Balliemeanoch Pumped Storage Hydro

Environmental Impact Assessment Report

Volume 2: Main Report
Chapter 7: Aquatic Ecology

ILI (Borders PSH) Ltd

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Quality information

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Table of Contents

7. Aquatic Ecology 1
7.1 Introduction 1
7.2 Legislation and Policy 1
7.3 Consultation 4
7.4 Study Area 7
7.5 Methods 8
7.6 Ecological Impact Assessment 9
7.7 Baseline Data Collection 10
7.8 Baseline Environment 15
7.9 Assessment of Effects 23
7.10 Cumulative Effects 33
7.11 Mitigation and Monitoring 33
7.12 Residual Effects 37
7.13 References 47

Tables

Table 7.1. Summary of Potentially Relevant Policies within the Argyll and Bute LDP2 3
Table 7.2 Consultee Responses to Scoping Report 4
Table 7.3 Desk Study Data Sources 11
Table 7.4 Aquatic Ecology Survey Locations 12
Table 7-5 Statutory Designated Sites in Proximity to the Development Site 15
Table 7-6 Importance of Ecological Features 22
Table 7.7 Locations of Proposed and Potential Impacts to Watercourses and Water Bodies 24
Table 7.8 Summary of Effects: Construction 41
Table 7.9 Summary of Effects: Operation 45

7. Aquatic Ecology

7.1 Introduction

As part of the overall Environmental Impact Assessment for the Development, this chapter addresses the findings from aquatic ecology surveys that have taken place between 2019 and 2023.

This chapter assesses the ecological impacts and effects of the Development on aquatic habitats, namely Loch Awe, Loch Fyne, smaller lochs, and watercourses throughout the Development Site. It addresses the potential impacts and effects of the construction, operation (including maintenance) and decommissioning / restoration of the Development on aquatic ecology features. Where appropriate, it provides details of committed mitigation and/or enhancement measures identified to minimise or compensate for adverse effects on these features.

This chapter concerns aquatic ecological features, including designated nature conservation sites, habitats, and species – features that are exclusively freshwater (excluding amphibious features such as otter *Lutra lutra*, which are addressed in *Chapter 6: Terrestrial Ecology*). For the overall ecological assessment, terrestrial ecology, marine features, and ornithological features are separately addressed in the following respective chapters:

- Chapter 6: Terrestrial Ecology (including terrestrial invasive non-native species (INNS));
- Chapter 8: Marine Ecology; and,
- Chapter 9: Ornithology.

Due to the interdisciplinary nature of effects, this chapter cross references to other chapters including:

- Chapter 11: Water Environment.

This chapter is supported by *Appendix 7.1 Aquatic Ecology Baseline Report (Volume 5: Appendices)* and *Figure 7.1 Aquatic Survey Sites (Sheets 1-4)(Volume 3 Figures).*

Also relevant to this chapter is *Appendix 6.2 Statement to Inform Habitats Regulations Appraisal (Volume 5: Appendices)* submitted as part of the Section 36 application in support of the Development. This sets out the assessment to test for adverse effects from the Development on qualifying features of European sites, which comprise Special Areas of Conservation (SAC) and Special Protection Areas (SPA). The latter are designated for the conservation of bird species and are therefore dealt with in *Chapter 9: Ornithology*.

Studies have been undertaken to identify potential impacts on aquatic receptors and protected species such as Atlantic salmon *Salmo salar* and freshwater pearl mussel (FWPM) *Margaritifera margaritifera.*

Where appropriate, this chapter provides details of proportionate mitigation and/or enhancement measures. This chapter is related to aquatic ecology only.

Chapter 2: Project and Site Description provides a detailed description of the Development and the works required to implement it, including the layout of the Development (the 'Site') and the red line boundary.

Throughout this chapter, species are given their Latin names when first referred to and their common names only thereafter. Vascular plant scientific names follow Stace (2019), and Atherton *et al.* (2010) for bryophytes. All distances are cited as the shortest boundary to boundary distance 'as the crow flies' unless otherwise specified.

7.2 Legislation and Policy

This assessment has been undertaken within the context of the following relevant legislative instruments, planning policies and guidance documents and legislative instruments.

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive');
- Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the 'Water Framework Directive');
- Regulation 1143/2014 on invasive alien species;

- Convention on Wetlands of International Importance ('Ramsar convention');
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the 'Habitats Regulations');
- Wildlife and Countryside Act 1981 (as amended) (the 'WCA');
- Wildlife and Natural Environment (Scotland) Act 2011 (as amended) (the 'WANE Act');
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011 (as amended);
- Scottish Planning Policy (SPP) 2014;
- Argyll & Bute Local Development Plan 2 (LDP2);
- Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003;
- Argyll and Bute Local Biodiversity Action Plan (LBAP);
- Wildlife & Natural Environment (Scotland) Act 2011 (as amended) (WANE Act).
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd Edition (CIEEM, 2016);
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR);
- Water Environment and Water Services (Scotland) Act 2003 ('WEWS Act').

The above legislation has been considered when planning and carrying out the ecological impact assessment (EcIA), using the methods described herein. Compliance with legislation may require obtaining of relevant protected species licences prior to the implementation of the Development.

7.2.1 Planning Policy

Detailed information on relevant planning policy can be found in the Planning Statement which has been submitted as part of the Section 36 application for the Development. However, a brief summary of national and local planning policy relevant to the conservation of aquatic species is given under the following sub-headings.

7.2.2 National Planning Policy

National Planning Framework 4 (NPF4) was formally adopted by Scottish Ministers on 13 February 2023. NPF4 includes the following statements of policy intent: "*To protect, restore and enhance natural assets making best use of nature-based solutions*" and "*To protect biodiversity, reverse biodiversity loss, deliver positive effects from development and strengthen nature networks*". Wherever possible and proportionate to the scale and nature of the project, the Development has therefore sought to deliver benefits for biodiversity, in addition to protecting existing biodiversity. NPF4 also states that major development will only be supported where nature networks "*are in a demonstrably better state than without intervention*" using best practice and including future monitoring and management where appropriate.

Prior to the UK's exit from the European Union (EU), Scotland's SACs and SPAs were part of a wider European network of such sites known as the 'Natura 2000 network'. They were consequently referred to as 'European sites.' Now that the UK has left the EU, Scotland's SACs and SPAs are no longer part of the Natura 2000 network but form part of a UK-wide network of designated sites referred to as the 'UK site network'. However, it is current Scottish Government policy to retain the term 'European site' to refer collectively to SACs and SPAs (Scottish Government, 2020).

7.2.3 Local Planning Policy

The Argyll and Bute Local Development Plan 2 (LDP) was adopted in February 2024. Planning policy relevant to nature conservation and the Development contained within LDP2 is summarised in *Table 7.1 Summary of Potentially Relevant Policies within the Argyll and Bute LDP2,* below. Further details are presented in the standalone Planning Statement submitted with the application for the Development, and are available from the Argyll and Bute Council website (https://www.argyll-bute.gov.uk/planning-and-building/planning-policy/local-development-plan-2).

Table 7.1. Summary of Potentially Relevant Policies within the Argyll and Bute LDP2

Planning Policy	Summary of Purpose
Policy 30 – The Sustainable Growth of Renewables	The Council will support renewable energy developments where consistent with the principles of sustainable development and it can be demonstrated that there would be no unacceptable environmental effects, including on ecological features.
Policy 73 – Development Impact on Habitats, Species and Biodiversity	The Council will consider nature conservation legislation, the Argyll and Bute Biodiversity Strategy and Action Plan and the Scottish Biodiversity Strategy when assessing developments. Where a development is likely to have effects on important habitats or species, the Council will require the developer to undertake appropriate surveys and, if necessary, to prepare a mitigation plan. Development proposals likely to have an adverse effect on protected species and habitats will only be permitted where it can be justified in accordance with the relevant protected species legislation.
Policy 74 – Development Impact on Sites of International Importance	This policy sets out the strict requirements for developments potentially affecting European sites, including compliance with the Habitats Regulations.
Policy 75 – Development Impact on Sites of Special Scientific Interest and National Nature Reserves	This policy sets out requirements for developments affecting Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR). Where adverse effects on these are possible, developments must demonstrate that integrity of the sites/interests would not be compromised, or that social, economic or environmental benefits of national important clearly outweigh adverse effects on the sites/interests, and that there no suitable alternative locations.
Policy 76 – Development Impact on Local Nature Conservation Sites	Development having a significant effect on Local Nature Conservation Sites (LNCS) will not be supported unless demonstrated that clear social, economic or environmental benefits outweigh the adverse effects and sufficient mitigation is provided to conserve and enhance the site interests.
Policy 77 – Forestry, Woodland and Trees	There is a strong presumption in favour of protecting these resources, particularly ancient semi-natural woodland, native or long-established woods, hedgerows and trees with high conservation value. Developments affecting these must demonstrate clear public benefits and provide adequate compensation.
Policy 78 – Woodland Removal	Woodland removal and compensation will be assessed using Scottish Government's Control of Woodland Removal Policy and Argyll and Bute Woodland and Forestry Strategy. Compensatory planting is preferred on-site, secondarily off-site in Argyll and Bute and least preferably elsewhere in Scotland.

The Argyll and Bute Local Biodiversity Action Plan (LBAP) (2015 to 2020) contributes to the biodiversity conservation aims, objectives and actions described at a national level and to the delivery of a number of other strategies and plans relevant to the biodiversity of the Council area. Specifically, it details six ecosystem works programmes to be delivered by the plan and lists habitats and species selected for action. Habitats selected for action that may be relevant to the Development include blanket bog, upland heathland, rivers, and oligotrophic and dystrophic lakes (Loch Awe and Lochan Airigh). Priority species for conservation action include Atlantic salmon *Salmo salar*, black grouse *Tetrao tetrix*, golden eagle *Aquila chrysaetos*, red squirrel *Scurius vulgaris*, otter *Lutra lutra* and soprano pipistrelle *Pipistrellus pygmaeus*. The 2010 to 2015 LBAP has not yet been superseded but is currently being re-drafted.

Argyll and Bute biodiversity guidance states the following regarding the freshwater environment, which is considered of direct relevance to this assessment:

The freshwater environment in Argyll is varied, ranging from large lochs and rivers with medium water chemistries to tiny nutrient-poor, peat-stained lochans. Argyll contains the longest freshwater loch in Scotland (Loch Awe – 41 kms) and the loch with the greatest surface area (Loch Lomond – 71 kms²). The Freshwater Pearl Mussel (Margaritifera margaritifera) an internationally important species, the Atlantic salmon (Salmo salar) and the Powan (Coregonus lavaret) are three such species associated with some of our river and loch systems. These freshwater inhabitants are good examples of why Argyll is important for biodiversity, but also why action is required to protect these resources.

The above planning policy has been considered when assessing potential ecological constraints and opportunities identified by the ecological impact assessment.

7.3 Consultation

The assessment of impacts on terrestrial ecological features has been informed and influenced by consultation held with several statutory and non-statutory stakeholders. A summary of the consultation held, the information / recommendations provided by consultees, and details of how this EIA has responded to consultee feedback is provided in *Table 7.2 Consultee Responses to Scoping Report*, below.

Table 7.2 Consultee Responses to Scoping Report

Consultee	Summary of Response	Action Taken
SEPA	Scope of information which should be provided in the EIA including: Map and assessment of all engineering activities in or impacting on the water environment including proposed buffers, details of any flood risk assessment and details of any related CAR applications. Schedule of mitigation including pollution prevention measures. Borrow Pit Site Management Plan of pollution prevention measures. SEPA do not support the proposed two Access Tracks. Their rationale is that Access Tracks should be kept to a minimum and is not clear why two Access Tracks are required to the same location. Alternatives should be considered, and a single track considered to reduce overall footprint and impacts on the environment. All tracks should be kept to a minimum 10 m away from any waterbody with the exception of watercourse crossing which should be minimised. As long as watercourse crossings are designed to accommodate the 1 in 200-year flow and other infrastructure is located well away from watercourses we do not foresee a need for detailed information on flood risk to be provided. All watercourse crossings must be designed as traditional style bridges or bottomless arched culverts.	Detail of engineering activities is presented in other reports and appendices accompanying the EIAR. Detail of pollution prevention measures is presented in *Chapter 11: Water Environment* and cross-referenced in this report. Potential impacts from Access Tracks, for example by watercourse crossings including culverting, has been assessed in this chapter. A standard approach to avoiding impacts to water bodies, including appropriate buffer zones / stand-offs and minimising watercourse crossings, has been taken in this chapter and in *Chapter 11: Water Environment*. It is recommended in this EIAR that best practice guidance is followed for all watercourse crossings, including culvert design.
NatureScot	In summary, where relevant to aquatic ecology, the scoping response expected: • consideration of operational hydrology impacts; • a Biosecurity Management Plan; • demonstration of biodiversity enhancement, considering measures by nearby developments.	This EIAR has responded to the advice provided by NatureScot as follows: Hydrological impacts have been considered in parallel with *Chapter 11: Water Environment*; Habitat enhancement has been considered, with consideration of proposals by nearby developments.
Argyll and Bute Council	ABC requested that a pre-commencement walkover Scottish Fisheries Coordination Centre (SFCC) fish habitat assessment should be undertaken on the Allt Beochlich watercourse and main tributary watercourses of Loch Awe and Loch Fyne. The assessment should aim to quantify and evaluate the condition of freshwater habitats utilised for recruitment by fish, and in particular salmonids prior to the commencement of the Construction Phase. ABC advised that the applicant consult with Argyll Fisheries Trust (AFT), Argyll District Salmon Fishery Board (ADSFB) and the Awe District River Improvement Association (ADRIA) in the first instance for further advice on survey methods.	The requested surveys have been completed and appropriate mitigation has been included within the EIAR. Engagement was undertaken with these stakeholders and surveys were completed to the advised methods (Scottish Government, 2019), including fish habitat assessments and semi-quantitative electric fishing surveys. Surveys were initially completed in 2021 under sub-optimal conditions and were repeated in 2023.
Argyll District Salmon Fishery Board	Argyll District Salmon Fishery Board ADSFB represent the interests of local fishery managers in the Awe Catchment including the Awe District River Improvement (ADRIA) and Loch Awe Improvement Association (LAIA) who administer the protection order for fish on Loch Awe. The Argyll Fisheries Trust inform the ADSFB of the habitats of different species of fish within the area of the Development. AFT fish and habitat surveys suggest the lower reaches are accessible to Atlantic Salmon, Brown Trout and Brook Lamprey and are used for spawning and juvenile nursery habitat. It is not [clear] if there is an intention to abstract water from other watercourses in the development area (apart from Lochan Airigh). ADSFB urge walkover habitat surveys to inform the location of monitoring sites for the pre-development stages to ensure that key sites are monitored during and after the proposed	A comprehensive desk study has been undertaken, including data requests to the relevant bodies and stakeholders, to provide accurate information on fish species present within the Site and the study area. The suggested surveys and desk study have been undertaken, as presented in the EIAR. The design has considered the fish species present and designed accordingly. Fish habitat assessment, electric fishing surveys, macroinvertebrate surveys (both updated in 2023), and quarterly eDNA sampling for fish in Loch Awe, have been undertaken and are also still in progress, with final samples being collected in June 2024.

	scheme is developed. Monitoring of macroinvertebrates should also be undertaken to ensure water quality is maintained. Note eDNA sampling should be conducted regularly over a period of a year. The design of the scheme should also consider the potential to draw fish into the pump storage scheme. ADSFB highlights Balliemeanoch should be assessed as an addition to existing impacts on aquatic resources as fish habitat and population in the awe catchment is already affected by a variety of renewable energy schemes.	An assessment of the effects of the inlet/outlet structure on Loch Awe in relation to fish has been completed. Fish habitat assessment, electric fishing surveys, macroinvertebrate surveys (both updated in 2023), and quarterly eDNA sampling for fish in Loch Awe, have been undertaken or are in progress. An assessment of the effects of the inlet/outlet structure on Loch Awe in relation to fish has been undertaken. Quarterly eDNA sampling is being undertaken over a period of 12 months in Loch Awe, with the first season's results presented in this EIAR. In addition, a cumulative assessment has been included within the EIAR.
Argyll District Salmon Fishery Board	ADSFB advised that the developer should undertake the following surveys: • provide a full audit of the habitat and fish species present in the development area so that all potential effects on the habitat and fish resources can be considered and minimised. • walkover habitat surveys inform the location of monitoring sites for the predevelopment stages to ensure that key sites are monitored during and after the proposed scheme is developed. • Monitoring of macroinvertebrates should also be undertaken to ensure water quality is maintained. • Noted that eDNA sampling is proposed for the tailrace site at Loch Awe and suggested that the study should be conducted regularly over a period of a year. • Stated the design of the scheme should also consider the potential to draw fish into the pump storage scheme. • Requested that the additional risks of the Balliemeanoch scheme are not assessed in isolation within the EIA but as an addition to the existing impact on aquatic resources within the catchment.	The suggested surveys and desk study have been undertaken, as presented in the EIAR. The design has considered the fish species present and designed accordingly. Fish habitat assessment, electric fishing surveys, macroinvertebrate surveys (both updated in 2023), and quarterly eDNA sampling for fish in Loch Awe, commenced in spring 2019. eDNA survey is still in progress with final eDNA samples being collected in June 2024. An assessment of the effects of the inlet/outlet structure on Loch Awe in relation to fish has been undertaken. Finally, a cumulative assessment has been included within the EIAR.
Marine Scotland Science	Impacts on fish, surveys, fish resilience, cumulative impacts, methodology, design to consider migratory fish and water quality. MSS advise that the developer should consider all potential impacts (e.g., entrainment, impingement, and impediment to fish migration) which are regulated by SEPA under the Controlled Activity Regulations (CAR). MSS note the fish surveys carried out to date and we agree with ADSFB that further surveys should be carried out to provide sufficient information to inform an assessment of the potential impacts of the proposed development on all fish species and associated fisheries in all water bodies likely to be at risk. MSS further advise that the developer should consider the likely resilience of the fish populations, particularly salmon and trout, to any impacts. Similar to ADSFB, we advise that this assessment should also consider the potential cumulative impact on the fish populations, particularly in relation to the change in water quantity and quality in Loch Awe, as a result of the present proposal and other adjacent developments (operational and consented) including Cruachan, Inverawe, Nant and Beochlich hydro schemes and fish farms. MSS requested that full details regarding fish surveys including methodology (e.g., electrofishing, eDNA, smolt/adult trapping, acoustic tracking), selection of monitoring sites (as outlined in the response from ADSFB) and results should be presented in the EIA report. MSS agree with ADSFB that proposed sampling/monitoring should consider the seasonal use by fish species within all water bodies that are likely to be at risk from the development. MSS stated that in addition to the advice provided by SEPA relating to the design of the watercourse crossings MSS advise that the developer should consider the uninhibited	Potential impacts upon fish and their habitats have been assessed within this EIAR. This has been included within the EIAR. Fish habitat assessment, electric fishing surveys, macroinvertebrate surveys (both updated in 2023), and quarterly eDNA sampling for fish in Loch Awe, have been undertaken or are in progress. An assessment of the effects of the inlet/outlet structure on Loch Awe in relation to fish has been completed. See response above. In addition, a cumulative assessment has been included within the EIAR. See responses above regarding surveys undertaken and underway; all survey methods are included within *Appendix 7.1 Aquatic Ecology Baseline Report (Volume 5: Appendices)*, and sampling/monitoring for seasonal species carried out. Recommendations are made in the EIAR for further monitoring prior to construction as appropriate. It was considered that smolt/adult trapping or acoustic tracking was not required to inform the impact assessment, given the comprehensive fish population data available for Loch Awe and the nature of water bodies within the Site. The design team have considered migratory fish within the design such as best practice design of watercourse crossings and culverts, as informed by the findings of fish surveys.

	passage of migratory fish in the design of all watercourse crossings. MSS advised that full details regarding proposed survey/monitoring of water quality (including macroinvertebrate sampling as advised by the ADSFB) and fish populations and appropriate mitigation measures should be provided in the EIA report.	This is included within this EIAR and associated *Appendix 7.1 Aquatic Ecology Baseline Report (Volume 5 Appendices)* – macroinvertebrate surveys have been completed as part of the Aquatic Ecology assessment, and water quality is assessed in *Chapter 11: Water Environment*.
Fisheries Management Scotland	Fisheries Management Scotland endorse the comments on the proposed development made by the Argyll District Salmon Fisheries Board. In particular, we note that the Scottish Government have recognised that Atlantic Salmon are in crisis and published a wild salmon strategy in January 2022. This situation should be fully taken into account in both the screening and scoping and any subsequent licence decisions.	See responses above. The assessment has included a robust assessment of Atlantic salmon and appropriate mitigation measures have been made to ensure there are no significant impacts to this Near Threatened species.
Peel Port Group	Invasive Non-Native Species have been considered however we would like to see a risk assessment undertaken as part of further environmental assessments.	INNS have been considered in the EIAR and appropriate mitigation has been included to ensure the implementation of biosecurity measures and to control the risk of spreading INNS.
Public	Having seen the proposed size of the upper reservoir (it looks more akin to Loch Avich than to the Cruachan reservoir) I'm very concerned about the effect so much water may have on Loch Awe. Most the time (circa 9/10ths the year) the loch stays within about a 0.5 m range, and generally changes less than 50 mm in a day.	Potential impacts on the aquatic ecology (and notably fisheries) in Loch Awe as a result of the development have been assessed in the EIAR. Development design and predictions of the effects on levels in Loch Awe have informed the assessment.

