between Newtonmore and Spean Bridge.

3.2.2 The site comprises predominantly wet heath, with some smaller areas of blanket bog, dry heath, mire, woodland and scrub. There is a small area of scheduled ancient woodland along the shore of Loch Earba. The Estate is used for highland sports, outdoor recreation, commercial forestry, hydroelectric generation (there are two existing reservoir storage hydro schemes), holiday accommodation and as a film location.

3.2.3 The site is within the river Spean catchment upstream of Loch Laggan. Lochan na h-Earba drains to Loch Laggan via the Allt Labhrach, and Loch a' Bhealaich Leamhain also drains to Loch Laggan via the Allt Loch a' Bhealaich Leamhain, the Allt Cam and the river Pattack. The catchment is already heavily modified by the operation of the existing Ardverikie, Pattack and Lochaber Hydro Schemes.

3.3 Scheme Operation

3.3.1 The Proposed Development would be operated either in 'generating' mode or in 'pumping' mode. Generating mode is when electricity would be produced by releasing water from the upper reservoir through the reversible pump turbines and into the lower reservoir. Pumping mode is when electricity would be imported to pump water through the reversible pump turbines from the lower up to the upper reservoir. The generating capacity of the scheme would be up to 1800 MW, with enough storage with the upper

reservoir full to generate for approximately 22 hours at this capacity (a storage capacity of 40 GWhr).

3.4 Site Selection

3.4.1 As discussed above, PSH for long duration electricity storage requires a site with the following attributes:

- Suitable topography to be able to create an upper and lower reservoir, either by altering the level of an existing waterbody or by creating a new one;
- As high as possible an elevation difference between the upper and lower reservoirs;
- As short as possible distance between the upper and lower reservoirs;
- Suitable geological conditions;
- Practicable access to the electricity transmission network;
- Practicable access to the site;
- The minimum number and impact of any effects on the natural environment from construction and operation of the scheme; and
- The minimum number and impact of any effects on other uses of the site from construction and operation of the scheme.

3.4.2 The Proposed Development scored highly on these attributes compared with others considered within the UK.

3.4.3 Compared with the existing pumped storage hydro schemes in operation in the UK and those already in the planning system, the Proposed Development would have the highest energy storage capacity and would effectively double the UK's existing energy storage capacity. This is illustrated in Plate 1-1 PSH Projects Compared in Chapter 1.

3.4.4 At a local level, various site layout options were considered within the Laggan / Earba / Leamhain area as shown in **Figure 3.1 - Pumped Storage Options Layout**.

3.4.5 Loch Laggan was discounted as a reservoir, as the level range in Laggan is limited with relatively small storage volume available and it would be difficult to integrate PSH operation with the ongoing Lochaber hydro operation which uses Loch Laggan.

3.4.6 The Option 2 proposed development, shown on **Figure 3.1 - Pumped Storage Options Layout** was selected as this offered suitable scale of energy storage with relatively low visual impact and minimum footprint on the more valuable montane habitat areas.

3.5 Carbon Balance

3.5.1 The benefits of PSH in relation to reduced carbon emissions include:

- reduction of electrical grid carbon emissions by displacing fossil fuel generation; and
- increasing efficiency of the electrical grid by reducing wind power curtailment during times of low demand.

3.5.2 An outline carbon balance assessment has been carried out for the Proposed Development in accordance with UK Government, Scottish Government at SEPA guidance. This is summarised in table 2.0 below. The assessment has identified a Greenhouse Gas (GHG) impact of 1,984,018 tCO2e for the development of the PSH, and

an annual benefit in avoided CO2 emissions of 1,944,000 tCO2e, giving a carbon payback period of approximately 1 year.

Table 3-1 Carbon Balance Assessment

Item	Description	Value	Units	Source
Greenhouse Gas (GHG - Carbon) Potential Losses Associated with Development				
1	GHG Emissions from construction and development.	1,743,381	tCO2e	SEPA Carbon Calculator Tool. Reference - UMEP-72LT-NKNZ v0
2	GHG Emissions from volume of materials extracted during construction.	240,638	tCO2e	EIA Chapter 3: Consideration of Alternatives and Design Evolution
Greenhouse Gas (GHG - Carbon) Potential Savings Associated with Development				
3	UK Fossil fuel-mix emission factor	0.432	(t CO2 MWh-1)	SEPA Carbon Calculator Tool
4	Annual generation from the Earba PHS. Assumes all operations are carried out using power generated by renewable sources i.e Wind Power.	4,500	GWh	Gilkes Energy Ltd.
5	Annual generation from the Earba PHS.	4,500,000	MWh	Converted from No.4 above.
6	GHG Emissions avoided.	1,944,000	tCO2e/ year	Annual Earba output of 1,000,000 MWh x Fossil Fuel Mix Emission Factor.

3.6 Scheme Description

3.6.1 The principal components of the Proposed Development would be:

- The Leamhain Dam and Upper Reservoir
- The Shuas and Shios Dams and Lower (Earba) Reservoir
- The Underground Waterway System and Associated Structures
- The Powerhouse and Substation
- The Pitridh and Shuas Aqueducts
- A new junction off the A86 and bridge over the River Spean / Moy Channel
- Access Tracks and Footpaths
- Temporary Construction Facilities and Borrow Pits
- Areas of Habitat Compensation and Biodiversity Enhancement

The Leamhain Dam and Upper Reservoir

3.6.2 A rockfill dam would be constructed just below the outflow of Loch a' Bhealaich Leamhain to create an upper reservoir capable of storing approximately 55 million cubic metres of water for use in the PSH. This would raise the level of the loch from its existing level of 636m AOD to a maximum level of 710m AOD. The reservoir would inundate an area of approximately 110 Ha as shown in **Figure 2.4 - Upper Leamhain Reservoir - Plan**.

3.6.3 The plan, sections and finishes of the dam are shown in **Figure 2.5 – Leamhain Dam GA**.

3.6.4 The dam would be a concrete or asphalt faced rockfill dam. The material for the dam would be quarried from borrow pits within the reservoir drawdown footprint. The faces of the dam will be at an approximately 1:1.5 gradient. The upstream face would have an impermeable membrane of concrete or asphalt. The downstream face would be rockfill.

3.6.5 The dam would have an access track across the crest, together with other facilities including a bottom outlet valve house for emergency drawdown reached by an access track around the toe of the south side of the dam. There would also be a concrete-lined spillway down the north side of the dam to accommodate the discharge of flood flows if these occurred when the reservoir was already full. Proposed general arrangement drawings of these facilities are shown in :-

- **Figure 2.5.1 - Leamhain Dam - Layout Plan,**
- **Figure 2.5.2 - Leamhain Dam - Layout of Spillway, Bottom outlet pipes and Valve house**
- **Figure 2.5.3 - Leamhain Dam - Lower Valve House - Layout Plan**
- **Figure 2.5.4 - Leamhain Dam - Valve House Sections**

3.6.6 During construction of the dam and associated facilities, Loch Leamhain would be temporarily partially drained to the level 612m AOD. This would offer significant benefits for silt and drainage management during construction and allow for working areas SC8 and the borrow pits BP5 A and B for the dam construction to remain below the final low water level in the reservoir, thus reducing the requirement for these facilities to be in otherwise undisturbed montane peatland areas. Dewatering of the loch during the construction period would be maintained by means of over-pumping from the loch to the Allt Loch a' Bealaich Leamhain, while using best practice in drainage and silt control management. The proposed construction arrangements are shown in :-

- **Figure 2.36 - Site Compound SC8 -Leamhain Dam,**
- **Figure 2.37 - Site Compound SC8 -Leamhain Dam – Sections, and**
- **Figure 2.5.5 - Leamhain Dam - Lower Valve House - Temp GA with diversion and cofferdam.**

3.6.7 A description is given of the proposals for de-watering Loch Leamhain, including a construction sequence, pollution prevention and drainage management in **Appendix E - Leamhain Dam Construction – Draft Pollution Prevention Plan**.

The Shuas and Shios Dams and Lower (Earba) Reservoir

3.6.8 Two earthfill or rockfill embankment dams would be constructed at each end of Loch Earba (Shios Dam and Shuas Dam) to create a reservoir capable of storing approximately 65 million cubic metres of water. This would raise the level of the loch, which is already a reservoir for the existing 1MW Ardverikie hydro scheme, from its existing top water level of 352m AOD to a maximum level of 376m AOD. The reservoir would inundate an area of approximately 365 ha as shown in **Figure 2.6 - Lower Earba Reservoir - Plan**.

Shios Dam

3.6.9 The north-eastern dam, the Shios Dam, shown in **Figure 2.7 – Shios Dam GA** is relatively constrained in its location by the existing dam and local topography. The dam would be an earthfill or rockfill dam with a nominal gradient of up to approximately 1:3 to the upstream and downstream faces. The upstream face would incorporate an impermeable membrane – either concrete or asphalt. The downstream face of the dam would require a section of concrete spillway but would otherwise be topsoiled and vegetated to blend in with the surrounding areas. There would be some flexibility in the final design of the profile of the dam to alter it to improve its setting in the landscape.

3.6.10 The Shios dam would be constructed from materials won from the construction of the powerhouse and tunnels, supplemented by material from local borrow pits.

3.6.11 For the existing 1MW Ardverikie hydro scheme there is currently no requirement to release any hands-off flow to the downstream Allt Labhrach, but it is expected that this would be required by SEPA for the Earba PSH scheme in order to improve the ecological status of the watercourse. The proposed dam will include facilities for the release of this flow. It will also incorporate a mechanism for releasing water to the existing Ardverikie hydro scheme, which will remain in operation. These will include a valve house and stilling pond at the toe of the dam. The dam will have a spillway for the safe passing of any flood flows. Proposed general arrangement drawings of these facilities are shown in :-

- **Figure 2.7.1 - Shios Dam - Layout Plan (with Ardverikie Hydro Intake)**
- **Figure 2.7.2 – Shios Dam GA - Enlarged Layout Plan - Spillway Valve House and Ardverikie Hydro Intake**
- **Figure 2.7.3 – Shios Dam – Sections thro Spillway and Compensation Pipes**
- **Figure 2.7.4 – Shios Dam - Valve House, pool and Spillway -GA**
- **Figure 2.7.5 - Shios Dam - New Hydro Intake GA**
- **Figure 2.7.6 - Shios Dam GA - Construction Stage Layout Plan**
- **Figure 2.7.7 - Shios Dam - Sections through Temporary Culvert and Cofferdams**

Shuas Dam

3.6.12 The southwestern dam, the Shuas Dam, shown in **Figure 2.8 – Shuas Dam GA**, will be located at or close to the SW end of Loch Earba. This location has been selected based on several factors including: - the avoidance of areas of peatland and other ecological sensitivities to its south-west, preliminary ground investigations, the setting of the dam within the landscape, and construction logistics considerations. Whilst preliminary geotechnical investigations already carried out give reasonable confidence on the dam location, the final micro-siting of this dam would be based on further detailed ground investigations prior to commencing construction. A micrositing allowance of up to 50m to the southwest and 100m to the northeast of the indicated location is requested.

3.6.13 The Shuas Dam would be an earth or rock fill dam with a nominal gradient of up to approximately 1:3 to the upstream and downstream faces. The downstream face of the dam will be topsoiled and vegetated to match the surrounding areas. There is some flexibility in the final design of the profile of the dam to alter it to improve its setting in the landscape.

3.6.14 The low-lying peatland to the southwest of Shuas Dam, which would be partly inundated in wet weather and which would require to be drained by the proposed Shuas

Aqueduct, are discussed below. Layouts of this area as well as temporary construction arrangements using cofferdams are shown in :-

- **Figure 2.8.1 Shuas Dam - Area Plan**
- **Figure 2.8.2 Shuas Dam - Construction Area Plan**
- **Figure 2.8.3 Shuas Dam - Construction cross sections (showing cofferdams)**

Promontories

3.6.15 The area of grassland separating the existing Earba lochs would be permanently inundated by the Earba reservoir. In order to retain the visual appearance and break up the linearity of the reservoir margins, it is proposed that promontory areas landscaped with trees, similar to those existing on the south shore of the existing north Earba Loch, would be created at the north and south sides reservoir, as shown in **Figure 2.2 – Scheme Arrangement**. The general arrangement of these is shown on **Figure 2.9 – GA of Promontories.**

Underground Waterway System

3.6.16 The underground waterway system, shown in **Figure 2.2 – Scheme Arrangement**, and **Figure 2.10 - Tunnel Layout Plan** plus **Figure 2.11 –Tunnel Section**, would include:

- up to three headrace tunnels connecting the Leamhain Reservoir to the Powerhouse;
- Intake/outfall arrangements including screens and isolation gates at the northern end of the Leamhain Reservoir – the upper control works;
- up to three surge shafts on the upper flank of Creag Pitridh;
- an access adit tunnel from Coire Pitridh to approximately the mid-point of the headrace tunnels to facilitate access for tunnel construction on multiple fronts and for maintenance access;
- Tailrace tunnels between the powerhouse and the Earba Reservoir;
- Access tunnels from the powerhouse area to the headrace tunnels; and
- Intake/outfall structures including screens and isolation gates on the East shore of the Earba Reservoir – the lower control works.

3.6.17 Excavated material from construction of the tunnel systems would be used in the construction of the lower reservoir dams and the promontories.

Leamhain Reservoir Upper Control Works

3.6.18 Up to three intake/outfall structures located side by side at the NW end of Loch Leamhain would feed up to three headrace tunnels carrying water between the upper and lower reservoirs, through the powerhouse. These are shown in **Figure 2.12 – Upper Control Works GA**. The intakes would be reinforced concrete structures, largely below the reservoir operational low water level. Flows through the intakes would be reversible, depending on whether the scheme was pumping or generating. The intakes would incorporate screens with a small bar spacing to prevent debris and fish from entering the underground waterway system, and a maximum approach velocity limit of approximately 0.3 m/sec in front of the screens. Access to the screens for maintenance would be with the reservoir at its lowest operating level.

3.6.19 A shaft would connect each tunnel to the surface, approximately 200m back from the outfall screens. These shafts would contain hydraulic gates for the isolation of the tunnels. The gatehouses would be semi-buried, set into the hillside, with access from the downslope side facing the Leamhain Reservoir. This would reduce the visual impact of the gatehouses from the popular walking routes close to this location. Details are shown in **Figure 2.13 – Upper Control Works Isolation Gates GA**.

Surge Shafts

3.6.20 Surge shafts would connect each tunnel to the surface to provide relief for transient water pressures within the tunnels during operation. The size and top level of the surge shafts is dictated by the hydraulics of the tunnels, which in turn drives the location of the surge shafts to where there is sufficient elevation. Each surge shaft would be up to 15m diameter at the surface. The surge shafts would be located on the flank of Creag Pitridh. At the surface there would be a concrete wall approximately 2.5m high around each surge shaft to provide security against personnel falling into the shafts. Details are shown in **Figure 2.14 – Surge Shafts GA**.

3.6.21 It is planned to construct the surge shafts with a raise boring technique which leaves the excavation arisings in the tunnel at the bottom of the shaft to be transported out through the low-level tunnels. This reduces the transport of excavated material from the top of the shafts, and consequently the scale of access track and site establishment required there. A small site compound, SC 7, would be located adjacent to the shaft works. Details are shown in **Figure 2.35 – Site Compound SC7 Surge Shaft Area**.

Tailrace Tunnels

3.6.22 An approximately 100m long tailrace tunnel would connect each pump turbine to the lower control works in the Earba Reservoir. These tunnels would be concrete lined.

Earba Reservoir Lower Control Works

3.6.23 The lower control works would need to accommodate flows into and from the powerhouse, depending on whether the scheme is operating in pumping or generating mode. The arrangement of these facilities is shown in **Figure 2.16 – Lower Control Works GA**.

3.6.24 The lower control works would comprise up to six concrete inlet / outlet structures positioned side by side at the end of the tailrace tunnels. These structures would house the necessary screen arrangements and be shaped to smoothly channel the water in and out of the Earba Reservoir at low velocities, similar to the upper control works.

3.6.25 The tailrace tunnels and lower control works would be below the normal Earba Reservoir minimum operating water level. The top of the structure would be just visible when the reservoir is at its lowest operating level. The tailrace screen frontage would be approximately 200m long and 18m in depth, below lowest operating level.

3.6.26 The tailrace tunnels would be provided with hydraulic gates for isolation of the tunnels from the reservoir during some maintenance activities. The gates would be connected to the ground surface by shafts, each with a hoist chamber at the top to house the operating mechanisms for the gates. The gate hoist chambers would be set below

ground level, details are shown on **Figure 2.17 – Lower Control Works Isolation Gates GA**.

3.6.27 The majority of construction at the lower control works would take place in dry conditions using drill, blast, muck and haul tunnelling techniques. The tailrace tunnel portals would be formed in an excavation behind a natural cofferdam of existing ground to minimise the amount of underwater construction work. Part of the excavation of the tailrace tunnels is likely to commence from this excavation.

3.6.28 The lower control works would require screens for the exclusion of fish and debris, likely to be vertical bar screens with a 12mm spacing and a maximum approach velocity limit of approximately 0.3 m/sec in front of the screens.

3.6.29 A hardstanding area would be provided to allow for access to and cleaning of the screens and maintenance of the lower control works.

The Powerhouse and Switchyard

3.6.30 The powerhouse, located by the shore of Loch Earba, would comprise a series of up to six shafts approximately 70m deep, sunk from a floor level of 377m AOD in a benched cutting into rock excavated approximately 25m below the sloping hillside, as shown in typical section on **Figure 2.18 – Powerhouse Plan and Figure 2.19 – Powerhouse Typical Cross Section**. Each shaft would contain a reversible pump turbine and motor generator together with associated equipment. The shafts would sit beneath a surface building which would contain an overhead crane and other facilities including offices, storage, transformers and other equipment.

Pitridh Aqueduct

3.6.31 An aqueduct would pick up flows from the watercourses Allt Coire Pitridh and Allt Coire a' Chlachair to divert them around the Shuas Dam into the Earba Reservoir. The overall layout and arrangement of this aqueduct is shown in **Figure 2.20 - Pitridh Aqueduct Plan and Long Section (Sheets 1-3)** and **Figures 2.20.4 &2.20.5 Cross Sections**.

3.6.32 The aqueduct would be an open trapezoidal channel up to approximately 5m wide and 2-3m deep, lined with local boulders to maintain a semi natural appearance similar to the existing Allt Coire Pitridh watercourse. Details are shown **on Figures 2.21.1 to Figure 2.21.5 - Pitridh Aqueduct Details**.

Shuas Aqueduct

3.6.33 There would be a residual run-off from the small direct catchment for the area downstream of the Pitridh aqueduct. The Shuas Dam would block the original outlet of these watercourses to Loch Earba, therefore an alternative drainage outlet would be required. It is proposed to construct a new water conduit – the Shuas Aqueduct – and divert any flows to this area through this into the small reservoir to the west of this area, which in turn drains to the Abhainn Ghuilbinn, just upstream of Loch Laggan.

3.6.34 The aqueduct would comprise an intake structure feeding a buried pipeline. The arrangement of this aqueduct is shown in **Figure 2.22 - Shuas Aqueduct GA** and the inlet structure to control upstream water levels in the existing peatland as well as stormwater culvert flows, is shown on **Figure 2.22.1- Shuas Aqueduct - GA of intake**

weir and headwall. Layouts of the drained area southwest of Shuas Dam are shown in **Figures 2.8.1** and **Figure 2.8.2**.

Access Tracks and Footpaths

3.6.35 Access tracks would be provided for the construction of the Proposed Development and for operational, maintenance, and emergency access.

3.6.36 The Proposed Development would be accessed for both construction and operation from the A86 trunk road at Moy Bridge. Existing tracks would be utilised wherever possible, subject to upgrading to the standard necessary for the expected construction and operational traffic. New permanent tracks will be necessary to replace sections that would become inundated by the new Earba reservoir, for access to the Leamhain reservoir, and where deviation from existing tracks is necessary to avoid locations of ornithological sensitivity.

3.6.37 All of the permanent tracks would be reduced in width after completion of construction.

3.6.38 Several new and upgraded bridges will be required to facilitate the access track network. For flooding, all bridges will be designed to accommodate a 1 in 1000 year storm event plus climate change factor along with appropriate freeboard. These bridges are shown in **Figure 2.41.1 to 2.41.3 and Figure 2.42.1 & 2.42.2**

3.6.39 Safe access for recreational users will be maintained throughout the construction and operation of the Proposed Development. Where existing routes are altered by inundation or new structures, alternative routes would be provided, with these in place before the original routes are affected by construction. Details of these arrangements are included in the Section 36 Application EIAR Appendix 15.1 - Draft Access Management Plan.

3.6.40 The overall layout of the existing and proposed assess tracks and footpaths is shown in the following figures:

- **Figure 15.1 – Site Plan Showing Existing Access Routes and Footpaths**
- **Figure 15.2 – Site Plan Showing Access Routes and Footpaths During Construction**
- **Figure 15.3 – Site Plan Showing Access Routes and Footpaths During Operation**

Junction with the A86 to Site Entrance Compound SC1

3.6.41 A new junction would be built to access the site from the A86 trunk road. This would be designed to a standard agreed with Transport Scotland. The preliminary layout of the new junction is shown in **Figure 2.23 - A86 Junction GA**. The new junction will include a new bridge over the River Spean / Moy Channel– the existing bridge is unsuitable – and would lead directly into a site entrance compound area (SC1). This bridge (Water crossing WX02) is shown in **Figure 2.24 - River Spean (Moy Channel) Bridge**. The original junction and bridge would be retained for use by Corrour Estate traffic and by recreational users bypassing the site entrance compound SC1. It would be preferable to have only one bridge over the Moy Channel to reduce the environmental impact on the banks of the channel. However, as this is already an engineered canal between Loch Laggan and the rest of the Laggan Reservoir, it is suggested that in view of the channel banks' already modified status, as well as the need to keep the separate access to the

neighbouring estate functioning throughout construction and into the future, retaining the original bridge as well as the new one should be acceptable.

3.6.42 The new bridge would be designed to accommodate the 1 in 1000 year flood event including an up to date allowance for climate change.

Mass Balance Strategy

3.6.43 A mass balance (spoil management) strategy and borrow pit plan has been designed for the Proposed Development which would maximise the use of materials generated from within the site for use in the construction of the permanent works, and which would put any surplus materials generated from construction of the permanent works to beneficial use within the site. This would minimise the environmental impact of the Proposed Development by avoiding the need to transport bulk materials to the site wherever possible and by avoiding the generation of any waste material that would need to be taken off site for disposal. The mass balance strategy is detailed within the **EIAR** Appendix 2.4 – Mass Balance Strategy and Borrow Pit Plan. Whilst this document has not been submitted as part of the CAR Application, it is available at the following link: https://earbastorage.co.uk/documents/

Borrow Pits

3.6.44 Borrow pits would be established at the locations shown in **Figure 2.2 – Scheme Arrangement**. The precise locations would be subject to micro-siting following detailed ground investigations. Some preliminary ground investigation (GI) has however been carried out at these locations to establish the suitability of the materials for use in the works, the depth to rock where this is the desired borrow material, and the volumes of peat and other soils which would need to be temporarily stored before being used to restore the borrow pits on completion of extraction operations.

Construction Stage Water Abstractions

3.6.45 During the construction stage of the project temporary abstraction points would be required to supply water for the following activities:

- Welfare facilities at the construction site compounds located at all the main works areas;
- Concrete production;
- Drilling;
- Piling;
- Grouting;
- Dust suppression; and
- Wheel washing.

3.6.46 Water for the above activities would be required for the full duration of the construction programme, albeit at varying abstraction rates.

3.6.47 Dewatering would be required in several parts of the site, the extent of which will be a function of the local ground conditions. It is expected that dewatering techniques will be required at the dams and the upper & lower control works construction areas.

3.6.48 The details of all abstraction and dewatering required during the construction phase would be set out in the Principal Contractor's methodology, which would be submitted

to SEPA as part of the requirements of the construction license required under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 covering the Construction Works.

Site Drainage

3.6.49 At the detailed design stage, a Drainage Impact Assessment (DIA) would be provided. The DIA would include details relating to any existing drainage and the management of surface water drainage, which would be designed in line with general Sustainable Drainage Systems (SuDS) principles. Mitigation measures to manage the residual risk of overland flow/pluvial flooding would be included in the DIA.

3.6.50 Natural flood management techniques would also be applied to reduce the rate of runoff where possible. Tracks would not act as preferential pathways for runoff and efforts would be made to retain any existing drainage network. Appropriate drainage would be provided to restrict runoff to pre-development rates and to minimise erosion to existing watercourses. The DIA would ensure that post development, runoff rate is no greater than pre-development runoff rate (i.e. greenfield runoff) for all return periods up to the 1 in 200 year event including an allowance for climate change.

3.6.51 Runoff from all events up to and including the 1 in 200 year plus climate change event would be managed within the site boundary, with no flooding to critical roads or buildings.

Site Accommodation

3.6.52 A number of site compounds would be required to accommodate the construction site establishment and lay down areas, as well as a workers' residential camp. The locations of these compounds are shown in **Figure 2.2 – Scheme Arrangement**.

3.6.53 A Site Entrance Compound (SC1), shown **in Figure 2.2.1 - Site Compound SC1 / Borrow Pit BP1 - Plan and Sections**, would be established for the duration of the construction of the Proposed Development on an area south of the Moy channel at the entrance point of the new access junction and would be in the same location as Borrow Pit 1 (BP1). This would be located on the area of wet heath, avoiding the blanket bog adjacent to this area. This compound would include the following facilities:

- Access security;
- Site offices;
- Parking for cars and lorries;
- Laydown Areas; and
- Wheel wash facilities.

3.6.54 The site entrance compound would be surrounded by an earth bund to screen the area visually and acoustically from neighbouring properties.

3.6.55 The Main Construction Compound and Accommodation Camp (SC2) would be located in the area to the southwest of the Shuas Dam. The final arrangement for this would be developed during design development and procurement and would be agreed with the planning authority in advance of works on the Proposed Development commencing.

