Aquatic Surveys To Assess Fish Populations and Aquatic Macro Invertebrate Communities In The Vicinity Of Hare Hill Wind Farm Repower

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RIVER NITH
FISHERY BOARD

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Cover photo: Juvenile salmonids

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1 Introduction

1.1 Background

The River Nith is a river of major importance as a salmon and sea trout fishery, and is the largest river in southwest Scotland. Its source is in Ayrshire and it flows through Dumfriesshire, spanning approximately one hundred kilometres to its estuary in the Solway Firth, a total catchment area of 1200 square kilometres.

Salmon and sea trout fishing throughout the entire catchment of the River Nith is of significant heritage and cultural importance to this rural area. In addition, the sport of fishing attracts a significant economic boost to the many rural businesses that rely on angling tourists coming to the area. However, salmon populations have declined in recent years and the focus is now on conserving stocks of this iconic species. It has been acknowledged by the Scottish Government that Atlantic Salmon are at crisis point in Scotland (Scottish Government, 2022) and in 2023 it was revealed at COP28 that the latest species assessment under the IUCN Red List of Threatened Species has reclassified Atlantic salmon from 'Least Concern' to 'Endangered' in Great Britain (Darwall & Noble. 2023). Anglers are contributing to the conservation of populations of salmon by adopting the practise of returning any salmon captured. Angling is widespread over most of the main stem and some larger tributaries of the Nith and catch returns on the Nith reflect the declining trend shown globally. The statutory recorded catch data for the whole of the River Nith for the 2023 fishing season recorded a catch of 391 salmon and grilse and 550 sea trout (NDSFB, 2023).

1.2 Nith District Salmon Fishery Board (NDSFB)

The NDSFB is a statutory body constituted under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003, tasked with the management of migratory salmonid species within their catchment area. The Board is empowered to conduct works and execute measures to safeguard, improve and enhance stocks of migratory salmonids within its jurisdictional area. The NDSFB has no remit to manage non-migratory species other than with the permission of riparian owners and only where management of these species would be deemed to be in the furtherance of migratory species. Management of non-migratory species of fish within the Nith catchment is conducted by the Nith Catchment Fishery Trust who works closely with the Board. The NDSFB is active and works in areas of fisheries protection, reinstatement of fish habitats and predator control (NDSFB, 2023).

As previously stated, salmon populations in the River Nith have dramatically reduced over the last decade. This phenomenon has been experienced right across the range that the species has throughout the north Atlantic region. Recorded catches of salmon in the Nith are down by approximately 80% and this is having a serious economic impact on the rural businesses that rely on the fishery. Unsurprisingly at this time of concern for salmon populations, managers and owners of salmon fishing are scrutinising any potential additional pressure on the resource and this brings into focus construction projects in parts of the catchment where salmonid species utilise as nursery areas. The reduction in salmon populations throughout Scotland is of such concern to the Scottish Government that they have categorised every river according to their ability to sustain populations of this species. The River Nith has been assigned a Category 3 status for a number of years, based on the recorded catches. This dictates that no salmon harvest is taken from the River Nith catchment for conservation reasons. It has never been more important than currently, to establish accurate fishery data and to monitor the potential impact that construction projects or management interventions may have on those populations, to enable validation of mitigation measures employed to protect fish.

1.3 Hare Hill Repower

A wind farm has existed on the Hare Hill site for some years and proposals for an expansion to the original wind farm are being considered. The Hare Hill site is located wholly within the water catchment of the river Nith and accordingly under the jurisdiction of the NDSFB. NDSFB were consulted by the developers of the original Hare Hill wind farm in accordance with the planning process in respect of aquatic environmental information. A series of aquatic surveys were conducted at that time to support the environmental protection of the site. Those surveys included aquatic invertebrates and fish in the immediately vicinity of the site and down catchment to enable an assessment of any adverse impacts to be detected and their reach to be measured. The aquatic surveys commenced prior to the start of construction work thus providing accurate, current, baseline data. They continued through the construction phase and were extended through to a post construction and wind farm commissioning stage. This allowed for a complete assessment of any impacts to be detected in the aquatic environment.

NDSFB have been contact by the developer's consultants in relation to the Hare Hill re power project. The re power project, with the associated expansion of the existing wind farm could potentially impact on the aquatic environment in the vicinity of the Hare Hill site. It has been agreed that it would be desirable to conduct a series of aquatic surveys which will

provide current data to appraise the developers as their plans for the Hare Hill site progress. The aquatic surveys to be conducted include fish and aquatic macro invertebrates and will be conducted according to the same protocols as those employed previously on the site.