Further comments received from Mowi Scotland and Dawnfresh Fish Farming (which is a wholly owned subsidiary of Mowi Scotland) subsequent to submission of the scoping report are addressed below.

MOWI Scotland Response:

'*MOWI has an interest in this development given the presence of operational fish farms on Loch Awe. 3rd April 2024 – whilst the Loch Awe fish farms have previously raised Rainbow trout, a consultation process is underway with stakeholders and regulators on the potential transition of the Loch Awe fish farms to rear Atlantic salmon smolts.*

Concerned that no specific assessments on the potential effects to the operation of the fish farms has been scoped for inclusion in the EIAR. We would consider that this is a material omission. The farmed salmon sector contributes to the Scottish economy every year providing direct employment for over 2,500 people in farming and a further 10,000 across Scotland. It is surprising therefore that there is no reference to the economic importance of fish farming in the socio-economic chapter of the Scoping Report given the presence of fish farms within Loch Awe.

The potential effects of the development on the continued operation of the fish farms requires to be scoped into the EIAR. We would expect the Water Environment and the Water Resources impact assessments outlined in the Scoping Report to be expanded to examine the specific risk to the fish farms and, if required identification of appropriate mitigation measures and actions. We would specifically highlight the following issues that require to be examined within the EIAR.

Construction Phase Impacts:
An assessment should be carried out to examine the risk of connectivity of any potential catchment scale water quality impacts from construction phase pollution with the Loch Awe fish farms. We would be especially Concerned with elevated suspended solids and liberation of metals from soil and rock excavations. Although the fish farm sites are located some distance from the main development site, potential construction run-of release points to the water environment and connectivity to Loch Awe should be identified for appropriate mitigation measures. – RESPONSE: Water quality effects are assessed in *Chapter 11: Water Environment*, along with appropriate mitigation to ensure impacts to water quality in Loch Awe are minimised during construction and operation.

Operational Phase Impacts:
A key concern for the continued viable operation of the fish farms is the potential impacts through changes to water levels within Loch Awe, both high water and low water levels. Mowi operates freshwater fish farms in a number of loch waterbodies which are also subject to storage hydro operations. Fluctuations in water levels outside of normal waterbody changes have the potential to significantly impact the operation of fish farms and we have direct experiences of this elsewhere.

The Scoping Report correctly identifies the range of existing hydro operations within the Loch Awe catchment and

the influences and behaviour these operations have on current water levels in Loch Awe. The proposed development will result in further changes to water levels within Loch Awe and a generic assessment on the likely variation in water levels in Loch Awe is proposed, based on the pumped and generating volumes and surface area of the loch with a commitment that if the outcomes are found to be significant, further modelling of the impact will be undertaken to identify mitigation measures to reduce the impact. It is essential that effects of changes in water levels in Loch Awe and the potential for impacts to the operation of the fish farms is scoped into the EIAR. This EIAR should examine the following:

• Assessment of water level changes on the mooring systems and containment measures for stock at the Tervine and Braevallich fish farms.
• Assessment of water level changes to shoreside farm infrastructure such as slipways and vessel pontoons. High water or low water level changes may render facilities such as slipways and pontoons unusable for periods of time. Maintenance of year-round vessel access to the fish farms is required especially during key in-year periods involving sensitive operations such as fish transfers in and out of the fish farms.

RESPONSES:

Construction phase impacts – embedded mitigation will ensure water quality is not adversely affected during construction, and considering the distance of the fish farms from the proposed development (approx. 10 km SW of the inlet/outlet, and at the mouth of the River Awe opposite the falls of Cruachan, approx. 11 km to the NW), there are no expected impacts on the fish farms due to water quality (suspended solids or metals). Water quality monitoring will be in place during the construction phase. Potential effects to water quality and appropriate mitigation measures and monitoring requirements are detailed in *Chapter 11: Water Environment.*

Operational phase impacts – the commitment made as part of the EIAR to maintain water levels in Loch Awe through the operational regime of the scheme will ensure this does not adversely affect the fish farms. The comments refer to 'Fluctuations in water levels outside of normal waterbody changes'; however, there is a commitment for the scheme to maintain water levels within normal fluctuations. Operational regime is proposed to limit the impact of the scheme during periods of high and low water levels. This is based on a hands-off arrangement when water levels fall below an agreed level together with a 'no discharge / generation' commitment when water level are above an agreed level. This will ensure that the scheme does not impact on extreme water level in Loch Awe. An assessment of the rate of variation in change of water level has been carried out based on the proposed generation and abstraction rate. The rate of change has been found to be in line with the current changes in Loch Awe based on review of historic water level. The larger rates of change however will occur on a more frequent basis as a result of the scheme operation. They will however be in line with the normal water level changes that are currently occurring in Loch Awe.

It is assumed that moorings and containment measures, and slipways and vessel pontoons, are designed to operate within the current normal loch level fluctuations, and these will therefore continue to operate unhindered by the proposed operation of the scheme.

7.4 Study Area

The site for the Development is situated west of Loch Lomond and The Trossachs National Park, in western Scotland. The proposed site is situated between freshwater and brackish Lochs (Loch Awe and Loch Fyne respectively) as shown on *Figure 1.1 Location Plan (Volume 3: Figures)*.

The Zone of Influence (ZoI) of the Development is the area over which aquatic ecological features may be subject to impacts as a result of its construction, operation, and/or decommissioning, and may extend beyond the boundary of the Development Site.

The ZoI will vary for different aquatic features depending on their sensitivity to an environmental change. It is therefore appropriate to identify different ZoI for different features. As recommended by the Chartered Institute of Ecology and Environmental Management in CIEEM (2022), professionally accredited or published studies and guidance, where available, were used to help determine the likely ZoI, as well as professional judgement. However, CIEEM also highlight that establishing the ZoI should be an iterative process and can be informed by further desk study and field survey. Where limited information was available, the Precautionary Principle (UNESCO, 2005) was adopted and a ZoI estimated on that basis.

The study areas used for desk study and field survey, and which are reported in *Appendix 7.1 Aquatic Ecology Baseline Report (Volume 5: Appendices)*, were designed to allow sufficient data to be collected to establish the baseline condition of aquatic ecological features.

Survey locations were selected based on their potential to be impacted by the Development. Any watercourses where a channel crossing may be required or had the potential to be impacted by runoff were surveyed to assess their conservation value and establish a baseline. The majority of survey locations assessed for this report are small headwater streams that arise in uplands between Loch Fyne (brackish) and Loch Awe (freshwater) and run through a variety of conifer plantations, broadleaved woodland, open field and moorland areas.

A small number of additional survey locations included potentially impacted freshwater bodies (lochs), and proposed developments (engineering works) on the shores of Loch Fyne and Loch Awe. For example, one of the proposed transportation routes would involve the construction of a temporary Marine Facility on the western shore of Loch Fyne, near Inveraray.

7.5 Methods

7.5.1 Guidance and Standards

The following guidance was used when designing the field surveys carried out to inform this assessment and to determine the scope and method of the assessment itself:

- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2022);
- Assessing the Cumulative Impact of Onshore Wind Energy Developments (SNH, 2012).
- Habitat Surveys Training Course Manual (SFCC, 2007).

7.5.2 Assessment Scope

The scope of survey and assessment described in this chapter was informed by the guidance contained in the published documents listed in *Appendix 7.1 Aquatic Ecology Baseline Report (Volume 5 Appendices)*, on the responses of consultees (as set out in *Table 7.2 Consultee Responses to Scoping Report, Section 7.3 Consultation*), and on the results of detailed study once underway.

The guidelines for EcIA published by CIEEM recommend that only those features that are 'important' and that could be significantly affected by the Development require detailed assessment, stating that "*it is not necessary to carry out detailed assessment of ecological features that are sufficiently widespread, unthreatened and resilient to project impacts and will remain viable and sustainable*".

Consequently, for the purposes of the desk study, field survey and assessment described in this chapter, 'important' aquatic ecological features were taken to include:

- The qualifying features of designated sites within the zone of influence (or further where connectivity exists) of the Development;
- Species listed on Annex II of the Habitats Directive;
- All species listed on Schedule 1 of the WCA;
- Species listed on the Scottish Biodiversity List (SBL);
- All species on the Argyll and Bute LBAP;
- Species or species assemblages shown to indicate Good habitat conditions, for example in relation to Good Ecological Status or better in relation to the Water Framework Directive (WFD);
- Species or habitats raised through consultation (see *Table 7.2 Consultee Responses to Scoping Report*, *Section 7.3 Consultation*) as being at risk, or of particular local significance or concern.

The assessment considers the effects during the four phases of the Development lifespan as identified in *Chapter 2: Project and Site Description*. The phases include pre-construction, construction, operation, and decommissioning.

The scope of the assessment described in this Chapter was defined by AECOM following the completion of ecological surveys and based on the comments provided by consultees in the Scoping Opinion response to the Scoping Report for the Development. A summary of the key comments provided by those organisations is provided in *Table 7.2 Consultee Responses to Scoping Report, Section 7.3 Consultation*.

Potential impacts to surveyed water bodies have been assessed in this chapter. These water bodies are also assessed in the WFD assessment, supported by WFD monitoring data which is contained within *Chapter 11: Water Environment* of the EIAR.

Based on the results of the PEA and the feedback provided on the Scoping Report, the scope of the aquatic ecology assessment for the Development included the following ecological features:

- Statutory and non-statutory designated nature conservation sites;
- Catchment-wide and cross-catchment desk study to establish records of protected / notable species and INNS in the study area;
- Freshwater pearl mussel (FWPM) habitats;
- Aquatic macrophytes;
- Aquatic macroinvertebrates;
- Fish and fish habitats;
- Aquatic INNS.

7.6 Ecological Impact Assessment

The assessment of ecological impacts described in this Chapter was conducted in accordance with the guidelines published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2016). The principal steps involved in the CIEEM approach can be summarised as:

- Ecological features that are both present and might be affected by the Development are identified (both those likely to be present at the time works begin, and for the sake of comparison, those predicted to be present at a set time in the future) through a combination of targeted desk-based study and field survey work to determine the relevant baseline conditions;
- The importance of the identified ecological features is evaluated to place their relative biodiversity and conservation value into geographic context, and this is used to define the relevant ecological features that need to be considered further within the impact assessment process;
- The changes or perturbations predicted to result as a consequence of the Development (i.e., the potential impacts) that have the potential to affect relevant ecological features are identified and their nature described. Established best-practice, legislative requirements, or other incorporated design measures to minimise or avoid impacts are also described and are taken into account;
- The likely effects (beneficial or adverse) on relevant ecological features are then assessed, and where possible quantified;
- Measures to avoid or reduce any predicted significant effects, if possible, are then developed in conjunction with other elements of the design (including mitigation for other environmental disciplines). If necessary, measures to compensate for effects on features of nature conservation importance are also included;
- Any residual effects of the proposed development are reported; and
- Scope for ecological enhancement is considered.

CIEEM impacts have been translated in this assessment into more widely-used terms. Taking account of professional judgement and the full range of impact assessment parameters, 'impact magnitude' has been translated as **negligible, minor, moderate or major (adverse or beneficial)**, and significance of effect has been expressed as **Low for site- or locally-significant effects, Medium for county- or regionally-significant effects, and High or Very High for nationally-or internationally-significant effects**.

7.6.1 Assessment Methodology

The assessment of impacts and effects on aquatic ecological features followed CIEEM EcIA guidelines (CIEEM, 2022). The principal steps involved in the CIEEM approach can be summarised as:

- Determine baseline conditions through targeted desk study and field survey, to identify Important [aquatic] Ecological Features (IEF) that might be affected;

- Evaluate the importance of identified ecological features on a geographic scale, determining those that need to be considered further;
- Describe potential impacts on relevant ecological features, considering best practice, legislation, and embedded design measures;
- Assess and quantify (as far as possible) likely effects (adverse or beneficial) on relevant ecological features;
- Develop measures to avoid, reduce or if necessary, compensate for predicted significant effects, in conjunction with other elements of the design (including mitigation for other environmental disciplines);
- Report residual effects considering developed mitigation or compensation; and
- Identify opportunities for biodiversity enhancement.

When baseline conditions have been determined, it can become apparent that there is no possibility of effect on certain ecological features, and in this case such features are scoped out of further assessment.

In line with CIEEM EcIA guidelines (CIEEM, 2022), this chapter draws a distinction between 'impact' and 'effect':

- Impact – action resulting in change to an ecological feature (e.g. a deterioration in water quality leading to adverse effects on aquatic flora and fauna; culverting of a watercourse presenting a barrier to fish migration);
- Effect – the outcome of an impact on the conservation status or structure and/or function of an ecological feature (e.g. deterioration in water quality may have an adverse effect on aquatic communities and corresponding WFD status at a particular scale; barriers to fish passage have an adverse effect on migratory and spawning success of fish species).

Impacts are assessed in view of the conservation status of the aquatic ecological feature under consideration. Conservation status is defined as follows:

- Habitats – the sum of influences acting on it that may affect its extent, structure/functions, distribution, and typical species within a given geographical area (CIEEM, 2022);
- Species – the sum of influences acting on it that may affect its long-term distribution and abundance within a given geographical area (CIEEM, 2022). Similarly, conservation objectives for European sites indicate that to contribute to favourable conservation status the following must be maintained: the population as a viable component of its habitats, distribution, and sufficiency of supporting habitats, processes, and prey.

NatureScot recommends that the concept of the favourable conservation status for species should be applied at a National (Scottish) level to determine the level of significance of an effect (SNH, 2018). However, consideration of effects at all scales is important (CIEEM, 2022), and where an impact may not affect conservation status at the national level, the potential for effects on conservation status at regional and local scales has been considered.

For the purposes of this EIA and in the context of the EIA Regulations, residual effects predicted to be significant at the Regional or higher geographic scale are considered 'Significant' in broader EIA terms, whereas those predicted to be significant at Local or Negligible scales are considered 'Not Significant'. The latter does not, however, necessarily imply that mitigation is not required.

A detailed description of the CIEEM method for impact assessment is provided in *Appendix 6.1: Method for Assessment of Ecological Impacts (Volume 5: Appendices).*

7.7 Baseline Data Collection

7.7.1 Desk Study

A desk study was carried out to identify designated sites, protected and notable habitats and species, and INNS within the zone of influence of the Development and of relevance to aquatic ecology. A stratified approach was taken when defining the desk study area, based on the likely zone of influence of the Development on different ecological receptors and an understanding of the maximum distances typically considered by statutory consultees. Accordingly, the desk study identified any international designated sites within 10 km of the red line boundary and other national statutory and local non-statutory designated sites and notable habitats and species within 2.5 km of the red line boundary.

Results of the desk study pertaining to statutory and non-statutory designated sites and terrestrial habitats and species are presented in *Chapter 6: Terrestrial Ecology*.

A desk study specific to the aquatic ecology scope was carried out to identify protected / notable aquatic species, and INNS.

For the purposes of the aquatic ecological assessment and baseline report, protected and notable habitats and species included:

- All species listed on Schedules 2 and 4 of the Habitats Regulations;
- All species listed on Schedules 1, 5 and 8 of the WCA;
- Species and habitats of principal importance for nature conservation in Scotland which are named on the SBL;
- Priority species listed on the UK Biodiversity Action Plan or the Argyll and Bute LBAP;
- Other species that are Nationally Rare, Nationally Scarce, or listed in national or local Red Data Lists;
- INNS of UK concern such as those identified on Schedule 9 of the WCA (although this no longer legally applies in Scotland) and in particular the 29 high impact species identified by Invasive Species Scotland and those listed as species of EU concern on the EU Invasive Alien Species Regulations.

The search of the NBN Atlas Scotland was extended to include records from 1993 onwards due to the sparsity of records in recent years. Although, where possible, data from the past ten years were prioritised.

The desk study was carried out using the data sources detailed in *Table 7.3 Desk Study Data Sources*.

Table 7.3 Desk Study Data Sources

Data Source	Date Accessed	Data Obtained
Argyll and Bute Council Open Data website (https://data-argyll-bute.opendata.arcgis.com/datasets/d05f7337b41e48b4af933404dc0592a2/explore)	06 July 2023	Information on local non-statutory nature conservation designations.
NatureScot SiteLink and Open Data Hub (https://sitelink.nature.scot/home; https://opendata.nature.scot/)	02 August 2023	Extents of and information on international and national statutory designations.
NBN Atlas Scotland (https://scotland.nbnatlas.org/)	December 2023	Commercially available records of species of conservation concern within 2 km since 1993.
Argyll Fisheries Trust (AFT)	December 2023	Information on habitats and habitat connections (based on aerial photography) relevant to interpretation of planning policy and assessment of potential protected and notable species constraints. Details of local planning policy relevant to nature conservation.
SEPA Water Environment Hub	January 2024	WFD status of ecological parameters for watercourses. Barriers to fish migration (natural and artificial).
Ordnance Survey (OS) 1:25,000 maps OS 1:50,000 maps and Bing aerial (https://www.bing.com/maps/)	31 October 2023	Habitats and connectivity relevant to interpretation of planning policy and potential presence of important features that could be used by protected and notable species.