3.6.56 This compound, illustrated indicatively in **Figure 2.31 SC2 - Main Construction Compound and Accommodation Camp**, would incorporate the following facilities:

- The main site offices and associated welfare facilities;
- Temporary accommodation facilities for up to 600 people, including welfare and recreation facilities;
- Workshop and internal storage facilities;
- Parking;
- Laydown areas for materials deliveries;
- Plant storage areas;
- Facilities for power generation, water supply and waste treatment;

3.6.57 In the Loch Earba area, site compounds, materials handling areas and office and welfare facilities would be needed for construction of the two dams, the powerhouse and for access for driving the tunnels. These are shown in **Figure 2.32 as SC3**, **Figure 2.33 as BP3/SC5**, **Figure 2.34 as SC6A and SC6B**. (SC4 is not used).

3.6.58 A small satellite compound SC7 would be required at the surge shafts location as shown in **Figure 2.35**.

3.6.59 At the Loch Leamhain dam and upper control works, a large site compound SC8 would be established within the proposed reservoir inundation area and the drawn down Loch Leamhain. This would accommodate large materials handling areas as well as site accommodation, welfare and lay-down areas. The proposed layout for this compound is shown in **Figures 2.36** and **2.37**. A description is given of the proposals for de-watering Loch Leamhain, construction sequence, pollution prevention and drainage management in **Appendix E - Leamhain Dam Construction – Draft Pollution Prevention Plan**.

3.6.60 Areas within the footprint of the lower reservoir would have the disadvantage of becoming inundated as impoundment of this reservoir would commence before the rest of the construction and reinstatement works are complete. However, these areas would be restricted to materials handling areas and would be reinstated before impoundment.

Areas of Habitat Compensation and Enhancement

3.6.61 The Proposed Development would include a very significant package of habitat compensation and biodiversity enhancement works, including approximately 600ha of peatland restoration as well as approximately 1,500ha of fenced land around the Earba reservoir and surrounding hills which will provide an area for woodland restoration, and some further species-specific habitat enhancement works. These proposals would demonstrably contribute significantly to the enhancement of biodiversity, including restoring degraded habitats and building and strengthening nature networks and the connections between them.

3.6.62 Details of the proposed habitat compensation and enhancement works are outlined in the **EIAR** Chapter 8 – Terrestrial Ecology and **EIAR** Appendix 8.6 - Outline Biodiversity Enhancement and Management Plan. Whilst these documents have not been submitted as part of the CAR Application, they are available at the following link: https://earbastorage.co.uk/documents/

3.7 Site Traffic

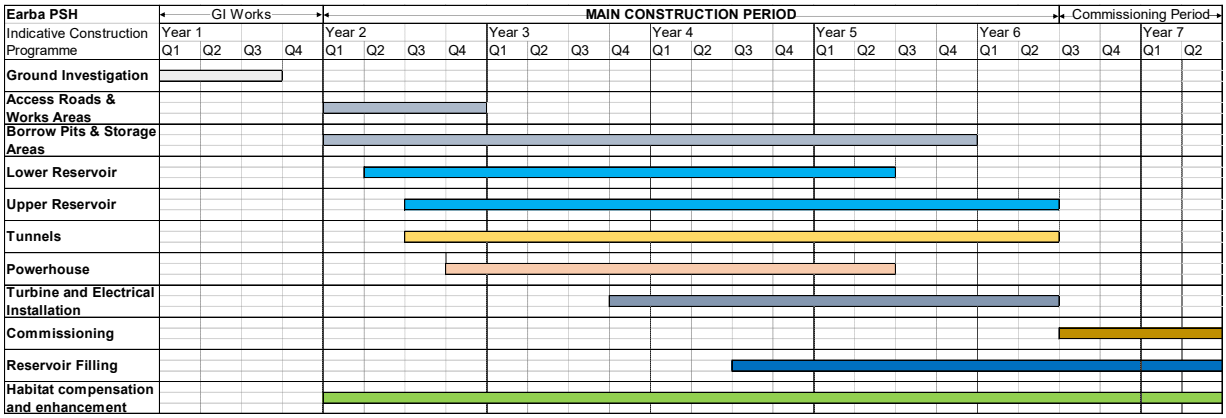
3.7.1 Construction traffic to the Proposed Development would take access from the A86 at Moy Bridge. All operational or maintenance traffic would also utilise this access route.

3.7.2 An estimate of construction traffic generation and the potential effects of this on the local road network, is included in **EIAR** Chapter 17: Transport and Access. Whilst this document has not been submitted as part of the CAR Application, it is available at the following link: https://earbastorage.co.uk/documents/

3.7.3 During operation, the Proposed Development would be manned from the administration area inside the powerhouse. It is estimated that an average of 10 to 15 staff would require daily access to the site. Infrequent access by heavier vehicles for maintenance and refurbishment would occur as required.

3.8 Construction Programme and Working Hours

3.8.1 An outline programme has been prepared for the Proposed Development and is shown below.



3.8.2 It is anticipated that the construction and commissioning period would last approximately five to six years and the workforce would reach approximately 500 people on-site at the peak of the construction phase. The number of construction workers on-site will vary depending on the stage of the works.

3.8.3 Normal construction shifts would generally apply for the surface works – access tracks, dams, powerhouse, upper control works and lower control works - but these could be subject to some variation to suit the ongoing work, weather conditions and time of year. It is anticipated that surface works would generally be undertaken between 07.00 and 19.00 hours, seven days a week and that underground operations would continue 24 hours a day, seven days a week. As the workforce would be housed within the site, these hours should not lead to any “out-of-hours” traffic on the local roads.

3.8.4 It is proposed that the movement of HGVs into or out of the Site would only take place between 08.00 and 18.00 on Mon - Friday and 08.00 - 16.00 hours on Saturdays and Sundays.

3.8.5 Although it will be far enough away from any noise sensitive receptors so as not to cause any nuisance, any surface blasting on site would only take place between the hours of 09.00 to 17.00 on Monday to Friday inclusive and 10.00 to 14.00 on Saturdays, Sundays

and on National Public Holidays, unless otherwise approved in advance in writing by the Planning Authority.

3.8.6 Underground operations and other agreed works that would continue to take place out-with normal surface working hours, would have management measures in place to ensure that any noise and lighting is mitigated for receptors above ground. The final CEMD, to be prepared by the appointed Principal Contractor, will include a Construction Noise and Vibration Management Plan (CNVMP) for construction activities, including blasting activities. This plan will also include measures that would be implemented during construction to ensure local receptors are not adversely affected by noise and measures for community liaison to advise on the timing and duration of blasting activities. The final CNVMP will be submitted to the Planning Authority for approval prior to the commencement of the Proposed Development.

3.8.7 An outline noise Management Plan is provided in the **EIAR** Appendix 18.3 – Draft Construction Noise and Vibration Management Plan (CNVMP). Further information on Noise is also provided in **EIAR** Chapter 18: Noise and Vibration . Whilst these documents have not been submitted as part of the CAR Application, they are available at the following link: https://earbastorage.co.uk/documents/

3.9 Construction Environmental Management

Construction Environmental Management Processes

3.9.1 Construction mitigation and environmental protection measures would be managed through a suite of documents under the umbrella of a Construction Environmental Management Document (CEMD). An outline CEMD is attached at **Appendix F – Outline Construction Environmental Management Document**.

3.9.2 The CEMD would apply to all construction activities and be implemented via the Contractors' Construction Method Statements. In particular, the CEMD would specify conditions relating to protection of habitats and species, pollution prevention and the means by which site monitoring would occur. The final site-specific CEMD would be the responsibility of the Principal Contractor. This document would be reviewed by the Authorised Person, in consultation with the Highland Council (THC), Scottish Environment Protection Agency (SEPA), and NatureScot.

3.9.3 The CEMD will include the following:

- Pollution Prevention Plan
- Mass Balance Strategy
    - Borrow Pit Management Plans and
    - Spoil Management Plans
- Site Monitoring Plan
- Waste Management Plan,
- Incident Response Plan
- Drainage Impact Assessment
- Drainage Management Plan
- Biodiversity Enhancement and Management Plan
- Ecological Management Plan
- Species Protection Plans (SPPs)

- Tree Protection Plan (TPP)
- Surface Water Quality Monitoring Programme (SWQMP)
- Dust Mitigation Plan
- Peat Management Plan & Soil Management Plan (PMP & SMP)
- Peat Hazard Emergency Plan
- GWDTE Assessments and Exclusion Plan
- A Schedule of Watercourse Crossings
- Access Management Plan
- Construction Traffic Management Plan (CTMP)
- Abnormal Indivisible Load - Transport Management Plan,
- Construction Staff Travel Plan
- Construction Noise and Vibration Management Plan
- Reinstatement Plan

Ecological Clerk of Works

3.9.4 Construction will be supervised and monitored by specialist advisers including Ecological Clerks of Works (ECoW) to ensure that sensitive ecological habitats and species are adequately protected in accordance with the methodologies in the CEMD and associated documents.

Micro-siting

3.9.5 There may be a requirement to micro-site elements of the Proposed Development from the positions shown on **Figure 2.2 – Scheme Arrangement**, as a result of additional constraints encountered during site works. Any micro-siting would require agreement of the specialist advisors (e.g. the ECoW) as appropriate.

Site Environmental Management

3.9.6 The Principal Contractor would have overall responsibility for environmental management on the Site. The services of specialist advisors, such as the project ECoW , would be retained as appropriate to be called on as required to advise on specific issues. The Principal Contractor and the Authorised Person would ensure construction activities are carried out in accordance with the mitigation measures outlined in this EIA Report and those detailed in the approved CEMD.

3.9.7 All contractors would be required to adhere to the following in order to reduce or mitigate the environmental effect of the construction process:

- The requirements set out in this EIAR;
- the conditions of any granted consent; and
- relevant environmental regulations.

3.9.8 A copy of any conditions of consent and the CEMD would be incorporated into tender and contract documents and form part of the contract between the Authorised Person and the Principal Contractor. The selection criteria for the Principal Contractor would include their record in dealing proactively with environmental issues, and provision of evidence that they incorporate all environmental requirements into their method statements and thereafter implement these on site.

Site Reinstatement

3.9.9 Reinstatement would be undertaken as soon as practical following the construction works in each area.

3.9.10 Site tracks and some hardstanding areas would be retained for use during maintenance operations, although, except for the main track from the A86 to the powerhouse, construction tracks would be reinstated to 4 m with passing places. The track edges would as far as possible be blended to the adjacent contours, with natural vegetation being allowed to re-establish.

3.9.11 All construction equipment and other temporary infrastructure would be removed from site and the temporary storage areas would be reinstated.

3.10 Land Take

3.10.1 It is estimated that the maximum permanent development footprint of the Proposed Development would be approximately 310 Ha. During the construction period it is estimated that a further 103 Ha would be temporarily required which would be reinstated following completion of the construction works.

3.11 Lighting

Construction Lighting

3.11.1 For safety reasons, temporary lighting would be required for all external construction activities during hours of darkness and low natural light. This lighting would be designed to minimise illumination, glare or light spillage to nearby receptors.

3.11.2 The final CEMD, to be prepared by the appointed Principal Contractor, will include a detailed description of lighting requirements for construction activities and measures that would be implemented during construction to minimise illumination, glare or light spillage out with the Site boundary.

Operational Lighting

3.11.3 Once operational, external lighting would only be provided at key areas, such as the lower control works but would only be used during essential operational and maintenance activities, for example if a switching operation was necessary in the external switchyard. No lighting would be operated by PIRs. Prior to the commencement of Proposed Development, final design details for the external lighting during operation would be agreed with the Planning Authority.

3.11.4 The powerhouse surface building will be designed with automatic blinds on all glazed windows and doors, with these closed between dusk and dawn.

3.12 Project Operation and Maintenance

3.12.1 The Proposed Development would be manned twenty-four hours a day, with most operations being controlled from the control building within the powerhouse or remotely. Regular visits would be made to inspect and maintain the scheme components as follows:

- Daily visits to the powerhouse, intake and tailrace screens for routine operation and maintenance;

- Weekly visits to the dams, for routine operation and maintenance;
- Non-routine and scheduled major maintenance tasks would be carried out at longer intervals as required. These tasks could potentially extend to several weeks/months;
- Periodic inspection of the underground tunnel works and dam structures; and
- As-required maintenance of the access tracks and other infrastructure.

3.13 Project Decommissioning

3.13.1 With proper maintenance, the Proposed Development should remain functional indefinitely and as such an assessment of decommissioning effects has not been provided as part of the EIA Report. If the Proposed Development ceases operation, decommissioning would take place and the site would be restored as follows:

- Moveable infrastructure would be removed;
- Underground tunnels would be sealed off;
- Generation plant would be removed;
- Where removal of infrastructure, for example the dams, would result in more damage than leaving in place, they would be left in-situ; and
- Disturbed ground would be reinstated.

3.13.2 Full details of the decommissioning plan would be agreed with the appropriate authorities and landowners prior to any decommissioning works commencing.

4 Water Management

4.1 Chapter Introduction

4.1.1 The Proposed Development comprises a pumped storage hydroelectric (PSH) scheme to transfer water between Loch Earba (lower reservoir) and Loch Leamhain (upper reservoir). This Chapter presents a summary of the baseline hydrological conditions and a review of the water management strategy for the Proposed Development. Details of the Proposed Development including plans and detailed drawings are included in the Figures referenced within **Chapter 3: The Proposed Development**.

4.1.2 This Chapter also considers the potential effects, including cumulative effects, of the Proposed Development on Water Resources during construction and operation. This chapter presents a summary of the baseline water management conditions and a review of the water management strategy for the Proposed Development as detailed in **Chapter 3: The Proposed Development**.

4.1.3 The water management assessment has been carried out by Gilkes Energy Ltd with hydrological input by Mott MacDonald Ltd, flow gauging by MNV Consulting and geomorphology assessment by Envirocentre Ltd.

4.2 Existing Water Bodies

Existing Baseline – Loch Earba

4.2.1 The catchment areas and layout of the existing lochs and proposed reservoirs are shown below in Plate 4-1 Catchment and Reservoir Plan.

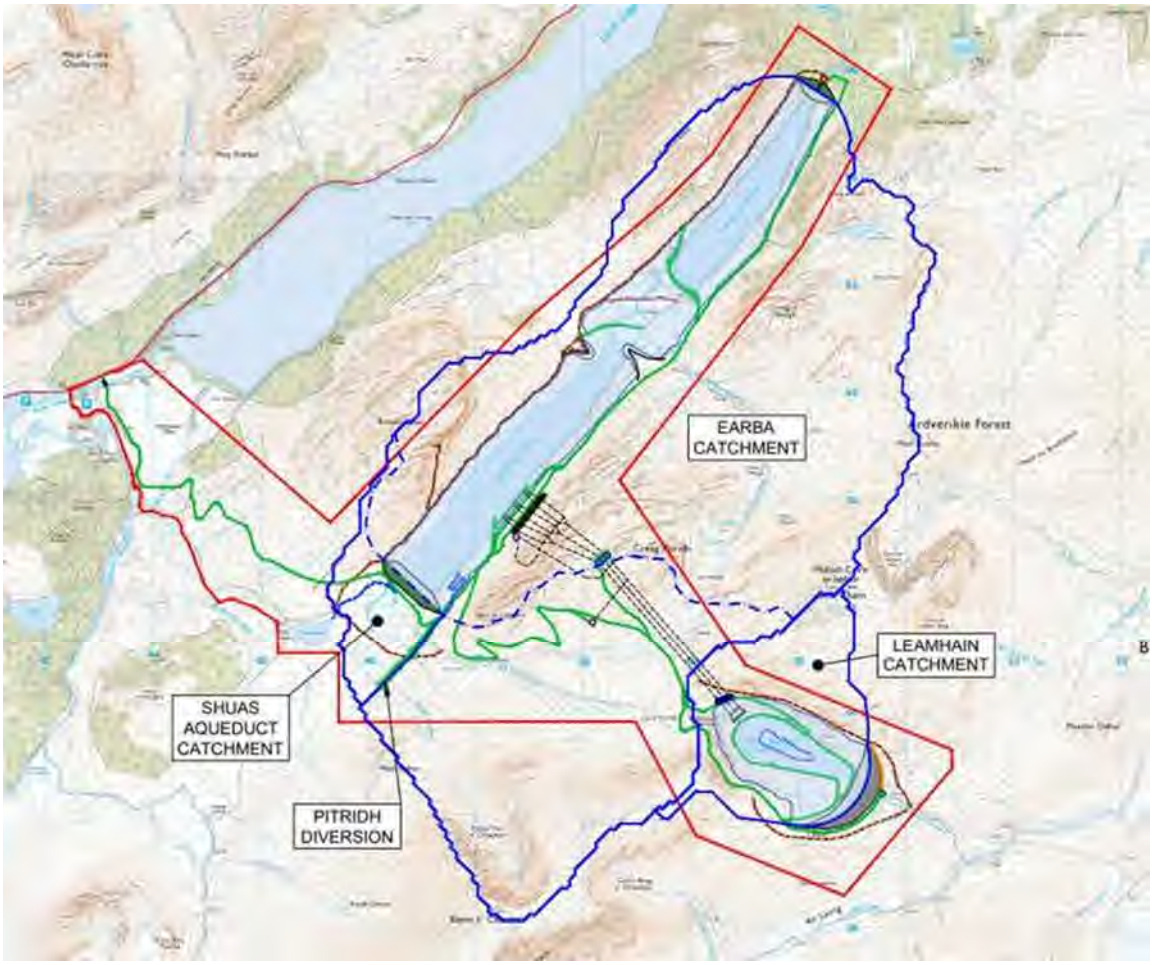


Plate 4-1 Catchment and Reservoir Plan

4.2.2 Loch Earba is formed by two lochans of the same name, separated by a short reach of channel and floodplain. There is an existing dam on this channel and this controls the level in the upper loch, providing water storage for the existing 1MW Ardverikie hydroelectric scheme. There is also a dam on the lower loch, on the natural outlet. This lower dam also includes the hydro intake and provides further storage for the existing hydroelectric scheme.

4.2.3 The catchment area of Loch Earba is 26.44km2. The operation of the existing hydroelectric scheme results in the upper Earba loch fluctuating by approximately two metres from a level of 350.57m AOD to 352.6 m AOD. The lower Earba loch fluctuates by approximately 1m from a level of 348.19m AOD to 349.19 m AOD (the spill level of the Ardverikie Hydro Dam). During the rare occasions when the existing dam at the hydro intake spills, the level increases above 349.19m AOD in the lower loch. Likewise, when the dam on the upper loch spills the level will rise above 352.6m AOD.

4.2.4 This gives a total impoundment volume across both lochs of approximately 2.6Mm3.

4.2.5 The existing hydro-electric scheme abstracts up to 1291 l/s to deliver up to 1MW of electricity.

4.2.6 No compensation flow is passed from Loch Earba into the Allt Labhrach, so all water in Loch Earba, excluding spill, is reserved for hydro operations.

Existing Baseline – Loch Leamhain - Allt Bhealaich Leamhain

4.2.7 Loch Leamhain is a hill loch with a natural outlet at the level of 635m AOD. Water flows from this loch into the Allt Loch a' Bhealaich Leamhain, the Allt Cam and onward to Loch Pattack. There are no existing abstractions from this loch.

4.2.8 The catchment area of Loch Leamhain is 2.57km^2.

4.2.9 It is estimated that the natural fluctuations in the level of Loch Leamhain are approximately 300mm.

Future Baseline – All Water Bodies

4.2.10 There are no proposals to introduce compensation flow into the Allt Labhrach.

4.2.11 The existing Ardverikie Hydro Scheme could continue to run for many more decades.

4.2.12 Vertical drawdown zones of 2m and 1m will continue to be present at the upper and lower Earba lochs respectively.

4.2.13 Any small-scale conventional hydro utilising the water from either the Allt Coire Pitridh watercourses or the outflow from Loch Leamhain is considered unviable and there are no plans for any development of this type.

4.2.14 In conclusion, no change to the baseline is proposed or expected.

4.3 Hydrology

Desk Studies

4.3.1 A review of available flow data and meteorological data applicable to the site has been undertaken. This is provided in **Appendix A – Hydrology Study**.

4.3.2 The hydrology study assesses the theoretical flow duration curves for the gauging sites and looks at fill times for the proposed Earba reservoir.

Field Study

4.3.3 Water Flow and Loch level gauging has been undertaken at 4 sites across the Proposed Development site since early 2023.

4.3.4 The data from the field work above is still being collected and, as such, assessments have been made at this time using the desk-based analysis, to derive flow duration curves for points of abstractions. It is planned that once a full record of gauging is complete, it will be submitted to SEPA with a view to confirming or adjusting any provisional CAR licence values.

4.3.5 A report of the gauging at the Allt Leamhain site is include in **Appendix B - MNV Leamhain final hydrology report**.

4.3.6 Mott MacDonald carried out a review of the theoretical values they calculated in the Appendix A report and the Appendix B MNV gauging data, and this review is provided in **Appendix C - Comparison of theoretical and gauged data**. The mitigation to minimise the risk of INNS transfer between Loch Earba and the downstream receptors to Loch Leamhain would mean that a set compensation flow value will not be released from

Leamhain Dam. Furthermore the engineered channel design of the Pitridh aqueduct would mean that no compensation flow would be released to the small section of downstream catchment beneath the aqueduct. This means the gauging work undertaken to date is no longer required to assist with the determination of compensation flow rates. However the monitoring of loch levels in Loch Earba can assist with determining the frequency and magnitude of the proposed freshet release which is designed to the reflect the current spill cycle at the existing hydro dam.

4.4 Geomorphology

4.4.1 A geomorphology survey has been undertaken. The hydromorphological character of key waterbodies has been assessed through a combination of spatial data analysis and site walkover survey, with a focus on channel forming processes. This is attached at **Appendix D – Hydromorphological Appraisal**.

4.4.2 The Hydromorphological report includes a number of key recommendations which have been incorporated into the design and drawings.

4.5 Details of the Controlled Activity – Construction

Filling Loch Earba

4.5.1 During construction it would be necessary to fill Loch Earba with sufficient water to able to run the pumping and generation cycles of the Proposed Development. This process would involve the full utilisation of inflows possibly over the entire year, subject to agreement with SEPA as part of the CAR licence, and agreement with downstream hydro operators. The filling process would start as soon as possible but would only commence once construction of the lower reservoir dams was completed and approved for filling by the Construction Engineer in accordance with the Reservoirs (Scotland) Act 2011.

4.5.2 Depending on rainfall during the filling period, the required volume will likely be accumulated over a period of 2 to 5 years assuming that filling occurs year-round. This would be significantly longer if a shorter seasonal filling window were applied.

4.5.3 Please refer to **Appendix A – Hydrology Study** for further detailed study of the estimated filling times demonstrating that the entire year would likely be required.

4.5.4 This filling process would temporarily reduce the flow of water to the Lochaber and Ardverikie Hydroelectric schemes. Once filling is completed the flows to these two hydro schemes would revert to a profile very similar to the existing situation. The PSH would not require any additional abstraction over and above existing evapotranspiration rates experienced by the runoff feeding the existing operational hydro stations.

4.5.5 Prior to any filling, an agreement would be reached with Ardverikie Hydro on compensation due to lost generation as a result of the Earba reservoir filling operations and additional HOF / compensation flows required in the Allt Labhrach.

4.5.6 Prior to any filling of the lower Earba reservoir, agreement would be reached with Lochaber Hydro on compensation due to any lost generation as a result of the filling operations.

Diversion Channel

4.5.7 During construction of the Pitridh aqueduct, water would still pass downstream as compensation flow to maintain the water levels in the blanket bog below. However, it should be noted that construction of the aqueduct is anticipated to be undertaken at the start of the Works and it would also be built offline with a very small time frame required to divert the existing burns into the new engineered channel.

Dam Construction

4.5.8 During construction of the Leamhain dam the natural flow up to an agreed return period would bypass the works. As the temporary diversion at the Leamhain dam works would be achieved by over pumping, the pumping capacity will likely not match the higher return period flood flows. This means that there will need to be a storm attenuation zone above the proposed temporary drawdown level of Loch Leamhain. This storm attenuation zone will need to be sufficient to store a set volume of storm water until it can be settled and transferred through the pumping system. Furthermore, the pumping methodology will require to be reliable and with built in redundancy such that there is minimal risk of: a) depleting the downstream Allt Loch a Bealaich Leamhain and b) allowing water to build up to unacceptable levels. Please refer to **Appendix G Loch Leamhain drawdown and buffer storage assessment** for details of drain down proposals and storm attenuation modelling. This report concludes that a 1 in 1,000-year winter storm event is well within the storage capacity of the loch following drain down. It is noted that the modelling reflects that storm flow releases will likely only occur 24 hours after the end of the storm event to allow any inflowing sediment to settle within the loch. Therefore, the drawn down loch is required to store the entire storm volume.

4.5.9 An outline draft methodology for the Leamhain construction works is contained in **Appendix E - Leamhain Dam Construction – Draft Pollution Prevention Plan**. The full methodology for the temporary dewatering and flow bypass at Loch Leamhain will form part of the Construction CAR Licence to be agreed with SEPA as well as the CEMD. Refer to the following **Figures 2.5.1** to **2.5.5** for details of the dam, spillway, valve house and **Figures 2.36, 2.37** and **2.5.5** for the proposed temporary diversion arrangements.

