Millenium East Wind Farm

Environmental Impact Assessment (EIA) Report

Appendix 6.4: Fish Habitat Survey Report

avianecology

CONTENTS

ANNEXES

1 INTRODUCTION

1.1 Background

1.1.1 This Technical Appendix has been prepared to accompany **Chapter 6: 'Ecology'** of the Millenium East Wind Farm Environmental Impact Assessment (EIA) Report . It presents detailed methodologies and results of desk studies and field surveys completed on the 24th and 25th October 2023 and on the 11th and 12th March 2024 to establish baseline conditions with regards to fisheries. In addition, opportunities for enhancements for fish are also considered.

1.1.2 It should be read with reference to the following Figures presented in Volume 2:

- **Figure 2.1 – Site Boundary**; and,
- **Figure 6.6 – Fisheries Habitat Survey Area**.

1.1.3 The following species of conservation significance are considered:

- European eel *Anguilla anguilla* - Council Regulation (EC) No 1100/2007 establishing measures for the recovery of the stock of European eel; listed by IUCN as Critically Endangered, and Scottish Biodiversity List (SBL);
- Atlantic salmon *Salmo salar* – Annex II of Habitats Directive, Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 and SBL (Conservation Action Needed & Avoid Negative Impacts);
- Brown trout/sea trout *Salmo trutta* - SBL (Conservation Action Needed);
- Freshwater pearl mussel *Margaritifera margaritifera* – Schedule 5 of the Wildlife and Countryside Act (1981) and Annex II of Habitats Directive and SBL (Conservation Action Needed);
- River lamprey *Lampetra fluviatilis* - Annex II of Habitats Directive and SBL (Avoid Negative Impacts);
- Brook lamprey *Lampetra planeri* - Annex II of Habitats Directive and SBL (Avoid Negative Impacts); and,
- Sea lamprey *Petromyzon marinus* - Annex II of Habitats Directive and SBL (Avoid Negative Impacts).

1.2 Site Overview

1.2.1 The term 'Site' in this report refers to the land within the red line application boundary as illustrated on **Figure 2.1**. The Site has evolved during the baseline study period, and so the study area covers a slightly different location to the Site in respect to the access route. This is addressed in 'Limitations' below.

1.2.2 The Site lies to the south of Glen Moriston, and is adjacent to, and east of the existing Millenium Wind Farm. The Site largely comprises open heathland and bog habitats and an area of commercial forestry associated with Inchnacardoch/Inverwick Forests in the north west. The watercourses within the Site largely tribute into the River Moriston to the north, with the easternmost watercourses flowing into the Caledonian Canal to the southeast.

1.2.3 The locations of all watercourses subject to fish habitat survey are illustrated on **Figure 6.6.**

2 DESK STUDY

2.1 Methodology

2.1.1 A desk study was undertaken in 2024 to identify any statutory designated sites, classified waterbodies and existing fisheries records within the Site and surrounding area.

2.1.2 The following key sources were consulted:

- NatureScot's Site Link Website https://sitelink.nature.scot/site/8363;
- The Scottish Environment Protection Agency's (SEPA) River Basin Management Plan (https://www.sepa.org.uk/data-visualisation/water-environment-hub);
- The Join Nature Conservation Committee's (JNCC) distribution of the Freshwater Pearl Mussel (https://sac.jncc.gov.uk/species/S1029/);
- Ness Catchment Biosecurity Plan 2021 – 2030: Ness District Salmon Fisheries Board and Ness and Beauly Fisheries Trust; and
- Ness District Salmon Fishery Board (2021). Ness Fisheries Management Plan 2021-2030.

2.2 Results

2.2.1 There is a single watercourse designated for fish fauna within the survey area. The River Moriston is designated as a Special Area of Conservation (SAC) on account of its important Atlantic salmon and freshwater pearl mussel populations.

2.2.2 The European Water Framework Directive (WFD)[1] requires that surface waterbodies in member states are classified according to ecological status. SEPA's River Basin Management Plan website confirms there are three classified watercourses within the survey area:

- Allt Lundie, part of the Aldernaig Burn which drains the southern part of the Site, is assessed as having an overall ecological status of 'Moderate' and 'High' access for migratory fish;
- Allt Dail a' Chuirn, which drains the southern part of the Site, is part of the Invervigar Burn, which is assessed as having an overall ecological status as 'High' and 'High' access for migratory fish; and,
- Allt Phocaichain, which drains the eastern part of the Site, is assessed as having an overall ecological status as 'Moderate' and 'High' access for migratory fish.