7.7.2 Field Survey

7.7.2.1 Survey Locations

Survey locations were identified according to the proximity of water bodies to areas of proposed works such as watercourse crossings for Access Tracks, inlet/outlet location, proposed culverts, Headpond location, or otherwise to assess potential impacts to water quality during construction. As such, 19 survey sites were selected, with each survey type completed at each survey location, as shown in *Table 7.4 Aquatic Ecology Survey Locations*, below, and within *Appendix 7.1 Aquatic Ecology Baseline Report, Figures A1-A4 (Volume 5: Appendices).*

Table 7.4 Aquatic Ecology Survey Locations

Site ID	Watercourse Name	Grid Reference	Surveys Undertaken
BL-01	Allt Criche (tributary of Erralich Water)	NN 08167 12302	Macrophyte, Macroinvertebrate and Fish
BL-02	Erralich Water	NN 07790 11867	Macrophyte, Macroinvertebrate and Fish
BL-03	Allt Blarghour	NN 02880 13037	Macrophyte and Macroinvertebrate
BL-04	Buinne Dhubh (Allt Beolich)	NN 03197 15552	Macrophyte, Macroinvertebrate and Fish
BL-05	Allt Beolich	NN 01347 15431	Macrophyte and Macroinvertebrate
BL-06	Unnamed (direct into Loch Awe)	NN 01175 15660	Macrophyte and Macroinvertebrate
BL-07	Allt a' Chrosaid	NN 01127 16082	Macrophyte, Macroinvertebrate and Fish
BL-14	Loch Fyne Wharf (Brackish site)	NN 08537 07116	Macrophyte and Macroinvertebrate
BL-16	Loch Fyne (Brackish site)	NN 11301 09358	Macrophyte and Macroinvertebrate
BL-17	Allt a' Gheataidh (outfall into Loch Awe)	NN 00960 16289	Macrophyte and Macroinvertebrate
BL-18	Loch Awe	NN 00683 15657	Macrophyte, Macroinvertebrate, and fish eDNA
BL-19	Loch Awe	NN 07693 26840	Macrophyte, Macroinvertebrate, and fish eDNA
BL-20	Lochan Airigh	NN 04278 16416	Macrophyte and Macroinvertebrate
BL-21	Lochan Breac-liath	NN 03430 16457	Macrophyte and Macroinvertebrate
BL-22	River Aray	NN 09062 18945	Macrophyte, Macroinvertebrate and Fish
BL-23	Unnamed tributary of River Aray	NN 09795 19225	Macrophyte, Macroinvertebrate and Fish
BL-24	Unnamed tributary of Achan River	NN 07687 19480	Macrophyte and Macroinvertebrate
BL-25	Unnamed tributary of Keppochan River	NN 06895 19355	Macrophyte, Macroinvertebrate and Fish
BL-26	Unnamed tributary of Allt na Cuile Riabhaiche	NN 05988 18950	Macrophyte, Macroinvertebrate and Fish

Macrophyte surveys were completed in 2019, with no further surveys considered necessary due to the consistency of morphological conditions since those surveys, and the general lack of macrophyte species recorded due to the nature of the upland water bodies. Similarly, fish habitat surveys were completed in 2019 and were used to inform locations for fish surveys in 2021, 2023, and scheduled further surveys for 2024. Macroinvertebrate and fish eDNA surveys were also undertaken in 2019, 2023, and further surveys scheduled for 2024.

INNS surveys were completed concurrently with macrophyte and macroinvertebrate surveys, and also during terrestrial ecology surveys as detailed in *Chapter 6: Terrestrial Ecology*.

Sites surveyed comprised two brackish sites on Loch Fyne, four freshwater loch sites (including Loch Awe), and 14 running water sites on various watercourses, as detailed in *Table 7.4 Aquatic Ecology Survey Locations*. Sites BL-14 and BL-16 were the only brackish sites to be surveyed in 2023 as the third brackish site, BL-15 (located at NN 08202 07116), was removed from survey scope due to a lack of access and proximity to BL-14. Data collected from surveys at BL-14 was deemed sufficient to represent the aquatic ecology of the immediate and surrounding area.

The following is a summary of methods used for the aquatic ecological assessments and field surveys completed to establish baseline conditions at the Site. All aquatic ecology surveys were undertaken by suitably qualified and experienced AECOM ecologists. For full details of survey methods and results, refer to *Appendix 7.1: Aquatic Ecology Baseline Report (Volume 5: Appendices).*

7.7.2.2 Freshwater Pearl Mussel Habitat Surveys

Freshwater Pearl Mussel (FWPM) habitat potential was assessed in 2019 to identify areas of optimal habitat (Hastie et al., 2000, 2003) within the boundary of the Development. At each site, FWPM habitat potential was assessed over a 100 m downstream reach at each watercourse. Key habitat requirements include riverbed substrate diversity and stability, high water quality, and the presence of host fish (salmon and trout). Pockets of clean sand, stabilised by boulders and cobbles in moderate- to fast-flowing waters create optimal microhabitats for FWPM (Hastie et al., 2000, 2003). As a result of the FWPM habitat appraisal and subsequent assessment, no further surveys were recommended for FWPM.

7.7.2.3 Macrophyte Surveys

Macrophyte surveys were completed in 2019. The survey methodology undertaken varied depending on the type of water body, as described below.

Macrophyte survey of flowing watercourses followed the method outlined in the UKTAG River Assessment Method (Macrophytes and Phytobenthos) for use with LEAFPACS2 (WFD-UKTAG, 2014), which conforms to BS EN 14184:2014 Water quality - Guidance for the surveying of aquatic macrophytes in running waters.

Macrophyte (and macroinvertebrate) surveys of Lochan Airigh and Lochan Breac-liath were based on the PSYM (Predictive System for Multimetrics) pond survey methodology (Freshwater Habitats Trust, formerly Pond Action, 2002). This method was developed to provide a method for assessing the biological quality of still waters in England and Wales. Due to the location in Scotland, the PSYM metrics could not be calculated, however the survey methodology remains valid for this type of standing water body.

Macrophyte surveys at the Loch sites were undertaken along transects, on the shore, at the identified survey sites. The strandline was inspected for macrophytes and plant fragments, with records collected of any taxa encountered and their relative abundance (taxon cover value).

All INNS within or adjacent to surveyed water bodies were also recorded as part of the macrophyte assessment, together with incidental records of INNS elsewhere on the Site where these were observed.

7.7.2.4 Macroinvertebrate Surveys

Macroinvertebrate surveys were completed during autumn 2019 and autumn 2023, with further surveys proposed for spring 2024.

Macroinvertebrate samples were taken to assess the biological quality of the surveyed water bodies. Using a standard Freshwater Biological Association (FBA) pattern pond net (mesh size: 1 mm), instream habitats were ‘kick sampled’ where practicable, or ‘sweep sampled’. Sampling methodology adhered to aquatic macroinvertebrate sampling procedures standardised by the Environment Agency (Environment Agency, 2017) and used by regulatory authorities across the UK. These sampling procedures also conform to BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters.

Subsequent laboratory analysis identified specimens to ‘mixed-taxon level’ using stereo-microscopes; and lists of the aquatic macroinvertebrate taxa present were produced in line with Environment Agency guidance (Environment Agency, 2014).

Using collated survey data, metrics were calculated to inform an assessment of relative conservation value, habitat condition, and general degradation of surveyed water bodies. Aquatic macroinvertebrate data were analysed to generate the Whalley, Hawkes, Paisley & Trigg (WHPT) score, Average Score Per Taxon (ASPT), and Number of scoring taxa (NTAXA) values, which provide an indication of ecological quality in the watercourse (WFD-UKTAG, 2021). Further calculations were undertaken to determine the Proportion of Sediment-sensitive Invertebrates (PSI) index (Extence et al., 2013), the Lotic-invertebrate Index for Flow Evaluation (LIFE) score (Extence et al., 1999), which links benthic macroinvertebrate data to flow regimes prevailing in UK waters, and finally the Community Conservation Index (CCI) (Chadd & Extence, 2004) was used to classify present aquatic macroinvertebrates according to their scarcity and conservation value in a geographic context.

The resultant WHPT-ASPT and NTAXA values and environmental data collected were processed through the River Invertebrate Classification Tool (RICT) version 3 web application, to produce outputs as Ecological Quality Ratio (EQR) values. The EQRs are then translated into a Water Framework Directive (WFD) equivalent classification.

7.7.2.5 Fish Habitat Survey

Fish habitat assessments were completed in 2019 at 15 sites to establish fish spawning habitat potential per site. Habitat potential was assessed through key aquatic features including channel dimensions, mesohabitat coverage, habitat features, substrate composition, accessibility for migratory species, and potential spawning areas for salmonid species (Atlantic salmon *Salmo salar*, and brown/sea trout *Salmo trutta*). Subsequent analysis followed SEPA’s Guidance for applicants on supporting information requirements for hydropower applications (SEPA, 2005). Consideration was also given to the degree of suitable fish passage, as any barriers may impact passage of salmonid and other fish species upstream on surveyed water bodies.

7.7.2.6 Fish Surveys

Fish surveys were undertaken following the EA Operational Instruction 993_08, Electric fishing operations (2019) and in accordance with the Scottish Fisheries Coordination Centre protocols (SFCC, 2021) through electric fishing methods.

Surveys consisted of semi-quantitative three-run surveys of depletive electric fishing, to give an indication of population densities, or time-delineated surveys, which provided an index of abundance as catch per unit of effort (time).

For three-run depletion surveys, through channel isolation using cross-channel stop nets where possible, watercourses were electric fished in an upstream direction within the 100 m survey area (where such an area was accessible for survey). For time-delineated surveys, operatives electric fished the watercourse in an upstream direction for 6 minutes. The number of fish caught during this time is regarded as an index of abundance as catch per unit effort (time).

Subsequent fish catches were individually measured and identified to species level to inform species presence and abundance within the watercourses.

7.7.2.7 Fish eDNA Surveys

Water samples were obtained and filtered at two sites; the first at the River Awe outflow from Loch Awe; and the second on the east bank of Loch Awe at the proposed inlet/outlet location. Approximately 1.5 – 2.0 L of water from each site was filtered and subsequently extracted by Nature Metrics using a commercial DNA extraction kit with a protocol modified to increase DNA yields. This provided a list of fish species present, and an indication of relative abundance based on the quantity of eDNA detected per species – this is not an absolute measure of fish abundance and is dependent on the amount of eDNA present at the particular sampling location, and also on the amount of eDNA shed by each particular species.

7.7.2.8 Invasive Non-Native Species

The aquatic macrophyte and macroinvertebrate surveys included an assessment for INNS at the survey locations, together with incidental records of INNS elsewhere on the Site, where these were observed. The extent of terrestrial INNS and potential impacts as a result of their presence has been described in *Chapter 6: Terrestrial Ecology* and appendices (*Volume 5: Appendices*).

7.7.3 Limitations And Assumptions

Refer to *Appendix 7.1: Aquatic Ecology Survey Report (Volume 5: Appendices)* for limitations and assumptions in relation to the aquatic ecology surveys. A summary is provided below.

Information obtained by desk study is dependent upon local recorders and organisations having submitted records for the area of interest. As such, a lack of records for a species does not necessarily mean that the habitats or species do not occur in the study area. Likewise, the record of a species does not automatically mean that these still occur within the area of interest or are relevant in the context of the Development. The utilisation of multiple sources of information for the desk study means that the ecological data obtained is as comprehensive as possible.

Although surveys were undertaken during optimal survey periods, the weather during some surveys was sub-optimal. All sites were subject to heavy rain and higher than normal flows at the time of surveys in 2023. Consequently, some habitats within the watercourse may not have been representatively surveyed. Heavy rainfall in 2023 prevented fish surveys being undertaken at two of the survey sites (BL-04 and BL-07) as flows in the watercourses were higher than normal. Semi-quantitative 3-run electric fishing surveys could only be completed at two of the sites: BL-22 and BL-23. Where this was not possible semi-quantitative timed delineated surveys were carried out for six minutes (BL-01, BL-02, BL-25, BL-26) as stop nets could not be deployed. With the combination of fish survey data from 2019 and 2023, it is considered that representative fish data were obtained.

During 2019 and 2023 electric fishing surveys, only downstream stop nets were primarily used as upstream survey points were either unsafe or unsuitable for using an additional stop net. Where two stop nets were not used, some individuals may have escaped upstream; however, this is considered insignificant in the context of the fish species captured.

Best practice guidelines for aquatic macroinvertebrate survey include repeat sampling in spring and autumn seasons. In this case sampling was undertaken in autumn in both 2019 and 2023with repeat surveys to assess macroinvertebrate communities present being carried out in the spring and summer seasons 2024 to further inform the baseline assessment in an addendum report. However, it is considered that the combination of 2019 and 2023 survey data provides an appropriate baseline to inform the assessment.

INNS surveys were limited to the macrophyte and macroinvertebrate survey locations for identifying their presence, in addition to incidental records elsewhere on the Site. INNS were also recorded during terrestrial ecology surveys as detailed in *Chapter 6 Terrestrial Ecology*, and therefore it is considered that comprehensive INNS data have

been obtained to inform the assessment and mitigation requirements, especially as aquatic ecology surveys were completed at specific points of potential impacts of the Development.

While the baseline is not expected to change sufficiently to alter the impact assessment at the time of construction, the precise situation regarding protected species may nevertheless differ at that time. For example, watercourse conditions may change through impacts of pollution or other anthropogenic activities. INNS may be introduced or spread through the Development Site. Pre-construction surveys should therefore be undertaken as required, depending upon the timescale of consenting and construction, with aquatic ecological data typically remaining valid for a period of three years from the point of collection.

7.8 Baseline Environment

7.8.1 Designated Sites

7.8.1.1 Statutory Designations

Refer to *Chapter 6: Terrestrial Ecology* for full details of all designated sites within the study area. A summary of the statutory designated sites relevant to the aquatic ecology assessment and within 10 km of the Development Site is provided below.

The Development does not lie within any statutory site designated for nature conservation. However, there are a number of statutorily designated sites within the potential zone of influence of the Development. These are described in *Table 7.5 Statutory Designated Sites in Proximity to the Development*. The designations are listed in descending order, with those closest to the Development Site listed first.

Table 7-5 Statutory Designated Sites in Proximity to the Development Site

Designated Site	Reason(s) for Designation	Relationship to the Development
Glen Etive and Glen Fyne SPA	A large, predominantly upland site encompassing a range of habitats including heather moorland, rough grassland, blanket bog, native woodland, montane heaths and exposed rock and scree with **numerous freshwater lochs and river systems**.	The SPA is split between two sites. One is situated approximately 4.2 km east of the proposed Headpond area, extending as far west as the A819. The second is 10.05 km north, on the opposite bank of the River Awe, and partially overlapping the Loch Etive Woods SAC. There is no hydrological connectivity between the Development and this SAC, and therefore it is not considered further in the Aquatic Ecology assessment – refer to *Chapter 6: Terrestrial* Ecology and *Chapter 9 Ornithology* for the assessment of impacts in relation to this site.
Glen Shira SAC	The sole qualifying feature is: Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles. General site character includes **inland water bodies (standing water, running water)**	A two-part site on opposite sides of a watercourse in Glen Shira. The closest point is approximately 5.5 km from the Development Site. There is intervening highly mountainous terrain of moorland and forestry, and the SAC is in a different water catchment. There is no hydrological connectivity between the Development and this SAC, and therefore it is not considered further in the Aquatic Ecology assessment – refer to *Chapter 6: Terrestrial Ecology* for the assessment of impacts in relation to this site.
Loch Etive Woods SAC	Designated for supporting the following habitats and species: • Otter *Lutra lutra* • Other habitats and species are not relevant to aquatic ecology but can be found within the PEA (AECOM, 2019)	A multi-part site of which two parts are within the study area. Both are located on the opposite bank of Loch Awe, with one 9.05 km north west of the Site and one 9.98 km north east of the Site, both separated by Loch Awe, farmland, moorland and conifer plantation. There is no hydrological connectivity between the Development and this SAC, and therefore it is not considered further in the Aquatic Ecology assessment – refer to *Chapter 6: Terrestrial Ecology* for the assessment of impacts in relation to this site.

7.8.1.2 Non-statutory Designations

There are no non-statutory designations for nature conservation within 2.5 km of the Development which have influence over aquatic ecology investigations within the area of influence of the Development.

7.8.2 Aquatic Ecology Desk Study

7.8.2.1 Invasive Non-Native Species

The terrestrial and riparian INNS Japanese knotweed *Reynoutria japonica*, New Zealand willowherb *Epilobium brunnescens* and American skunk cabbage *Lysichiton americanus* were all present.

Additional accounts of the aquatics INNS Canadian pondweed *Elodea canadensis*, Nuttall's waterweed *Elodea nuttallii,* and New Zealand pigmyweed *Crassula helmsii*, were also identified. These species were notably present within Loch Awe.

Historic records of the New Zealand Mud Snail *Potamopyrgus antipodarum*, although none from within the past 12 years, were recorded in the desk study.

No records of the amphipod *Crangonyx pseudogracilis* were recorded in the desk study within the Loch Awe or Loch Fyne catchment.

7.8.2.2 Macrophytes

No protected macrophyte species were identified in the desk study. Species previously listed under the IUCN Red List are now all listed as Least Concern.

7.8.2.3 Macroinvertebrates

No macroinvertebrate species of national or local designation were identified within the study area. Scottish records within the Development Site were for widespread and common species only.

7.8.2.4 Freshwater Pearl Mussel (FWPM)

No records of freshwater pearl mussel were identified in the catchment-wide data search. The potential for aquatic habitats to support this species depends upon the presence of suitable salmonid host fish species, upon the gills of which the mussel's larval stage, Glochidia, attach.

7.8.2.5 Fish

Recent fish data was based off the results of gill netting (2011) and eDNA (2016) surveys completed by SEPA within Loch Awe. Records of protected or SBL species included Atlantic salmon *Salmo salar*, brown/sea trout *Salmo trutta*, arctic char *Salvelinus alpinus*, lamprey *Lampetra* sp. and European eel *Anguilla anguilla*.

Additional records of common and widespread fish species were also present and included Minnow *Phoxinus phoxinus*, Perch *Perca fluviatilis*, Pike *Esox Lucius*, Roach *Rutilus rutilus*, three-spined Stickleback *Gasterosteus aculeatus,* and Stone loach *Barbatula barbatula*.

The non-native Rainbow trout *Oncorhynchus mykiss* was also identified, although it is assumed specimens are escaped stocked fish or farmed fish, as there are no self-sustaining populations within Scotland.

7.8.3 Aquatic Ecology Field Survey

7.8.3.1 Aquatic Habitats - Flowing Watercourses

Flowing watercourses throughout the Site represent the SBL priority habitat Rivers, as small fast-flowing headwaters. The main notable watercourses within the red line boundary are Erallich Water, River Aray, Allt Blarghour, and Allt Beochlich. The first two watercourses flow south into Loch Fyne, while the latter two watercourses flow west into the freshwater Loch Awe. Together with minor tributaries, land drains, ponds, lochans and upland flushes, these water bodies form an important network of aquatic habitats.

7.8.3.2 Water Framework Directive Water Bodies

Erallich Water is a river (ID: 10225) in the Loch Fyne Coastal catchment of the Scotland river basin district. The main stem of this river is approximately 8.4 kilometres in length. Survey site BL-02 was located toward the centre of this stem, with brown trout present at the site. Site BL-01 was also located on a tributary of this watercourse and multiple brown trout and one individual of salmon were caught during fish surveys. The river is monitored under the WFD, with a current WFD (2020) overall ecological status of 'Moderate' due to the biological element fish ecology, being classified as 'Moderate'.

