March 2025

Glen Earrach Pumped Storage Hydro

Environmental Impact Assessment Report

Volume 2: Main Report
Chapter 11: Flood Risk & Water Resources

Glen Earrach Energy Ltd

Glen Earrach AECOM

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	March 2025	Submission	DL	DL	Technical Director – Renewable Energy

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11. Water Resources and Flood Risk

11.1 Introduction

11.1.1 This chapter of the EIAR provides an assessment of the potential impacts on flood risk and water resources from the Proposed Development.

11.1.2 As described within **Chapter 2 Project and Site Description** and summarised within **Chapter 3 Evolution of Design and Alternatives (Volume 2: Main Report),** the Proposed Development presents two options, Option A and Option B. The differences between these options involve the location of the below ground works and the associated positioning of the Upper Control Works within the Headpond footprint. This assessment has considered both Options A and B; regardless of which option is taken forward, the conclusions of the Flood Risk and Water Resources assessment remain the same for both.

11.1.3 This chapter is supported by the following appendices contained within **Volume 5: Appendices** of the EIAR.

- **Appendix 11.1: Water Resources Assessment**
- **Appendix 11.2: Flood Risk Assessment**

11.1.4 These two assessments identify baseline conditions in the study area (described below), identify potential receptors and analyse the impact of the Proposed Development on water resources and flood risk. These appendices contain the detailed analyses which are used in this chapter to summarise the magnitude and significance of effects on the receptors identified, and are best read prior to this chapter.

11.1.5 For details on relevant water environment sections including water quality, hydromorphology and hydrogeology please see **Chapter 10: Water Environment (Volume 2: Main Report)**.

11.1.6 Consultation has been undertaken with SEPA, The Highland Council, Scottish Canals and Caley Cruisers this is further detailed within **Section 11.6 Consultation.**

11.1.7 The following terms (and descriptions) are used throughout this Chapter, unless otherwise stated:

- Ness Weir (colloquially known as Dochfour Weir) – The existing weir, located at the north of Loch Dochfour where it separates into the outflow into the River Ness and the northern section of the Caledonian Canal
- Dochfour Weir Upgrade – Upgrade works being developed separately in support of the Proposed Development; and,
- Ness Weir II – An alternative proposal by Stratera Energy to support Loch Kemp Pumped Storage Hydro Scheme (PSH). The project proposes modifying the existing weir to include raising the crest height of the weir, creating a new fish pass and installing a new outlet sluice in the form of a tilting weir. A Pre-Application Notice (24/04644/PAN) was submitted in October 2024.

11.2 Proposed Development

Introduction

11.2.1 The Proposed Development is a large pumped storage hydro scheme that comprises an impounding reservoir (Headpond) at the location of Loch nam Breac Dearga, Waterways, a Power Cavern Complex and Lower Control Works (LCW) consisting of an inlet / outlet structure at the banks of Loch Ness. Please see **Chapter 2: Project and Site Description (Volume 2 Main Report)** for further details on the Proposed Development.

11.2.2 In addition to the Proposed Development, consideration is also given to other developments at Loch Ness that may impact on flood risk. These include the Loch na Cathrach and Loch Kemp PSH projects, together with the Dochfour Weir Upgrade The key features impacting of flood are summarised below.

Headpond

11.2.3 The Headpond is located within the valley between the hills of Meall Fuar-mhonaidh, Nighean a Mhill and Glas-bheinn Mhor. The Headpond consists of a body of water contained within the topographical landscape created by the adjacent hills, with three embankments (Main Dam, Saddle Dam 1 and Saddle Dam 2) and a Spillway structure created between those hills to create the Headpond. The Headpond includes one Spillway (**Section 2.5.2 – 2.5.3 Headpond Waterbody**) and the Upper Control Works (UCW) (**Section 2.5.7 – 2.5.10 Upper Control Works**). A Borrow Pit Search Area is located within the Headpond to help with material provision of supply on site (**Section 2.5.11 – 2.5.12 Borrow Pit Search Area**).

11.2.4 The Headpond is designed to hold approximately 30 Mm^3 of water with approximately 29 Mm^3 of it being used as the working volume during Operation. **Figure 2.9: Headpond – Indicative Arrangement (Volume 3: Figures)** provides a general arrangement of the Headpond.

11.2.5 The working bottom level (BWL) will be 475 m AOD, and the working top water level (TWL) will be 518 m AOD giving a maximum operational drawdown of 43 m. The water levels can be viewed on **Figure 2.10: Headpond Cross Sections (Volume 3: Figures)**.

11.2.6 The Secondary Bund will be a small earthen or concrete dam downstream of the Main Dam. This structure will be installed to protect the downstream watercourses during the scour release at the Valve House (**Section 2.6.13-2.6.15 Valve House**). Scour operation for maintenance purposes is expected every 6 months so the secondary bund is expected to be full of water every 6 months before dissipating naturally into the downstream watercourse. It will provide approximately 4,000 m^3 of storage, with final dimensions and volumes to be determined in the detail design stage.

Access Tracks and Watercourse Crossings

11.2.7 Several Temporary and Permanent Access Tracks are proposed as part of the Proposed Development. Where there are existing access tracks, with associated watercourse crossings, these may require upgrading to widen the tracks, resulting in a longer length of culvert at each of these crossings. Where new Temporary and Permanent Access Tracks are required, new pipe or bottomless watercourse crossings will be created in line with the standard detail in **Figure 2.33 Water Crossing Detail (Volume 3: Figures).**

11.2.8 The routes of the access tracks have been selected to minimise watercourse crossings, whilst balancing other considerations including, but not limited to the presence of peat, topography, buildability and ornithological, terrestrial and hydro-geomorphological habitat. All crossings will adhere to the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR). For further details on watercourse crossings, please refer to **Appendix 10.3: Geomorphic Baseline and Watercourse Crossings (Volume 5: Appendices).**

Loch Ness Intake / Outlet (Lower Control Works)

11.2.9 The Waterways will terminate at the LCW situated on the western bank of Loch Ness at approximately NH 48071 21802. The LCW can be viewed on **Figure 2.15: Lower Control Works – 3D Visualisation, Figure 2.16 Lower Control Works Plan and 2.17 Lower Control Works Section (Volume 3: Figures**).

11.2.10 The LCW consists of 4No. discrete intake-outlet structures and a road providing access to the structures from the A82. In addition to the main intake-outlet structures, the LCW has a smolt screen that is separated from the main works. The detailed design of the LCW intake-outlet structures will be finalised at detailed design stage to allow for flexibility in the splays and angling flows of water discharging into Loch Ness.

11.3 Cumulative Impacts of other Developments

11.3.1 In addition to the existing Foyers PSH, Glendoe and Glenmoriston hydro schemes which are implicitly included in the baseline, a number of developments are either consented but not built or in the planning stage that could impact on the baseline conditions of this assessment and are therefore considered based on a cumulative impact in the event that they are constructed. These include the following:

- Loch na Cathrach: This is a consented PSH scheme set to the north of Loch Ness, near the village of Dores. It proposes a new impounded Headpond and a uses Loch Ness as a Tailpond. It has an operating volume of 5 Mm^3 and generation capacity of 450 MW. The generation and pumping rates are 220 and 154 m^3/s respectively.

- Loch Kemp: This is a proposed PSH scheme set to the south, on the east bank of Loch Ness. It contains an impounded Headpond formed by raising Loch Kemp, and a uses Loch Ness as a Tailpond. It has an operating volume of 21 Mm^3 and generation capacity of 600 MW. The generation and pumping rates are 416 and 289 m^3/s respectively. A planning submission has been made, but the scheme is not consented.
- Ness Weir II: Initial public consultation has been carried out by Statera Energy, the developer behind Loch Kemp PSH scheme to make modifications to the existing Ness Weir at Loch Dochfour. However, due to limited information provided within the proposal, it is not possible to assess it as part of the cumulative impact.
- An alternative scheme, referred to as Dochfour Weir Upgrades: An alternative upgrade project to the existing Ness Weir is being considered in collaboration with Scottish Canals, and in anticipated partnership with the existing PSH operator and future operators, the Applicant for this Proposed Development and Loch na Cathrach. Refer to **Appendix 2.2 Letter from Scottish Canals (Volume 5: Appendices**) Whilst the Dochfour Weir Upgrades do not form part of this application, the upgrade words here would form part of the additional mitigation measures for the Proposed Development, mitigating both standalone impacts and those identified as rising from the cumulative assessment of other proposed developments. The scheme consists of the construction and operation of a variable weir that will adjust the height of the weir to manage flows within the River Ness to isolate the flows in the River Ness from the impact of the PSH activities in Loch Ness. This will result in a more natural flow in the River Ness controlled by meteorological conditions rather than PSH activities. Additional details are included in **Appendix 2.1 Dochfour Weir Upgrade Description (Volume 5: Appendices)**.