The River Moriston is also a SEPA classified watercourse and lies just outwith the survey area. This stretch of the river is named as 'Dundreggan Dam to Bun Loyne' on SEPA's River Basin Management Plan. It is assessed as having an overall ecological status of 'Good' and has 'High' access for migratory fish.

[1] The requirements of the Water Framework Directive have been retained under the UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021.

3 FIELD SURVEY

3.1 Methodology

3.1.1 A Fish Habitat Survey was completed on 24th and 25th October 2023 and on the 11th and 12th March 2024 and was undertaken by Colin Nisbet. Colin is a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and is fully trained on Fish Habitat Survey as part of his Level 3 Management of Electrofishing Operations qualification as accredited by the Scottish Fisheries Coordination Centre (SFCC). He has been undertaking Fish Habitat Surveys for 17 years.

3.1.2 The survey area comprised sections of each watercourse within the Site and out to a 100m buffer of the Site where accessible.

3.1.3 The survey aimed to identify any areas of critical fish habitat (i.e. spawning habitat, nursery areas, juvenile and adult holding areas, juvenile lamprey habitat and freshwater pearl mussel habitat).

3.1.4 All stretches of watercourse with a gradient of ≥6 % are considered to be unsuitable or non-productive fish habitat for Atlantic salmon and brown/sea trout. Mills (1973) found that gradients of <3 % were favourable for Atlantic salmon, whilst sea trout were found to spawn in streams with gradients up to 4 %. Most populations of lamprey occur where the average stream gradient is 1.9 – 5.7 m/km, being rarely found where gradients exceed 7.8 m/km or 0.78 % (Maitland and Campbell, 1992). Whilst gradients of ≥6 % are considered to be typically unsuitable for fish fauna, it is recognised that small, isolated, populations of brown trout may occur in locally suitable habitat in stretches with steeper gradients.

3.1.5 The watercourses within the survey area were systematically walked (including in-stream inspections where required) and the habitats mapped according to the classifications presented in Table 3.1 below.

3.1.6 Specifically, the habitat survey focused on the identification of the following:

- Spawning habitat for salmonid and lamprey species;
- Nursery habitat for lamprey species;
- Areas of habitat important for juvenile salmonids (fry and parr);
- Areas of habitat important for adult salmonid holding areas; and
- Areas of suitable substrate and flow conditions for supporting freshwater pearl mussels.

3.1.7 The habitat classification used in this study is based on the SFCC's Habitat Surveys Training Course Manual (SFCC, 2007), the Environment Agency's Restoration of Riverine Salmon Habitats Guidance Manual (Hendry & Cragg-Hine, 1997) and a review of key habitat requirements for other species of conservation significance including lamprey, salmonids and freshwater pearl mussel (e.g. Maitland, 2003; Hendry & Cragg-Hine, 2003; Skinner et al. 2003).

3.1.8 Each watercourse within the survey area was visited. Detailed analysis was undertaken at sample points with any diverse geomorphological and hydrological conditions within each watercourse. Samples were taken at each of the representative sections of each watercourse. The following information was collected at each sample location: channel gradient; substrate composition (% bedrock, boulders >256 mm, cobbles 65-256 mm, pebbles 4-64 mm, gravel 2-4 mm, coarse sand 0.5-2 mm and fine sand/silt/peat <0.5 mm); average wetted channel width (m); average depth (m) and turbidity (1 [clear] – 3 [turbid]). Any potential barriers to fish movement within watercourses were also recorded. A photograph was taken at each sample point.

Table 3.1: Fish river habitat classifications.