1.4 Fisheries Surveys

These surveys are carried out to primarily assess the densities of juvenile salmonid species of fish present in the watercourses. The salmonid species targeted are juvenile Atlantic salmon (*Salmo salar*) and Sea/brown trout (*Salmo trutta*). Salmon and sea trout are anadromous, meaning that they spend their adult life at sea and their juvenile life in freshwater. The returning adults migrate back to their natal rivers to spawn in late autumn laying their eggs in the spawning gravels. The adults either die or return to sea to repeat the process again. The eggs hatch in the riverine substrate after 440-degree days (i.e. 44 days at 10°C) where the young fish (alevins) exist for a number of weeks before emerging out of the gravels in March/April (Hendry and Cragg-Hine, 2003). The young salmonids remain in their natal watercourses for typically two to three years before smolting and migrating to sea, where they will spend their adult lives. Salmonids are a very good biological indicator species as they are sensitive to both direct and diffuse pollution. Silt, high nutrient levels and vibrations can all impact on their survival rate. Salmon are classified as 'Endangered' in Great Briain in the IUCN Red List of Threatened species (Darwall & Noble. 2023). This reclassification has taken them from 'Least concern' to Endangered' in Great Britain and the global population from 'Least concern' to 'Near Threatened'. This follows a 23% decrease in the global population between 2006 and 2020 (IUCM 2023). Atlantic salmon and listed in Appendix III of the Bern Convention and Annex II and V of the EC Habitats and Species Directive and both salmon and sea trout are on the UK Biodiversity Action Plan (UKBAP) Priority Species List (JNCC. 2007).

Sea trout and brown trout are the same species (*Salmo trutta*) but brown trout are resident within freshwater and do not migrate to sea during their life history. It is not possible to determine if the juvenile trout captured during a survey are destined to remain as resident brown trout or migrate to sea and become sea trout. Consequently, they are referred to as trout for the purposes of this survey. Brown trout will often be found upstream of impassable falls and these populations will have discrete gene pools. However, the majority of both sea trout and brown trout progeny will migrate to sea to become sea trout due to the lack of available habitat. Although the decision to migrate or not will, in part, be down to genetics, environmental factors are fundamentally important to the choice they make. In a watercourse that has plentiful adult habitat i.e. deep pools, and is rich in food, a larger

proportion of the juvenile trout will develop into resident brown trout. However, in a watercourse that has limited adult habitat and has a reduced abundance of food, it is in the best interests of the trout to migrate to sea.

Although the fisheries surveys do not target non-salmonid species they are captured as a matter of course during these surveys. Other species typically found in watercourses within the Nith catchment include eel, stone loach, minnow, lamprey, stickleback and grayling. Of significance to any construction project will be the presence of lamprey or eel due to their protected status. There are three different species of lamprey that reside within the River Nith; sea lamprey, river lamprey and brook lamprey. All three species of lamprey are listed in Annex II of the EU Habitats Directive (River lamprey are also listed in Annex V) and in Appendix III of the Bern Convention. River and sea lamprey are on the UKBAP Priority List. Eels are under threat with their populations declining by 90% over the last two decades. They are now protected under Scottish law and the EU commission has developed an Eel Recovery Plan. Eels are also on the UKBAP Priority List.

1.4.1 Fish Habitat surveys

At each site a fish habitat assessment was made. This survey recorded instream and riparian habitat to enable an assessment to be made of the likelihood of fish being present. This is a useful index to record and can assist in explaining both the presence and absence of certain species of fish.

1.4.2 Aquatic Macro Invertebrate surveys

Invertebrate surveys are conducted twice during the year. Once during the spring months and repeated during the late summer. The composition of freshwater macro invertebrate communities can provide an insight into the health of a watercourse. Certain species of invertebrates are more tolerant to pollution than others and as such their presence/absence provides an indication of water quality. Changes in invertebrate communities over a period can indicate a pollution event, both point source and diffuse. As aquatic invertebrates have a life cycle over months and sometimes years, this allows for the analysis of temporal changes caused by pollution and act as a continuous monitor of the waters they inhabit. Invertebrate surveys are of particular importance when any type of construction activity is occurring within a river catchment as they can assist in the long-term monitoring of the watercourse.

2 This Study

2.1 Aims

This study of the Hare Hill Wind Farm Re Power site set out with the following aims:

a) To utilise the Scottish Fisheries Coordination Centre (SFCC, 2021a & 2021b) protocol for electrofishing which is a replicable and efficient capture technique for juvenile salmonids and other species of fish that is suitable for the watercourses in the vicinity of Hare Hill.

b) To assess juvenile salmonid population densities and presence of other species of fish.

c) To utilise the Scottish Environment Protection Agency's (S.E.P.A., 2011) standardised kick sampling technique for the collection of aquatic invertebrates.

d) To produce data which may be used to assess fish and aquatic invertebrate populations when compared with future surveys.

e) To compare data gained from the Hare Hill Wind Farm Re Power site with that gained from the control sites included in this suite of surveys.

f) To produce data to assist in the environmental policy, considerations and safeguards which may be implemented for the general protection of the River Nith catchment and its environs.

g) To make recommendations to the developers of the Hare Hill Wind Farm Re Power site and their contractors on how best they can protect those populations of aquatic species known to exist in the watercourses draining the site, from an informed position, based on facts.