- **Figure 2.5.1 - Leamhain Dam - Layout Plan,**
- **Figure 2.5.2 - Leamhain Dam - Layout of Spillway, Bottom outlet pipes and Valve house**
- **Figure 2.5.3 - Leamhain Dam - Lower Valve House - Layout Plan**
- **Figure 2.5.4 - Leamhain Dam - Valve House Sections**
- **Figure 2.5.5 - Leamhain Dam - Lower Valve House - Temp GA with diversion and cofferdam**
- **Figure 2.36 - Site Compound SC8 -Leamhain Dam**
- **Figure 2.37 - Site Compound SC8 -Leamhain Dam – Sections**

4.5.10 At the Shios dam, until filling can commence, water would be diverted around or through the dam works, most likely by means of a temporary culvert. Immediately downstream of the works, this water would be utilised by the Ardverikie Hydro scheme in a reconfigured intake. It is proposed that the water levels in Loch Earba are kept within the lower bound of existing loch water levels during the construction of the dam foundations and the lower control works at the powerhouse. Therefore, the existing

dams on both the upper and lower Earba lochs would likely be decommissioned at the start of the works, but may form part of the temporary works operations during the construction stage. Keeping the water levels in Loch Earba at a lower level provides a buffer storage to protect the temporary works. Please refer to **Appendix H Loch Earba drawdown and buffer storage assessment** for details of drain down proposals and storm attenuation modelling. Modelling suggests that even with a small release of $2m^3/s$ at Shuas dam works, the buffer storage is expected to still have capacity for up to the 1 in 1,000-year return period winter storm event.

4.5.11 Refer to the following Figures 2.7.1 to 2.7.7 for details of the Shios dam, spillway, valve house and proposed new Ardverikie Hydro Intake as well as the proposed temporary diversion and cofferdams.

- **Figure 2.7.1 - Shios Dam - Layout Plan (with Ardverikie Hydro Intake)**
- **Figure 2.7.2 – Shios Dam GA - Enlarged Layout Plan - Spillway Valve House and Ardverikie Hydro Intake**
- **Figure 2.7.3 - Shios Dam – Sections thro Spillway and Compensation Pipes**
- **Figure 2.7.4 - Shios Dam - Valve House, pool and Spillway -GA**
- **Figure 2.7.5 - Shios Dam - New Hydro Intake GA**
- **Figure 2.7.6 - Shios Dam GA - Construction Stage Layout Plan**
- **Figure 2.7.7 - Shios Dam - Sections through Temporary Culvert and Cofferdams**

4.5.12 At the Shuas dam, the majority of run off would be diverted away from the works through the implementation of the Pitridh Diversion Aqueduct built before the dam works commences. The Shuas aqueduct would also assist in dewatering the Shuas dam working area. Refer to the following Figures 2.8.1, 2.22 and 2.22.1 for details of the Shuas Dam, and Shuas Aqueduct as well as Figure 2.8.2 and 2.83 showing the proposed temporary diversion and cofferdams at Shuas. The arrangement of the Pitridh Diversion Aqueduct is shown in Figures 2.20.1 to 2.20.5 and 2.21.1 to 2.21.3.

- **Figure 2.8.1 - Shuas Dam - Area Plan**
- **Figure 2.8.2 - Shuas Dam - Construction Area Plan**
- **Figure 2.8.3 - Shuas Dam - Construction cross sections (showing cofferdams)**
- **Figure 2.22 - Shuas Aqueduct GA**
- **Figure 2.22.1 - Shuas Aqueduct - GA of intake weir and headwall**

4.6 Details of the Controlled Activity – During Operation

Storage Volumes & Stop Levels

4.6.1 The Proposed Development would mean that there are three demands for water from Loch Earba: the supply of water to the pumps to transfer water from Loch Earba to Loch Leamhain; a new compensation flow from Loch Earba to the Allt Labhrach; and maintaining the existing supply of water to the Ardverikie Hydro scheme.

4.6.2 As part of the proposed development, two new dams would be constructed at the eastern and western ends of Loch Earba. These are called Shios and Shuas respectively.

4.6.3 These two new dams on Loch Earba would create a reservoir with a top water level (TWL) of 376m AOD which would store a total of approximately 62Mm3 of water.

4.6.4 To provide mitigation such that there is almost always availability of water for the compensation flow and water to run the Ardverikie Hydro this 62Mm3 includes up to 6Mm3 of "buffer" storage reserved for the Ardverikie Hydro, compensation flow and a minimum reserve for PSH operation. It also includes a 1Mm^3 flood freeboard, however the flow of water through the system would be managed such that this freeboard is only utilised in when rainfall exceeds forecasted levels. In any case there will be a spillway on Shios dam designed for PMF events.

4.6.5 It is important to note that this buffer storage may be drawn down over the course of the year through servicing the water demands of compensation flow principally and secondly the Ardverikie hydro. In very dry conditions, in order to maintain the minimum PSH operational volumes, the flows downstream of Shios Dam would revert to the pass through natural run off. The recharge of the buffer storage would likely happen during the winter. This is considered to be a conservative buffer that would provide a robust operational regime and protect the provision of continuous compensation flow and the operation of the Ardverikie hydro under normal conditions.

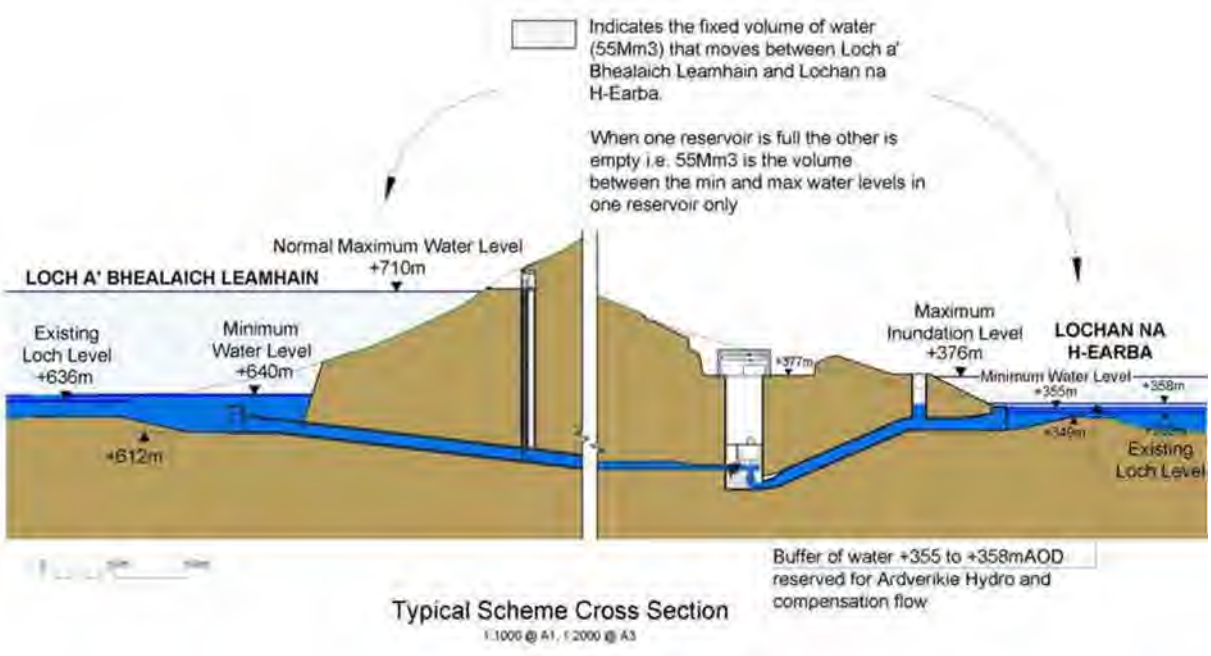


Plate 4-2 Cross Section through Upper and Lower Reservoirs

4.6.6 Referring to Plate 4-2 Cross Section through Upper and Lower Reservoirs above, during operation if Loch Earba is at the level 358m AOD and the Leamhain reservoir is full then the full 6Mm^3 buffer storage would be available. Should heavy rain be forecast, the valve house at Shios dam would open to maintain no more than the 6Mm^3 buffer storage level (always retaining a further 1Mm^3 for as an emergency flood freeboard). This means that Leamhain reservoir could fully discharge for power generation if required. By controlling and releasing water at Shuas dam to match inflows, the risk of curtailment on generation or Shios dam spilling is greatly reduced.

4.6.7 Assuming that the buffer storage has reached the capacity of 6Mm^3 then the stop pumping level of the Proposed Development would be 358m AOD to maintain this

minimum level. It is proposed that a stop pumping level of 355m AOD would be implemented for the Earba reservoir when the buffer storage has been reduced to zero. Whilst this means the stop pumping level in Earba will change as the buffer storage varies, the process to control this will be straightforward. By monitoring levels in the upstream and downstream reservoirs the total available volume in each reservoir will be known. If the volume is greater than 55Mm3 then the remainder would be buffer storage and the stop pumping level can be adjusted accordingly. This monitoring process will also ensure that the volume of buffer storage for Ardverikie hydro generation, compensation flow and any evapo-transpiration is maintained and topped up with natural inflow as necessary.

4.6.8 It is proposed that when water levels in the Earba reservoir reach the lower limit of 355m AOD all abstraction for the Ardverikie hydro would stop, this is effectively the proposed 'hands off level'. This level is approximately 3m higher than the existing TWL so that at all times a continuous body of water remains over the floodplain that separates the two lochs. This would maintain connectivity between the lochs for normal pumping operation down to 355m AOD level.

4.6.9 It is proposed that a stop discharge or generating level would be set at a maximum level of just below 376m AOD in the Earba reservoir, prior to reaching the spillway level.

4.6.10 During generation the upper reservoir will be drawn down, therefore it is proposed that a stop generating lower level of 640m AOD would be implemented for the Leamhain reservoir.

4.6.11 During pumping the upper reservoir will rise, therefore it is proposed that a stop pumping level would be set at just below 710m AOD in Leamhain reservoir. The proposed stop pumping and stop generating levels for both reservoirs are provided in Table 4-1 Reservoir Maximum and Minimum Operating Levels.

4.6.12 When the system is full with 55Mm3 of water for PSH storage and 6Mm3 of buffer storage, the reservoirs would be balanced, and both the Leamhain and Earba reservoirs would reach their respective stop generation or stop pumping levels at the same time.

Table 4-1 Reservoir Maximum and Minimum Operating Levels

Location	OS NGR	Stop Generating Level (m AOD)	Stop Pumping Level (m AOD)
Lower Reservoir (Earba)	NN 472 817	376	355 (buffer storage =0m³) 358 (buffer storage = 7Mm³)
Upper Reservoir (Leamhain)	NN 494 799	640	710

- The levels above are applicable even without the other so for example stop generating would be initiated when either 376m AoD (Earba) or 640m AoD (Lemahin) was reached.

Proposed Abstraction and Discharge Rates and Volumes

4.6.13 The Proposed Development would both abstract from or discharge water to the upper and lower reservoirs dependent upon operating mode. These flow rates are shown in Table 4-2 Proposed Abstraction and Discharge Flows.

Table 4-2 Proposed Abstraction and Discharge Flows

Location	OS NGR	Maximum Discharge (m^3/s)	Maximum Abstraction (m^3/s)
Lower Reservoir (Earba)	NN 472 817	820 (generating)	620 (pumping)
Upper Reservoir (Leamhain)	NN 494 799	620 (pumping)	820 (generating)

Drawdown

4.6.14 The maximum volume of water that would be transferred from the upper to the lower reservoir (or lower to upper) by the operation of The Proposed Development is 55 Mm^3.

4.6.15 Based upon an installed generation capacity of up to 1800 MW, it would take approximately 22 hours continuous electricity production at maximum output to transfer 55Mm3 of water from the upper to the lower reservoir. This represents the fastest maximum single continuous transfer of water which the Proposed Development could physically perform.

4.6.16 When the Proposed Development is generating at 1800MW the rate of rise in the lower reservoir, Loch Earba, would be around 0.8m per hour.

4.6.17 At the upper reservoir, Loch Leamhain, the rate of level fall when the Proposed Development is generating 1800MW would be around 3m per hour.

4.6.18 The pumping operation typically involves a lower flow of water than generation mode. In a full pumping cycle, with 55Mm3 of water moving from lower to upper, the Earba reservoir level would fall from top to bottom in 30 hours.

4.6.19 If the Proposed Development is pumping at maximum capacity this would draw down Earba reservoir at approximately 0.6m per hour. At the same time this pumping operation would increase the Leamhain reservoir at a rate of approximately 2.3m per hour.

4.6.20 Once the Proposed Development is operational, the fluctuations in reservoir levels will be a function of the UK electricity supply and demand and this may vary significantly from day to day. However it is considered that a continuous full generating cycle (or full pumping cycle) will be a relatively rare event.

Proposed Compensation Flows

4.6.21 No compensation flow will be passed directly from the Leamhain reservoir to minimise the risk of INNS transfer. However flow will continue in the Allt Leamhain downstream of the dam. To mitigate against any deterioration in the Allt Leamhain and areas downstream of Leamhain around the Allt Cam, approximately 50 % of the catchment area, with FDC profile following the natural flow spectrum, would be provided through the Leamhain catchment diversion channels. These channels would bypass and hence

remove the Leamhain reservoir from the wider Leamhain catchment inflows as part of the INNS mitigation. Please refer to **Appendix I INNS mitigation Flow impact on flows** for details of the proposed flow downstream of Leamhain dam and the impact on the FDCs at various locations downstream.

4.6.22 Whilst not a mitigation as such, a potential benefit of the project is to introduce a continuous compensation flow into the Allt Labhrach below Shios Dam. Currently this water course has no compensation flow entering it from the existing Ardverikie hydro scheme. The proposed compensation flow into the Allt Labhrach is provided in table 4-3 below.

Table 4-3 Proposed Project Compensation Flows

Catchment	OS NGR	Catchment (km^2)	Compensation flow (Litres/second)
Allt an Labhrach	X = 250232.353 Y = 785917.028 NN 50232 85917	24.19	190
Allt Loch a Bhealaich Leamhain	X = 250788.514 Y = 779249.149 NN 50789 79249	2.56	Natural run off flow from 50% of catchment provided

4.6.23 It should be noted that flow from the residual catchment of the Pitridh water courses, accumulating downstream of the proposed aqueduct, could collect on the downstream side of Shuas dam. To prevent this water from impounding against the downstream face of the Shuas dam this water would be diverted via the Shuas Aqueduct, as shown on **Figure 2.22 - Shuas Aqueduct - Plan and long section**. This would be a gravity drain / culvert draining to the small reservoir at the head of the Allt Meall Ardruighe. Over-pumping into the Earba reservoir may also be installed as a back-up method for ensuring water does not collect on the downstream side of the dam. This pumping method would discharge water to the Earba reservoir. In both cases the water would travel to the river Spean via Loch Laggan.

4.6.24 Taking water from the Pitridh catchment watercourses has the potential to impact the area of blanket bog at the south end of Loch Earba. Therefore, a substantial peatland restoration plan is proposed as part of this scheme, and this includes improving the quality of the blanket bog at the south of Loch Earba and controlling the peatland water levels using the new headwall / culvert inlet at Shuas Aqueduct, as shown on **Figure 2.22.1 - Shuas Aqueduct - GA of Intake Weir & Headwall**.

Geomorphology

4.6.25 The upper and lower parts of Loch Earba and its connecting channel will fundamentally be combined as part of the scheme. It is considered that the relative impact of the new dam construction on the geomorphology of the downstream Allt Labrach will be low in the context that it is already artificially impounded for hydropower purposes, with little or no transport of sediment presently.

4.6.26 The proposed dam on the Leamhain will enhance the existing natural impoundment. Both watercourses downstream of the Shios and Leamhain dams are high energy systems which are relatively resistant to physical change, in hydromorphological terms.

4.6.27 The effects will diminish in the downstream direction, and the lengths of the affected reach are also physically limited by the presence of lochs / reservoirs downstream. The steep upper reaches of the tributaries proposed for diversion will be unaffected by the scheme, with the most significant impacts being in the immediate vicinity and downstream of the Pitridh diversion channel. Here, 'Type C' river typologies will be impacted by reduced sediment supply as well as flows.

4.6.28 Over time, it is anticipated that the affected reaches will adjust to reduced flows (particularly less significant channel-forming flows) and become smaller in profile. This will be mitigated, for instance through the provision of compensatory flows and through the re-introduction of sediments removed from the diversion channel as part of a routine maintenance regime.

4.6.29 Consideration has been given to potential options for mitigating spawning habitat displacement on the Moy Burn, with the formation of a shallower-gradient secondary channel above the maximum inundation level proposed. More detail of this is provided in **Appendix D – Hydromorphological Appraisal**. Subsequent detailed design prior to construction will be developed through ongoing collaboration with fish specialists, engineers and SEPA as required.

Reservoir Safety

4.6.30 Flood risk associated with the reservoirs will be dealt with in accordance with the Reservoirs (Scotland) Act 2011.

4.6.31 Although both the Shios and Leamhain dams would be designed with a spillway for reservoir safety reasons, the small catchment and the large water transfer capability with water shared between the reservoirs, make it extremely unlikely that the upper reservoir would reach spillway level. The residual flow regime downstream of the dams would therefore ordinarily be unaffected by spill events from the dams.

4.6.32 The Proposed Development would be designed with fail-safe control systems which would prevent pumping once the upper reservoir is full (the stop pumping level has been reached). These control systems would also prevent generation when the lower reservoir is full. The spillways would therefore be designed to pass the naturally occurring extreme flood event (which would have occurred with or without the Proposed Development being present) required for reservoir safety reasons to ensure the safety of the dam structure.

4.6.33 The Shios spillway would be design for Probable Maximum Flood (PMF) with minimal damage, based on the catchment area characteristics. The design would also assume that the Earba reservoir is full when a PMF occurs, a scenario that is considered unlikely.

4.6.34 The Leamhain dam spillway would be designed for PMF of the smaller Leamhain catchment area and assuming that the Leamhain reservoir is full when a PMF occurs.

Loch Laggan Catchment

4.6.35 Once filling is complete the Proposed Development would be operated effectively as a closed system, which means that at all times sufficient water to operate the full cycle of the pumping or generation cycle would be retained within the Earba and Leamhain reservoirs. Once fully operational, run-off from any rainfall within the catchment areas of the two reservoirs would not be stored beyond the buffer volume and in the case of Earba would be passed into the downstream catchment.

4.6.36 As a result of the Proposed Development, no water would be transferred outside of the overall Laggan Dam Reservoir catchment.

4.6.37 Compensation flow and any spill from Loch Earba would flow into the Allt Labhrach and then into Loch Laggan. The Ardverikie Hydro would continue to discharge directly into Loch Laggan.

Completion of the filling of Earba reservoir

4.6.38 It is possible that the Proposed Development would commence part capacity operation prior to the reservoirs containing their final design water volume. In this case the filling process would be completed as soon as possible so that the system is a full capacity. Once the 55Mm3 of storage has been achieved, generation flow to the Ardverikie Hydro would resume.

4.7 Conclusion

4.7.1 The Proposed Development is to build and operate a new PSH with an installed capacity of up to 1800 Megawatts (MW) utilising the existing Loch Earba as the lower storage reservoir and Loch Leamhain as the upper storage reservoir.

4.7.2 The maximum energy storage of the Proposed Development would be up to 40 GWh, which corresponds to a useable water storage volume of 55 Mm^3 (million cubic metres) in the reservoir system.

4.7.3 During the filling of Earba reservoir there will be a temporary loss of renewable energy at the Ardverikie (full outage) and Lochaber hydro schemes (small 1-2% percent reduction).

4.7.4 The Proposed Development would only operate between agreed minimum and maximum levels of the proposed Earba and Leamhain reservoirs.

4.7.5 A volume of water, separate to the PSH useable volume, would be maintained to provide storage for the existing Ardverikie Hydro and for compensation flow under normal conditions.

4.7.6 The Proposed Development would release compensation flow at the Shios dam into the Allt Labrach which is the natural outlet of Loch Earba. This would be an enhancement of the water quality status of the Allt Labrach. The introduction of compensation flow into the Allt Labhrach may slightly reduce power from a renewable source - Ardverikie hydro.

4.7.7 To mitigate the risk of INNS a catchment diversion channel would divert water away from the Leamhain reservoir and directly into the Allt Loch a Bhealaich Leamhain which is the natural outlet of Loch Leamhain. The flow would replicate the natural flows in the watercourse all be it with a reduced catchment area.

4.7.8 During construction of the Proposed Development and during the filling process, downstream flow would be maintained at both the Leamhain and Shios dams.

5 Effects on Biodiversity – Aquatic

5.1 Chapter Introduction

5.1.1 This chapter considers the likely effects of the Earba Pumped Storage Hydro scheme (PSH), hereafter referred to as the 'Proposed Development', on the water environment for the purposes of Controlled Activity Regulations. For the purpose of this chapter, the scope is limited to the impact on the water environment encompassing waterbodies, watercourses, fish fauna, fish habitat, macroinvertebrates and macrophytes where a direct impact is likely to occur during the operation of the Proposed Development as a result of the controlled activity. Impacts predicted are considered post mitigation implementation.

5.1.2 The controlled activities referred to in this assessment include abstractions from surface water, impoundment of river and lochs, engineering in rivers and lochs, engineering activities in the vicinity of rivers and lochs which are likely to have a significant impact upon the water environment, and other activities which directly or indirectly are liable to cause a significant adverse impact upon the water environment.

5.1.3 The chapter was prepared by Gavia Environmental Ltd, with specialist input from [redacted] of Glasgow University.

5.2 Scope of Assessment

5.2.1 The assessment of effects within this report is informed by client derived, desk based and field survey data. Baseline surveys were undertaken in accordance with relevant good practice guidelines between Autumn 2022 and Autumn 2024. Please refer to **Appendix J - Aquatic Ecology Technical Appendix for the CAR Licence** for the full results of the surveys undertaken.

5.2.2 The impacted area encompasses the area over which all desk-based and field data were gathered to inform the assessment presented in the accompanying Ecological Impact Assessment and Technical Appendices. The impacted area comprises all watercourses, waterbodies and aquatic species that will likely be affected as a result of the controlled activity, referred to as 'factors', but not necessarily all infrastructure within the red line boundary area.

5.2.3 Table 5-1refers to the important factors (with SEPA ID if applicable). Nature conservation level refers to conservation status of species/habitat in Scotland, and Ecological status to SEPA's water classification hub (where applicable).

Table 5-1 Aquatic Ecology Study Area

Important factor with SEPA ID (if applicable)	Nature Conservation Level / Ecological Status	Type of Factor	Area impacted by controlled activity
Loch Earba (ID: 100204, 100200)	Good Ecological Status	Waterbody	Whole area of Loch Earba for both East and West Basins.
Mid Lochan na h' Earba (ID: 20370)	Good Ecological Status	Watercourse	Whole stretch of watercourse,

Important factor with SEPA ID (if applicable)	Nature Conservation Level / Ecological Status	Type of Factor	Area impacted by controlled activity
			approximately 0.9 km in length.
Allt Labrach (ID: 20369)	Bad Ecological Status	Watercourse	Whole stretch of watercourse, approximately 2.0 km in length.
Moy Burn	No information	Watercourse	Section of watercourse inundated by increasing water levels.
Allt Coire Pitridh (ID: 20371)	Good Ecological Status	Watercourse	Section of 3.6 km long watercourse inundated by increasing water levels.
Loch Leamhain	No information	Waterbody	Whole area of Loch.
Allt Loch a' Bhealaich Leamhain	No information	Watercourse	Whole stretch of watercourse, approximately 1.5 km in length.
Arctic charr *Salvelinus alpinus*	National	Fish Species	Arctic charr were confirmed as present within Loch Earba (east basin).
Brown trout *Salmo trutta*	Local	Fish Species	Brown trout are known to be present within all waterbodies and watercourses considered within the assessment.
Macroinvertebrates	Local	Macroinvertebrate Species	All watercourses and marginal waterbody areas of Loch Earba and Loch Leamhain included above. One species present, *Pisidium conventus* (Arctic-alpine pea mussel), is present only in the Allt Loch a' Bhealaich Leamhain, downstream of Leamhain Dam.

Important factor with SEPA ID (if applicable)	Nature Conservation Level / Ecological Status	Type of Factor	Area impacted by controlled activity
Macrophytes (higher plants)	Local	Macrophyte Species	All watercourses and marginal waterbody areas.

5.3 Consultation

5.3.1 To inform the scope of the assessment for the Proposed Development, consultation was undertaken with the statutory and non-statutory bodies listed below.

- The Scottish Government Energy Consents Unit;
- The Highland Council;
- SEPA;
- NatureScot;
- Marine Scotland;
- Ardverikie Estate Ltd;
- The Lochaber District Salmon Fishery Board; and
- Buglife Scotland.

5.3.2 The following organisations were also consulted but did not provide any response:

- Crown Estate Scotland;
- Fisheries Management Scotland;
- Lochaber Fisheries Trust; and
- Scottish Wildlife Trust

5.4 Mitigation Measures

Proposed mitigation measures are described below. For more detailed information on mitigation measures please refer to: **Earba Arctic Charr Species Protection Plan (Appendix K)**.

Moy Burn Habitat Creation

5.4.1 Spawning habitat will be created at the Moy Burn via a new optimised diversion channel running adjacent to the existing Moy burn. This would direct a controlled flow of water over optimal salmonid spawning gravels, with meanders to optimise the available space. The rate of flow and water depth will be set/controlled to provide stable, optimal conditions unlikely to be impacted by spate events. This will also improve accessibility for fish to the upper reaches of the Moy Burn by bypassing barriers (where present).

Pitridh Aqueduct Diversion Channel

5.4.2 The connection of the Allt Choire Pitridh and the Allt a' Choire Chlachair to Loch Earba via a new aqueduct channel will maintain accessibility of the watercourses to spawning tributaries. Arctic charr (and brown trout) will be able to access the aqueduct channel during all water levels. Additionally, upper sections of the aqueduct (upper straight

sections) will be designed in a manner to contain optimal substrates and conditions for salmonid spawning.

Engineered Spawning Areas

5.4.3 Marginal loch spawning habitat would be maintained through the creation of habitat in the form of spawning areas below the minimum water level of the proposed combined Loch Earba reservoir. These spawning beds would be designed to contain optimal spawning substrate types for both Arctic charr and brown trout. Current spawning opportunities on loch margins are affected by existing depleted drawdown zones (due to the existing hydro scheme) therefore the proposed new spawning beds would present an opportunity for enhancement.

