EARBA STORAGE

A GILKES ENERGY COMPANY

Earba Pumped Storage Hydro Scheme

EIA Report

Appendix 11.1: Aquatic Technical Appendix

February 2024

Quality Information

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Revision History

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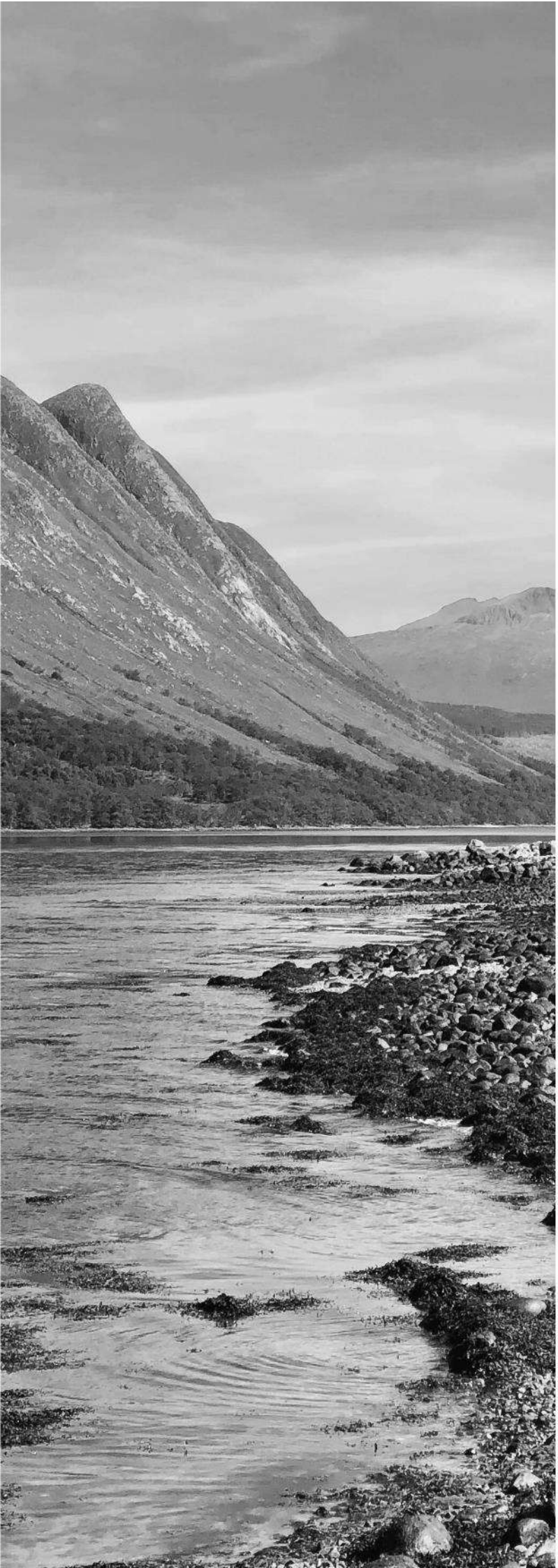

EARBA PUMPED STORAGE HYDROSCHEME

AQUATIC TECHNICAL APPENDIX

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23/02/2024

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Quality Assurance

This report has been prepared according to Gavia Environmental Quality Management Process. Gavia Environmental employs consultant scientists who are members of appropriate professional institutions and adhere to professional codes of conduct.

Disclaimer

This report is presented to Earba Ltd. in respect of Earba Pumped Storage Hydroscheme, and may not be used or relied on by any other person or by the client in relation to other matters not covered specifically by the scope of this report.

Notwithstanding anything to the contrary contained in the report, Gavia Environmental Ltd is obliged to exercise reasonable skill, care, and diligence in the performance of the services required by Earba Ltd. and shall not be liable except to the extent that it has failed to exercise reasonable skill care and diligence, and this report shall be read and construed accordingly.

The report has been prepared by Gavia Environmental Ltd. No individual is personally liable in connection with the preparation of this report. By receiving this report and acting on it, the client or any other person accepts that no individual is personally liable whether in contract, tort, for breach of statutory duty or otherwise.

Contents

List of Figures

List of Tables

Executive Summary

Gavia Environmental Ltd. was commissioned by Earba Ltd. to undertake aquatic surveys within Lochan Na-Hearba (hereafter referred to as Loch Earba) and Loch a' Bhealaich Leamhain (hereafter referred to as Loch Leamhain) and effected watercourses in relation to the proposed Earba Pumped Storage Hydroscheme. Surveys undertaken were in relation to fish population and species, macroinvertebrates, water quality, macrophytes and fish habitat quality and informed by Scoping Responses/Opinions.

This document has been compiled to inform an Ecological Impact Assessment Report (EIAR).

Macroinvertebrate Survey

Macroinvertebrate surveys were undertaken at ten survey locations in accordance with standard Scottish Environment Protection Agency (SEPA) and Environment Agency (EA) kick sampling methodology. Samples were analysed and scored in accordance with the following biotic index's: Biological Monitoring Working Party (BMWP), Proportion of Sediment-sensitive Invertebrates (PSI), Community Conservation Index (CCI), and Empirical Proportion of Sediment-sensitive Invertebrates (EPSI).

Macroinvertebrate results indicated variation in water quality. Within Loch Earba East and adjoining tributaries Survey Locations MS1 and MS2 indicated high water quality with high Biological Monitoring Working Party (BMWP) (118 and 82), PSI (77.27 and 95.00) and EPSI (89.78 and 100.00). MS02 displayed high BMWP, PSI and EPSI scores, however, the CCI score was considerably lower. Summer sampling was also indicative of variation scoring highly on BMWP (73 and 125) and EPSI (89.87 and 94.79) index's.

Within Loch Earba West and adjoining tributaries Survey Location MS03 scored high BMWP (75), PSI (100), EPSI (100) but low on CCI (6.00). Similarly MS04 scored low BMWP (22) but high PSI (100), EPSI (83.33) and very high CCI (17.5), the highest CCI observed. Little variation was observed between Spring and Summer sampling.

Within Loch Leamhain MS7 scored moderately on BMWP, PSI and EPSI but indicated Fairly high conservation value on the CCI index throughout both Spring and Summer sampling. MS8 indicated very high BMWP (122), PSI (95.24), EPSI (95.42) and CCI (14.00).

Several species of conservation value were identified including the Arctic-alpine pea mussel (*Euglesa conventus),* Davis's river diver (*Oreodytes davisii*) and of oligotrophic lentic specialists (*Oligotrophic striata* and *Apatania wallengreni*).

Water Quality

Water quality was undertaken at 10 water quality monitoring location in tandem with macroinvertebrate survey locations. Water quality was measured *in-situ* for: pH; Temperature; Electrical Conductivity; Total Dissolved Solids; Dissolved Oxygen; and Oxidative Reduction Potential.

Water Quality results indicated high ambient water quality. No parameters observed were indicative of underlying pollution. All parameters conformed to standards suitable to support salmonids (of parameters available).

All temperature values were within 6 - 20°C established optimal ranges, however, no Survey Locations reached optimal growth values of 16 -17°C.

pH ranges fell outwith optimal ranges for salmonids (pH 6.5 – 8.0) at six Survey Locations, however, these deviated by pH 0.4 below pH 6.5. All other Survey Locations fell within optimal ranges, no Survey Locations observed values too alkaline.

Electrical Conductivity ranged from 20 – 52 µS/cm, all values were considered low and did not indicate pollution sources present.

Total Dissolved Solids ranged from 13 – 35 mg/l, all values were considered low and did not indicate pollution sources present.

Dissolved Oxygen ranged from 89.6 – 110% saturation and 9.8 - 12.5 mg/l. All values fell within criteria assessment of 8-15 mg/l with no Survey Locations being considered hypoxic or hyperoxic.

Oxidative Reduction Potential ranged from 109.6 – 163.7 mV.

Fish Habitat

Fish habitat surveys were undertaken on all major watercourses likely to be affected by the Proposed Development using an adapted SEPA fish habitat methodology. Areas of suitable spawning for salmonids and obstructions to fish passage/migration were additionally noted.

Fish Habitat results indicated a dominance of Productive habitat type, covering 91.46% of habitat surveyed; this was sub-categorised into Productive (high) at 2.47%; Productive (moderate) at 69.95%; and Productive (low) at 19.69%. Lamprey and Not Suitable habitat types were present at 0.23 and 7.95% respectively. No Bedrock habitat types were present. Losses in habitat due to inundation levels were dominated by Productive (moderate), Productive (low) and Not Suitable; all Productive (high) habitat was lost.

Fish Population Assessment

Gill netting surveys were undertaken on both basins of Loch Earba in accordance with the methodology outlined in Bean (2003). An eight net night effort was undertaken on both basins using pelagic and benthic net types, covering benthic and pelagic habitat types.

Gill netting results indicated the presence of three species: brown trout, Arctic charr and Eurasian minnow. Brown trout and Eurasian minnow were found in both basins of Loch Earba and Arctic charr were found only in the East basin. Arctic charr are presumed to be present in both basins due to the presence of juvenile Arctic charr in adjoining tributaries. Both Arctic charr populations were determined to be in unfavourable condition.

Macrophyte Survey

Macrophyte surveys were undertaken in accordance with the standard approach to biological monitoring of standing water habitats, as is recommended by the Joint Nature Conservation Committee. Four 100 m transects were conducted per waterbody (considered representative where the waterbody area is <100 ha). Locations of the transects were strategic to characterise macrophyte communities and/or where species of interest are likely to occur. As historical macrophyte data was not present prior to this survey, transect locations were chosen to represent the potential range of habitats or species within the marginal areas of waterbodies. This was assessed by undertaking an initial walkover of the waterbody perimeter prior to conducting transect surveys. A strandline survey and a wader survey were carried out in each waterbody examined.

The Macrophyte survey indicated the presence of 37 species in all three waterbodies surveyed. All species identified were designated as 'Least concern' for conservation value. Submergent communities displayed smaller species variation, when compared to emergent communities, with 17 species identified compared to 22. Loch Leamhain displayed little overall assemblage variation with 4 species identified.

No invasive non-native species were present in any waterbody surveyed.

1 Introduction

Gavia Environmental Ltd. was commissioned by Earba Ltd. (hereafter 'The Client') to undertake aquatic surveys within Lochan Na-Hearba (hereafter referred to as Loch Earba) and Loch a' Bhealaich Leamhain (hereafter referred to as Loch Leamhain) and effected watercourses in relation to the proposed Earba Pumped Storage Hydroscheme (PSH). Although Loch Earba is considered to be one waterbody, it is considered to have two basins (separated by a river and dam) hereafter referred to as Loch Earba East (approximate grid reference NN 49477 84783) and Loch Earba West (approximate grid reference NN 47315 82322).

Surveys undertaken were in relation to fish population and species, macroinvertebrates, water quality, macrophytes and fish habitat quality.

This document has been compiled to inform an Ecological Impact Assessment Report (EIAR).

1.1 Background

The client is proposing to construct a new long-scale long duration 1500 MW pumped storage hydroscheme and associated infrastructure on Loch Earba and Loch Leamhain located on the Ardverikie Estate (see **Appendix A, 'Proposed Development'** for Red Line Boundary of development). The Proposed Development would function by transferring water between a lower reservoir, Loch Earba, and an upper reservoir, Loch Leamhain. The maximum water level of both lochs would be increased by constructing dams to increase their natural water storage capacity, consequently a large area of peripheral habitat will be inundated (submerged in water) as shown in **Appendix A, 'Proposed Development'**. The reservoirs would be connected by an underground waterway system including up to three headrace tunnels.

1.2 Scoping and Consultation

To inform the scope of the assessment for the Proposed Development, consultation was undertaken with statutory and non-statutory bodies. Full details of the consultation responses and scoping opinion specific to Aquatic Ecology can be reviewed in the EIAR: Chapter 11.

NatureScot was consulted on the presence of Freshwater Pearl Mussels, *Margaritifera margaritifera,* within the catchment. NatureScot suggested that they '*don't hold any records for the catchments listed*' and that the area is unlikely to have any '*appropriate freshwater pearl mussel (FWPM) habitat that would be affected by the proposal*'[1], therefore surveys were not undertaken.

SEPA was consulted on the proposed aquatic surveys and the methodologies employed; revisions were made to the document accordingly (V3.0 onwards).

MarineScotland was consulted on the gillnetting methodology employed, as stated on the licence, and prior to any changes in methods employed.

Baseline surveys undertaken were guided by scoping responses/opinion and included:

- Macroinvertebrate sampling;
- Water Quality;
- Fish Habitat;
- Fish Population Surveys (Electrofishing, Gillnetting and eDNA); and
- Macrophyte.

[1] C. Mertens (NatureScot), personal communication, 02/06/2023

1.3 Licencing

Gillnetting was conducted under a Marine Scotland issued licence (Application Reference CSM-23-118 to 119). All licence conditions were met.

Electrofishing was conducted under a Marine Scotland issued Licence (Application Reference CSM-23-117). The Lochaber Fisheries Trust was notified regarding the intention to survey (a condition of the licence).

1.4 Survey dates

Dates surveys were conducted on are provided in **Table 1**.

Table 1. Survey Dates

Field Survey	Survey Dates	Surveyors
Macroinvertebrate sampling	Spring Sampling: May 2023 Autumn Sampling: September 2023	Rowan Smith Grant Hill
Water quality	May and September 2023	Rowan Smith Grant Hill
Fish habitat assessment	May 2023	Rowan Smith Donald Morrison
Fish population assessment (electrofishing)	July 2023	Donald Morrison Toni Dwyer Grant Hill
Fish population assessment (Gillnetting)	August/September 2023	Rowan Smith Joris Phillip Grant Hill
eDNA	October 2023	Rowan Smith Toni Dwyer
Macrophyte survey	September 2023	Connor Johnstone Adrian Davies Chris Baker Toni Dwyer

2 Methodology

2.1 Desk Study

A desktop study was carried out at the start of the commission and ahead of the field survey. Information sources used for this study are described below:

- Bing Maps – aerial imagery was obtained and used to inform the field survey;
- Ordnance Survey Map – site mapping was reviewed to inform survey location selection;
- Scotland's Environment Web – data on obstacles to fish migration on affected watercourses obtained to guide likely species present;
- SEPA – the SEPA Water Classification Hub was referred to for information on the classification status of the affected watercourses;

- NatureScot Sitelink – A search was performed to identify sites with relevant (aquatic) interests within 2 km of the development; and
- National Library of Scotland – bathymetric data on waterbodies.

2.2 Field Surveys

2.2.1 Macroinvertebrate

The survey locations, shown in **Table 2**, were used for repeat monitoring; available in (**Appendix A, Figure 1-2**).

Survey locations were chosen to be representative of the features of the river system. Given that the river system is typical of upland streams (i.e., fast-flowing, steep margins) riffles are generally considered the most suitable morphological feature for sampling the aquatic invertebrate assemblage within a given river system.

Table 2. Survey Locations for Macroinvertebrate Sampling and Water Quality Analysis

Survey Locations	British Grid Reference	
	Easting	Northing
MS01	250230	785886
MS02	249534	784553
MS03	248488	78344
MS04	248345	783374
MS05	248475	783741
MS06	248856	784039
MS07	250464	779402
MS08	250584	779355
MS09	246225	781012
MS10	249404	779923

Surveys were collected using the standard Scottish Environment Protection Agency / Environment Agency kick sample method. A three-minute kick sample was conducted in riffled areas, moving within the river to account for differences in substrate and habitat types. During each kick sample the net was held down-stream of the surveyor, with its bottom edge in contact with the substrate. The surveyor kicked and dislodged the substrate, moving slowly backwards, and in an upstream direction. Invertebrates dislodged from the substrate were washed downstream and trapped in the pond net. This was followed by a one-minute manual search in which substrate too large to dislodge during the initial three-minute sample were over-turned and examined. To account for surface macroinvertebrate presence a further one-minute sweep was conducted in the shallow margins and across the surface of the river.

The macroinvertebrate sample was collected using a standard Freshwater Biological Association pond net (mesh diameter 1.0 x 1.0mm); which was disinfected with Virkon S prior to and after use.

Invertebrates and substrate trapped in the pond net or collected during the manual search were stored in a labelled sample bucket (with a paper sample identification label also added to the sample container for security) for later extraction. The sample was fixed with bioethanol prior to analysis.

Macroinvertebrate identification and indices compilation was conducted by GELs accredited sub-contractor.

Macroinvertebrate analysis was conducted on several biotic score indexes.

Biological Monitoring Working Party (BMWP) measures the biological quality of rivers using invertebrates as indicators on five scores from: Very good; Good; Moderate; Poor and Very poor. The score related to the pollution tolerance of an invertebrate assemblage, and thus the biological quality of the river. Pollution sensitive families score higher than pollution tolerant families. The cumulative score of assigned values of species provides an indication of biological water quality.

Proportion of Sediment-sensitive Invertebrates (PSI) index measures the sedimentation impacts on watercourses based on the conditions fauna are adapted to. This is based on five categories: Heavily sedimented; Sedimented; Moderately sedimented; Slightly sedimented; and Minimally sedimented.

The Community Conservation Index (CCI) is an expression of conservation values and accounts for community richness and the relative rarity of macroinvertebrate species. Each species is assigned a conservation score of 1 – 10 based on a number of parameters ranging from 1 (Very common) to 10 (Red data book 1, Endangered). The sum of the conservation score is calculated and divided by the number of individuals contributing to mean CCI score. Scoring ranges from Low conservation value (conservation score of 0-5) to High conservation value (conservation score of >20).

Empirical Proportion of Sediment-sensitive Invertebrates (EPSI) index measures the sedimentation from fine sediments based on a scale from Dominated by fine sediment (0 score) to Minimal amounts of fine sediments (100 score).

Average Score Per Taxon (ASPT) is derived from the WHPT index and is calculated by dividing the total WHPT score by the Number of Scoring Taxa Present (NTAXA).

Lotic-invertebrate Index for Flow Evaluation (LIFE) assesses the flow conditions using macroinvertebrates, each assigned a LIFE score. The score for each taxa is added together and the total is divided by the number of scoring taxa/species

Table 3. Biotic Score Index Interpretation

BMWP Score Category Interpretation		**PSI Score Category Interpretation**	
0-10	Very poor	0-20	Heavily sedimented
11-40	Poor	21-40	Sedimented
41-70	Moderate	41-60	Moderately sedimented
71-100	Good	61-80	Slightly sedimented
>100	Very good	81-100	Minimally sedimented
CCI Score Category Interpretation		EPSI Index Interpretation	
0-5	Low conservation value	0	Dominated by fine sediment
>5-10	Moderate conservation value		

>10-15	Fairly high conservation value	100	Minimal amounts of fine sediments
>15-20	High conservation value		
>20	Very high conservation value		

2.2.2 Water Quality

In-situ water quality monitoring was taken in relevant watercourses and waterbodies. Initial sampling was undertaken in 12 Survey Locations (including macroinvertebrate survey locations). Repeat water quality was taken at macroinvertebrate survey locations and additional locations within Loch Leamhain. Water quality locations are shown in **Table 3**, and in **Appendix A**, **Figure 1-2**.

Table 4. Water Quality Survey Locations

Survey Location	Description	British Grid Reference	
		Easting	Northing
WQ01	Allt Labhrach	250230	785886
WQ02	Allt Loch Coire Chur	249534	784553
WQ03	Unnamed watercourse Loch Earba East	249631	784596
WQ04	Moy Burn	248488	783444
WQ05	River between Loch Earba East/West	248475	783741
WQ06	Loch Earba East	248856	784039
WQ07	Loch Earba West	246248	781349
WQ08	Allt Coire Pitridh	246225	781012
WQ09	Allt Coire a' Chlachair	246357	780154
WQ10	Tributary of Allt Coire a' Chlachair	246334	780060
WQ11	Loch Leamhain outflow	250584	779355
WQ12	Bridge at Loch Laggan outflow	243249	783003
WQ13	Loch Leamhain inflow	249404	779923
WQ14	Loch Leamhain	250464	779402

Data was obtained using an Aquaread meter (Model: AP-2000) to test for the following parameters:

- Temperature (°C);
- pH;
- Electrical conductivity (Micro Seiemens/cm (µS/cm));
- Dissolved oxygen (mg/L) and (%);
- Total dissolved solids (TDS) (mg/L);
- Turbidity (Nephelometric turbidity units (NTU)); and
- Oxidative reduction potential (mV).