2.2 Feasibility

To accurately survey fish populations and aquatic macro invertebrate populations present in the watercourses within the vicinity of the Hare Hill Wind Farm Re Power site this study had to take account of the time of year when surveying was conducted, the height of water and general conditions at time of survey. For these reasons, the survey was conducted during conducive conditions to ensure efficiency of capture was optimum.

2.3 Site selection

This study conducted surveys in the watercourses in the Hare Hill Wind Farm Re Power site and within the catchment downstream of the site. A matrix of sites had previously been

designed by NDSFB to provide sufficient information to appraise the developers of the project.

3 Methods

3.1 Electrofishing surveys

3.1.1 Electrofishing apparatus

NDSFB utilised backpack electrofishing equipment throughout the duration of these surveys. The backpack unit used was a Hans Grassl IG600 backpack linked to a mobile cathode of braided copper (placed in the stream behind the operative) and one mobile anode, which consisted of a two-metre pole with a stainless-steel ring (used to draw fish) and an operator-controlled switch (**Figure 1**).

3.1.2 Ancillary equipment

One banner net was employed where appropriate, and dip nets with 1.3 metre handles attached were used to capture stunned fish which were placed into a water-filled bucket to recover.

Figure 1 – Backpack electrofishing

3.1.3 Personnel

To conduct this electrofishing survey, NDSFB utilised the services of their own staff, who are qualified and experienced in the use of electrofishing equipment and capable of conducting

such research. The Scottish Fisheries Co-ordination Centre (SFCC) protocol for electrofishing was adhered to throughout this survey (SFCC, 2021a & 2021b).

For their personal protection, all personnel wore waders. All personnel could swim. All members of the team were qualified in first aid, and first aid equipment was available in the Fishery Board vehicle present throughout the survey.

3.1.4 Techniques

To accurately assess the populations of fish throughout this survey, a method of electrofishing was adopted which could efficiently capture the appropriate age classes and species likely to be present. As previously stated, the SFCC protocol for electrofishing was adhered to throughout this set of surveys (SFCC, 2021a & 2021b). The method adopted entailed selecting natural features on the river which provided boundaries to each electrofishing site. Features such as shallow riffles at the top and bottom of a section of river were typically utilised.

Fully quantitative electrofishing methods were utilized during this survey in order to accurately assess the population of juvenile salmonids. This involved fishing the identified site multiple times, depletion sampling, to provide an estimate of the density of juvenile salmonids within the survey site. If fish were present within the first run it was fished again, a minimum of two times and up to a maximum of four times. The electrofishing team systematically worked from downstream to upstream following a carefully agreed pattern removing all fish caught. Working in an upstream direction prevents any sediment caused by wading in the river from obscuring the working area.

The anode operator was able to draw stunned fish downstream, assisted by the current, towards the hand-held dip net which was lifted clear of the water after each sweep, to permit the removal of captured fish for transfer into water-filled buckets. Electrofishing continued at each site until a depletion rate could be identified. At least 30% of the fish should be caught during each run for an accurate estimate to be achieved.

This method of capture for salmonids also captured all other species present in the sites. All fish were returned, unharmed to their original capture sites on completion of examination and data recording.

3.1.5 Data recording

All fish captured were removed from the survey sites, placed in water-filled buckets and allowed to recover from the temporary stunning effects of electrofishing. The fish from each electrofishing run had their own bucket and care was taken to keep them separated. Each bucket of fish was processed by removing the fish from the water using a small net and placing them into anaesthetic. Once sufficiently anesthetised, the fish were placed onto a wet measuring board where they were identified, and fork lengths were measured. The area electrofished at each site was measured and recorded. Water chemistry and habitat data was recorded.

3.1.6 Salmonid species

Salmonid species were counted and recorded as:

- Salmon fry (O^+) which refers to a young fish less than one-year-old, resulting from spawning at end of 2023.
- Salmon parr (1^+) which refers to a young fish which is older than one-year-old, resulting from spawning at end of 2021/2022.
- Trout fry (O^+) which refers to a young fish less than one-year-old, resulting from spawning at end of 2023.
- Trout parr (1^+) which refers to a young fish which is older than one-year-old, resulting from spawning at end of 2021/2022, or earlier in the case of larger specimens.

