Earraghail Renewable Energy Development

on behalf of ScottishPower Renewables

Appendix 8.2: Fish Habitat Survey

avianecology

CONTENTS

ANNEXES

1 INTRODUCTION

1.1 Background

1.1.1 This Technical Appendix has been prepared to accompany **Chapter 8** of the Environmental Impact Assessment (EIA) Report for ScottishPower Renewables' (SPR) Earraghail Renewable Energy Development (hereafter 'the proposed Development').

1.1.2 It presents detailed methodologies and results of desk studies and field survey completed to establish baseline conditions with regards to fisheries. Latin names for species are included in **Annex 1**.

1.1.3 The purpose of desk studies and field survey is to identify any potentially important/critical fish habitat which may be impacted by the proposed development and to inform any required changes to scheme design and the requirement for mitigation.

1.1.4 It should be read with reference to the following Figures presented in Volume 3 of the EIA Report:

- **Figure 8.3a** – Fish Habitat Survey Plan (North); and
- **Figure 8.3b** – Fish Habitat Survey Plan (South).

1.1.5 The following species of conservation significance are considered:

- European eel - Council Regulation (EC) No 1100/ 2007) establishing measures for the recovery of the stock of European eel; listed by International Union for Conservation of Nature (IUCN) as 'Critically Endangered', listed on the Scottish Biodiversity List (SBL) (Watching Brief Only)[1]:
- Atlantic salmon– listed on Annex II of Habitats Directive[2], Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003, SBL (Conservation Action Needed & Avoid Negative Impacts);
- Brown trout/sea trout - SBL (Conservation Action Needed);
- Freshwater pearl mussel – Schedule 5 of the Wildlife and Countryside Act (1981) and Annex II of Habitats Directive, SBL (Conservation Action Needed);
- River lamprey - Annex II of Habitats Directive, SBL (Avoid Negative Impacts);
- Brook lamprey - Annex II of Habitats Directive, SBL (Avoid Negative Impacts); and
- Sea lamprey - Annex II of Habitats Directive, SBL (Avoid Negative Impacts).

[1] The SBL are species and habitats considered to be of principal importance for biodiversity conservation in Scotland, and are a list to satisfy the requirements under Section 2(4) of the Nature Conservation (Scotland) Act 2004. The UK Biodiversity Action Plan (BAP) Priority Species was superseded by the UK Post-2010 Biodiversity Framework and the UK BAP Priority Species list remains an important reference source to draw up the SBL.

[2] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

1.2 Site Overview

1.2.1 The Site is shown by the application boundary in **Figure 8.3a** and **Figure 8.3b.** The Site largely comprises commercial forestry plantation, interspersed with some areas of open hill ground, most notably around the summit of Doire Lèithe comprising a mixture of acid grassland, bog and heathland habitats. Existing forestry access tracks also intersect the Site through much of its extent.

1.2.2 A number of minor watercourses flow through the Site. The locations of all watercourses subject to fish habitat survey are illustrated on **Figure 8.3a** and **Figure 8.3b**.

1.2.3 Watercourses W1 – W7 discharge into and from Abhainn Achachoish which discharges into West Loch Tarbert to the west of the Site. Watercourses W8 – W13 and W25 drain into the sea, east of the Site. The remaining watercourses drain into the Skipness River to the south of the Site.

1.2.4 The Site includes two *'Main river and coastal catchments'*: Loch Fyne Coastal Catchment in the east and Kintyre Coastal Catchment to the west (taken from Scottish Government website[3]). Within those main catchments, Loch Fyne Coastal Catchment has a *'Baseline Confluence Inter Catchment*' called *'Loch Fyne Coastal from Kintyre Coastal to Inverneil Burn'*, and the Kintyre Coastal Catchment is split into two separate *'Baseline Confluence Inter Catchments*' called '*Kintyre Coastal from Knapdale Coastal to Clachan Burn'* in the north-west and *'Skipness River @ mouth'* in the south, of the Site.

2 METHODOLOGY

2.1 Desk Study and Consultation

2.1.1 A desk study was undertaken to identify the proximity of the Site to any statutory or non-statutory designated site for nature conservation, any classified waterbodies, barriers to fish migration and any existing fisheries records within the Site and surrounding area.