Cat.	Habitat Type	Description	Species Suitability
1 **1a** **1b** **1c**	**Unsuitable** **Steep > 10% gradient** **6-10% gradient** **Other – ephemeral, shallow drains, dry beds**	Usually 1st – 2nd order watercourses with steep gradient, ≥6% slopes (often substantially greater), abundant bedrock, lack of fixed substrates, high velocity (*e.g.* headwaters/rivulets). Also includes less steep ephemeral stretches (*e.g.* headwater sources), shallow drains and modified watercourses with dry beds.	No productive fish habitat, although some species may migrate through these areas (also refer to 7. Rapids) depending on whether they represent a migration barrier.
2 **2a** **2b**	**Spawning Habitat** **Salmonids** **Lamprey**	Stable "gravels" of minimum 15-30 cm depth, optimal 20-30 mm, not compacted or with excessive silt/sands (<20% by weight) for salmonids. Lamprey spawning habitat where "gravels" include sands. Often at tail end of pools or upstream ends of riffle-runs ensuring oxygenated substrate. Can also be found at end of weir pools.	Spawning habitat - Atlantic salmon (*c.* 9 m^2 per pair) and sea/brown trout; lamprey.
3	**Riffle**	Shallow (< 20 cm) and fast flowing, with upstream-facing wavelets which are unbroken (although often some broken water), with substrate dominated by gravel and cobbles.	Fry (0+) habitat – Atlantic salmon/ brown trout/sea trout.
4 4a **4b**	**Run** **Shallow (< 0.5 m deep)** **Deep (>0.5 m deep)**	Generally deeper (20-40 cm) and less steep bed compared to riffle, with substrate of boulders, cobbles and gravels. Usually disturbed, rippled surface. Often located immediately downstream of riffle.	Mixed salmonid juvenile habitat. Fry (0+) & Par (1+) habitat - Atlantic salmon/ brown trout/sea trout.
5 **5a** **5b**	**Glide** **Shallow (<0.5 m deep)** **Deep (> 0.5 m deep)**	Shallow gradient stretches with smooth laminar flow with little surface turbulence and generally > 30 cm deep; water flow is silent. Often located below pool.	European eel; non-productive salmonid habitat, although may provide some shelter for adults.
6 6a **6b** **6c**	**Pool** **Plunge/Scour pool** **Meander pool** **Weir/bridge pool**	No perceptible flow, eddying and usually > 100 cm deep. Substrate with high proportion of sand and silts. Often located on the outside of meanders, but includes natural scour or plunge pools and artificial weir pools.	Adult refugia Atlantic salmon, sea/brown trout, European eel.
7 **7a** **7b** **7c**	**Rapids** **Steep - >10% gradient** **Moderate - 6-10% gradient Low - <6% gradient**	Sections of relatively steep gradient with fast currents and turbulence, with mixed flow types, including free-fall, chutes and broken, with obstructions such as large boulders, rock outcrops and falls.	Negative feature for migratory species and may pose a migratory barrier; elvers and eels limited to velocity of <0.5 m/sec and 2.0 m/sec respectively; lamprey to 2 m/sec.
8 8a **8b**	**Banks of fine sediment of silts and sands** **Optimal** **Sub-optimal**	Limited flow (sometimes back-flow) allowing deposition of silts/sands, not anoxic, with/without riparian trees. Optimal habitat is stable fine sediment and sand ≥15 cm deep with some organic detritus. Sub-optimal habitat includes small areas of deposited silts/sands behind boulders.	Lamprey ammocete nursery and adult refuge.
9 **9a** **9b** **9c** **9d** **9e**	**Vegetation features** **Riparian trees (tunnel)** **Flow constriction** **Aquatic macrophytes** **Emergent macrophytes** **Large woody debris**	 Closed woodland canopy forming tunnel vegetation In-stream emergent, boulders Stands of aquatic and floating vegetation Stands of emergent (usually marginal) vegetation LWD forming dams, *etc.*	Tunnel riparian trees may be negative feature for salmonids, although tree roots and fallen trees may provide refugia for Atlantic salmon/ brown trout/sea trout and European eel. Aquatics/emergents provide cover for fish, particularly juveniles.
10	**Obstructions to migration**	Impassable waterfalls, rapids, flow constrictions, weirs, bridge sills, culverts, shallow braided river sections, pollution preventing upstream migration.	All migratory species; impassability varies between species. Leaping ability: <3.7 m Atlantic salmon; <1.81 m trout; European eel and lamprey none.
11 **11a** **11b** **11c**	**Other features** **Side channel** **Backwater** **Artificial channel**	Includes other channel features, with side channel (connected to main channel) and backwaters. Artificial channels may comprise either man-made banks and/or beds.	Side channel/backwater often important refugia for juveniles. Artificial channels have limited diversity and are often non-productive fish habitat.

3.2 Limitations

3.2.1 There were no limitations to the surveys.

3.3 Results

3.3.1 Environmental data from all surveyed sample points (1-51) including channel dimensions, gradient and substrate composition, are provided in Table 1 of Annex 1. Photographs from the sample points are given in Annex 2.

Allt an Eoin – Watercourse W1

3.3.2 Watercourse W1, which flows along the Site's north western boundary, has a predominantly rapid flow type due to its steep gradient, which makes it of extremely limited suitability for migratory fish fauna and therefore also freshwater pearl mussel. There is also an absence of spawning and juvenile habitat for lamprey. There are also some riffle sections present over shallower gradient sections. The channel has an average wetted width of approximately 2m throughout the survey reach and an average depth of approximately 0.3m. Substrate within the channel largely comprises larger boulders, cobbles and pebbles, and also contains a small proportion of gravel.