11.4 Legislation and Policy

11.4.1 This section outlines the relevant legislation, planning policy and guidance relevant to this assessment.

Legislation

11.4.2 Legislation relevant to this chapter includes:

- EU Directive 2000/60/EC (Water Framework Directive (WFD))
- Water Environment and Water Services Act (Scotland) 2003 (‘the WEWS Act’)
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) in respect of discharges to surface or groundwater (‘the CAR Regulations’)
- Flood Risk Management (Scotland) Act 2009 and the Flood Risk Management (Flood Protection Schemes, Potentially Vulnerable Areas and Local Plan Districts) (Scotland) Regulations 2010
- Reservoirs (Scotland) Act 2011.

11.4.3 The legislative framework protects and enhances the status of aquatic ecosystems, seeks to prevent further deterioration of such ecosystems, promotes sustainable use of available water resources, and contributes to the mitigation of floods and droughts.

National Planning Policy

11.4.4 National Planning Framework 4 (NPF4) was formally adopted by Scottish Ministers on 13 February 2023. NPF4 sets out Scotland’s long-term spatial strategy and provides a framework for addressing national planning priorities, including sustainability, health, and environmental protection.

11.4.5 NPF4 Policy 11 e) requires energy developments to demonstrate how effects on hydrology, the water environment and flood risk are addressed.

11.4.6 NPF4 Policy 22 aims to strengthen resilience to current and future flood risk, ensure water resources are used efficiently and sustainably, and wider use of natural flood risk management benefits people and nature. This is achieved by first avoiding development in areas at flood risk. Development proposals at risk of flooding will only be supported if they are for essential infrastructure where the location is required for operational reasons, water compatible uses, redevelopment of an existing site for an equal or less vulnerable use, or redevelopment of previously used sites in built up areas where the local authority has identified a need to bring these into positive

use and where proposals demonstrate that long-term safety and resilience can be secured. In such cases, it must be demonstrated by the Applicant that:

- All risks to flooding are understood and addressed.
- There is no reduction in floodplain capacity, increased risk for others, or a need for future flood protection schemes.
- The development remains safe and operational during floods.
- Flood resistant and resilient materials and Construction methods are used.
- Future adaptations can be made to accommodate the effects of climate change.
- The development must not increase the risk of surface water flooding to others or itself be at risk.
- The development must manage all rain and surface water through sustainable urban drainage systems (SUDS).
- The development must seek to minimise the area of impermeable surface.

11.4.7 Planning Advice Notes (PAN) provide further national guidance and SEPA has produced a range of guidance documents relevant to the water environment and flood risk – see **Table 11.1**.

Local Planning Policy

11.4.8 The Highland-wide Local Development Plan (HwLDP) was adopted in April 2012. The 20-year plan predates NPF4 and still refers to Scottish Planning Policy (SPP) which has since been superseded by NPF4. The HwLDP should therefore be read in conjunction with NPF4. This plan sets out a balanced strategy to support the growth of all communities across the Highlands. However, it is important to ensure that development is, in the first instance, directed to places with sufficient existing or planned infrastructure and facilities to support sustainable development.

Highland Council Local Development Plan Policy 64 – Flood Risk

- Development proposals should avoid areas susceptible to flooding and promote sustainable flood management.
- Development proposals within or bordering medium to high flood risk areas, will need to demonstrate compliance with SPP through the submission of suitable information which may take the form of a Flood Risk Assessment.
- Development proposals outwith indicative medium to high flood risk areas may be acceptable. However, where:
  - better local flood risk information is available and suggests a higher risk;
  - a sensitive land use (as specified in the risk framework of Scottish Planning Policy) is proposed, and/or;
  - the development borders the coast and therefore may be at risk from climate change,
  - a Flood Risk Assessment or other suitable information which demonstrates compliance with SPP will be required.
- Developments may also be possible where they are in accord with the flood prevention or management measures as specified within a local (development) plan allocation or a development brief. Any developments, particularly those on the flood plain, should not compromise the objectives of the EU Water Framework Directive.
- Where flood management measures are required, natural methods such as restoration of floodplains, wetlands and water bodies should be incorporated, or adequate justification should be provided as to why they are impracticable.

11.5 Advice and Guidance Documents

11.5.1 **Table 11-1 Best practice Guidance** lists the relevant advice and guidance that has informed this chapter.

Table 11-1 Best practice Guidance

Author	Guidance Document
Scottish Government Planning Department	PAN 51 – Planning, Environmental Protection and Regulation (Revised 2006)
Scottish Government Planning Department	PAN 61 – Planning and Sustainable Urban Drainage Systems (2001)
Scottish Government Planning Department	PAN 79 – Water and Drainage (2006)
Scottish Government Planning Department	Planning Circular 1/2017- Environmental Impact Assessment regulations
SEPA	Engineering activities in the water environment: Good practice guide – River Crossings,(2nd ed, 2010)
SEPA	Flood Risk and Land Use Vulnerability Guidance – version 4
SEPA	Technical Flood Risk Guidance for Stakeholders - version 13
SEPA	Flood Modelling Guidance for Responsible Authorities Version 1.1
SEPA	Climate change allowances for flood risk assessment in land use planning – Version 5, August 2024
SEPA	Regulatory Method (WAT-RM-08), Sustainable Urban Drainage Systems (SUDS or SUDS Systems), 2016
CIRIA	The SuDS Manual (C753) (2015)
DEFRA	Guidance to Flood Risk assessments: climate change allowances (2016)
The Highland Council	Supplementary Guidance, Flood Risk & Drainage Impact (2013)
National Highways	Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 10 “Road Drainage and the Water Environment - DMRB HD45/09

11.6 Consultation

11.6.1 The following table provides details on the consultation comments received relevant to this chapter. The key issues and actions taken to address these points have been set out within **Table 11-2. Summary of Consultation Response.**

Table 11-2 Summary of Consultation Response

Key Issue	Summary of Response	Action Taken
SEPA	The Proposed Development will require authorisation from SEPA under CAR. It is likely that the CAR application will be subject to a derogation (exemption under the Water Framework Directive) assessment and third-party consultation which could result in amendments to the scheme. SEPA encourage applicants to twin-track CAR / Section 36 applications to ensure that CAR requirements can be accommodated when proposals are at their most fluid.	The need for a CAR licence (with or without derogation) has been recognised and an application will be made alongside the application for consent under Section 36 of the Electricity Act. Post screening opinion meetings were held with SEPA to discuss the approach to the water resources assessment, flood risk assessment and CAR licence requirements.
The Highland Council	The Highland Council noted that the following guidance applies: All tracks should be kept a minimum 10 m away from a waterbody except water crossings; Access tracks not acting as preferential pathways for runoff and efforts should be made to retain existing natural drainage wherever possible; Natural flood management techniques should be applied to reduce the rate of runoff rates and to minimise erosion on existing watercourses; Water crossing in the form of culverts or bridges, or upgrades to existing crossings must be designed to	Feedback from The Highland Council has informed the design of the Proposed Development and has been considered in this Chapter and accompanying appendices.

	accommodate to 1 in 200 year flood event, plus climate change; Land rising within any floodplain to be avoided; if ultimately required, compensatory storage must be provided; and The EIAR should be informed by the Council's Flood Risk and Drainage Impact Assessment Supplemental Guidance.	
Caley Cruisers	The main concern expressed by Caley Cruisers is the impact of the Proposed Development on water levels in Loch Ness, especially in relation to access to Urquhart Bay. The company expressed concerns about significant variance in Loch Level overnight, causing disruptions and damage to their cruises.	A water balance model has been included within the assessment. This model inputs all the pumped storage hydro schemes that are in operation or proposed within the Loch Ness catchment. The water balance model additionally includes a cut-off levels, both high and low where the PSH will not be able to operate. The analysis carried out shows that the Proposed Development has no detrimental impact at these extreme events. Leisure cruise operators, present on Loch Ness, will be able to discuss any issues or provide feedback on the programme of Construction activities, via the proposed Community Liaison Group as detailed within **Chapter 16: Socio-economics, Tourism and Recreation (Volume 2: Main Report)**

11.7 Study Area

11.7.1 The Zone of Influence (ZoI) of the Proposed Development is the area over which water resources and flood risk may be subject to impacts as a result of its Pre-Construction and Enabling, Construction and Operation. The Study Area was designed to allow sufficient data to be collected to establish the baseline conditions and determine the potential impacts of the Proposed Development on water resources and flood risk. The ZoI can extend beyond a development; however, beyond a certain distance from a development its impacts might not result in significant effects, and only significant effects are the focus of Ecological Impact Assessment (EcIA) according to CIEEM guidance. The Study Area adopted for this assessment was sufficiently precautionary to allow assessment of potentially significant effects from the Proposed Development on water resources and flood risk and include the Allt Loch an t-Sionnaich catchment, Loch Ness, Loch Dochfour, River Ness, Loch Ashie, Loch Duntelchaig and the Caledonian Canal.