2.1.2 The following key sources were consulted:

- SiteLink[4];
- The Scottish Environmental Protection Agency (SEPA) River Basin Management Plan[5];
- Scotland's Environment Map[6];
- The Joint Nature Conservation Committee (JNCC) distribution of the Freshwater Pearl Mussel[7] https://sac.jncc.gov.uk/species/S1029/distribution);
- 'Loch Fyne Rivers Project: Summary of 2011 Fish Populations, Fish Habitat and Potential Habitat Management Initiatives' report (Argyll Fisheries Trust, 2012);
- 'Argyll & the Islands Strategic Fishery Management Plan' (Argyll Fisheries Trust, 2009); and,
- The Argyll District Salmon Fisheries Board website[8].

[3] https://map.environment.gov.scot/sewebmap/?layers=riverClass [Accessed July 2021].

[4] https://sitelink.nature.scot/home [Accessed December 2020].

[5] https://www.sepa.org.uk/data-visualisation/water-environment-hub [Accessed December 2020].

[6] https://map.environment.gov.scot/sewebmap/ [Accessed December 2020].

[7] https://sac.jncc.gov.uk/species/S1029/distribution [Accessed December 2020].

2.1.3 Consultation was also undertaken with the following consultees:

- NatureScot;
- Marine Scotland;
- Argyll District Salmon Fishery Board (ADSFB); and
- Argyll Biological Records Centre (ABReC[9]).

2.1.4 Further details of consultations are provided in **Chapter 8** of the EIA Report.

2.2 Fish Habitat Survey

2.2.1 A Fish Habitat Survey was completed on the 20th and 21st of January 2021.

2.2.2 The survey was undertaken by Mr C. Nisbet, a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM), fully trained on fish habitat survey as part of Level 3 Management of Electrofishing Operations qualification as accredited by the Scottish Fisheries Coordination Centre (SFCC). He has been undertaking fish habitat surveys at comparable sites across Scotland for over 16 years.

2.2.3 The study area comprised all sections of accessible watercourses within a 100m of the footprint of the proposed Development as shown in **Figures 8.4a** and **8.4b**.

2.2.4 The survey aimed to identify any areas of critical fish habitat within the study area including spawning, nursery, juvenile and adult holding areas, juvenile lamprey habitat and freshwater pearl mussel habitat.

2.2.5 An initial gradient analysis of the study area was completed based on the contour intervals in GIS, and during an initial walkover prior to survey. This allowed the identification of all linear 100 m stretches of watercourses within the study site with a gradient of ≥6 %.

2.2.6 All stretches of watercourses 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.

2.2.7 The watercourses within the study area were systematically walked (including in-stream inspections where required) and the habitats mapped according to the classification presented in **Table 2.1**.

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

- Spawning habitat for salmonid and lamprey species;
- Nursery habitat for lamprey species;

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[8] https://argyll.dsfb.org.uk/ [Accessed December 2020].

[9] Via the Highland Biological Recording Group (HBRG).

- Areas of habitat important for juvenile salmonids (fry and parr);
- Areas of habitat important for adult holding areas; and
- Areas of suitable substrate and flow conditions for supporting freshwater pearl mussel.

2.2.9 The habitat classification used followed that of the SFCC Habitat Surveys Training Course Manual (SFCC 2007), the Environment Agency's Restoration of Riverine Salmon Habitats Guidance Manual (Hendry and 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 and Cragg-Hine, 2003; Skinner *et al.* 2003).

2.2.10 Each watercourse was walked in full across its extent within the study area. Detailed analysis was undertaken at sample points representative of sections of each watercourse and within any sections of diverse geomorphological and hydrological conditions.

2.2.11 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]).

2.2.12 Any potential barriers to fish movement within watercourses were also recorded and a photograph was taken at each sample point.

Table 2.1: 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.

Cat.	Habitat Type	Description	Species Suitability
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 ammocoete nursery and adult refuge.
9 **9a** **9b** **9c** **9d 9e**	**Vegetation features** **Riparian trees (tunnel)** **Flow constriction** **Aquatic macrophytes** **Emergent macrophytes** **Large woody debris (LWD)**	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 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.

2.3 Limitations

2.3.1 The fish habitat survey was completed in January 2021, and thus outside the optimal survey period (mid-May to September) as recommended in SFCC guidance (2007). This is not considered a substantive limitation however, given the survey was completed within the normal range of flows for watercourses in the geographical area, as defined by Scottish Environmental Protection Agency (SEPA)[10]. Furthermore, the vegetation recorded is considered to provide valid indicative evidence of the flora (e.g., riparian trees and macrophytes) which would also be present in the main growing season (May-September).