Artificial Floating Spawning Nests

5.4.4 Artificial floating spawning nests would be installed into Loch Earba. It is proposed that the artificial structures would incorporate known spawning requirements of Arctic charr including depth, depth of substrate and type of substrate. Structures would be suspended via buoys at a constant depth to maintain a favourable depth at around 1-2 m in depth, whilst water levels fluctuate as a result of the PSH pumping / generating. Structures may be deployed at variable depths to cover a range of preferences and/or inform success of mitigation at different depths for incorporation in future PSH mitigation. An upper tier at the surface would also provide opportunities for macrophyte growth, which in turn will benefit macroinvertebrates and fish which feed on macroinvertebrates.

5.5 Methodology - Overview

5.5.1 The methodology for identifying likely effects and their significance is based on that outlined in 'Supporting Guidance (WAT-SG-67), Assessing the Significance of Impact – Social, Economic and Environmental (V5.1)'. This involved a 5-stage approach in determining impact.

5.6 Methodology Step 1: Identifying Likely Effects

Negative Effects

5.6.1 Negative effects were based on those likely to be forgone as a result of a proposal's impact on the water environment, this includes:

- Benefits no longer provided by the affected part of the water environment in cases where a proposed development would result in deterioration of the water environment; and
- Where a proposed development would prevent a waterbody from being restored to its target objective (typically good status or good ecological potential).

5.6.2 Negative effects resulting from the changes to the water environment caused by the controlled activity (the proposed development) are only considered. Potential negative effects of other aspects of the proposed development, e.g. access roads or other infrastructure, are not considered within this report and will be taken into account by the relevant local planning authority. Additionally, negative effects associated with the construction phase of the proposed development are not accounted for as these are

controlled by appropriate authorisation conditions and are therefore not relevant to this report.

5.6.3 To account for negative effects preventing the achievement of good status the loss of the benefit of improving the water environment should be accounted for. This is done by assessing the negative effects of a proposal as if the affected water body is at its target restoration objective (where available).

5.6.4 For example, if a waterbody is in moderate ecological status and has an objective of restoration to good ecological status, the proposed development's negative effects are assessed on the waterbody being in good ecological condition, in the absence of the proposed development going ahead.

Positive Effects

5.6.5 Positive effects include:

- Positive environmental benefits flowing directly from, and which are reliant on, the proposed development; and
- Indirect benefits (including social and economic) likely to result from those direct benefits.

5.6.6 Positive effects do not include any benefit resulting from developers using the financial resources available to them, including the profits of the development or any benefit resulting from a part of the proposed development that is not directly dependent on the controlled activity and could, in principle, be delivered without the controlled activity.

5.6.7 All effects, both negative and positive, are considered post mitigation. Compensatory measures are not considered as these are considered not directly dependent on the controlled activity.

Information Sources

5.6.8 The following information sources were used to identify the relevant factors:

- The information accompanying the application, including any subsequent information provided by the Applicant in response to requests for further information;
- Responses from any relevant public bodies that have been consulted on the proposed development;
- Representations from the wider public in response to advertisements of the proposal or made at any meetings that SEPA or the Authorised Person have organised to discuss the proposed development;
- Any environmental impact assessment that has been undertaken with respect to the proposed development (e.g., in support of an associated planning application); and
- Any relevant information SEPA already holds or any relevant in-house expertise (e.g., SEPA waterbody classification hub).

5.6.9 The following documents were used to compile this chapter:

- SEPA. (2017). Supporting Guidance (WAT-SG-67), Assessing the Significance of Impact – Social, Economic and Environmental (V5.1);
- SEPA. (2017). WAT-RM-34: Derogation Determination – Adverse Impacts on the Water Environment;

- Scottish Biodiversity List (SBL);
- Gavia Environmental. (2023). Environmental Impact Assessment Report Chapter 11 Aquatic Ecology
- Gavia Environmental. (2023). Environmental Impact Assessment Report Appendix 11.1 Aquatic Technical Appendix.
- Gavia Environmental. (2024). Aquatic Ecology Technical Appendix for the CAR Licence Report, **Appendix J** ; and
- Gavia Environmental. (2024). Earba Arctic Charr Species Protection Plan , **Appendix K** (This document contains a memo on mitigation options written by Professor Colin Adams)

5.7 Methodology Step 2: Assessment of magnitude of impact

5.7.1 The magnitude of an effect reflects its scale and duration.

5.7.2 Scale considers:

- The severity of the impact on the plant/animals that are directly affected;
- The spatial extent over which this direct impact occurs; and
- The consequences of the direct impact for the wider conservation of the affected species or assemblages of species.

5.7.3 The scale of effects has been assessed using the guidance in **Table 5-2** (for watercourses) and **Table 5-3** (for freshwater lochs) below.

Table 5-2 Guide to assessing the scale of an effect on the biodiversity of watercourses (SEPA WAT-SG-67 2017, Table 6)

Length of watercourse affected (km)		< 0.1	0.1 < 0.5	0.5 to < 1.5	1.5 to < 5	5 to < 10	10 to < 20	≥ 20
Extent of any relevant habitat or species population affected as a proportion the total relevant habitat or species population of the "high biodiversity interest site" (%)		< 0.1	0.1 < 1	1 to < 2	2 to < 10	10 to < 20	20 to < 30	≥30
Change in condition								
H → G	Minor or slight	N	N	VS	VS - S	S - M	M	M - L
P ↔ B **M ↔ P** **G ↔ M** **H → M**	Slight or moderate	N	N - VS	VS - S	S - M	M	M - L	L
G ↔ P **H → P**	Major	N	VS	S	M	M - L	L - VL	L - VL
M ↔ B **G ↔ B** **H → B**	Major or severe	N - VS	VS - S	S - M	M - L	L	L - VL	VL

Notes

"High biodiversity interest site" means one of such sites referred to in Table 4.

To assess the likely change in condition, you should apply the appropriate environmental standards. In this context, "change in condition" includes changes that do not affect the status of the water body as a whole (eg because the spatial extent over which the change occurs is too limited, etc).

The scale of an effect on a high biodiversity interest site should only be assessed if the change in condition is expected to affect the particular biodiversity interest of that site. Where the particular interest is likely to be affected, you should assess the likely change in its condition. This scale of change in its condition may differ substantially from that of other aspects of the ecological quality of the affected part of the watercourse.

N = negligible; VS = very small; S = small; M = medium; L = large; and VL = very large

H = high; G = good; M = moderate; P = poor; and B = bad.

Table 5-3 Guide to assessing the scale of an effect on the biodiversity of waterbodies (SEPA WAT-SG-67 2017, Table 7)

Area of loch affected (ha)		< 0.5	0.5 < 2.5	2.5 to < 7.5	7.5 to < 50	50 to < 100	100 to < 500	≥ 500
Length of loch shore affected (km)		<0.1	0.1 < 0.5	0.5 to < 1.5	> 1.5 to < 5	> 5 to < 10	> 10 to < 20	≥ 20
Extent of any relevant habitat affected as a proportion the total relevant habitat of the "high biodiversity interest site" (%)		< 0.1	0.1 < 1	1 to < 2	2 to < 10	10 to < 20	20 to < 30	≥30
Change in condition								
H → G	Minor to slight	N	N	VS	VS - S	S - M	M	M - L
P ↔ B **M ↔ P** **G ↔ M**	Slight to moderate	N	N - VS	VS - S	S - M	M	M - L	L
H → M **G ↔ P** **H → P**	Major	N	VS	S	M	M - L	L - VL	L - VL
M ↔ B **G ↔ B** **H → B**	Major to severe	N - VS	VS - S	S - M	M - L	L	L - VL	VL

Notes

Depending on the proposed activity, the effects may be concentrated along the shore of the loch or extend across the body of the loch. You should refer to the most relevant of the first two rows of the table when assessing the scale of the effect.

"High biodiversity interest site" means one of such sites referred to in Table 4.

To assess the likely change in condition, you should apply the appropriate environmental standards. In this context, "change in condition" includes changes that do not affect the status of the water body as a whole (eg because the spatial extent over which the change occurs is too limited, etc).

The scale of an effect on a high biodiversity interest site should only be assessed if the change in condition is expected to affect the particular biodiversity interest of that site. Where the particular interest is likely to be affected, you should assess the likely change in its condition. This scale of change in its condition may differ substantially from that of other aspects of the ecological quality of the affected part of the watercourse.

N = negligible; VS = very small; S = small; M = medium; L = large; and VL = very large

H = high; G = good; M = moderate; P = poor; and B = bad.

5.7.4 Duration considers how long the effect is likely to occur from 1 year to more than 12 years. Magnitude determination is summarised in Table 5-4 below.

Table 5-4 Indicative guide to assessing the magnitude of an effect (SEPA WAT-SG-67 2017, Table 1)

	Scale of effect				
Duration of effect	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Only lasts up to around 1 year	VS	VS	VS	S	M
Only lasts up to around years 6 years	VS	VS	S	M	L
Lasts significantly more than 6 years	VS	S	M	L	VL
Starts up to around 2 to 3 years earlier*	VS	S	M	L	VL
Starts up to 3 to 12 years earlier*	VL	S-M	M-L	L	VL
Starts more than 12 years earlier*	S	M	L	L-VL	VL

Notes:

You should use these rows in the table when you are assessing a benefit that is already expected to be delivered through the implementation of the river basin management plan (RBMP) but which is expected to be realised sooner as a result of the proposal (ie the proposal will enable the early achievement of an RBMP improvement objective).

If you have assessed the scale of an effect as being negligible, you should not consider that effect further in your assessments.

5.7.5 Scale was determined by indicative guidance on assessing the scale of an effect on the biodiversity of watercourse.

5.8 Methodology Step 3: Assessment of importance of each effected factor

5.8.1 Importance is determined by the environmental value of a factor to society. An effect on a very important factor (e.g. one of national importance) will be of greater significance than the same magnitude of effect on a factor of limited importance (e.g. local importance), as highlighted in **Table 5-5** below.

Table 5-5 Indicative guide to assessing the magnitude of an effect (SEPA WAT-SG-67 2017, Table 1)

Low importance	The part of the water environment concerned is: • a loch that is locally rare or otherwise locally important based on its type and condition. To assess this, you should consider the frequency (locally, regionally and nationally) of lochs of the same or similar type and status to the loch concerned; or • a river or stream of low importance as identified according to Table 5 based on its type and condition; or • a high biodiversity interest site designated as a *Local nature reserve* or a *Local nature conservation site*.
Medium importance	The part of the water environment concerned is: • a loch that is regionally rare or otherwise regionally important based on its type and condition. To assess this, you should consider the frequency (locally, regionally and nationally) of lochs of the same or similar type and status to the loch concerned; or • a river or stream of medium importance as identified according to Table 5 based on its type and condition; or • a high biodiversity interest site because it plays an ecologically significant role in maintaining the ecological health of a large (regional-scale) river basin; or • a high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the *Scottish Biodiversity List*. • a high biodiversity interest site because it supports a significant population of a species for which there is an *ICES* emergency plan (eg European eel).
High importance	The part of the water environment concerned is: • a loch that is nationally rare or otherwise nationally important based on its type and condition. To assess this, you should consider the frequency (locally, regionally and nationally) of lochs of the same or similar type and status to the loch concerned; or • a river of high importance as identified according to Table 5 based on its type and condition; or • a high biodiversity interest site designated as such (eg *Sites of Special Scientific Interest*; *National Nature Reserves*) because of its national importance for the conservation of a species it supports; a habitat it contains; or the rarity or quality of its geomorphological characteristics; or; or; • a high biodiversity interest site because it supports a nationally important assemblage of *Oceanic bryophytes*.
Very high importance	The part of the water environment concerned is: • a high biodiversity interest site designated as such because of its international importance for the conservation of a species it supports or a habitat it contains (ie *Special Areas of Conservation*, *Special Protection Areas* or *Ramsar sites*); or • a high biodiversity interest site because it supports a significant population of a globally threatened species (ie an *IUCN Red List of Threatened Species* species such as freshwater pearl mussel); or • a high biodiversity interest site because it supports an internationally important assemblage of *Oceanic bryophytes*.

5.9 Methodology Step 4: Assessment of significance of each effect

5.9.1 The significance of effects, both positive and negative, are a combination of the importance of the factor that is affected and the magnitude of the effect on the factor. Combined, importance and magnitude dictate significance of the effect, as shown in **Table 5-6** below.

Table 5-6 Indicative guide to assessing the significance of an effect (SEPA WAT-SG-67 2017, Table 2)

Importance of affected factor	Magnitude of effect					
	Negligible	V Small	Small	Medium	Large	V Large
Very low / negligible	N	N	N	N	N	N
Low	N	VL	VL	L	M	M-H
Medium	N	VL	L	M	M-H	H
High	N	VL-L	M	H	H-VH	VH
Very High	N	L	M-H	H-VH	VH	VH

Key:
N = negligible significance; VL = very low significance; L = low significance; M = moderate significance; H = high significance; and VH = very high significance.

5.10 Assessment Step 1: Likely Effects

5.10.1 Likely significant effects resulting from the controlled activity on identified factors are summarised in Table 5-7 below.

Table 5-7 Aquatic Biodiversity likely effects

Likely Effect	Area effected	Feature effected	Effect (Positive or Negative)	Description of effect
Loss of Spawning Habitat	Watercourses	Arctic charr, Brown trout	Negative	Riverine salmonid spawning habitat will likely be affected by the inundation at Loch Earba due to the increased depth of maximum inundation and frequent fluctuations in water level. Water levels affected include the Moy Burn, Allt Coire Pitridh and the Mid Lochan na h' Earba. Suitable riverine spawning habitat was within a very localised area (connecting river between Loch Earba basins, Moy Burn and Allt Coire Pitridh). All suitable riverine spawning substrate identified is predicted to be inundated and permanently impacted. The Pitridh aqueduct which joins Loch Earba (west basin) will maintain fish passage beyond the dam and feature newly created optimal spawning habitat within its channel. Optimal spawning habitat will also be created at the Moy burn via a new engineered channel. The minimum inundation level of the PSH will cause both Earba basins to become one body of water, therefore Arctic charr detected in Earba (east basin) could potentially use newly created habitat for spawning (Moy Burn, Pitridh aqueduct and tributaries) as their range will have the potential to increase.
Loss of Spawning Habitat	Waterbodies	Arctic charr, Brown trout	Negative	Salmonid spawning in loch margins will likely be affected by the increase of average water levels, above current levels. The proposed reservoir operating levels will permanently submerge current spawning areas such that these existing areas are no longer subject to 'cleaning' wave action. This means that optimal or sub-optimal spawning areas would become poor.
Reduction in Egg Viability and hatch success	Waterbodies	Arctic charr, Brown trout	Negative	Spawning areas on loch margins of both Loch Earba and Loch Leamhain will likely be affected by water level fluctuations as a result of hydro generation

Likely Effect	Area effected	Feature effected	Effect (Positive or Negative)	Description of effect
				cycles. Due to relative homogeneity of substrate in marginal/littoral areas there is a risk that fish may spawn in suitable areas (shallow gravel/pebble) during periods of artificially elevated water levels. Eggs deposited in such habitats may become aerially exposed as a result of subsequent water level reduction, with a consequent degradation to viability and hatch success.
Fish attraction to the intake	Waterbodies	Brown trout	Negative	The fish present do not typically display migratory pathways within waterbodies, therefore under the precautionary principle it is assumed that fish will likely be present around the proposed location of the intake structures. Brown trout are known to demonstrate a rheotactic movement response to currents/flowing water[3] , however, this may not be as strong a response as other migratory salmonids (e.g. Atlantic salmon or sea trout). Attraction towards the screen during abstraction periods could increase energy expenditure and make fish more vulnerable to predation from mammalian (e.g. otter) and avian predators (e.g. divers).
Ingress and entrainment	Waterbodies	Arctic charr, Brown trout	Negative	Ingress and entrainment of fishes within the 'pipe structures' presents a risk of injury, mortality and/or transfer of individuals between Loch Earba and Loch Leamhain. Given high morphological and phenotypic variations in Arctic charr recorded within other lochs in Scotland[4] , and the isolation of individuals within Loch Earba (Northeast), it is considered under the precautionary principle that individuals in Loch Earba (Northeast) are also genetically distinct. The best practice guide for screening for intakes and outfalls recommend screens dimensions of ≤12.5 mm to protect migratory salmonids from hydro scheme infrastructure[5] , a maximum mesh size or bar spacing of 12.5 mm will be employed at the intake.
Impingement	Waterbodies	Arctic charr, Brown trout	Negative	Fish present near the intake screens pose a risk of impingement against intake screens. The sustained swimming speed of salmonids for 0.15 m body length is 0.54 m/s[6] and the designed maximum velocity approaching the intake is 0.3 m/s, therefore juvenile salmonids would have the ability to overcome the draw of the intake velocity voluntarily preventing any injury / mortality associated with impingement on the screens. Regular clearing of the intake screen by the pumping/generation cycling of the scheme should prevent debris build-up that may increase approach velocities across the screen out with escapable velocities.
Reduction in food availability for fish	Waterbodies	Arctic charr, Brown trout	Negative	Zooplankton species are less likely to be affected by fluctuating water levels as they will be subject to diurnal movement horizontally within the water column, rather than the washing actions affecting the littoral zone species likely to be impacted by water level change. This is unlikely to impact plankton feeding Arctic charr morphs, however,

[3] O'Keeffe, N. & Turnpenny, A.W.H. (2005) Screening for Inlet and Outlets: a best practice guide. Science Report SC030231. Environment Agency: Bristol
[4] Maitland, P. S. and Adams, C. E. (2017). Arctic Charr in the Lochs of Scotland: An Assessment of Distribution and Status.
[5] Turnpenny, A.W.H. and O'Keeffe, N. (2005). Screening for Intake and Outfalls: a best practice guide. [Online] Available at: Microsoft Word - W6_103 TR _amended__1.doc (publishing.servici.e aov.uk)
[6] Tang, J. & Wardle, C. S. (1992) Power Output of Two Sizes of Atlantic Salmon (Salmo Salar) at their Maximum Sustained Swimming Speeds. The Journal of Experimental Biology Volume 166. pp. 33-46

Likely Effect	Area effected	Feature effected	Effect (Positive or Negative)	Description of effect
				zoobenthos, favoured by brown trout are likely to be significantly affected. Food sources for Arctic charr, pelagic and benthic sources will be less affected by fluctuations of water levels than other fish species (e.g. brown trout) which feed within the littoral zone and are therefore more likely to be affected by fluctuations in water levels.
Fish stranding	Waterbodies and Watercourses	Brown trout	Negative	Fish occupying newly flooded areas at maximum inundation may become stranded on dry land or within small puddles when the water level recedes during generation/pumping periods. This would place individuals at greater risk of injury, mortality and/or predation. It is anticipated that most fish will track receding water levels during generation/pumping periods, as is observed in established hydro schemes (pumped storage and conventional). Arctic charr are not anticipated to be impacted given their tendency to occupy deeper loch areas at 20 m+ depth (and not littoral zones primarily affected).
Fluctuations in Water Levels	Waterbodies and Watercourses	Loch Earba, Loch Leamhain, Allt Coire Pitridh and Moy Burn.	Negative	Loch margins are likely to be affected by the fluctuations in water level within Loch Earba and Loch Leamhain. The level of Loch Earba is expected to fluctuate by approximately 22 m and Loch Leamhain approximately by approximately 70 m. This is likely to lead to deterioration in drawdown areas.
Fragmentation of Habitat (including access to spawning habitat).	Watercourses	Allt Coire Pitridh, Allt Coire a' Chlachair and the Allt Loch a' Bhealaich Leamhain	Negative	The dam footprints will result in permanent fragmentation of habitat within the tributary and loch habitat on Allt Coire Pitridh, Allt Coire a' Chlachair and the Allt Loch a' Bhealaich Leamhain. This would prevent direct access to spawning areas for loch dwelling brown trout. Access between the Allt Coire Pitridh and Allt Coire a' Chlachair, and Loch Earba will be maintained via diversion channels, however, migratory distance/periods for fish travelling to the Allt Coire a' Chlachair will be in excess of those for the current route. Access between Loch Leamhain and the Allt Loch a' Bhealaich Leamhain will be permanently lost. The dam footprint is predicted to cover existing suitable spawning substrate. This will permanently prevent loch dwelling brown trout from reaching riverine spawning areas.
Additional flow to watercourses	Watercourses	Allt Labrach and brown trout	Positive	Current access and compensation flow to the Allt Labrach is limited. Providing an increased flow to the Allt Labrach provides habitat creation and an opportunity for brown trout to expand in range.
Noise and Vibration	Waterbodies	Loch Earba and Loch Leamhain	Positive and Negative	All fish species have the potential to be impacted by operational noise and vibration associated with the Proposed Development. Likely effects are expected to be non-lethal for fish but may cause temporary displacement and avoidance of the area around the inlet/outlet. Positive effects may be experienced in that displacement resulting from noise and vibration avoidance would mitigate potential effects associated with abstraction and generation (e.g. impingement).
Water temperature changes from compensation flow	Watercourses	Allt Labrach	Positive	Compensation flow released from the Shios dam into the Allt Labhrach will be low in temperature due to the discharge pipe being located at the bottom of the dam where temperature is lowest. As there is currently no water in the Allt Labhrach immediately below the existing dam, water will not cause thermal shock to fish as they are not present, and fish will have the choice to actively move into this area of colder water after a flow is introduced. Water

Likely Effect	Area effected	Feature effected	Effect (Positive or Negative)	Description of effect
				downstream may decrease in temperature, however, in light of projected water temperature increases from climate change this may be beneficial in buffering this effect.
Water temperature changes from water transfer	Waterbodies	Loch Earba and Loch Leamhain	No difference	Minimal variation was observed in surface water temperatures between Loch Leamhain and Loch Earba during baseline surveys (variation of averages was 0.95°C March-September; Loch Leamhain variation 7.1 -11.3°C; Loch Earba 9.6 – 11.5°C). Where receptive bodies vary in temperature, small variations are unlikely to be sufficient to cause thermal shock to individuals, with temperatures likely to return quickly to ambient levels. Regular generation cycles will prevent large differences in water temperature from developing. Optimal Arctic charr temperature ranges between 4.5°C to 11.6°C[7],[8] , but they are tolerant of lower temperature ranges. Sudden temperature variation of up to 2°C can modify physiology and behaviour.
Water quality reduction	Waterbodies	Loch Earba and Loch Leamhain	Negative	Increased water level fluctuation and reduction in macrophyte growth will have the likely effect of destabilisation within the drawdown zone and a consequent erosion of marginal substrate. This may lead to increases in water quality parameters within thresholds capable of causing injury and/or mortality (e.g. total dissolved solids and/or turbidity). Due to the impact occurring over months/seasons water quality deterioration is likely to be gradual and not in concentrations consistent with major pollution events.
Reduction in macrophyte cover	Waterbodies and Watercourses	Loch Earba and Loch Leamhain	Negative	Increased water level fluctuation is likely to affect existing macrophytes. Increased water level fluctuation is likely to result in long exposure and submerged periods. Submerging macrophytes out with current depths with likely limit photosynthetic ability due to decreased light levels at greater depths. If water quality deteriorates in these areas, notably turbidity, this will further reduce light penetration. Combined this is likely to affect macrophyte cover. It should be noted that macrophyte cover is currently limited on Loch Earba due to existing drawdown zones from current hydro scheme infrastructure.
Reduction in macroinvertebrate abundance	Waterbodies and Watercourses	Loch Earba, Loch Leamhain, Allt Coire Pitridh, Moy Burn, Allt Loch a' Bhealaich Leamhain, Mid Lochan na h'earba	Negative	Increased water level fluctuation is likely to affect existing macroinvertebrates. Increased water level fluctuation is likely to result in long exposure and submerged periods placing macroinvertebrates out with preferential habitat leading to injury and/or death. Water quality deterioration resulting from the controlled activity may further reduce macroinvertebrate abundance.

5.10.2 Catastrophic failure of the Loch Leamhain dam and Loch Earba dams, Shios and Shuas are not considered within likely effects. Under the Reservoirs (Scotland) Act 2011 it is

[7] Larsson, S., Forseth, T., Berglund, I., Jensen, A.J., Näslund, I., Elliott, J.M. And Jonsson, B. (2005), Thermal adaptation of Arctic charr: experimental studies of growth in eleven charr populations from Sweden, Norway and Britain. Freshwater Biology, 50: 353-368. https://doi.org/10.1111/j.1365-2427.2004.01326.x

[8] Siikavuopio, S. I., Sæther, BS., Johnsen, H. et al. (2014) Temperature preference of juvenile Arctic charr originating from different thermal environments. Aquatic Ecology. 48, 313–320. https://doi.org/10.1007/s10452-014-9485-0

considered that catastrophic failure is highly unlikely given the extremely stringent building and maintenance standards set.

5.10.3 Likely effects such as light pollution associated with other infrastructure is not considered, as is stipulated under the methodology.

5.10.4 The risk of transfer of INNS with regards to the Proposed Development has been assessed and is covered within a separate chapter as part of this report.

5.11 Assessment Step 2: Magnitude of Effect

5.11.1 Assessment of magnitude of impact is summarised in Table 5-8, comprising both scale (and justification of scale) and duration aspects to provide magnitude of effect (final column).