Age determination of salmonids has been assessed by the length of individuals captured from each fishing site. (**Figure 2**).

3.1.7 Non-salmonid species

The presence and densities of non-salmonid species was recorded at each survey site.

Figure 2 – Juvenile salmonids

3.1.8 *Data Analysis*

Estimates of density are calculated using the Zippin (1956) method of estimation. This provides an estimate of density expressed as the number of fish present within 100m^2. If no fish were found during the second run it is not possible to use Zippin's method to estimate densities, instead a minimum density can be estimated and expressed per 100m^2.

The densities of fry and parr were then classified using the Scottish Fisheries Co-ordination Centre national classification scheme (Godfrey, 2005). **(Table 1)** This classification scheme categorises the data according to five categories derived using data from over 1600 Scottish sites. This allows the performance of each site surveyed to be demonstrated graphically.

Table 1. SFCC Salmonid classification scheme

Species/Age class	A Excellent	B Good	C Moderate	D Poor	E Very Poor	F Absent
Salmon fry (per 100m^2)	>42.1	20.3 – <42.1	10.3 - <20.3	4.7 - <10.3	<4.7	0.0
Salmon parr (per 100m^2)	>15.8	9.1 - <15.8	5.1 - <9.1	2.6 - <5.1	<2.6	0.0
Trout fry (per 100m^2)	>30.3	12.4 - <30.3	5.3 - <12.4	2.5 - <5.3	<2.5	0.0
Trout parr (per 100m^2)	>10.4	5.6 - <10.4	3.1 - <5.6	1.6 - <3.1	<1.6	0.0

3.2 Photography

All sites were photographed to provide an accurate record of conditions at time of survey. These photographs are a useful aid in assessing environmental status and to assess the quality of each site with regard to its potential as a salmonid habitat.

4 Results and discussion

A total of seventeen sites were surveyed for fish in relation to the Hare Hill Re Power site. **Map 1** displays all survey site locations, including the control sites, and photographs of each site can be found in **Appendix 1**. A complete list of all those sites surveyed and the type of surveys conducted can be found in **Table 1**.

4.1 Electrofishing and fish habitat

Seventeen sites were surveyed by means of electrofishing. The results of the electrofishing surveys are presented in **Table 2**, which provides the densities of salmonids for each site, displayed per 100m^2. Numbers of fish recorded are described as minimum densities. The table also includes the site numbers, general site descriptions, easting, northing, date of survey and other species present.

The results of the habitat surveys can be found in **Table 3**. Fisheries habitat data included percentage estimates of flow type, riparian habitat types and substrate composition as well as a classification of instream fish cover.

All seventeen sites surveyed contained salmon species of fish. Six of those sites also contained non-salmonid species of fish. Of note was the presence of eels in Site 3, March Burn which is a tributary of Afton Water.

NDSFB are of the opinion that the presence and densities of salmonid species of fish in many of the sites surveyed indicates that salmon and trout were utilising these areas as spawning habitats. The presence of salmonids in these, often minor, watercourses is testament to their ability to migrate through testing geomorphological features.

4.2 Aquatic invertebrate results

Invertebrate surveys were conducted in all seventeen sites. The results of the invertebrate surveys are presented in **Table 4**.

The results from the aquatic invertebrate surveys indicated that most of the watercourses sampled have good to high water quality. The only exception to this is the site surveyed on the Polneul Burn. This site was classified as having moderate ecological status due to the lower number of taxa found to be present. However, the taxa found had an average score per taxa (ASPT) of 7.30 which represents a high score. The lower score at this site does not reflect historic aquatic invertebrate surveys conducted in this burn and highlights the benefits from collecting two samples annually.

Overall, the abundance and diversity of the aquatic invertebrate communities indicate that most of the watercourses draining the proposed Hare Hill Repower site are healthy and that the results are consistent when compared to the two control sites on the Mennock and Scaur Waters.

5 Conclusions

This study concludes that in the sites surveyed on the watercourses draining the proposed Hare Hill Repower site:

- That salmonid species of fish were present in all seventeen of the sites surveyed.
- That salmonid species of fish are present in all of the watercourses draining the site.
- That non salmonid species of fish were present in six of the seventeen sites surveyed.
- That populations of aquatic invertebrates are healthy in all but one of the sites surveyed, indicating good to high ecological status of those watercourses.
- The Polneul Burn contained fewer taxa than predicted or expected. There were no obvious reasons for this result.