2.3.2 The original extent of the Site considered during fish surveys was more extensive than the Site presented in the EIA Report, with the southern boundary extending out by approximately 1 km to include a larger area of commercial conifer plantation. The previous boundary in the north extended out to a maximum of approximately 2 km to the west from the access track, and the eastern extreme included Tarbert Wood Special Area of Conservation (SAC) and Tarbert to Skipness Coast Site of Special Scientific Interest (SSSI). The Site was subsequently reduced to the application boundary as shown in **Figures 8.3a** and **8.3b**. Although the Site boundary has altered over the course of the survey period (reduced in extent in June 2021), the study areas for the fish surveys were covered, given the extent of the Site was at its greatest extent when these were undertaken.

2.3.3 The survey is therefore considered not to be subject to any significant limitations.

[10] http://apps.sepa.org.uk/ [Accessed January 2021].

3 RESULTS

3.1 Desk Study and Consultation

Designated Sites for Nature Conservation

3.1.1 In review of Sitelink and consultation with ABReC, the Site is not located within 10 km of any statutory designated site for nature conservation, or within 2 km of any non-statutory designated site with fisheries qualifying interests.

Classified Waterbodies

3.1.2 SEPA's River Basin Management Plan confirms there is only a single classified watercourse within the study area. This comprises the Skipness River and extending along its main tributary, and is classified as having good ecological status and high access for fish migration.

Barriers to Fish Migration

3.1.3 Based on review of Scotland's Environment Map, there are no existing known barriers to fish migration identified on the Skipness River, or along additional watercourses intersecting the Site.

3.1.4 The 'Loch Fyne Rivers Project: Summary of 2011 Fish Populations, Fish Habitat and Potential Habitat Management Initiatives' report (Argyll Fisheries Trust, 2012) does however detail that the accumulation of large woody debris, in the form of log jams, is thought to be forming upstream barriers in the Skipness River and its tributaries.

Existing Fisheries Records

3.1.5 The most recently known distribution of fish within the study area (from Skipness River within the Kintyre Coastal Catchment) is summarised in the Loch Fyne Rivers Project: Summary of 2011 Fish Populations, Fish Habitat and Potential Habitat Management Initiatives' report (Argyll Fisheries Trust, 2012). Earlier distributions are also detailed within the 'Argyll & the Islands Strategic Fishery Management Plan' (Argyll Fisheries Trust, 2009).

3.1.6 In summary and more recently on the basis of studies in 2011 (Argyll Fisheries Trust, 2012), the Skipness River was found to support high abundances of juvenile trout (parr and fry) and European eel. Juvenile salmon were not recorded, although modest salmon fisheries were known to have operated in the past.

3.1.7 In consultation in May 2020, the ADSFB advised that they held no survey information on fish populations within the Site but advised the Skipness River and coastal streams which intersect the Site are host to migratory salmonids, with upland streams and lochs likely to host brown trout populations.

3.1.8 In review of the JNCC distribution of the freshwater pearl mussel, the study area, located on the Kintyre peninsula is not located within the known species range, and so this species is not considered further in this report.

3.2 Fish Habitat Survey

3.2.1 This section should be read with reference to **Figure 8.4a** and **Figure 8.4b**.

3.2.2 A description of all of the watercourses surveyed is presented below, including a summary of channel characteristics at the time of survey.

3.2.3 Fish habitat data, including channel dimensions, gradient and substrate composition, are included in **Annex 2**. Photographs from each of the sample points are given in **Annex 3**.

3.2.4 For all watercourses within the study area the neighbouring land use is predominantly commercial forestry.

W1 – W7 Abhainn Achachoish and Minor Tributaries

W5 - Allt Airigh nan Eun

3.2.5 Watercourses W1, W2 and W4 to W7 are all tributaries of Abhainnn Achachoish (W3), which in itself is a relatively minor watercourse and flows into Loch Tarbert. All are unclassified watercourses.

3.2.6 W1 – W7 are within the Kintyre Coastal Catchment.

3.2.7 W1 – W4 lie within native oak *Quercus* woodland with some infringement from the neighbouring conifer plantation. The invasive rhododendron was recorded at W1 and W2.

3.2.8 W5 – W7 are surrounded by coniferous trees.

3.2.9 Watercourses W1 - W3 lie on a moderate gradient, which is considered to be passable by migratory fish which can access these watercourses from the sea loch, Loch Tarbert. There is an operational hydro scheme present on W3[11] and W1, however there is a fish pass *in situ* on W3.