11.8 Assessment Scope

11.8.1 The scope of the assessment discussed in this chapter considers the effects on water resources and flood risk during the Pre-Construction and Enabling, Construction and Operation phases of the Proposed Development. The assessment has been informed by the following detailed studies, the results of which have been used to identify potential receptors, assess the magnitude of any impact on those receptors in relation to flood risk and water resources, propose mitigation and determine the significance of those impacts.

Water Resources Assessment

11.8.2 The Water Resources Assessment (**Appendix 11.1 Water Resources Assessment (Volume 5: Appendices))** assesses the potential impact on water resources as a result of Operation of the Proposed Development. **Appendix 11.1** also identifies appropriate mitigation measures to reduce the impact of the Proposed Development on water resources including outlining the operational rules.

Flood Risk Assessment

11.8.3 The Flood Risk Assessment (FRA) **(Appendix 11.2 Flood Risk Assessment (Volume 5: Appendices))** was undertaken to assess the impact of flooding of the Proposed Development from the Pre-Construction and Enabling, Construction and Operation of the Proposed Development . **Appendix 11.2** outlines the work

undertaken to evaluate the impact and details mitigation measures to reduce the impact of the Proposed Development.

Baseline Data Collection

11.8.4 To assess the potential impacts of the Proposed Development, it is necessary to determine the environmental conditions, resources and receptors that currently exist within the Red Line Boundary and study area. Data has been obtained from the following sources:

- Ordnance Survey (OS) mapping to identify surface water bodies and topography.
- SEPA online Flood Risk Management (FRM) Maps.
- River Ness Flood Scheme – Details of Hydraulic Modelling undertaken for Development of Preferred Scheme – The Highland Council/ Mott MacDonald October 2011.
- Guidance to risk assessment for reservoir safety management – Volume 2: methodology and supporting information Report – SC090001/R2 – Department for Environment, Food and Rural Affairs (Defra).
- Flood Risk & Drainage Impact – Supplementary Guidance Jan 2013 – The Highland Council.
- Dochgarroch Lock water levels – Scottish Canals.
- River Ness flow data – SEPA and National River Flow Archive.
- Loch Ness water level data – SEPA.
- Elevation Discharge curve for Loch Dochfour – extracted from Loch Dochfour Reservoirs Act Section 10 Inspection 1987.
- Flood Estimation Handbook (FEH) Catchment data, 2018.
- Climate change allowances for flood risk assessment in land use planning Version 5, August 2024, SEPA.

11.8.5 A desktop study of the hydrological features associated with the Proposed Development has been undertaken and feeds into the Water Resources Assessment (**Appendix 11.1: Water Resources Assessment (Volume 5: Appendices)**). The significant water features included in this desktop study are Loch Ness, Loch nam Breac Dearga, Loch Dochfour, Caledonian Canal, Loch Ashie, Loch Duntelchaig and the River Ness. The following data has been obtained to inform the desktop study:

- SEPA River Ness at the Ness-side flow gauge, September 1972 – present.
- SEPA Foyers water level gauge, April 2014 – present.
- Dochgarroch Lock Water levels (Scottish Canals) -2018 – 2024.
- Scheme capacity and average flow/pump rate for Foyers, Loch na Cathrach and Loch Kemp hydro schemes. Source: Loch Kemp EIA report.
- Scheme capacity and flow/pump rate for the Proposed Development – from AECOM.
- Operating profile for the Proposed Development, developed by New Stream Renewables for Glen Earrach Energy for the years 2016-2024.

11.9 Assessment Methodology

Water Resources Assessment

11.9.1 To assess the potential effect on water resources, the Proposed Development has been modelled to ensure compliance with the current water management regimes for the key receptors.

11.9.2 The specified generation/pumping regimes for the Proposed Development are based on a detailed assessment of the operating profile of the Proposed Development undertaken by energy consultant New Stream Renewables. This looks at the periods of generation and pumping on hourly timesteps over a yearly period.

11.9.3 A review of the impact of the impoundment of the Allt Loch an t-Sionnaich watercourse through the Construction of the Headpond has been undertaken and appropriate mitigation measures put in place.

Flood Risk Assessment

11.9.4 The assessment of potential effects on flood risk has been carried out with reference to the guidance and techniques presented within the “Design Manual for Roads and Bridges” (DMRB), Volume 11, Section 3, Part 10 “Road Drainage and the Water Environment”.

11.9.5 The DMRB methodology takes into account the importance of the sensitivity of receptors and the magnitude of predicted impacts on flood risk. Importance/sensitivity is based on the value of the feature or resource, whilst the magnitude of potential impact is estimated based on the degree of effect and is independent of the feature.

11.9.6 The flood risk assessment has been carried out in line with the guidance set out by SEPA and Highland Council. Further details on the methodology can be seen in **Appendix 11.2: Flood Risk Assessment (Volume 5: Appendices).**

Sensitivity of Important Receptors

11.9.7 The sensitivity of receptors has been scaled from negligible, to low, medium, high and very high as set out in (**Table 4-5**) from **Chapter 4: Approach to EIA (Volume 2: Main Report)**. The definitions that are applied to each sensitivity level are those set out in the SEPA Flood Risk and Land Use Vulnerability Guidance report. The key indicators used to derive the sensitivity of each receptor are identified in **Section 11.11**: Baseline Environment.

Table 11-3 Sensitivity of Important Receptors

Sensitivity	Definition
Very High	Most Vulnerable Uses e.g. hospitals, schools, care homes, nurseries
High	Highly Vulnerable Uses e.g. residential, hotels
Medium	Least Vulnerable Uses e.g. offices, shops, general industry
Low	Essential infrastructure e.g. essential transport infrastructure, water and wastewater infrastructure , digital communications infrastructure
Negligible	Water Compatible Uses e.g. flood control infrastructure, docks and marinas, water-based recreation

Magnitude of Impact

11.9.8 The magnitude of the potential effect was determined using the criteria outlined in **Table 11-4 Impact Criteria** scaled from high to medium, low and negligible magnitude.

Table 11-4 Impact Magnitude Criteria

Magnitude	Definition
High	Total loss or major alteration to key elements/features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed. Flood Risk – Loss of floodplain or defence protecting more than 100 residential properties from flooding.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that the post development character/composition of the baseline condition will be materially changed. Flood Risk – Loss of floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of the baseline condition will be similar to the pre-development situation. Flood Risk – Loss of floodplain or defence protecting 10 or fewer industrial properties from flooding.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximately to a ‘no change’ situation Flood Risk – Loss of floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

Significance of Effect

11.9.9 The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of the impact, using a matrix as illustrated in **Table 11-5 Significance of Effect** below. This approach provides a general framework but should not be treated as a simple matrix, professional judgement and project experience was applied in all cases.

Table 11-5 Significance of effect

	Sensitivity				
Magnitude of Impact	***Very High***	***High***	***Medium***	***Low***	***Negligible***
High	*Major*	*Major*	*Moderate*	*Moderate*	*Minor*
Medium	*Major*	*Moderate*	*Moderate*	*Minor*	*Negligible*
Low	*Moderate*	*Moderate*	*Minor*	*Negligible*	*Negligible*
Negligible	*Minor*	*Minor*	*Negligible*	*Negligible*	*Negligible*

11.9.10 Any effect predicted to be Negligible or Minor is considered to be 'Not Significant', those assessed as Moderate or Major are considered to be 'Significant'.

11.10 Limitations and Assumptions

11.10.1 **Appendix 11.1: Water Resources Assessment** and **Appendix 11.2: Flood Risk Assessment** (**Volume 5: Appendices)** have been based on available information. With regard to the receptors on the shores of Loch Ness and along the River Ness outlined in the flood risk assessment, these have been based on the work undertaken in support of the River Ness Flood Risk Protection Scheme, a flood scheme completed in 2015 to protect low lying areas in Inverness from fluvial and tidal flood risk.

11.10.2 Based on the low vulnerability of the Proposed Development elements next to Loch Ness, a high level approach has been adopted using the flow data calculated for the River Ness Flood Protection Scheme with appropriate climate change allowances. The flood levels have been calculated based on the Ness Weir stage discharge relationship. The upscaling of the outflows will underestimate the attenuation impact of the loch and therefore provide a conservative assessment of the flood levels.