6 Recommendations

This study recommends that if work progresses on the Hare Hill Wind Farm Re Power site:

- That the information gained from this series of fisheries and habitat surveys should be used to inform both the Water Management Plan and construction method statements on appropriate mitigation to be employed throughout the build phase of the Wind Farm project.
- That the information and results of this series of surveys is used to illustrate the sensitivities of the site and the vulnerability of species contained within the water environment.

- That the full suite of fisheries and aquatic invertebrate surveys to support the environmental protection of the site, be repeated no longer than 12 months prior to construction commencing to provide current baseline data which will take account of seasonal fluctuations. The suite of surveys must be repeated annually whilst construction continues on the site and following completion of construction activities. Thus, an assessment of overall impacts can be made on the fish and invertebrate communities known to exist in the vicinity of the Hare Hill site.
- That future aquatic invertebrate surveys are conducted bi-annually (twice per year) to enable a more robust assessment of any changes in aquatic invertebrate communities.
- That construction activity either in, or in proximity of a watercourse be discussed with Nith District Salmon Fishery Board prior to work commencing.

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Table 1: List of survey sites within the vicinity of Hare Hill Repower 2024

Watercourse	Site code	Location description	Easting	Northing	Altitude (m)	Surveys conducted	Sampling date/s	Wet width (m)	Water Temp (©)	Conductivity (µS)	pH
Garepool Burn, Upper Nith	1	Downstream from riparian wood at Glen Roe Lodge	265211	613416	189	Fish and Invertebrates	26/06/24	4.3	15.9	140	7.23
March Burn, Upper Nith	2	Upstream from ford	267323	613096	189	Fish and Invertebrates	26/06/24	1.9	20.7	83	7.67
March Burn, Afton Water	3	Downstream of road culvert	262825	609032	247	Fish and Invertebrates	17/06/24	2.4	14.3	50	7.46
Pollach Burn, Afton Water	4	25m downstream of culvert	262978	608794	253	Fish and Invertebrates	17/06/24	1.7	15.6	60	7.82
Langlee Burn, Afton Water	5	20m upstream from confluence with Afton Water	263207	608026	258	Fish and Invertebrates	17/06/24	2.1	13.6	47	7.53
Kello Water	6	Downstream from water gate	266651	606755	425	Fish and Invertebrates	21/06/24	2.7	14.3	71	6.74
Black Burn, Kello Water	7	Upstream from confluence with Kello Water	266698	606771	426	Fish and invertebrates	21/06/24	0.8	15.1	71	6.51
Kello Water	8	Below shed	267480	607910	393	Fish and invertebrates	21/06/24	7.4	14.2	69	6.84
Kello Water	9	Downstream of unnamed tributary	267959	608484	379	Fish and invertebrates	21/06/24	5.4	14.6	72	6.78
Bottom Burn, Kello Water	10	Upstream from confluence with Kello Water	267002	607506	408	Fish and invertebrates	21/06/24	4.5	13.4	70	6.35
Polstacher Burn, Kello Water	11	Upstream from ford	267608	609184	388	Fish and invertebrates	21/06/24	3.8	13.8	94	6.68
Kello Water	12	100m upstream from confluence with Nith	274655	611539	143	Fish and invertebrates	24/06/24	4.3	16.4	70	7.06
Polneul Burn, Upper Nith	13	Upstream from confluence with Nith	270431	613008	165	Fish and invertebrates	26/06/24	3.1	11.2	136	7.56
Polhote Burn, Upper Nith	14	Upstream of A76 bridge	268673	612633	192	Fish and invertebrates	24/06/24	2.5	16.6	85	6.90
Polmarlach Burn, Upper Nith	15	50m downstream from A76 road culvert	268220	612796	192	Fish and invertebrates	26/06/24	1.7	16.6	119	7.02
Mennock Water - control	16	Upstream from confluence with Glenim Burn	283779	609801	183	Fish and invertebrates	16/06/24	4.4	16.3	114	6.59
Scaur Water - control	17	Downstream of bridge at Glenwhargen	275911	602987	215	Fish and invertebrates	16/06/24	10.4	17.9	68	6.51