3.2.10 W5 and W7 pass sections of open ground prior to becoming more enclosed by conifer plantation upstream in their upper reaches. W6 is considered to comprise little more than a drainage ditch and is closely bound by conifer plantation.

3.2.11 The riverine habitats present in W1-W3 are likely to support low numbers of salmonids, however they are underlain with a predominantly boulder/cobble substrate and therefore provide little in the way of suitable habitat for juvenile fish fauna.

3.2.12 By contrast W4, W5 and W7 contain a higher proportion of gravel and pebble stone in the stream beds and contain suitable run/riffle flow sections within the study area, which are suitable for fry and parr.

3.2.13 W6 is very narrow and almost completely shaded and provides little in the way of suitable habitat for fish fauna.

W8 – W10 Tributaries of Unnamed Minor Watercourse

3.2.14 Watercourses W8 – W10 are unclassified watercourses which converge before flowing into the sea, south of Mealdarroch Point.

3.2.15 W8 – W10 are within the Loch Fyne Coastal Catchment.

3.2.16 W8 originates from a spring south of Cnoc a' Bholainn-airigh, and flows north easterly through a moderately steep, narrow (<0.5 m) channel, which is overgrown with soft rush *Juncus effusus* and purple moor grass *Molinia caerulea* vegetation on both banks. After the watercourse passes an

[11] Information on the hydro power scheme is available from the Argyll and Bute Council planning website at the following location (Ref: 15/02435/PP): https://publicaccess.argyll-bute.gov.uk/online-applications/caseDetails.do?caseType=Application&keyVal=NU1YMLCH0CM00 [accessed August 2021]

existing forestry track north east of Cnoc nan Caorach it becomes steep, with a gradient of over 10 %, which is of little- to no- suitability for fish fauna.

3.2.17 W8 contains a predominantly peaty substrate at its upper reaches, changing to boulder/bedrock as it crosses to the northern side of the forestry access track.

3.2.18 W9 and W10 are more substantial in width, with each varying between 1 m and 2 m through their length within the study area. Similarly to W8, both W9 and W10 also become much steeper to the north side of the forestry access track (> 10% gradient), with small waterfall and pool sections present over boulder/bedrock substrates.

3.2.19 In summary, W8-W10 are unlikely to support migratory fish fauna due to the steepness of the gradients present at their lower reaches which flow into the sea, to the east of the Site. The upper reach of W8 is also of limited suitability for fish due to its minor nature and the abundant marginal rush vegetation.

3.2.20 W9 and W10 may support small non-migratory populations of brown trout within their upper reaches. The average depth of each of these watercourses (at time of survey) varied between 0.25 – 0.45 m, excluding the pools below recorded waterfall sections in their lower reaches, which were inaccessible for depth measurement.

W11 & W12 – Allt Beithe and Unnamed Tributary

3.2.21 Watercourses W11 and W12 are unclassified watercourses and are within the Loch Fyne Coastal Catchment.

3.2.22 Allt Beithe (W12) flows in a north-easterly direction where it discharges into the sea, south of Eilean a' Chomhraig. W11 flows parallel with W12 before joining it at its confluence approximately 300 m northeast of a forestry access track. W12 originates from a spring approximately 0.1 km to the west of the access track and flows, in a north easterly direction, through a moderately steep gradient.

3.2.23 Bankside habitat for both W11 and W12 comprises heather *Calluna vulgaris* dominated moorland in the upper open reaches and coniferous plantation downstream. The gradient of both watercourses increases in steepness as they flow towards the sea and is > 10 % on the eastern (downstream) side of a forestry access track, resulting in little to no suitability for fish fauna in this section.

3.2.24 To the west of the access track, W12 has some suitability for supporting small numbers of non-migratory fish fauna in shallower gradients, predominantly underlain with a range of pebble cobble and boulder substrate. W11 does not extend west of the access track.

3.2.25 W11 varied in width between 0.5 m and 1.1 m and the width of W12 varied between 0.4 m and 0.9 m over the study area. The channels of both watercourses comprised greater proportions of boulders in steeper downstream sections.

3.2.26 In summary, W11-W12 are unlikely to support migratory fish fauna due to the steepness of the gradients present at their lower reaches. The upper reach of W12 may support small non-migratory populations of brown trout. The average depth of each of these watercourses at time of survey (excluding pools below waterfall sections) was 0.25 m for W11 and 0.20 m for W12.