The River Aray is a river (ID: 10224), in the Loch Fyne Coastal catchment of the Scotland river basin district. The main stem is approximately 13.4 kilometres in length, which flows south into Loch Fyne. The river is designated under the WFD, with a current WFD (2020) overall ecological status of 'Moderate' due to the biological element

fish ecology, being classified as 'Moderate'. Survey site BL-22 is near the northern end of this watercourse before the watercourse crosses under the A819. Brown trout were also identified at BL-22.

Allt Blarghour is a river (ID: 10274), in the River Awe catchment of the Scotland river basin district. The main stem is approximately 8.5 kilometres in length. The river is designated under the WFD, with a current WFD (2020) status of 'Moderate' driven by hydromorphology, classified as 'Moderate'. Survey site BL-03 is located on a tributary of this river.

Allt Beochlich is a river (ID: 10275), in the River Awe catchment of the Scotland river basin district. The main stem is approximately 7.7 kilometres in length. The river has a current WFD (2020) status of 'Moderate' due to hydromorphology - hydrology (medium/high flows), classified as 'Bad'. Survey sites BL-04 and BL-05 are both situated on the watercourse, with the Lochan sites BL-20 and BL-21 on tributary watercourse to Allt Beochlich.

Other flowing watercourses on the Site are not designated under the WFD, although feed into WFD water body catchments, and these include:

- The watercourse Allt a' Chrosaid into the River Aray, on which BL-07 is located;
- The watercourse Allt a' Gheataidh, which flows into Loch Awe, on which BL-17 is located;
- The watercourse unnamed tributary of River Aray on which BL-23 is located;
- The watercourse unnamed tributary of Achan River on which BL-24 is located;
- The watercourse unnamed tributary of Keppochan River on which BL-25 is located; and,
- The watercourse unnamed tributary of Allt na Cuile Riabhaiche on which BL-26 is located.

No previous monitoring data is available for these watercourses. However, baseline surveys have provided detail of the biological water quality within the watercourses. This is assessed as Very good/unimpacted at nine sites and Good/slightly impacted at two sites. However, the Good/slightly impacted sites are likely to be subject to natural pressures such as peat runoff and siltation, rather than anthropogenic impacts of organic pollution. However, there was evidence of recent deforestation alongside watercourses, notably BL-22 to BL-26, which may have contributed to this impact. The watercourses were also assessed as of moderate conservation value (based on the macroinvertebrate community present) at eight sites, and fairly high / high conservation value at three sites.

The flowing watercourses within the Development Site provide sustainable areas of priority habitat that form an essential component of the network of aquatic habitats, including other priority habitats, in the area of the Development. In addition, these watercourses have been assessed as providing suitable habitat for SBL priority species including brown trout and salmon.

Due to the prevalence of watercourses of this type locally, the majority of watercourses within the Development Site are assessed as of Local value.

However, due to the potential for four watercourses to provide suitable spawning habitat for salmonids, with brown trout caught at BL-01, BL-02 and BL-22, and Atlantic salmon caught at BL-01, these watercourses are assessed as of Regional value:

- Allt Criche (tributary of Erralich Water): BL-01 – Atlantic salmon presence and spawning habitat;
- Erralich Water: BL02 – brown trout spawning habitat;
- River Aray: BL-22 – brown trout spawning habitat; and
- Unnamed tributary of River Aray: BL-23 – brown trout spawning habitat.

7.8.3.3 Aquatic Habitats - Lochs and Lochans

Two lochs are present within the red line boundary of the Development, Loch Awe and Loch Fyne.

Loch Awe is designated as a WFD lake water body (ID: 100585), in the River Awe catchment of the Scotland river basin district, totalling 38.0 km^2 in area. It is one of the four largest lochs in Scotland and is the longest lake in Great Britain at 41 km. This Loch has been designated as a heavily modified water body, based on physical alterations that cannot be addressed without a significant impact on water storage for current hydroelectricity generation (Cruachan Power Station). It has a current WFD (2022) overall ecological potential of 'Moderate'. Hydrology and hydromorphology elements are classified as 'Poor', while biological parameters are overall classified as 'Moderate' driven by aquatic plants (macrophytes).

The fish barrier element for Loch Awe is classified as High status, indicating that there are no barriers to fish migration in Loch Awe. Likewise, the downstream River Awe water body is also classified as High status for the fish barrier element, indicating that there are no barriers to fish passage between the River Awe and Loch Awe. Outflow from Loch Awe is controlled by the operation of the Loch Awe Barrage, operated by Scottish and Southern Energy (SSE). The barrage consists of three gates, a fish pass, and two turbines. The operation of these structures (opening or closing gates and abstracting water) determines the outflow from Loch Awe. Operation aims to keep water levels within specific ranges for the Summer (April-November) and Winter (December-March) periods.

Loch Awe is assessed as of National value as it represents SBL Priority Habitat Oligotrophic and dystrophic lakes and is an important resource of large lochs of this size nationally.

Loch Fyne (Upper Basin) is a coastal water body (ID: 200334), in the Scotland river basin district. It is 47.3 km^2 in area. It is designated under the WFD, with a current WFD (2020) overall status of 'Good' due to Good-High classification for hydromorphological and ecological parameters. Loch Fyne is described and assessed in detail in *Chapter 8 Marine Ecology*.

Lochan Airigh is a small loch of approximately 2.4 ha; therefore, it satisfies the criteria as priority habitat: oligotrophic and dystrophic lakes of surface area larger than 1 ha. It drains into Loch Awe through a tributary of the WFD designated river Allt Beochlich. Lochan Airigh does not constitute a designated site and there are no records of protected species therein.

Lochan Breac-Iiath is another small loch of approximately 0.016 km^2; therefore, it satisfies the criteria as priority habitat: oligotrophic and dystrophic lakes of surface area larger than 1 ha. It also drains into Loch Awe through a tributary of WFD designated river Allt Beochlich, via another water body, Lochan Romach.

It is considered that both Lochans represent a receptor of Regional value as small areas of priority habitat that are an important component of this habitat resource locally.

7.8.4 Freshwater Pearl Mussel

No optimal riverbed FWPM habitat (boulder-stabilised deposits of clean sand) was observed at any of the surveyed sites. However, potential sub-optimal habitats (small patches of coarse sands and gravels) that may support small numbers of adult mussels, were noted at sites BL-01, BL-02, BL-04, BL-07, BL-22.

No evidence of FWPM (mussels, shells) was found at any site, and no historical records were found in the Development Site during the desk study. Therefore, FWPM are considered absent from water bodies within the Development Site, and this species is not considered further in the assessment.

7.8.5 Macrophytes

7.8.5.1 Flowing Water Habitats (BL-01, 02, 04, 05, 06, 07, 17, 22, 23, 25 and 26)

No rare or notable species were recorded within any of the survey sites. The sites surveyed were on small oligotrophic headwater streams and supported typical macrophyte communities characterised by an abundance of bryophytes, with higher plants limited and generally confined to the margins and riparian zone. Margins were therefore typified by emergent rushes and sedges, and plants of transitional wetland habitat.

These macrophyte communities are considered typical of upland watercourses in this part of Scotland. The steep gradients, resulting high velocity flow conditions, and unstable substrates, do not allow the development of extensive or diverse stands of macrophytes, while bryophytes, which are able to cope with these conditions, dominate. Although there was a slight increase in the diversity of vascular plants within sites with less dynamic flow conditions (such as BL- 17 and BL-22), the sites were still relatively species-poor, as is expected under these habitat conditions.

Similar macrophyte communities are likely to be very common across the wider landscape and therefore the macrophyte communities encountered are considered of Negligible conservation value.

7.8.5.2 Loch Awe (BL18 and BL19)

No rare or notable species were recorded within either of the survey sites on Loch Awe. The current WFD status for aquatic macrophytes and phytobenthos (diatoms) in Loch Awe is 'Moderate' and 'High' (Cycle 2: 2016) respectively. The communities surveyed were species poor and the species present are typical of a large oligotrophic lake.

The macrophyte community was similar at both survey sites and does not indicate that the potential intake and outfall locations are a particularly sensitive area for aquatic macrophytes. The communities present are likely to occur in numerous other locations within Loch Awe and in other similar lochs within the local area. As such, macrophyte community is of Negligible conservation value.

Both sites are exposed and subject to dynamic conditions, which combined with seasonally fluctuating water levels, limit the available niches for plants to exploit.

7.8.5.3 Standing Water (Lochan Airigh BL-20 and Lochan Breac-liath BL-21)

No rare or notable species were recorded within either lochan. The communities surveyed were species-poor and typical of upland oligotrophic lakes of this type.

The macrophyte communities present were similar to the flowing sites and supported a number of species typical of transitional habitats located between upland acid grassland and adjacent areas of standing and flowing water. Rush, reed, and moss species were recorded that grow on drainage impeded ground and the margins of water bodies. The diversity of strictly aquatic species was limited to spearwort, water milfoil, and broad-leaved pondweed. These macrophyte communities were similar at both sites and the communities present are likely to occur in numerous other locations in similar lochs within the local area. As such, macrophyte community is of Negligible conservation value. However, macrophyte cover does provide a valuable local resource for fauna, in particular aquatic macroinvertebrate community.

7.8.6 Macroinvertebrates

The majority of surveyed sites were classified as having Moderate conservation value, while three sites (BL-02, Bl-05 and BL-23) scored Fairly high conservation value under the CCI index. The survey sites of Loch Awe received a Low conservation value at BL-18, at the site of the intake, and Very High conservation value at BL-19, near the outflow of the River Awe from Loch Awe.

There were no taxa recorded that were Red Data Book RDB1 (Endangered) or RDB2 (Vulnerable), but one species of RDB3 (Rare) was found at BL-19, the diving beetle *Oreodytes davisii*. Several Locally Notable (but not RDB status) species were also present within the Development Site. The diving beetle *Agabus arcticus* was found in Lochan Airigh at BL-20. Although it is not rare and is widespread through Scotland, its distribution is limited by specific habitat requirements within montane lakes. However, in the local context, these habitats are fairly common and as such it can be expected to occur wherever there are comparable habitats. Most caddisflies identified were of common or lower conservation status with the exception of the Locally Notable caddisfly *Limnephilus bipuncatus*, which was found within the community at BL-06. A singular species of alderfly was recorded from macroinvertebrate samples and was later identified as the Locally Notable *Sialis fuliginosa* at BL-22.

Stonefly presence was extensive among most sites with two Locally Notable species present, as classified by their conservation score. The stonefly *Protonemura meyeri* was widespread among the survey sites, being found at 10 sites, only not being found on the shores of Loch Awe and at two running water sites (BL-06 and BL-24). An additional two records of the Locally Notable *Protonemura praecox* was also found on the hillside of Loch Awe at BL-05 and BL-07. Although both species are Locally Notable, both seem to be locally abundant as they are found in small stony streams, typical of those found within the Development Site.

Survey sites were also assessed to determine if they were potentially impacted by organic pollution using the WHPT and ASPT metrics. Nine of the fourteen assessed survey sites had WHPT scores that were indicative of very good, unpolluted and unimpacted status. A further three survey sites (BL-06, BL-17, BL-18) attained a good, clean but slightly impacted status and two survey sites (BL-14 and BL-19) were classified as poor, polluted or impacted. Two survey sites were Lochans. Similarly, BL-14 on Loch Fyne and BL-18 and BL-19 on Loch Awe are on the shores of Lochs so scores should be treated with caution as proportionally a small area of the Lochs has been sampled and assessed.

While several survey sites were found to support an aquatic macroinvertebrate community indicative of very good, unpolluted and unimpacted status, all species recorded were widespread and common. Therefore, the aquatic macroinvertebrate community throughout the Development Site is assessed as of Local value, and similar macroinvertebrate communities are likely to be common across the wider landscape.

7.8.7 Fish Habitat and Fish Species

7.8.7.1 Fish eDNA

Previous eDNA results from Loch Awe, in 2021, indicated the presence of three protected fish species; European eel (IUCN Critically Endangered, UKBAP and Scottish Biodiversity List (SBL) Priority Species), brown/sea trout (UKBAP and SBL Priority Species), and Atlantic salmon (Annex II Habitats Directive, UKBAP, and SBL Priority Species).

Arctic charr (SBL Priority Species; UKBAP species), pike, Lamprey, and three-spined stickleback, were not detected by eDNA survey but are known to be present in Loch Awe (SEPA survey database). Sea lamprey and river lamprey are listed in Annex II of the Habitats Directive and are UKBAP and LBAP priority species (Argyll and Bute LBAP, JNCC. 2007).

The presence of carp at site BL-18 and rainbow trout at site BL-19 are due to their introduction as sport fish and/or proximity to a nearby fish farm.

7.8.7.2 Fish Species and Assessment of Value

Due to the high gradient, steep banks, and the number of impassable barriers for migration throughout the catchment, migratory species including salmon, sea trout, sea lamprey and river lamprey are considered unlikely to be present and utilising the flowing watercourses for spawning throughout the west of the Development Site (sites BL-01, 02, 03, 04, 05, 06, 07, 17, 20 and 21).

Salmon and sea trout are also unlikely to be utilising the margins of Loch Awe or Loch Fyne to spawn as it is widely understood that migratory salmonids prefer to spawn in rivers and streams (Jonsson and Jonsson, 2011). Migratory species however will be utilising Loch Fyne as a migratory pathway from the sea to rivers such as the River Aray and Erralich Water, in which salmon and brown/sea trout have been found. Migratory species are considered not to be utilising the watercourses on the Development Site entering Loch Awe due to their steep nature, and the presence of multiple natural and artificial barriers to fish migration along the loch margins.

From eDNA surveys in 2021, Atlantic salmon and brown trout were present in Loch Awe, most likely utilising it as a migratory route between the sea and their spawning grounds. Lamprey species (brook and river) are also European protected species (listed in Annex II of the Habitats Directive) and are likely still present in Loch Awe, as indicated by SEPA eDNA surveys in 2016. As European protected species and in the case of salmon an endangered species in the UK (IUCN, 2024[1]), these species are assessed as of **National value**.

Loch Awe supports a community of priority fish species including the species Arctic char, European eel, Atlantic salmon, and brown trout, together with a wider range of more common species. Together this fish community is assessed as of **National value** due to the presence of a community including SBL priority species.

Brown trout is listed as a SBL priority species, with isolated lochs and watercourses potentially containing genetically distinct populations. The desk study highlighted a population at BL-20, on Lochan Airigh, which is likely isolated by the dam downstream on Allt Beochlich, near the survey site BL-04. Fish surveys could not be completed at BL-04 in 2023, although presence is likely as this species is found upstream in the Lochans. If brown trout are present, these would be small populations restricted due to the size of the watercourses and abundance of foodstuffs from macroinvertebrates or allochthonous input.

Limited habitat to support resident and spawning fish species was found during the baseline surveys. Only four survey sites; BL-01, BL02, BL-22, and BL-23, were identified to provide suitable spawning habitat for salmonids. During subsequent fish surveys at these sites, brown trout were caught at BL-01, BL-02 and BL-22, in addition to one specimen of Atlantic salmon caught at BL-01. Small patches (<1 m^2) of suitable salmonid spawning habitat were also noted at four more survey sites: BL-04, BL-07, BL-25, BL-26. However, it should be noted that the steep gradients and numerous natural and artificial obstacles likely prevent or restrict fish migration within these watercourses.

As such, Atlantic salmon populations in Allt Criche (tributary of Erralich Water): BL-01 are assessed as of **National value**.

Due to the prevalence of habitat for brown trout locally, and the likelihood that these represent resident rather than migratory populations due to the presence of natural and artificial barriers to migration, this species is considered as of **Local value**.

[1] IUCN (2024). Atlantic Salmon *Salmo salar* (Great Britain subpopulation) https://www.iucnredlist.org/species/213546282/213546288#geographic-range

Some survey sites could potentially support small numbers of European eel, but natural and artificial obstacles severely restrict fish movements and have reduced the chance of colonisation. Similarly, the steep gradients of the watercourses, in addition to a lack of suitable riverbed substrates (stable fine sand deposits) are unlikely to support suitable nursery habitats for lamprey ammocoetes (larvae). Although both species were not observed during fish habitat or fish surveys, their presence is likely within the wider red line boundary of the Development, due to persistent identification during eDNA surveys in Loch Awe between 2016 and 2023.

There is limited potential for resident salmonids to disperse widely through the Development Site due to the presence of multiple barriers to migration. This is especially evident at survey sites to the west of the development but within the Development Site boundary, where large artificial and natural obstacles to fish migration and passage have been observed, together with the lack of fish caught during surveys. The River Aray and Erralich Water are the only watercourses found to support notable fish populations during surveys.

Other fish species present within the Development Site are widespread and common and are assessed as of **Local value**.

7.8.8 Invasive Non-Native Species

7.8.8.1 INNS Macrophytes and Plants

Macrophyte INNS were recorded at two sampling sites, BL-14 and BL-19.

Japanese knotweed and Himalayan balsam were both identified above the strandline at BL-14 in 2019 and 2023, in long extensive stands over 10 m in width. Both are Schedule 9 species in the WCA, and therefore it is an offence to release them or otherwise cause them to grow in the wild.

A fragment of waterweed (*Elodea* sp.) was present within the strandline at BL-19 in 2019. Although it was not possible to identify the species, this genus is listed as a Schedule 9 species in the WCA in the case of Canadian pondweed *Elodea canadensis*, and as a Species of Special Concern in Scotland in the case of Nuttall's waterweed *Elodea nuttallii* (under EU Regulation (1143/2014) on the prevention and management of the introduction and spread of invasive alien species).

Nuttall's waterweed, Canadian pondweed, and New Zealand pigmyweed have been previously recorded within Loch Awe. As sampling surveys were limited to shallower water, there is the potential for these species to occur in close proximity to the area of the Development. Their absence from the survey data in 2023 should not be interpreted as absence from Loch Awe.

7.8.8.2 Non-native Macroinvertebrates

Macroinvertebrate non-native species were present at three sampling sites. The invasive amphipod *Crangonyx pseudogracilis* was present at survey location BL-19 (Loch Awe). This is the only surveyed site in which this species was recorded, and only four individuals were found, indicating low species density. It was not present in the other Loch Awe sampling location (BL-18) or in the smaller water bodies (BL-05, BL-06, BL-07 and BL-17) surveyed nearby.

The New Zealand mud snail was present at BL-06 and BL-17, outfall tributaries to Loch Awe on the western side of the Development.

C. pseudogracilis and the New Zealand mud snail are not listed in Schedule 9 of WCA, and therefore there is no legislative restriction on their spread, or requirement for their control. However, SEPA and NatureScot monitor data on the distribution of these species to inform WFD classification, and therefore appropriate precautions should be implemented to prevent their spread.

The presence of INNS presents potential risks to native species and habitats, and therefore the assessment of impacts will be in relation to those species and habitats rather than to the INNS themselves.

7.8.9 Future Baseline

7.8.9.1 Baseline at Time of Construction

Construction of the Development is expected to start in 2027 and is expected to last up to 7 years, including the pre-construction works to complete. As stated below, no major land use changes are expected within the Development Site prior to commencement of construction. No meaningful changes to the environment within the Development Site are therefore likely before construction starts.

Changes in the distribution of freshwater aquatic species before the commencement of construction are considered unlikely due to the stability of aquatic habitats, and the existence of natural and artificial barriers to fish migration, which limit fish communities present under current circumstances. Any such changes are very likely to be within the range of normal inter-annual variation in the distribution and abundance of species populations.

