Appendix 10.**5**
Fish Survey Report

A Scottish Registered Charity
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Commissioned Report No. – VSAD15

Pre-construction electrofishing survey for Kendoon to Tongland 132kV Reinforcement Project

For Land Use Consultants Limited

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Summary

Pre-construction electrofishing survey for Kendoon to Tongland 132kV Reinforcement Project

Commissioned Report No.: VSAD15
Contractor: Land Use Consultants Limited
Year of publication: November 2017

Keywords

Electrofishing; Kendoon; Tongland; Overhead lines; salmonids; juvenile surveys.

Background

Electrofishing surveys were undertaken in September 2017 in watercourses which could potentially support fish, along the length of the new overhead line (OHL). The electrofishing surveys were carried out with the aim of providing a baseline overview of fish population data (distribution and abundance), to inform the pre-construction phase of the OHL development.

Main findings

- Twenty-three watercourses were identified which could support fish populations along the route of the proposed construction work to replace the OHL. All were proposed to be surveyed by electrofishing.
- Three of the watercourses were found to be unsuitable to support fish species and thus were not surveyed.
- Nine of the watercourses supported populations of juvenile salmonids (salmon and/or trout).
- Two watercourses supported non-salmonid species; stone loach, minnow and three-spined stickleback. One of these sites also supported salmonids.
- Seventeen of the watercourses surveyed were found not to support fish populations. The reasons for the lack of fish at these sites included poor instream habitat quality, low water flows or poor water quality.
- A traffic light system was developed to highlight sensitive watercourses. Sites surveyed were given a Red, Amber or Green rating (Red = High Sensitivity, Amber = Moderate Sensitivity, and Green = Low Sensitivity).
- On watercourses of High and Moderate Sensitivity, great care must be taken to ensure there is no impact to fish populations either at crossing points or further downstream. Any works being carried out instream must allow for free movement of fish both upstream / downstream and silt control must be put in place to stop any silt entering the water both at the work area and downstream. Instream habitat

disturbance should be kept to a minimum. Any specific areas of these sensitive watercourses that need to be crossed or disturbed during construction should be reconsidered to allow for the most suitable crossing system to be established. Fish rescues may be required at these watercourses if instream works take place during the construction of the new overhead line.

- On watercourses of Low Sensitivity, it should be considered that although the specific watercourse may not support fish, the downstream waters into which it flows will at some point. Pollution prevention measures are still required to protect downstream waters. Localised disturbance within the work area is not as detrimental on these watercourses.
- During construction and post construction fish monitoring programme will be required at the ten High and Moderately Sensitive watercourses.

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1 INTRODUCTION

Galloway Fisheries Trust (GFT) was commissioned by Land Use Consultants Limited (LUC) to carry out electrofishing surveys in watercourses which could potentially support fish, along the length of the new overhead line (OHL). GFT identified 23 sites along the route and these were surveyed in September 2017. The location of these sites are mapped in Appendix 1 and further details are provided in Table 3. The electrofishing surveys were carried out with the aim of providing a baseline overview of fish population data (distribution and abundance), to inform the pre-construction phase of the OHL development. Details regarding where the OHL would cross over certain watercourses were provided to GFT by LUC.

The route is within the Kirkcudbrightshire Dee catchment, SW Scotland. This river system is considered to be a 'heavily modified water body' in the Solway and Tweed River Basin Management Plan due to the presence of the Galloway Hydro Scheme, run by Scottish Power, which has a series of dams and power stations present across the catchment. The large Tongland Dam located at the bottom of the river system has a fish pass located through it for salmon and sea trout but which is impassable to ascending European eels and Lamprey species. Thus neither of these fish species are found anywhere in the catchment.