Unnamed Tributaries of the River Moriston – Watercourses W2, W3 and W26

3.3.3 These unnamed tributaries of the River Moriston drain the north western part of the Site.

3.3.4 Watercourses W2 and W3 both lie on a moderately steep gradient (6-10%), which reduces their suitability for migratory fish fauna. Both contain a mix of run, riffle and rapid flow conditions and predominantly comprise larger substrate types within their channels, but smaller proportions of gravel are also present. The habitats present within the survey reaches are of negligible suitability for freshwater pearl mussel and lamprey species.

3.3.5 Watercourse 26 lies on a shallower gradient and contains a broader mix of substrates within the channel. The channel within the survey area supports a largely run/riffle flow structure and this watercourse is considered suitable for both migratory and non-migratory fish fauna. It also has some suitability for freshwater pearl mussel in gravel areas, though none were noted during the survey visit. There is a lack of marginal silt favoured by lamprey species.

Allt a' Ghoirtein – Watercouse W4

3.3.6 The Allt a' Ghoirtein (Watercourse W4), which drains the north western part of the Site is essentially a peaty headwater and is considered to be of negligible suitability for fish fauna.

Allt na Criche and Tributaries – Watercourses W5 – W7

3.3.7 Allt na Criche and its tributaries drain the north western part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston.

3.3.8 Watercourse W5 is Allt na Criche, which flows over a moderate to shallow gradient and supports a largely run/riffle flow type within the survey reach. The substrate within the channel ranges from boulder to pebble, with a lack of finer gravels and sands present. There are no barriers present between it and the River Moriston and it is considered suitable for supporting small numbers of migratory and non-migratory fish. There is, however, a lack of suitable spawning habitat within this watercourse and also a lack of habitats favoured by freshwater pearl mussel and lamprey species.

3.3.9 W6 and W7 are the tributaries of Allt na Criche (W5). W6 is a peaty headwater and of negligible suitability for fish. W7 is dominated with cobbles and lacks much in the way of finer substrates within

the channel, it is also running over a moderately steep gradient, which is further reducing its suitability for fish fauna. It is considered that it may support small numbers of fish, and is of negligible suitability for freshwater pearl mussel and lamprey.

Allt a' Coire Bhuidhe and Tributary – Watercourses W8 and W9

3.3.10 Allt a' Coire Bhuidhe and its tributary drain the north western part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston.

3.3.11 Watercourse W8 (Allt a' Coire Bhuidhe) lies on a moderate gradient and supports a predominantly run and riffle flow over a mostly cobble substrate. The channel bed is also comprised of smaller proportions of boulder and pebble, but there is a lack of finer gravels and sands present, thus limiting potential for spawning and freshwater pearl mussel.

3.3.12 Watercourse W9 is of a similar scale to W8 and has a broader spectrum of substrates present in the channel although the presence of smaller gravels and sand is limited. There is also a lack of marginal silts favoured by lamprey species in either watercourse. Both watercourses have a run and riffle flow type present within the survey reach and may support some migratory and non-migratory fish fauna, albeit in small numbers only.

Allt a' Chaitchinn and Tributaries – Watercourses W10 – W12

3.3.13 Allt a' Chaitchinn and its tributaries drain the north western part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston.

3.3.14 Allt a Chaitchinn (Watercourse W11) and watercourse W10 have an average width of 2m across the survey reach and support largely boulder and cobble substrates, with smaller areas of pebble also present. There is a lack of smaller gravels and sand within these channels, resulting in negligible spawning opportunities, or freshwater pearl mussel habitat. There is also a lack of lamprey habitat present. The flow conditions comprise run and riffle areas and areas of category 7b moderate rapids, which reduces opportunities for migratory fish. Having said that, these watercourses are considered to be suitable for supporting small numbers of fish fauna.

3.3.15 By contrast watercourse W12 is considered to be both ephemeral in nature and blocked with woody debris from forestry operations and is thus unsuitable for fish.

Tributaries of Allt a Chaise – Watercourses W13 and W14

3.3.16 These tributaries of the Allt a Chaise drain the northern part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston.