11.10.3 The Loch Ness catchment is complex and heavily modified by existing hydroelectric operations. A net inflow model for Loch Ness has been adopted as opposed to a detailed hydrological model of the catchment. Therefore, long term water levels have been based on generated water levels calculated from River Ness recorded flows and the Ness Weir stage discharge relationship. The calculated water levels have been used to assess the operational impact of abstraction of water from Loch Ness and the discharge of water into Loch Ness during the storage and generation cycle of the Proposed Development.

11.10.4 Levels in Loch Ness are controlled by Ness Weir, which discharges into the River Ness, and by spill over Dochgarroch Lock into the Caledonian Canal. Ness weir is approximately 525 m in length and incorporates a fish pass with additional small flows through smolt passes. There are two radial gates within the weir structure, operated by SSE, which allow water to be discharged through the weir on an occasional basis.

11.10.5 The stage discharge relationship at the Ness Weir is based on six years of overlapping water level records at Loch Ness and the flow records in the River Ness at Ness-side. No information has been provided on the operation of the radial gates at the weir. The empirical method used however will capture the periods when the gates are operated. The flood flow stage discharge at Ness Weir and the relationship between Loch Ness and Loch Dochfour water level are based on studies undertaken following historic flood events.

11.10.6 The Water Resources Assessment has been undertaken using an hourly time step (interval) based on a scheme-specific operating profile developed by New Stream Renewables for Glen Earrach Energy. This operating profile has been adjusted for the other cumulative schemes (refer to **Section 11.3)** taking account of their generation capacities and Headpond volumes. All schemes have been assessed based on simultaneous operation. This will be a conservative assumption.

11.10.7 As explained above, the Water Resources Assessment has been undertaken based on recorded levels and flows in Loch Dochfour and River Ness, respectively. These take account of all current hydroelectric activities within the catchment (therefore including Glendoe and Foyers) and canal activities. This is therefore regarded as the baseline scenario.

11.11 Baseline Environment

The Proposed Development Site

11.11.1 The Proposed Development would be located on the north-west side of Loch Ness at national grid reference (NGR) NH 45255 22395, approximately 9.5 km to the south of Drumnadrochit, and 6.5 km north of Invermoriston.

11.11.2 Loch Ness is a large glacially eroded freshwater loch covering approximately 55.33 km^2. It is a water source for the northern section of the Caledonian Canal and provides a location for various recreational activities. During drought conditions, Southern and Scottish Energy (SSE) is required to release water from upstream catchments and reservoirs to provide minimum 'compensation' flows and maintain minimum navigational depths over lock upstream cills.

11.11.3 The Proposed Development consists of a storage capacity of up to 34,000 megawatt hours (MWh) with up to 2,000 MW installed electrical capacity. The Proposed Development will utilise Loch Ness as its Tailpond, with a Headpond located in an area that includes the current Loch nam Breac Dearga. Please see **Chapter 2: Project and Site Description (Volume 2: Main Report)** or further details.

11.11.4 There are three existing hydroelectric schemes in operation discharging to Loch Ness, Foyers PSH, Glendoe, and Glenmoriston. The 300 MW Foyers PSH scheme has been operating since the late 1960s (although it was initially constructed in the late 19th Century to power an aluminium smelting plant) and the 100 MW Glendoe conventional hydro-electric scheme began generation in June 2009. Glenmoriston, part of the Great Glen Scheme, has an installed capacity of 37MW. Two additional pumped storage hydro schemes are under development, the consented 450 MW Loch na Cathrach scheme and the 600 MW Loch Kemp scheme (in planning process).

11.11.5 A desktop study of the hydrological features associated with the Proposed Development has been undertaken and feeds into the water resources assessment set out in **Appendix 11.1: Water Resources Assessment (Volume 5: Appendices)**. The significant water features included in this desktop study are Loch Ness, Loch nam Breac Dearga, Loch Dochfour, Caledonian Canal, Loch Ashie, Loch Duntelchaig and the River Ness. The following data has been obtained to inform the desktop study:

- SEPA Ness at the Ness-side flow gauge, September 1972 – present
- SEPA Foyers water level gauge, April 2014 – present
- Dochgarroch Lock Water levels (Scottish Canals) -2018 – 2024
- Scheme capacity and average flow/pump rate for Foyers, Loch na Cathrach and Loch Kemp hydro schemes. Source: Loch Kemp EIA report
- Scheme capacity and flow/pump rate for the Proposed Development – from AECOM
- Generation curve for the Proposed Development, developed by New Stream Renewables for Glen Earrach Energy. For each hour, the % of the hour either generating or pumping.

Water Resource – Loch Ness

11.11.6 Loch Dochfour and Loch Ness are water sources for the northern section of the Caledonian Canal and provide a location for various recreational activities. Details of the operational arrangements of the Caledonian Canal were provided by Scottish Canals.

11.11.7 Loch Ness spans from Fort Augustus to the Bona Narrows at Lochend where it becomes Loch Dochfour. At the downstream end of Loch Dochfour, the watercourse splits with the Caledonian Canal continuing northeast towards Dochgarroch and the River Ness passing over the Ness Weir and flowing parallel to the canal towards Inverness. The weir was constructed during the works to construct the Caledonian Canal and effectively controls the level of Loch Dochfour and subsequently Loch Ness. During low flows the level of Loch Ness and Loch Dochfour are

equal, but when discharges from Dochfour over the weir exceed 200 meters cubic per second (m^3/s) the Bona Narrows become a control point and the level of Loch Ness rises above Loch Dochfour.

Direct Flood Risk to the Proposed Development Site

11.11.8 SEPA flood maps were accessed from the SEPA website, for the following sources of flooding: fluvial, pluvial, coastal, groundwater. The SEPA flood risk maps indicated that fluvial and pluvial flooding were potential sources of flooding to the Proposed Development Site. These maps are strategic level maps and are used to give an indication of the flood risk to a development; however, they do not contain adequate detail to correctly map flood risk to planned sites or individual properties.

11.11.9 SEPA flood maps were analysed for the potential fluvial flood risk. The maps showed the largest fluvial flood risk follows both the River Coiltie and the River Enrick where they both meet to enter Loch Ness, particularly the A82 at Drumnadrochit. However, the maps do not give an indication of flood risk from smaller watercourses in close proximity to the Proposed Development Site. The watercourses are likely to have a quick response to rainfall events which may lead to a rapid rise in flow, but the likelihood of this causing flooding on the steeply graded slopes around the site is considered low. The watercourses generally flow away from the Proposed Development Site, with little likelihood that any flooding would affect the Proposed Development. Based on the above, direct risk of fluvial flooding to the Proposed Development is considered low and is scoped out of further assessment as set out within **Table 11-7 Flood Risk Sources Scoped out of Further Assessment.**

Fluvial Flood Risk

11.11.10 The shore of Loch Ness is the lowest point of the Proposed Development Site at approximately 16 metres Above Ordnance Datum (mAOD). The terrain climbs steeply from the banks of Loch Ness. The Headpond is located on higher ground behind Meall Fuar-mhonaidh at a level of 450 to 500 m AOD.

11.11.11 Loch Ness and its upstream catchment feeds flood water into a Potentially Vulnerable Area (PVA) with regard to flood risk – PVA 01/21 Inverness. Significant flooding has been experienced in Inverness from the River Ness. This has resulted in The Highland Council constructing the River Ness Flood Protection Scheme to protect low lying areas of Inverness from both tidal and fluvial flooding.

11.11.12 SEPA FRM maps indicate that there are several properties may be at risk of flooding from Loch Ness during extreme flood events.

11.11.13 Extensive areas of Inverness are at risk from direct inundation from the River Ness during extreme flood events. The completed River Ness Flood Protection Scheme has increased the standard of protection to areas downstream of the Ness Bridge (OSNGR 266520 845150) to a 1 in 200-year standard. Areas further upstream are however still at risk. The detailed modelling carried out as part of the River Ness Scheme show that these areas currently have a standard of protection of between 1 in 10 and 1 in 25 years.

Flood Risk from Existing Reservoirs

11.11.14 Currently ten potential sources of reservoir flooding are in proximity to the Proposed Development Site, with varying degrees of downstream influence. The Proposed Development Site itself (with the exception of the proposed Inlet / Outlet Screen) is not in an area which would be at risk of flooding from these reservoirs. Full details are included within the **Appendix 11.2: Flood Risk Assessment (Volume 5: Appendices),** within this the risk of existing reservoir flooding to the Proposed Development is considered low and acceptable

Direct Pluvial Flooding to the Proposed Development

11.11.15 The potential pluvial flooding was assessed by SEPA flood maps. The maps showed the same areas that are at risk to fluvial flooding are also at risk of pluvial flooding with further ponded areas of high likelihood flooding along the A82 around Drumnadrochit. During Pre-Construction and Enabling and Construction, consideration should be given to the potential of surface water flooding in these areas with appropriate mitigation measures to eliminate the risk of contaminated surface water released into the natural environment. Due to the steeply graded and semi-impermeable nature of the Proposed Development Site and surrounding area, it should be expected that local storm events produce rapid surface water run-off. The addition of hardstanding areas and new tracks, as part of the Proposed Development, also has the potential to change natural flow paths and increase surface water run-off from these areas. It is also recognised that during the winter, surface water run-off could be increased by melting snow.