The Aquaread metre was calibrated daily and prior to sampling session as per the manufacturer's guidance using the RapidCal function.

2.2.3 Fish Habitat

Methodology employed for the fish habitat survey followed adapted guidance from the 'SEPA fish and fish habitat guidance[2] as per the Scoping Opinion.

The full length of watercourse was walked categorising segments into one of four SEPA categories: bedrock channels; lamprey habitat; productive habitat; and an obstruction to migration, as described in **Table 5**.

Productive habitat was sub-categorised into productive (high); productive (moderate); and productive (low) to provide additional information regarding habitat quality and to place on emphasis on the highest quality habitat areas.

Productive (high) was categorised by a dominance of optimal riverine features including the presence of spawning substrate, favourable flow types, depths, substrates and instream cover. Productive (moderate) was categorised by a mix of optimal and sub-optimal features including the presence of some barriers, variation in suitability of flow types, depths, substrates and limited instream cover. Productive (low) was categorised by a dominance of sub-optimal and/or not-suitable riverine features including presence of multiple barriers, limited areas of favourable flow types, depths, substrates and no instream cover.

An additional fifth category of 'Not Suitable' was included to quantify areas where the riverine habitat is not suitable for fish and does not fall into the categories of bedrock or lamprey habitat (e.g. the watercourse was dry at the time of survey).

Lamprey habitat was assessed on juvenile nursery habitat quality, as per SEPA guidance, including areas of stable / fairly stable fine sediments. Habitat for lamprey spawning requirements was not assessed.

[2] SEPA. (2023). Information on fish and fish habitat. [Online] Available at: https://www.sepa.org.uk/regulations/water/hydropower/fish-and-fish-habitat/

Table 5. SEPA Habitat Type Classifications

Habitat Type	Classification	Sub-category
Bedrock Channels	Areas where the streambed is predominantly bedrock, i.e., a continuous rock surface	N/A
Lamprey Habitat	Stable/fairly stable fine sediment, particularly along the edges of watercourses. May be patchy and interspersed among coarser substrates	N/A
Productive Habitat	All other areas, i.e. riffles, pools and glides with mixed bed substrates	Due to wide variance in productive habitat types the sub-categories of productive (high); productive (moderate); and productive (low) have been employed to put an emphasis on the potential loss of high quality habitat.
Obstacles to migration	Potentially impassable waterfalls, weirs, bridge sills, etc	N/A
Not Suitable	Areas of habitat not suitable for aquatic species that do not fit any category listed above.	N/A

Suitability of water quality parameters is assessed under Section 2.2.2 Water Quality.

Obstacles to fish passage and migration were recorded within the survey. Due to the presence of known impassable dams (with no fish pass) downstream it is considered that migratory fish are not present within the survey area, therefore leaping abilities of Atlantic salmon and sea trout, and the climbing abilities of European eel and lamprey sp. where not considered. Features were considered obstacles where watercourse, or anthropogenic, features were likely to prevent movement of fish within a watercourse, such as through a large waterfall or poorly designed culvert.

2.2.4 Fish Population (Electrofishing)

Electrofishing was conducted at 9 locations where fish habitat was assessed to be of suitable quality to support salmonids during the initial habitat walkover surveys. All surveys were conducted within the Red Line Boundary where relevant landownership was attained. Survey locations are provided in **Table 5**.

Table 6. Electrofishing Survey Locations

Survey Location	Easting	Northing	Survey Type
EF1	248466	783751	Semi-quantitative
EF2	248475	783444	Semi-quantitative
EF3	246237	781277	Fully-quantitative
EF4	250932	779180	Fully-quantitative
EF5	249556	784520	Fully-quantitative
EF6	246405	780832	Fully-quantitative
EF7	249024	783952	Semi-quantitative
EF8	247308	781982	Semi-quantitative

Survey Location	Easting	Northing	Survey Type
EF9	250154	785750	Semi-quantitative

Assessment of the species composition, abundance and age class structure of fish fauna was carried out in accordance with SFCC guidelines on undertaking and managing electrofishing operations (SFCC, 2007) and British Standards BS 14011 (sampling of fish with electricity) & BS 14962 (guidance on the scope and selection of fish sampling methods) within fully-quantitative surveys.

All works were administered under Marine Scotland Licence (issued in line with the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 – Sections 27 & 28) and all terms & conditions were adhered to.

Before any fish fauna sampling was carried out, specific risk assessments were prepared and followed during the works. The risk assessments covered other issues such as fish handling protocols for minimising stress, proper use of equipment to minimise potential for damage to fish and other species, biosecurity protocols for disinfection of nets/equipment and numbers of species likely to be present.

The baseline electrofishing surveys were carried out during July 2023. This is within the optimal time of year for survey as salmon and trout young of year have emerged from spawning redds and reached a sufficient size to be safely captured and identified to species level. Water temperatures will also generally be within the optimal range for capture by electrofishing (10 – 15 ◦C).

The survey team comprised three experienced surveyors. The survey lead was qualified to SVQ Level III (leading electrofishing operations and undertaking fish habitat surveys) and both assistants were qualified to SVQ Level II (introduction to electrofishing). The surveys were undertaken using a Hans Grassl Electrofishing kit which is battery powered and was set up to drive a single anode. Smooth DC current was utilised as this is generally accepted as the least damaging to fish during this type of survey.

Fully-quantitative sampling was the preferred methodology for all sites as it allows for enumeration of a stock, or stock component, within a given site and provides a reasonably accurate estimate of a given population. In sites where fish numbers were very low, or in areas of loch margins semi-quantitative timed surveys were undertaken to determine minimum density. Survey type for each electrofishing survey location is provided in **Table 5**.

Individuals caught were carefully placed in an aerated freshwater container with a small hand net. Individuals were anaesthetised using 5 ml^{-1} benzocaine solution and fork length (mm) recorded. A sub-sample of fish were photographed for reference. All individuals were released at the upstream limit of the survey location post-processing. A sub-sample of fry were externally verified to species level.

Species data collected from fully-quantitative survey methods is typically assessed to estimate the population density for each watercourse. Fish densities were expressed as fish per $100m^2$. The National Fisheries Classification scheme grades, as shown in **Table 6**, is typically used to describe trout fry and parr, as is the industry standard. No such classification currently exists for other species (e.g. Arctic charr and Eurasian minnows).

Table 7. National Fisheries Classification Scheme Grades

Grade	Description	Density (fish $100m^2$)	
		Trout fry	Trout parr
F	Absent	0	0.1 – 1.5
E	Very Poor	0.1 – 2.4	1.6 – 3.0

D	Poor	2.5 – 5.2	3.1 – 5.55
C	Fair	5.3 – 12.3	5.6 – 10.3
B	Good	12.4 – 30.2	5.6 – 10.3
A	Excellent	≥ 30.3	≥ 10.4

2.2.5 Fish Population (Gill netting)

The gill netting monitoring strategy employed is that described in Bean (2003)[3], as recommended by Marine Scotland Science advice in the Scoping Opinion, 'to provide information on the presence and abundance of the different fish species'[4]. This was achieved through a combination of targeted NORDIC style multi-mesh gill netting and quantitative hydroacoustics. Swedish standard methods (Appelberg, 2000) were not adopted due to considerable levels of fish mortality and resource intensity required[5].

Two gill net types were used: benthic and pelagic, consistent with the new standard multi-mesh gill nets outlined in Bean (2003). Benthic gill net consist of twelve panels differing in mesh sizes ranging from 5 – 55 mm (bar mesh size) stretched knot to knot recommended as standard sampling method type. Each gill net measures 30 m in length and 1.5 m in height with each individual mesh panel reaching 2.5 m in length. Pelagic gill nets are similar but exclude the 5 mm mesh size (eleven panels overall) and measure 27.5 m in length and 6 m in height.

Hydroacoustic surveys were initially conducted. Equipment used was the Hummingbird HELIX 9 DI·GPS. A discrete random parallel design was followed for hydroacoustic transects to identify areas where fish were present to guide gill net placement and to identify areas to be excluded (e.g. areas of dense macrophyte growth or large boulders).

The start and end points of each transect were recorded using a handheld GPS in addition to the time taken to complete each transect. The speed of the boat did not exceed 4.0 knots to reduce a flee response from fish and to allow the equipment to work effectively. Additional information including weather condition, water state (Beaufort scale) and potential disturbances (anthropogenic and ecological) were noted. An initial analysis of the hydroacoustic survey was used to dictate gill net location. Additional information is available in **Appendix C**: gill netting subsidiary information.

Gill nets were set in areas where the highest fish density was recorded. Nets were set before dusk and rose before dawn over a minimum 12 hour period (between 22:00-06:30), to ensure sampling covered crepuscular and nocturnal periods (peak Arctic charr activity). Start and end GPS points were taken when deploying gill nets to ensure relocation at a later point. Gill nets were additionally fixed with large, identifiable buoys and appropriate weight anchors to prevent net movement. Two benthic and two pelagic gill nets were used for each loch (four net sample effort). For Loch Earba East and West nets were set over two nights (eight net night sample effort for each basin) due to both basins reaching >50 hectares. It was proposed that Loch Leamhain consisted of a four net night effort over one night.

Gill nets were recovered after 12 hrs and taken ashore for sorting and sampling. Fish were removed from nets as quickly as possible and placed in an aerated water bucket. Data collected includes fish species, abundance, body mass, fork length, fin-clip sample for genetic analysis (sample of individuals) as well as a sample of photographs for morphometric analysis). Fish were released into their appropriate benthic/pelagic habitats after sampling.

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[3] Bean, C. W. (2003). A standardised survey and monitoring protocol for the assessment of Arctic charr, *Salvelinus alpinus* L., populations in the UK. Scottish Natural Heritage.

[4] Scoping Opinion (2003).

[5] In accordance with consultation with MarineScotland Licencing

Post-fieldwork a condition assessment was undertaken based on the criteria outlined by Bean (2003), this is based on abundance, population demographic structure and maintenance of habitat quality. For Oligotrophic lochs, such as Loch Earba/Leamhain, unfavourable condition is considered if abundance is less than 37 fish ha^{-1}. Population demographic structure was assessed with favourable condition being achieved if 70% of individuals were within the 0+/1+ category (this is 40-99 mm for charr). Maintenance of habitat quality considered nutrient enrichment, siltation, gravel exposure and loss of spawning substrate; this was supported by ongoing water quality monitoring. If no fish were caught in benthic and/or pelagic environments, nets were re-deployed for an additional 12-hours. All fish were released alive if possible.

2.2.6 eDNA

Five locations were sampled for eDNA around Loch Leamhain, as detailed in **Table 7.**

Samples were filtered using a standard manual hand pump. The pump was rinsed three times with sample water prior to use; water was poured onto the bankside at a distance that would prevent surface run-off reaching the sample location and contaminating water, and increased turbidity.

The pump was filled with water with the initial volume noted. The filter was placed at the end of tubing attached to the pump and secured with cable ties to create an air seal. Water was pumped through the filter until sediment and suspended solids sufficiently clogged the filter paper to reduce water passing through this. The end volume was noted, and total volume passed through the filter calculated. Volume filtered is variable per site due to varying suspended solid load. The pump is then emptied of water and air passed through the filter to remove any excess water.

Filters were placed sealed in centrifuge tubes with silica to remove any excess water/condensation. Care to reduce human DNA contamination was achieved by wearing nitrile gloves and avoiding touching the ends of the filters. Contact with water was additionally avoided.

Two samples (duplicates) were collected at each of the five locations (10 samples in total). These were externally analysed by the University of Glasgow.

Table 8. eDNA sample locations

Sample Number	Easting	Northing	Description	Volume water pumped
1	250570	779352	Allt Loch a' Bhealaich Leamhain	750
2	250466	779397	Outflow of Loch Leamhain	500
3	250384	779404	Loch Leamhain	500
4	250276	779416	Loch Leamhain	500
5	250052	779459	Loch Leamhain	500

2.2.7 Macrophyte

The standard approach to biological monitoring of standing water habitats, as recommended by the JNCC was employed for the macrophyte survey (Interagency Freshwater Group, 2015).

Four 100 m transects were conducted per waterbody; this is considered representative where the waterbody area is <100 ha. Where waterbodies are small (<5 ha) less transects are considered sufficient to characterise the waterbody.

Locations of the transects were strategic to characterise macrophyte communities and/or where species of interest are likely to occur (e.g. selection is not random). Where possible, the selection should be based on previous surveys. As historical macrophyte data was not present prior to this survey, transect locations were chosen to represent the potential range of habitats or species within the marginal areas of waterbodies. This was assessed by undertaking an initial walkover of the waterbody perimeter prior to conducting transect surveys. At least one transect should be located in the sheltered part of the shore where plant fragments are likely to accumulate.

A strandline survey and a wader survey were carried out in each waterbody examined.

The strandline survey was incorporated into each 100 m transect recording the presence / absence of species. This was sub-divided into 5 equal sections with presence of species recorded within each section. This did not comprise a formative part of the assessment but was undertaken as a guide to inform the potential presence of charismatic species. In the event wader and /or boat surveys could not be undertaken this may be used in the assessment.

Wader surveys were conducted over the same 100 m transects with five sections surveyed perpendicular to the main transect line at 20 m intervals each covering an area of 1 m^2 (see **Figure 1**). Additional 1 m^2 areas were surveyed at depths of 0.25 m, 0.5 m, 0.75 m and >0.75 m. A bathyscope and/or grapnel hook was used to examine the species present at each sampling point. The following data was recorded from each transect:

I. All species present;

II. An estimate of total abundance using the DAFOR scale (see **Table 8**); and

III. A photograph of a selection of species identified for future reference.

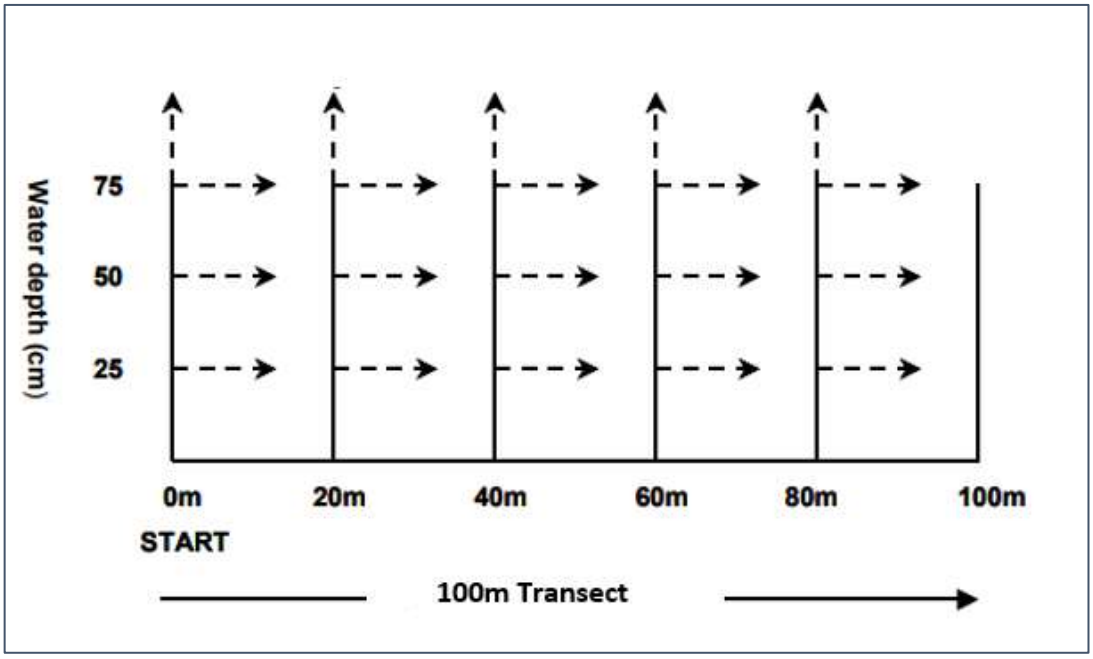

Figure 1. The location of Survey Sections Relevant to the 100 m Transect (Interagency Freshwater Group, 2015).

DAFOR abundance categories were given to each species identified based on the percentage coverage within each transect, as shown in **Table 8**. This provides a comparable base for future surveys to identify growth / reduction in species coverage in addition to species present.

Table 9. DAFOR Abundance Category

Abundance		Cover
D	Dominant	50-100%
A	Abundant	30-50%
F	Frequent	15-30%
O	Occasional	5-15%
R	Rare	<5%

Boat surveys were not conducted as part of this survey. Grapnel hooks were used to obtain samples where water depth was >5 m.

Additional information such as the water level, or reference photos of the water level relative to fixed structures should be taken. Photos of rare or unknown plants were taken for future reference. Future macrophyte surveys should be conducted under similar water levels to ensure compatibility of results.

Conservation statuses for plants was assessed via the Botanical Society of Britain & Ireland (2023) latest 'List of Conservation Statuses for all UK Plants'.

2.2.8 Limitations to Surveys

Weather constraints, and a lack of accurate weather information, for Loch Leamhain prevented gillnetting surveys to be conducted on the grounds of health and safety. As a result eDNA (qPCR) was conducted to establish the presence of Arctic charr. Additionally, extremely adverse weather, comprising safety, on Loch Earba West prevented the deployment of a single pelagic gill nets; seven net nights in total were conducted. Presence of Arctic charr was confirmed on Loch Earba West due to the presence of juveniles within adjoining tributaries.

The Bean (2003) gillnetting methodology was limited in that it targeted waterbody populations of Arctic charr, and does not account for the presence of Arctic charr in both waterbodies and adjoining tributaries (which is not common in Scotland). Consequently, it could not be established whether 70% of individuals were within the 0+/1+ category (40-99 mm for Arctic charr) as juveniles were present in the adjoining tributaries and therefore not detectable by gillnetting. Additionally, there is currently no alternative methodology to incorporate both waterbody and watercourse data to determine favourable condition. As such favourable condition could only be assessed on abundance (ha^{-1}) and maintenance of habitat quality.

Rising water levels of Loch Earba East and West during macrophyte surveys likely obscured some submerged/floating plant species, as such they may be underrepresented in this report. It is recommended that macrophyte surveys are repeated during summer optimal periods to assess species assemblages in optimal survey periods.

Due to similarities of salmonids at the youngest life stages (fry), not all individuals could be practicably identified to species level (either Arctic charr or brown trout). Three individuals were externally verified confirming the presence of both Arctic charr and brown trout, consequently population abundance could not be established for either species (only presence). Resultingly, population abundance (as described in **Table 6**) was calculated using all salmonids present. It is recommended that electrofishing is conducted pre-construction at the end of the survey season to assess population abundance before construction to account for Arctic charr / brown trout abundance when they are further on in their development, and therefore distinguishable. Additionally, due to some watercourses being unsuitable for electrofishing at the time of survey semi-quantitative electrofishing was conducted on waterbody margins as compensatory sites.

3 Results

3.1 Macroinvertebrates

Macroinvertebrate indices scores are shown in **Table 9** for Spring sampling. Full species list is provided in **Appendix B**.

Survey Locations MS02, MS03, MS04, MS05, MS06, MS07, MS08 and MS10 are within the proposed inundation zone. Survey Locations MS01 and MS09 are outwith the inundation zones.