There is a variety of legislation, regulations and guidance in place relating to fish species that may be present in watercourses within the Kirkcudbrightshire Dee catchment. Atlantic salmon is an internationally important fish species which is listed under Annex II and V of the European Habitats Directive (1992) (only in freshwater), Appendix III of the Bern Convention (1979) (only in freshwater) and is a local priority species in the Dumfries and Galloway Local Biodiversity Action Plan. Atlantic salmon is also a species of conservation concern on a UK level. Brown trout / sea trout is also a UK Biodiversity Action Plan species. Salmon and migratory Sea trout within the Dee Catchment are managed by the River Dee (Kirkcudbright) District Salmon Fishery Board.

The potential for fish species and their habitats to be affected by this development mainly occurs during the construction phase of the development. During the construction phase potential impacts include siltation from ground disturbance, accelerated or exacerbated erosion, hydrological changes, pollution, and the blocking or hindering of the upstream / downstream migration of fish. During the operational phase, potential concerns include the effects of poor road drainage, accelerated levels of erosion and the maintenance of silt traps. These potential effects could all impact on the surrounding fish populations by causing direct mortality of juveniles and adults, changes in food availability, avoidance behaviour resulting in unused habitat, blocking of migration routes to spawning beds or the damage of instream and riparian habitats.

This report will detail the fish species present and their densities at each site (standardised to 100 m^2 of water), describe the instream and riparian habitats at each survey site, rank watercourses on its fisheries sensitivity and highlight potential risks to the fish populations from the planned construction works. Any highlighted sensitive fish issue and how to mitigate to protect them should be considered during the design phase of this project. The data collected during the baseline surveys can be used to design any follow up surveys which may be required.

2 AIMS

The aims of this work were as follows:

2.1 To undertake pre-construction electrofishing surveys close to the proposed OHL route providing a baseline overview of fish population data.

2.2 Undertake a detailed bankside and habitat survey at each electrofishing site.

2.3 To analyse and present results from the surveys in report form, briefly discussing any particular sensitivities and/or issues relating to juvenile salmonids found within the electrofishing surveys.

2.4 Develop a traffic light sensitivity rating in relation to fish population assemblages and densities for each electrofishing location.

2.5 Provide advice in relation to potential mitigation measures to protect fish populations during construction.

3 METHODOLOGY

3.1 Data recording

The GFT is a partner in the Scottish Fisheries Co-ordination Centre[1] (SFCC), an initiative involving Scottish Fishery Trusts and others, including the Marine Scotland Science (Scottish Government), The Tweed Foundation, the Tay Foundation and the Cromarty Firth Fisheries Trust.

This group has, in partnership, developed a set of agreed survey and data collection methodologies for electrofishing surveys and an associated database in which to record information gathered from such surveys.

The electrofishing surveys undertaken by GFT for this study have been completed to the high standards that are required by the SFCC and recorded using the agreed methodologies.

3.2 Electrofishing surveys

To assess the fish population present within a section of river various techniques have been developed in the recent decades. The main method of determining the status of a fish population is through employing the use of electrofishing equipment.

This technique of electrofishing involves the 'stunning' of fish using an electric current which enables the operator to remove the fish from the water. Once captured, the fish recover in a holding container. They are then anaesthetised using a specific fish anaesthetic, identified to species, measured and recorded, and once fully recovered, returned unharmed to the area from which they were captured.

The method of fishing involves the anode operator drawing stunned fish downstream to a banner net held against the current by an assistant. A hand net operator completes the three-man team. Captured fish are then transferred to a water-filled recovery container. The fishing team works its way across the survey section and upstream, thereby fishing thoroughly all the water in the chosen survey area.

To obtain fully quantitative information on the fish, primarily juvenile salmonid, populations within an area of interest, each survey site is fished through up to four times consecutively to allow the calculation of a more accurate estimate of the fish population present. A Zippin estimation[2] of a fish population is a common calculation carried out using data derived from the depletion method of fishing (multiple run fishing). The result provides an estimate of the fish population density per 100 m^2 of water, including the 95% confidence limits (this information is presented in Table 3). When the calculation of a Zippin estimate of the population is not possible, a minimum estimate of the fish population is calculated for that section of river.