Flooding from Drainage Networks

11.11.16 There is no existing artificial drainage in the area, except that which may serve the residential dwellings within the Proposed Development Site boundary (Red Line Boundary). Therefore, the flood risk from them is not considered further.

Coastal/Tidal Flooding to the Proposed Development

11.11.17 The SEPA flood maps show that Loch Ness is not susceptible to coastal flooding and the location of the Proposed Development. An elevation assessment of the surrounding area and the Proposed Development Site showed a minimum elevation of 16 mAOD. The surrounding water bodies and watercourses are additionally not tidally influenced. The risk of tidal flooding is therefore low and does not require further consideration.

Direct Groundwater flood risk to the Proposed Development

11.11.18 There are no known records of groundwater flooding, and it is unlikely in this location due to the steep slope and freedom of drainage to Loch Ness. Additionally, the SEPA flood maps showed that there was no risk of groundwater flooding within the site. Further details of groundwater management are included within **Chapter 10: Water Environment (Volume 2: Main Report)**.

Sensitivity of Receptors

11.11.19 To enable a meaningful assessment of environmental impact to be made in accordance with the guidance in DMRB HD45/09, the sensitivity of flood risk receptors must be defined.

11.11.20 **Offsite properties, residential and non-residential infrastructure** would be vulnerable to any adverse change in flood risk that could be caused by the Proposed Development. This could result in financial loss and emotional distress to residents, and disruption to transport and services. SEPA guidance suggests that residential properties are classified as Category 2 – Highly Vulnerable Uses with regard to flood risk. The sensitivity of these receptors, including all property types, in reference to the criteria in this assessment, is therefore categorised as **High**.

11.11.21 **Site workers, construction and permanent site workers** may be sensitive to flood risk at the proposed development. During periods of severe weather, the usage of the site may be restricted, reducing the risk to workers. SEPA guidance indicated that the Proposed Development Site is classified under Category 6 – Water Compatible Uses with regard to flood risk. Due to the balance of vulnerable users and the water compatible land use, the sensitivity of these receptors, in reference to the criteria in this assessment, is categorised as **Medium**.

11.11.22 Flooding of the **Proposed Development Site** could cause damage to equipment and pollution. However, equipment located in flood prone areas would be water compatible and are likely to be able to withstand additional inundation during flood events. The sensitivity of these receptors is therefore assessed to be **Low**.

11.11.23 During prolonged dry periods **Loch Ness** and the downstream **River Ness and Caledonian Canal** are sensitive to changes in water levels which could be altered by the Proposed Development. The Caledonian Canal is of national importance and a reliable water supply is essential for its operation. The provision of the environmental minimum flow down the River Ness and the need to maintain a minimum water level within Loch Ness forms part of the operational parameters of the wider catchment. The ability to work within and not compromise the ability of others to work within those operational parameters is therefore essential. The sensitivity of these receptors is therefore categorised to be **High**.

11.11.24 **Aquatic ecology**, and in particular fish passage over Ness Weir and down the River Ness is sensitive to changes to the flow regime in the River Ness . Further details on the Aquatic and Marine Ecology can be found in **Chapter 9: Aquatic and Marine Ecology (Volume 2: Main Report)**. The sensitivity of these receptors is therefore categorised to be **High**.

Table 11-6 Sensitivity of Flood Risk and Water Balance

Receptor	Features	Overall Sensitivity
Offsite properties and infrastructure	Health and wellbeing implications of flooding, disruption, and financial cost.	High
Proposed site users	Health and safety	Medium
Development infrastructure	Financial cost	Low

Receptor	Features	Overall Sensitivity
Loch Ness, River Ness and Caledonian Canal	Maintenance of environmental minimum flow in River Ness and operation of Caledonian Canal	High
Aquatic ecology	Fish passage over Ness Weir and down River Ness	High

Climate Change

11.11.25 According to SEPA guidance rainfall intensity is projected to increase by up to 42% by 2080 due to climate change. The minimum lifetime of the Proposed Development is believed to be 125 years; the drainage infrastructure provisions put in place therefore must have an applied rainfall intensity of 42% to reduce the risk of surface water flooding over the Proposed Development's lifetime. The mitigation measures within the Mitigation and Monitoring section are based on the levels within Loch Ness and therefore will protect the key receptors from any impact from the scheme under both current and with climate change impact.

11.12 Embedded Mitigation

11.12.1 There are a number of water resources and flood risk impacts that could occur as a result of the Proposed Development. However, with mitigation, potential impacts can be avoided or reduced, lowering the magnitude of residual impacts. Mitigation measures that have been designed into the Proposed Development are considered 'embedded mitigation'. As these measures are secured through the actual design they are taken into account in the initial effects prediction, alongside standard mitigation (but not mitigation that is considered to be additional).

11.12.2 A more detailed description of the embedded mitigation relevant to a particular effect / receptor is provided in this section. Details of the Proposed Development can be found within **Chapter 2 Project and Site Description**, a summary of embedded mitigation measures within **Chapter 3: Evolution of Design and Alternatives (Volume 2: Main Report)** with a comprehensive list within the Mitigation Register in **Appendix 19.1: Mitigation Register (Volume 5: Appendices**), and the scheme drawings can be found within **Volume 3: Figures**.

11.12.3 The key embedded mitigation measures that impact on water resources and flood risk are as follows:

- Operational Rules based on Loch Ness water levels
- Surface water drainage
- Headpond Area
- Dam and Construction Methods
- Interception and Diversion of watercourses
- Compensation Flow
- Secondary Bund
- Design of watercourse crossings

Operational Rules based on Loch Ness Water Levels

11.12.4 The operation of the Proposed Development is dependent on the receiving water levels in the Tailpond, Loch Ness. Based on both water resource and flood risk receptors in Loch Ness and further downstream in the River Ness operational levels have been set setting out when the scheme can operate. Based on known receptors and constraints the following operation controls are embedded into the operation of the Proposed Development. Stop pumping and stop generating levels have been set when water levels in Loch Ness recorded at the LCW and at the SEPA level gauge at Foyers falls below or exceed a level of 15.42 mAOD and 17.6 mAOD respectively.

Surface Water Drainage

11.12.5 Each of the Permanent and Temporary Compounds will include sustainable drainage and / or proprietary drainage measures to intercept and treat surface water run-off from the Proposed Development Site during Pre-construction, Construction and Operation phases (as is relevant).

11.12.6 During operation, surface water runoff from permanent above ground facilities will be treated using sustainable drainage systems (e.g. ditches, swales, ponds etc.) where possible or otherwise proprietary treatment measures will be considered (e.g. filter drains, vortex flow separators). The Access Tracks will have adjacent swales or other suitable sustainable drainage measures to capture and treat any runoff, although these will only be relatively lightly trafficked following the completion of construction activities.

11.12.7 Overall, the design of surface water drainage systems, incorporating appropriate attenuation and treatment measures, will be undertaken post-consent as part of a Detailed Design Strategy. The surface water drainage arrangement will be developed based on the principles set out in **Appendix 11.2 Flood Risk Assessment - Section 5.2 Surface Water Drainage**

Headpond

Dams and Construction Method

11.12.8 As shown on **Figure 10.1 Surface Water Receptors (Volume 3: Figures)**, the Main Dam crosses the headwater channel of the Allt Loch an t-Sionnaich. Saddle Dam 1 lies to the north of the Headpond and Saddle Dam 2 lies at the Northeast corner of the Headpond. The Spillway lies to the southeast of Saddle Dam 2.

11.12.9 The Headpond will be classed as a High-Risk reservoir under the Reservoirs (Scotland) Act 2011. It will therefore be designed, constructed and certified by an appropriately appointed Reservoir Engineer in line with the Act. The Headpond will then be supervised and inspected in line with the Act. This will ensure that the Headpond is designed to appropriate standards, constructed to an appropriate standard and maintained to an appropriate standard.

11.12.10 At this stage there is no detailed method for the construction of any of the three proposed Dams. For this assessment it has been assumed that a concrete box culvert will be constructed offline in the location of the Main Dam along the face of the Headpond but adjacent to the channel of Allt Loch an t-Sionnaich and its tributaries. The Allt Loch an t-Sionnaich and its tributaries will then be diverted through the culverts, which will allow flows to be maintained while the Dam is constructed either side and over the culverts. The culverts will be closed to allow the Headpond to fill once construction of the Dams and associated infrastructure is complete but will then be used to allow a continuous outflow in line with the compensation flow requirements as set out in **Appendix 11.1 Water Resource Assessment - Section 3.3 Allt Loch an t-Sionnaich.**

Interception and Diversion of Watercourses

11.12.11 The upper reaches of the Allt Loch an t-Sionnaich will be intercepted by the Main Dam which will form a permanent barrier to downstream flows.