Table 10. Macroinvertebrate Indices Scores Spring Samples

Biotic Index	Survey Location									
	MS01	MS02	MS03	MS04	MS05	MS06	MS07	MS08	MS09	MS10
BMWP (TL1)	118	82	75	22	85	37	64	100	70	123
NTAXA (TL1)	18	13	11	5	12	6	10	17	12	18
ASPT (TL1)	6.56	6.31	6.82	4.40	7.08	6.17	6.40	5.88	5.83	6.83
LIFE (TL5)	7.88	8.69	8.75	8.50	8.53	6.00	7.88	8.43	8.73	8.61
LIFE(FAM) (TL2)	7.44	8.18	8.20	6.67	7.91	6.33	7.11	7.53	7.5	7.65
PSI (TL5)	66.67	100.00	100.00	100.00	100.00	37.50	75.00	75.00	100.0	92.50
PSI(FAM) (TL3)	77.27	95.00	94.44	100.00	94.44	71.43	84.62	75.00	88.24	87.50
E-PSI (FAM)	93.82	100.00	100.00	100.00	100.00	53.55	98.04	90.51	100.00	99.29
E-PSI (TL5)	89.78	100.00	100.00	83.33	100.00	63.13	81.23	90.81	100.00	98.00
CCI (TL5)	11.67	4.62	6.00	17.50	10.36	8.40	12.50	14.00	5.10	9.41
WHPT (TL2)	125.8	99.8	83.1	25.1	92.6	33.2	76.3	129.2	83.2	144.5
NTAXA (TL2)	18	14	11	5	12	6	10	18	12	18
ASPT (TL2)	6.99	7.13	7.55	5.02	7.72	5.53	7.63	7.18	6.93	8.03

Spring macroinvertebrate samples ranged in BMWP score category from Very Good (MS01, MS10); Good (MS02, MS03, MS05, MS08); Moderate (MS07, MS09); to Poor (MS04, MS06) throughout all Survey Locations.

CCI scores ranged from High Conservation Value (MS04); Fairly High Conservation Value (MS01, MS05, MS07, MS08); Moderate Conservation Value (MS02, MS06, MS09, MS10).

PSI scores ranged from Sedimented (MS06); Slightly Sedimented (MS01, MS07, MS08); and Minimally Sedimented (MS02, MS03, MS04, MS05, MS09, MS10).

The EPSI index indicated overall minimal amounts of fine sediments with the exception of MS06 that contained significant amounts.

Macroinvertebrate indices scores are shown in **Table 10** for Summer sampling. Full species list is provided in **Appendix B**.

Table 11. Macroinvertebrate Indices Scores Summer Samples

Biotic Index	Survey Location									
	MS01	MS02	MS03	MS04	MS05	MS06	MS07	MS08	MS09	MS10
BMWP (TL1)	73	125	85	19	123	25	79	122	69	80
NTAXA (TL1)	12	20	13	5	19	5	13	19	9	13
ASPT (TL1)	6.08	6.25	6.54	3.80	6.47	5.00	6.08	6.42	7.67	6.15
LIFE (TL5)	7.33	8.10	8.42	N/A	8.24	6.00	7.67	8.73	8.55	8.67
LIFE(FAM) (TL2)	7.20	7.28	7.82	6.33	7.41	6.50	6.82	7.71	7.44	7.45
PSI (TL5)	46.15	90.70	100.00	66.67	91.49	28.57	63.16	95.24	100.00	93.33
PSI(FAM) (TL3)	73.33	80.00	100.00	100.00	90.00	60.00	71.43	82.86	92.31	84.21
E-PSI (FAM)	100.00	98.62	100.00	100.00	99.33	75.33	85.17	97.16	100.00	99.08
E-PSI (TL5)	89.87	94.79	100.00	100.00	100.00	100.00	87.94	95.42	100.00	97.29
CCI (TL5)	5.57	11.43	5.10	0.00	12.11	1.50	10.56	14.00	5.40	25.45
WHPT (TL2)	66.3	144.2	101.9	27.2	139.6	22.2	80.8	151.9	76	94.6
NTAXA (TL2)	12	21	14	6	20	5	13	20	10	13
ASPT (TL2)	5.53	6.87	7.28	4.53	6.98	4.44	6.2	7.60	7.60	7.28

Summer macroinvertebrate samples ranged in BMWP score category from Very Good (MS02, MS05, MS08); Good (MS01, MS03, MS07, MS10); Moderate (MS09); to Poor (MS04, MS06) throughout all Survey Locations.

CCI scores ranged from Very High Conservation Value (MS10); Fairly High Conservation Value (MS02, MS05, MS07, MS08); Moderate Conservation Value (MS01, MS03, MS09); and Low Conservation Value (MS04, MS06).

PSI scores ranged from Sedimented (MS06); Slightly Sedimented (MS01); Slightly Sedimented (MS04, MS07); and Minimally Sedimented (MS02, MS03, MS05, MS08, MS09, MS10).

The EPSI index indicated overall minimal amounts of fine sediments with slightly elevated values at MS06.

3.2 Water Quality

Water quality results are shown in **Table 11**.

Table 12. Water Quality Results

	Temperature (°C)		pH		Electrical Conductivity (µS/cm)		Total Dissolved Solids (mg/L)		DO(%)		Do (mg/L)		ORP (mV)	
Visit Number	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
WQ1	11.3	9.7	7.2	7.7	23	31	15	18	108.8	100.8	11.6	10.7	130.7	108.9
WQ2	11.1	8.2	7.2	6.4	49	22	34	13	110.0	104.4	11.7	11.4	140.2	179.4
WQ3	10.3	/	7.3	/	52	/	35	/	106.2	/	11.6	/	131.8	/
WQ4	10.6	8.9	7	6.4	33	17	19	10	107.8	100.0	11.8	10.9	152.3	170.3
WQ5	11.1	11.9	6.2	6.4	24	17	13	14	105.1	104.1	11.0	10.7	136.1	155.7
WQ6	9.6	11.5	6.6	6.3	22	26	14	14	106.5	103.3	11.8	10.5	163.7	171.5
WQ7	10.2	10.4	6.3	6.1	41	17	26	11	89.6	104.5	9.8	10.1	145.8	147.2
WQ8	10.0	9.3	6.7	6.8	29	14	18	9	108.8	103.0	11.9	11.2	109.6	114.2
WQ9	9.3	/	6.5	/	20	/	14	/	106.1	/	11.8	/	136.1	/
WQ10	8.8	/	6.8	/	27	/	18	/	105.1	/	11.7	/	115.2	/
WQ11	11.3	9.9	7.0	6.4	24	23	16	14	108.2	103.3	11.5	10.6	139.4	146.3
WQ12	8.7	/	7.9	/	46	/	29	/	104.5	/	12.5	/	116.9	/
WQ13	/	7.1	/	7.8	/	18	/	12	/	103.5	/	11.4	/	161.5
WQ14	/	9.6	/	7.5	/	22	/	16	/	101.6	/	10.4	/	128.5

Within Visit 1 Temperature ranged from 8.7°C (WQ12) to 11.3°C (WQ01), with an average of 10.18°C.

The pH ranged from 6.2 (WQ05) to 7.9 (WQ12), with an average of 6.89.

Electrical conductivity (µS/cm) ranged from 20 µS/cm to 52 µS/cm, with an average of 32.5 µS/cm.

Total dissolved solids (TDS) (mg/l) ranged from 13 mg/l to 35 mg/l, with an average of 20.92 mg/l.

Dissolved oxygen (DO as %) ranged from 89.6% to 110%, with an average of 105.5%. Dissolved oxygen (DO as mg/l) ranged from 12.5 mg/l to 9.8 mg/l, with an average of 11.56 mg/l.

Oxidative reduction potential (ORP) (millivolts (mV)) ranged from 109.6 mV to 163.7 mV, with an average of 134.82 mV.

Within Visit 2 Temperature ranged from 7.1°C (WQ) to 11.9°C (WQ), with an average of 9.65°C.

The pH ranged from 6.1 (WQ) to 7.8 (WQ), with an average of 6.78.

Electrical conductivity (µS/cm) ranged from 14 µS/cm (WQ) to 31 µS/cm (WQ), with an average of 20.7 µS/cm.

Total dissolved solids (TDS) (mg/l) ranged from 9 mg/l (WQ) to 18 mg/l (WQ), with an average of 13.10 mg/l.

Dissolved oxygen (DO as %) ranged from 100% (WQ) to 104.5% (WQ), with an average of 102.85%. Dissolved oxygen (DO as mg/l) ranged from 10.1 mg/l (WQ) to 911.4 mg/l (WQ), with an average of 10.79 mg/l.

Oxidative reduction potential (ORP) (millivolts (mV)) ranged from 108.9 mV (WQ) to 179.4 mV (WQ), with an average of 148.35 mV.

3.3 Fish Habitat

Fish habitat surveys indicated a dominance of Productive habitat type (91.46% of surveyed area). Within Productive habitat types Productive (moderate) displayed highest abundance (69.65%), followed by Productive (low) (19.34%) and Productive (high) (2.47%). Habitat lengths (m) and their percentage of surveyed area is presented in **Table 13**, refer to **Table 4** for Habitat descriptions.

Not Suitable habitat comprised 8.31% of total surveyed area. Lamprey habitat comprised the lowest habitat type at 0.23%.

No extensive areas of bedrock or bedrock channels were identified during the habitat survey.

Table 13. Riverine Habitat Lengths

Habitat Type	Total Length (m)	Percentage of Total Habitat Assessed	Length Lost (m)
Productive (high)	267	2.47	267
Productive (moderate)	7538	69.65	1459.4
Productive (low)	2131	19.69	498.3
Bedrock	0	0	0

Habitat Type	Total Length (m)	Percentage of Total Habitat Assessed	Length Lost (m)
Lamprey	25	0.23	0
Not Suitable	861	7.95	496.9
Total:	10822		2694.6

A total habitat loss of 2694.6 m is predicted under maximum inundation levels (see **Appendix A, Figure 3-7)**, this represents 24.9% of surveyed area.

Productive habitat loss is predicted to be greatest at 267 m, 1459.4 m and 498.3 m for Productive (high), Productive (moderate) and Productive (low) respectively.

A total loss of 496.9 m of Not Suitable habitat is also predicted.

No loss of bedrock and lamprey habitat is predicted.

3.3.1 Obstacles

Numerous obstacles to upstream movement of fish were identified on watercourses assessed, summarised in **Table 14**. The majority of obstacles were natural, comprised of waterfalls, rapids or chutes, however, anthropogenic obstacles were present in the form of dams with no fish passes.

Several watercourses, e.g. Allt Coire Pitridh, were categorised by a large number of passable and semi-passable (under certain flows) obstacles.

Table 14. Obstacles identified during the habitat survey

Number	Watercourse	British Grid Reference		Type	Notes
		Easting	Northing		
1	Tributary of Allt Coire a Chlachair	246529	780427	Series of impassable obstacles	Majority of watercourse categorised by small sequential obstacles due to steep gradient
2	Allt Coire Pitridh	246881	780457	Impassable obstacles	Majority of watercourse categorised by small sequential obstacles due to steep gradient
3	Connective river between Loch Earba Basins	248442	783730	Dam	Dam separating Loch Earba East and West, no fish pass information available
4	Allt Labrach	250131	785728	Dam	Dam at outflow of Loch Earba East, no fish pass information available
5	Unnamed tributary (Loch Earba East)	249245	784698	Culvert	Poorly installed stone culvert with no flow immediately by Loch Earba East waters edge.
6	Allt Labrach	250429	786342	Impassable obstacles	Large impassable obstacles in succession of several smaller obstacles
7	Moy Burn	248851	783280	Impassable obstacles	Large obstacles

Number	Watercourse	British Grid Reference		Type	Notes
		Easting	Northing		
8	Moy Burn	248941	783219	Series of impassable obstacles	Bedrock chute with large, eroded steps, water flow was minimal. Additional large waterfalls noted on OS map upstream of survey area at: 249242, 781597 and 249484, 781761
9	Unnamed tributary (Loch Earba East)	249698	784428	Impassable obstacles	Two large impassable obstacles at confluence of tributaries
10	Allt Coire a Chlachair	246282	780262	Boulder obstruction	Multiple boulders with water passing through, no opportunities for fish to pass through
11	Unnamed tributary (Loch Leamhain)	249431	779904	Steep gradient	Extremely steep gradient interspersed with small obstacles

3.3.2 Spawning habitat

Numerous areas of optimal spawning were identified throughout the site, as shown in **Table 14**. Overall availability of optimal spawning substrate throughout the surveyed areas was limited in both occurrence and area.

Table 15. Optimal Spawning Areas

Number	Watercourse	British Grid Reference		Notes
		Easting	Northing	
1	Connective river between Loch Earba Basins	248596	783927	Smaller interspersed areas of well washed optimal gravel/pebble on inside corners of meanders
2	Connective river between Loch Earba Basins	248476	783759	Large areas of well washed optimal gravel/pebble
3	Moy Burn	248589	783414	Small patches of suitable spawning substrate interspersed with drops in gradient
4	Allt Loch a' Bhealaich Leamhain	250469	779395	Optimal stretch of well-washed gravel/pebble at outflow of Loch Leamhain
5	Allt Coire Pitridh	246244	781147	Small areas of exposed gravel bank likely useable during winter spawning periods

Areas where optimal spawning was identified, e.g. number 1 and 3 in Table 15, occurred as small patches of optimal substrate spread throughout a larger area and not occurring as a single spawning bed. Areas were primarily located in the inside bends of watercourses where water velocity was slower (and deposition of smaller substrate is more prominent). Several identified areas where wholly or partially exposed, however, due to lower water levels at the time of survey (May), areas will likely be immersed during winter spawning periods and have thus been included.

3.4 Fish Population (Electrofishing)

Results of electrofishing are provided in **Table 16** and shown as population density estimates. Electrofishing Survey Locations are shown in **Appendix A, Figure 8**.

Results of full-quantitative surveys indicate low population densities ranging from 0.03 fish per m^2 (EA3) to 0.81 fish per m^2 (EA5).

Results of semi-quantitative surveys indicate higher population densities ranging from 1.5 - 4.8 fish per m^2. Three Survey Locations (EA7 – EA9) indicated no presence of fish.

Three species were identified via electrofishing: brown trout; Eurasian minnow (*Phoxinus phoxinus*); and Arctic charr.

Table 16. Electrofishing Population Estimates

Survey Location	Fully-Quantitative Population Estimate (fish per m^2)	Semi-Quantitative Population Estimate (fish per minute fished)	Species Present
EA1	N/A	1.5	Brown trout, Eurasian minnow
EA2	N/A	4.8	Brown trout, Eurasian minnow, Arctic charr
EA3	0.03	N/A	Brown trout, Eurasian minnow, Arctic charr
EA4	0.12	N/A	Brown trout, Arctic charr
EA5	0.81	N/A	Brown trout, Eurasian minnow
EA6	0.08	N/A	Brown trout, Eurasian minnow
EA7	N/A	0	N/A
EA8	N/A	0	N/A
EA9	N/A	0	N/A

Fish size distributions are provided for brown trout and Arctic charr (combined) in **Table 16**.

Table 17. Electrofishing Salmonid Fish Size Distribution

Survey Location	Minimum Size (mm)	Maximum Size (mm)	Average Size (mm)
EA1	42	75	47.50
EA2	35	90	54.33
EA3	33	85	50.33
EA4	40	142	84.30
EA5	36	91	48.08
EA6	49	77	63.20
EA7	0	0	0
EA8	0	0	0
EA9	0	0	0

3.5 Fish Population (Gillnetting)

In total 185 fish were caught via gillnetting effort (15 net nights). Gillnetting catch effort per species per waterbody is provided in **Table 17.**

Within Loch Earba East a total of 80 individuals were identified comprising three species: brown trout (71); Arctic charr (4); and Eurasian minnow, *Phoxinus phoxinus* (5).

Within Loch Earba West a total of 105 individuals were identified comprising two species: brown trout (103); and Eurasian minnow (2).

Brown trout was the dominant species in both Loch Earba East and West, comprising 88.75% and 98.10% respectively.

Table 18. Gillnetting catch effort per waterbody

Waterbody	Brown trout	Arctic charr	Minnows
Loch Earba East	71	4	5
Loch Earba West	103	0	2
Total:	174	4	7

A comprehensive summary of net effort is provided in **Appendix C**.

Within Loch Earba East brown trout, Arctic Charr and minnows, *Phoxinus phoxinus*, were the sole species identified. Fork length of brown trout varied considerably from 60 – 500 mm in Loch Earba East, with an average of 209.53 mm. One fish at 500 mm was the largest recorded on site.

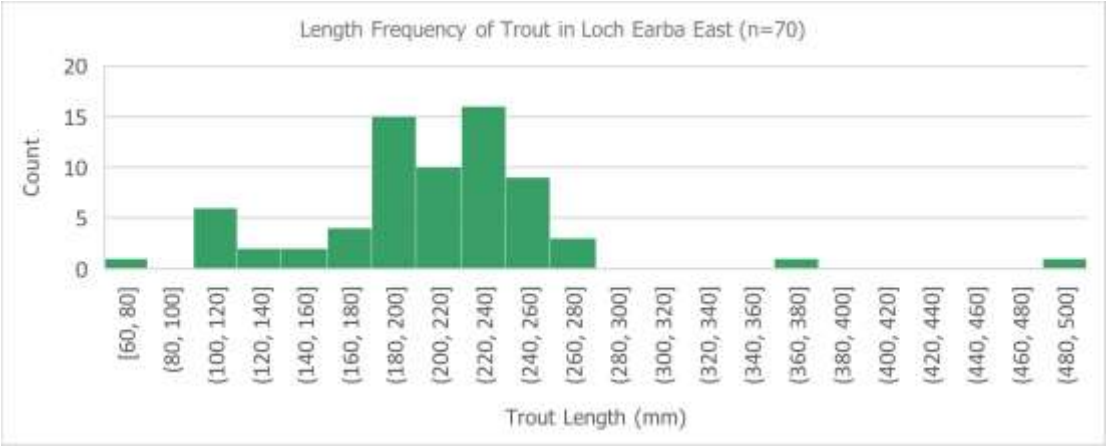

Figure 2. Trout Length Frequency Loch Earba East

Within Loch Earba West brown trout and minnows, *Phoxinus phoxinus*, were the sole species identified. Fork length of brown trout varied considerably from 80 – 300 mm in Loch Earba West, with an average of 186.37 mm.

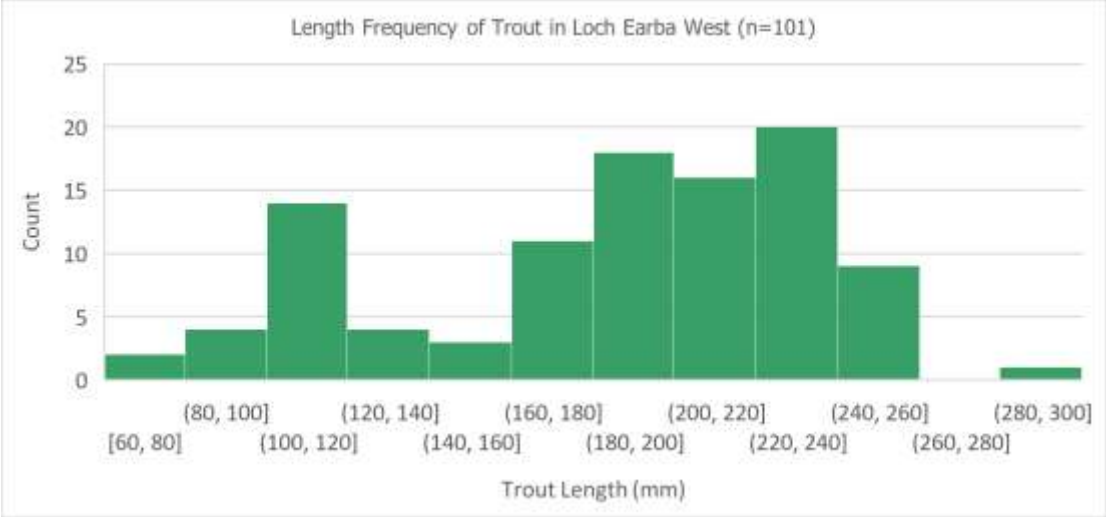

Figure 3. Trout Length Frequency Loch Earba West

3.5.1 Arctic Charr Condition Assessment

Arctic charr condition assessment is comprised of three factors: abundance; population demographic; and maintenance of habitat quality.