It is therefore expected that the current baseline conditions will remain largely unchanged by the time of construction of the Development.

7.8.9.2 Baseline in the Absence of the Development

In the absence of the Development, the Development Site is likely to continue to be used for sheep grazing, and no major change in the baseline conditions with respect of freshwater aquatic ecology are expected. No major changes to baseline conditions are expected around the town of Inveraray, at the location of the Marine Facility, Construction Compounds, and Access Tracks.

7.8.10 Importance of Ecological Features

The assessed importance of those ecological features identified in the baseline conditions, and which have not been screened out above, is set out in *Table 7.6 Importance of Ecological Features*, below, together with rationale for the assessment. Ecological importance has been assessed considering geographic scale (as per CIEEM (2016) guidelines) and is used in this chapter as a surrogate for 'sensitivity' as defined in Chapter 4: Approach to Environmental Impact Assessment. The approach to valuing ecological features is described in detail in Appendix 6.1: Method for Assessment of Ecological Impacts.

Table 7-6 Importance of Ecological Features

Ecological Feature	Importance	Rationale
Habitats		
Loch Awe: SBL Oligotrophic and dystrophic lakes	High (National)	Loch Awe is assessed as of National value as it represents SBL Priority Habitat Oligotrophic and dystrophic lakes and is an important resource of large lochs of this size nationally.
Lochan Airigh and Lochan Breac-Iiath: SBL oligotrophic and dystrophic lakes of surface area larger than 1 ha	Medium (Regional)	Both Lochans represent a receptor of Regional value as small areas of SBL priority habitat: oligotrophic and dystrophic lakes of surface area larger than 1 ha, that are an important component of this habitat resource regionally.
Flowing watercourses: SBL Rivers: Allt Criche (tributary of Erralich Water): BL-01 Erralich Water: BL02 River Aray: BL-22 Unnamed tributary of River Aray: BL-23	Medium (Regional)	Sustainable areas of SBL priority habitat: Rivers that form an essential component of the network of aquatic habitats, including other priority habitats, in the Development Site. Provide suitable habitat, including spawning habitat, for the SBL species Atlantic salmon and brown trout.
Flowing watercourses: SBL Rivers: All other watercourses and water bodies within the Site	Low (Local)	Sustainable areas of SBL priority habitat: Rivers that form an essential component of the network of aquatic habitats, including other priority habitats, in the Development Site.
Species		
Aquatic macrophyte assemblage: All water bodies	Negligible	The communities present are likely to occur in numerous other locations and in other similar lochs and water bodies within the local area. However, macrophyte cover does provide a valuable local resource for fauna, in particular aquatic macroinvertebrate community.
Aquatic macroinvertebrates	Low (Local)	While several sites were found to support an aquatic macroinvertebrate community indicative of very good, unpolluted and unimpacted status, all species recorded were widespread and common. Similar macroinvertebrate communities are likely to be common across the wider landscape.
Atlantic salmon, brown/sea trout, arctic char, European eel, and lamprey species (Loch Awe)	High (National)	Loch Awe is a migratory route between the sea and spawning grounds, although these do not include watercourses within the Development red line boundary. Salmon and lamprey species are European protected species and are present in Loch Awe. Loch Awe supports a fish community of several notable species, including SBL species.

Ecological Feature	Importance	Rationale
Atlantic salmon in Allt Criche (tributary of Erralich Water): BL-01	High (National)	Salmon is a European protected species listed in Annex II of the Habitats Directive, and an endangered species in the UK (IUCN, 2024), as well as a SBL species. Salmon was caught at BL-01 and suitable salmonid spawning habitat was identified.
Brown/sea trout in four watercourses: Allt Criche (tributary of Erralich Water): BL-01 Erralich Water: BL02 River Aray: BL-22 Unnamed tributary of River Aray: BL-23	Low (Local)	Brown/sea trout is a SBL priority species. BL-01, BL02, BL-22, and BL-23, were identified to provide suitable spawning habitat for salmonids. During subsequent fish surveys at these sites, brown trout were caught at BL-01, BL-02 and BL-22. Similar habitat is abundant locally, and the habitat resource within the red line boundary is considered of Local significance given natural and artificial barriers to fish migration limit the dispersal of trout locally.
Other fish species (All water bodies)	Low (Local)	Water bodies support a broader community of common and widespread fish species.
INNS	N/A	INNS represent a threat to native species and habitats, and it is an offence to cause their spread during construction or operation of the Development. Therefore, mitigation will be required to ensure biosecurity and prevent the spread of INNS during construction and operation and is included within *Appendix 3.1 Outline CEMP (Volume 5 Appendices*). However, with the Development being a 'closed-loop' system, there is a low risk of the spread of INNS to adjacent catchments during operation.

7.9 Assessment of Effects

Relevant ecological features are those that are considered to be 'important' and have the potential to be affected by the Development (CIEEM, 2016). In view of the baseline data obtained through desk study and field survey, the following features have been excluded from further assessment because they have been found to be absent from the Development Site or it is clear that no effect from the Development is anticipated:

- **Glen Etive and Glen Fyne SPA** – There is no hydrological connectivity between the Development and this SAC, and therefore it is not considered further in the Aquatic Ecology assessment – refer to Chapter 6 Terrestrial Ecology and Chapter 9 Ornithology for the assessment of impacts in relation to this site.
- **Glen Shira SAC –** There is no hydrological connectivity between the Development and this SAC, and therefore it is not considered further in the Aquatic Ecology assessment – refer to Chapter 6 Terrestrial Ecology for the assessment of impacts in relation to this site.
- **Loch Etive Woods SAC –** There is no hydrological connectivity between the Development and this SAC, and therefore it is not considered further in the Aquatic Ecology assessment – refer to Chapter 6 Terrestrial Ecology for the assessment of impacts in relation to this site.
- Sites with non-statutory designation for nature conservation – there are no such sites within 2 km of the Development.
- **Freshwater Pearl Mussel –** No evidence of FWPM (mussels, shells) was found at any site, and no historical records were found in the Development area during the desk study. Therefore, FWPM are considered absent from water bodies within the Development Site, and this species is not considered further in the assessment.
    - This assessment should be read in conjunction with Chapter 11: Water Environment, which presents the assessment of impacts to surface water and groundwater receptors. Therefore, there is overlap with the assessment of impacts on freshwater ecology presented in this chapter.
    - The impact assessment for Loch Fyne and its shoreline is presented in *Chapter 8: Marine Ecology*, and impacts in this location are not considered further in this chapter.

7.9.1 Construction Effects

Considering the above, the potential effects during construction of the Development on aquatic ecological features that require impact assessment are considered to comprise the following:

- Loss of habitat which supports freshwater aquatic species as a result of the construction of infrastructure associated with the Development;

  - Loss of Lochan Airigh and part of the upstream catchment of Allt Beochlich / Buinne Dhubh as a result of construction of the Headpond and Embankments (refer to *Chapter 11: Water Environment* for further details, and also operational effects below).

- Disturbance to and/or displacement of species during construction, operation and/or decommissioning;
- Impacts resulting from the construction of the cofferdam on the shoreline of Loch Awe at the inlet/outlet location, including piling, de-watering and substrate removal;
  - Cofferdam (during Construction) – a Cofferdam will be installed in Loch Awe, which is a water-tight, temporary structure that will encircle the area required for the Tailpond works. The area within the Cofferdam will be pumped dry to facilitate the construction of the Tailpond inlet / outlet Structure.
- Effects of construction of the temporary Marine Facility and delivery of abnormal indivisible loads (AILs) by barge;);
- Effects as a result of watercourse crossings for temporary Access Tracks and temporary site compounds, including culverting of watercourses;
- Effects as a result of construction of the Headpond and Headpond Embankments, including land take and transport of excavated material;
- Effects due to the transport of excavated tunnel material to Headpond via dump trucks, and spoil management of material from tunnelling works;
- Effects as a result of temporary site drainage, including SUDs, settlement ponds, temporary ditches and other drainage features;
- Effects of general plant movement throughout the Development Site;
- Potential effects resulting from the spread of INNS through the Development Site, notably from Loch Awe during de-watering and substrate excavation, and effects of transporting materials onto or away from the Development Site and the potential introduction of INNS.

Table 7.7 Locations of Proposed and Potential Impacts to Watercourses and Water Bodies, below provides a summary of all proposed impacts to watercourses, whether from proposed new crossing points (culverts or bridges), potential upgrades to existing Access Tracks, or sections of watercourses lost due to construction of the Headpond and Embankments.

Table 7.7 Locations of Proposed and Potential Impacts to Watercourses and Water Bodies

Impact to Water Body	Watercourse Name	Grid Reference
Three Bridges Access Track, to be constructed for Blarghour Wind Farm - construction impacts are excluded from the assessment, but operational impacts for all watercourse crossings are considered.	Allt Crìche (Trib of Erallich Water)	NN 07257 12590
	Unnamed Trib of Erallich Water	NN 07367 12353
	Unnamed Trib of Erallich Water	NN 07357 12147
	Unnamed Trib of Erallich Water	NN 07585 12018
	Allt Crìche (Trib of Erallich Water)	NN 08740 12424
	Unnamed Trib of Erallich Water	NN 05749 12006
	Unnamed Trib of Erallich Water	NN 06046 12067
	Unnamed Trib of Alltan Airigh Mhic Choinnich	NN 05096 12370
	Unnamed Trib of Alltan Airigh Mhic Choinnich	NN 04950 12494
	Unnamed Trib of Alltan Airigh Mhic Choinnich	NN 04744 12657
	Unnamed Trib of Allt Blarghour	NN 04042 13011
	Unnamed Trib of Allt Blarghour	NN 04001 13273
	Unnamed Trib of Allt Blarghour	NN 03945 13339
	Unnamed trib of Allt na h-Airigh	NN 03637 13580
	Unnamed trib of Allt na h-Airigh	NN 03595 13701
	Unnamed trib of Allt na h-Airigh	NN 03602 13825
	Unnamed trib of Allt na h-Airigh	NN 03634 14001
	Unnamed trib of Allt na h-Airigh	NN 03800 14243

Impact to Water Body	Watercourse Name	Grid Reference
	Pond/Lake	NN 03893 14434
	Bog area	NN 04128 14777
	Bog Area	NN 04154 14939
Existing Access Tracks to be upgraded	Unnamed Trib of Allt Beochlich	NN 02064 15280
	Unnamed Trib of Allt Beochlich	NN 01993 15371
	Unnamed Trib of Allt Beochlich	NN 01541 15543
	Unnamed water course into Loch Awe	NN 01186 15650
	Allt Beochlich	NN 00577 15361
	Unnamed water course into Loch Awe	NN 00945 15652
	Allt a' Chrosaid	NN 01135 16078
	Allt a' Gheataidh	NN 01148 16320
Upper Sonachan Access Track to be constructed / upgraded – main Access Track for the Development from the north-east	Unnamed Trib of Allt na Cùile Riabhaiche	NN 06190 18709
	Unnamed Trib of Archan River	NN 07611 19570
	Unnamed Trib of Allt na Cùile Riabhaiche	NN 05432 18078
	Unnamed Trib of Allt na Cùile Riabhaiche	NN 05507 18079
	Unnamed Trib of Allt na Cùile Riabhaiche	NN 05631 18096
	Unnamed Trib of Allt na Cùile Riabhaiche	NN 05691 18183
	Unnamed Trib of Keppochan River	NN 06750 19328
	Unnamed Trib of Keppochan River	NN 06878 19345
	Unnamed Trib of Archan River	NN 08107 20069
	Unnamed Trib of Archan River	NN 08176 19937
	Unnamed Trib of Archan River	NN 09024 20391
	Allt na Cùile Riabhaiche	NN 05037 17944
Proposed Culvert / Bridge (new infrastructure for the Development)	Unnamed trib of Allt Beochlich	NN 02614 15966
	Unnamed trib of Allt Beochlich	NN 02997 15896
	Buinne Dhubh	NN 03602 15972
	Unnamed trib of Buinne Dhubh	NN 03545 15974
	Unnamed trib of Buinne Dhubh	NN 03769 16842
	No symbol for culvert - floating transition	NN 04012 16707
	No symbol for culvert - floating transition	NN 04581 15248
	Allt Mòr	NN 05393 15920
	Buinne Dhubh	NN 05344 15842
	Unnamed trib of Buinne Dhubh	NN 05108 15574
	Unnamed trib of Buinne Dhubh	NN 05499 16379
	Unnamed trib of Buinne Dhubh	NN 05302 16578
	Unnamed trib of Buinne Dhubh	NN 05256 17064
	Unnamed trib of Buinne Dhubh	NN 05252 17181
	Buinne Dhubh	NN 03744 15903
	Allt Mòr	NN 04162 15130
	Allt Mòr	NN 04316 15143
	Allt na Fainge	NN 01143 16496
	Trib of Cròm Allt	NN 08374 07473

Impact to Water Body	Watercourse Name	Grid Reference
Water body and watercourses lost for Headpond and Embankments	Lochan Airigh and 12 further tributaries of the Allt Beochlich / Buinne Dhubh catchment	NN 04319 16454 (Lochan Airigh)

7.9.2 Operational Effects

The potential effects during operation of the Development on aquatic ecological features that require impact assessment are considered to comprise the following:

- Effects on water levels in Loch Awe due to regular generation cycles with water pumped up to the Headpond then returned to the loch. Corresponding effects on the Loch Awe Barrage, associated fish lift, and fish passage, due to fluctuating water levels.
- Lasting effects of the inlet / outlet structure on the Loch Awe shoreline, including effects in relation to loch priority habitat, fish (e.g., entrainment, impingement, and distraction from migratory routes), and INNS;
- Effects as a result of watercourse crossings for permanent Access Tracks, including permanent culverting of watercourses;
- Effects as a result of permanent Construction Compounds, including land take and permanent culverting of watercourses;
- Effects due to utilities and diversions, including public road diversion, core paths, and new watercourse crossing points;
- Permanent effects as a result of the Headpond and Embankments, including land take and drainage, and impacts to the hydrological regime of downstream watercourses;
    - The construction of the Headpond will result in the loss of a proportion of the Allt Beochlich / Buinne Dhubh hydrological catchment (refer to Chapter 11 Water Environment for further detail).
    - Loss of a large proportion of the catchment may result in significant changes to the hydrology and the flow regime of the Allt Beochlich / Buinne Dhubh, in the absence of mitigation such as compensation flow into the downstream catchment (refer to Chapter 11 Water Environment for further detail).
    - Reduced flows may correspond to a drying up of parts of the bed and reduced aquatic habitat along the river corridor.
- Effects resulting from permanent site drainage, including SUDs, settlement ponds, temporary ditches, and other drainage features;
- Effects due to the spread of INNS through the Development Site as a result of operation of the Development, for example from Loch Awe to the Headpond and connected catchment, especially if compensation flows are required to downstream watercourses.

7.9.3 Assessment of Construction Effects

7.9.3.1 Cofferdam Construction (Loch Awe)

There will be temporary disturbance to the shoreline and margins of Loch Awe, with the temporary cofferdam extending out into the loch. The Cofferdam, which is a water-tight, temporary structure that will encircle the area required for the Tailpond works. The area within the Cofferdam will be pumped dry to facilitate the construction of the Tailpond inlet / outlet Structure.

The effects on habitats within Loch Awe (High value) will be localised to the relatively small area of the cofferdam (< 0.05% of the total loch area). These effects will consist of disruption and removal of substrate, including dredging after removal of the cofferdam, and de-watering of this area. Due to the small area to be temporarily impacted, this is considered to represent a Low magnitude impact, resulting in a **temporary Moderate adverse effect**.

The migratory route of salmon and other migratory species through Loch Awe is not known, but it is likely that these species will be present in the vicinity of the cofferdam during their migration: late spring and early summer for salmon smolt migration; late autumn or early winter for adult migration.

Potential impacts on the assemblage of fish in Loch Awe including Atlantic salmon, brown/sea trout, arctic char, European eel, and lamprey species (High value receptor) through the cofferdam construction include:

- Direct mortality or physical injury through construction, piling and de-watering activities;
- Physical injury as a result of piling noise – although the effects of piling noise vary with size of piles and blow energy, under the most likely scenario (vibro-driven piles, so percussive noise will be kept to a minimum), auditory injury to salmon is calculated to occur out to approximately 20 m from the noise source, a strong avoidance reaction is calculated to occur out to 330 m and a significant avoidance behaviour reaction is calculated to occur out to 2.1 km (Mason and Collett, 2011);
- The impacts of piling noise on other fish species remains largely unstudied (Hawkins and Popper, 2012); however, the effects are likely to be similar to those for salmon described above.
- Avoidance reaction by salmon, potentially disrupting the migratory pathway.

In the absence of mitigation, the potential effects on this fish assemblage in Loch Awe through construction of the cofferdam are considered of Medium magnitude due to the disruption of migratory behaviour and potential mortality and physical injury to fish, including Atlantic salmon. This would result in a **temporary Moderate adverse effect**.

Effects on aquatic macrophytes (Negligible value), and macroinvertebrates and other fish species (Low value) through the cofferdam construction are considered Negligible, resulting in a **Negligible effect** that is effectively a 'no change' situation and not significant.

Effects due to the potential spread of INNS through cofferdam construction are considered in the relevant sections below.

7.9.3.2 Watercourse Crossings for Temporary Access Tracks and Temporary Site Compounds, Including Diversion and Culverting of Watercourses

Watercourse crossings will be required for temporary Access Tracks to provide access to Construction Compounds and the Headpond and Embankments, and for the compounds themselves (refer to *Table 7.7 Locations of Proposed and Potential Impacts to Watercourses and Water Bodies*). Where possible, existing crossing points will be utilised; however, these may need to be upgraded by the use of closed-pipe (culvert) crossings or bottomless arch watercourse crossings.

Watercourses throughout the Development Site are assessed as of Medium value (Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, Unnamed tributary of River Aray: BL-23) or otherwise Low value. Where diversions are required or culverts for temporary watercourse crossings it is not clear whether these will be removed upon completion of the temporary works, and therefore these will be assessed as permanent features. This is considered a Medium magnitude permanent **Moderate adverse effect** due to the loss or alteration of sections of watercourses.

Atlantic salmon are present in Allt Criche (tributary of Erralich Water): BL-01, and brown/sea trout are present in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, Unnamed tributary of River Aray: BL-23. Due to the potential spawning habitat present in these watercourses, culverting of these watercourses may have an impact on fish passage and spawning habitat for species of up to High importance (salmon). Therefore, this is assessed as a Medium magnitude permanent **Moderate adverse effect**.

The effects on other watercourses of Low value of permanent or temporary watercourse crossings is assessed as a Medium magnitude permanent **Minor adverse effect.**

Effects on aquatic macrophytes (Negligible), macroinvertebrates (Low), and other fish (Low value) through watercourse crossings are considered of Low magnitude, resulting in a **Negligible effect** that is effectively a 'no change' situation and not significant.

7.9.3.3 Construction of the Headpond and Headpond Embankments, Including Land Take and Transport of Excavated Material

Construction of the Headpond and Embankments will result in the loss of a proportion of the Allt Beochlich / Buinne Dhubh hydrological catchment (refer to *Chapter 11 Water Environment* for further detail). This impact is assessed in detail in the Water Environment chapter. The loss of these watercourses (refer to *Table 7.7 Locations of Proposed and Potential Impacts to Watercourses and Water Bodies*) of Low value will not result in the loss of habitat for notable aquatic species; fish are largely excluded from this catchment due to the presence of the existing hydro-power plant downstream, the presence of natural and artificial barriers to migration downstream, and their generally steep and inaccessible nature. Therefore, the impact on these watercourses and the aquatic species therein is assessed as a Low magnitude **Negligible effect**.