11.12.12 To ensure that significant impacts on the downstream flow regime for Allt Loch an t-Sionnaich are avoided, including to aquatic ecology and the local Hydroelectric Power (HEP) scheme, it is proposed to ensure that a suitable compensation flow is maintained at all times.

11.12.13 Unlike conventional HEP schemes, water for the pumped storage scheme is abstracted from Loch Ness rather than the catchment in which the Headpond is located. Flow into the Headpond from further upstream is not required and can effectively be passed forward to maintain downstream flows and the existing flow regime as far as practically possible.

11.12.14 A Valve House will be located at NH 44485 21945 and will be a permanent structure throughout the operation of the Proposed Development. The Valve House will contain the discharge valve for the compensation flow at the foot of the Main Dam.

11.12.15 The compensation flow will be determined as part of the CAR Licence application. In advance of this, a programme of water level and flow monitoring will be undertaken. This data will inform determination of a suitable compensation flow regime that maintains as close to the current flow regime as is practical.

Spillway

11.12.16 In order to manage water levels in the Headpond in the unlikely event that the pumps do not shut off, or during extreme flood events resulting in over-filling, a concrete Spillway is proposed in the east corner between Nighean a Mhill and Meall Fuar-mhonaidh.

11.12.17 To minimise the likelihood of discharge due to flooding to a nominal level the Spillway sill has been set above the 1 in 200 year plus climate change level. This ensures that no flood water spills form the Headpond in the 1 in 200

year flood event plus climate change, the standard defined in NPF 4 as being at risk of flooding. The Spillway has therefore been set to a level of 518.4 m AOD.

11.12.18 In the unlikely event that the Spillway is used, water will be released on to moorland that will help dissipate over an extended area prior to draining to the northeast via Allt Coire an Ruighe ultimately Loch Ness. However, operation of the Spillway is an unlikely event.

Secondary Bund

11.12.19 A Secondary Bund is proposed downstream of the Main Dam across the Allt Loch an t-Sionnaich. This structure will be a small earthen or concrete dam and is required protect the downstream watercourse from excessive erosion during the scour release at the Valve House (as per **Chapter 2 Project and Site Description Section 2.6.13-2.6.15 Valve House**). The Secondary Bund is expected to be filled with water from the Head pond during valve exercise every six months for a short duration (for maintenance of the Main Dam when the scour release valve is opened) and dissipate naturally into the downstream watercourse at a suitable rate. It will store approximately 4,000 m^3 of attenuated water, with final dimensions and volumes to be determined in the detail design stage.

Design of Watercourse Crossings

11.12.20 Two types of watercourse crossings are proposed. Where existing crossings are to be extended, the existing culvert (15 no.) or bridge (4 no.) will be extended on a 'like for like' basis. For example, if the culvert is currently a closed pipe, it will be extended with a closed pipe. Bottomless culverts will be used where new crossings (14 no.) are required, other than in a few locations where bridges (2 no.) are proposed by virtue of the size of the watercourse being crossed.

11.12.21 All new crossings will be sized appropriately to allow bank and riparian habitat to remain under the new crossing to facilitate crossings for mammals. Where this cannot be achieved or may be routinely impassable, a mammal ledge or alternative tunnel near the watercourse crossing should be incorporated into the crossing design.

11.12.22 All new and upgraded crossings must be designed to accommodate the 0.5% Annual Exceedance Probability (AEP) flows in line with SEPA good practice.

11.12.23 Two types of watercourse crossings are proposed. Where existing crossings are to be extended, the existing culvert (15 no.) or bridge (4 no.) will be extended on a 'like for like' basis. For example, if the culvert is currently a closed pipe, it will be extended with a closed pipe. Bottomless culverts will be used where new crossings (14 no.) are required, other than in a few locations where bridges (2 no.) are proposed by virtue of the size of the watercourse being crossed. Further details of these measures can be found in **Chapter 10: Water Environment** (**Volume 2: Main Report).**

11.13 Assessment of Effects

11.13.1 The following section considers the effects of the Pre-Construction and Enabling, Construction, and Operation of the Proposed Development on the flood risk and water resource receptors found within the Study Area.

Features Scoped out of Further Assessment

11.13.2 **Section 11.11** considers the baseline environment in terms of existing water resources and flood risk. A number of flood risk sources that are non-existent or negligible are identified and these have been scoped out of further assessment. These are set out in the table below.

Table 11-7 Flood Risk Sources Scoped out of Further Assessment

Source	Rationale for exclusion from further assessment
Fluvial flood risk to Proposed Development Site	The watercourses near the Proposed Development Site are small and likely to have a quick response to rainfall events which may lead to a rapid rise in flow, but the likelihood of this causing flooding on the steeply graded slopes around the site is considered low. The watercourses generally flow away from the Proposed Development Site, with little likelihood that any flooding would affect the Proposed Development. Based on the above, direct risk of fluvial flooding to the Proposed Development is considered low

Flood risk from existing reservoirs	The Proposed Development Site itself (with the exception of the proposed Inlet / Outlet Screen) is not in an area which would be at risk of flooding from these reservoirs
Flooding from drainage networks	There is no existing artificial drainage in the area
Coastal/tidal flooding	Minimum elevations of the Proposed Development site are above levels influenced by tides or coastal flooding

Pre-Construction and Enabling, and Construction Effects

11.13.3 During Pre-Construction and Enabling, and Construction phases, there is the potential for an increase in flooding due to:

- Increased runoff due to increased area of hardstanding and compacted ground from site clearance, Access Tracks and Compounds.
- Temporary water storage (in attenuation ponds and drainage systems); and

11.13.4 Temporary hard standing or compacted surfaces, such as those in the compounds, Access Tracks and as a result of Pre-Construction and Enabling site clearance, could result in rapid surface water run-off to local watercourses via the surface water drainage system or increased overland flow.

11.13.5 In the absence of mitigation, this is considered to be of Low magnitude and considering the High sensitivity of offsite receptors; this results in a **Moderate adverse effect**.

11.13.6 The Low magnitude effect considered with the Medium sensitivity of proposed on-site users and Low sensitivity of the Proposed Development, results in a **Minor** and **Negligible adverse effect** respectively.

11.13.7 It is anticipated that there will be **no adverse effects** on Water Resources during Pre-Construction and Enabling or Construction to any receptors identified in **Table 11-6 Sensitivity of Flood Risk and Water Balance** .

Operational Effects

11.13.8 The operational flood risks associated with the Proposed Development are discussed in detail in **Appendix 11.1: Water Resources Assessment** and **Appendix 11.2: Flood Risk Assessment (Volume 5: Appendices).** The following is a summary of the risk identified therein which are:

- Discharge under normal operating conditions - risk of development increasing fluvial flood risk from Loch Ness, River Ness and Caledonian Canal due to release of flows
- Risk of flooding from the Headpond including embankment breach and scour release
- Groundwater flooding of Below Ground Infrastructure;
- Reduction in water level in Loch Ness and flows in River Ness including
  - Reduction in water levels in Loch Ness and Loch Dochfour during low flows leading to impact on the ability to maintain navigation levels within the Caledonian Canal
  - Reduction in flow at Ness Weir and River Ness impacting aquatic ecology and fish passage
- Changes to the flow regime of Allt Loch an t-Sionnaich due to construction of the Headpond. This is addressed in **Chapter 10: Water Environment**.

Discharge under Normal Operating Conditions

11.13.9 As the Proposed Development will include a discharge to Loch Ness under normal Operation, it could result in increased flood risk, which would be contrary to the guidance set out by The Highland Council in their supplementary guidance The Flood Risk and Drainage Impact. Without mitigation the effect could be of high magnitude on a high sensitivity receptor, leading to a potential **Major adverse effect**, which would be **Significant**. It has therefore been considered further in Mitigation and Monitoring section. With the operational parameters set in place based on operational levels result in the impacts on flood risk being managed and the Proposed Development resulting in **no increase in flood risk**.