Abundance was considered to be in unfavourable condition in both waterbodies. Loch Earba East had a population abundance of 0.07 ha^{-1}, and therefore below the 37 fish ha^{-1} outlined in Bean (2003).

Individuals ranged in length from 114 – 156 mm, therefore outwith the 0+/1+ category (this is 40-99 mm for Arctic charr). Consequently, the criteria of 70% of individuals being within the 0+/1+ category was not achieved; therefore population demographic is considered to be unfavourable. It should be noted that individuals were identified between the 0+/1+ category during electrofishing, however, percentage of total population cannot be quantified due to the methodology adopted not accounting for presence both in waterbodies and watercourses.

Current maintenance of habitat quality is considered sub-optimal due to existing hydroscheme developments on both waterbodies resulting in unstable loch margins and unnatural water regimes. Gravel substrate on loch margins is regularly exposed as a result of fluctuating water level due to the presence of hydroschemes on both lochs currently. Spawning areas are currently unknown in all waterbodies, consequently loss and/or maintenance of spawning substrates cannot be ascertained. Water quality was undertaken on loch margins and connected watercourses and thus do not account for typical deep water Arctic charr habitat, however, no constraints were identified.

No Arctic charr were detected via gillnetting in Loch Earba West. Due to the presence of Arctic charr fry in the Moy Burn and the Allt Coire Pitridh, connected only to the West basin, for the purposes of this assessment it is considered that Arctic charr are present in densities above zero fish ha^{-1} and lower than detection capabilities for survey effort employed. Consequently, Arctic charr in Loch Earba West are considered to be in unfavourable condition.

Arctic charr caught did not appear to display polymorphism (two or more distinct morph groups), however, sample sizes were too low to confirm only one morph is present.

Overall, Arctic charr failed 2/3 criterion for favourable condition in both Loch Earba East and Loch Earba West.

3.5.2 eDNA

The eDNA results did not detect the presence of Arctic charr in any water samples assessed, when compared to a positive sample of Arctic charr. **Figure 4** illustrates minimal amplification of Arctic charr eDNA when compared to a positive Arctic charr tissue sample (from Loch Ard

Achadh). Presence or absence of Arctic charr cannot be determined in Loch Leamhain due to being lower that the limit of detection.

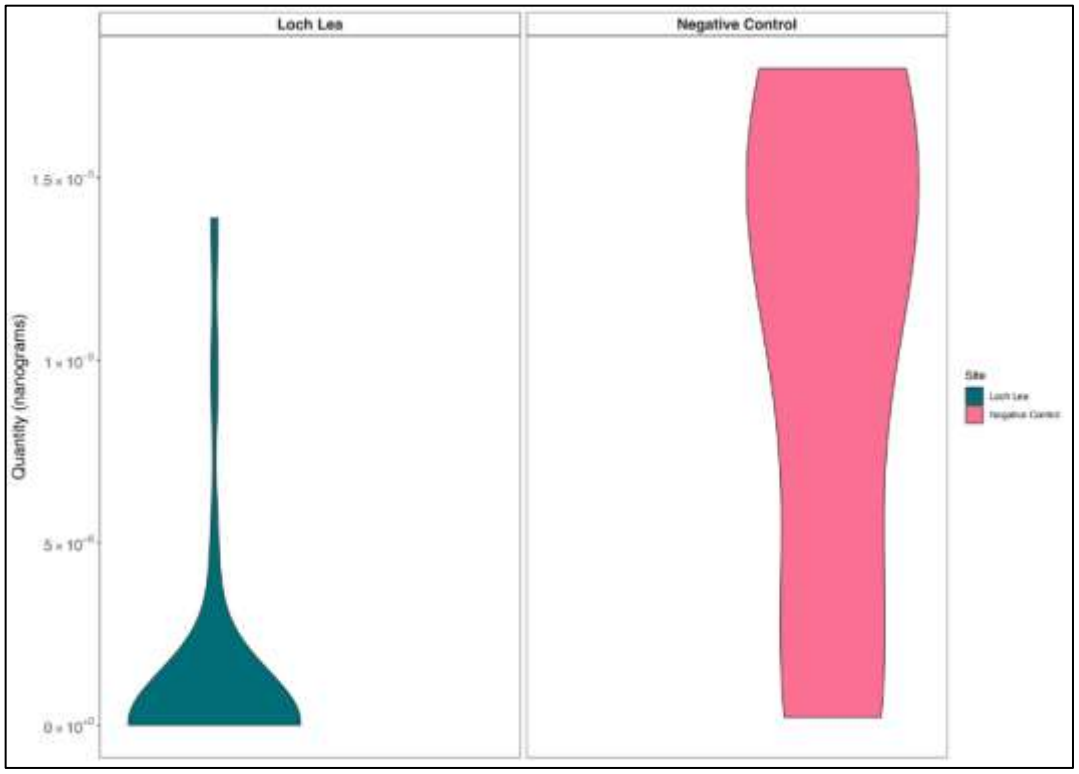

Figure 4. eDNA Results

3.6 Macrophyte

In total 37 species were identified throughout the three waterbodies sampled: 17 submerged/floating; and 22 emergent/edge species (*Isolepis setacea* and *Littorella uniflora* were identified in both submerged and emergent communities). A full species list is provided in **Table 18**.

No invasive non-native species were identified in any of the lochs sampled.

Within Loch Earba East 26 species were identified, 13 submerged species and 13 emergent species.

Within Loch Earba West 18 species were identified, 1 submerged species and 17 emergent species. All species were classified as 'Least Concern' or 'Data deficient' for their conservation value.

Within Loch Leamhain 5 species were identified, 3 submerged species and 2 emergent species. All species were classified as 'Least Concern' or 'Data deficient' for their conservation value.

National vegetation communities around the lochs are generally dominated by wet heath M15 *Scirpus cespitosum-Erica tetralix* wet heath.

Loch Earba has extensive wet heath on the north side down to the loch edge with patches of unimproved grassland, mainly U4 *Festuca ovina-Agrostis capillaris-Galium* saxatile with occasional patches of blanket bog M17 *Scirpus cespitosum-Erioporum vaginatum* blanket mire. There are patches of swamp S9 *Carex rostrata* swamp and S10 *Equisetum fluviatile* swamp at the west end of Loch Earba where the river flows into the loch.

Loch Leamhain is a higher loch with M15 and some more base rich flushes M10 *Carex dioica-Pinguicula vulgaris* mire on the north and east side. The southern end has a mix of wet heath

and blanket bog M15/M17 with M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire becoming prominent on the north and west margins of the loch on deeper peat on sloping ground. A little peat is exposed here but it is nowhere extensive on the west side.

Table 19. Macrophyte Species List

Transect	Waterbody	Start Transect Coordinates		End Transect Coordinates		Submerged / Floating	DAFOR	Emergent / Edge	DAFOR	Dominant Substrate Type
		Easting	Northing	Easting	Northing					
T1	Loch Earba East	248851	784141	248854	784044	*Littorella uniflora*	A	*Equisetum fluviatile*	R	Stones, Gravel, Sand, Silt, Peat
						Callitreien bretia	A			
						Isoetes lacustris	A			
T2	Loch Earba East	249000	783932	248925	783080	*Littorella uniflora*	F	*Carex rostrata*	A	Stones, Gravel, Sand, Silt, Peat
						Lobelia dortmanna	F			
						Myriophyllum alterniflorum	A	*Equisetum fluviatile*	O	
						Potamogeton natans	A			
						Utricularia minor	R	*Littorella uniflora*	O	
						Potamogeton polygonifolius	O			
T3	Loch Earba East	250011	785628	249945	785571	*Littorella uniflora*	F	*Carex rostrata*	F	Boulders, Stones, Gravel, Peat
						Myriophyllum alterniflorum	F	*Equisetum fluviatile*	F	
						Juncus Bufonius	A	*Littorella uniflora*	F	
						Callitreiche brutia	A	*Schoenoplectus lacustris*	O	
								Isolepis setacea	A	
T4	Loch Earba East	250110	785579	250055	785531	*Myriophyllum alterniflorum*	F	*Carex rostrata*	F	Boulders, Stones, Gravel, Peat
								Littorella uniflora	O	
						Potamogeton natans	R	*Ranunculus flammula*	O	
								Molinia caerulea	A	

Transect	Waterbody	Start Transect Coordinates		End Transect Coordinates		Submerged / Floating	DAFOR	Emergent / Edge	DAFOR	Dominant Substrate Type
		Easting	Northing	Easting	Northing					
						Littorella uniflora	O	*Carex panicea*	A	
								Galium palustre	F	
						Utricularia sp.	O	*Chara sp.*	F	
								Equisetum fluviatile	R	
						Chara sp.	O	*Glyceria fluitans*	O	
						Potamogeton polygonifolius	O	*Juncus articulatus*	O	
								Juncus bulbosus	O	
T5	Loch Leamhain	250148	779734	250213	779693	*Littorella uniflora*	R	*Littorella uniflora*	R	Boulders, Stones, Gravel, Sand Silt, Peat
						Isolepis setacea	F	*Juncus bufonius*	R	
						Callitriche brutia	O			
T6	Loch Earba West	246395	781491	246623	781167			*Equisetum fluviatile*	R	Sand dominated
								Juncus bulbosus	F	
								Ranunculus fluitans	O	
								Carex rostrata	O	
								Viola palustris	O	
								Carex pseudocyperus	R	
								Myrica gale	O	
								Carex riparia	O	

Transect	Waterbody	Start Transect Coordinates		End Transect Coordinates		Submerged / Floating	DAFOR	Emergent / Edge	DAFOR	Dominant Substrate Type
		Easting	Northing	Easting	Northing					
								Equisetum arvense	R	
T7	Loch Earba West	248318	783233	248348	783240	*Potamogeton polygonifolius*	F	*Juncus bulbosus*	F	Boulders within marginal areas with Sand/Silt/Gravel where macrophytes were located
								Juncus bufonius	F	
								Ranunculus flammula	F	
								Viola palustris	O	
								Carex panicea	F	
								Carex nigra	F	
T8 & T9	Loch Earba West	248297	783464	248206	783453	*Potamogeton polygonifolius*	F	*Lobelia dortmanna*	F	Boulder, Sand, Peat Wet heath creeping into shoreline area
								Juncus bufonius	F	
								Carex panicea	F	
								Carex nigra	F	
								Ranunculus flammula	F	
								Salix repens	R	
								Juncus articulatus	O	
								Eriophorum angustifolium	O	

4 Discussion

4.1 Macroinvertebrates

Macroinvertebrate results in Loch Earba East and adjoining tributaries (MS1, MS2 and MS6) displayed high variation in BMWP, CCI, PSI(TL5) and EPSI(TL5) values throughout Spring sampling. Both MS1 and MS2 were indicative of high water quality with high BMWP (118 and 82), PSI (77.27 and 95.00) and EPSI (89.78 and 100.00). MS02 displayed high BMWP, PSI and EPSI scores, however, the CCI score was considerably lower. Summer sampling was also indicative of variation scoring highly on BMWP (73 and 125) and EPSI (89.87 and 94.79) index's.

MS06 displayed lower values on all biotic index's in Spring: BMWP (37); PSI (37.50); EPSI (63.13); and CCI (8.40) and in Summer: BMWP (25); PSI (28.57); and CCI (1.5) with the exception of EPSI (100). The watercourse sampled for MS06 was noted to periodically dry out with limited compensation flow during summer months, resultingly the watercourse is unlikely to host species indicative of high water quality such is seen in MS01 and MS02.

Macroinvertebrate results in Loch Earba West (MS3 and MS4) similarly displayed variation between survey points. MS03 scored high BMWP (75), PSI (100), EPSI (100) but low on CCI (6.00). Similarly MS04 scored low BMWP (22) but high PSI (100), EPSI (83.33) and very high CCI (17.5), the highest CCI observed. Little variation was observed between Spring and Summer sampling.

Macroinvertebrate results in Loch Leamhain (MS7, MS8 and MS10) varied between Spring and Summer sampling. MS7 scored moderately on BMWP, PSI and EPSI but indicated Fairly high conservation value on the CCI index throughout both Spring and Summer sampling. MS8 indicated very high BMWP (122), PSI (95.24), EPSI (95.42) and CCI (14.00). The presence of the Arctic-alpine pea mussel (*Euglesa conventus*) was identified within this site[6]. The Arctic-alpine pea mussel is considered rare and limited in UK distribution to one site in Wales and several in the Scottish highlands. Presence in Loch Leamhain is characteristic of cold water at high elevations, however, presence within watercourses is not typical of the species (Moorkens and Killeen, 2009).

MS10 indicated high BMWP (80), PSI (93.33) and EPSI (97.29). CCI values were extremely high, and the only Survey Location recorded to have a Very high conservation status, that was in considerable excess of >20 at 25.45. This is due to the presence of Davis's river diver (*Oreodytes davisii*) and the presence of oligotrophic lentic specialists (*Oligotrophic striata* and *Apatania wallengreni*). Overall, Loch Leamhain indicated macroinvertebrates of higher conservation value both in the Loch itself and the outflow.

Macroinvertebrates observed are categorised by a diverse range of environmental tolerances and preferences, consequently communities are likely to exhibit both qualitative and quantitative responses to the range of environmental changes (for example: water depth; water temperature; water quality changes) (Sykes *et al.,* 1999).

Increasing the water level of both Loch Earba and Loch Leamhain is additionally likely to alter the profiles of both shorelines. Existing marginal habitat is dominated by shallow shelfs and/or gently sloping margins, this is predicted to become steeper in light of water level changes reducing the area of suitable habitat and therefore the diversity within these areas. Re-profiling or changes to marginal areas is considered damaging to invertebrates (Buglife, 2023). Due to this change, and increased rates of water level changes in drawdown zones, benthic communities are likely to shift to a dominance of mobile groups, e.g. beetles and

[6] Species was externally verified by Dr. Ben Rowson, National Museum Wales

water boatmen, that are able to track water levels or profundal communities better adapted to predicted future conditions.

Macroinvertebrates are reliant on established macrophyte communities in marginal areas, for changes in macrophyte communities see Section 4.7.

4.2 Water Quality

Within Visit 1 Temperature ranged from 8.7°C (WQ12) to 11.3°C (WQ01), with an average of 10.18°C and from 7.1°C (WQ) to 11.9°C (WQ), with an average of 9.65°C within Visit 2. All values are within the optimal range of 6-20°C, however, no values were within the range of 16-17°C where maximal growth occurs in salmonids (Fisheries Management Scotland, 2023). This is not unexpected given the elevation of the drainage basin contributed colder water on average.

The pH ranged from 6.2 (WQ05) to 7.9 (WQ12) (average of 6.89) during Visit 1 and from 6.1 (WQ) to 7.8 (WQ) (average of 6.78). Optimal ranges for salmonids is pH 6.5 - 8.0 (Staurnes *et al.,* 1995). A large number of observed water quality Survey Locations fell outwith this threshold including WQ2, WQ4, WQ5, WQ6, WQ7, WQ11, however, the maximum deviance from optimal ranges was pH 0.4 below pH 6.5. No Survey Locations exceeded alkalinity limits. The pH Loch Earba East (6.6-6.3) and Loch Earba West (6.3-6.1) are consistent with oligotrophic status that is typically less than 7. The pH within Loch Leamhain exceeded this by 0.5 at pH 7.5.

Electrical Conductivity (µS/cm) ranged from 20 µS/cm to 52 µS/cm (average of 32.5 µS/cm) during Visit 1 and ranged from 14 µS/cm (WQ) to 31 µS/cm (WQ) (average of 20.7 µS/cm) during Visit 2. All conductivity values observed are considered low and indicative of minimal pollution sources.

Total Dissolved Solids (TDS) (mg/l) ranged from 13 mg/l to 35 mg/l (average of 20.92 mg/l) during Visit 1 and ranged from 9 mg/l (WQ) to 18 mg/l (WQ) (average of 13.10 mg/l) during Visit 2. All TDS values are low and indicative of minimal pollution sources within the watercourses/waterbodies sampled, this is reflective of low conductivity. Salmonids are sensitive to high TDS values (e.g. >250 mg/L may reduce fertilisation), however, values observed are considerably lower (Stekoll *et al.,* 2003).

Dissolved Oxygen (DO as %) ranged from 89.6% to 110% (average of 105.5%) and ranged from 100% (WQ) to 104.5% (WQ) (average of 102.85%). Dissolved oxygen (DO as mg/l) ranged from 9.8 mg/l to 12.5 mg/l (average of 11.56 mg/l) and ranged from 10.1 mg/l (WQ) to 911.4 mg/l (WQ) (average of 10.79 mg/l). All values of dissolved oxygen fell within assessment criteria, 8-15 mg/L and were considerably higher than hypoxic levels, <6 mg/L (Alver *et al.,* 2022).

Oxidative Reduction Potential (ORP) (millivolts (mV)) ranged from 109.6 mV to 163.7 mV (average of 134.82 mV) and ranged from 108.9 mV (WQ) to 179.4 mV (WQ) (average of 148.35 mV). No thresholds relevant to salmonids or other species present is currently available.

4.3 Fish Habitat

The habitat quality at each Survey Location was variable for supporting salmonid populations (as dictated by SEPA methodology). Survey locations varied in the occurrence of Productive (high), Productive (moderate), Productive (low), Lamprey and Not Suitable habitat; no bedrock channels were present.

Productive habitat displayed high variation from Productive (high) to Productive (low).

Productive (high) habitats were not widely present throughout the areas surveyed primarily due to a lack of instream and bankside cover, and the presence of impassable obstacles. All Productive (high) habitat was located on the Moy Burn and the river connecting Loch Earba East and West. The Moy burn displayed good instream cover, riffle/run flow sequences, a lack of obstacles to fish movement and patches of optimal spawning substrate (well-washed

gravel/pebble stretches). The connective river was categorised for the presence of riffle/run flow sequences, instream and bankside vegetation, a large section of optimal substrate was additionally identified.

Productive (moderate) was the predominant habitat type covering 69.65% of the area surveyed. All watercourses surveyed at Loch Leamhain were categorised as Productive (moderate), watercourses were limited by steep altitudes of the tributary and a lack of bankside cover.

Productive (low) habitats were primarily situated in lower lying catchments and on the loch margins where tributaries meet waterbodies. Such habitats were characterised by high percentages of silt and fine sediments, no instream/bankside cover, little/no water flow and visibly turbid/stained water.

No Bedrock Channel habitat was identified on the watercourse surveyed. Several stretches of watercourse, notably the Allt Coire Pitridh, contained a high percentage of boulder within the substrate however this wasn't present as channels and provided some instream cover.

Not suitable habitat detailed habitat that had no potential to support salmonid populations. Two unnamed tributaries in Loch Earba West were dry at the time of survey (indicated by Not Suitable Habitat) and displayed limited substrate presence. As habitat quality was assessed at the time of survey they displayed no potential to support salmonid populations. Such watercourses are likely seasonal drainage channels and not established watercourses, and therefore may have water during high rainfall periods.

Despite this presence of Lamprey Habitat, Lamprey are unlikely to be present within any waterbodies and watercourses surveyed due to the presence of existing obstacles both downstream in the catchment and within the red line boundary; 'Lamprey Habitat' thus details the presence of silted areas suitable for lamprey and is not indicative of presence.

Loch margin substrate, including rocky substrate and sand, is consistent with oligotrophic status of Loch Earba West and East, and Loch Leamhain.

4.4 Fish Population (Electrofishing)

In total three fish species were identified during electrofishing surveys: brown trout, Arctic charr and Eurasian minnow.

Brown trout showed the greatest distribution within the survey areas and was present on all watercourses where fish were detected. Eurasian minnows were similarly present on 5 out of 6 electrofishing Survey Locations where fish were detected. Arctic charr were detected within three Survey Locations.