3.3.17 Watercourse W13 has an average width of 2m across the survey reach and supports largely boulder and cobble substrates, with smaller areas of bedrock and pebble also present. There is a lack of smaller gravels and sand within the channel, resulting in negligible spawning opportunities and a lack of freshwater pearl mussel habitat. There is also a lack of lamprey habitat present. The flow conditions comprise run and riffle areas and areas of category 7b moderate rapids, which reduces opportunities for migratory fish. Having said that, W13 is considered suitable for supporting small numbers of fish fauna.

3.3.18 Watercourse W14 is ephemeral in nature and blocked with woody debris from forestry operations and is considered to be unsuitable for fish.

Headwaters of Allt a Chaise – Watercourses W15 – W18 and W27

3.3.19 The headwaters of the Allt a Chaise drain the northern part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston.

3.3.20 Watercourse W15 lies on a moderately steep gradient and comprises run, riffle and category 7b rapid flow types across the survey area. It contains a boulder and cobble substrate and therefore is limited in offering spawning opportunities, or freshwater pearl mussel or lamprey habitat. However, it is likely to support non-migratory fish in small numbers.

3.3.21 W18 lies on a shallower gradient with run and riffle flow conditions over a substrate that contains cobbles, boulders and areas of peat towards its origin. It is of limited suitability for fish fauna.

3.3.22 W16, W17 and W27 are all ephemeral peaty headwaters and offer negligible opportunities for fish.

Tributary of Allt Dubh – Watercourse W19

3.3.23 This tributary of the Allt Dubh (Watercourse W19) drains the northern part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston. It lies on a moderately steep gradient and supports run, riffle and category 7b rapid flow conditions within the survey area. The substrate is dominated by cobbles and there are also small proportions of boulder, pebble and gravel present within the stream bed. This watercourse offers some, albeit limited due to gradient, opportunities for both migratory and non-migratory fish fauna, as well as localised patches of suitable spawning habitats for salmonids and freshwater pearl mussel (although none were recorded during the survey). No marginal silt (favoured by juvenile lamprey) was recorded.

Tributaries of Allt na h-Innse Mor – Watercourses W20 and W21

3.3.24 These tributaries of the Allt na h-Innse Mor drain the northern part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston.

3.3.25 Watercourse W20 lies on a moderately steep gradient and supports largely category 7b rapid flow conditions, with areas of run and riffle also present within the survey area. The substrate is dominated by boulders and cobbles and peat towards its origin. The are also some localised patches of gravel present. This watercourse offers some, albeit very limited, opportunities for fish. It has negligible opportunities for freshwater pearl mussel and no marginal silt (favoured by juvenile lamprey) was recorded.

3.3.26 Watercourse W21 is an ephemeral peaty headwater and considered to be unsuitable for fish fauna.

Allt Phocaichain and Tributaries – Watercourses W22 – W25, W31-W42 and W46

3.3.27 The Allt Phocaichain and its tributaries drain the north eastern part of the Site before passing through Inchnacardoch/Inverwick Forest en route to the River Moriston.

3.3.28 Allt Phocaichain (Watercourse W23) is the most substantial watercourse within the survey area. It has an average wetted width of 4m and predominantly comprises run, riffle and glide flow types. A range of substrates are present within the stream bed, with higher proportions of boulder, cobble and pebble and low proportions of gravel and sand present. There are waterfalls downstream, several kilometres north of the site, prior to W23's confluence with the River Moriston, which may reduce opportunities for migratory fish. However, the habitats within the survey area are suitable for fish fauna across a full range of age classes. Habitats for freshwater pearl mussel are limited due to only small amounts of gravel being present within the substrate composition and, also potentially by barrier effects from waterfalls downstream. There is an absence of marginal silt favourable by juvenile lamprey within the survey area.

3.3.29 In terms of the tributaries, Watercourse W24 lies on a moderately steep gradient and has a predominantly larger boulder/cobble substrate with areas of bedrock and thus lacks much in the way of habitat for juvenile or spawning fish. It is considered to be suitable for lower numbers of adult and

sub-adult salmonids (parr and above), although similarly to W23 opportunities for migration may be limited by the waterfalls downstream.

3.3.30 Watercourses W35 – W38 are also all considered to have the potential to support fish fauna based on their largely run and riffle flow types, scale and substrates which typically vary from boulder to pebble in dimension. Watercourse W35 also contains a reasonable proportion of gravel, which provides opportunities for spawning, or freshwater pearl mussel on the basis that some migratory salmonids are able to traverse the waterfalls downstream. There is a lack of depositional silt in these watercourses and there are negligible opportunities for lamprey species.