The primary potential indirect effects due to construction of the Headpond and Embankments are impacts to water quality in watercourses and water bodies that will receive temporary and permanent drainage from the Embankment areas. The effects of permanent drainage from the Embankments are assessed in the Operational Effects section that follows.

Lochan Airigh will be lost due to construction of the Headpond. This lochan is of Medium importance, and its loss is considered to represent a Medium magnitude impact due to the presence of multiple similar water bodies in the surrounding area. Therefore, in the absence of mitigation, this is assessed as a **Moderate adverse effect**.

There is the potential for Loch Awe (High value) and smaller water bodies within the construction area to receive runoff from the Headpond construction area and associated impacts on water quality. In the absence of mitigation, the assessment of impacts for these water bodies is as follows:

- Loch Awe (High value) – this water body is currently at Moderate WFD status. In terms of aquatic ecology, impacts to species are assessed below, and impacts to water quality and hydrology are assessed in *Chapter 11: Water Environment*. Therefore, the potential impacts to species within Loch Awe are assessed as Low magnitude and represent a **temporary Moderate adverse effect**, in the absence of mitigation.
- Lochan Breac-liath (Medium value) is likewise assessed in *Chapter 11: Water Environment*. The potential impacts to species within this Lochan are assessed as Low magnitude and represent a **temporary Minor adverse effect**, in the absence of mitigation.
- Smaller water bodies (Low value) within the Site are likely to receive only minimal quantities of runoff due to the surrounding topography. Therefore, the potential impacts to species within these water bodies is assessed as a Low magnitude and represent a **temporary Negligible effect**.

There is the potential for small watercourses (Low value) to receive runoff from the area of Headpond and Embankments construction and associated impacts on water quality. Impacts to these watercourses is assessed in *Chapter 11: Water Environment*. Effects to aquatic ecology in these watercourses due to water quality impacts are assessed as of Low magnitude and represent a **temporary negligible effect**.

Effects on fish species including brown trout, aquatic macrophytes, and macroinvertebrates through the Headpond and Embankments construction are considered to be Low, resulting in a **Negligible effect** that is effectively a 'no change' situation.

7.9.3.4 Transport of Excavated Tunnel Material to Headpond via Dump Truck, and Spoil Management of Material from Tunnelling Works

Material will be excavated from tunnels and from the cofferdam area in Loch Awe.

The primary potential impact of substrate excavation from Loch Awe is the translocation of INNS, which is assessed in a later section.

Materials excavated from the tunnels will be transported throughout the Development Site and stockpiled in pre-agreed locations. Therefore, the primary potential impacts on aquatic habitats associated with spoil transport and management are the spread and runoff of sediment and resulting reductions in water quality.

The effects of sediment input into watercourses and water bodies on each receptor is assessed in the points that follow:

- Loch Awe – the assessment of impacts to Loch Awe from runoff from spoil management areas is the same as described above for Headpond construction: Low magnitude **temporary Moderate adverse effect.**
- There is the potential for Loch Awe to be impacted due to substrate and sediment removal and mobilisation, together with runoff from stockpiled material on the loch shore. Due to the localised area of works on the loch shore and in the context of Loch Awe as a whole, this is considered to constitute a Low magnitude temporary **Moderate adverse effect**.
- Impacts to other watercourses and water bodies due to the transport of excavated tunnel material are the same as those described above for Headpond construction.

The fish community in Loch Awe (Atlantic salmon, brown/sea trout, arctic char, European eel, and lamprey species) (High value) is considered unlikely to be adversely affected by sediment runoff due to the localised nature of the works on the loch shoreline in the context of the loch as a whole. Therefore, this is assessed as Negligible magnitude and represents a **temporary Minor adverse effect**.

Other fish species in Loch Awe and other watercourses in this area of construction (Low value) will also be unlikely be adversely affected by sediment runoff due to the localised nature of the works on the loch shoreline in the context of the loch as a whole. Therefore, this is assessed as a **Negligible effect**.

Atlantic salmon are present in Allt Criche (tributary of Erralich Water): BL-01, and brown/sea trout are present in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23. Due to the potential spawning habitat present in these watercourses, impacts to water quality may have an impact on spawning success for species of up to High importance (salmon). Therefore, this is assessed as a Medium magnitude temporary **Moderate adverse effect**.

Macrophytes, macroinvertebrates, and fish species (other than salmon and brown trout) would be subject to similar reductions in water quality and reduced oxygen levels, and therefore impacts to these receptors is assessed as a Low magnitude **temporary Negligible effect**.

7.9.3.5 Temporary Site Drainage, Including SUDs, Settlement Ponds, Temporary Ditches and Other Drainage Features

It is anticipated that the choice of locations for these components will avoid direct impacts to aquatic receptors, and therefore **no effects** are envisaged.

Potential effects of runoff and siltation through these components are assessed in the preceding section for effects due to spoil transport and management, including in the event that temporary site drainage features fail or are ineffective, and thus result in the introduction of runoff or sediment into aquatic habitats.

7.9.3.6 General Plant Movement Throughout the Development Site

Plant movement through the Development Site has the potential to result in the spread of sediment through the Development Site, or introduce pollutants such as oil or diesel into aquatic habitats. Such effects are assessed in the section above on effects due to spoil transport and management.

Plant movement also has the potential to spread invasive species through the Development Site, and this has been assessed in the section on INNS below.

7.9.3.7 Potential Spread or Introduction of INNS

There is the potential for INNS to be spread through or introduced to the Development Site during construction by:

- Cofferdam construction, including de-watering of Loch Awe;
- Stockpiling of spoil materials;
- Transport of spoil materials throughout the Development Site;
- General plant and vehicle movement onto and through the Development Site;
- Transfer of INNS on Personal Protective Equipment (PPE), site clothing and other materials and equipment;
- Transport of materials by barge on Loch Fyne, where required.

The effects of the introduction of INNS on different receptors are summarised in the points below:

Loch Awe is currently inhabited by several INNS, as established in the baseline assessment. Equipment and materials will be transported to Loch Awe and to the Development Site by barge via Loch Fyne and road routes. Therefore, the potential for the spread of INNS from elsewhere on the Development Site or off-site to Loch Awe as a result of construction activity is considered low, and this is assessed as a **Negligible effect**.

Other watercourses and water bodies throughout the Development Site have been predominantly shown through the baseline assessments as having a likely absence of INNS (refer also to *Chapter 6: Terrestrial Ecology*). Therefore, the introduction of INNS, in the absence of mitigation, would cause a potential deterioration in the ecological quality of these water bodies, and is considered to constitute:

- For Medium value watercourses Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02 River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, and water bodies of Medium value (Lochan Airigh and Lochan Breac-Iiath), a high magnitude **permanent Moderate adverse effect**.
- For all other watercourses (Low value), a high magnitude **permanent Moderate adverse effect**.

The fish assemblage in Loch Awe (High value) co-exist with the INNS that are already present in that waterbody. However, there are other INNS that have the potential to adversely affect the salmon population, namely the salmon fluke, which is currently absent from this country. There is a pathway for the introduction of this and other INNS into

Loch Awe, namely construction routes from Loch Fyne, therefore it is considered that the potential for the Development to increase the risk of introduction is low. This is assessed as a low magnitude **Moderate adverse effect**, in the absence of mitigation.

Atlantic salmon (High value) and Brown trout (Low value) in watercourses, namely Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, would potentially be impacted by the introduction of INNS, for example by choking of the watercourse with invasive plant species. Therefore, the potential introduction of INNS is assessed as a high magnitude **Major adverse effect in the case of salmon, and a Moderate adverse effect on brown trout**.

Macrophytes, macroinvertebrates and fish species (other than brown trout) are also likely to be adversely affected by the potential introduction of INNS, through factors such as inter-species competition and displacement. Therefore, this is assessed as a high magnitude impact of up to a **Moderate adverse effect**.

7.9.4 Assessment of Operational Effects

7.9.4.1 Effects on Water Levels in Loch Awe

Due to regular generation cycles with water pumped up to the Headpond then returned to the loch, water levels in Loch Awe will fluctuate to a greater extent than in the baseline scenario, and with greater regularity. There will be resulting effects on the Loch Awe Barrage, associated fish lift, and fish passage, due to fluctuating water levels.

Outflow from Loch Awe is controlled by the operation of the Loch Awe Barrage, operated by Scottish and Southern Energy (SSE). The barrage consists of three gates, a fish pass, and two turbines. The operation of these structures (opening or closing gates and abstracting water) determines the outflow from Loch Awe into the River Awe. Operation aims to keep water levels within specific ranges for the Summer (April-November) and Winter (December-March) periods to regulate water levels in Loch Awe.

As described in the baseline, both Loch Awe and the River Awe are classified in the WFD assessment as ‘High Status’ for the ‘fish barrier’ element, indicating that there are currently no constraints to the migration of fish in and out of the loch. Although no information on the operation or effectiveness of the fish lift is available, it is assumed therefore that it operates successfully in allowing migratory fish to navigate the barrage, or otherwise fish are able to navigate the barrage at high flows. The Loch Awe Barrage operates with a compensation flow regime designed to ensure fish passage is maintained.

Publicly available data from the fish counter on the Loch Awe barrage fish lift show that prior to 1985 (the fish lift and counter were installed in 1964), fish numbers (assumed to constitute Atlantic salmon and brown/sea trout) were stable at approximately 3000 fish annually. Numbers declined to approximately 2000 per annum from 1990 onwards. This is likely due to general declines in salmon populations through that time, with the UK population of salmon now being classified as Endangered by IUCN (2024).

The predicted rate of change of loch level during operation is at the extremes of recorded level changes, as predicted by hydrological modelling for the Development. The winter target minimum operating level for the Loch Awe Barrage is 36.96 mAOD. This corresponds to the 95% percentile exceedance probability for the entire flow series. It is unknown at which levels the fish passes of the Loch Awe Barrage are no longer able to operate. A prolonged period of low loch levels in July 2021 took the level down to 35.52 mAOD. Other low periods in 2013, 2014 and 2019 had minimum levels of approximately 35.8 mAOD.

It is noted, however, that a generation cycle will not result in water levels in Loch Awe being reduced for a significant amount of time, as water will be returned to the loch during generation. It is also the case that a full generation cycle may not run, and a proportion of water may be retained in the Headpond as loch levels recharge naturally. Therefore, the levels detailed above are a worst-case scenario in the absence of mitigation measures to be detailed later.

Hydrological effects on Loch Awe are assessed in detail in *Chapter 11: Water Environment*. However, due to the existing natural fluctuation of the loch and the uniformity of aquatic habitats in the margins, this is assessed as a Low magnitude effect on Loch Awe habitats and in the absence of mitigation represents a **Moderate adverse effect**.

Fluctuating water levels in Loch Awe have the potential to impact upon fish passage at the Loch Awe barrage and associated fish lift, and therefore impact on the migratory success of fish species in the loch and River Awe, including Atlantic salmon, brown/sea trout, European eel, and lamprey species. Reduced water levels could also affect the migratory success of fish to upstream catchments from Loch Awe, although this is considered a reduced risk in autumn and winter when loch levels are likely to be higher. This is not considered likely to impact Arctic char,

which are a deep-water species. In the absence of mitigation, the impact on this fish assemblage in Loch Awe is assessed as Medium magnitude and represents a **Moderate adverse effect**.

The effects on aquatic macrophytes, macroinvertebrates, and other fish species in Loch Awe, including Arctic char, of fluctuating water levels is considered a **Negligible effect**.

7.9.4.2 Inlet / Outlet Structure on Loch Awe Shoreline, Including Screen During Operation

The inlet / outlet structure will occupy a relatively small area of the Loch Awe shoreline and during operation it is anticipated that it will operate relatively maintenance-free, with the exception of regular maintenance checks and screen cleaning. It is also envisaged that the substrate on the bed of Loch Awe will be reinstated to pre-works condition. Therefore, the effects of this structure on Loch Awe during operation are considered Negligible and represent a **Minor adverse effect**.

Fish species of High value in Loch Awe (Atlantic salmon, brown/sea trout, arctic char, European eel, and lamprey species) will continue to utilise the loch, including as a migratory pathway, and may therefore pass the inlet / outlet structure. Screening requirements will be finalised through discussion with SEPA / Nature Scot for the CAR Licence to prevent the entrapment and/or impingement of fish. It is predicted that the maximum inlet velocity will be 0.15 m/s. More information on development operation (e.g., turbine design & associated pressure changes), and liaison with SEPA would be required should deviation from best-practice screening be required.

The maximum sustained swimming speed of salmon has been shown to be 0.91 m/s (0.45 m body length) and 0.54 m/s (0.15 m body length) (Tang and Wardle, 1992), with burst swimming speeds much higher than this.

The sustained / burst swimming speed of European eel has been shown to be 0.09 m/s / 1.01 m/s (0.10 m body length) and 0.58 m/s / 1.26 m/s (0.70 m body length) (Sheridan et al, 2011).

The swimming speed of lamprey ammocoetes (juvenile lamprey) is no more than 0.45 m/s, and more usually between 0.10 and 0.30 m/s (Maitland, 2003). These swimming speeds seem to apply when the lamprey are disturbed or are seeking out food resources, and most larval movement results from passive downstream migration.

Lamprey ammocoetes will be among the weaker swimming fish species in Loch Awe, and therefore the majority of fish in the loch will swim sufficiently fast to avoid impingement at the inlet screen. Sustained and burst swimming speeds of salmon and eel certainly indicate that they will be able to escape the inlet screen. It is not clear for how long the inlet will operate during a pumping cycle, but it is anticipated that one cycle will operate a maximum of once per day.

Given the sporadic operation of the inlet and the evidence that even the weaker swimming fish species swim sufficiently fast to escape the inlet velocity, together with the very small size of the inlet structure in the context of the size of Loch Awe, the potential impact of the inlet / outlet on the High value fish assemblage in the loch is assessed as of Negligible magnitude and represents a **Minor adverse effect**.

The inlet / outlet may present a rheotactic (the tendency of fish to face into an oncoming current) distraction by attracting migratory fish such as salmon from their migration path (O'Keeffe & Turnpenny, 2005). The main risk of such distraction is fish entering the inlet / outlet and becoming trapped. This will not be the case for this Development, as the inlet / outlet Screen will be completely impassable to such migratory fish. The inlet / outlet will not discharge constantly, and the sporadic nature of the discharge will ensure that fish are not constantly distracted and are able to continue on their migration. In addition, Loch Awe is approximately 1.2 km wide at the location of the inlet / outlet and therefore provides ample migratory pathway for fish to avoid the inlet / outlet structure. Therefore, the effect of distraction by the inlet / outlet on High value migratory fish species in Loch Awe is considered Negligible and constitutes a **Minor adverse effect** in the context of this EIA.

Other fish species in Loch Awe are, as above, considered able to escape the inlet velocity and therefore avoid entrapment and impingement effects. Therefore, the effect of the inlet / outlet on other fish species of Low value is assessed as **Negligible**.

Macrophytes and macroinvertebrates in Loch Awe will not be subject to any adverse effects through the operation of the inlet / outlet. A small number of macroinvertebrates may be drawn into the inlet, but in the context of their populations in Loch Awe as a whole, this is considered to constitute a **Negligible effect**.

INNS are known to be present within Loch Awe, including *Elodea* sp. (Nuttall's waterweed and/or Canadian pondweed) identified at the inlet / outlet location. While fragments of *Elodea* sp. may be drawn into the inlet, the closed-loop system has been designed to prevent cross-catchment contamination, although such INNS may

become established in the Headpond, resulting in on-going maintenance requirements to prevent clogging of infrastructure.

The effects of the transfer of INNS through construction activities have been assessed above, and these would result in INNS becoming permanently established in the water bodies they were transferred to. However, the transfer of INNS into the Headpond would introduce a new pathway for the transfer of INNS, i.e. from the Headpond to nearby water bodies and watercourses. The effects of the transfer of INNS to those receptors from the Headpond would be comparable with the effects assessed above, and therefore the impact assessment will not be repeated here.

7.9.4.3 Watercourse Crossings for Permanent Access Tracks, Including Culverting of Watercourses

Several watercourses may be crossed by permanent Access Tracks, or existing Access Tracks upgraded to accommodate construction traffic. There are existing forestry Access Tracks and a proposed Access Track to the consented wind farm – no upgrades are proposed to the consented Access Track, however, some other watercourse crossings may need to be improved and/or widened, including the upgrade of culverts and/or bridge crossings. Culverting of watercourses, where required, will follow SEPA best practice guidance, but this may result in a permanent impact on watercourse conditions in those locations. This is considered a **Medium magnitude permanent effect, and is assessed as follows for the watercourses crossed:**

- For Medium value watercourses Allt Criche (tributary of Erralich Water): BL-01, Erallich Water: BL02 River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, a **permanent Moderate adverse effect**.
- For all other watercourses (Low value), a **permanent Minor adverse effect**.

Atlantic salmon (High value) and Brown trout (Low value) in watercourses, namely Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, would potentially be impacted by the upgrade of existing watercourse crossings, or the installation of new crossings, for example by presenting barriers to fish migration, or direct impacts to spawning habitat. This is assessed as a **Moderate adverse effect in the case of salmon, and a Minor adverse effect on brown trout**.

Effects on aquatic macrophytes (Negligible value), macroinvertebrates and other fish (Low value) through new or upgraded watercourse crossings are considered to be Low, resulting in a **Negligible effect**.

7.9.4.4 Waterway Pipes and Tunnels

Waterways transfer water between the Headpond and Tailpond within a closed loop system. Waterways including the high-pressure tunnel (connecting Headpond to pump turbines), low-pressure tunnel (connecting pump turbines to the inlet / outlet structure on Loch Awe, the Tailpond), spillway pipe used to drain any excess water from the Headpond, and scour pipe used for draining down the Headpond in an emergency situation, will be buried pipes and therefore will not require any watercourse crossings. Therefore, these are not assessed further.

7.9.4.5 Construction Compounds, Including Permanent Land-Take

Where Construction Compounds will be constructed to facilitate the Development, these have been designed to avoid watercourses and water bodies, and therefore there will be no adverse effects to these features. Potential effects to water quality due to Construction Compounds are assessed in the construction effects section, and also in *Chapter 11: Water Environment.*

7.9.4.6 Headpond and Embankments, including Land Take and Drainage

The loss of Lochan Airigh through construction of the Headpond and Embankments is assessed in the construction effects section, and also in *Chapter 11: Water Environment.*

7.9.4.7 Permanent Site Drainage, Including SUDs, Settlement Ponds, Temporary Ditches, and Other Drainage Features

During the operational phase, drainage from the Development Site will constitute clean surface water runoff, which will be comparable with current drainage conditions. *Chapter 11: Water Environment*, assesses the effects of site drainage and hydrology. It is anticipated that the design of site drainage will facilitate the maintenance of water supply to the existing water bodies and watercourses on the Development Site.

7.9.4.8 Spread of INNS through the Development Site as a Result of Operation of the Development

There is the potential for INNS to be spread or introduced during the operation of the Development, for example through movement of vehicles and personnel, delivery of materials from off-site by barge or vehicles, and through

the regular pumping of water from Loch Awe to the Headpond. The latter could be exacerbated by the utilisation of the Headpond by wildlife and the transfer of INNS to nearby water bodies.