Table 5-8 Assessment of Magnitude of Impact

Likely Effect	Scale	Scale Justification	Duration	Magnitude of Effect
Loss of Spawning Habitat (watercourse)	Medium	Length affected would be 5 - 10 km but due to the Pitridh aqueduct maintaining fish passage and creating fish spawning habitat, this is reduced to 1.5 - <5 km. The highest condition of overall status is currently Good (Allt Coire Pitridh and Mid Lochan na h-Earba). The Moy burn and outflow of Loch Leamhain are unclassified. The condition of affected stretches of watercourses is expected to deteriorate to poor (predicted to be inundated / temporarily inundated). The Allt Labrach is not considered as spawning habitat as it periodically dries out and is downstream of existing hydro scheme infrastructure. The affected watercourses do not feature 100% optimal spawning habitat. The construction of dams would prevent fish migration to spawning grounds, however the Pitridh aqueduct on Earba (west basin) will maintain passage beyond the dam and feature created optimal spawning habitat. Optimal spawning habitat will also be created on the Moy burn via a new engineered channel. The minimum inundation level will cause both Earba basins to become one body of water, therefore Arctic charr detected in Earba (east basin) could potentially use newly created habitat for spawning. This mitigation is considered in assessing the overall magnitude of impact and resulting significance of effect. Access to spawning grounds on Loch Leamhain (outflow) will be lost due to the dam at the outflow and inundation of the inflowing tributary.	>6 years	Medium
Loss of Spawning Habitat (waterbody)	Small - Medium	Likely effects will occur over Loch Earba (east basin) – 60 ha / 4.7 km margins. Effects on Arctic charr in Loch Earba (east basin) shoreline habitats are considered of greater significance than on Brown trout in the other basins which are more likely to make use of watercourses for spawning, therefore Loch Earba (east basin) is considered further. Spawning habitat assessments carried out on Loch Earba (east and west basins) found habitat on deeper areas (beyond 15m from the water's edge) to be unsuitable for salmonid spawning. Optimal spawning habitat was limited to short sections within shallower water along the wetted shoreline. Optimal substrate made up ~21% of the linear perpendicular 15m transects at the time of survey however this is likely to be impacted periodically by fluctuations in level caused by the existing hydro scheme operation. Only 6.4% of the habitat surveyed is unaffected by the existing hydro scheme operation and classified as physically optimal. The PSH will have a negative effect on any optimal habitat around the entire perimeter of the loch basins due to the effect of inundation. Mitigation includes creating and then maintaining optimal spawning habitat around Loch Earba in the form of new spawning beds below the minimum proposed reservoir water	>6 years	Small

Likely Effect	Scale	Scale Justification	Duration	Magnitude of Effect
		level. Floating spawning nests on Loch Earba with suitable habitat at fixed depth will also be installed. If proved successful, more could be installed. The minimum inundation level will cause both Earba basins to become one body of water, therefore Arctic charr detected in Earba (east basin) could use created habitat for spawning. This mitigation is considered in assessing the scale of effect, hence the scale was considered *Small-Medium*.		
Reduction in Egg Viability and hatch success	Small	Likely effects will occur over Loch Earba (east basin) – 60 ha / 4.7 km margins. Effects on Arctic charr in Loch Earba (east basin) shoreline habitats are considered of greater significance than on Brown trout in the other basins which are more likely to make use of watercourses for spawning, therefore Loch Earba (east basin) is considered further. Mitigation in the form of creating and then maintaining optimal spawning habitat around Loch Earba in the form of new spawning beds below the minimum reservoir water level. Floating spawning nests on Loch Earba with suitable habitat at fixed depth will also be trialled. If proved successful, more could be installed. The minimum inundation level will cause both Earba basins to become one body of water, therefore Arctic charr detected in Earba (east basin) could use created habitat for spawning. This mitigation is considered in assessing the scale of effect, hence the scale was considered *Small-Medium*.	>6 years	Small
Fish attraction to the intake	Small	Likely effects will occur over a small waterbody area (7.5 <50 ha) and small area of loch shore effected (0.5 < 2.5 km). Effect is unlikely to result in change in condition of Brown trout.	>6 years	Small
Ingress and entrainment	Negligible	Likely effects will occur over a small waterbody area (7.5 <50 ha) and small area of loch shore effected (0.5 < 2.5 km). Effect is unlikely to result in change in condition of Brown trout.	>6 years	Very Small / Not considered further
Impingement	Negligible	Likely effects will occur over a small waterbody area (7.5 <50 ha) and small area of loch shore effected (0.5 < 2.5 km). Effect is unlikely to result in change in condition of Brown trout or Arctic charr.	>6 years	Very Small / Not considered further
Reduction in food availability for fish	Large	Likely effects will occur over Earba West – 100 ha / 6.55 km margins; Earba East – 60 ha / 4.7 km margins; and Loch Leamhain – 30 ha / 2.55 km margins. Food decrease will likely occur in margins and therefore effect brown trout.	>6 years	Large
Fish stranding	Small	Likely effects will occur across all marginal areas in Earba West, Earba East and Loch Leamhain, however, the occurrence of strandings is considered small.	>6 years	Small
Fluctuations in Water Levels	Very Large	Likely effects will occur over Earba West – 100 ha / 6.55 km margins; Earba East – 60 ha / 4.7 km margins; and Loch Leamhain – 30 ha / 2.55 km margins. Due to large variation in water level scale of impact is very large.	>6 years	Very Large
Fragmentation of Habitat (including access to spawning habitat).	Large	Likely effect over 0.1 <0.5 km of the Allt Labrach and Allt Coire Pitridh.	>6 years	Large
Additional flow to watercourses	Very Large	No compensation flow is currently provided, effect is likely to occur over0.1 <0.5 km of the Allt Labrach.	>6 years	Very Large
Noise and Vibration	Negligible	Likely effects will occur over a small waterbody area (7.5 <50 ha) and small area of loch shore effected (0.5 < 2.5 km). Effect is unlikely to result in change in condition of Brown trout.	>6 years	Very Small / Not considered further
Water temperature changes from compensation flow	Small	Likely effects are over 0.1 <0.5 km of the Allt Labrach.	>6 years	Small
Water temperature changes from water transfer	Very Small	Likely effects will occur over Earba West (100 ha); Earba East (60 ha) and Loch Leamhain (30 ha), however, due to similar existing water temperatures and continual mixing scale is likely to be minimal.	>6 years	Very Small
Water quality reduction	Medium	Likely effects will occur over Earba West (100 ha); Earba East (60 ha) and Loch Leamhain (30 ha).	>6 years	Medium

Likely Effect	Scale	Scale Justification	Duration	Magnitude of Effect
Reduction in macrophyte cover	Medium	Likely effects will occur over marginal areas of Earba West (6.55 km), Earba East (4.7 km) and Loch Leamhain (2.55 km) and effect macrophyte populations. Existing macrophyte cover is poor due to existing hydro scheme (with indefinite lifecycle), however, is likely to further deteriorate.	>6 years	Medium
Reduction in macroinvertebrate abundance	Medium	Likely effects will occur over marginal areas of Earba West (6.55 km), Earba East (4.7 km) and Loch Leamhain (2.55 km) and effect macroinvertebrate populations. Existing macroinvertebrate cover is limited due to existing hydro scheme (with indefinite lifecycle), however, is likely to further deteriorate.	>6 years	Medium

5.11.2 If a likely effect has a scale of an effect as being negligible, these are not considered further in the assessment. Likely effects excluded include: ingress and entrainment, impingement, and noise and vibration.

5.12 Assessment Step 3: Importance of effect

5.12.1 Importance of effect is considered in Table 5-9. Where importance may vary for both different factors the highest importance is given, e.g. where a likely effect will incur on both Arctic charr (medium importance) and brown trout (low importance). Importance justification provides an abstract from Figure 2 (SEPA WAT-SG-67 2017) with reference to species, where applicable.

Table 5-9 Importance of effect

Likely Effect	Importance	Importance Justification
Loss of Spawning Habitat (watercourse)	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the Scottish Biodiversity List, Arctic charr. Brown trout will additionally be impacted; however, these are of local (low) importance.
Loss of Spawning Habitat (waterbody)	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the Scottish Biodiversity List, Arctic charr. Brown trout will additionally be impacted; however, these are of local (low) importance.
Reduction in Egg Viability and hatch success	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the Scottish Biodiversity List, Arctic charr. Brown trout will additionally be impacted; however, these are of local (low) importance.
Fish attraction to the intake	Low	A loch that is locally rare or otherwise locally important based on its type and condition. Supports a locally important population of brown trout. The loch is not regionally rare or important based on its type and condition and therefore not of medium importance.
Reduction in food availability for fish	Low	A loch that is locally rare or otherwise locally important based on its type and condition. Supports a locally important population of brown trout.
Fish stranding	Low	A loch that is locally rare or otherwise locally important based on its type and condition. Supports a locally important population of brown trout.
Fluctuations in Water Levels	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the Scottish Biodiversity List, Arctic charr. Brown trout will additionally be impacted; however, these are of local (low) importance.
Fragmentation of Habitat (including access to spawning habitat).	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the Scottish Biodiversity List, Arctic charr. Brown trout will additionally be impacted; however, these are of local (low) importance.

Likely Effect	Importance	Importance Justification
Additional flow to watercourses	Low	A river of stream of low importance based on its condition. Supports a locally important population of brown trout.
Water temperature changes from compensation flow	Low	A river of stream of low importance based on its condition. Supports a locally important population of brown trout.
Water temperature changes from water transfer	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the Scottish Biodiversity List, Arctic charr. Brown trout will additionally be impacted; however, these are of local (low) importance.
Water quality reduction	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a species on the Scottish Biodiversity List, Arctic charr. Brown trout will additionally be impacted; however, these are of local (low) importance.
Reduction in macrophyte cover	Low	A loch that is locally rare or otherwise locally important based on its type and condition. Supports a locally important macrophyte assemblage.
Reduction in macroinvertebrate abundance	Medium	A high biodiversity interest site because it supports a significant proportion of a habitat or a significant population of a nationally rare species (*Pisidium conventus*).

5.13 Assessment Step 4: Significance of effect

5.13.1 Significance of effect is summarised in **Table 5-10** below.

5.13.2 It is noted that water temperature changes from water transfer was predicted to have no impact, therefore significance effect was Very Low.

5.13.3 It should also be noted that ingress and entrainment, impingement, and noise and vibration were scoped out of further assessment in Step 1 as likely effect was considered negligible in line with SEPA guidance.

Table 5-10 Significance of Effect

Likely Effect	Positive/Negative	Scale	Duration	Magnitude	Importance	Significance
Loss of Spawning Habitat (watercourse)	Negative	Medium	>6 years	Medium	Medium	Moderate
Loss of Spawning Habitat (waterbody)	Negative	Small - Medium	>6 years	Medium	Medium	Low
Reduction in Egg Viability and hatch success	Negative	Small - Medium	>6 years	Medium	Medium	Low
Fish attraction to the intake	Negative	Small	>6 years	Small	Low	Very Low
Reduction in food availability for fish	Negative	Large	>6 years	Large	Low	Moderate
Fish stranding	Negative	Small	>6 years	Large	Low	Moderate
Fluctuations in Water Levels	Negative	Very Large	>6 years	Very Large	Medium	High
Fragmentation of Habitat (including access to spawning habitat).	Negative	Large	>6 years	Large	Medium	Moderate
Additional flow to watercourses	Positive	Large	>6 years	Very Large	Low	Moderate
Water temperature changes from compensation flow	Positive	Small	>6 years	Small	Low	Very Low
Water temperature changes from water transfer	No difference	Very Small	>6 years	Very Small	Medium	Very Low
Water quality reduction	Negative	Medium	>6 years	Medium	Medium	Moderate

Reduction in macrophyte cover	Negative	Medium	>6 years	Medium	Low	Low
Reduction in macroinvertebrate abundance	Negative	Medium	>6 years	Medium	Medium	Moderate

5.14 Conclusion

5.14.1 To conclude, a total of 17 likely effects were identified. Three of these were scoped out in Section 3.2 due to predicted negligible impacts and included ingress and entrainment, impingement, and noise and vibration.

5.14.2 Assessment of magnitude, importance and significance of 14 remaining factors concluded:

- Negative effects (11 total) ranged in significance from Very Low (fish attraction to intake and water temperature changes from water transfer), loss of spawning habitat (waterbody), reduction in egg viability and hatch success, Moderate (loss of spawning habitat (watercourse), reduction in food availability for fish, fish stranding, fragmentation of habitat (including access to spawning habitat), water quality reduction and reduction in macroinvertebrate abundance), and High (fluctuations in water level).
- Positive effects (2 total) ranged in significance from Very Low (water changes from compensation flow) to Moderate (additional flow to watercourses).
- Water temperature changes from water transfer was predicted to have no impact, therefore significance effect was Very Low.

5.14.3 Mitigation of the negative effects on spawning and habitat loss within the watercourses and around the shoreline of the reservoirs will be provided by proposed new spawning habitat creation at the Moy Burn and the upper sections of the Pitridh aqueduct diversion channel which will both be above the maximum inundation level of the lower reservoir and accessible to spawning fish. The new channels will contain optimal spawning substrates to benefit both tributary spawning Arctic charr (if present) and Brown trout.

5.14.4 Marginal loch spawning habitat would be provided through the creation and maintenance of suitable areas of substrate just below the minimum reservoir drawdown level. These areas would contain optimal spawning substrate types for both Arctic charr and Brown trout. Current spawning opportunities on loch margins is considered low due to existing depleted drawdown zones, thus presenting an opportunity for enhancement.

5.14.5 Further mitigation for spawning and habitat loss around the shoreline of the reservoirs will be considered through providing floating / suspended habitats, to replicate shoreline margins, which may be utilised for spawning within the reservoirs under fluctuating water levels.

5.14.6 For more detailed information on proposed mitigation measures, please refer to: **Earba Arctic Charr Species Protection Plan (Appendix K)**.

6 Effects on Terrestrial Biodiversity

6.1 Chapter Introduction

6.1.1 This assessment addresses impacts on terrestrial biodiversity associated with the proposed controlled activities' effects on waterbodies and watercourses.

6.1.2 A full Environmental Impact Assessment (EIA) has been carried out in support of the planning application for the Proposed Development under Section 36 of The Electricity Act. This is available at this link: https://earbastorage.co.uk/documents/ The following sections are relevant:

Terrestrial Ecology
Chapter 8 Text
Figures
Figure 8.1: Locations of Designated Sites
Figure 8.2: Woodland mapped on the Ancient Woodland Inventory database
Figure 8.3: Phase 1 and NVC habitat map with proposed infrastructure overlain
Figure 8.4: Potential GWDTE habitats with proposed infrastructure overlain
Figure 8.5: **CONFIDENTIAL** Protected mammals field signs with proposed infrastructure overlain
Figure 8.6: **CONFIDENTIAL** Bat survey summary with proposed infrastructure overlain
Figure 8.7: Outline BEMP Overview Drawing
Appendices
Appendix 8.1: Results of Desk Study
Appendix 8.2: Extended Phase 1 Habitat Survey (2022)
Appendix 8.3: Habitat Survey Report (2023) (Vol 1 of 2)
Appendix 8.3: Habitat Survey Report (2023) (Vol 2 of 2)
Appendix 8.4: Protected Mammal Survey Report (2023)
Appendix 8.5: Bat Survey Report (2023)
Appendix 8.6: Outline Biodiversity Enhancement and Management Plan (OBEMP)
Appendix 8.7 NatureScot Peatland Guidance Site Visit Template
Habitats Regulations Appraisal
Shadow Habitats Regulations Appraisal Report (Stage 1 & 2): Ben Alder and Aonach Beag SAC

6.1.3 Rather than transpose this extensive and complex assessment into the format defined in the SEPA guidance "Supporting Guidance (WAT-SG-67) - Assessing the Significance of Impacts -Social, Economic and Environmental, Version: v5.1, November 2017", a summary of the terrestrial ecology EIA is included below, together with Table 1 which summarises the significance effects on important ecological receptors both before and after mitigation.

6.1.4 A number of the habitats covered in this assessment are not linked to the proposed controlled activities' effects on waterbodies and watercourses, but a significant majority are, due to the loss of these habitats to construction of the associated infrastructure and the reservoir inundations.

6.2 Summary of the Terrestrial Ecology EIA

6.2.1 The potential effects of the Proposed Development on designated sites (selected for non-avian, terrestrial ecology features), terrestrial habitats, and non-avian terrestrial species, during construction and operation have been assessed. A detailed assessment of effects on Ben Alder and Aonach Beag Special Area of Conservation (SAC), which is hydrologically linked to the Site, is provided in a separate Shadow Habitats Regulations Appraisal (HRA) report.

6.2.2 The assessment of effects within this Chapter is informed by desk based and field survey data. Baseline habitat and protected mammals surveys were undertaken in accordance with relevant good practice guidelines, in summer 2022 – autumn 2023.

6.2.3 No significant residual adverse effects have been identified upon Ben Alder and Aonach Site of Special Scientific Interest (SSSI) or SAC, once mitigation measures have been applied, including stringent pollution prevention and sediment management measures, implementation of a Biosecurity Management Plan (BMP), and maintenance of the natural flow regime of the Allt a' Bhealaich Leamhain during construction and operation. All other designated sites (selected for non-avian terrestrial ecology features) were scoped out of assessment, due to a lack of potential pathways for significant effects.

6.2.4 A locally significant effect was identified for the loss to inundation of a 5.35 ha strip of habitat mapped on the Ancient Woodland Inventory (AWI), which was found to support scattered mature trees on purple-moor grass dominated vegetation, comprising remnant ancient woodland in poor condition.

6.2.5 With the application of embedded and best practice mitigation to minimise impacts where possible and adherence to relevant legislation, significant adverse residual effects from habitat loss have been identified during construction for: blanket bog and modified bog including montane bog (at the County to national level); montane willow scrub (at the national level); unimproved calcareous grassland, base-rich marshy grassland, upland species-rich ledges, montane heath / dwarf herb, basic flush and bryophyte-dominated spring (at the County level); semi-natural woodland, wet and dry dwarf shrub heath, unimproved acid grassland, acid / neutral flushes and watercourses (at the local level). A small number of locations of some of these habitats are assessed as being sustained by groundwater. These effects would be compensated for by a significant positive effect through implementation of a Biodiversity Enhancement and Management Plan (BEMP), which includes extensive bog restoration, native woodland restoration / creation, montane willow scrub and other montane habitat restoration, heathland restoration and management, aquatic and riparian enhancement, and other habitat restoration and management measures.

6.2.6 Significant adverse residual effects have been identified at the local level upon invertebrates and reptiles, due to habitat loss during construction. These effects would be compensated for through habitat works and species-specific habitat features, delivered via the BEMP. Once embedded and best practice mitigation has been applied, including protected species licensing where required, non-significant residual adverse effects have also been identified upon water vole, otter, bats, red squirrel and pine marten.

6.2.7 Additional to the compensation proposed, the woodland restoration / creation, montane willow scrub and other montane habitat restoration, heathland enhancement and positive management of a range of other upland habitats via deer control, as well as the provision of bat, red squirrel and pine marten boxes, would provide a significant enhancement, which would be delivered via the BEMP.

6.2.8 With the implementation of continued best practice measures, no significant negative effects are predicted during the operational phase.

6.2.9 No potentially significant cumulative effects were identified.

Table 6-1 Summary of effects on Important Ecological Receptors

Predicted Effect	Good Practice Measures	Significance	Additional Mitigation/ Compensation/ Enhancement	Residual Significance
Construction				
Ben Alder and Aonach Beag SSSI: water quality impacts, a change in flow regime or introduction of invasive species into Loch Pattack via the Allt a' Bhealaich Leamhain, with potential to affect adjacent habitats within the SSSI; catastrophic failure of Leamhain Dam; temperature changes through water transfer; and displacement of deer.	Stringent pollution and sediment management measures; implementation of BMP; installation of an outfall and construction methods to maintain the natural flow regime of the Allt a' Bhealaich Leamhain.	Not significant.	-	Not significant.
Loss of 5.35 ha of AWI habitat (remnant of ancient woodland in poor condition).	-	Significant at local level.	Restoration / creation of c. 596 ha of native woodland, through deer management and targeted planting.	Significant negative effect at local level but offset through significant positive effect from woodland restoration / creation and management, providing a significant enhancement.
Loss of 7.36 ha of locally important semi-natural woodland (1.56 ha broad-leaved, 5.48 ha conifer, and 0.32 ha mixed woodland).	Erection of protective fencing around retained habitat.	Significant at a local level.		Significant negative effect at local level but offset through significant positive effects from woodland restoration / creation and management, providing a significant enhancement.
Loss of three patches of montane willow scrub (GWDTE) and associated downy willow.	Track micro-siting where possible; erection of protective fencing around retained habitat under ECoW supervision; GWDTE mitigation measures.	Significant at a national level.	Translocation of downy willow within construction footprint during construction. Restoration of c. 200 ha of montane willow scrub and other montane habitats, via deer exclusion and targeted planting.	Not significant, mitigated for by translocation. Significant positive effect from montane willow scrub restoration, providing a significant enhancement.
Permanent loss of 14.72 ha and temporary loss of 4.80 ha of unimproved acid grassland.	Erection of protective fencing around retained habitat; reinstatement of habitats subject to temporary loss within the working corridor.	Significant at a local level.	–Exclusion or reduction of deer grazing across an estimated c. 120 ha of grassland habitat, and restoration of other habitat types as part of the BEMP.	Significant negative effect at a local level, but offset through significant positive effect of grassland enhancement and other habitat restoration measures,

Predicted Effect	Good Practice Measures	Significance	Additional Mitigation/ Compensation/ Enhancement	Residual Significance
				providing a significant enhancement
Permanent loss of 0.65 ha and temporary loss of 0.45 ha of locally important unimproved calcareous grassland.		Significant at a local level.		Significant negative effect at a local level, but offset through significant positive effect of grassland enhancement and other habitat restoration measures, providing a significant enhancement
Permanent loss of up to 3.64 ha and temporary loss of up to 0.54 ha of County important unimproved calcareous grassland.		Significant at a County level.		Significant negative effect at a County level, but offset through significant positive effect of grassland enhancement and other habitat restoration measures, providing a significant enhancement
Permanent loss of 14.77 ha and temporary / indirect loss of 4.06 ha of County-level important marshy grassland.	Hydrological mitigation measures; erection of protective fencing around retained habitat; reinstatement of habitats subject to temporary loss within the working corridor.	Significant at a County level.		Significant negative effect at a County level, but offset through significant positive effect of grassland enhancement and other habitat restoration measures, providing a significant enhancement
Loss of three patches of upland species-rich ledges (GWDTE).	Erection of protective fencing around retained habitat; GWDTE mitigation measures.	Significant at a County level.	Restoration of c. 200 ha of montane habitats, via deer exclusion and targeted planting.	Significant negative effect at a County level, but offset through compensatory montane habitat restoration
Permanent loss of 8.01 ha and temporary loss of 1.08 ha of dry dwarf shrub heath / calcareous grassland mosaic.	Erection of protective fencing around retained habitat; reinstatement of habitats subject to temporary loss within the working corridor.	Significant at a local level.	Restoration of c. 328 ha of open habitats via the exclusion of grazing119; enhancement of an estimated 6,490 ha of heathland via a 39% reduction in deer density120.	Significant negative effect at a local level, but offset through significant positive effect of heathland restoration and management, providing a significant enhancement;
Permanent loss of 124.67 ha and temporary / indirect loss of 54.81 ha of wet dwarf shrub heath.	Hydrological mitigation measures; erection of protective fencing around retained habitat; reinstatement of habitats subject to temporary loss within the working corridor.	Significant at a local level.		Significant negative effect at a local level, but offset through significant positive effect of heathland restoration and management, providing a significant enhancement.
Permanent loss of 1.20 ha and temporary loss of 0.07 ha of montane heath / dwarf herb.	Erection of protective fencing around retained habitat; reinstatement of habitats subject to temporary loss within the working corridor.	Significant at a County level.	Restoration of c. 200 ha of montane habitats, via deer exclusion and targeted planting.	Significant negative effect at a County level, but offset through compensatory montane habitat restoration
Permanent loss (direct and indirect) of 58.41 ha of blanket bog (of which 43.13	Hydrological mitigation measures; erection of protective fencing around	Significant at a County to	Restoration of 625 ha of bog habitat.	Significant negative effect at a County to national level, but

Predicted Effect	Good Practice Measures	Significance	Additional Mitigation/ Compensation/ Enhancement	Residual Significance
ha comprises montane bog, and 15.28 ha comprises non-montane bog).	retained habitat; use of 'floated' access where possible; reinstatement of habitats within the working corridor.	national level.		offset through compensatory bog restoration
Permanent loss (direct and indirect) of 0.62 ha of wet modified bog (non-montane).				
Permanent loss (direct and indirect) of 14.71 ha of dry modified bog (montane).				
Permanent loss (direct and indirect) of 0.17 ha of bare peat.		Significant at a local level.		Significant negative effect at a local level, but offset through compensatory bog restoration
Permanent loss of 0.91 ha and temporary loss of 0.11 ha of acid / neutral flush.	Pollution prevention and hydrological mitigation measures to minimise effects on retained habitats; erection of protective fencing; reinstatement of habitats within the working corridor.	Significant at a local level.	Restoration of c. 200 ha of montane habitats, via deer exclusion and targeted planting.	Significant negative effect at a local level, but offset through compensatory montane habitat restoration
Permanent loss of three basic flushes (GWDTE).	Pollution prevention and hydrological mitigation measures to minimise effects on retained habitats; erection of protective fencing; GWDTE mitigation measures.	Significant at a County level.	Restoration of c. 200 ha of montane habitats, via deer exclusion and targeted planting.	Significant negative effect at a County level, but offset through compensatory montane habitat restoration
Permanent loss of one and temporary loss of two bryophyte-dominated flushes (GWDTE)	Pollution prevention and hydrological mitigation measures to minimise effects on retained habitats; erection of protective fencing; GWDTE mitigation measures.	Significant at a County level.		Significant negative effect at a County level, but offset through compensatory montane habitat restoration
Loss / modification of 2.69 km of watercourses.	Water flow management, pollution prevention and hydrological mitigation measures, fish mitigation measures.	Significant at a local level.	Re-wetting of Allt Labhrach; instalment of large woody structures in littoral zone; improvement of fish spawning habitat quality and accessibility on c. 0.7 km stretch of the Moy Burn; riparian planting (20.9 ha); provision of marginal loch spawning habitat and artificial floating spawning nests.	Significant negative effect at a local level, but offset through compensatory watercourse and riparian enhancement measures
Small-scale loss of semi-improved acid grassland, dry heath, acid grassland and dry heath mosaic, bryophyte-dominated spring, swamp and marginal / inundation habitats.	Pollution prevention and hydrological mitigation measures to minimise effects on retained habitats; erection of protective fencing; reinstatement of habitats within the working corridor.	Not significant.	-	Not significant.
Inadvertent spread of invasive non-native plant species.	Pre-construction species survey, Rhododendron control, and implementation of BMP.	Not significant.	-	Not significant.