11.13.10 The low water controls result in hands-off levels for pumping resulting in the Operation of the Proposed Development not having an impact on low water levels in Loch Ness. The impact on water level and flows in Loch Ness and the River Ness is negligible, resulting in a **Minor effect**. The overall effect is therefore regarded as **Not Significant.**

11.13.11 The Operation of the Proposed Development would result in more frequent fluctuations in water levels. These are however within the current range of Loch Ness and therefore again regarded as being negligible, and so **Not Significant.**

Risk of Flooding from Headpond

11.13.12 The Proposed Development will include the creation of a Headpond, which will impound a substantial volume of water, in excess of 30 Mm^3 during Operation of the Proposed Development. Therefore, there is a risk of flooding associated with this component of the Proposed Development, the magnitude of which is high. Flooding would impact offsite properties and infrastructure with a high sensitivity, resulting in a **High adverse effect**. However, due to the high standard of design, management and maintenance required under the Reservoir (Scotland) Act 2011 and provided by any responsible operator, the probability of occurrence is considered extremely remote, mitigating the impact to negligible, resulting in an effect of Minor Significance. This will be in addition to the requirements set out within **Chapter 2: Project and Site Description** to guarantee the safety of the Proposed Development. The overall effect is therefore regarded as **Not Significant.**

11.13.13 A scour release arrangement is required at the Headpond which is expected to be operated for maintenance purposes every 6 months . This flow release will be attenuated at a secondary bund and its Operation restricted to a few minutes. The flows downstream of the secondary bund will be limited to Qmed, which is the 1 in 2 year return period flow from the impounded catchment. The risk of any flooding as a result of scour release is negligible, resulting in an **Minor effect** on offsite properties**.** The overall effect is therefore regarded as **Not Significant.**

Groundwater Flooding

11.13.14 A Construction Groundwater Control Strategy will be prepared to detail how groundwater will be managed. Details of the groundwater assessment in relation to quality, quantity and water level impacts are included in **Chapter 10 Water Environment (Volume 2: Main Report).** The effect of the Proposed Development on groundwater flooding is negligible, which is **Not Significant**.

Reduction in water levels and flows

11.13.15 A detailed assessment of the impact of the Proposed Development on water levels has been undertaken as part of the **Appendix 11.1: Water Resources Assessment (Volume 5: Appendices)**. The implementation of the operating regime with the hands-off levels together with the implementation of the variable weir (Dochfour Weir Upgrades) at Ness Weir results in the impact of the Proposed Development on low water levels being Negligible. This impact on the high sensitivity receptors of Loch Ness, River Ness, Caledonian Canal and fish results in a **Minor effect** which is **Not Significant**.

11.14 Additional Mitigation

11.14.1 Additional mitigation is proposed as part of the Proposed Development to address impacts based on other considerations and to provide further data with regard to baseline flow parameters. These include the modification to Dochfour Weir and a Flow Monitoring Plan (refer to **Chapter 10: Water Environment, Section 10.10.1 Water Quality and Flow Monitoring Plan**):

- Construction of the Dochfour Weir works that will introduce a variable height weir at the location of Ness Weir to address impacts based on other considerations.
- Construction of the Headpond and severance of the Allt Loch an t-Sionnaich catchment requires the determination of a suitable compensation flow, and this will require flow monitoring of the catchment to generate a baseline flow duration curve.

11.14.2 The Dochfour Weir proposals consist of the construction and operation of a variable weir that will adjust the height of the weir to manage flows within the River Ness to isolate these flows from the impact of the PSH activities in

Loch Ness. This will result in a more natural flow in the River Ness controlled by meteorological conditions (and conventional hydro releases within the catchment) rather than PSH activities. Additional details are included in **Appendix 2.1 Dochfour Weir Upgrade Description (Volume 5: Appendices).** It should be noted that while the Dochfour Weir Upgrade works are required for the mitigation of the potential impacts of the Proposed Development on water levels and flows in the River Ness, these works do not form part of this application. Instead, they are being developed separately in collaboration with Scottish Canals and other stakeholders as additional mitigation measures. The Applicant is committed to ensuring these works are implemented prior to the operation of the Proposed Development, and this is anticipated to be managed by condition of consent.

11.14.3 The construction of the Headpond and severance of the Allt Loch an t-Sionnaich catchment requires the determination of a suitable compensation flow for aquatic habitats and the continued and uninterrupted operation of the small local HEP scheme. The basis of this compensation flow will require the generation of a flow duration curve, which will require monitoring of the flow at multiple locations. This will involve continuous stage monitoring combined with spot-flow gauging or other suitable method (e.g. deployment of an acoustic doppler current profiler) depending on the Proposed Development Site constraints to data collection. It is recommended that this data is collected over a minimum of 12 months prior to any works occurring in order for a robust baseline flow duration curve to be generated. The data will also need to be interpreted in the context of the weather conditions during the monitoring period to account for whether the monitoring was carried out in a drier or wetter year than average, as well as consider the future influence of climate change. Beyond initial determination of a suitable compensation flow, there will be a need to obtain a CAR licence from SEPA. This may require further monitoring of flows.

11.15 Residual Effects

11.15.1 The operational parameters set in place based on Loch Ness water levels and the introduction of seasonal operational only at the Dochfour Weir variable weir result in the impacts on flood risk being managed and the Proposed Development resulting in no increase in flood risk.

11.15.2 The low water controls result in hands-off levels for pumping resulting in the Operation of the Proposed Development not having an impact on low water levels in Loch Ness. The impact on water level and flows in Loch Ness and the River Ness is therefore negligible. The overall effect is therefore regarded as **Not Significant.**

11.15.3 During Pre-Construction and Enabling, Construction and Operation (based on implementation of the operational rules for the Proposed Development and the proposed Dochfour Weir works), the Proposed Development will result in negligible effects, which are **Not Significant**.

11.15.4 The Operation of the Proposed Development would result in more frequent fluctuations in water levels. These are however within the current range of Loch Ness and therefore again regarded as being negligible, and so **Not Significant**.

11.15.5 A summary table is presented below for the Pre-Construction and Enabling, Construction and Operational phases that indicates whether the residual effects, after the implementation of all mitigation, are Not Significant at a given receptor or group of receptors

Table 11-8 Assessment Summary Table

Receptor	Sensitivity	Description of Effect	Magnitude of Impact	Significance	Additional Mitigation	Residual Magnitude of Impact	Significance (post Additional Mitigation)
		Pre-Construction and Enabling, and Construction Phases					
Offsite properties	High	Flooding due to temporary increases in impermeable area and compacted ground, temporary water storage and increased flow due to dewatering activities	Low	Moderate	Implementation of Construction Environmental Management Plan (CEMP). Suitable design of surface water drainage (Drainage Strategy)	Negligible	Negligible - **Not Significant**
Onsite users	Medium	Flooding due to temporary increases in impermeable area and compacted ground, temporary water storage and increased flow due to dewatering activities.	Low	Minor	Implementation of CEMP. Suitable design of surface water drainage (Drainage Strategy)	Negligible	Negligible - **Not Significant**
Development infrastructure	Low	Flooding due to temporary increases in impermeable area and compacted ground, temporary water storage and increased flow due to dewatering activities.	Low	Negligible	Implementation of CEMP. Suitable design of surface water drainage (Drainage Strategy)	Negligible	Negligible - **Not Significant**
		Operational Phase					
Offsite properties	High	Discharge to Loch Ness under Normal Operation	High	Major	Implementation of operational parameters based on maximum level in Loch Ness for generation. Limitation of the Dochfour Weir variable weir arrangement during winter months	Negligible	Minor - **Not Significant**
Offsite properties	High	Risk of flooding from breach of Headpond. The Headpond will be designed to a high standard to minimise risk. Appropriate management and maintenance of the Headpond is key to manage the flood risk from this source.	High	Major	High standard of management and maintenance in accordance with the Reservoir (Scotland) Act 2011 reduces probability of occurrence to negligible	Negligible	Minor - **Not Significant**
Onsite users	Medium	Risk of flooding from breach of Headpond. The Headpond will	High	Moderate	High standard of management and maintenance in accordance with the	Negligible	Negligible - **Not Significant**

Receptor	Sensitivity	Description of Effect	Magnitude of Impact	Significance	Additional Mitigation	Residual Magnitude of Impact	Significance (post Additional Mitigation)
		be designed to a high standard to minimise risk. Appropriate management and maintenance of the Headpond is key to manage the flood risk from this source.			Reservoir (Scotland) Act 2011 reduces probability of occurrence to negligible		
Development Infrastructure	Low	Risk of flooding from breach of Headpond	High	Moderate	High standard of design, management and maintenance in accordance with the Reservoir (Scotland) Act 2011 reduces probability of occurrence to negligible	Negligible	Negligible - **Not Significant**
Offsite properties	High	Risk of flooding from scour Operation	Low	Moderate	Downstream bund constriction to limit flow to Qmed	Negligible	Minor - **Not Significant**
Development	Low	Groundwater flooding	Negligible	Negligible		Negligible	Negligible - **Not Significant**
Loch Ness, River Ness and Caledonian Canal Water Level	High	Reduction in water levels in Loch Ness during normal and low flows	High	Major	Implementation of operational parameters based on minimum level in Loch Ness for abstraction. Construction of the Dochfour Weir upgrades and operation during summer months.	Negligible	Minor - **Not Significant**
Fish passage over Ness Weir and down River Ness	High	Reduction in water levels in Loch Ness during normal and low flows	High	Major	Implementation of operational parameters based on minimum level in Loch Ness for abstraction. Construction of the Dochfour Weir upgrades and operation during summer months.	Negligible	Minor - **Not Significant**

11.16 Cumulative Effects

11.16.1 Intra-cumulative and inter-cumulative effects have been considered as part of **Appendix 11.1: Water Resources Assessment** and **Appendix 11.2: Flood Risk Assessment (Volume 5: Appendices).** The results are described below.