3.3.31 The remaining tributaries of Allt Phocaichain (watercourses W22, W25, W31-W34, W39-W42 and W46) are all ephemeral peaty headwaters and offer negligible opportunities for fish.

Headwaters of Allt Lundie – Watercourses W28 and W29

3.3.32 The headwaters of the Allt Lundie drain the central-southern part of the Site and ultimately drain into the River Garry after passing through Loch Lundie, several kilometres downstream.

3.3.33 Watercourse W28 comprises a run, riffle and glide flow type within the survey area and a substrate dominated by boulder and cobble, with smaller proportions of pebbles within the channel. It is considered to be suitable for small numbers of salmonids. Watercourse W29 is on a shallow gradient and, as such, has a glide flow type and is considered likely to be more suitable for small numbers of parr and older salmonids. There is little in the way of freshwater pearl mussel, lamprey or spawning habitat present in the stretches of these watercourses that lie within the survey area.

Allt Dail a' Chuirn and Tributaries – Watercourses W30 and W48 – W51

3.3.34 Allt Dail a' Chuirn and its tributaries drain the southern part of the Site before joining the Invervigar Burn and passing through Inchnacardoch Forest en route to the Caledonian Canal.

3.3.35 Allt Dail a' Chuirn itself (Watercourse W50) comprises predominantly run, riffle and category 7b flow conditions within the survey area and a substrate comprising boulder, cobble, pebble and gravel. The gradient of this watercourse is moderately steep and there is a waterfall section downstream of the survey area, which is likely to reduce opportunities for migratory fish fauna. This watercourse supports opportunities for non-migratory fish within the survey area.

3.3.36 Watercourse W51 is the most significant tributary of Allt Dail a' Chuirn, but is minor in nature. It is dominated by a boulder and cobble substrate, with small proportions of pebbles and lies on a moderately steep gradient, overlain by run, riffle and rapid flow types. It is considered to be suitable for low numbers of non-migratory fish.

3.3.37 Watercourse W30 is minor in nature and lies over a steep gradient, comprising category 7a rapids and is thus of limited suitability for fish fauna.

3.3.38 Watercourses W48 and W49 are peaty headwaters and hence of negligible suitability for fish.

Headwaters of Allt Achadh nan Darach Beag – Watercourses W43 – W45

3.3.39 The headwaters of the Allt Achadh nan Darach Beag drain the eastern part of the Site before passing through Inchnacardoch Forest where they join the Invervigar Burn en route to the Caledonian Canal. These watercourses all comprise peaty headwaters and are of negligible suitability for fish.

Headwater of Allt na Graidhe – Watercourse W47

3.3.40 This headwater of the Allt na Graidhe drains the eastern part of the Site before passing through Inchnacardoch Forest en route to the Caledonian Canal. This watercourse is a peaty headwater and is of negligible suitability for fish.

4 SUMMARY AND OPPORTUNITIES FOR ENHANCEMENT

4.1.1 The watercourses within Site the largely drain to the north into the River Moriston catchment, with the southern and easternmost watercourses predominantly draining into the Caledonian Canal. The River Moriston is designated as an SAC on account of its Atlantic salmon and freshwater pearl mussel populations.

4.1.2 There are three SEPA classified watercourses within the survey area, which comprise Allt Lundie, Allt Dail a' Chuirn and Allt Phocaichain. The River Morison lies adjacent to, and outwith the survey area and is also a SEPA classified watercourse. All are listed as having high access for fish fauna, but there are waterfalls present on Allt Phocaichain and Allt Dail a' Chuirn which may limit migratory fish passage upstream of these features to the sections within the Site.

4.1.3 Specific freshwater pearl mussel surveys have not been undertaken and no freshwater pearl mussels were recorded during the surveys.

4.1.4 Generally, the watercourses present within the survey area are minor in nature, save for Allt Phochaichain which is more substantial. There is some suitability for migratory salmonids in watercourses across the survey area, albeit largely in low numbers due to the minor nature of the majority of the watercourses. Opportunities for freshwater pearl mussel are also present, albeit limited, and there is a general lack of lamprey habitat within the survey area.

4.1.5 Among impacts to fish fauna identified in The Ness District Salmon Fisheries Board Fisheries Management Plan, those considered to be particularly relevant at the Millenium East Site level are:

- Flow regulation and impoundment;
- Loss of shading and changing temperature patterns;
- Hydro modification;
- Loss of sediment transfer; and
- Loss of natural riparian vegetation and associated lack of large woody debris.