W13 – Unnamed Minor Watercourse

3.2.27 W13 is an unclassified watercourse which originates at a small lochan near Cruach Lagain to the east of an existing forestry access track. It is not crossed by the track itself but runs almost parallel with it at a distance of approximately 50 m, for 1.5 km before tapering off in a north-easterly direction, prior to discharging into the sea. W13 is within the Loch Fyne Coastal Catchment.

3.2.28 The upper reach of W13 lies on a relatively shallow gradient for the most part, before becoming steep between Cnoc na Faire to where it discharges into the sea. W13 has a naturally meandering channel that is up to 1 m wide within the study area. Within the study area bankside vegetation along W13 largely comprises rush and heather. The stream bed is a mixture of cobble, pebble and gravel and this, combined with the shallow gradient in the upper reach, make this section of the watercourse suitable for non-migratory fish fauna and the watercourse is considered likely to support brown trout.

3.2.29 The steep lower reach to the sea is of limited suitability for fish migration due to the gradient in this section. The average depth of W13 (at time of survey) was 0.25 m.

W14 – Allt Càrn Chaluim

3.2.30 W14 originates near to the existing access track south-west of Cruach Doire Lèithe and flows in an easterly direction for approximately 3 km before eventually joining the classified Skipness River but is not itself classified. It is crossed twice by an existing forestry access track. W14 is within the Kintyre Coastal Catchment.

3.2.31 The upper reach of W14 lies on a shallow gradient, but after it is crossed by the existing track, it splits and flows down moderately steep tributaries (c. 10 %) into the Strath nan Coileach Valley, which limits suitability for migratory fish fauna. W14 is a little more substantial in size than the majority of minor watercourses within the Site and has widths ranging between 0.75 m and 1.8 m in the study area.

3.2.32 Like most of the watercourses within the study area, W14 also has a naturally meandering channel. Bankside vegetation comprises largely soft rush and heather vegetation. Channel substrate largely comprises a mix of boulder, cobble, pebble and gravel.

3.2.33 Channel depth varied between 0.2 m and 0.5 m (in a shallow pool) at the time of survey.

W15 – W18 Minor Tributaries of Garbh Allt

3.2.34 W15 - W18 are all short, minor tributaries which form the headwaters of Garbh Allt. All of these tributaries are themselves unclassified, however Garbh Allt forms part of the the Skipness River which is classified as having good ecological status and high access for fish migration.

3.2.35 W15 – W18 are within the Kintyre Coastal Catchment.

3.2.36 W15 and W16 lie on shallow to moderate gradients and W17 and W18 typically lie on more shallow gradients, but also contain occasional steeper sections, though not considered sufficiently steep to prevent fish migration. W15 is very minor and approximately 0.3 m wide for its extent within the study area with a depth of 0.15 m – 0.2 m. It is crossed twice by the existing track and joins with W16 prior to W16's confluence with Garbh Allt. W16 – W18 are all slightly more substantial in nature with a width of up to 0.8 m (W16) and 1.0 m (W17 and W18).

3.2.37 W15-W18 all have stream beds comprising a range of stone from cobble to gravel, largely over Category 3 - 4 riffle run flow types. None of these watercourses had any observed barriers to fish migration present within the study area. It is therefore considered that they all provide suitable habitat for fish fauna and have the potential to act as spawning resources for migratory salmonid species, as well as nursey habitat for low numbers of juvenile fish.

W19 – Unnamed Tributary of Allt Càrn Chaluim

3.2.38 W19 is an unclassified watercourse which originates south of Cruach na Machrach and tributes in a southerly direction for approximately 3 km before eventually joining Allt Càrn Chaluim to the south of an existing forestry access track. W19 is within the Kintyre Coastal Catchment.

3.2.39 The channel is up to 0.8 m wide within the study area and appears to have been historically straightened. Bankside vegetation largely comprises rush and heather, although occasional rhododendron was also noted to be present.

3.2.40 The stream bed is largely a mixture of cobble and pebble with small areas of gravel and boulder, and this, combined with the shallow gradient, provides some suitable habitat for fish fauna. However, this is limited due to a lack of a meandering channel and bankside cover, and its minor nature.

3.2.41 The average depth of W19 (at time of survey) was 0.45 m.

W20 – W24 – Unnamed Tributaries of Skipness River

3.2.42 W20 – W24 are all minor unclassified tributaries which form the headwaters of the classified Skipness River. W20 – W24 are within the Kintyre Coastal Catchment.