Table 2: Results of Electrofishing Surveys 2024

Watercourse	Site code	Location	Easting	Northing	Sampling date	Salmon fry (/100m^2)	Salmon parr (/100m^2)	Trout fry (/100m^2)	Trout parr (/100m^2)	Other species present
Garepool Burn, Upper Nith	1	Downstream from riparian wood at Glen Roe Lodge	265211	613416	26/06/24	186.05	152.05	186.05	116.95	SL
March Burn, Upper Nith	2	Upstream from ford	267323	613096	26/06/24	0.00	52.63	0.00	0.00	SL
March Burn, Afton Water	3	Downstream of road culvert	262825	609032	17/06/24	0.00	22.52	12.5	5.00	E
Pollach Burn, Afton Water	4	25m downstream of culvert	262978	608794	17/06/24	7.16	0.00	11.93	1.64	-
Langlee Burn, Afton Water	5	20m upstream from confluence with Afton Water	263207	608026	17/06/24	84.46	13.56	37.90	16.86	-
Kello Water	6	Downstream from watergate	266651	606755	21/06/24	0.00	0.00	2.65	2.65	-
Black Burn, Kello Water	7	Upstream from confluence with Kello Water	266698	606771	21/06/24	0.00	0.00	0.00	4.81	-
Kello Water	8	Below shed	267480	607910	21/06/24	0.00	0.00	0.87	0.87	-
Kello Water	9	Downstream of unnamed tributary	267959	608484	21/06/24	0.00	0.00	2.85	2.85	-
Bottom Burn, Kello Water	10	Upstream from confluence with Kello Water	267002	607506	21/06/24	0.00	0.00	0.00	9.375	-
Polstacher Burn, Kello Water	11	Upstream from ford	267608	609184	21/06/24	0.00	0.00	3.30	16.12	-
Kello Water	12	100m upstream from confluence with Nith	274655	611539	24/06/24	179.18	19.89	68.62	0.00	SL, M
Polneul Burn, Upper Nith	13	Upstream from confluence with Nith	270431	613008	26/06/24	11.73	0.00	8.80	0.00	SL, M
Polhote Burn, Upper Nith	14	Upstream of A76 bridge	268673	612633	24/06/24	0.00	0.00	7.06	4.71	-
Polmarlach Burn, Upper Nith	15	50m downstream from A76 road culvert	268220	612796	26/06/24	3.85	15.38	3.85	3.85	SL
Mennock Water - control	16	Upstream from confluence with Glenim Burn	283779	609801	16/06/24	72.49	0.00	80.33	0.00	-
Scaur Water - control	17	Downstream of bridge at Glenwhargen	275911	602987	16/06/24	11.19	2.77	5.78	0.93	-

* Calculated using Zippin's estimate of density. All other densities are minimum densities.

Key to other species: E – Eel, M – Minnow, SL - Stone Loach, L – Lamprey, SB – Stickleback, G – Grayling, F – Flounder, P – Pike.

Key to classification of salmonids per 100m^2

absent	very poor	poor	moderate	good	excellent

Table 3: Results of Habitat Surveys 2024

					Left Bank fish cover							Right Bank fish cover						
Site code	Water Clarity	Instream Parr Cover	Bank face vegetation	Bank top vegetation	UC %	DR %	BA %	MA %	RT %	RK %	OTH %	UC %	DR %	BA %	MA %	RT %	RK %	OTH %
1	Clear	Excellent	Complex	Complex	20	20	80	0	0	0	0	10	10	0	0	0	0	0
2	Clear	Good	Simple	Simple	0	0	100	0	0	0	0	0	0	100	0	0	0	0
3	Clear	Good	Complex	Complex	25	15	60	0	0	20	0	20	10	60	0	0	20	0
4	Clear	Good	Simple	Simple	5	10	90	0	0	0	0	5	10	90	0	0	0	0
5	Clear	Good	Uniform	Complex	0	0	100	0	0	0	0	5	5	90	0	0	0	0
6	Clear	Excellent	Simple	Simple	20	20	70	0	0	0	0	30	20	60	0	0	0	0
7	Clear	Excellent	Simple	Simple	30	20	60	0	0	0	0	35	20	60	0	0	0	0
8	Clear	Poor	Uniform	Uniform	0	0	100	0	0	0	0	0	0	100	0	0	0	0
9	Clear	Excellent	Simple	Simple	50	0	50	0	0	0	0	50	0	50	0	0	0	0
10	Clear	Excellent	Simple	Simple	70	50	20	0	0	0	0	50	50	40	0	0	0	0
11	Clear	Excellent	Uniform	Simple	60	0	100	0	0	0	0	0	0	100	0	0	0	0
12	Clear	Poor	Bare	Uniform	10	15	50	0	10	0	0	0	0	100	0	0	0	0
13	Clear	Excellent	Simple	Complex	20	0	90	0	0	0	0	80	0	100	0	0	0	0
14	Clear	Poor	Simple	Simple	15	5	70	5	0	0	0	0	10	80	0	0	0	0
15	Clear	Good	Simple	Complex	60	40	40	0	0	0	0	100	0	100	0	0	0	0
16	Clear	Excellent	Simple	Simple	30	5	70	0	0	0	0	25	10	75	0	0	0	0
17	Clear	Excellent	Simple	Simple	30	10	60	0	0	0	0	20	0	80	0	0	0	0