Presence of Arctic charr in streams is not unexpected given juveniles have been readily recorded utilising streams as nursery areas in Scotland (Maitland *et al.*, 1984). As no adults were recorded during electrofishing surveys, results suggest some Arctic charr utilise streams for spawning and drop back into the deeper water of standing waterbodies or juveniles actively move into streams as fry. The presence of river spawning Arctic charr would increase their conservation value due to limited identified occurrences in Scotland (10 recorded instances with several having gone extinct) (Walker, 2007).

Population density and average fish size displayed a weak inverse relationship with the sites of highest population density supporting the smallest average fish size. Survey Location EA6 displayed a population density of 0.08 fish per m^2 and the second highest average size at 63.20 mm. Survey Location EA4 displaying a population density of 0.12 fish per m^2 and displayed the largest average size at 84.30 mm.

Population status analysis was limited by similarities in brown trout and Arctic charr during their fry life stage that inhibited accurate identification to species level in the field. A selection of three photographs were sent for external verification and confirmed as Arctic charr.

Although presence of Arctic charr were not identified in Loch Earba West during gillnetting, presence of juveniles and absence of adults indicates they reside in the Loch. As numbers in

Loch Earba West were undetectable via gillnetting, the population is considered to be in unfavourable condition status.

Survey Locations where no fish species were identified (EA7-EA9) did not provide high quality habitat. Both EA7 and EA8 were located on the loch margins, this provided poor fish habitat quality in the ecologically depleted zone.

All fish populations are considered natural and self-sustaining; there were no records of stocking identified during the desk study.

4.5 Fish Population (Gillnetting)

Trout in Loch Earba East showed highest range in fork length with individuals ranging from 105mm to 500mm (range of 395 mm) compared to Loch Earba West that ranged from 80 mm to 300 mm (range of 220 mm). Disparities in fork length are largely due to the presence of one large trout in Loch Earba East (500 mm) that significantly increased the range; this was the largest fish identified throughout all surveys.

Within Loch Earba East, pelagic gillnets set in deep water (21 m) caught the largest number of fish at 9 and 25 individuals over both net nights. Benthic gillnets set in shallow (8 m) water similarly caught a large proportion of the total fish caught at 8 and 17 individuals over both net nets. Benthic gillnets in deep water caught the least number of fish at 1 and 4 individuals over both net nights. The second net night caught 4 fish, all Arctic charr, representing the total Arctic charr caught with gillnetting effort.

Similarly in Loch Earba West, pelagic gillnets set in deep water (20 – 20.5 m) and benthic gillnets in shallow water (8 m) represented a significant proportion of the total catch at 25 and 20 individuals, and 10 and 26 individuals respectively over both net nights. Although presence of Arctic charr were not identified in Loch Earba West during gillnetting, presence of juveniles and absence of adults in adjoining watercourse indicates adults likely reside in the Loch. As numbers in Loch Earba West were undetectable via gillnetting, the population is considered to be in unfavourable condition status.

Although present in large numbers within pelagic habitats, results are indicative of habitat use during crepuscular and nocturnal periods and thus may be a result of diurnal vertical diurnal migration. Consequently, fish may only be present in pelagic environments during this period. Fish have also been identified as showing seasonal changes in habitat use associated with reproduction and during summer where changes in solar radiation, flow and water temperature may influence prey availability (Garcia-Vega *et al.*, 2017).

Overall, results suggest a wide use of depths and zones of water usage from brown trout throughout all areas of both waterbodies.

4.6 Macrophyte

In total 37 species were identified in the three waterbodies surveyed.

All transects undertaken indicated species with little conservation, designated as 'Least Concern' (Botanical Society of Britain & Ireland, 2023).

Submergent communities displayed smaller species variation, when compared to emergent communities, with 17 species identified. There was a wide disparity in submergent species presence and abundance between Loch Earba East and, Loch Leamhain and Loch Earba West. Loch Earba East identified 18 species whereas Loch Leamhain and Loch Earba West identified 3 and 1 respectively. Submergent macrophyte communities are critical for maintaining sediment stability on loch margins. Any loss of species diversity and abundance as a result of the proposed development may contribute deterioration and erosion of marginal substrate with consequent effects on water quality (Salgado *et al.,* 2010).

Emergent communities contributed 22 species. Each transect displayed greater species count when compared to submergent communities, however, similar species were identified within each transect. Loch Earba West showed highest species variation with 18 identified followed by 12 in Loch Earba East; Loch Leamhain was significantly lower at 2 species present. Overall

low macrophyte diversity and abundance is consistent with nutrient poor oligotrophic status Lochs (Smith, Maitland and Pennock, 1987).

Of species identified within Loch Earba East the majority displayed relatively high abundance on the DAFOR scale with the majority of species being recorded as 'Frequent', 'Abundant' or 'Occasional'. Three species were categorised as 'Rare', one emergent (*Equisetum fluviatile*) and two submerged (*Potamogeton natans, Utricularia minor*). Loch Earba West recorded most species as 'Abundant' or 'Occasional' with four species recorded as 'Rare' (*Equisetum fluviatile, Carex pseudocyperus, Equisetum arvense, Salix repens*). Loch Leamhain was considerably lower in both species presence and abundance with 2 species recorded as 'Rare' in abundance (*Littorella uniflora, Juncus bufonius*). No species were recorded to be in 'Dominant' abundance.

Discrepancies between emergent and submergent species present, and their abundance, throughout loch surveyed are likely explained by the differences in environmental conditions. Loch Leamhain likely experiences colder average temperatures due to increased elevation (600 m AOD vs 350 m AOD) and can thus only support macrophytes with greater temperature resistance. Limited species present in Loch Leamhain are consistent with those in the nearest Loch of similar altitude and size, Loch Pattack, that recorded a dominance of *Juncus bulbolus* and *Littorella uniflora* (Hardin and Day, 1995).

Studies of upper lochs utilised for Pump Storage Hydro (e.g. Cruachan Reservoir) have displayed negligible or reduced macrophyte communities during operational period (no baseline surveys available) (Smith, Maitland and Pennock, 1987). The frequency at which maximum and minimum water levels are reached is not established, however, water level is predicted to vary by 70 m (640 m AOD to 710 m AOD) during operation. Such extreme changes in environmental conditions including light, temperature and nutrient availability are likely to reduce macrophyte community assemblages resulting in a less diverse and abundant macrophyte community. This is likely to reduce macroinvertebrate diversity and abundance in marginal zones (Beckett *et al.,* 1992).

Current impoundments on Loch Earba East and West display water level changes of several metres. Thus, the waterbodies likely have an existing effect of water level change. Due to a lack of baseline macrophyte data preceding historical development, any effect of current impoundments cannot be concluded (as current macrophyte communities may represent original communities or decreased coverage), however, comparisons with other nutrient poor oligotrophic lochs suggest minimal effect is likely to occur due to reduce baseline abundance/diversity (Smith, Maitland and Pennock, 1987). Similarly to Loch Leamhain (upper loch) extreme changes in environmental conditions are likely to reduce macrophyte community assemblages in both abundance and diversity. The majority of species identified, e.g. emergent *Juncus bulbosus,* are tolerant of moderate water level changes but are absent if fluctuations are large.

No invasive non-native species (INNS) were identified in the three waterbodies surveyed. The presence of *Rhododendron ponticum* was identified in terrestrial habitats on the loch margins. Therefore, there is no risk of the proposed development facilitating the transfer of INNS between the three lochs surveyed, and waterbodies further down the catchment (e.g. Loch Laggan and Loch Pattack).

Species identified including: *Potamogeton polygonifolius*, *Juncus bulbosus*, *Lobelia dortmanna* and *Isoetes lacustri* support the characterisation of oligotrophic status in Loch Earba West and East, and Loch Leamhain.

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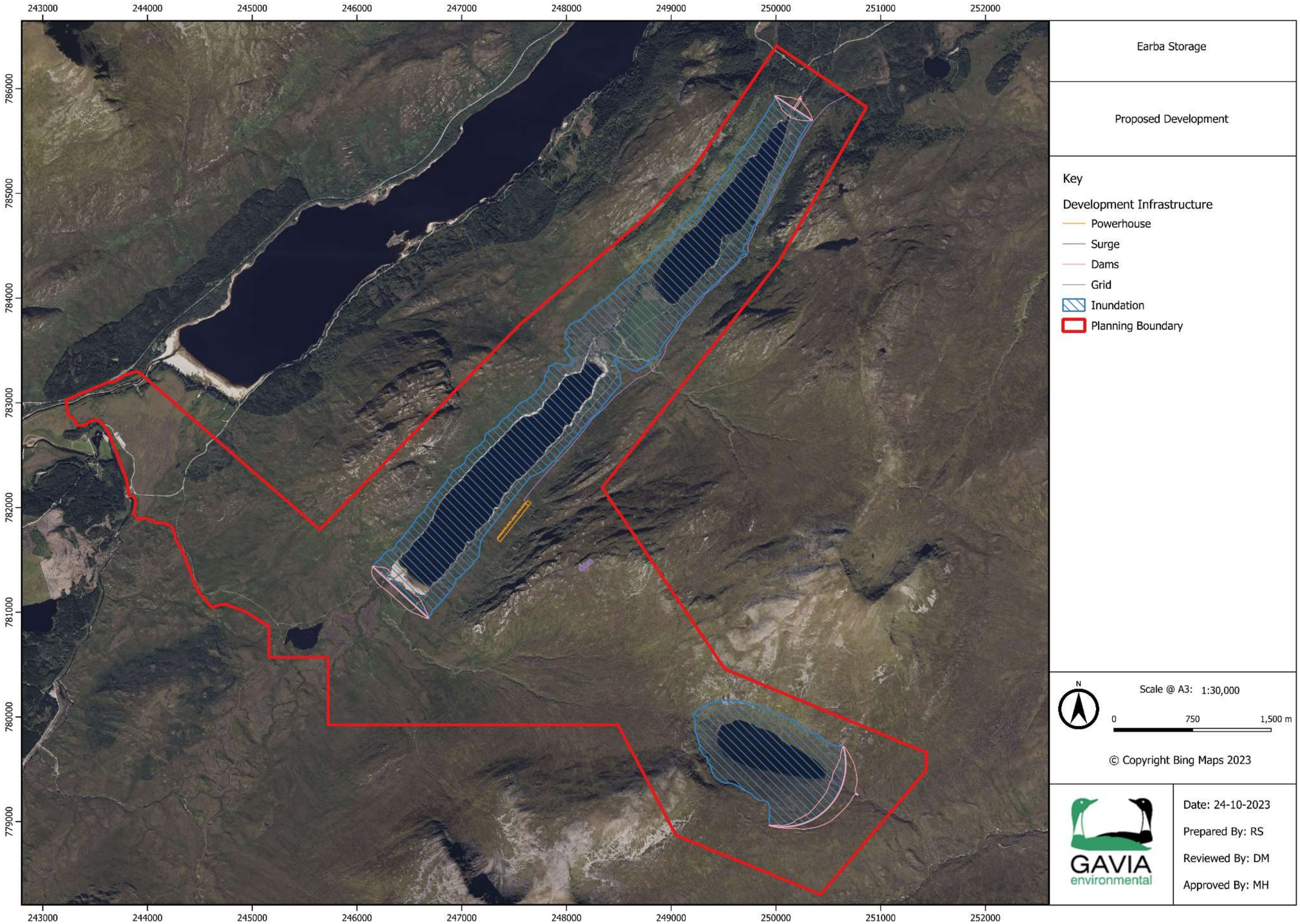
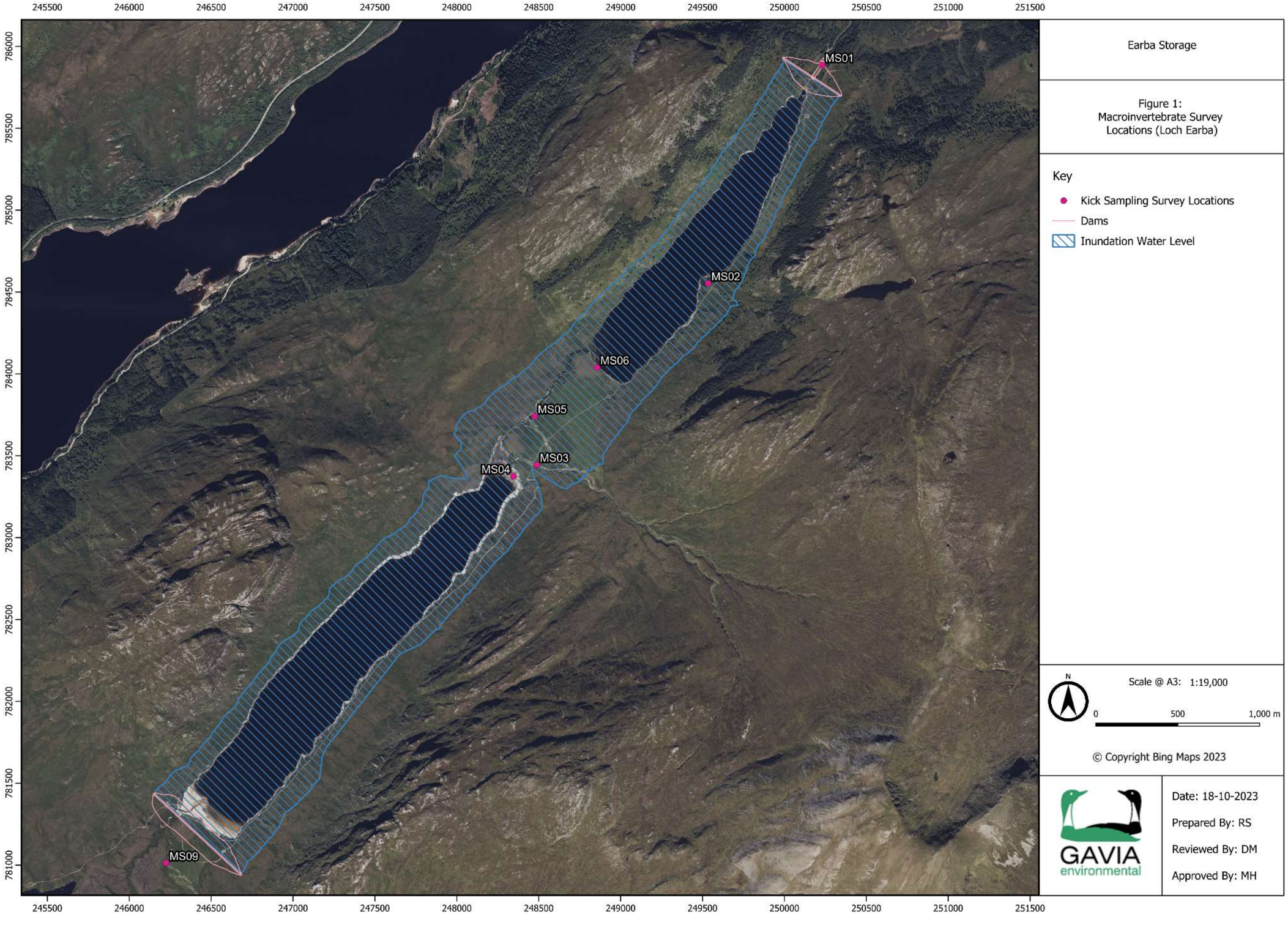
6 Appendices

Appendix A Maps



Earba Pumped Storage Hydroscheme



Earba Storage

Figure 1:
Macroinvertebrate Survey
Locations (Loch Earba)

Key

- Kick Sampling Survey Locations
- Dams
- Inundation Water Level

N

Scale @ A3: 1:19,000

0 500 1,000 m

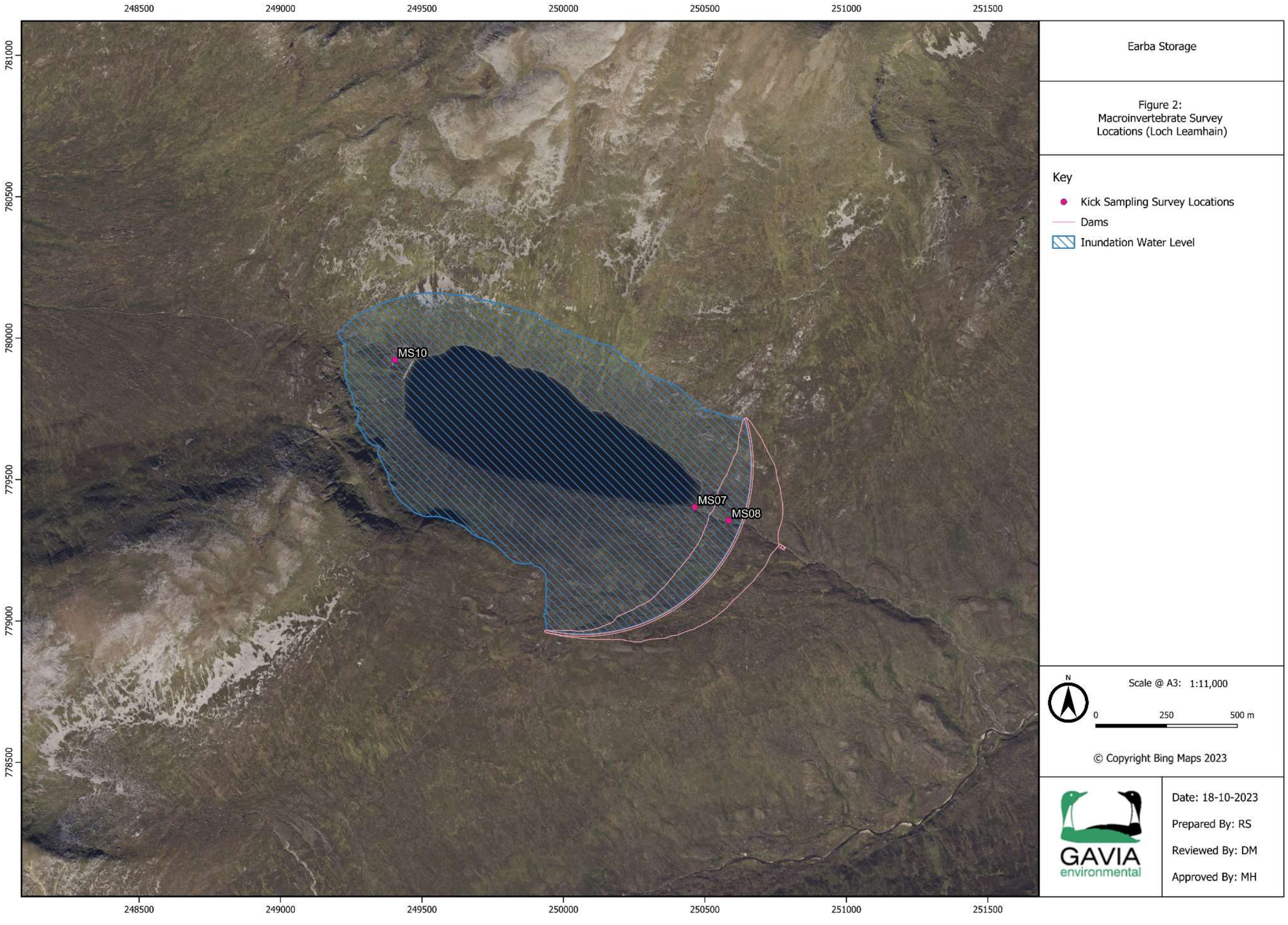
GAVIA
environmental

Date: 18-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH



Earba Storage

Figure 2:
Macroinvertebrate Survey
Locations (Loch Leamhain)