The effects of the introduction of INNS on different receptors during operation are consistent with construction effects assessed above; refer to *Potential spread or introduction of INNS* and are therefore not repeated here.

7.9.5 Decommissioning Effects

As detailed within Section 3.3 Scope of the EIA within the Scoping Report, the decommissioning phase has been scoped out of the assessment. Decommissioning has been scoped out of assessment as the decommissioning of large-scale pumped storage hydro projects is extremely rare due to the long operational lifespan of the facility. Potential decommissioning effects are therefore considered to be similar to, and associated with the components described in the operational project phase. Given the approximated operational lifetime of PSH is in the region of 100 years, a decision would made in the future whether to refurbish the PSH or to decommission the scheme. The refurbishment plan or if the latter, a detailed decommissioning plan, would be prepared as required as this may be subject to a separate planning application at the time. Decommissioning will not be referred to again throughout this chapter

7.10 Cumulative Effects

7.10.1 Inter-Cumulative Effects

The assessment of likely cumulative effects based on the cumulative schemes identified in *Chapter 4: Approach to EIA.* Cumulative schemes identified are those that are reasonably foreseeable – i.e., in the public domain at scoping stage, or has been consented but not yet under construction/constructed at the point of writing the assessment or at submission.

It is not considered at this stage that there are any other developments that could have a cumulative effect with this Development.

7.10.2 Intra-Cumulative Effects

7.10.2.1 Intra-Project Effects

Intra-project effects due to component parts of the project being undertaken concurrently have been assessed as part of the construction effects assessment above. This assessment has been made on a worst-case precautionary approach, and therefore cumulative intra-project effects will not increase the magnitude or significance of effects on individual receptors.

Construction is expected to last up to seven years including the pre-construction works. The construction work is anticipated to peak within years 2 and 3 of construction as the tunnelling construction and the Headpond construction are the two biggest operations, and they are likely to be sequenced in parallel. Tunnelling is anticipated to be a 24-hour operation, and therefore there may be potential effects of lighting on aquatic habitats, see below.

There will be a requirement for lighting during construction, and operational external lighting at tunnel portals and along Access Tracks and Construction Compounds. External lighting will also be required at the Headpond and Tailpond for access, although this will only be used occasionally. Lighting may also be fitted to the Marine Facility on Loch Awe. It is envisaged that embedded mitigation, including directional cowling and restrictions to the hours of operation, will ensure that the potential effects of this lighting will be **Negligible** on all receptors.

7.11 Mitigation and Monitoring

7.11.1 Embedded Mitigation

7.11.1.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) will be developed alongside the Construction Methodology report and will set out the methods and procedures that will be implemented by the Construction Contractor to minimise the environmental impact, including potential effects on aquatic habitats due to water quality, pollution, and runoff (refer also to *Chapter 11: Water Environment*), and due to the potential spread of INNS. An Outline CEMP can be found in *Appendix 3.1 Outline CEMP (Volume 5: Appendices)*. This would be expanded upon by the appointed contractor and considered a live document.

7.11.1.2 CAR Licence

Works in Loch Awe (and potentially other water bodies) will require a Controlled Activities Regulations (CAR) licence application to SEPA before the works can proceed.

Under the CAR licence the works in Loch Awe may be restricted as to the timing of their completion, to avoid the migratory season of salmon and other fish species, which may be migrating through Loch Awe.

7.11.1.3 Design Evolution

Steps have been taken during the design process to minimise impacts via design evolution, including design workshops to facilitate input from all disciplines. This facilitated the development of various design principles to minimise impacts, including those summarised below.

- The implementation of Sustainable Drainage (SuDs) features and attenuation features will control runoff into watercourses and Lochs and avoid contamination of these water bodies.
- The design is for a completely 'closed-loop' system, whereby water will be drawn from Loch Awe to the Headpond and returned to Loch Awe via the tunnels and spillway pipes. Therefore, the risk of water spilling into adjacent water bodies will be negligible.
- The risk of cross-catchment contamination during construction, for example by the spread of INNS between Loch Fyne, Loch Awe, and other catchments, will be minimised by measures set out in the CEMP, and the incorporation of temporary SuDs and attenuation features in the intervening land.
- Dust screens will be installed along Access Tracks to prevent contamination of the surroundings with dust and fine sediments during construction.
- Where culverts are installed at watercourse crossings, i.e., for the installation of new watercourse crossings or the upgrade of existing crossings, the culvert invert will be set below the existing watercourse bed to ensure continued longitudinal connectivity and fish passage through the culvert. Such culverts will be designed and installed according to SEPA best practice guidance[2].
- Watercourse crossings (new or upgraded) where appropriate will be designed as bottomless arch watercourse crossings, which will maintain natural bed material to ensure continued longitudinal connectivity and fish passage.
- Where possible, a 50 m buffer from watercourses will be maintained to avoid the need for mitigation such as temporary silt fencing.
- Pipeline and tunnel infrastructure will be installed by drill and blast avoid impacts to surface habitats, including watercourses.
- Screening requirements at the inlet / outlet on Loch Awe will be finalised through discussion with SEPA / NatureScot for the CAR Licence to prevent the entrapment and/or impingement of fish, and to minimise the transfer of INNS. More information on Development operation (e.g., turbine design & associated pressure changes), and liaison with SEPA would be required should deviation from best-practice screening be considered appropriate, for example in the presence of additional mitigation such as bubble curtains to deter fish from the inlet / outlet structure.
- The maximum inlet velocity from Loch Awe is predicted to be 0.15 m/s given the size of the inlet structure and screen.

7.11.1.4 Embedded Mitigation During Construction

Construction of the cofferdam on the shoreline of Loch Awe, including piling, de-watering, and substrate removal

As detailed in the standalone Design Statement submitted with the application, a silt curtain or equivalent will be installed prior to the cofferdam being installed. This is to reduce the potential for sediment mobilisation and dispersal in Loch Awe during construction.

Once the cofferdam has been removed there may be a requirement for some localised dredging to remove any material that has built about around the piles. This will require a dredger and a silt curtain (or equivalent) to prevent any pollution to Loch Awe. Dredging should be supervised by the Aquatic Ecological Clerk of Works (EcoW) due to the potential for INNS and fish to be encountered during the works.

Construction of temporary Marine Facility and delivery of materials by barge, including AILs

[2] SEPA (2015). WAT-PS-06-02: Culverting of Watercourses - Position Statement and Supporting Guidance. Available at: https://www.sepa.org.uk/media/150919/wat_ps_06_02.pdf

Mitigation in relation to the Marine Facility at Loch Fyne is detailed in *Chapter 8: Marine Ecology*.

Watercourse crossings for temporary Access Tracks, including culverting of watercourses
Where culverts are required for watercourse crossings, these will be installed as per SEPA guidelines based on the principles set out in the standalone Design Statement submitted with the application.

A CAR licence for all watercourse crossings will be obtained well in advance of the works, where required in consultation with SEPA / NatureScot.

The construction of watercourse crossings will avoid the migration and spawning seasons of resident brown trout and migratory Atlantic salmon, where those species are present (Atlantic salmon in Allt Criche (tributary of Erralich Water): BL-01; Brown/sea trout in four watercourses: Allt Criche (tributary of Erralich Water): BL-01; Erralich Water: BL02; River Aray: BL-22; Unnamed tributary of River Aray: BL-23), as follows:

- Brown trout spawning – January to March
- Atlantic salmon upstream migration and spawning – November to February

Construction of the Headpond and Headpond Embankments, including land take and transport of excavated material
Details of drainage and water management measures during the Headpond and Embankment works will be detailed in the standalone Design Statement submitted with the application and will be informed by the CEMP. *(Appendix 3.1 Outline CEMP (Volume 5: Appendices)*

Transport of excavated tunnel material to Headpond via dump trucks, and spoil management of material from tunnelling works, including general plant movement throughout the Development Site
Spoil management, including stockpiling and transport, will be carried out according to the standalone Design Statement submitted with the application and CEMP. Measures have been built into the design to ensure that spoil management is effective in minimising runoff and subsequent contamination of water bodies. It is anticipated that such measures in the CEMP will include dust screens and vehicle washing facilities to minimise dust and siltation.

Wherever feasible, a 50 m standoff buffer between works, especially those involving spoil management, and aquatic habitats will be maintained to reduce the risk of runoff contaminating water bodies. This buffer will be maintained as a vegetated strip to act as a sediment trap if runoff does occur.

Where considered necessary to prevent silt-laden runoff into aquatic habitats, silt fencing will be installed alongside spoil stockpiles. This will be supervised and monitored by the ECoW to ensure that silt control measures are effective.

Potential spread of INNS through the site
There are potential effects due to the spread of INNS through the Development Site, notably from Loch Awe during de-watering and substrate excavation, and effects of transporting materials onto the Development Site and the potential introduction of INNS from Loch Fyne and other catchments.

Mitigation has been built into the design, and will be outlines in the Outline CEMP, to prevent the transport of INNS into other areas and to prevent the upstream transport of INNS. *(Appendix 3.1 Outline CEMP (Volume 5: Appendices)*

7.11.2 Further Surveys and Pre-Commencement Checks

It is recommended that the following pre-commencement surveys are completed to inform the proposed works:

- Fish survey of Lochan Airigh to inform the requirement for fish rescue and translocation during the construction of the Headpond and Embankments, when this lochan will be lost. Fish surveys have been completed by eDNA sampling for baseline assessment, but further surveys should include a combination of electric fishing, seine netting, and/or fyke netting as considered appropriate to determine the fish population and density within the lochan.
- Electric fishing surveys of the Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, to inform mitigation for permanent and temporary watercourse crossings. The presence of resident Atlantic salmon and brown trout populations has been demonstrated in these watercourses, and fish rescue and translocation may be required during construction, for example prior to and during the draw-down and/or over-pumping of watercourses for the installation of watercourse crossings.

- On-going seasonal (quarterly) fish eDNA survey in Loch Awe to include spring and summer 2024 (currently being undertaken).
- Survey of the extent of the proposed cofferdam in Loch Awe for the presence of INNS, notably Elodea sp. (Nuttall's waterweed and/or Canadian pondweed).
- Walkover survey of watercourse crossing locations for INNS, both aquatic and riparian species (to be combined with pre-commencement surveys for terrestrial INNS: refer to *Chapter 6: Terrestrial Ecology*).

7.11.3 Additional Mitigation

7.11.3.1 Additional Mitigation During Construction

Construction of the cofferdam on the shoreline of Loch Awe, including piling, de-watering, and substrate removal

To minimise the effects of noise from piling on fish, there should be a 'soft start' to piling works to deter fish from the immediate area where physical injury may occur. Mason and Collett (2011) suggest a soft start to piling using a blow energy of 150 kJ and show that using a soft start will have a lower impact on the salmon initially. Alternatively, vibro-driven piles will be used to minimise the effects of underwater noise and vibration on fish, including Atlantic salmon.

Works in Loch Awe should be carried out under the supervision of an Aquatic ECoW; this is likely to be a condition of the CAR licence.

A fish rescue will be required during de-watering of the cofferdam as it is highly likely that fish will congregate in these sheltered areas during construction and then become trapped as the cofferdam is sealed. This process will form part of the CAR licence, and detailed methodology will be provided for the licence application.

Watercourse crossings for temporary Access Tracks, including culverting of watercourses

In addition to the pre-commencement fish surveys described above, it is recommended that culverting of watercourses is supervised by the Aquatic ECoW, and this is likely to form a condition of the CAR licence. The ECoW will ensure the correct installation and functioning of silt and pollution control measures.

Culverting of watercourses will require sections to be isolated and fish rescues carried out, according to the conditions of the CAR licence. This process will be informed by the fish surveys of watercourse crossing locations.

Construction of the Headpond and Headpond Embankments, including land take and transport of excavated material

The pre-construction fish surveys described above will inform the mitigation requirements for the loss of Lochan Airigh. It is envisaged that this will involve the translocation of fish to a suitable nearby receptor site – there are numerous similar lochans locally. Due to the abundance of this type of habitat locally, it is considered that a replacement water body is not required.

Works in this area will be supervised by the Aquatic ECoW to ensure that water management measures, including drainage ditches, attenuation ponds, buffer strips, and silt fencing, will be effective in preventing the runoff of silt-laden water to adjacent watercourses and water bodies.

Effects due to temporary site drainage, including settlement ponds, temporary ditches, and other drainage features

As described above, the installation of temporary site drainage will be supervised and monitored by the ECoW to ensure that it is effective in preventing the contamination of watercourses and water bodies.

Potential effects due to the spread of INNS through the Site

Material excavated or dredged from Loch Awe must be retained in the immediate area, i.e., stockpiled on the loch shoreline, to prevent the spread of INNS, including *Elodea sp.*, which is known to be present in Loch Awe.

The Aquatic ECoW will supervise all excavation and dredging works in Loch Awe to check for the presence of INNS and ensure that appropriate biosecurity measures, as detailed in the CEMP, are implemented. (Appendix 3.1 Outline CEMP (*Volume 5: Appendices*)

Biosecurity measures should be implemented throughout the development, following 'Check, Clean, Dry' principles as set out in the CEMP. These measures will include, but are not limited to:

- Vigilance for the presence of INNS, including pre-commencement surveys, supervision, and monitoring by the ECoW;

- Vehicle washing facilities, including washing plant and vehicles before transferring between this and different construction sites;
- Washing and disinfection of Plant, PPE, and materials after works in aquatic habitats, especially in Loch Awe where INNS are known to be present;
- Ensuring where possible that materials are retained in the habitats where they originated, especially where INNS are known to be present, i.e. Loch Awe;
- Drying facilities should be provided for equipment and PPE – some INNS can live, or seeds and propagules remain viable, in moist conditions for long periods;
- Avoid the transfer of water between aquatic habitats on site.

7.11.3.2 Additional Mitigation During Operation

Effects on water levels in Loch Awe

Running a full generation cycle has the potential to push loch levels out of an acceptable range, in terms of ecology, flood risk, operation of Cruachan power station, and operation of the Loch Awe Barrage and associated fish lift. The impact of operation is dependent on initial water level and balancing inflows and outflows to the loch.

Additional mitigation is proposed through the hydrological assessment (*Chapter 12: Water Resources and Flood Risk),* whereby operational conditions will ensure that water levels in Loch Awe remain within the historic range. In this way, the continued operation of the Loch Awe barrage and fish lift will be maintained. This includes:

- Ensuring that the maximum recorded level is not exceeded, likely based on the annual maximum flood level. The highest levels recorded in the 2013-2021 period were 38.3 mAOD in 2014 and 2018. The 5% exceedance level is 36.97 mAOD. It is recommended that a commitment be made to restrict the draw-down of Loch Awe to the 95% exceedance level of 35.97 mAOD. This will be implemented as an operational restriction on the operation of the Scheme, to ensure that fish passage is maintained at the fish lift at the Loch Awe Barrage.
- Ensuring that loch levels do not fall below the minimum operating level: The winter target minimum operating level for the Loch Awe Barrage is 36.96 mAOD. This corresponds to the 95% percentile exceedance probability for the entire flow series. It is unknown at this stage at which levels the fish lift (fish pass) of the Loch Awe Barrage is no longer able to operate. A prolonged period of low loch levels in July 2021 took the level down to 35.52 mAOD. Other low periods in 2013, 2014 and 2019 had minimum levels of approximately 35.8 mAOD.

These operational conditions will be confirmed and set post-consent, to ensure the continued operation of the Loch Awe barrage and fish lift.

7.11.3.3 Future Monitoring

Monitoring of aquatic habitats upon completion of the Development is recommended for the following aspects:

- Annual monitoring surveys for the presence of aquatic INNS, to be combined with surveys for terrestrial INNS, in watercourses within the Site and assessed as receptors in relation to INNS above. Due to the potential for INNS to be transferred to the Headpond, it is recommended that the Headpond and these receptors are monitored for INNS for a period of five years.
- Regular monitoring and maintenance of the inlet / outlet on the shore of Loch Awe should be carried out to ensure the integrity of the screen and assess any potential impacts in relation to fish, in particular migratory salmon, and other species due to the potential for distraction and entrapment / impingement.
- Where permanent culverts are installed in watercourse crossings, it is recommended that these are monitored to ensure that there are no lasting effects on fish passage, especially in the event that Atlantic salmon or brown trout or other protected / notable species are shown to be present in pre-commencement fish surveys (i.e., in particular for Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23).

7.12 Residual Effects

Design and construction mitigation has been taken into account when evaluating the significance of potential effects, meaning that in some instances the significance of residual effects is not the same as that reported for potential effects.

Where residual effects are the same as those reported for potential effects, they have not been repeated in this section but are presented in the summary of effects *Table 7.9 Summary of Effects: Construction*.

7.12.1 Construction Residual Effects

7.12.1.1 Construction of the cofferdam on the shoreline of Loch Awe, including piling, de-watering, and substrate removal

Considering the proposed mitigation it is considered that the residual effect of cofferdam construction on each receptor will be as follows:

- Loch Awe habitat – Negligible magnitude **Minor adverse effect**.
- Fish assemblage in Loch Awe (High value) – Negligible magnitude **Minor adverse effect;**
- Macrophytes, macroinvertebrates, and other fish species in Loch Awe – **Negligible effect**;

7.12.1.2 Watercourse crossings for temporary Access Tracks, including culverting of watercourses

Considering the implementation of additional mitigation measures under the conditions of a CAR licence, the residual effects of watercourse crossings for temporary and permanent Access Tracks are as follows:

- Flowing watercourses of Medium value (Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, Unnamed tributary of River Aray: BL-23) or otherwise Low value – Low magnitude **Minor adverse effect**;
- Atlantic salmon present in Allt Criche (tributary of Erralich Water): BL-01, and brown/sea trout present in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, Unnamed tributary of River Aray: BL-23 – Negligible effect of **Minor significance**;
- Other watercourses, aquatic macrophytes, macroinvertebrates and other fish - **Negligible effect**.

7.12.1.3 Construction of the Headpond and Headpond Embankments, including land take and transport of excavated material

Works in this area will be supervised by the ECoW to ensure that water management measures, including drainage ditches and attenuation ponds, will be effective in preventing the runoff of silt-laden water to adjacent watercourses and water bodies.

Residual effects as a result of construction of the Headpond and Embankments for each receptor are as follows:

- Watercourses of Low value – **Negligible effect.**
- Loss of Lochan Airigh – Low magnitude **Minor adverse effect**;
- Loch Awe, Lochan Breac-liath, smaller water bodies, and aquatic species – **Negligible effect**.

7.12.1.4 Transport of excavated tunnel material to Headpond via dump trucks, and spoil management of material from tunnelling works, including general plant movement throughout the Development Site

With the implementation of mitigation in addition to that built into the design, the residual impacts of spoil excavation, transport, and management are as follows:

- Loch Awe – Negligible magnitude **Minor adverse effect.**
- Atlantic salmon present in Allt Criche (tributary of Erralich Water): BL-01, and brown/sea trout present in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23 – Negligible magnitude **Minor adverse effect**.
- Macrophytes, macroinvertebrates, and fish species (other than salmon and brown trout) – **Negligible effect.**

7.12.1.5 Temporary site drainage, including SUDs, settlement ponds, temporary ditches, and other drainage features

- The installation of temporary site drainage will be supervised and monitored by the ECoW to ensure that it is effective in preventing the contamination of watercourses and water bodies.
- The implementation of Sustainable Drainage (SuDs) features and attenuation features will control runoff into watercourses and Lochs and avoid contamination of these water bodies.