Inter-Cumulative Effects

11.16.2 The inter-cumulative effects that could have cumulative effects on the water bodies that will be affected by the Proposed Development, either during the periods of Pre-Construction and Enabling, Construction or Operation.

11.16.3 The cumulative assessment within the water resources and flood risk assessments has taken into account current operational arrangements for Loch Ness ensuring minimum water levels and hence navigation of the canal and pass-forward flows to the River Ness. It is assumed that all other PSH developments will operate within these protocols.

11.16.4 There are three other significant operational hydro power schemes utilising Loch Ness (Foyers, Glendoe and Glenmoriston which is part of the Great Glen Scheme), in addition to the downstream Caledonian Canal. These are historic uses of Loch Ness and therefore form part of the baseline scenario.

11.16.5 The cumulative effects of the other proposed schemes result in greater impacts on water levels within Loch Ness. For the purpose of this assessment, all schemes have been assumed to be operating simultaneously, which is a conservative assumption, but suitable for assessing the worst case. The impact of the schemes operating in this manner with appropriate mitigation measures in place based on operating level has been assessed. The cumulative impact of all schemes operating together is regarded as **Not Significant.**

Intra-Cumulative Effects

11.16.6 Intra-project cumulative effects due to components of the Proposed Development being undertaken synergistically have been analysed as part of the 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.

11.16.7 The impact of changes in water level as a result of the Proposed Development are Negligible during Pre-Construction and Enabling, Construction and Operation of the Proposed Development. The residual effect that the Proposed Development has on the water environment and shared receptors as a result of these changes is considered to be negligible, and so **Not Significant**, on the basis of the seasonal operation of the proposed variable weir at Dochfour Weir being implemented and operated.

11.17 Summary

11.17.1 This chapter summarises the potential effects of the Proposed Development on water resources and flood risk in the Study Area. This includes Loch Ness, the River Ness and other small watercourses in the area. It presents the baseline water resources scenario looking at water levels and flows and highlights the potential effects and their significance, taking into account embedded, standard and additional mitigation measures. The chapter also looks at the flood risk to the Proposed Development under baseline conditions and the effects of the scheme and its operation and their significance. Full details of the assessments conducted can be found in **Appendix 11.1: Water Resources Assessment** and **Appendix 11.2: Flood Risk Assessment (Volume 5: Appendices).**

11.17.2 The baseline was informed from a number of online sources included within **Section 11.8.4 Baseline Data Collection**, a Scottish Canals data request and SEPA flow and level data download. The key receptors and the potential effect to both water resource impacts and flood risk are identified in **Section 11.13 Assessment of Effects**.

11.17.3 The Proposed Development has the potential to impact on the volume, rate and timing of inflows into Loch Ness. This can impact on both water resources within Loch Ness as well and flood risk around the loch and further downstream on the River Ness. In addition to the impact on Loch Ness the impoundment of watercourses through the construction of the Headpond has the potential to impact on the flow regime locally in the impounded watercourses.

11.17.4 The key receptors with regard to the impact on water resources and flood risk are those that are hydraulically linked to the Proposed Development. This includes link to the both the Headpond and the Tailpond. These include the following:

- Loch Ness and Loch Dochfour which are connected via the Bona Narrows
- River Ness
- Caledonian Canal
- Allt Saigh and its tributary Allt Loch an t-Sionnaich

11.17.5 In order to assess the impact on water resources a detailed water balance assessment has been carried out together with an assessment of flows in the impounded watercourses. A flood risk assessment has been carried out looking at the Proposed Development Site as well as the impact of the Proposed Development on flood risk at the key receptors note above.

11.17.6 A water balance model has been developed to both replicate baseline conditions and to allow the operation of the Proposed Development to be assessed. The findings of the water balance model have been used to assess the impact, develop mitigation measures and identify the residual risk.

11.17.7 The assessment has been carried out in line with National and Local Guidance. These predominantly refer to flood risk and are summarised in Section 11.5.

11.17.8 Water levels in Loch Ness and Loch Dochfour are driven by a combination of catchment inflows (a large proportion of which are modified by reservoirs and hydro schemes), operation of Foyers PSH, and spill over Ness Weir and Dochgarroch Lock. Levels are controlled within Loch Ness to ensure that water supply into the Caledonian Canal is maintained to ensure navigability and minimum flows are maintained in the River Ness.

11.17.9 There is a history of both flood and drought events in Loch Ness with a significant flood event in March 2015 and a prolonged drought event in May 2023.

11.17.10 A number of the receptors are particularly vulnerable to changes to both low water and flood conditions. The Proposed Development (without mitigation) could lead to Significant Effect on water resources and flood risk with the movement of significant volumes of water between Loch Ness and the Headpond. The impoundment of a large volume of water within the Headpond introduces a new flood source and therefore is designed and maintained in an appropriate manner to manage this risk.

11.17.11 Impounding the tributary of the Allt Loch an t-Sionnaich will reduce the flows in the channel and have a detrimental effect on the water environment in that water body.

11.17.12 Significant amount of embedded mitigation is included within the Proposed Development design to address the potential identified impacts. These include operational rules based on water levels in Loch Ness, appropriate

compensation flows in the Allt Loch an t-Sionnaich and the design, construction and the maintenance of the Headpond in line with the Reservoirs (Scotland) Act 2011.

11.17.13 It was found that with the adoption of standard mitigation and good working practices to manage the Pre-construction and Enabling Phase and the Construction Phase, embedded mitigation to avoid adverse impacts, and additional mitigation measures, all potential effects are considered to be **Not Significant** for the Pre-construction and Enabling Phase and the Construction Phase.

11.17.14 Further mitigation measures are proposed for the operational phase based on maintaining more natural flows in the River Ness through the construction of the Dochfour Weir proposal. The Dochfour Weir proposals consist of the construction and operation of a variable weir that will adjust the height of the weir to manage flows within the River Ness to isolate these flows from the impact of the PSH activities in Loch Ness. This will result in a more natural flow in the River Ness controlled by meteorological conditions (and conventional hydro releases within the catchment) rather than PSH activities.

11.17.15 It should be noted that while the Dochfour Weir Upgrade works are required for the mitigation of the potential impacts of the Proposed Development on water levels and flows in the River Ness, these works do not form part of this application. Instead, they are being developed separately in collaboration with Scottish Canals and other stakeholders as additional mitigation measures. The Applicant is committed to ensuring these works are implemented prior to the operation of the Proposed Development, and this is anticipated to be managed by condition of consent.

11.17.16 Overall, to ensure that these Operational Phase mitigation measures are secured through planning, a number of management plans, strategies and assessments are proposed, that can be secured under a planning condition, with these including:

- Detailed Design of the proposed Dochfour Weir variable weir arrangement.
- Detailed Drainage Strategy (surface and foul drainage).
- Water Crossing Detailed Assessment.
- CEMP to address construction stage drainage arrangements.
- Flow Monitoring Plan

11.17.17 The operation of the Proposed Development will result in greater daily fluctuations in Loch Ness. These will however be in line with existing fluctuation range of water level and extreme levels will not be impacted.

11.17.18 With the introduction of the further mitigation measures the potential effects are considered to be **Not Significant** for the Operational phase.

11.17.19 A number of developments are currently being considered at Loch Ness. The cumulative effects of the Proposed Development together with the other proposed schemes result in greater impacts on water levels within Loch Ness based on greater volumes of water being transferred between Loch Ness and the respective Headponds. With the other proposed schemes operating in line with the parameters set out by existing CAR licences or as set out within their S106 applications the impact on low water and flood conditions are regarded as **Not Significant**

11.17.20 The water resource and flood risk assessment show that with the Proposed Development with the embedded mitigation measures and the additional mitigations identified in this assessment result in **No Significant** effect to low water and flood conditions in Loch Ness.

11.17.21 In a similar manner with the embedded mitigations the Headpond result in **No Significant** Impact on water resources and flood risk.

11.17.22 The water resource and flood risk assessment conclude that the Proposed Development results in **No Significant** impact on the basis of the development of the management plans, strategies and assessments identified in this assessment.

11.18 References

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