Key to habitat:
Vegetation: Bare – Bare ground, Uniform – One vegetation type, Simple – 2-3 vegetation types, Complex – 4 or more vegetation types including scrub/trees.
Bankside fish cover: UC – Undercut, DR – Draped, BA – Bare, MA – Marginal plants, RT – Roots, RK - Rocks, OTH - Other

Table 3 continued: Results of Habitat Surveys 2024

	Depths (cm)						Substrate								Flow type							
Site code	**<10 %**	**11-20 %**	**21-30 %**	**31-40 %**	**41-50 %**	**50> %**	**HO %**	**SI %**	**SA %**	**GR %**	**PE %**	**CO %**	**BO %**	**BE %**	**SM %**	**DP %**	**SP %**	**DG %**	**SG %**	**RU %**	**RI %**	**TO %**
1	30	50	20	0	0	0	0	0	5	10	20	40	25	0	5	0	0	0	10	55	30	0
2	30	40	30	0	0	0	0	0	0	10	30	40	20	0	0	0	0	0	20	70	10	0
3	10	20	40	20	10	0	0	0	0	0	30	40	30	0	0	15	0	0	15	35	35	0
4	10	70	20	0	0	0	0	0	0	10	20	50	20	0	0	0	0	0	0	80	20	0
5	5	45	30	20	0	0	0	0	5	10	30	40	15	0	0	0	0	0	30	50	20	0
6	10	25	35	30	0	0	0	0	10	15	20	35	20	0	10	0	0	0	15	45	30	0
7	20	50	30	0	0	0	0	0	15	30	40	0	0	15	0	0	0	0	10	60	30	0
8	10	20	40	20	10	0	0	0	0	5	25	20	30	20	0	10	5	0	0	60	25	0
9	0	0	20	50	30	0	0	0	0	0	0	40	40	20	0	20	20	30	0	0	30	0
10	0	20	30	30	20	0	0	0	5	10	20	20	40	5	10	15	20	0	0	25	30	0
11	20	20	20	30	10	0	0	0	5	15	20	35	25	0	5	10	20	15	15	20	15	0
12	20	30	40	10	0	0	0	0	0	20	40	20	10	0	5	0	0	75	10	0	10	0
13	10	50	30	10	0	0	0	0	0	10	20	30	40	0	5	0	0	0	10	45	40	0
14	40	40	10	10	0	0	30	0	15	30	10	10	5	0	30	15	5	0	0	0	50	0
15	20	50	30	0	0	0	0	0	10	20	30	40	20	0	10	0	5	0	20	5	25	0
16	10	20	0	40	20	10	0	0	0	20	20	35	15	10	0	0	0	0	10	30	60	0
17	20	40	40	0	0	0	0	0	0	40	20	20	20	0	0	0	0	0	10	60	30	0

Key to habitat:
Substrate: HO – High organic, SI – Silt, SA – Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock.
Flow type: SM – shallow marginal, DP – deep pool, SP – shallow pool, DG – deep glide, SG – shallow glide, RU – run, RI – riffle, TO – torrent.