After the electrofishing exercise has been completed, a targeted and detailed SFCC habitat survey is completed of the actual fishing site. Details are provided in Section 4.1.3.

For this study, electrofishing was undertaken by three SFCC accredited GFT staff at all survey sites.

It is the policy of GFT to disinfect all relevant equipment both prior to and following work in each river catchment to ensure that there is no transfer of disease organisms.

[1] http://www.sfcc.co.uk/

[2] Zippin, C. (1958). The Removal Method of Population Estimation Journal of Wildlife Management, 22. Pp 82-90.

3.2.1 Limitations of electrofishing surveys

The SFCC method of electrofishing was primarily developed to survey juvenile salmonids in relatively shallow running water. Non-salmonid fish species may be present and caught during these surveys but their populations may not be properly determined using this method of electrofishing. Any non-salmonid fish species are therefore counted and measured but no population estimate is made (see Table 3).

Electrofishing will never capture all the fish in a survey site so densities presented in this report are an estimate (either a minimum estimate, or where possible the calculation of a Zippin estimate, has been presented, see Section 4.1.2, 4.1.3 and Table 3) of the juvenile salmonid population residing within the site. The absence of fish cannot be ascertained with certainty using electrofishing techniques so a density of zero does not always guarantee these fish are altogether absent from this section of watercourse.

A low density of fish can be assessed with electrofishing techniques however it is harder to fully assess the actual population density of the watercourse or the representative site. If there is a low and patchy distribution of fish it may be harder to draw conclusions from the data.

3.2.2 Electrofishing equipment

The bankside generator apparatus which is employed during GFT electrofishing surveys is powered by a 2.2 kW petrol generator (5 horse power) with a variable voltage output (200 – 400 volts) linked to an Electracatch controller unit (model WFC7 – 1a). GFT endeavors to use a bankside generator kit wherever possible. Where distance prevents the use of the bankside kit, a mobile, battery powered backpack electrofishing kit is used to undertake the survey. GFT employs the use of an E-Fish backpack electrofishing kit. Both the bankside and backpack controller units are linked to a cathode of braided copper (negative electrode) and a mobile, single anode, consisting of a pole-mounted stainless steel ring (positive electrode) and trigger switch is used instream to capture the fish.

Smooth direct current was used in all survey sites.

3.2.3 Age determination

For this study the electrofishing survey concentrated on assessing the status of juvenile salmonid species, namely salmon (*Salmo salar*) and trout (*Salmo trutta*). In the majority of cases age determination can be made by assessment of the length of fish present. However, with older fish it is often more difficult to clarify age classes. In these cases a small number of scale samples can be taken from fish, in addition to taking length assessments, to verify the ages of fish whose age cannot be determined with certainty from the length.

In this survey juvenile salmonids are differentiated into fry (age 0+) and parr (age 1++) age groups.

With regard to the juvenile salmonid age classes, these are separated into four categories, which are defined in Table 1 below.

Table 1: Salmonid age classifications

Salmon Fry (0+):	Young fish less than one year old resulting from spawning at the end of 2016
Trout Fry (0+):	Young fish less than one year old resulting from spawning at the end of 2016
Salmon Parr (1+ and older (1++)):	Young fish of greater than one year and greater than two years old (where present) from spawning in 2015 or previously
Trout Parr (1+ and older (1++)):	Young fish of greater than one year and greater than two years old (where present) from spawning in 2015 or previously. Trout of up to three or four years old are also included in this category

3.2.4 Classification of density categories

Juvenile salmonid numbers are also classified into several 'density' categories. A classification scheme for densities of salmonids was previously generated by the SFCC using data collected from 1,638 Scottish electrofishing survey sites covering the period 1997 to 2002 (SFCC, 2006[3]). From this, regional figures were created to allow more accurate local 'density ranges'. The categories referred to in this report are based on quintile ranges for one-run electrofishing events in the Solway region (Solway Salmon Fishery Statistical Region). Table 2 shows these quintile ranges for the Solway region, within which the Kirkcudbrightshire Dee lies.