4.1.6 It is advised the Biodiversity Enhancement Management Plan (BEMP) for the Proposed Development includes target areas for new riparian habitat management and consultation with the Ness District Salmon Fisheries Board and landowners should also consider removal of woody debris, and suitable locations for new riparian planting to provide areas of bankside cover, but not overshading. This would be best provided by planting of local broadleaved species of local provenance, such as oak *Quercus* spp, alder *Alnus glutinosa*, hazel *Corylus avellana*, rowan *Sorbus aucuparia*, willow *Salix* spp. or birch *Betula* spp.

4.1.7 It is also advised that prior to any instream works, a fish rescue exercise is undertaken, whereby the affected section of the watercourse is netted off and fish removed from the works area via an electrofishing exercise. Nets should then be left in situ and the watercourse over-pumped with works then undertaken in a dry section of channel. Once instream works have been completed the nets should be removed immediately to allow the continuation of fish passage.

5 REFERENCES

Bibliography Ness District Salmon Fishery Board (2021). Ness Fisheries Management Plan 2021-2030.

Ness Catchment Biosecurity Plan 2021 – 2030: Ness District Salmon Fisheries Board and Ness and Beauly Fisheries Trust (2021).

Gardiner, R. (2003) *Identifying Lamprey. A field key for Sea, River and Brook Lamprey.* Conserving Natura 2000 Rivers Conservation Techniques Series No. 4. English Nature, Peterborough.

Harvey, J. & Cowx, I. (2003) *Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus.* Conserving Natura 2000 Rivers Monitoring Series No 5, English Nature, Peterborough.

Hendry, K. & Cragg-Hine, D. (1997) *Restoration of riverine salmon habitats: A guidance manual*. R&D Technical Report W44. Environment Agency, Bristol.

Hendry K & Cragg-Hine D. (2003) *Ecology of the Atlantic Salmon*. Conserving Natura 2000 Rivers Ecology Series No. 7. English Nature, Peterborough.

Maitland, P.S. (2003) *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Maitland, P.S. & Campbell, R.N. (1992) *Freshwater Fishes of the British Isles*. New Naturalist. HarperCollins, London.

Mills, D.H. (1973) Preliminary assessment of the characteristics of spawning tributaries of the River Tweed with a view to management. In: M.W. Smith & W.M. Carter (eds.). *International Atlantic Salmon Symposium*, St Andrew's, International Atlantic Salmon Special Publication Series 4 (1), 145-55.

Skinner, A,Young M & Hastie L (2003).Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2 English Nature, Peterborough.

SNIFFER. WFD111 (2a). Coarse resolution rapid assessment methodology to assess obstacles to fish migration: Field Manual Level A Assessment. SNIFFER. http://www.sniffer.org.uk/files/7113/4183/8010/WFD111_Phase_2a_Fish_obstacles_manual.

ANNEX 1: ENVIRONMENTAL DATA

Table 1: Environmental data from Watercourses W1 – W51

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No/ Photo	Easting	Northing	Bed-rock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4 – 64 mm	Gravel 2 – 4 mm	Coarse sand 0.5 –2 mm	Peat/fine sand/silt <0.5 mm	Av. Wetted Width (m)	Av. Depth (m)	Turbidity (1 [clear]-3[turbid])	Channel Gradient (%)	
W1	225378	810312	0	40	20	30	10	0	0	2	0.3	1	>10	3, 7a, 7b, 7a
W2	225452	811163	0	30	50	10	10	0	0	2	0.35	1	6-10	3, 4, 7b, 7c
W3	225414	811301	20	10	40	20	10	0	0	1	0.25	1	6-10	3, 4, 7b, 7c
W4	226686	810568	0	0	0	0	0	0	100	0.5	0.1	1	6-10	1c
W5	226902	810234	0	30	40	30	0	0	0	2	0.15	1	5	3, 4
W6	227023	810387	0	0	0	0	0	0	100	1	0.35	1	2-3	1c
W7	227211	810065	0	10	75	10	5	0	0	1	0.15	1	6-10	3, 4, 7b
W8	227128	810405	0	30	60	10	0	0	0	2	0.2	1	5	3, 4
W9	227103	810390	0	20	30	35	10	5	0	2	0.2	1	3-5	3, 4
W10	227372	810836	10	30	50	10	0	0	0	2	0.15	1	6-10	3, 4, 7b
W11	227421	811014	0	30	50	20	0	0	0	2	0.3	1	6-10	3, 4, 7b
W12	227516	811186	0	0	0	0	0	0	100	0.5	0.1	1	6-10	1c, 9, 10
W13	227858	811410	10	40	40	10	0	0	0	2	0.25	1	6-10	3, 4, 7b
W14	227912	811325	0	0	0	0	0	0	100	0.5	0.15	1	6-10	1c, 9, 10
W15	228580	810090	0	60	40	0	0	0	0	2	0.2	1	6-10	3, 4, 7b
W16	228527	810006	0	0	0	0	0	0	100	0.5	0.1	1	6-10	1c
W17	228607	810039	0	0	0	0	0	0	100	1	0.1	1	6-10	1c
W18	228683	810149	0	20	40	0	0	0	40	1	0.15	1	6-10	3, 4
W19	229142	810330	0	10	60	20	10	0	0	1	0.2	1	6-10	3, 4, 7b
W20	229487	810557	0	20	35	10	5	0	30	1	0.15	1	6-10	3, 4, 7b
W21	229739	810595	0	0	0	0	0	0	100	0.5	0.1	1	<10	1c
W22	231699	810450	0	0	0	0	0	0	100	0.5	0.1	1	<10	1c
W23	231774	810329	0	20	35	25	15	5	0	4	0.3	1	3-5	3, 4, 5
W24	231803	810313	30	30	40	0	0	0	0	3	0.3	1	6-10	3, 4, 7b