Table 4: Results of Invertebrate surveys - WHPT scores 2024

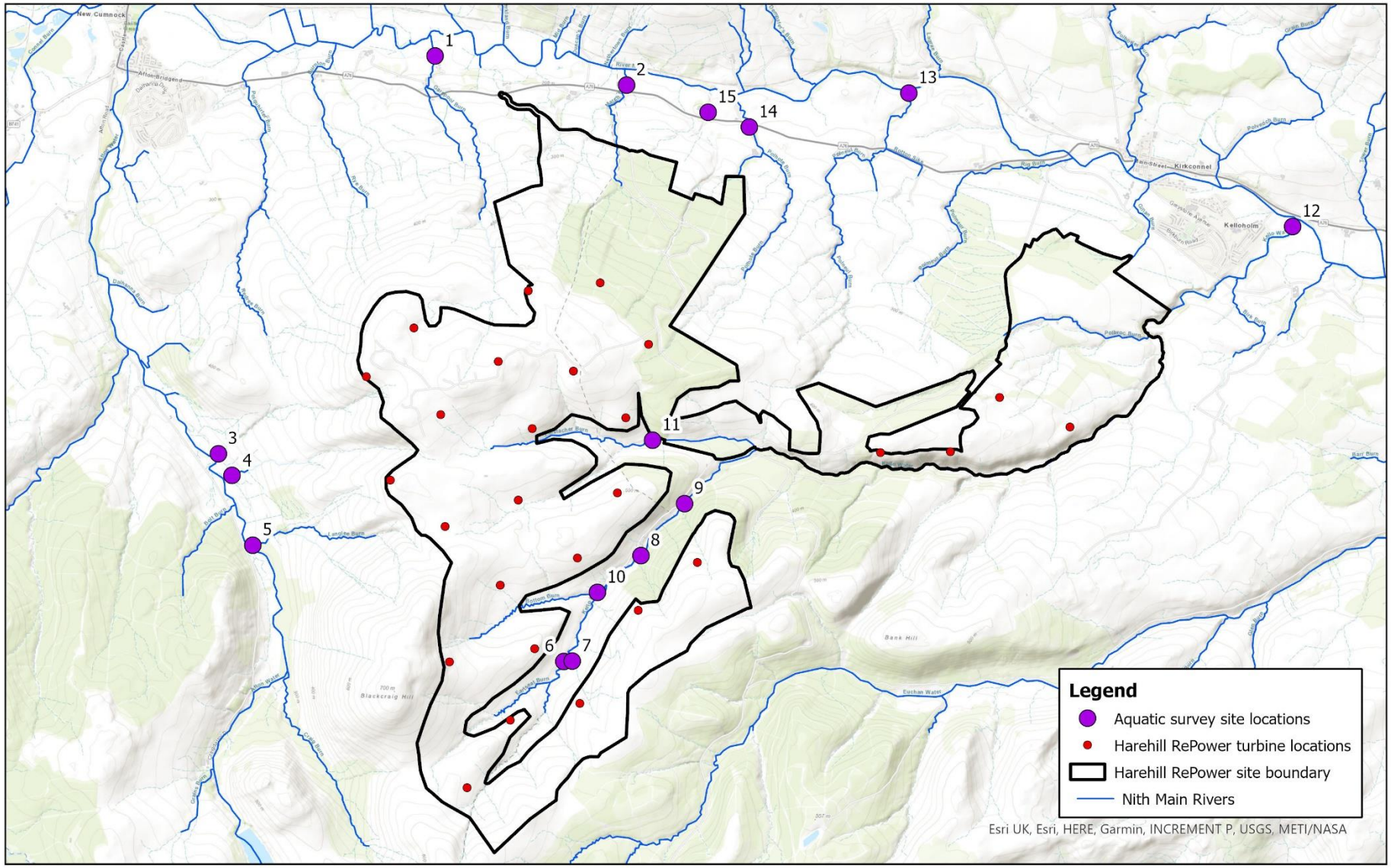
Watercourse	Site code	Sampling date	WHPT ASPT Abunb. *	NTAXA	WFD Classification
Garepool Burn, Upper Nith	1	26/06/24	6.95	15	G
March Burn, Upper Nith	2	26/06/24	6.29	17	G
March Burn, Afton Water	3	17/06/24	7.29	18	H
Pollach Burn, Afton Water	4	17/06/24	7.38	14	H
Langlee Burn, Afton Water	5	17/06/24	6.95	12	G
Kello Water	6	21/06/24	6.95	12	G
Black Burn, Kello Water	7	21/06/24	7.88	12	H
Kello Water	8	21/06/24	7.36	11	G
Kello Water	9	21/06/24	7.30	14	H
Bottom Burn, Kello Water	10	21/06/24	6.90	13	G
Polstacher Burn, Kello Water	11	21/06/24	7.35	11	M
Kello Water	12	24/06/24	7.13	19	H
Polneul Burn, Upper Nith	13	26/06/24	7.30	10	M
Polhote Burn, Upper Nith	14	24/06/24	6.25	15	G
Polmarlach Burn, Upper Nith	15	26/06/24	6.53	15	G
Mennock Water - control	16	16/06/24	8.03	20	H
Scaur Water - control	17	16/06/24	6.73	14	G

* WHPT ASPT abund – abundance-related WHPT Average Score Per Taxa

WFD Five Stage Classification System

High Ecological Status	No or minimal change from natural condition
Good Ecological Status	Slight change from natural condition
Moderate Ecological Status	Moderate change from natural condition
Poor Ecological Status	Major change from natural condition
Bad Ecological Status	Severe change from natural condition

Map 1 – Survey site locations



Appendix 1 - Photographs of survey sites

Site 01 – Garepool Burn

Site 02 – March Burn

Site 03 – March Burn

Site 04 - Pollach Burn

Site 05 - Langlee Burn

Site 06 - Kello Water

Appendix 1 - Photographs of survey sites continued

Site 07 - Black Burn

Site 08 - Kello Water

Site 09 - Kello Water

Site 10 - Bottom Burn

Site 11 - Polstacher Burn

Site 12 - Kello Water

Site 13 - Polneul Burn

Site 14 - Polhote Burn

Site 15 - Polmarlach Burn

Site 15 - Mennock Water – Control site

Site 17 – Scaur Water – Control site