Key

- Kick Sampling Survey Locations
- Dams
- Inundation Water Level

N

Scale @ A3: 1:11,000

0 250 500 m

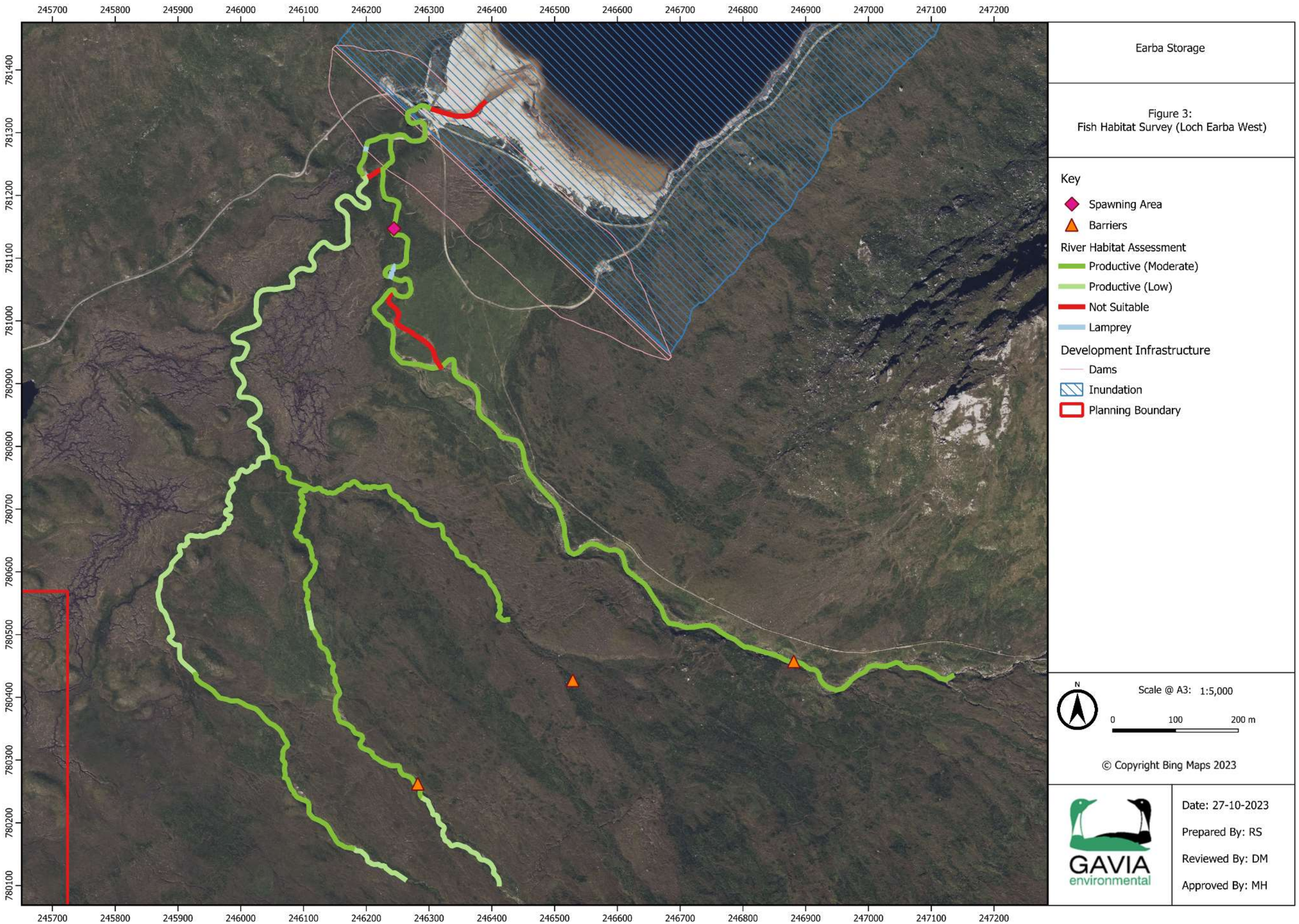
GAVIA
environmental

Date: 18-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH


245700
245800
245900
246000
246100
246200
246300
246400
246500
246600
246700
246800
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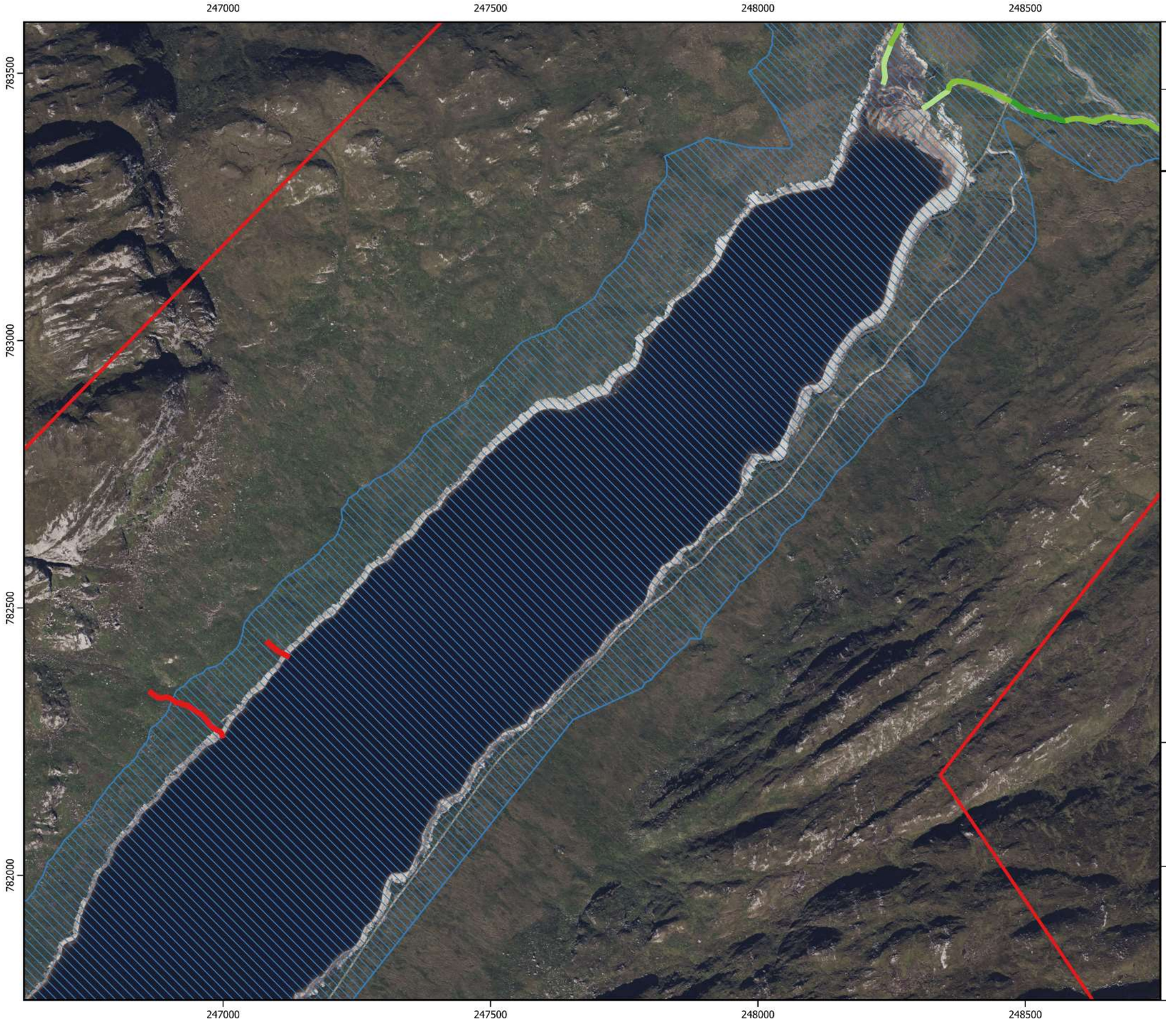
247000
247100
247200
781400
781300
781200
781100
781000
780900
780800
780700
780600
780500
780400
780300
780200
780100
Earba Storage
Figure 3:
Fish Habitat Survey (Loch Earba West)
Key
Spawning Area
Barriers
River Habitat Assessment
Productive (Moderate)
Productive (Low)
Not Suitable
Lamprey
Development Infrastructure
Dams
Inundation
Planning Boundary
N
Scale @ A3: 1:5,000
0
100
200 m
© Copyright Bing Maps 2023
GAVIA
environmental
Date: 27-10-2023
Prepared By: RS
Reviewed By: DM
Approved By: MH



Earba Storage

Figure 4:
Fish Habitat Survey (Loch Earba West)

Key

- Inundation Water Level
- Planning Boundary

River Habitat Assessment

- Productive (High)
- Productive (Moderate)
- Productive (Low)
- Not Suitable

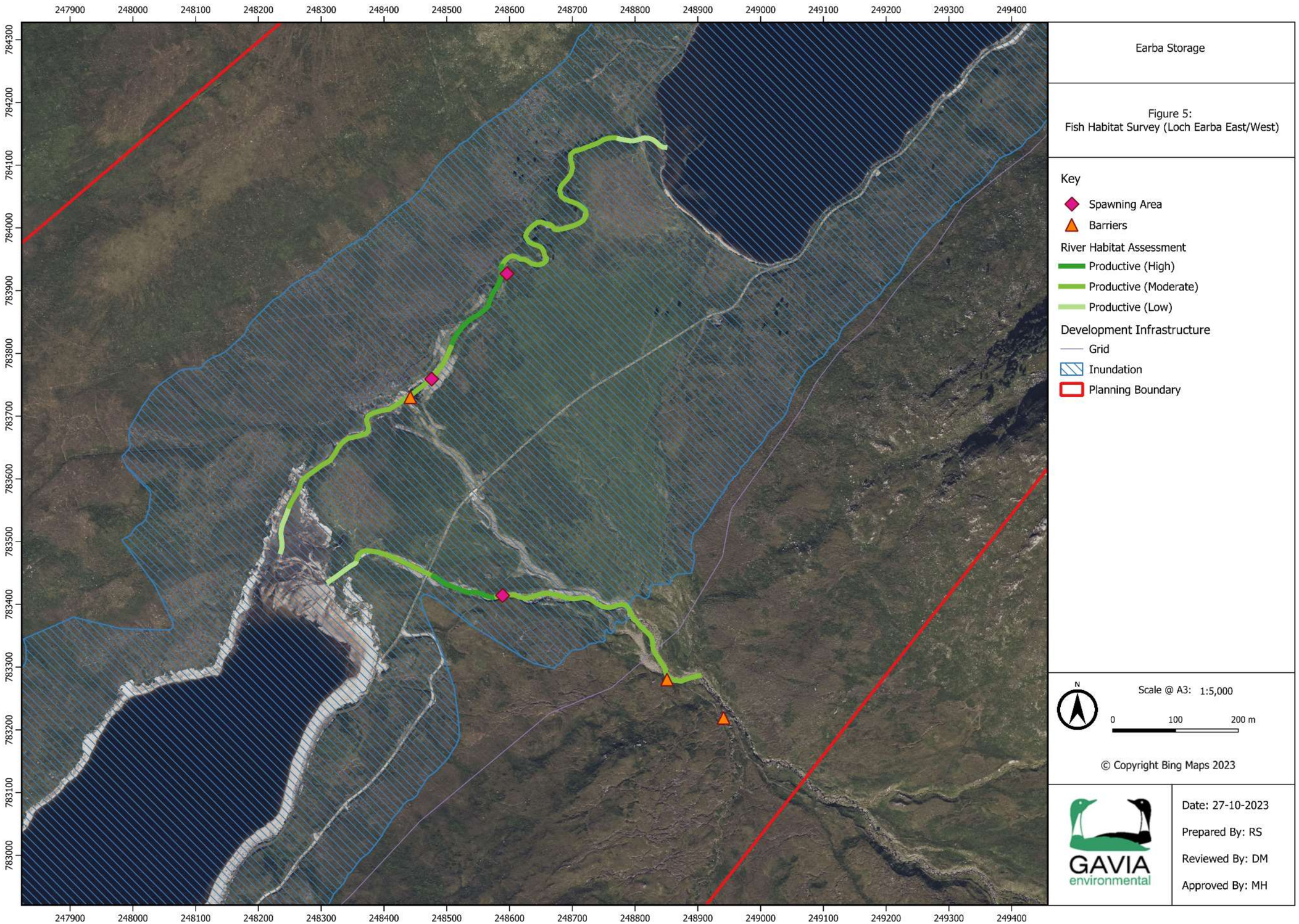
N

Scale @ A3: 1:6,500

0 100 200 m

GAVIA
environmental

Date: 18-10-2023
Prepared By: RS
Reviewed By: DM
Approved By: MH



Earba Storage

Figure 5:
Fish Habitat Survey (Loch Earba East/West)

Key

- Spawning Area
- Barriers

River Habitat Assessment

- Productive (High)
- Productive (Moderate)
- Productive (Low)

Development Infrastructure

- Grid
- Inundation
- Planning Boundary

N

Scale @ A3: 1:5,000

0 100 200 m

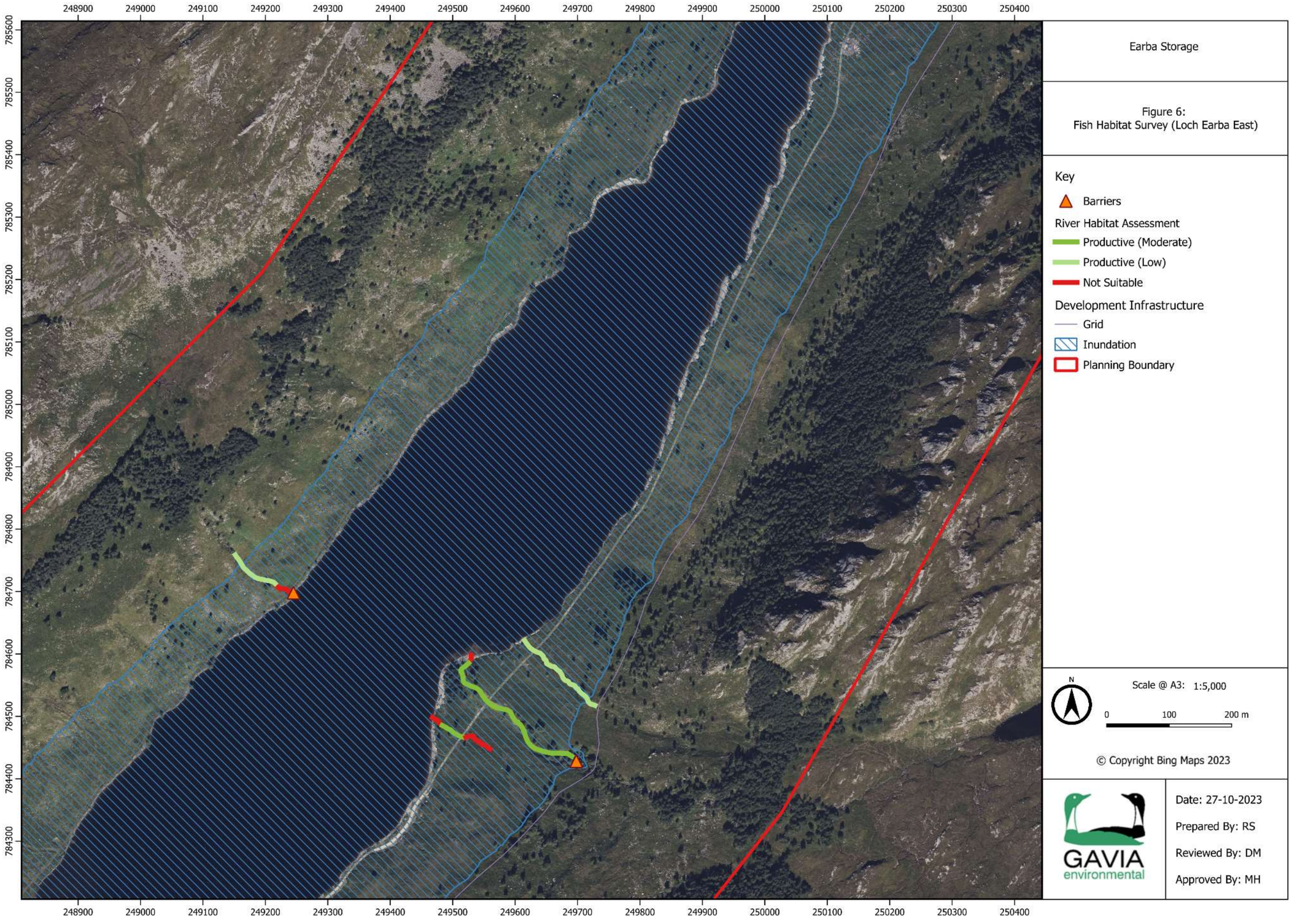
GAVIA
environmental

Date: 27-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH



Earba Storage

Figure 6:
Fish Habitat Survey (Loch Earba East)

Key

Barriers

River Habitat Assessment

Productive (Moderate)

Productive (Low)

Not Suitable

Development Infrastructure

Grid

Inundation

Planning Boundary

N

Scale @ A3: 1:5,000

0 100 200 m

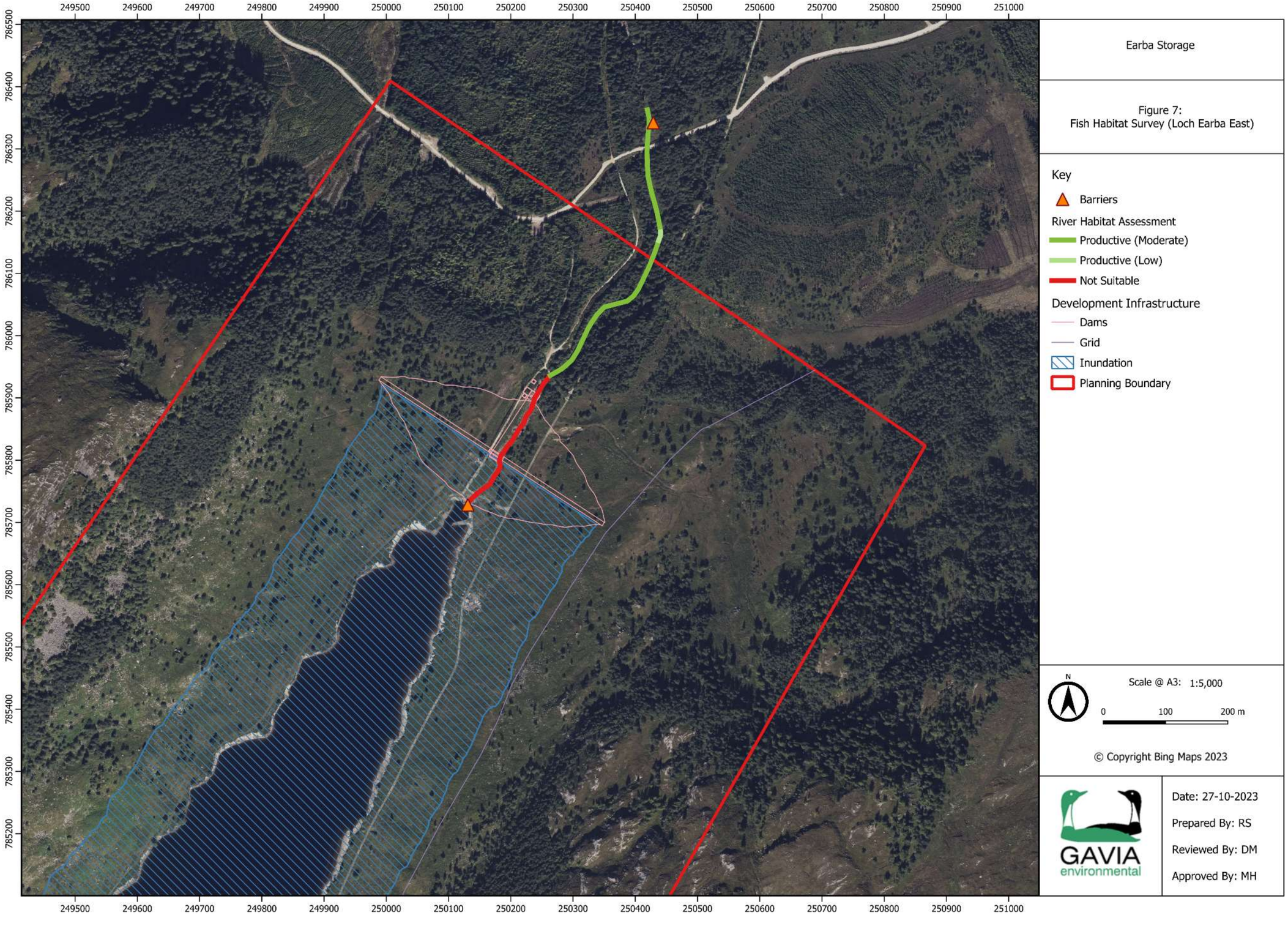
GAVIA
environmental

Date: 27-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH



Earba Storage

Figure 7:
Fish Habitat Survey (Loch Earba East)