Table 2: Quintile ranges for juvenile salmonids (per 100 m^2 of water) based on one-run electrofishing events, calculated on densities >0 over 291 sites in the Solway Statistical Region

	Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
Minimum (Very Low)	0.22	0.38	0.38	0.35
20th Percentile (Low)	5.21	2.86	4.14	2.27
40th Percentile (Moderate)	12.68	5.87	12.09	4.71
60th Percentile (High)	25.28	9.12	26.63	8.25
80th Percentile (Very High)	46.53	15.03	56.49	16.28

The juvenile salmonid density classification scheme (SFCC, 2006) is based solely on data from surveyed sites containing fish in 1997 to 2002 and refers to regional conditions at that time; it must only be used as a very relative guide and not be used to draw conclusions. Moreover, the figures for juvenile trout are less reliable for various reasons (e.g. some surveyed populations of trout are isolated; sea trout contributing to stock in some areas etc) and so can only be used as a relative indication of numbers.

3.2.5 Non-salmonid fish species

At each survey site the presence of non-salmonid fish species is noted. Population densities for these species are not calculated (see Section 3.2.1).

3.2.6 Site measurement

At each survey site a total site length was recorded and average wet and dry widths calculated.

The average wet width is calculated from five or more individual widths recorded at equidistant intervals from the bottom of the site (0 m) to the top. At each site a final width is

[3] Godfrey, J. D. (2006), Site Condition Monitoring of Atlantic Salmon SACs: Report by the SFCC to Scottish Natural Heritage, Contract F02AC608 http://www.gov.scot/resource/doc/295194/0096508.pdf

noted at the absolute upper limit of the surveyed water. From these site measurements the total area fished can be calculated.

3.2.7 Bankside/instream electrofishing site habitat assessment

At each electrofishing site a detailed habitat assessment using SFCC protocol is made of the instream habitat available for older (parr (1++) aged) fish. This assessment grades the cover available to salmonids instream as none, poor, moderate, good or excellent. This grading provides an index of instream cover where diverse substrate compositions will score more favorably than areas of uniform substrate which provides lower levels of cover.

In accordance with SFCC protocols, percentage estimates of depths, substrate type and flow type are made at each electrofishing site. Additionally, percentage estimates of the quantity of the bankside cover features such as undercut banks, draped vegetation, bare banks and marginal vegetation are made.

When reference to left or right bank is made, it is always left and right bank when facing downstream.

3.3 Survey areas and site selection

The specific sites to be surveyed were identified from Ordinance Survey Mapping (1:25,000).

Survey work was carried out within September and October 2017 which is within the optimal time for surveying for juvenile salmonids.

3.4 Calculating site sensitivity

Data from across the survey will be analysed and results presented as a traffic light sensitivity rating (see Table 4 below).

Table 4: Showing traffic light rating of sensitivity based on densities of juvenile salmonids found at each electrofishing site

Traffic Light Rating	Description
Green	Not sensitive for fish at the survey location and unlikely to cause a localised effect. Works could still potentially cause downstream impact so mitigations still need to be in place. No fish rescue required for any instream works.
Amber	Moderately sensitive for fish at the survey location as non-salmonid fish species are present. Fish rescue will be required prior to any instream work such as culvert placement. May cause a localised and downstream impact so strict pollution requirements still stand.
Red	Very sensitive for fish at the survey location and pylon associated work could potentially cause a localised and downstream impact on fish populations. Fish rescue required prior to any instream works.

For an electrofishing site to classify as having a Green sensitivity rating (Low Sensitivity) it was found to contain any of the following: no fish present, site is a field ditch/drain, has unsuitable habitat to support fish, no watercourse visible during the

surveys.