- Dust screens will be installed along Access Tracks to prevent contamination of the surroundings with dust and fine sediments during construction.
- Where possible, a 50 m buffer from watercourses and water bodies will be maintained to avoid the need for mitigation such as temporary silt fencing.
- Where considered necessary to prevent silt-laden runoff into aquatic habitats, silt fencing will be installed alongside spoil stockpiles. This will be supervised and monitored by the ECoW to ensure that silt control measures are effective.

Considering the implementation of the above mitigation measures, as detailed in *Chapter 11: Water Environment*, it is considered that there will be no adverse effects of temporary site drainage.

7.12.1.6 Potential spread or introduction of INNS

Specific additional mitigation measures have been recommended to minimise the risk of spreading INNS through or introducing them to the Site, including spoil management, ECoW supervision, and strict biosecurity measures. These measures are outlined in the Outline CEMP which includes an outline Biosecurity Management Plan *(Appendix 3.1 Outline CEMP, Volume 5: Appendices).*

Residual effects as a result of the potential spread or introduction of INNS are as follows:

- Loch Awe - Negligible effect.
- Medium value watercourses Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02 River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, and water bodies of Medium value (Lochan Airigh and Lochan Breac-Iiath) – Low magnitude **Minor adverse effect**.
- Other watercourses (Low value) – **Negligible effect**.
- Fish assemblage in Loch Awe (High value) – Low magnitude **Minor adverse effect**.
- Atlantic salmon (High value) in watercourses, namely Allt Criche (tributary of Erralich Water): BL-01 – Negligible magnitude **Minor adverse effect**.
- Brown trout (Low value) in watercourses, namely Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23 – Negligible magnitude **Negligible effect.**
- Macrophytes, macroinvertebrates and fish species (other than brown trout) – Low magnitude **Negligible effect.**

7.12.2 Operation Residual Effects

7.12.2.1 Effects on Water Levels in Loch Awe

Due to regular generation cycles with water pumped up to the Headpond then returned to the loch, water levels in Loch Awe will fluctuate to a greater extent than in the baseline scenario, and with greater regularity. There will be resulting effects on the Loch Awe Barrage, associated fish lift, and fish passage, due to fluctuating water levels.

Additional mitigation is proposed through the hydrological assessment (*Chapter 12: Water Resources and Flood Risk),* whereby operational conditions will ensure that water levels in Loch Awe remain within the historic range. In this way, the continued operation of the Loch Awe barrage and fish lift will be maintained.

Residual effects due to fluctuating water levels in Loch Awe are as follows:

- Loch Awe habitats (High value) – Negligible magnitude, resulting in a **Minor adverse effect**.
- Migratory fish species in Loch Awe, including Atlantic salmon, brown/sea trout, European eel, and lamprey species (High value) – Considering the operational regime outlined above, the residual effect on migratory fish will be Low, resulting in a **Minor adverse effect**.
- Aquatic macrophytes, macroinvertebrates, and other fish species in Loch Awe, including Arctic char – **Negligible**

7.12.2.2 Inlet / Outlet structure on Loch Awe shoreline, including Screen during Operation

Screening requirements at the inlet / outlet on Loch Awe will be finalised through discussion with SEPA / NatureScot for the CAR Licence to prevent the entrapment and/or impingement of fish, and to minimise the transfer of INNS.

More information on Development operation (e.g., turbine design & associated pressure changes), and liaison with SEPA would be required should deviation from best-practice screening be considered appropriate, for example in the presence of additional mitigation such as bubble curtains to deter fish from the inlet / outlet structure.

The residual effects due to the operation of the inlet / outlet structure and associated screen on Loch Awe are as follows:

- Loch Awe – Negligible magnitude **Minor adverse effect**.
- Fish species of High value in Loch Awe (Atlantic salmon, brown/sea trout, arctic char, European eel, and lamprey species) – Negligible magnitude **Minor adverse effect**.
- Migratory fish species in Loch Awe (Atlantic salmon, brown/sea trout, European eel, lamprey species) - Negligible magnitude **Minor adverse effect.**
- Other fish species, macrophytes, and macroinvertebrates in Loch Awe - **Negligible effect.**

7.12.2.3 Watercourse Crossings for Permanent Access Tracks, Including Culverting of Watercourses

Where culverts are required for watercourse crossings, these will be installed as per SEPA guidelines. Alternatively, bottomless arch watercourse crossings may be utilised, where appropriate.

The residual effects on watercourses during operation are as follows:

- Medium value watercourses Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02 River Aray: BL-22, and Unnamed tributary of River Aray: BL-23 – Low magnitude **Minor adverse effect**.
- All other watercourses (Low value) - **Negligible effect**.
- Atlantic salmon (High value) in Allt Criche (tributary of Erralich Water): BL-01 – Negligible magnitude **Minor adverse effect**.
- Brown trout (Low value) in watercourses, namely Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23 – **Negligible effect**.
- Aquatic macrophytes, macroinvertebrates, and other fish – **Negligible effect**.

7.12.2.4 Headpond and Embankments, including Land Take and Drainage

The loss of Lochan Airigh through construction of the Headpond and Embankments is assessed in the construction effects section, and in *Chapter 11: Water Environment*.

7.12.2.5 Spread of INNS through the Development Site as a Result of Operation of the Development

The effects of the introduction of INNS on different receptors during operation are consistent with construction effects assessed above; refer to *Potential spread or introduction of INNS* and are therefore not repeated here.

7.12.3 Summary of Residual Effects

Table 7.8 Summary of Effects: Construction, below, presents a summary of residual effects during construction, with *Table 7.10 Summary of Effects: Operation*, presenting a summary of residual effects during operation.

Table 7.8 Summary of Effects: Construction

Description of Effect	Receptor	Effect	Additional Mitigation	Residual Effects	Significance
Construction of the cofferdam on the shoreline of Loch Awe, including piling, de-watering, and substrate removal	Loch Awe (Habitat)	Moderate	Works in Loch Awe should be carried out under the supervision of an Aquatic Ecological Clerk of Works (ECoW). To minimise the effects of noise from piling on fish, there should be a 'soft start' to piling works to deter fish from the immediate area where physical injury may occur. Mason and Collett (2011) suggest a soft start to piling using a blow energy of 150 kJ and show that using a soft start will have a lower impact on the salmon initially. Alternatively, vibro-driven piles will be used to minimise the effects of underwater noise and vibration on fish, including Atlantic salmon. Works in Loch Awe should be carried out under the supervision of an Aquatic ECoW; this is likely to be a condition of the CAR licence. A fish rescue will be required during de-watering of the cofferdam as it is highly likely that fish will congregate in these sheltered areas during construction and then become trapped as the cofferdam is sealed. This process will form part of the CAR licence, and detailed methodology will be provided for the licence application.	Minor	Not significant
	High value fish assemblage in Loch Awe	Moderate		Minor	Not significant
	Aquatic macrophytes (Negligible value), and macroinvertebrates and other fish species (Low value)	Negligible	N/A	N/A	Not significant
Watercourse crossings for temporary Access Tracks and temporary site compounds, including diversion and culverting of watercourses	Watercourses throughout the Site are assessed as of Medium value (Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, Unnamed tributary of River Aray: BL-23) or otherwise Low value	Moderate	Culverting of watercourses supervised by the Aquatic ECoW to ensure the correct installation and functioning of SuDS and silt control measures. In addition to the pre-commencement fish surveys described above, it is recommended that culverting of watercourses is supervised by the Aquatic ECoW, and this is likely to form a condition of the CAR licence. The ECoW will ensure the correct installation and functioning of silt and pollution control measures.	Minor	Not significant

Description of Effect	Receptor	Effect	Additional Mitigation	Residual Effects	Significance
	Atlantic salmon present in Allt Criche (tributary of Erralich Water): BL-01, and brown/sea trout present in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, Unnamed tributary of River Aray: BL-23	Moderate	Culverting of watercourses will require sections to be isolated and fish rescues carried out, according to the conditions of the CAR licence. This process will be informed by the fish surveys of watercourse crossing locations.	Minor	Not significant
	Other watercourses of Low value	Minor		Negligible	Not significant
	Aquatic macrophytes (Negligible), macroinvertebrates (Low), and other fish (Low value)	Negligible	N/A	N/A	Not significant
Construction of the Headpond and Headpond Embankments, including land take and transport of excavated material	Watercourses of Low value (Allt Beochlich / Buinne Dhubh)	Negligible	Works in this area will be supervised by the ECoW to ensure that water management measures, including SuDS, drainage ditches and attenuation ponds, will be effective in preventing the runoff of silt-laden water to adjacent watercourses and water bodies. In addition to the pre-commencement fish surveys for Lochan Airigh described above: The pre-construction fish surveys will inform the mitigation requirements for the loss of Lochan Airigh. It is envisaged that this will involve the translocation of fish to a suitable nearby receptor site – there are numerous similar lochans locally. Due to the abundance of this type of habitat locally, it is considered that a replacement water body is not required. Works in this area will be supervised by the ECoW to ensure that water management measures, including drainage ditches, attenuation ponds, buffer strips, and silt fencing, will be effective in preventing the runoff of silt-laden water to adjacent watercourses and water bodies.	Negligible	Not significant
	Lochan Airigh	Moderate		Minor	Not significant
	Loch Awe (Habitats)	Moderate		Negligible	Not significant
	Lochan Breac-liath (Medium value)	Minor		Negligible	Not significant
	Other watercourses and water bodies (Low value); macrophytes, macroinvertebrates, and fish	Negligible	N/A	N/A	Not significant
Transport of excavated tunnel material to Headpond via dump trucks, and spoil management of material from tunnelling works	Loch Awe (Habitats)	Moderate	As described above, the installation of temporary site drainage will be supervised and monitored by the ECoW to ensure that it is effective in preventing the contamination of watercourses and water bodies. The implementation of Sustainable Drainage (SuDs) features and attenuation features will control runoff into watercourses and Lochs and avoid contamination of these water bodies.	Minor	Not significant
	Fish community in Loch Awe (Atlantic salmon, brown/sea trout, arctic char, European eel, and lamprey species) (High value)	Minor		Negligible	Not significant

Description of Effect	Receptor	Effect	Additional Mitigation	Residual Effects	Significance
	Other fish species in Loch Awe and other watercourses in this area of construction (Low value)	Negligible	Dust screens will be installed along Access Tracks to prevent contamination of the surroundings with dust and fine sediments during construction. Where possible, a 50 m buffer from watercourses and water bodies will be maintained to avoid the need for mitigation such as temporary silt fencing. Where considered necessary to prevent silt-laden runoff into aquatic habitats, silt fencing will be installed alongside spoil stockpiles. This will be supervised and monitored by the ECoW to ensure that silt control measures are effective.	Negligible	Not significant
	Atlantic salmon present in Allt Criche (tributary of Erralich Water): BL-01, and brown/sea trout present in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23	Moderate		Minor	Not significant
	Macrophytes, macroinvertebrates, and other fish species	Negligible	N/A	N/A	Not significant
Temporary site drainage, including SUDs, settlement ponds, temporary ditches, and other drainage features	All	No Effects	Assessed in *Chapter 11: Water Environment* As described above, the installation of temporary site drainage will be supervised and monitored by the ECoW to ensure that it is effective in preventing the contamination of watercourses and water bodies. The implementation of Sustainable Drainage (SuDs) features and attenuation features will control runoff into watercourses and Lochs and avoid contamination of these water bodies. Dust screens will be installed along Access Tracks to prevent contamination of the surroundings with dust and fine sediments during construction. Where possible, a 50 m buffer from watercourses and water bodies will be maintained to avoid the need for mitigation such as temporary silt fencing. Where considered necessary to prevent silt-laden runoff into aquatic habitats, silt fencing will be installed alongside spoil stockpiles. This will be supervised and monitored by the ECoW to ensure that silt control measures are effective.	-	-
Potential spread or introduction of INNS	Loch Awe (Habitats)	Negligible	Mitigation has been built into the design, and will be detailed in the CEMP, to prevent the transport of INNS into other areas and to prevent the upstream transport of INNS. Survey of the extent of the proposed cofferdam and temporary jetty works in Loch Awe for the presence of INNS, notably Elodea sp. (Nuttall's waterweed and/or Canadian pondweed). Walkover survey of watercourse crossing locations for INNS, both aquatic and riparian species (to be combined with pre-commencement surveys for terrestrial INNS: refer to *Chapter 6: Terrestrial Ecology*).	Negligible	Not significant
	Medium value watercourses Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02 River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, and water bodies of Medium value (Lochan Airigh and Lochan Breac-liath)	Moderate		Minor	Not significant

Description of Effect	Receptor	Effect	Additional Mitigation	Residual Effects	Significance
	Other watercourses (Low value)	Moderate	Material excavated or dredged from Loch Awe must be retained in the immediate area, i.e., stockpiled on the loch shoreline, to prevent the spread of INNS, including Elodea sp., which is known to be present in Loch Awe. The Aquatic ECoW will supervise all excavation and dredging works in Loch Awe to check for the presence of INNS and ensure that appropriate biosecurity measures, as detailed in the CEMP, are implemented. Biosecurity measures should be implemented throughout the development, following 'Check, Clean, Dry' principles as set out in the CEMP. These measures will include, but are not limited to: • Vigilance for the presence of INNS, including pre-commencement surveys, supervision, and monitoring by the ECoW; • Vehicle washing facilities, including washing plant and vehicles before transferring between this and different construction sites; • Washing and disinfection of Plant, PPE, and materials after works in aquatic habitats, especially in Loch Awe where INNS are known to be present; • Ensuring where possible that materials are retained in the habitats where they originated, especially where INNS are known to be present, i.e. Loch Awe; • Drying facilities should be provided for equipment and PPE – some INNS can live, or seeds and propagules remain viable, in moist conditions for long periods; • Avoid the transfer of water between aquatic habitats on site.	Negligible	Not significant
	Fish assemblage in Loch Awe (High value)	Moderate		Minor	Not significant
	Atlantic salmon (High value) in Allt Criche (tributary of Erralich Water): BL-01	Major		Minor	Not significant
	Brown trout (Low value) in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23	Moderate		Negligible	Not significant
	Macrophytes, macroinvertebrates and fish species	Moderate		Negligible	Not significant

Table 7.9 Summary of Effects: Operation

Description of Effect	Receptor	Effect	Additional Mitigation	Residual Effects	Significance
Effects on water levels in Loch Awe	Loch Awe (Habitats)	Moderate	Running a full generation cycle has the potential to push loch levels out of an acceptable range, in terms of ecology, flood risk, operation of Cruachan power station, and operation of the Loch Awe Barrage and associated fish lift. The impact of operation is dependent on initial water level and balancing inflows and outflows to the loch. Additional mitigation is proposed through the hydrological assessment (*Chapter 12: Water Resources and Flood Risk*), whereby operational conditions will ensure that water levels in Loch Awe remain within the historic range. In this way, the continued operation of the Loch Awe barrage and fish lift will be maintained. This includes: • Ensuring that the maximum recorded level is not exceeded, likely based on the annual maximum flood level. The highest levels recorded in the 2013-2021 period were 38.3 mAOD in 2014 and 2018. The 5% exceedance level is 36.97 mAOD. • Ensuring that loch levels do not fall below the minimum operating level: The winter target minimum operating level for the Loch Awe Barrage is 36.96 mAOD. This corresponds to the 95% percentile exceedance probability for the entire flow series. It is unknown at this stage at which levels the fish lift (fish pass) of the Loch Awe Barrage is no longer able to operate. A prolonged period of low loch levels in July 2021 took the level down to 35.52 mAOD. Other low periods in 2013, 2014 and 2019 had minimum levels of approximately 35.8 mAOD. These operational conditions will be confirmed and set as the design evolution progresses, to ensure the continued operation of the Loch Awe barrage and fish lift.	Minor	Not significant
	Migratory fish species in Loch Awe and River Awe, including Atlantic salmon, brown/sea trout, European eel, and lamprey species	Moderate		Moderate	**Significant**
	Aquatic macrophytes, macroinvertebrates, and other fish species in Loch Awe, including Arctic char	Negligible		Negligible	Not significant
Inlet / Outlet structure on Loch Awe shoreline, including Screen during operation	Loch Awe (Habitats)	Minor	Works in Loch Awe should be carried out under the supervision of an Aquatic Ecological Clerk of Works (ECoW). Screening requirements at the inlet / outlet on Loch Awe will be finalised through discussion with SEPA / Nature Scot for the CAR Licence to prevent the entrapment and/or impingement of fish, and to minimise the transfer of INNS. More information on development operation (e.g., turbine design & associated pressure changes), and liaison with SEPA would be required should deviation from best-practice screening be considered appropriate, for example in the presence of additional mitigation such as bubble curtains to deter fish from the inlet / outlet structure.	Minor	Not significant
	Fish species of High value in Loch Awe (Atlantic salmon, brown/sea trout, arctic char, European eel, and lamprey species), including migratory species	Minor		Minor	Not significant
	Other fish species in Loch Awe	Negligible		Negligible	Not significant
	Macrophytes and macroinvertebrates in Loch Awe	Negligible		Negligible	Not significant

Description of Effect	Receptor	Effect	Additional Mitigation	Residual Effects	Significance
Watercourse crossings for permanent Access Tracks, including culverting of watercourses	Medium value watercourses Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02 River Aray: BL-22, and Unnamed tributary of River Aray: BL-23	Moderate	The implementation of Sustainable Drainage (SuDs) features and attenuation features will control runoff into watercourses and Lochs and avoid contamination of these water bodies. Electric fishing surveys of the Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23, to inform mitigation for permanent and temporary watercourse crossings. The presence of resident Atlantic salmon and brown trout populations has been demonstrated in these watercourses, and fish rescue and translocation may be required during construction, for example prior to and during the draw-down and/or over-pumping of watercourses for the installation of watercourse crossings. Where culverts are installed at watercourse crossings, i.e., for the installation of new watercourse crossings or the upgrade of existing crossings, the culvert invert will be set below the existing watercourse bed to ensure continued longitudinal connectivity and fish passage through the culvert. Such culverts will be designed and installed according to SEPA best practice guidance. Watercourse crossings (new or upgraded) where appropriate will be designed as bottomless arch watercourse crossings, which will maintain natural bed material to ensure continued longitudinal connectivity and fish passage.	Minor	Not significant
	Other watercourses (Low value)	Minor		Negligible	Not significant
	Atlantic salmon (High value) in Allt Criche (tributary of Erralich Water): BL-01	Moderate		Minor	Not significant
	Brown trout (Low value) in Allt Criche (tributary of Erralich Water): BL-01, Erralich Water: BL02, River Aray: BL-22, and Unnamed tributary of River Aray: BL-23	Minor		Negligible	Not significant
	Aquatic macrophytes (Negligible value), macroinvertebrates and other fish (Low value)	Negligible		Negligible	Not significant
Headpond and Embankments, including Land Take and Drainage	All	No Effects	Assessed in *Chapter 11: Water Environment* The implementation of Sustainable Drainage (SuDs) features and attenuation features will control runoff into watercourses and Lochs and avoid contamination of these water bodies.	-	-
Spread of INNS through the Development Site through operation of the Development	Refer to Construction Effects section above	-	The design is for a completely 'closed-loop' system, whereby water will be drawn from Loch Awe to the Headpond and returned to Loch Awe via the tunnels and spillway pipes. Therefore, the risk of water spilling into adjacent water bodies will be negligible.	-	-

7.13 References

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