Key

Barriers

River Habitat Assessment

Productive (Moderate)

Productive (Low)

Not Suitable

Development Infrastructure

Dams

Grid

Inundation

Planning Boundary

N

Scale @ A3: 1:5,000

0 100 200 m

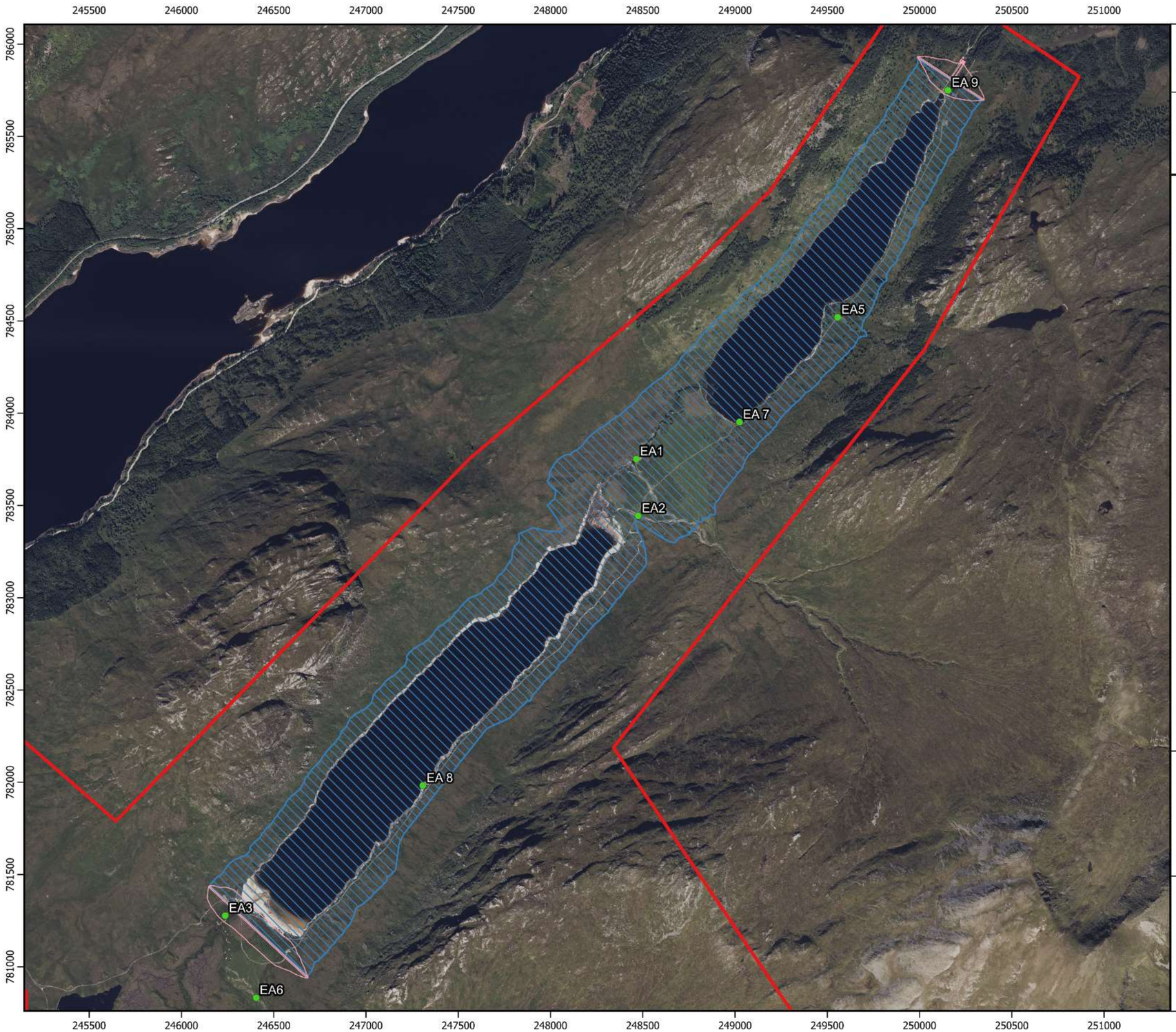
GAVIA
environmental

Date: 27-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH



Earba Storage

Figure 8:
Electrofishing Survey Locations
Loch Earba

Key

- Dams
- Inundation Water Level
- Planning Boundary
- Electrofishing Survey Locations

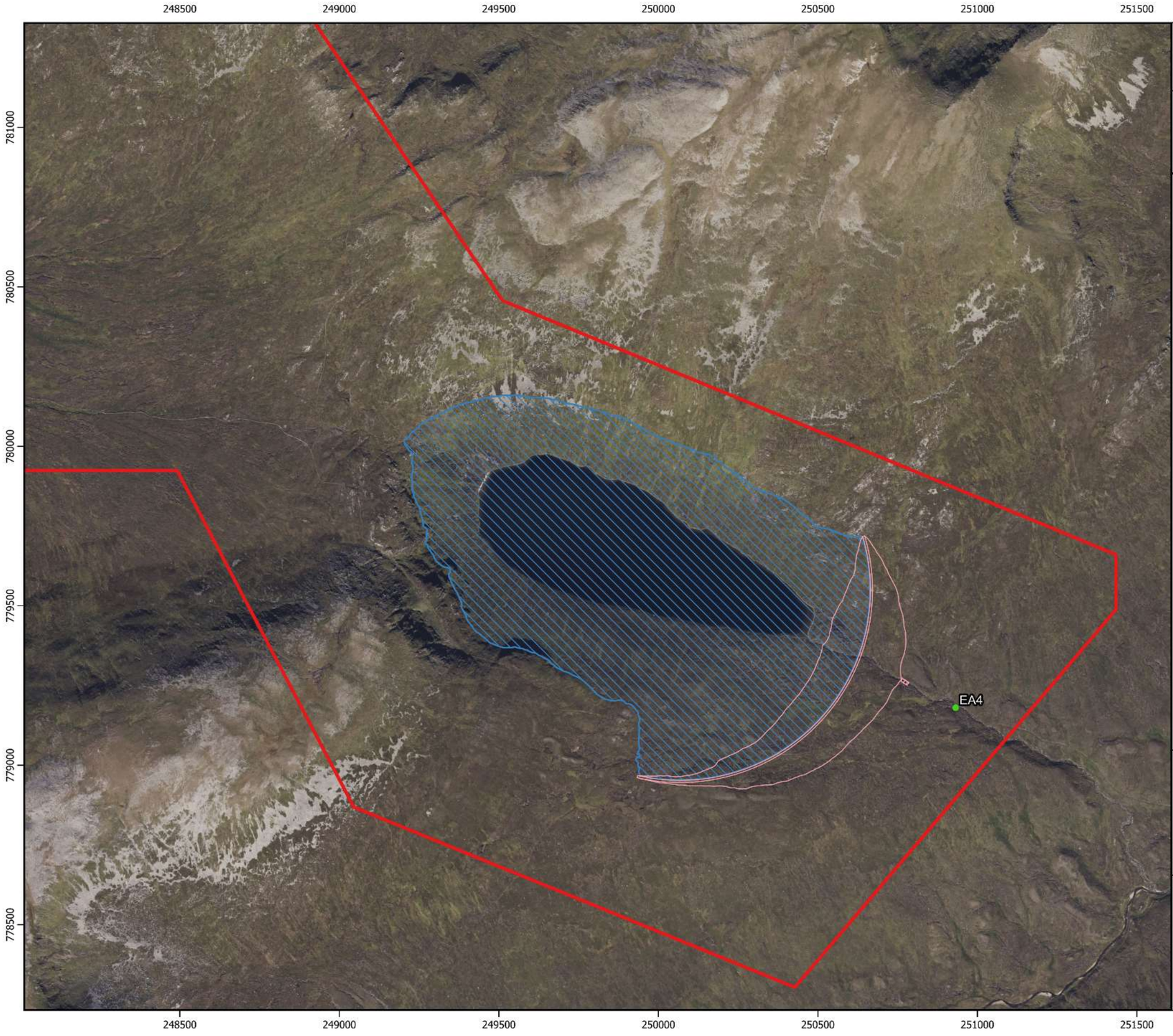
N

Scale @ A3: 1:19,000

0 500 1,000 m

GAVIA
environmental

Date: 18-10-2023
Prepared By: RS
Reviewed By: DM
Approved By: MH



Earba Storage

Figure 9:
Electrofishing Survey Locations
Loch Ieamhain

Key

- Dams
- Inundation Water Level
- Planning Boundary
- Electrofishing Survey Locations

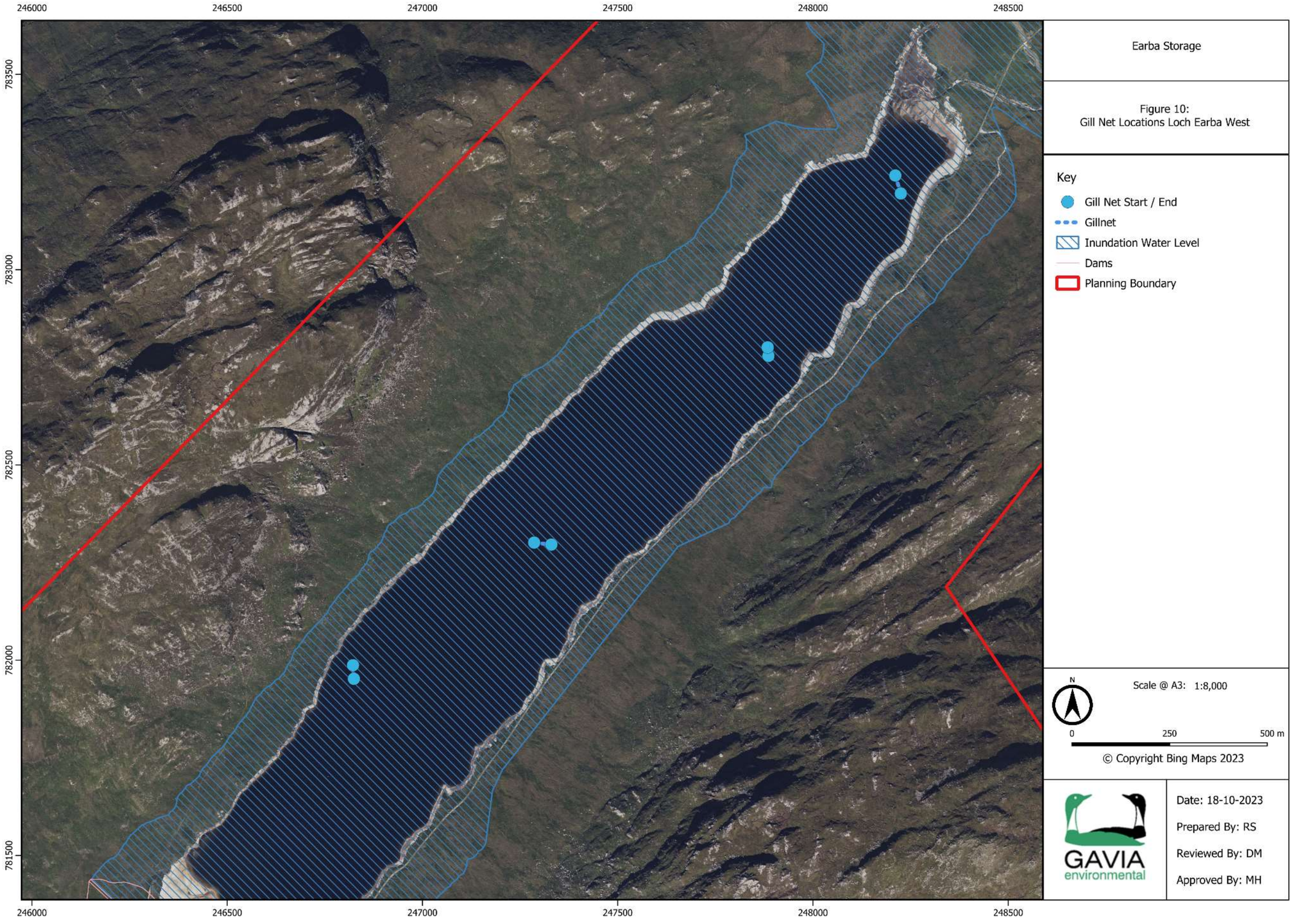
N

Scale @ A3: 1:11,000

0 250 500 m

GAVIA
environmental

Date: 18-10-2023
Prepared By: RS
Reviewed By: DM
Approved By: MH



Earba Storage

Figure 10:
Gill Net Locations Loch Earba West

Key

- Gill Net Start / End
- Gillnet
- Inundation Water Level
- Dams
- Planning Boundary

N

Scale @ A3: 1:8,000

0 250 500 m

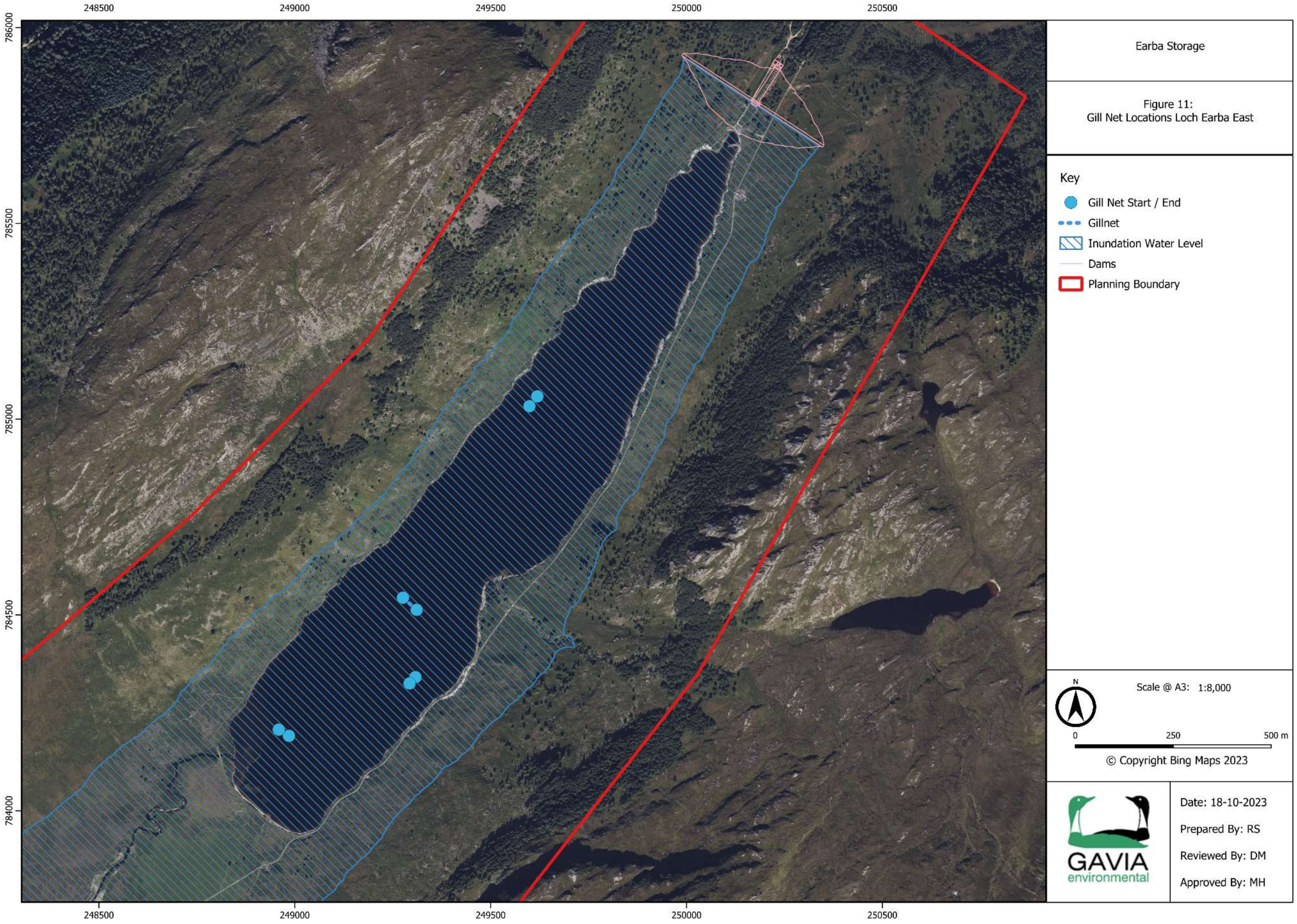
GAVIA
environmental

Date: 18-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH


248500
249000
249500
250000
250500
786000
785500
785000
784500
784000
Earba Storage
Figure 11:
Gill Net Locations Loch Earba East
Key
Gill Net Start / End
Gillnet
Inundation Water Level
Dams
Planning Boundary
N
Scale @ A3: 1:8,000
0
250
500 m
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GAVIA
environmental
Date: 18-10-2023
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Reviewed By: DM
Approved By: MH