3.2.43 W20 had no known or observed barriers to fish movement present at the time of survey. It contained a suitable range of cobble, pebble and gravel habitat for supporting fish fauna including migratory fish species. The channel width was 0.4 m – 0.55 m and was surrounded by soft rush, heather and bracken *Pteridium aquilinum* bankside vegetation. W20 supported category 3 and 4 (riffle and run) flow conditions and typically had a depth of 0.2 m.

3.2.44 The culvert of W21 at the existing access track crossing has a high drop and discharges approximately 0.3 m above the channel. The culvert is considered to be unsuitable for fish passage upstream in its current form. Additional passage issues were also recorded downstream on W21, with the presence of large amounts of woody debris present in the channel down-stream of the existing access track, which would likely obstruct fish movement. W21 has negligible suitability for fish fauna in its current form.

3.2.45 W22 also has obstructive woody debris in the channel downstream of an existing access track crossing and immediately upstream of the track there is a localised steep cliff-like section, which is considered to comprise a barrier to fish movement.

3.2.46 W23 held little to no water at the time of survey and considering recent wet conditions W23 is categorised as ephemeral and with little to no suitability for supporting fish.

3.2.47 W24 contains a suitable range of cobble, pebble and gravel habitat for supporting fish fauna and had a channel width was 0.4 m – 0.5 m, which was surrounded by soft rush and recently felled plantation. Woody debris was again recorded in the channel and could pose an obstruction to fish movement. W24 supported category 3 and 4 (riffle and run) flow conditions and typically had a depth of 0.2 m.

W25 – Unnamed Minor Watercourse

3.2.48 W25 is not crossed by any existing access track but its origin lies within 100 m of the east of an existing track, where it discharges down a steep slope into the sea approximately 1 km from its origin. The spring head lies within recently felled forestry and its presence within the study area is almost imperceptible. W25 is within the Loch Fyne Coastal Catchment.

3.2.49 Due to this minor nature, it is considered unsuitable for fish fauna and due to the steepness of the channel gradient it is considered to be of negligible suitability for fish fauna overall.

W26 – Eas a' Chromain

3.2.50 W26 is an unclassified watercourse which lies on an almost flat area of ground within the study area. W26 is within the Kintyre Coastal Catchment.

3.2.51 It is the headwater of the Eas a' Chromain which lies in an area of rush vegetation with a fairly indistinct channel, over a peaty substrate. This section of the watercourse is also choked with emergent soft rush and of limited suitability for fish fauna.

4 SUMMARY

4.1.1 Functional fish habitat within the study area is relatively restricted within watercourses of the Site and is considered to be of low sensitivity, given the short extents and low-quality habitat recorded. Many of the watercourses have steep sections which are likely to be unsuitable for fish passage and there are several barriers created by brash in the headwater sections from previous forestry felling.

4.1.2 No category 2a Salmonid spawning habitat was identified within any watercourses within the Site, with habitat suitability where present, limited to juvenile fish. Some of the tributaries of Garbh Allt and the Skipness River do however, have some potential to act as a spawning resource.

4.1.3 No areas of spawning or nursery habitat for lamprey species were noted, and suitable habitat for European eel is limited.

4.1.4 Atlantic salmon are unlikely to be present within the tributaries of the Skipness River intersecting the Site and are understood to be absent on the basis of most recent population studies. The presence of brown trout, eels and perhaps lampreys is however possible within the upland stream sections that occur within the Site.

5 REFERENCES

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ANNEX 1: FISH SCIENTIFIC NAMES

- European eel *Anguilla anguilla*;
- Atlantic salmon *Salmo salar*;
- Brown trout/sea trout *Salmo trutta*;
- Freshwater pearl mussel *Margaritifera margaritifera*;
- River lamprey *Lampetra fluviatilis*;
- Brook lamprey *Lampetra planeri*; and,
- Sea lamprey *Petromyzon marinus*.

ANNEX 2 - ENVIRONMENTAL DATA

Sample locations (Sample No.) are illustrated on **Figure 8.4a** and **Figure 8.4b** with photographic plates provided in **Annex 3**.