For an electrofishing site to classify as having an Amber sensitivity rating (Moderately Sensitive) it was found to contain any of the following: only non-salmonid species of fish. In general, the habitat was not suitable to support salmon or trout populations.

For an electrofishing site to classify as having a Red sensitivity rating (Very Sensitive) it was found to contain any of the following: presence of salmonids in any density or display habitats of particular significance.

4 ELECTROFISHING SURVEY

4.1 Figures presented

The results of the electrofishing survey are outlined in this section and presented in detail in Table 3, which provides information on the population densities of juvenile salmonids at each survey site. Ages of fish were determined from length frequency distributions. Site code, watercourse, site location, O.S. Grid reference, survey date, non-salmonid species and area fished (m^2) are shown in Table 3.

4.1.1 Electrofishing results (see Table 3 for tabulated results)

- Site 1 (Water of Ken) Grid reference: 260376 587621

Salmon fry and parr were absent from this site. Trout fry were recorded in a low density (>7.56 per 100 m^2 of water) alongside a very low density of trout parr (>0.84 per 100 m^2 of water).

- Site 2 (Unnamed burn) Grid reference: 260404 586210

Salmon fry and parr were absent at this site. Trout fry and parr were also absent. No non-salmonid fish species were recorded.

- Site 3 (Water of Ken) Grid reference: 260543 584951

Salmon fry and parr were absent at this site. Trout fry were recorded in very low densities (>0.30 per 100 m^2 of water), whereas trout parr were found to be absent. Five minnow and three stone loach were found.

- Site 4 (Polharrow Burn) Grid reference: 260331 584344

Salmon fry were recorded in high density (>32.0 per 100 m^2 of water) and salmon parr, in very low density (>1.0 per 100 m^2 of water). Trout fry were recorded in very low density (>4.0 per 100 m^2 of water) and trout parr were absent. Three stone loach were found.

- Site 5 (Unnamed burn) Grid reference: 260734 583000

Salmon fry and parr were absent at this site. Trout fry and parr were also absent. No non-salmonid fish species were recorded.

- Site 6 (Coom Burn) Grid reference: 260904 580587

Salmon fry were present in a moderate density (>19.12 per 100 m^2 of water) however salmon parr were only recorded in a very low density (>1.37 per 100 m^2 of water). Five crayfish were caught within the site.

- Site 7 (Craigshinnie Burn) Grid reference: 260345 579553

Salmon fry and parr were absent from this site. Trout fry were present in a very high density (92.69 ± 26.47 fry per 100 m^2 of water) and trout parr were recorded in very high density (21.66 ± 8.37 per 100 m^2 of water).

- Site 8 (Tributary of Craigshinnie Burn) Grid reference: 260388 579413

Juvenile salmon were absent from this site. A very low density of trout fry (>1.56 per 100 m^2 of water) was recorded here alongside a low density of trout parr (>4.69 per 100 m^2 of water). No other fish species were found at this site.

- Site 9 (Tributary of Knocknairling Burn) Grid reference: 261310 577626

No fish were found at this site.

- Site 10 (Knocknairling Burn) Grid reference: 261373 577352

Juvenile salmon were absent from this site. Trout fry were found in a moderate density (>16.13 per 100 m^2 of water). A moderate density was also found of trout parr (>5.38 per 100 m^2 of water). No other species of fish were caught.

- Site 11 (Darsalloch Burn) Grid reference: 260687 576414

No fish were caught within this site.

- Site 12 (Pultarson Burn, Black Water of Dee) Grid reference: 261033 575303

No fish were caught within this site.

- Site 13 (Mid Burn, Black Water of Dee) Grid reference: 261781 573225

No fish were caught within this site.

- Site 14 (Acre Burn, Black Water of Dee) Grid reference: 262903 571995

No fish were caught within this site.

- Site 15 (Unnamed tributary of Acre Burn) Grid reference: 263225 571779

No fish were caught within this site.

- Site 16 (Clachrum Burn, Black Water of Dee) Grid reference: 264450 571020

No fish were caught within this site.