Predicted Effect	Good Practice Measures	Significance	Additional Mitigation/ Compensation/ Enhancement	Residual Significance
Small-scale loss of field gentian and hawkweed sp.	Track micro-siting where possible; erection of protective fencing around retained habitat under ECoW supervision.	Significant at County level.	–Translocation of affected plants during construction	Not significant
Small-scale loss of petty whin.		Significant at local level.		Not significant
Loss of 300.5 ha of locally important invertebrate habitat.	Erection of protective fencing around retained habitat; reinstatement of habitats within the working corridor.	Significant at a local level.	Creation of log piles; restoration of 625 ha of bog habitat; restoration / creation of c. 796 ha of native woodland and montane willow scrub; reduced deer densities over c. 11,390 ha.	Significant negative effect at a local level, but offset through significant positive effect of habitat restoration, creation and management, providing a significant enhancement.
Loss of 293.1 ha of habitat suitable for reptiles.	Erection of protective fencing around retained habitat; reinstatement of habitats within the working corridor.	Significant at a local level.	Creation of log piles and ten hibernacula; restoration of 625 ha of bog habitat; creation of c. 796 ha of native woodland and montane willow scrub; reduced deer densities over c. 11,390 ha.	Significant negative effect at a local level, but offset through significant positive effect of habitat restoration, creation and management, providing a significant enhancement.
Inadvertent disturbance, injury and / or death of reptiles.	Habitat manipulation to make habitat unsuitable (overseen by ECoW); site speed limit.	Not significant.	-	Not significant.
Loss of two otter couches	Obtain licence in consultation with NatureScot; pre-construction surveys; provide otter protection plan.	Not significant.	-	Not significant.
Fragmentation to otter habitat from dam construction.	-	Not significant.	-	Not significant.
Impacts to otter prey	Suite of fish mitigation measures	Not significant	-	Not significant
Displacement of small water vole colony.	Pre-construction survey; adherence to SPP; translocate water vole colony subject to inundation under licence from NatureScot to nearby retained suitable habitat; demarcation of retained water vole burrows and watercourses (overseen by ECoW); track micro-siting where possible; water management and pollution prevention measures.	Not significant.	-	Not significant.
Inadvertent disturbance, injury and / or death of otter, pine marten and red squirrel.	Site speed limit; covering / ramping of excavations; suitable storage of materials.	Not significant.	None.	Not significant.
Disturbance of fauna utilising retained habitat via human presence, construction noise, vibration and temporary construction lighting.	Restrict lighting to minimum required; direct lighting away from sensitive habitats; avoid lighting specifications with a high UV component.	Not significant.	-	Not significant.

Predicted Effect	Good Practice Measures	Significance	Additional Mitigation/ Compensation/ Enhancement	Residual Significance
Loss of 7.4 ha of woodland habitat suitable for pine marten, red squirrel and foraging / commuting bats.	Reinstatement of habitats within the working corridor.	Not significant.	Erect 30 pine marten boxes; erect 50 red squirrel boxes; restoration / creation of c. 596 ha of native woodland.	No significant negative effect, with boxes and habitat works providing a significant enhancement.
Loss of one confirmed small common pipistrelle day roost, and ten trees with PRFs for bats.	Further tree roost surveys (including all trees to be affected); obtain licence from NatureScot (for the confirmed roost and any subsequent identified roosts if required); erect 11 bat boxes (i.e. one per tree with PRF or confirmed roost lost); undertake tree inspection / exclusion and supervised sensitive section felling under licence.	Not significant.	Erect a further 39 boxes for enhancement.	Not significant, with the additional roosting provision providing an enhancement.
Operation				
Damage to habitats, and disturbance / injury / killing of invertebrates, reptiles and protected mammals.	Environmental measures implemented during operational maintenance similar to construction period; pollution prevention measures; site speed limit; suitable storage of chemicals; sensitive low-level lighting directed away from sensitive habitats.	Not significant.	-	Not significant.

7 Effects on Biodiversity - Ornithology

7.1 Chapter Introduction

7.1.1 This assessment addresses impacts on ornithological biodiversity associated with the proposed controlled activities' effects on waterbodies and watercourses.

7.1.2 A full Environmental Impact Assessment (EIA) has been carried out in support of the planning application for the Proposed Development under Section 36 of The Electricity Act. This is available at this link: https://earbastorage.co.uk/documents/ The following sections are relevant:

Ornithology
EIAR Chapter 10 Text
Appendices
Appendix 10.1 - Ornithology **CONFIDENTIAL** Annex
Appendix 10.2 - Field Survey Methodology
Appendix 10.1.1 - **CONFIDENTIAL** Ornithology Report March 2023
Appendix 10.1.2 - **CONFIDENTIAL** Ornithology Report August 2023
Appendix 10.1.3 – **CONFIDENTIAL** HRSG Protected Species Map
Appendix 10.1.4 – **CONFIDENTIAL** Golden Eagle Protection Plan

7.1.3 Rather than transpose this extensive and complex assessment into the format defined in the SEPA guidance "Supporting Guidance (WAT-SG-67) - Assessing the Significance of Impacts -Social, Economic and Environmental, Version: v5.1, November 2017", a summary and conclusions of the ornithology chapter of the EIA report are included below.

7.1.4 Two protected species, black throated divers and red throated divers would be affected by the proposed controlled activities' effects on waterbodies and watercourses. Only details of these are included in this chapter.

7.2 Relevant Summary and Conclusions of the Ornithology EIA

7.2.1 This section considers the potential effects of the Proposed Development on the wild bird populations of the area that are afforded additional legal protection and that would be affected by the proposed controlled activities and reaches conclusions on the likely significant effects on those species, namely black and red throated divers. In addition to these two species, the Ornithology EIA also assessed common sandpiper – a species not afforded additional legal protection, but one that appears on the Amber list of conservation concern, and which is considered to be of regional importance.

7.2.2 A desk study and field study were undertaken during the summers of 2022 and 2023 and the winter of 2022/23 to establish baseline bird populations in the area. Four ornithologically-designated sites are located within 5 km of the Proposed Development (Creag Meagaidh Special Protection Area (SPA), Ben Alder SPA, Creag Meagaidh Site of Special Scientific Interest (SSSI), and Ben Alder & Aonach Beag SSSI), and of the 59 species recorded during the survey period, four are afforded additional legal protection (Golden Eagle, Black-throated Diver, Red-throated Diver, and Black Grouse) and have

been assessed in this Chapter. Only black and red throated divers are considered in this assessment.

7.2.3 There were three potential impacts on the bird life of the area identified during the construction phase of the Proposed Development (habitat loss, disturbance and displacement), with disturbance and displacement also being assessed as potential impacts during the operational phase.

7.2.4 The assessment of the black and red throated divers considered in this Chapter determined that they would be subjected to minor displacement and disturbance throughout the construction period. However, due to the temporary nature of the impacts, they would suffer negligible to low-moderate impacts from the construction phase and negligible to low-moderate impacts from the operational phase of the Proposed Development. In the worst case scenario, the current congregation of Black-throated Divers on Lochan na h-Earba may be displaced by the fluctuating water levels and potential decline in prey items. However, as there is no breeding occurring on the loch, and other suitable waterbodies are located in the area, this outcome has been assessed as Not Significant.

7.2.5 It is recommended that the Black-throated Diver population at Earba be monitored, as it is assessed as having a Low to Moderate sensitivity and suffering a Low to Moderate impact from the operation of the Proposed Development. However, with no breeding birds being displaced and the potential for new nesting rafts to be installed to encourage a new pair to nest on Site, this is considered to be Not Significant, and thus does not affect the coherence of its ecological structure and function within the UK. With no further effects to be considered, the cumulative effects remain as being Not Significant for Black-throated Diver.

7.2.6 The loss of habitat and displacement from the fluctuating water levels of the new reservoir will potentially impact Common Sandpiper, as this species nests in the heather moorland and mossy patches within the scattered trees just above the current high-water line. The construction impact on the sandpipers was assessed as likely to be Low and Not Significant. The overall operational impact on Common Sandpiper would be temporary, as, over time, the loss of vegetation from around the edge of the water will dissuade birds from attempting to nest within the inundation zone and was assessed as Negligible and Not Significant.

7.2.7 Table 7-1 below summarises the residual effects of the Proposed Development on the three species considered to be impacted by the fluctuating water levels.

Table 7-1 Summary of Residual Effects on Black and Red Throated Divers and Common Sandpiper

Phase of Project	Important Ecological Feature (IEF	Importance of IEF	Sensitivity of IEF	Nature of Impact	Duration of Impact	Magnitude of Impact	Significance of Effect
Construction	Black-throated Diver	International	Low	Noise & Visual Disturbance	Temporary	Low	Not Significant
				Displacement	Temporary		
	Red-throated Diver	International	Low	Noise & Visual Disturbance	Temporary	Low	Not Significant
	Common Sandpiper	Regional	Low	Displacement		Low	Not Significant
					Temporary		

				Habitat Loss	Permanent		
Operation	Black-throated Diver	International	Low > Moderate	Noise & Visual Disturbance	Temporary	Low > Moderate	Not Significant
				Displacement	Temporary		
	Red-throated Diver	International	Negligible	Noise & Visual Disturbance	Temporary	Negligible	Not Significant
				Displacement	Permanent		
				Noise & Visual Disturbance	Temporary		
	Common Sandpiper	Regional	Negligible	Displacement	Temporary	Negligible	Not Significant
				Displacement	Temporary		

8 Effects on Economy

8.1 Chapter Introduction

8.1.1 The economic effect of the proposed Earba Pumped Storage Hydro scheme (the Proposed Development) has been assessed in accordance with the SEPA Guidance Note WAT-SG-67.

8.1.2 The assessment set out below has determined that the significance of the effect on the economy as a consequence of the Proposed Development is **Positive High to Very High**.

8.1.3 As part of the EIAR a separate report on the socioeconomic impact of the Proposed Development was drafted. This document contains significant detail on the wider benefits of the Proposed Development and therefore is included in **Appendix L** of this report.

8.2 Economic Effect Summary

Employment

8.2.1 The Proposed Development will employ a large number of people throughout the five-to-six-year construction period. This employment is estimated to reach 500 people on site during the peak of the construction activities.

8.2.2 Once operational, the Proposed Development will directly require 20 full time skilled positions. Including multiplier effects, it is estimated that the Proposed Development will create 46 new full-time jobs, injecting £2.0 million per annum into the local economy. More details of this can be found in **Appendix L** of this report which contains the Socioeconomic chapter of the EIAR.

The effect of importing electricity

8.2.3 Renewable energy generation requires to be curtailed at times of excess power production. Curtailment has a significant cost which is largely passed on to electricity consumers. Analysis undertaken by LCP estimates that wind curtailment cost GB consumers £299m in 2020 and £507m in 2021.

8.2.4 LDES projects can make use of the excess renewable electricity which in turn would substantially reduce curtailment payments, saving the UK consumer money.

8.2.5 Wind congestion costs across the Scotland-England boundary are only set to grow in the coming years and without the implementation of appropriate Long Duration Electricity Storage (LDES) projects these costs could surpass £3.5 billion by 2030 .

The effect of exporting electricity

8.2.6 Currently, unabated natural gas generation is the only realistic option to support the electricity network at times of renewable energy shortfall. LDES and specifically Pumped Storage Hydro can release large quantities of electricity to balance this renewable deficit. Without LDES the only way to balance the electricity network will be to continue to use large quantities of gas which is highly costly and inconsistent with

Net-Zero. Alternatives such as gas generation with carbon capture or hydrogen storage are both far from being commercially viable.

Employee Spend

8.2.7 During construction, a proportion of the workforce will arrive from out-with Scotland and as a consequence they will spend money in the Scottish Economy on food, transport and accommodation.

8.2.8 During operation, full-time employees will likely settle in the local area and this will increase the permanent population which will introduce spending in local shops and businesses.

8.3 Determining the Scale of Economic Effect

Gross Value Added (GVA)

8.3.1 The direct economic effect (GVA in £/year) of the Proposed Development has been estimated using the information in Table 8-1, Appendix B of SEPA's Supporting Guidance (WAT-SG-67). For Electricity Developments this is £47k per annual GWh generated.

Table 8-1 WAT-SG-67 Table 8 with the Proposed Development Business Sector highlighted in the red box

Business sector	Units	Approximate annual GVA per unit (£/year)
Aquaculture	Number of employees at site	£63,000
Agriculture	Number of employees at site	£25,000
Electricity generation	Giga Watt hours power generated/year at site	£47,000
Manufacture of beverages	Number of employees at site	£204,000
Manufacture of chemicals and chemical products	Number of employees at site	£95,000
Manufacture of food products	Number of employees at site	£46,000
Manufacture of paper and paper products	Number of employees at site	£52,000
Mining and quarrying	Number of employees at site	£64,000
Notes: GVA = Gross Value Added		

8.3.2 Earba is forecast to generate 4,500,000 MWh/year or 4,500 GWh/year and therefore the annual GVA will be £212M.

8.3.3 Referring to Table 9, a multiplier of 1.9 has been applied to the GVA to account for indirect and induced economic effects.

Table 8-2 WAT-SG-67 Table 9 Multiplier for the Proposed Development shown in the red box

Business sector	GVA multiplier
Aquaculture	2.4
Agriculture	1.7
Beverage manufacture	1.8
Chemicals manufacturing (listed as 'other chemicals)	1.5
Electricity generation	1.9
Food manufacturing	1.8
Mining and quarrying (average of coal and lignite and other mining and quarrying)	1.8
Paper and paper products manufacture	1.9
The Scottish Government has produced estimates of the *Multipliers* associated with all industrial sectors. This Table reproduces only a sub-set of multipliers	

8.3.4 This means that the adjusted GVA for the Proposed Development is £402M.

Scale of Economic Impact

8.3.5 Referring to Table 10 of the SEPA guidance the scale of economic impact has been assessed.

Table 8-3 WAT-SG-67 Table 10 with the Proposed Developments Scale of economic impact highlighted in red box

	Scale of economic impact				
	Very Small	Small	Medium	Large	Very Large
% of Scottish GVA	≤ 0.002%	0.002 – 0.01%	0.01 - 0.04%	0.04 – 0.2%	> 0.2%
GVA based on the Scottish economy's GVA in 2015/16 (£/year) (rounded)	≤ £3m	£3 - £100m	£100-£500m	£500-£3,000m	>£3,000m

8.3.6 The Proposed Development is classed as having a medium scale of economic impact based on the Scottish economy's GVA in 2015/16 (£/year) (rounded).

Assessing Magnitude of Economic Effect

8.3.7 The magnitude of the effect has been assessed based on Table 1, shown below. The duration of the Proposed Development's effect will last considerably longer than 6 years. PSH has a typical operational life of 100 years or more. Furthermore, considerable expenditure on the Proposed Development has started and there are a number of years before operation will commence. Therefore, it is considered that the magnitude of the effect is medium tending towards **Large**.

Table 8-4 WAT-SG-67 Table 1 with the Proposed Development shown in red box

	Scale of effect				
Duration of effect	V Small	Small	Medium	Large	V Large
Only lasts up to around 1 year	VS	VS	VS	S	M
Only lasts up to around years 6 years	VS	VS	S	M	L
Lasts significantly more than 6 years	VS	S	M	L	VL
Starts up to around 2 to 3 years earlier*	VS	S	M	L	VL
Starts up to 3 to 12 years earlier*	VL	S-M	M-L	L	VL
Starts more than 12 years earlier*	S	M	L	L-VL	VL

Notes:

You should use these rows in the table when you are assessing a benefit that is already expected to be delivered through the implementation of the river basin management plan (RBMP) but which is expected to be realised sooner as a result of the proposal (ie the proposal will enable the early achievement of an RBMP improvement objective).

If you have assessed the scale of an effect as being negligible, you should not consider that effect further in your assessments.

Assessing the Significance of the Economic Effect

8.3.8 Referring to Table 2 of the SEPA guidance the importance of the Proposed Development's economic benefit has been assessed. The Importance of Economic benefit has been assessed as Very High due to the current economic climate and the cost-of-living crisis.

Table 8-5 WAT-SG-67 Table 2 with the Proposed Development shown in the red box

Importance of affected factor	Magnitude of effect					
	Negligible	V Small	Small	Medium	Large	V Large
Very low / negligible	N	N	N	N	N	N
Low	N	VL	VL	L	M	M-H
Medium	N	VL	L	M	M-H	H
High	N	VL-L	M	H	H-VH	VH
Very High	N	L	M-H	H-VH	VH	VH

Key:
N = negligible significance; VL = very low significance; L = low significance; M = moderate significance; H = high significance; and VH = very high significance.

8.3.9 Therefore, in conclusion the economic effect of the Proposed Development is a **Positive of High to Very High Significance**.

9 Effects on Health and Safety

9.1 Chapter Introduction

9.1.1 This chapter assess the likely effects of the Proposed Development on the population in terms of human health and human safety under the following categories:

- the risk of ill-health or disease;
- the risk of injury; or
- human well-being more generally.

9.2 Study Area

9.2.1 The Study Area comprises Ardverikie Estate, and more specifically the area including and surrounding the Proposed Development, together with the waterbodies and watercourses downstream from the Proposed Development.

9.3 Methodology

9.3.1 This assessment has been carried out in accordance with the SEPA guidance "Supporting Guidance (WAT-SG-67) - Assessing the Significance of Impacts -Social, Economic and Environmental, Version: v5.1, November 2017".

9.3.2 The assessment has involved the following key tasks:

- Consultation with organisations and landowners concerned with recreational interests in the area;
- Site survey and recording;
- Reference to relevant Local Development Plans and other literature to obtain baseline information; and
- Evaluation of impacts based on the following steps:
    - Step 1: Identifying the positive and negative economic, social and environmental effects likely to result from the proposal.
    - Step 2: Assessing the magnitude of each identified effect.
    - Step 3: Assessing the importance of each affected economic, social and environmental factor.
    - Step 4: Taking account of the results of steps 2 and 3, assessing the significance of each identified effect.
    - Step 5: Weighing up all the significant positive and negative effects.

Magnitude of Effect

9.3.3 The magnitude of an effect reflects its scale and duration. An effect of a particular scale will be of greater magnitude if it is long-lasting than if it is only short-term. Similarly, a beneficial effect that will be produced in due course by other means will be of greater magnitude than it would otherwise be if it happens earlier as a result of the proposed activity.

9.3.4 Before you can assess the magnitude of an effect, you need to decide on its scale. To do so, you need to consider both the quantity/extent and degree of the effect. For example,

all else being equal, the effect on river biodiversity of a proposal damaging 1 kilometre of a river is smaller in terms of its extent than that of a proposal damaging 2 kilometres; and the degree of an effect that causes deterioration from good to bad is greater than that of an effect that causes deterioration from good to moderate.

9.3.5 The scale of an effect on human health or human safety depends on:

- the degree to which risks to health and safety are altered; and
- the number of people likely to be affected.

9.3.6 Guidance on assessing the scale of a range of effects is provided in Table 9-1 Indicative guide to assessing the scale of an effect on human health or human safety (WAT-SG-67 Table 12). Once you have assessed the scale of the effect, you can use Table 2 - Indicative guide to assessing the magnitude of an effect, to judge the magnitude of the effect.

Table 9-1 Indicative guide to assessing the scale of an effect on human health or human safety (WAT-SG-67 Table 12)

Increase or decrease in risk, or benefit, to health and well-being	**Number of people likely to be affected**					
	< 10	10 to < 100	100 to < 1,000	1,000 to < 10,000	> 10,000	*General population, or*
			10 to < 100	100 to < 1,000	> 1,000	*Disadvantaged groups*
Very small *(perhaps imperceptible)*	N	VS	VS - S	S	S - M	
Small	VS	VS - S	S	S - M	M	
Modest	S	S - M	M	M	M - L	
Large	S - M	M	M - L	L	L - VL	
Very large *(eg a risk to health completely, or nearly completely, eliminated)*	M	M - L	L	L - VL	VL	
Key: N = negligible; VS = very small; S = small; M = medium; L = large; and VL = very large						

Table 9-2 Indicative guide to assessing the magnitude of an effect (WAT-SG-67 Table 1)

	Scale of effect				
Duration of effect	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Only lasts up to around 1 year	VS	VS	VS	S	M
Only lasts up to around years 6 years	VS	VS	S	M	L
Lasts significantly more than 6 years	VS	S	M	L	VL
Starts up to around 2 to 3 years earlier*	VS	S	M	L	VL
Starts up to 3 to 12 years earlier*	VL	S-M	M-L	L	VL
Starts more than 12 years earlier*	S	M	L	L-VL	VL

Notes:

You should use these rows in the table when you are assessing a benefit that is already expected to be delivered through the implementation of the river basin management plan (RBMP) but which is expected to be realised sooner as a result of the proposal (ie the proposal will enable the early achievement of an RBMP improvement objective).

If you have assessed the scale of an effect as being negligible, you should not consider that effect further in your assessments.

Importance of Affected Factor

9.3.7 The importance of a factor refers to its relative social, economic or environmental value to society. An effect on a very important factor (e.g. one of national importance) will be of much greater significance than the same magnitude of effect on a factor of limited importance (e.g. one of only local value).

9.3.8 The importance of an effect on human health and safety depends on the seriousness of the potential effect were it to occur and the degree of control people have over their exposure to a risk. You can use the guidance in Table 3 to help judge the importance of an effect on human health or safety.

Table 9-3 indicative guide to assessing the importance of an effect on health and safety (WAT-SG-67 Table 11)

Low importance	• The effect would be to produce or remove a health or safety issue that would not be (or is) not very serious; people are unlikely to notice the change; and people are easily able to control their exposure to the risk to their health or safety.
Medium importance	• The effect would be to produce or remove a health or safety issue that would not be (or is) not life-threatening, not particularly debilitating and not long-lasting; effective treatments/alternatives are readily available and full recovery would be likely in a few days; and with care, people are able to avoid exposure to the risk to their health or safety
High importance	• The effect would change the status of a Bathing Water; or • The effect would be to produce or remove a health or safety issue of significant concern and that would be (or is) debilitating at least for a short period; effective treatments/alternatives exist but recovery may take several weeks; people are unlikely to be able to completely avoid exposure to the risk to their health or safety but may have some control over exposure; and the people affected will tend to include those from vulnerable or disadvantaged groups.
Very high importance	• The effect would be to produce or remove a health or safety issue that would be (or is) very serious, life-threatening or very debilitating; completely effective treatments/alternatives may not available and recovery is likely to require a lengthy period of time; people are not able to avoid their exposure to the risk to their health or safety; and the effect is likely to be particularly concentrated on vulnerable or disadvantaged groups.
Notes: To use this guide, you need to decide if a proposal would remove or create effects falling within a particular importance category.	

Significance of Effect

9.3.9 The significance of an effect (whether positive or negative) is a combination of the importance of the factor that is affected and the magnitude of the effect on the factor.

9.3.10 Once you have worked out the magnitude of an effect and the importance of the affected factor, you can use Table 4 below to help judge the significance of the effect.

Table 9-4 Indicative guide to assessing the significance of an effect (WAT-SG-67 Table 2)

Importance of affected factor	**Magnitude of effect**					
	Negligible	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Very low / negligible	N	N	N	N	N	N
Low	N	VL	VL	L	M	M-H
Medium	N	VL	L	M	M-H	H
High	N	VL-L	M	H	H-VH	VH
Very High	N	L	M-H	H-VH	VH	VH
Key: N = negligible significance; VL = very low significance; L = low significance; M = moderate significance; H = high significance; and VH = very high significance.						

9.3.11 The assessment considers the potential effects of the Controlled Activities on human health and safety during both the construction phase and the longer-term operation.

9.4 Potential Significant Effects

9.4.1 This section considers the potential effect of the Controlled Activities on human health and human safety under the following categories:

- the risk of ill-health or disease;
- the risk of injury; or
- human well-being more generally.

Ill Health or Disease

9.4.2 The operation of the Controlled Activities would not give rise to any emissions which could cause ill health or disease.

9.4.3 There are no public water supplies within the area of the controlled activities.

9.4.4 A private water supply risk assessment has identified a number of private water supplies that could potentially be affected by the controlled activities, together with the processes that would be followed to manage any risks to these.

9.4.5 Fewer than 100 people would be affected with a Small increase in risk, giving rise to a Very Small – Small scale and a Very Small - Small magnitude based on the long term operation of the controlled activities. The importance has been assessed as Medium based on the possible impact of foreseeable health risks, giving rise to a Very Low – Low significance.

9.4.6 Hydrocarbon pollution from turbine or transformer lubricants and vehicles could pose a risk of pollution of waterbodies and watercourses. The risk of this hazard would be controlled by the management processes outlined in the Draft Construction Environmental Management Document (during construction) (**Appendix F**) and similar operational management processes thereafter.

9.4.7 Fewer than 100 people would be affected with a Small increase in risk, giving rise to a Very Small – Small scale and a Very Small to Small magnitude based on the long term operation of the controlled activities. The importance has been assessed as Medium based on the possible impact of foreseeable health risks, giving rise to a Very Low – Low significance.

The Risk of Injury

9.4.8 There is a risk of injury to recreational users of the area from interaction with the construction process. Mitigation for this is addressed in the Draft Access Management Plan (EIAR Appendix 15.1).

9.4.9 Fewer than 1000 people would be affected with a Modest increase in risk, giving rise to a Medium scale and a Small magnitude based on the construction period not exceeding 6 years. The importance has been assessed as Very High based on the possible impact of foreseeable health risks, giving rise to a Moderate – High significance.

9.4.10 There is a risk of injury to recreational users of the area from water hazards caused by the operation of the reservoirs. Mitigation for this is also addressed in the Draft Access Management Plan (EIAR Appendix 15.1).

9.4.11 Fewer than 100 people would be affected with a Small increase in risk, giving rise to a Very Small scale and a Very Small magnitude based on the long term operation of the controlled activities. The importance has been assessed as Very High based on the possible impact of foreseeable health risks, giving rise to a Low significance.