Table A2.1: Environmental data from W1.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S1	NR 84432 65815	1	0	30	50	10	5	0	0	0.80	0.25	1	3-4%	3, 4

Table A2.2: Environmental data from W2.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S2	NR 84908 65700	2	0	25	40	30	5	0	0	1.45	0.4	1	2-3%	3, 4

Table A2.3: Environmental data from W3.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S3	NR 85286 65799	3	0	40	25	20	15	0	0	2.75	1	1	1%	3, 4, 5b

Table A2.4: Environmental data from W4.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S4	NR 85977	4	0	30	25	25	20	0	0	1.1	0.35	1	5-6%	3, 4

	66195													

Table A2.5: Environmental data from W5.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S5	NR 86139 66410	5	0	5	35	30	25	5	0	0.9	0.25	1	4 %	3, 4

Table A2.6: Environmental data from W6.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
6	NR 86507 66707	6	0	0	0	0	5	5	90	0.3	0.2	1	5 %	1c

Table A2.7: Environmental data from W7.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S7	NR 86722 66971	7	0	10	30	25	25	10	0	0.3	0.65	1	4-5 %	3, 4

Table A2.8: Environmental data from W8.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S8	NR 87593 67296	8	0	0	0	5	0	5	90	0.4	0.2	1	6->10 %	3, 4

Table A2.9: Environmental data from W9.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S9	NR 87915 67244	9	50	25	15	10	0	0	0	1.3	0.6	1	4 %	1a, 7a, b, 10
S10	NR 87847 67174	10	20	40	25	10	5	0	0	0.9	0.25	1	6 - >10 %	3, 4

Table A2.10: Environmental data from W10.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S11	NR 88102 66810	11	65	15	10	10	0	0	0	0.8	0.7	1	> 10 %	1a, 7a, b, 10

Table A2.11 Environmental data from W11.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S12	NR 88260 66552	12	25	50	20	5	0	0	0	0.75	0.25	1	> 10 %	1a, 7a, b, 10

Table A2.12: Environmental data from W12.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S13	NR 88249 66235	13	20	25	30	15	10	0	0	0.5	0.2	1	6 - > 10 %	7a, b
S14	NR 88278 66282	14	10	20	35	20	10	5	0	0.6	0.25	1	5 – 8 %	3, 4

Table A2.13: Environmental data from W13.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S15	NR 88068 65286	15	0	5	30	40	20	5	0	0.3	0.3	1	2 – > 10 %	3, 4, 7

Table A2.14: Environmental data from W14.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S16	NR 87600 63464	16	0	20	40	25	10	5	0	0.8	0.25	1	2 – 4 %	3, 4
S17	NR 87669 63365	17	0	35	25	25	15	0	0	1.1	0.35	1	4 – 10 %	3, 4, 7

Table A2.15: Environmental data from W15.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S18	NR 87550 63024	18	0	0	30	40	25	5	0	0.3	0.15	1	3 – 6 %	3, 4, 7

Table A2.16: Environmental data from W16.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S19	NR 87570 62303	19	0	0	35	40	20	5	0	0.65	0.25	1	3 – 6 %	3, 4

Table A2.17: Environmental data from W17.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S20	NR 88150 61985	20	0	20	35	20	20	5	0	0.7	0.3	1	4 - 7 %	3, 4, 7b

Table A2.18: Environmental data from W18.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S21	NR 88253 61736	21	0	15	40	20	20	5	0	0.65	0.25	1	4 - 7 %	3, 4, 7b

Table A2.19: Environmental data from W19.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S22	NR 89062 62088	22	0	5	45	40	10	0	95	0.75	0.45	1	<1	1c

Table A2.20: Environmental data from W20.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S23	NR 89714 62319	23	0	0	40	30	25	5	0	0.5	0.2	1	3 – 6 %	3, 4

Table A2.21: Environmental data from W21.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S24	NR 89902 61896	24	0	45	35	20	0	0	0	0.5	0.2	1	3 – 6 %	3, 4, 9e, 10
S25	NR 89912 61967	25	0	15	40	25	15	5	0	0.5	0.2	1	2-4 %	3, 4, 9e

Table A2.22: Environmental data from W22.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	**Co-ordinates**	**Photo No.**	**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 (%)**	
S26	NR 90224 61686	26	0	15	35	30	15	5	0	0.5	0.2	1	2-4 %	3, 4, 9e
S27	NR 90232 61768	27	100	0	0	0	0	0	0	0.3	0.1	1	> 10 %	10