- Site 17 (Black Water of Dee) Grid reference: 265373 569189

Salmon fry were present in a very low density (>0.69 per 100 m^2 of water) however no parr were found. Trout fry were recorded in a low density (>6.22 per 100 m^2 of water), alongside a very low density of trout parr (>0.69 per 100 m^2 of water). Two crayfish were also caught within the site.

- Site 18 (Unnamed burn, Black Water of Dee) Grid reference: 264648 567243

No fish were caught within this site.

- Site 19 (Kennick Burn) Grid reference: 266137 565137

Salmon fry and parr were absent from this site. Trout fry were recorded in a moderate density (>17.77 per 100 m^2 of water) alongside a high density of trout parr (>8.88 per 100 m^2 of water). No non-salmonid fish species were recorded in this site.

- Site 20 (Camelon Burn, Black Water of Dee) Grid reference: 267705 563295

No salmonids were present at this site. One stickleback was found within the site.

- Site 21 (Outlet of Bargatton Loch, Tarff) Grid reference: 268863 561925

No fish were caught within this site.

- Site 22 (Unnamed burn) Grid reference: 270080 557640

No fish were caught within this site.

- Site 23 (Unnamed burn) Grid reference: 269865 556698

No fish were caught within this site.

4.1.2 Electrofishing results discussion

- *Site 1, Water of Ken at Kendoon Power Station*

Instream habitats in this site were considered to be of moderate standard. Wet width within the site averaged 12.5 m and the survey covered an area of 119.1 m^2 of water. Instream substrates were dominated by boulders (50%) with the remainder of substrates composed of cobbles (20%), bedrock (20%) and a small amount of pebble and gravel mix (10% combined). Flows were characterised by predominantly run (65%) with 15% of the site considered riffle. There were small areas of deep and shallow glide (20% combined), and therefore the flow types and the instream substrates present only offered moderate quality juvenile habitats. Water depths were recorded up to 50 cm deep, with the majority of water lying between 21 and 40 cm deep (80%). No bankside cover was available for fish. The left bank was lined with Alder trees and the right bank has sparse scraggy bushes on bedrock. There was only 10% canopy cover shading the site.

Figure 1: Site 1 on Water of Ken, looking downstream

Salmon fry and parr were absent from this site. Trout fry were recorded in a low density (>7.56 per 100 m^2 of water) alongside a very low density of trout parr (>0.84 per 100 m^2 of water).

Within this site five stone loach and one minnow were recorded.

Figure 2: Trout parr caught from within site 1 on the Water of Ken

- *Site 2, Unnamed burn (Dee)*

Site 2 is located downstream of the A701 between two large overhanging trees, downstream of a small bridge.

The instream habitat (for parr aged fish) was considered 'good'. An area of 43.5 m^2 was electrofished between two over hanging trees. The depth of the water ranged from 10 cm to 20 cm with the majority of the water being <10 cm (90%). Instream substrates were dominated by pebbles (40%) and cobbles (35%), gravel and boulders were also recorded. Substrates were noted as being stable, uncompacted and not silted providing suitable spawning opportunities. Wetted width averaged 1 m. The flow type was predominantly faster run (70%) and some riffle (20%) with small areas of shallow glide. The banksides were ungrazed with a low level of fish cover mostly consisting of draped vegetation and small areas of undercut banksides. There was 100% canopy cover made up of overhanging boughs however the site was not considered over shaded. This cover was provided by a large tree on the right bank (looking downstream).

No fish species were present within this site.

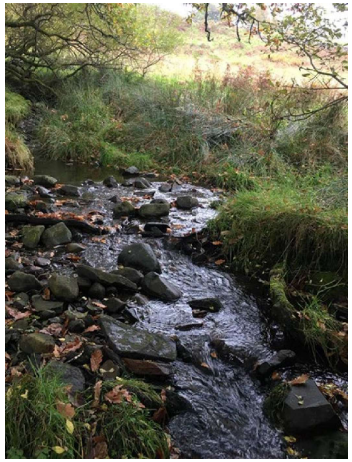

Figure 3: Site 2 on an unnamed burn, looking upstream

- *Site 3, Water of Ken*

Site 3 is situated a short distance downstream of Carsfad Dam.