Earba Storage

Figure 12:
Macrophyte Survey Loch Earba West

Key

Transect Line

Transect start / end

Planning Boundary

N

Scale @ A3: 1:8,000

0 250 500 m

GAVIA
environmental

Date: 18-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH

Earba Storage

Figure 13:
Macrophyte Survey Loch Earba West / East

Key

- Transect Line
- Transect start / end
- Planning Boundary

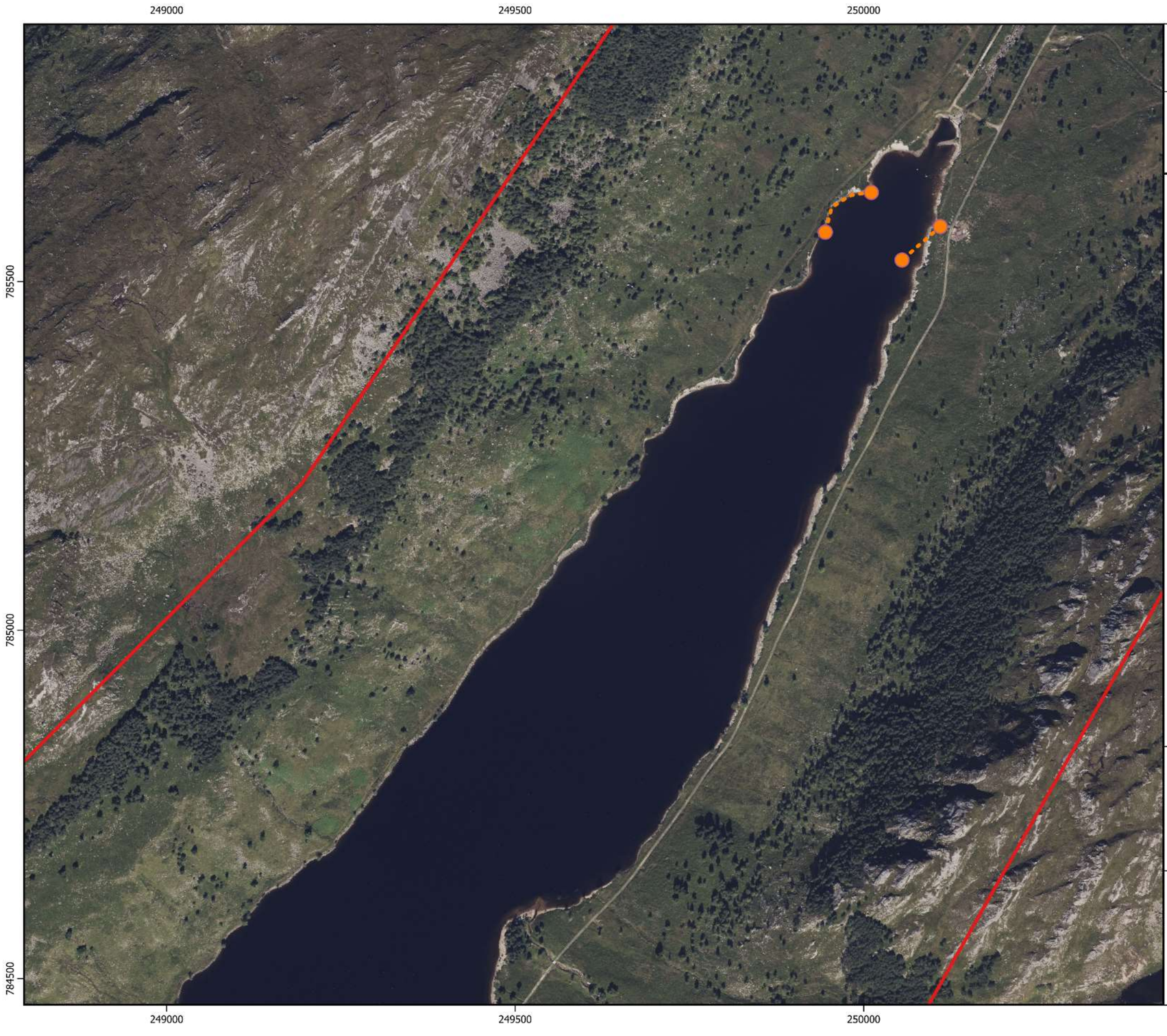
N

Scale @ A3: 1:5,000

0 100 200 m

GAVIA
environmental

Date: 18-10-2023
Prepared By: RS
Reviewed By: DM
Approved By: MH



Earba Storage

Figure 14:
Macrophyte Survey Loch Earba East

Key

Transect Line

Transect start / end

Planning Boundary

N

Scale @ A3: 1:5,000

0 100 200 m

GAVIA
environmental

Date: 18-10-2023

Prepared By: RS

Reviewed By: DM

Approved By: MH

Appendix B Macroinvertebrate List

Table 20 Macroinvertebrate Spring Sampling Results

Order	Family	Taxa Name	MS01 Allt Labrach	MS02 Allt Loch Coire Chur	MS03 Moy Burn	MS04 L. Earba Shuas	MS05 River Earba	MS06 L. Earba Shios	MS07 Loch Leamhain	MS08 Loch Leamhain Outflow	MS09 Allt Coire Pitridh	MS10 Loch Leamhain Inflow
			17/05/2023	*17/05/2023*	*17/05/2023*	*17/05/2023*	*17/05/2023*	*17/05/2023*	*17/05/2023*	*17/05/2023*	*17/05/2023*	*17/05/2023*
			Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance
BIVALVIA	SPHAERIIDAE	Euglesa conventus								5		
BIVALVIA	SPHAERIIDAE	Euglesa sp.								30		
CLADOCERA	N/A	Cladocera						18				
COLEOPTERA	DYTISCIDAE	Oreodytes sanmarkii										3
COLEOPTERA	ELMIDAE	Elmis aenea			2		1			3	3	33
COLEOPTERA	ELMIDAE	Esolus parallelepipedus								1		3
COLEOPTERA	ELMIDAE	Limnius volckmari	6	11			8		1	25		
COLEOPTERA	ELMIDAE	Oulimnius sp.							5	4		8
COLEOPTERA	ELMIDAE	Oulimnius tuberculatus							4			1
COLEOPTERA	HALIPLIDAE	Haliplus fulvus						1	2			
COLEOPTERA	HYDRAENIDAE	Hydraena gracilis								1	1	1
COLEOPTERA	SCIRTIDAE	Cyphon sp.	2									
DIPTERA	CERATOPOGONIDAE	Ceratopogonidae		1								
DIPTERA	CHIRONOMIDAE	Brillia longifurca					2			5		
DIPTERA	CHIRONOMIDAE	Chironomidae	1	7	1	8	3			30	3	24
DIPTERA	CHIRONOMIDAE	Tanypodinae								1		1
DIPTERA	CHIRONOMIDAE	Tanytarsini	1							4		2
DIPTERA	EMPIDIDAE	Clinocera sp.								1		
DIPTERA	LIMONIIDAE	Eloeophila sp.										1
DIPTERA	LIMONIIDAE	Hexatoma sp.				6		3				
DIPTERA	PEDICIIDAE	Dicranota sp.		4	2	1	6				1	2
DIPTERA	SIMULIIDAE	Prosimulium sp.			4							
DIPTERA	SIMULIIDAE	Simulium argyreatum/variegatum		1	5						30	
DIPTERA	SIMULIIDAE	Simulium sp.	1							3		4
DIPTERA	TIPULIDAE	Tipula sp.						1	1			
EPHEMEROPTERA	AMELETIDAE	Ameletus inopinatus	1			1			11			
EPHEMEROPTERA	BAETIDAE	Baetidae	3									
EPHEMEROPTERA	BAETIDAE	Baetis muticus		10	7		18			27	14	8
EPHEMEROPTERA	BAETIDAE	Baetis rhodani/atlanticus agg.		7	25	1	4			2	4	15
EPHEMEROPTERA	BAETIDAE	Centroptilum luteolum						2				

EPHEMEROPTERA	HEPTAGENIIDAE	Ecdyonurus dispar		1			2					
EPHEMEROPTERA	HEPTAGENIIDAE	Ecdyonurus sp.	1				1				2	6
EPHEMEROPTERA	HEPTAGENIIDAE	Ecdyonurus venosus		2	3						2	1
EPHEMEROPTERA	HEPTAGENIIDAE	Electrogena lateralis	5	1	1		2				1	1
EPHEMEROPTERA	HEPTAGENIIDAE	Heptagenia sulphurea	1									
EPHEMEROPTERA	HEPTAGENIIDAE	Heptageniidae										2
EPHEMEROPTERA	HEPTAGENIIDAE	Rhithrogena semicolorata			2						1	1
EPHEMEROPTERA	LEPTOPHLEBIIDAE	Leptophlebia vespertina	3									
EPHEMEROPTERA	SIPHLONURIDAE	Siphlonurus lacustris						8				
GASTROPODA	LYMNAEIDAE	Ampullaceana balthica	2							9		
ODONOTA	COENAGRIONIDAE	Enallagma cyathigerum						1				
ODONOTA	COENAGRIONIDAE	Pyrrhosoma nymphula	3									
ODONOTA	CORDULEGASTRIDAE	Cordulegaster boltonii	1									
OLIGOCHAETA	LUMBRICIDAE	Eiseniella tetraedra	1							1		
OLIGOCHAETA	N/A	Oligochaeta	12	2		1			1	2	3	
PLECOPTERA	CHLOROPERLIDAE	Chloroperla tripunctata			1							
PLECOPTERA	CHLOROPERLIDAE	Siphonoperla torrentium	2	2	1		2		5	1		2
PLECOPTERA	LEUCTRIDAE	Leuctra inermis		1						4	7	39
PLECOPTERA	LEUCTRIDAE	Leuctra sp.									2	
PLECOPTERA	NEMOURIDAE	Amphinemura sulcicollis		6	1		7			11	15	68
PLECOPTERA	NEMOURIDAE	Nemoura cinerea	1									
PLECOPTERA	PERLIDAE	Dinocras cephalotes	1		1		2		1	16		3
PLECOPTERA	PERLIDAE	Perla bipunctata									2	
PLECOPTERA	PERLODIDAE	Isoperla grammatica		1	2		16					4
TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche pellucidula		1			93					
TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche siltalai	1	2					1	71		
TRICHOPTERA	HYDROPTILLIDAE	Hydroptila sp.							8	3	9	35
TRICHOPTERA	HYDROPTILLIDAE	Oxyethira sp.										4
TRICHOPTERA	LEPTOCERIDAE	Athripsodes bilineatus					1					
TRICHOPTERA	LIMNEPHILIDAE	Limnephilidae						1				1
TRICHOPTERA	LIMNEPHILIDAE	Limnephilus lunatus						1				
TRICHOPTERA	PHILOPOTAMIDAE	Philopotamus montanus		1								1
TRICHOPTERA	POLYCENTROPODIDAE	Neureclipsis bimaculata					2					
TRICHOPTERA	POLYCENTROPODIDAE	Plectrocnemia conspersa	1									
TRICHOPTERA	POLYCENTROPODIDAE	Plectrocnemia sp.										2
TRICHOPTERA	POLYCENTROPODIDAE	Polycentropus flavomaculatus	1				1		2	1		2
TRICHOPTERA	POLYCENTROPODIDAE	Polycentropus sp.							5			2
TRICHOPTERA	RHYACOPHILIDAE	Rhyacophila dorsalis			1							
TRICHOPTERA	RHYACOPHILIDAE	Rhyacophila sp.								1		1

TRICHOPTERA	SERICOSTOMATIDAE	Sericostoma personatum	1							1		
TROMBIDIFORMES	N/A	Hydracarina					1	1				3

Order	Family	Taxa Name	MS01 Allt Labrach	MS02 Allt Loch Coire Chur	MS03 Moy Burn	MS04 L. Earba Shuas	MS05 River Earba	MS06 L. Earba Shios	MS07 Loch Leamhain	MS08 Loch Leamhain Outflow	MS09 Allt Coire Pitridh	MS10 Loch Leamhain Inflow
			22/09/2023	*22/09/2023*	*22/09/2023*	*22/09/2023*	*22/09/2023*	*22/09/2023*	*22/09/2023*	*22/09/2023*	*22/09/2023*	*22/09/2023*
			Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance
BIVALVIA	SPHAERIIDAE	Euglesa conventus								6		
BIVALVIA	SPHAERIIDAE	Euglesa sp.							2			
CLADOCERA	N/A	Cladocera				11						
COLEOPTERA	DYTISCIDAE	Oreodytes davisii										2
COLEOPTERA	DYTISCIDAE	Oreodytes sanmarkii								1		1
COLEOPTERA	ELMIDAE	Elmis aenea			6				2	3		15
COLEOPTERA	ELMIDAE	Limnius volckmari	3	38	3		36			16	1	
COLEOPTERA	ELMIDAE	Oulimnius sp.				1	2	1		2		6
COLEOPTERA	ELMIDAE	Oulimnius tuberculatus		1			1		1			1
COLEOPTERA	HYDRAENIDAE	Hydraena gracilis		1						1		2
COLEOPTERA	SCIRTIDAE	Elodes sp.		1	1							
DIPTERA	CERATOPOGONIDAE	Ceratopogonidae				1						
DIPTERA	CERATOPOGONIDAE	Dasyhelea sp.				1	1				8	
DIPTERA	CHIRONOMIDAE	Brillia longifurca			1	1		1	1	11		1
DIPTERA	CHIRONOMIDAE	Chironomidae	4	1		1	5	1		35		4
DIPTERA	CHIRONOMIDAE	Tanypodinae	1		1	2	3		1	14		
DIPTERA	CHIRONOMIDAE	Tanytarsini	1		1		2					2
DIPTERA	DIXIDAE	Dixa sp.								2		
DIPTERA	EMPIDIDAE	Clinocera sp.		1	1							
DIPTERA	LIMONIIDAE	Hexatoma sp.					17	2				
DIPTERA	LIMONIIDAE	Neolimnomyia sp.					1					
DIPTERA	PEDICIIDAE	Dicranota sp.		2			1					2
DIPTERA	SIMULIIDAE	Simulium angustipes/velutinum					1					
DIPTERA	SIMULIIDAE	Simulium rostratum					1					
DIPTERA	SIMULIIDAE	Simulium sp.	4									
DIPTERA	TIPULIDAE	Tipula sp.				11		1	8	1		
EPHEMEROPTERA	BAETIDAE	Baetidae	1									
EPHEMEROPTERA	BAETIDAE	Baetis muticus		3			1			21	1	
EPHEMEROPTERA	BAETIDAE	Baetis rhodani/atlanticus agg.		3	8		17			138		

EPHEMEROPTERA	BAETIDAE	Baetis scambus		1								
EPHEMEROPTERA	BAETIDAE	Baetis sp.		2						36	1	9
EPHEMEROPTERA	EPHEMERELLIDAE	Serratella ignita									1	
EPHEMEROPTERA	HEPTAGENIIDAE	Ecdyonurus dispar			1						1	
EPHEMEROPTERA	HEPTAGENIIDAE	Ecdyonurus sp.		4	9				1	26	2	13
EPHEMEROPTERA	HEPTAGENIIDAE	Ecdyonurus venosus		47					5			14
EPHEMEROPTERA	HEPTAGENIIDAE	Electrogena lateralis									4	
EPHEMEROPTERA	HEPTAGENIIDAE	Heptageniidae					1					
EPHEMEROPTERA	HEPTAGENIIDAE	Rhithrogena semicolorata									1	
EPHEMEROPTERA	HEPTAGENIIDAE	Rhithrogena sp.			11							
EPHEMEROPTERA	LEPTOPHLEBIIDAE	Leptophlebia sp.	11									
EPHEMEROPTERA	LEPTOPHLEBIIDAE	Paraleptophlebia sp.			2							
GASTROPODA	LYMNAEIDAE	Ampullaceana balthica	4	1			2	3	5			
MEGALOPTERA	SIALIDAE	Sialis fuliginosa		1								
ODONOTA	COENAGRIONIDAE	Pyrrhosoma nymphula	21	1			1					
OLIGOCHAETA	LUMBRICIDAE	Eiseniella tetraedra								1		
OLIGOCHAETA	N/A	Oligochaeta	13	24	5	30	8		7	44		1
PLECOPTERA	CHLOROPERLIDAE	Chloroperla tripunctata		1								
PLECOPTERA	CHLOROPERLIDAE	Siphonoperla torrentium		3	1		2			2		2
PLECOPTERA	LEUCTRIDAE	Leuctra fusca									1	
PLECOPTERA	LEUCTRIDAE	Leuctra inermis	1	1							1	1
PLECOPTERA	LEUCTRIDAE	Leuctra sp.		1	5		1			280	1	10
PLECOPTERA	NEMOURIDAE	Amphinemura sulcicollis		4			2			17		1
PLECOPTERA	NEMOURIDAE	Nemoura avicularis		1								
PLECOPTERA	NEMOURIDAE	Nemouridae								28	2	1
PLECOPTERA	NEMOURIDAE	Protonemura meyeri		1								1
PLECOPTERA	NEMOURIDAE	Protonemura sp.		1						1	1	1
PLECOPTERA	PERLIDAE	Dinocras cephalotes			1		4		1	22	3	1
PLECOPTERA	PERLODIDAE	Isoperla grammatica					2			7		
PLECOPTERA	PERLODIDAE	Perlodes mortoni		5			9					
TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche angustipennis			4		78					
TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche pellucidula			6		155					
TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche siltalai		5						8		
TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche sp.			6		35					
TRICHOPTERA	HYDROPTILLIDAE	Hydroptila sp.		14	64	1	27		14	73	32	103
TRICHOPTERA	HYDROPTILLIDAE	Oxyethira sp.			1		1					2
TRICHOPTERA	LEPTOCERIDAE	Athripsodes bilineatus					2					
TRICHOPTERA	LEPTOCERIDAE	Athripsodes sp.					4					
TRICHOPTERA	LEPTOCERIDAE	Mystacides azurea						1	1			

TRICHOPTERA	LIMNEPHILIDAE	Apatania wallengreni							3			
TRICHOPTERA	LIMNEPHILIDAE	Limnephilidae					1					
TRICHOPTERA	ODONTOCERIDAE	Odontocerum albicorne		2								
TRICHOPTERA	PHRYGANEIDAE	Oligotricha striata	1									
TRICHOPTERA	POLYCENTROPODIDAE	Neureclipsis bimaculata			4		52					
TRICHOPTERA	POLYCENTROPODIDAE	Plectrocnemia conspersa	1							6		
TRICHOPTERA	POLYCENTROPODIDAE	Plectrocnemia geniculata					1					
TRICHOPTERA	POLYCENTROPODIDAE	Polycentropodidae					4					
TRICHOPTERA	POLYCENTROPODIDAE	Polycentropus flavomaculatus		1	3		12		2	7	1	
TRICHOPTERA	POLYCENTROPODIDAE	Polycentropus sp.					5					
TRICHOPTERA	RHYACOPHILIDAE	Rhyacophila sp.								1		
TRICHOPTERA	SERICOSTOMATIDAE	Sericostoma personatum	2	1					1	2		
TROMBIDIFORMES	N/A	Hydracarina					4					

Appendix C Gill Netting subsidiary information

Table 21. Gill Netting subsidiary information

Waterbody	Net Night	Net Type	Habitat	Average depth	Date (set)	Net Set	Net Collected	Trout	Charr	Minnows	Beaufort	Temperature (water)
Loch Earba East	1	Benthic	Shallow	8	12/12/2023	18:05	06:25	8	0		0	14.2
Loch Earba East	2	Pelagic	Deep	21	12/12/2023	19:40	07:40	9	0		0	14.2
Loch Earba East	3	Benthic	Deep	18.5	12/12/2023	18:15	06:30	1	0		0	14.2
Loch Earba East	4	Pelagic	Shallow	10	12/12/2023	19:25	07:30	7	0		0	14.2
Loch Earba East	5	Benthic	Shallow	8	13/12/2023	18:30	07:00	19	0		5	14.1
Loch Earba East	6	Pelagic	Deep	21	13/12/2023	18:00	06:00	25	0		5	14.1
Loch Earba East	7	Benthic	Deep	18.5	13/12/2023	18:00	06:30	0	4		5	14.1
Loch Earba East	8	Pelagic	Shallow	10	13/12/2023	18:50	07:15	5	0		5	14.1
Loch Earba West	1	Benthic	Shallow	8	30/08/2023	20:40	09:40	10	0		0	12.4
Loch Earba West	2	Pelagic	Deep	20	30/08/2023	21:50	10:00	25	0		0	12.4
Loch Earba West	3	Benthic	Deep	18.5	30/08/2023	20:55	09:50	8	0		0	12.4
Loch Earba West	4	Pelagic	Shallow	-	-	-	-	-	-	-	-	-
Loch Earba West	5	Benthic	Shallow	8	01/09/2023	17:30	06:15	26	0		3	12.4
Loch Earba West	6	Pelagic	Deep	19.5	01/09/2023	17:35	06:20	20	0		3	12.4
Loch Earba West	7	Benthic	Deep	20.5	01/09/2023	17:45	06:30	1	0		3	12.4
Loch Earba West	8	Pelagic	Shallow	12.5	01/09/2023	18:00	06:45	13	0		3	12.4

Appendix D Photographs

Plate Number	Description	Photograph
1. Macroinvertebrates		
1.1	*Apatania wallengreni*	
1.2	*Oligotrichia striata*	
1.3	*Oreodytes davisii*	

3. Fish Habitat		
3.1	Productive habitat between Loch Earba East and West	
3.2	Productive habitat on the Allt Coire a' Chlachair	
4. Electrofishing		
4.1	Brown trout identified in the outflow of Loch Leamhain	

4.2	Arctic charr fry identified in the outflow of Loch Leamhain	
4.3	Arctic charr fry identified in the Moy Burn	
5. Gillnetting		
5.1	A selection of Arctic charr caught via gillnetting on Loch Earba East	
5.2	Large male brown trout caught via gillnetting on Loch Earba East with distinct kype (hooked lower jaw)	

5.3	Selection of Brown trout from Loch Earba East displaying morphological variation	
6. Macrophytes		
6.1	Utrikularia bladderwort	
6.2	*Potamogeton natans*	

6.3	Marginal areas of Loch Earba West lacking macrophyte growth	
7. Other		
7.1	Otter footprint on Loch Earba East	
7.2	Invasive *Rhododendron ponticum* in the marginal areas of Loch Earba East