Table A2.23: Environmental data from W23.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	**Co-ordinates**	**Photo No.**	**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 (%)**	
S28	NR 90353 61783	28	0	60	30	10	0	0	0	0.3	0.4	1	4 – 6 %	1c
S29	NR 90367 61807	29	100	0	0	0	0	0	0	0.3	0.05	1	> 10 %	1c, 10

Table A2.24: Environmental data from W24.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	**Co-ordinates**	**Photo No.**	**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 (%)**	
S30	NR 90452 61795	30	0	0	50	30	20	0	0	0.45	0.2	1	2-4 %	3, 4, 9e

Table A2.25: Environmental data from W25.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S31	NR 90585 62594	31	0	0	0	0	0	0	100	0.2	0.1	1	2 - > 10 %	1c

Table A2.26: Environmental data from W26.

Location			Substrate Composition (%)							Channel Information				Habitat Type
Sample No.	Co-ordinates	Photo No.	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 (%)	
S32	NR 90274 60619	32	0	0	0	0	0	5	95	0.4	0.3	1	1-2 %	1c
S33	NR 90299 60670	33	0	0	0	0	0	0	100	0.5	0.3	1	1-2 %	1c

ANNEX 3 - PHOTOGRAPHIC PLATES

Photo No. 1: W1.

Photo No. 2: W2.

Photo No. 3: W3.

Photo No. 4: W4.

Photo No. 5: W5.

Photo No. 6: W6.

Photo No. 7: W7.

Photo No. 8: W8.

Photo No. 9: W9

Photo No. 10: W9.

Photo No. 11: W10.

Photo No. 12: W11

Photo No. 13: W12.

Photo No. 14: W12.

Photo No. 15: W13.

Photo No. 16: W14.

Photo No. 17: W14.

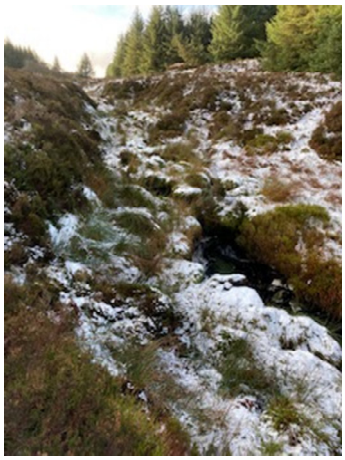

Photo No. 18: W15.

Photo No. 19: W16.

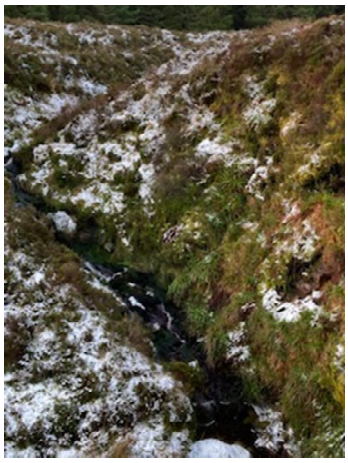

Photo No. 20: W17.

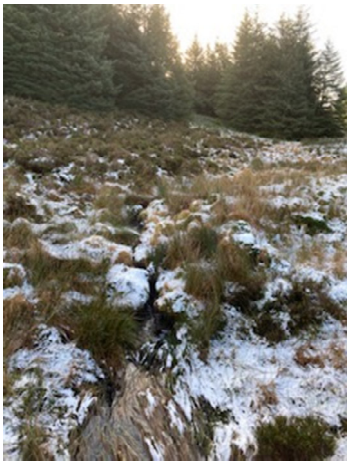

Photo No. 21: W18.

Photo No. 22: W19.

Photo No. 23: W20.

Photo No. 24: W21.

Photo No. 25: W21.

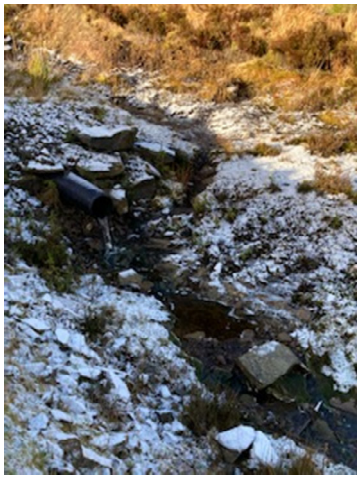

Photo No. 26: W22.

Photo No. 27: W22.

Photo No. 28: W23.

Photo No. 29: W23.

Photo No. 30: W24.

Photo No. 31: W25.

Photo No. 32: W26.

Photo No. 33: W26.