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No/ Photo	Easting	Northing	Bed-rock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4 – 64 mm	Gravel 2 – 4 mm	Coarse sand 0.5 –2 mm	Peat/fine sand/silt <0.5 mm	Av. Wetted Width (m)	Av. Depth (m)	Turbidity (1 [clear]-3[turbid])	Channel Gradient (%)	
W25	231840	809844	0	0	0	0	0	0	100	0.5	0.1	1	3	1c
W26	226055	812003	0	10	40	25	20	5	0	1	0.2	1	4	3, 4
W27	228381	809984	0	0	0	0	0	0	100	1	0.1	1	<10	1c
W28	228328	808273	0	35	45	20	0	0	0	2	0.3	1	3	3, 4, 5
W29	226696	808094	0	20	40	20	0	0	20	2	0.35	1	2	5
W30	229298	807199	0	50	40	10	0	0	0	2	0.2	1	<10	7a
W31	229483	808599	0	0	0	0	0	0	100	1	0.2	1	2-3	1c
W32	229823	808729	0	0	0	0	0	0	100	1	02	1	3-5	1c
W33	230306	808717	0	10	10	10	0	0	70	1	0.15	1	3-5	1c
W34	230423	808854	0	0	0	0	0	0	100	1	0.15	1	3-5	1c
W35	230472	809086	0	20	40	20	20	0	0	2	0.25	1	3	3, 4
W36	230515	809445	0	40	40	20	0	0	0	1	0.3	1	4	3, 4, 7c
W37	230632	809733	0	40	40	20	0	0	0	4	0.3	1	3-5	3, 4
W38	230675	809675	10	30	50	10	0	0	0	1	0.2	1	3-5	3, 4
W39	230863	809632	0	0	0	0	0	0	100	0.2	0.1	1	3	1c
W40	231016	809616	0	0	0	0	0	0	100	0.3	0.1	1	3	1c
W41	231298	809616	0	0	0	0	0	0	100	0.6	0.2	1	3	1c
W42	231193	809746	0	0	0	0	0	0	100	1	0.2	1	3	1c
W43	231186	808257	0	0	0	0	0	0	100	0.8	0.15	1	3-5	1c
W44	230649	808255	0	0	0	0	0	0	100	0.3	0.1	1	3-5	1c
W45	230728	807812	0	0	0	0	0	0	100	0.5	0.1	1	2	1c
W46	231416	809901	0	0	0	0	0	0	100	0.5	0.1	1	3-5	1c
W47	231801	808661	0	0	0	0	0	0	100	0.2	0.1	1	<10	1c
W48	229962	807068	0	0	0	0	0	0	100	0.7	0.15	1	6-10	1c
W49	230142	807169	0	0	0	0	0	0	100	0.8	0.1	1	6-10	1c
W50	229474	807008	0	20	50	30	10	0	0	1.2	0.2	1	6-10	3, 4, 7b
W51	229303	807090	0	50	40	10	0	0	0	1	0.25	1	6-10	3, 4, 7b

ANNEX 2: PHOTOGRAPHIC PLATES

W1

W2

W3

W4

W5

W6

W7

W8

W9

W10

W11

W12

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