9.4.12 There is a risk of injury due to partial of complete failure of any of the three dams, Shuas, Shios and Leamhain. This risk would be managed through the application of the Reservoirs (Scotland) Act 2011.

9.4.13 Fewer than 1000 people would be affected with a Very Small increase in risk, giving rise to a Very Small - Small scale and a Very Small - Small magnitude based on the long term operation of the controlled activities. The importance has been assessed as Very High based on the possible impact of foreseeable health risks, giving rise to a Low – Moderate significance.

9.4.14 Outside of the site there would be an increased risk of injury in a road traffic accident caused by the additional traffic generated by the construction only of the scheme. Mitigations have been proposed to reduce this as far as possible, which are outlined in the Transport chapter of the S36 planning application EIA Report.

9.4.15 Fewer than 10,000 people would be affected with a Small increase in risk, giving rise to a Small scale and a Very Small - Small magnitude based on the long term operation of the controlled activities. The importance has been assessed as Very High based on the possible impact of foreseeable health risks, giving rise to a Low – Moderate significance.

Human Well Being

9.4.16 The primary potential effect on human well-being would arise from any disturbance to recreational access to the area around the Proposed Development. Mitigation for this is detailed in the Draft Access Management Plan (EIAR Appendix 15.1). In addition, the Draft Construction Environmental Management Plan outlines the management processes that would be in place to manage noise, dust and any other nuisances.

9.4.17 Fewer than 1,000 people would be affected with a Very Small increase in risk, giving rise to a Small - Medium scale and a Very Small magnitude based on the construction period not exceeding 6 years. The importance has been assessed as Medium based on the possible impact of foreseeable health risks, giving rise to a Low significance.

9.5 Summary of Effects

9.5.1 Potential effects after mitigation and associated effect significance of the construction and operation of the Proposed Development following the implementation of mitigation measures are summarised in Table 9-5.

Table 9-5 Summary of effects on human health and human safety

Effect	Type of Effect	Magnitude of Effect	Importance of Effect	Significance of Effect
Ill Health or Disease				
Private water supplies	Negative	Very Small - Small	Medium	Very Low - Low
Hydrocarbon pollution	Negative	Very Small - Small	Medium	Very Low - Low

Effect	Type of Effect	Magnitude of Effect	Importance of Effect	Significance of Effect
Risk of Injury				
Public / Construction interface	Negative	Small	Very High	**Moderate - High**
Water Hazards	Negative	Very Small	Very High	Low
Road Traffic Accidents	Negative	Very Small - Small	Very High	Low - Moderate
Human Well Being				
Disturbance to recreational access	Negative	Very Small	Medium	Low

10Effects on Recreation

10.1 Introduction

10.1.1 This chapter uses publicly available information to assess the likely effects of the Proposed Development on the population in terms of public recreation and access.

10.1.2 The forms of public recreation known to take place within and around the site of the Proposed Development, and which are considered in this Chapter are as follows:

- Canoeing;
- Swimming;
- Angling; and
- Land based recreation including walking and running, mountaineering, rock climbing, cycling, backpacking, horse riding and caving.

10.1.3 This Chapter considers the potential effects of the Proposed Development on public recreation during construction and operation. Such effects generally include disruption to the use of recreational facilities/sites. The proposed scheme may also result in changes to the perceived amenity value of recreational facilities/sites. These however generally relate to visual and noise effects which are assessed in Chapter 11 - Visual Amenity and Landscapes.

10.2 Study Area

10.2.1 The Study Area comprises Ardverikie Estate, and more specifically the area including and surrounding the Proposed Development, together with the waterbodies and watercourses downstream from the Proposed Development.

10.3 Methodology – Desk Study & Field Study

Desk Study

10.3.1 A desk study to identify the key components of recreational use in the local area has been undertaken to establish the existing conditions.

10.3.2 The following sources of data have been used in the preparation of this assessment:

- Ordnance Survey mapping;
- The SCA Guidebook Scottish White Water – 3rd Edition, 2018[9] ;
- The UK Rivers Guidebook[10] ;
- The East Highland Way website[11] ;
- The Scottish Mountaineering Club guidebook “The Munros”[12] ;
- Walkhighlands website[13] ;

[9] The SCA Guidebook Scottish White Water – 3rd Edition, 2018: https://www.pesdapress.com/index.php/product/scottish-white-water/

[10] The UK Rivers Guidebook: https://www.ukriversguidebook.co.uk/rivers/scotland/west-highlands/river-spean-roybridge-to-spean-bridge , accessed September 2023.

[11] The East Highland Way: http://www.easthighlandway.com/ , accessed September 2023

[12] “The Munros” – Scottish Mountaineering Press, 2021

[13] Walkhighlands: https://www.walkhighlands.co.uk/ , accessed September 2023

- The Scottish Mountaineering Club rock climbing guidebook "Highland Outcrops South"[14];
- The UKClimbing website [15]
- Strava Global Heatmap[16] ;
- The Cycling UK website[17] ;
- The Scottish Mine and Cave Database[18] ; and
- Information provided by Ardverikie Estate.

Field Study

10.3.3 Feedback has been sought from recreational users on the site of the Proposed Development including canoeists, hillwalkers, rock climbers, cyclists, backpackers and swimmers. Additional information has been volunteered by attendees at public consultation meetings held in Laggan and Spean Bridge in February and November 2023.

10.3.4 Information on canoeing was provided by [redacted] an Access Officer with the Highland Council and author of the SCA Guidebook, Scottish White Water.

10.4 Assessment Methodology

10.4.1 This assessment has been carried out in accordance with the SEPA guidance "Supporting Guidance (WAT-SG-67) - Assessing the Significance of Impacts -Social, Economic and Environmental, Version: v5.1, November 2017".

10.4.2 The assessment has involved the following key tasks:

- Consultation with organisations and landowners concerned with recreational interests in the area;
- Site survey and recording;
- Reference to relevant Local Development Plans and other literature to obtain baseline information; and
- Evaluation of impacts based on the following steps:
    - Step 1: Identifying the positive and negative economic, social and environmental effects likely to result from the proposal.
    - Step 2: Assessing the magnitude of each identified effect.
    - Step 3: Assessing the importance of each affected economic, social and environmental factor.
    - Step 4: Taking account of the results of steps 2 and 3, assessing the significance of each identified effect.
    - Step 5: Weighing up all the significant positive and negative effects.

[14] Scottish Mountaineering Club Climbers' Guide Highland Outcrops South – Scottish Mountaineering Trust, 2016
[15] The UKClimbing website: https://www.ukclimbing.com/, accessed September 2023
[16] Strava Global Heatmap: https://www.strava.com/heatmap#7.00/-120.90000/38.36000/hot/all , accessed September 2023
[17] The Cycling UK website: https://www.cyclinguk.org/route/weekender-badger-divide , accessed November 2023
[18] The Scottish Cave and Mine Database: https://registry.gsg.org.uk/sr/sitedetails.php?id=1312 , accessed September 2023

Magnitude of Effect

10.4.3 The magnitude of an effect reflects its scale and duration. An effect of a particular scale will be of greater magnitude if it is long-lasting than if it is only short-term. Similarly, a beneficial effect that will be produced in due course by other means will be of greater magnitude than it would otherwise be if it happens earlier as a result of the proposed activity.

10.4.4 Before you can assess the magnitude of an effect, you need to decide on its scale. To do so, you need to consider both the quantity/extent and degree of the effect. For example, all else being equal, the effect on river biodiversity of a proposal damaging 1 kilometre of a river is smaller in terms of its extent than that of a proposal damaging 2 kilometres; and the degree of an effect that causes deterioration from good to bad is greater than that of an effect that causes deterioration from good to moderate.

10.4.5 Guidance on assessing the scale of a range of effects is provided in Table 10-1 – Indicative guide to assessing the scale of an effect on recreation, and Table 10-2- Indicative guide assessing the scale of an effect on canoeing/kayaking. Once you have assessed the scale of the effect, you can use Table 10-3- Indicative guide to assessing the magnitude of an effect, to judge the magnitude of the effect.

Table 10-1 Indicative guide to assessing the scale of an effect on recreation (WAT-SG-67 Table 14)

Very small	Very small effects less than around a 5% increase in: • the availability of the recreational resource (within a time period); or • the usage of the resource (numbers of people)
Small	Small effects - around a 6% to 15% reduction or increase in: • the availability of the recreational resource; or • the usage of the resource If effects are concentrated at low usage times (eg week days) then a greater than 15% reduction or increase in the availability of the resource at these times may still be small. If effects are concentrated at high usage times (eg weekends), then reductions or increases in availability of less than 15% may be medium scale
Medium	Moderate effects - around a 16% to 40% reduction or increase in: • the availability of the recreational resource; or • the usage of the resource If effects are concentrated at low usage times (eg week days) then a greater than 40% reduction or increase in the availability of the resource at these times may still be small. If effects are concentrated at high usage times (eg weekends), then reductions or increases in availability of less than 40% may be medium scale
Large	Large effects - around a 41% to 80% reduction or increase in: • the availability of the recreational resource; or • the usage of the resource
Very Large	Very large scale effects - more than an 80% reduction or increase in: • the availability of the recreational resource; or • the usage of the resource

Table 10-2 Indicative guide assessing the scale of an effect on canoeing/kayaking (WAT-SG-67 Table 15)

Very small	• No more than 5% of potential canoe days completely lost or gained; and/or • less than a 5% reduction or increase in number of potential canoe-able days on which flows are better than scrape-able Aesthetic impacts would be expected to be minor.
Small	• Between 6% - 15% of potential canoe days completely lost or gained; and/or • between a 6 % - 15% reduction or increase in number of potential canoe-able days on which flows are better than scrape-able If the availability, quality and extent of the recreational resource on weekends is largely unaffected and there is evidence that weekday use is much less important than weekend use, the scale of the impact may be considered small even if the overall reduction in the availability and quality of the resource is as high as 20 - 30 %.
Medium	• Between 16% – 40% of potential canoe days completely lost or gained; and/or • between a 16% - 40% reduction or increase in the number of potential canoe-able days on which flows are better than scrape-able. If the availability, quality and extent of the recreational resource on weekends is only subject to a very small reduction and there is evidence that weekday use is much less important than weekend use, the scale of the effect overall may be considered medium even if the overall reduction in the availability and quality of the resource is as high as 45 - 55 %.
Large	• Between 41% - 80% of potential canoe days completely lost or gained; and/or • between a 41% - 80% reduction or increase in the number of potential canoe-able days on which flows are better than scrape-able
Very Large	• More than 80% of potential canoe days completely lost or gained; and/or • more than an 80% reduction or increase in number of potential canoe-able days on which flows are better than scrape-able

Table 10-3 Indicative guide to assessing the magnitude of an effect (WAT-SG-67 Table 1)

	Scale of effect				
Duration of effect	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Only lasts up to around 1 year	VS	VS	VS	S	M
Only lasts up to around years 6 years	VS	VS	S	M	L
Lasts significantly more than 6 years	VS	S	M	L	VL
Starts up to around 2 to 3 years earlier*	VS	S	M	L	VL
Starts up to 3 to 12 years earlier*	VL	S-M	M-L	L	VL
Starts more than 12 years earlier*	S	M	L	L-VL	VL

Notes:

You should use these rows in the table when you are assessing a benefit that is already expected to be delivered through the implementation of the river basin management plan (RBMP) but which is expected to be realised sooner as a result of the proposal (ie the proposal will enable the early achievement of an RBMP improvement objective).

If you have assessed the scale of an effect as being negligible, you should not consider that effect further in your assessments.

Importance of Affected Factor

10.4.6 The importance of a factor refers to its relative social, economic or environmental value to society. An effect on a very important factor (e.g. one of national importance) will be of much greater significance than the same magnitude of effect on a factor of limited importance (e.g. one of only local value).

10.4.7 The indicative guide to assessing the importance of an effect on recreation is given in Table 10-4 below:

Table 10-4 indicative guide to assessing the importance of an effect on recreation (WAT-SG-67 Table 13)

Low importance	• The part of the water environment is frequently used for recreation but does not meet any of the other criteria listed in this Table.
Medium importance	• The part of the water environment is among the most popular locations regionally for a particular form of recreation or type of experience/challenge within that form; and the qualities of the part of the water environment (including its landscape qualities) place it amongst the best sites in the region for a particular form of recreation or type of experience/challenge within that form. Similar sites are likely to be rare to very rare in the region; or the site is used by clubs in the region as a venue for training or competitions; or the site is particularly important regionally because its location means that it is particularly accessible to recreational users in the region; or the site is a recreational resource for deprived or otherwise disadvantaged communities or groups.
High importance	• The part of the water environment is regularly used by people from all over Scotland; and the qualities of the part of the water environment place it amongst the best sites in Scotland for a particular form of recreation or type of experience/challenge within that form. Similar sites are likely to be rare to very rare in Scotland; or the site is one of the top sites regionally for a particular form of recreation and its location means that it is particularly accessible from a number of Scotland's major population centres - so making it of national importance; or the site is a recreational resource for one or more of the most deprived or otherwise disadvantaged communities in Scotland; or the site may host national competitions or events or be an important training site for such events.
Very high importance	• The part of the water environment specifically attracts overseas visitors interested in this form of recreation; and the qualities of the part of the water environment make it one of the most renowned sites for this form of recreation or type of experience/challenge within the form in the UK; or the site is a venue for international competitions or events or an important training venue for such events.

Significance of Effect

10.4.8 The significance of an effect (whether positive or negative) is a combination of the importance of the factor that is affected and the magnitude of the effect on the factor.

10.4.9 Once you have worked out the magnitude of an effect and the importance of the affected factor, you can use Table 5 below to help judge the significance of the effect.

Table 10-5 Indicative guide to assessing the significance of an effect (WAT-SG-67 Table 2)

Importance of affected factor	Magnitude of effect					
	Negligible	V Small	Small	Medium	Large	V Large
Very low / negligible	N	N	N	N	N	N
Low	N	VL	VL	L	M	M-H
Medium	N	VL	L	M	M-H	H
High	N	VL-L	M	H	H-VH	VH
Very High	N	L	M-H	H-VH	VH	VH

Key
N = negligible significance; VL = very low significance; L = low significance; M = moderate significance; H = high significance; and VH = very high significance.

10.4.10 The assessment considers the potential effects of the Proposed Development on recreational activities during both the construction phase and the longer-term operation.

Assumptions and Limitations

10.4.11 Whilst every effort has been made to ensure that the information on public recreation and access from the desk study, consultation and fieldwork described above is comprehensive, it is possible that other less well known forms of recreation are pursued at the site of the Proposed Development, that have been overlooked and have not been considered in this assessment.

10.5 Baseline Conditions

Existing Baseline

10.5.1 Recreation and tourism are key activities within the area, with Ardverikie Estate and neighbouring areas being a significant destination for these visitors. The site of the Proposed Development lies within an area which is used by walkers, summer and winter mountaineers, rock climbers, cyclists, canoeists, backpackers, swimmers, horse riders and cavers.

10.5.2 For all recreation not directly using the lochs and watercourses for the activity, which is all of them except for canoeing, swimming and angling, the effects will be limited to those associated with visual amenity and landscapes. These activities are not considered further in this chapter.

Canoeing

10.5.3 No canoeing is recorded on Strava or reported by the Estate on the lochs within the site, these being inaccessible by the public by vehicle from the public roads.

10.5.4 Canoeing is likely to take place on Loch Laggan, but this would be unaffected by the Proposed Development.

10.5.5 White water canoeing is practiced on the following rivers downstream of the Proposed Development:

- The River Pattack, a 2km stretch described as a good intermediate trip;
- The Allt Labhrach, a 1.5km grade 4+ stretch of river between Loch Earba and Loch Laggan requiring the existing Ardverikie hydro dam to be spilling to be paddleable; and
- The River Spean:
    - Upper Spean, 4km just downstream of the Laggan dam, grade 3+(5);
    - Spean (Monessie), 3km of grade 3+(5) starting below the Monessie Gorge
    - Middle Spean, below the confluence with the River Roy, 5km of grade 2/3; and
    - The Spean Gorge, 6km of grade 3/4 (5) starting from Spean Bridge.

Swimming

10.5.6 Open water swimming in the Earba lochs, one of a number of swimming locations in the area, is reportedly relatively popular, notably from the sandy beach created by low water levels in the existing Earba reservoir. It does not however feature in any published list of popular open water swimming locations.

Angling

10.5.7 None of the watercourses are used by the Estate for fishing.

10.5.8 Fishing on Loch Earba is available for the Ardverikie Estate owners and their guests, as well as guests staying in the holiday cottages. The loch is very rarely fished, however.

10.5.9 Badenoch Angling Association have a recurring annual licence from the Estate to fish on Loch Laggan. By arrangement, generally once a year, the Estate occasionally permit a group from the Badenoch Angling Association to hold a charity fishing match on Loch an Earba.

10.5.10 Due to its inaccessibility, Loch Leamhain is very rarely, if ever, fished.

10.6 Potential Significant Effects

10.6.1 This section considers the potential effect of The Proposed Development on recreational in the area.

Canoeing

<u>Canoeing on Lochs</u>

10.6.2 Canoeing would remain available on Loch Earba and would be unaffected on Loch Laggan during construction and operation.

<u>River Pattack</u>

10.6.3 To mitigate the risk of INNS transfer during operation it is proposed to isolate Loch Leamhain and divert the loch's catchment area downstream of the dam using catchwater channels. This would be proportionate to half to the natural flow from the loch. This means that there will be a very small change to the current hydrology of the River Pattack catchment arising from the Earba PSH. During construction there would be no change.

<u>Allt Labhrach</u>

10.6.4 Once filled, the Earba PSH will operate broadly as a closed system, with 55Mm3 of water pumped up or released through the pump/turbines and any natural catchment to Loch Earba continuing downstream to Loch Laggan. This water will either pass through the existing Ardverikie hydro scheme or be released as hands off flow, compensation flow or spill down the Allt Labhrach. There is currently no hands-off or compensation flow from the existing Ardverikie Estate hydro dam. The existing reservoir has a moderate capacity but does on occasion spill to the Allt Labhrach, particularly during the winter months and this would continue during operation.

10.6.5 During the initial filling of the Earba reservoir, which would start part way through the construction period, there would be no spill proposed, with this being the case for between 2 and 5 years depending on when during the construction period filling of the reservoir started. Only minimum Q95 HOF would be discharged at Shios Dam downstream into the Allt Labhrach.

10.6.6 The magnitude of effect for canoeing the Allt Labhrach during construction (Earba reservoir filling period only) is considered to be Large (Very Large but < 6 years duration) and the importance of effect is assessed as Very Low (understood to be very infrequently paddled). The significance of the effect on canoeing is therefore considered to be Negligible during construction.

10.6.7 Once the Proposed Development is operational, during the initial filling of the Earba reservoir, which would end between 2 and 3 years after the construction period, there would be no spill proposed, with this being the case for between 2 and 3 years depending on when during the construction period filling of the reservoir started.

10.6.8 There is currently no hands off or compensation flow from the existing Ardverikie Estate hydro dam. The existing reservoir has a moderate capacity but does on occasion spill to the Allt Labhrach, particularly during the winter months. Whilst the larger reservoir capacity of the proposed Earba reservoir may reduce the incidence of spills, the dam would still spill occasionally during the winter months. So, spate flows suitable for canoeing, which are also necessary to maintain the passage of sediments down the Allt Labhrach, would continue to be available during the operation of the scheme. Mitigation for any reduction in the canoeing opportunity could be providing information to the SCA on the times that the Allt Labhrach is paddleable.

10.6.9 The magnitude of effect for canoeing the Allt Labhrach during operation is considered to be Very Large and permanent and the importance of effect is assessed as Very Low (understood to be very infrequently paddled). The significance of the effect on canoeing is therefore considered to be Negligible during operation.

River Spean

10.6.10 The filling of the Earba reservoir from its natural catchment is predicted to take between 2 and 5 years, depending on rainfall patterns, with between 2 and 3 years of these being during the construction period. During this time, it is proposed that only minimum Q95 HOF would be released from Earba to Loch Laggan.

10.6.11 The water withheld from reaching Loch Laggan would be that arising from approximately 4% of the catchment area of the Spean at Laggan dam. (The Earba catchment area of about 24km2 represents about 6% of the overall direct catchment to Laggan Dam (375km2). Furthermore, if transfers into the Laggan catchment (particularly from the

Spey) are considered, its share of the Laggan Dam catchment drops to about 4%). This will reduce the amount of spill from Laggan dam on which the Upper and Monessie sections of the River Spean rely for paddling. It is difficult to predict the precise amount of reduction in spill because of various complexities including the diversion from the Spey catchment and the operation of the Lochaber hydro scheme in relation to water management of the Laggan reservoir. It is however reasonable to predict that the filling of the Earba reservoir would reduce the volume of spills at the Laggan dam by less than 10%.

10.6.12 There is no mitigation that can be provided for this temporary and relatively small effect on canoeing the two upper sections of the River Spean. For the sections below the confluence with the River Roy, the effect of the reduced spill from Laggan dam will be less significant, and the two sections of the river below here are reportedly paddleable at a wide range of water levels.

10.6.13 The magnitude of effect for canoeing the River Spean during a period of 2 to 5 years during construction and potentially the start of operation (Earba reservoir filling period only) is considered to be Very Small (Small but < 6 years duration) and the importance of effect is assessed as High. The significance of the effect on canoeing is therefore considered to be Minor during construction and early operational period.

10.6.14 Once the initial filling of the Earba Reservoir is complete, there would be no further effect on canoeing the River Spean.

Swimming

10.6.15 Open water swimming in the Earba lochs would remain accessible during construction and operation, but access to the water from the beach at the southwest end of Loch Earba would be precluded by construction of the Shuas Dam. There are many other local open water swimming locations, for example at Loch Laggan and Strathmashie.

10.6.16 The magnitude of effect for swimming during construction is considered to be Medium and the importance of effect is assessed as low. The significance of the effect on swimming is therefore considered to be Low during construction.

Angling

10.6.17 Although rarely carried out on the lochs within the site, angling would remain available during the construction period.

10.6.18 The magnitude of effect for angling during construction and operation is considered to be Small and the importance of effect is assessed as Low. The significance of the effect on canoeing is therefore considered to be Very Low during construction.

10.7 Mitigation and Enhancement

10.7.1 Mitigation and enhancement during construction and operation is as outlined in EIAR Appendix 15.1 - Draft Access Management Plan, which has been prepared in consultation with The Highland Council.

10.8 Residual Effects

10.8.1 Potential residual effects and associated effect significance of the construction and operation of the Proposed Development following the implementation of mitigation measures are outlined in paragraph 10.7 above.

10.8.2 A summary of the proposed scheme's residual effects is provided in Table 10.6.

Effect	Type of Effect	Magnitude of Effect	Importance of Effect	Significance of Effect
Construction				
Canoeing – River Pattack	Neutral	None	Low	Neutral
Canoeing – Allt Labhrach	Negative	Large	Very Low	Negligible
Canoeing – River Spean	Negative	Very Small	High	Low
Swimming	Negative	Medium	Low	Low
Angling	Negative	Small	Low	Very Low
Operation				
Canoeing – River Pattack	Neutral	High	Low	Neutral
Canoeing – Allt Labhrach	Negative	Very Large	Very Low	Negligible
Canoeing – River Spean	Neutral	None	High	Neutral

10.9 Conclusion

10.9.1 The assessment addresses only direct impacts on recreation and access, with those associated with visual amenity assessed in Chapter 11 - Visual Amenity and Landscapes.

10.9.2 The forms of public recreation known to take place within and around the site of the Proposed Development, and which have been assessed in this Chapter are as follows:

- Canoeing;
- Swimming; and
- Angling.

10.9.3 The Proposed Development has the potential to impact upon recreational use and access within the proposed site and surrounding area. Most effects relate to construction disturbance and modifications to water discharges. Construction and operational disturbance would be managed by provision of the measures outlined in EIAR Appendix 15.1 – Draft Access Management Plan, which has been prepared in consultation with the Highland Council.

10.9.4 The most significant impacts on recreation and access during both construction and operation have been assessed as Moderate (for swimming) and Minor (for canoeing the River Spean during filling of the Earba Reservoir only).

11 Effects on Visual Amenity and Landscapes

11.1 Chapter Introduction

11.1.1 This chapter addresses effects on visual amenity and landscapes.

11.1.2 A full Landscape and Visual Impact assessment (LVIA) has been carried out as part of the Environmental Impact Assessment supporting the planning application for the Proposed Development under Section 36 of The Electricity Act. This is available at this link: https://earbastorage.co.uk/documents/ The following sections are relevant:

Landscape and Visual
Chapter 7 Text
Figures
Figure7.1a - Study Area with ZTVs for Dams and Powerhouse
Figure7.1b - Study Area with ZTVs for Dams
Figure7.2a - ZTV for Access Track - Section from Moy Bridge to Shuas Dam
Figure7.2b - ZTV for Access Track - Section from Shuas Dam to Upper Reservoir
Figure 7.3 - Visualisation Locations
Figure7.4 - Designated and Protected Landscapes
Figure 7.5 - Landscape Character Types
Figure 7.6 - Potential Visual Receptors
Figure 7.7 - Visual Receptors included within the Assessment
Figure 7.8 - Cumulative Developments
Figure 7.5.1 - WLA Study Area
Figure 7.5.2 - WLA Map of Relative Wildness
Figure 7.5.3 - WLA Individual Attribute Mapping
Figure 7.5.4 - WLA Jenks 8 Mapping Interpretation
Figure 7.5.5 - WLA Changes to the Study Area since Production of the WLA Mapping
Figure 7.5.6a – 7.5.6i: Representative Wirelines from WL 1 – WL 9
Visualisations to NatureScot Standards
Figure V3a-1a-f VL1 - Carn Liath summit
Figure V3a-2a-f VL2 - Beinn a Chaorainn summit
Figure V3a-3a-f VL3 - Carn Dearg summit
Figure V3a-4a-g VL4 - Creag Pitridh summit
Figure V3a-5a-f VL5 - Beinn a Chlachair summit
Figure V3a-6a-f VL6 - Proposed access track to NE of Lochan na h-Earba
Figure V3a-7a-f VL7 - Proposed access track to SE of Lochan na h-Earba
Figure V3a-8a-f VL8 - West of Loch a Bhealaich Leamhain
Figure V3a-9a-f VL9 - Binnein Shuas, near summit
Figure V3a-10a-g VL10 - Track to Loch Pattack
Figure V3a-11a-f VL11 - Geal Charn summit
Visualisations to THC Standards
Figure V3b-1a-k VL1 - Carn Liath summit
Figure V3b-2a-k VL2 - Beinn a Chaorainn summit
Figure V3b-3a-k VL3 - Carn Dearg summit
Figure V3b-4a-n VL4 - Creag Pitridh summit
Figure V3b-5a-k VL5 - Beinn a Chlachair summit

	Figure V3b-6a-k VL6 - Proposed access track to NE of Lochan na h-Earba
	Figure V3b-7a-k VL7 - Proposed access track to SE of Lochan na h-Earba
	Figure V3b-8a-k VL8 - West of Loch a Bhealaich Leamhain
	Figure V3b-9a-k VL9 - Binnein Shuas, near summit
	Figure V3b-10a-n VL10 - Track to Loch Pattack
	Figure V3b-11a-k VL11 - Geal Charn summit
	Appendices
	Appendix 7.1 – Technical Methodologies for Visual Representation
	Appendix 7.2 – Visual Assessment Tables
	Appendix 7.3 – Assessment of Landscape Character Types
	Appendix 7.4 – Assessment of CNP
	Appendix 7.5 – Assessment of Wild Land Area 14: Rannoch – Nevis – Mamores - Alder
	Appendix 7.5.1 - WLA Locational Assessment Analysis
	Appendix 7.6 – Assessment of Special Landscape Areas

11.1.3 Rather than transpose this extensive and complex assessment into the format defined in the SEPA guidance "Supporting Guidance (WAT-SG-67) - Assessing the Significance of Impacts -Social, Economic and Environmental, Version: v5.1, November 2017", the summary of the EIA LVIA is included below.

11.1.4 The EIA LVIA concludes that the Proposed Development would give rise to temporary, localised significant effects during construction but that these would reduce with time and no longer be significant 15 years after construction. There would be a localised significant effect on Wild Land Area 14 during operation, although the wider effect on the WLA as a whole is not predicted to be significant. In addition, no significant effects are predicted on the Special Landscape Qualities of the Cairngorm National Park.

11.1.5 No waterfalls or other similar features would be affected by the Proposed Development and as such, this is not addressed in this chapter nor in the EIA Report LVIA Chapter.

11.2 Summary of EIA Landscape and Visual Impact Assessment

11.2.1 A Landscape and Visual Impact Assessment (LVIA) has been undertaken for the Proposed Development within a study area of 10 km. The LVIA has been undertaken by Chartered Landscape Architects at ASH design + assessment Ltd. (ASH), a registered practice with the Landscape Institute, in accordance with best practice guidance, the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA).

11.2.2 The LVIA considers the two separate subjects of landscape and visual amenity as follows:

- The landscape assessment considers the potential effects of the Proposed Development on landscape character, designated and protected landscapes.
- The visual assessment considers the potential effects of the Proposed Development on the visual amenity of those present within the landscape, including established views from residential areas and routes.

11.2.3 The LVIA also gives consideration to cumulative effects occurring as a result of the addition of the Proposed Development to other proposed hydro and electrical infrastructure development within the study area.

11.2.4 Potential effects have been considered during the construction phase of the Proposed Development and during operation, in approximately year 1 and year 15 of operation, to illustrate the change associated with proposed landscape mitigation and regeneration. This includes the narrowing of access tracks, vegetated front faces to the Shios and Shuas Dams and woodland planting around the lower reservoir area and lower access track areas.

Summary of Landscape Effects

11.2.5 The landscape assessment has considered the potential effects of the Proposed Development to Landscape Character Types (LCTs) identified by NatureScot National Landscape Character Assessment of Scotland and designated and protected landscapes within the area including the Cairngorms National Park, Ben Alder, Laggan and Glen Banchor Special Landscape Area (SLA), and Wild Land Area (WLA) 14: Rannoch – Nevis – Mamores – Alder.

11.2.6 The landscape assessment has established that during construction, there would be temporary, localised significant effects resulting from the Proposed Development, focussed around the upper and lower reservoir areas and dams, and areas to the west of the Shuas Dam and south and east of the Leamhain Dam towards the summit area of Càrn Dearg and Loch Pattack, for up to around 3 – 4km. These effects would lead to some corresponding localised significant effects on the Ben Alder, Laggan and Glen Banchor SLA, and WLA 14: Rannoch – Nevis – Mamores – Alder.

11.2.7 After completion of construction and following restoration, the extent of significant effects would reduce to a more localised area around the permanent features of the Proposed Development: the upper and lower reservoirs, the dams, surge shafts and powerhouse. Over time, with the growth of planting around the lower reservoir tracks, and particularly the powerhouse, the extent of significant effects would continue to reduce and after 15 years, whilst some localised significant effects on wild land are predicted around the powerhouse and Shuas Dam, wider significant effects on landscape character would be largely limited to an area within around 1 - 2 km of the upper reservoir and Leamhain Dam.

11.2.8 These effects would also result in a localised significant effect to WLA 14 during operation, although the wider effect on the WLA as a whole is not predicted to be significant.

11.2.9 No significant effects are predicted on the Special Landscape Qualities of the Cairngorm National Park.

Summary of Visual Effects

11.2.10 The detailed assessment of effects on visual amenity has considered potential effects on visual receptors (those obtaining views) based in buildings and residential properties and areas, using transport and recreational routes and taking advantage of the views at defined outdoor viewing locations. Significant effects have been identified for recreational receptors using six upland walking routes during construction of the Proposed Development, where recreational users would pass adjacent to the reservoirs and dams, would overlook the key areas of construction from surrounding mountains, or where works would feature prominently in the hills above. In some cases, parts of these routes would also be upgraded and used by construction traffic.

11.2.11 During operation, the visual effects would reduce and would be limited to users of tracks directly alongside the upper and lower reservoir, and hill routes immediately overlooking the reservoirs. Over time, proposed woodland planting around Lochan na h-Earba would reduce the visual effects to recreational users in this area and these effects are predicted to become not significant after 15 years. Long term significant effects are therefore only expected to occur for recreational receptors within close proximity to the upper reservoir, Loch a' Bhealach Leamhain.

11.2.12 There would be no significant effects to the visual amenity of residents or other building-based visual receptors within the study area.

11.2.13 Cumulative Landscape and Visual Effects

11.2.14 The cumulative assessment has not identified any areas where the landscape and visual effects of the Proposed Development would be increased if other proposed developments were considered within the baseline.

11.3 Conclusion

11.3.1 The LVIA has identified that there would be localised significant landscape and visual effects occurring during the construction of the Proposed Development within an area around the Proposed Development up to around 3 – 4 km also affecting the Ben Alder, Laggan and Glen Banchor SLA and WLA 14: Rannoch – Nevis – Mamores – Alder. However, during operation, these effects would reduce and significant effects would become more localised, associated with the main permanent structures of the Proposed Development at the upper and lower reservoirs. Over time, and after 15 years, mitigation measures, including woodland planting proposed as part of the Proposed Development would lead to significant effects becoming further localised, mostly focussed around the Leamhain Dam and proposed upper reservoir, with some very localised effects to wild land characteristics around the Shuas Dam and powerhouse. Although other elements of the Proposed Development, including operational drawdown would be perceptible, and in some cases more noticeable in the wider landscape, the overriding qualities of the surrounding landscape would remain present and these effects are not predicted to significantly change the existing characteristics of the landscape or lead to significant visual effects being experienced in the wider area.

11.3.2 By 15 years post construction, with the growth of proposed planting and other vegetation, the effect on the Ben Alder, Laggan and Glen Banchor SLA is predicted to be not significant. Whist localised significant effects are predicted for Wild Land Area 14, this is not predicted to lead to a significant effect on the Wild Land Area overall. **No significant effects** are predicted to the Special Landscape Qualities of the Cairngorms National Park.

12 Economic opportunities for disadvantage groups

12.1.1 The effect of the Earba Pumped Storage Hydro (the Proposed Development) on economic opportunities for disadvantaged groups has been assessed in accordance with the SEPA Guidance Note WAT-SG-67.

12.1.2 The Construction stage of the project will provide around 500 employment opportunities for semi-skilled and skilled workers. The 6 year construction period is the focus of the assessment on opportunities for disadvantaged groups.

The Operational stage of the project will require around 20 skilled workers. The Authorised Person continues to explore training and educational opportunities for these skilled workers such that there would be a benefit to disadvantaged groups but this is ongoing and as such has been omitted from this assessment.

12.1.3 The assessment set out below has determined that the Proposed Development has a Positive effect of very low Significance relating to economic opportunities to disadvantaged groups.

12.2 Assessment of the effect of the Proposed Development

Importance of the effect

12.2.1 The Proposed Development impacts on two areas within the Scottish Index of Multiple Deprivation 2020. These are Lochaber East and North & Badenoch and Strathspey South.

12.2.2 Both the areas listed above are in the most deprived 40% to 60 % of neighbourhoods in Scotland[19].

12.2.3 The Proposed Development will be a large construction project with an accommodation camp on site for the workforce. It is therefore feasible that disadvantaged groups from across Scotland could find employment opportunities at the Proposed Development for the duration of the construction works. As the employment opportunities will fall to communities across Scotland it is considered that whilst the two areas that the site encompass are out with the classification in Table 12-1 below, the opportunities during construction mean that it is still considered that the Proposed Development would have a low to medium social importance of economic effect.

Table 12-1Indicative guide to assessing the social importance of an economic effect (Table 20)

Low importance	The affected community is, or would be, in the most deprived >20% to 30 % of neighbourhoods in Scotland
Medium importance	The affected community is, or would be, in the most deprived >10% to 20% of neighbourhoods in Scotland
High importance	The affected community is, or would be, in the most deprived > 5% to 10% of neighbourhoods in Scotland
Very high importance	The affected community is, or would be, in the most deprived 5% of neighbourhoods in Scotland

[19] Scottish Index of Multiple Deprivation 2020 https://simd.scot/#/simd2020/BTTTFTT/9/-4.0000/55.9000/

Scale of the effect

12.2.4 The scale of an effect on economic opportunity depends on the degree of change in economic opportunity and the numbers of people affected by the change. This has been assessed as small to medium, as indicated by the red box, due to the potential employment opportunities at the construction stage of the Proposed Development.

Table 12-2 Indicative guide to assessing the scale of an effect on a disadvantaged group (Table 21)

Very small	There would be a very small change to the economic opportunities of the group as a whole. A very small number of individuals may benefit more significantly
Small	There would be a small change to the economic opportunities of the group as a whole. A small number individuals may benefit more significantly
Medium	There would be a moderate change to a moderate proportion of the affected group
Large	There would be a large change to a moderate proportion of the affected group or a moderate change to a very large proportion of the group
Very Large	There would be a very large change to the economic opportunities available to a very large proportion of the affected group. The size of the affected group or groups is large (eg several 1,000s of people)

Magnitude of effect

12.2.5 The construction period will be up to 6 years and therefore referring to Table 12-3 the magnitude of the effect is assessed to be small as indicated by the red box.

Table 12-3 Guide to assessing the magnitude of effect (Table 1)

	Scale of effect				
Duration of effect	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Only lasts up to around 1 year	VS	VS	VS	S	M
Only lasts up to around years 6 years	VS	VS	S	M	L
Lasts significantly more than 6 years	VS	S	M	L	VL
Starts up to around 2 to 3 years earlier*	VS	S	M	L	VL
Starts up to 3 to 12 years earlier*	VL	S-M	M-L	L	VL
Starts more than 12 years earlier*	S	M	L	L-VL	VL

Notes:
You should use these rows in the table when you are assessing a benefit that is already expected to be delivered through the implementation of the river basin management plan (RBMP) but which is expected to be realised sooner as a result of the proposal (ie the proposal will enable the early achievement of an RBMP improvement objective).
If you have assessed the scale of an effect as being negligible, you should not consider that effect further in your assessments.

Significance of Effect

12.2.6 The significance of effect has been assessed using Table 12-4 below with the result, a very low positive impact, shown within the red box.

Table 12-4 Guide to assessing the significance of effect (Table 2)

Importance of affected factor	**Magnitude of effect**					
	Negligible	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Very low / negligible	N	N	N	N	N	N
Low	N	VL	VL	L	M	M-H
Medium	N	VL	L	M	M-H	H
High	N	VL-L	M	H	H-VH	VH
Very High	N	L	M-H	H-VH	VH	VH

Key:
N = negligible significance; VL = very low significance; L = low significance; M = moderate significance; H = high significance; and VH = very high significance.

12.2.7 The conclusion is that the **positive** economic effect of the Proposed Development on disadvantaged groups would be **very low**. It should be noted that as part of a sensitivity analysis it was considered that a significant proportion of the workforce was to come

from the 5% most deprived areas of Scotland then the significance of effect become Medium to High.

13 Effects on Climate Change

13.1 Chapter Introduction

13.1.1 The effect of the Earba Pumped Storage Hydro (the Proposed Development) on climate change has been assessed in accordance with the SEPA Guidance Note WAT-SG-67.

13.1.2 The assessment set out below has determined that the Proposed Development has a Positive effect of Very High Significance on Climate Change.

13.2 Climate Change Effect Summary

Reducing Reliance on Fossil Fuels

13.2.1 To achieve Net Zero a significant expansion of renewable energy generating capacity is required. This increase in deployment of renewables means that there will be increasingly longer periods of time when there is an excess or deficit in renewable generation. At present a deficit in renewable generation means that there is a reliance on carbon emitting gas power generation.

13.2.2 While battery storage and interconnectors can mitigate some of the deficit on an hour by hour basis, there is a need to balance power across longer periods, for example when wind and solar power isn't operating. This means that there is a need for investment in large-scale, long duration electricity storage 'LDES'.

13.2.3 Pumped Storage Hydro 'PSH' is the only form of LDES which is a mature, proven, long-lifespan technology and has the ability to deliver large capacities of power and energy storage at a competitively low cost per MW and MWh vs other storage technologies.

13.2.4 The Proposed Development would significantly reduce the national reliance on fossil fuel energy by enabling us to maximise the use of our renewable energy assets. The Proposed Development would make a contribution to our Net Zero targets by saving approximately 2 million tonnes of CO2 per annum, which is considered to be nationally significant.

13.3 Determining the Significance of the Effect on Climate Change

Importance of Climate Change Effects

13.3.1 Tackling climate change is a priority. Therefore, the reduction of greenhouse gases that the Proposed Development could bring is considered of High Importance.

Assessing the Scale of Climate Change Effect

13.3.2 The Proposed Development could deliver 4,500 GWh of clean electricity which would save over 2 million tonnes of CO2 per annum. Referring to Table 13-1 below the Proposed Development has a Positive Very Large scale effect on Climate Change.

Table 13-1 WAT-SG-67 Table 22 The scale of the Proposed Development is shown in the red box

	Scale					
	Negligible	Very Small	Small	Medium	Large	Very Large
Average net increase in renewable energy generated or non-renewable energy consumed per year (GWh)	≤ 0.25	> 0.25 to < 20	20 to < 120	120 to < 150	150 to < 200	≥ 200
Carbon equivalents[9] (t/year)	≤ 108	> 108 to < 8,600	8,600 to < 51,600	51,600 to < 65,000	65,000 to < 86,000	≥ 86,000
Note: You should treat effects on greenhouse gas emissions that are smaller than those in the "very small" category as non-significant effects. You should ignore such effects when weighing up the positive and negative effects of the proposed activity.						

Assessing the Magnitude of the Climate Change Effect

13.3.3 Once operational, the effect of the Proposed Development would last significantly more than 6 years. The typical operational lifespan of a PSH project can be in excess of 100 years. Referring to Table 13-2 below the Proposed Development has a Very Large magnitude of effect on Climate Change.

Table 13-2 WAT-SG-67 Table 1 with the Proposed Development shown in red box

	Scale of effect				
Duration of effect	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Only lasts up to around 1 year	VS	VS	VS	S	M
Only lasts up to around years 6 years	VS	VS	S	M	L
Lasts significantly more than 6 years	VS	S	M	L	VL
Starts up to around 2 to 3 years earlier*	VS	S	M	L	VL
Starts up to 3 to 12 years earlier*	VL	S-M	M-L	L	VL
Starts more than 12 years earlier*	S	M	L	L-VL	VL

Notes:
You should use these rows in the table when you are assessing a benefit that is already expected to be delivered through the implementation of the river basin management plan (RBMP) but which is expected to be realised sooner as a result of the proposal (ie the proposal will enable the early achievement of an RBMP improvement objective).
If you have assessed the scale of an effect as being negligible, you should not consider that effect further in your assessments.

Assessing the Significance of the Climate Change Effect

13.3.4 Referring to Table 13-3, shown below, the importance of the Proposed Development's Climate Change benefit has been assessed. The Importance of Climate Change benefit has been assessed as **Very High**.

13.3.5 This means that the significance of the Proposed Development's effect on Climate Change has been assessed as having a **Positive effect of Very High Significance**.

Table 13-3 WAT-SG-67 Table 2 with the proposed Development shown in the red box

Importance of affected factor	Magnitude of effect					
	Negligible	**V Small**	**Small**	**Medium**	**Large**	**V Large**
Very low / negligible	N	N	N	N	N	N
Low	N	VL	VL	L	M	M-H
Medium	N	VL	L	M	M-H	H
High	N	VL-L	M	H	H-VH	VH
Very High	N	L	M-H	H-VH	VH	VH

Key:
N = negligible significance; VL = very low significance; L = low significance; M = moderate significance; H = high significance; and VH = very high significance.

14 Invasive Non-native Species (INNS)

14.1 Introduction

This chapter sets out the effect the proposed development would have on the likelihood of transfer of INNS between catchments. A risk assessment was undertaken by SEPA and the results of this are documented below along with the proposed mitigation proposals.

14.2 Background

The Earba PSH scheme would convey water between Loch Earba (lower reservoir) and Loch Leamhain (upper reservoir).

This waterway would mean that a new link is formed between two small sub-catchments of Loch Laggan creating a hydrological pathway that does not currently exist. This waterway link would mean that there is a potential new pathway for the transmission of invasive non-native species (INNS) within these sub-catchments. Pathways for the transmission of INNS between the lochs already exist through natural means such as eggs being carried on birds or birds carrying fish, so there is still a risk regardless of the development.

SEPA have undertaken a risk assessment of the raw water cross-catchment transfer associated with the Loch Earba PSH scheme and this was submitted to the Applicant on 11th April 2024. SEPA concluded the following:

"Overall, the INNS presence risk factors for both catchments is relatively low. The main current risk factor for INNS is fishing in Loch na h-Earba, but this activity is likely to become non-viable should the scheme go ahead.

Whilst there may be some uncertainty over the natural status of minnows in the area, they are not known to be present in the upper Pattack catchment, so would potentially need to be considered a locally non-native species if transferred there. If the scheme were to go ahead, transfer of minnows is highly likely without appropriate mitigation.

Additionally, because the proposed water transfer creates a new pathway between lochs, it represents a high-risk pathway. As such, mitigation to prevent the transfer of INNS would be required to the same level as for unconnected catchments; fail safe and completely effective in the prevention of spread of all life stages of INNS (including eggs, larval stages, small fragments and microscopic organisms). It is unlikely that such mitigation is feasible for the volumes of water likely to be transferred.

The conservation procedure for the effects of controlled activities on designated sites will need to be followed for any licence application."

SEPA have subsequently designated the risk level of INNS transfer as high, particularly in the Loch Earba to Loch Leamhain direction. It should be noted that this has been considered as a matter of principle based on the potential for transfer if INNS were, in the future, introduced to either loch / sub-catchment, rather than the current possible threat for these waterbodies.

Furthermore, survey work done has indicated that currently the only differing species in the two water bodies are minnows, which have been found in Earba but not Leamhain. In a Scotland wide context minnows are not non-native, but that they are currently non-native in the Pattack sub-catchment.

It is considered that the main risk is with the Earba to Leamhain transfer, given the downstream receptors within the upper reaches of the River Pattack and Loch Pattack. A number of options to both reduce and remove the risk of transmission of INNS have been considered and these focus on mitigating the risk of water transfer in the Earba to Leamhain direction.

14.3 Summary of Mitigation Options reviewed to reduce INNS risk

The summary of options considered to reduce the INNS risk for the Earba to Leamhain transfer are summarised in the table below:

Option	Description	Option that it would be combined with	Conclusion
1	Screening the Outflow of Loch Leamhain	5	Considered unviable as all INNS organisms cannot be removed by screening
2	Treatment of Compensation flow	1, 5	Considered not preferred as a significant treatment works would be required at Leamhain dam
3	Fully isolate the Upper reservoir and catchment	5	Considered unviable due to the impact of no compensation flow on the Allt Loch a' Bhealaich Leamhain
4	Isolate only the Leamhain reservoir	5	Considered the preferred option
5	Robust Biosecurity Management Plan	All	This will be implemented but a risk remains
6	Need for project	5	The overriding need for the project is one that on balance could mean that the relatively minor local INNS risk is accepted. However given that there is a practical way to significantly reduce the risk this option shall not be relied on.

14.4 Preferred Option - Isolate only the Leamhain reservoir

Isolating only the water in the Leamhain reservoir, ensuring that no water flows directly out from Loch Leamhain, but allowing the wider catchment area to flow into the Allt Loch a' Bhealaich Leamhain is the preferred option to be taken forward. This means that a compensation flow, which reflects natural flow would be provided. A system of catchwater drainage channels would be unconnected to the upper reservoir water body and would discharge downstream of the proposed Leamhain dam. This arrangement is shown in the figure below with the drainage channels indicated by the blue arrows:

Figure 1 Extract from Figure 2.4 showing layout of channels to isolate catchment from reservoir

The residual catchment that would drain to the Allt Loch a' Bhealaich Leamhain would be approximately 50% of the current loch catchment area. So 50% of the flow would continue to flow into the downstream Allt Loch a' Bhealaich Leamhain.

It is considered that this reduced compensation flow, which would react naturally to rainfall, would still allow the retention of the attributes of the downstream reaches of the Allt Loch a' Bhealaich Leamhain. It is also considered that this reduction in flow would also have a limited hydrological impact on the downstream areas. Please refer to Mott MacDonald Report "Impact on flows upstream of Loch Pattack".

It is worth noting that the attenuation of Loch Leamhain would no longer be present so this flow would be flashier than before.

The isolation of Loch Leamhain would mean a 9.4% reduction in the overall catchment of the Allt Cam[20] and 3.6% of Loch Pattack[21] .

[20] The catchment area of the Allt Cam as it meets Loch Pattack is 19.02km^2

[21] The catchment area of Loch Pattack is 48.7km^2

Whilst the conduits around the upper inundation area would need to be installed in fairly challenging topography, they would each be catching just over 0.9km2 of catchment and so would not be large in size and would follow proposed paths and tracks.

14.5 Benefit during Construction

As a further benefit to this option, a robust catchment transfer would assist the temporary works at Leamhain dam by reducing the runoff entering the working area during construction. This diversion would therefore serve a dual purpose.

14.6 Dam Safety

The detailed design of the Leamhain dam will include for a number of safety provisions that will likely only be finalised as the dam design is reviewed and approved by the All Reservoir Panel Engineer in accordance with the Reservoirs (Scotland) Act 2011.

These measures are likely to include the provision of a spillway. The spillway would be very much considered to be an emergency provision. The water can be balanced through the pumped storage hydro system, even in very wet weather, to avoid spill events. It is considered extremely unlikely that any spillway at Leamhain dam would be utilised during the operational life of the project and therefore it would not be a risk to INNS transfer.

Valves within the dam (or sluice gates on the dam) will likely be required to assist with drawing down the reservoir as an emergency provision. The hydro system would provide a much faster method by which to draw down the upper reservoir with the main waterways fitted with emergency drawdown provision towards Loch Earba.

It is likely that the local valves (or sluice gates) fitted to the Leamhain dam would require to be tested on a periodic basis and this process would need to be done in a way that minimises any risk of INNS being transferred. The installation of two isolations could allow the testing of the upstream gate or valve to be undertaken against the downstream isolation. The water could then be returned to the reservoir by pumping to avoid downstream discharge. Testing of water for INNS could also be undertaken in advance of any planned valve testing to minimise risk further.

14.7 Conclusion

The mitigation outlined above is considered a robust approach to minimise the INNS risk to the catchment downstream of Loch Leamhain. It is considered that the mitigation proposed means that the risk of INNS transfer is low.

15 Draft Balancing Test

15.1.1 The Applicant acknowledges that SEPA must weigh up the positive and negative effects and make a recommendation based on the balance of these effects.

15.1.2 The Applicant has undertaken a draft balancing test and considers that the Proposed Development has positive benefits that outweigh those that are negative.

15.1.3 Further assessment was then done using a sensitivity analysis which involved assessing the implications of applying a best case and worst-case assumptions in relation to aspects of those effects about which you are uncertain. The effects that are classed as Moderate-High or greater are listed in the table below along with the results of the sensitivity analysis.

Effect	**Type of Effect**	**Significance of Effect**	**sensitivity analysis**
fluctuations in water level	Negative	High	sensitive to uncertainties*
Public / Construction interface	Negative	Moderate - High	sensitive to uncertainties
Economy	Positive	High to Very High	insensitive to uncertainties
Climate Change	Positive	Very High	insensitive to uncertainties

**Reduced considerably with the success of new floating habitat spawning grounds*

15.1.4 The Very High positive effect on Climate Change was very robust when scrutinised in the sensitivity analysis and remained at Very High positive effect even with adjustment of associated factors used to determine the overall significance. This supports the conclusion that the very high positive effect on Climate Change is of a magnitude that concludes that the project has resulting greater positive benefits than negative.