Instream habitats in this site were considered to be of excellent standard (for parr aged fish). The wet width within the site averaged 27.5 m and the survey covered an area of 335 m^2 of water. Substrates were dominated by boulders and bedrock (70% combined) with a cobble (20%), pebble (5%) and gravel (5%) mix. It was noted that very little spawning habitat was present due to the upstream dam impacting on natural sediment movement within the river channel. Run (45%) and shallow pools dominated the flow regime, with some shallow glide and riffle also recorded. There were also some areas of smooth marginal flows. Water depths were recorded up to 30 cm deep, with the majority of water (50%) lying between 11 and 20 cm deep. Due to the low water levels much of the site was exposed. The shallow pools within the site which were disconnected from the main flows were fished which is where the non-salmonids were found.

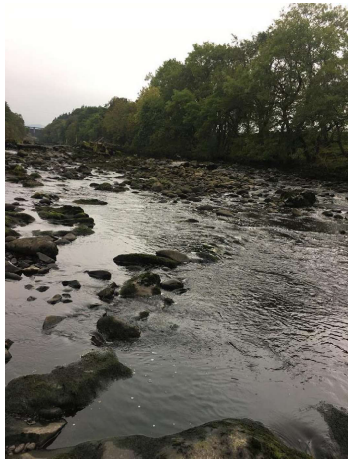

Figure 4: Site 3, Water of Ken, looking upstream

No juvenile salmon were present. Trout fry were found in low densities (>0.298 per 100 m^2). No trout parr were present.

Figure 5: A trout fry found within site 3

- *Site 4: Polharrow Burn*

Site 4 was located at the bottom of the Polharrow Burn, just upstream from the confluence with the Water of Ken. Due to areas of higher flows and slippery bedrock it was considered unsafe to fish the whole channel so only two thirds of the burn was

fished, giving a total surveyed area of 100 m^2. The wetted width averaged at 8 m. Instream cover was recorded as being good with the majority of the substrate being made up of cobbles and boulders (70% combined). The remaining substrate split into gravel (10%), pebble (10%) and some areas of bedrock (10%). Under medium flows 60% of the channel surveyed was recorded between 21-30 cm, 20% between 11-20 cm and the remaining 20% was less than 10 cm deep. There was no instream vegetation and the substrate was stable and un-compacted and it was noted the rocks were very slippery. As the site only reached two thirds of the channel, the left bank was recorded as having no fish cover. The right bank only had small areas of draped vegetation providing little fish cover.

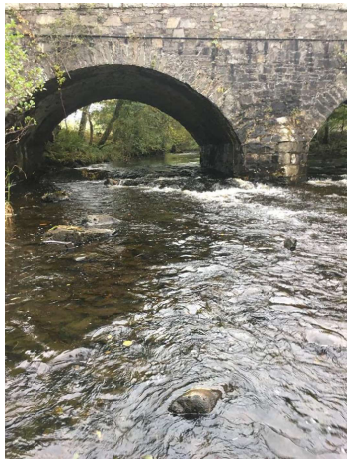

Figure 6: Polharrow Burn, looking upstream

Figure 7: Salmon fry and parr caught within site 4

Salmon fry were found in a high density (>32.0 per 100 m^2 of water) and salmon parr were found in very low densities) >1.0 per 100 m^2. Trout fry were found in very low densities (>4.0 per 100 m^2 of water) and no parr were found within the site.

- *Site 5: Unnamed burn*

This unnamed burn is a tributary of the Dee. This small watercourse has a steep waterfall between the Dee and the electrofishing site. The fall would be problematic for salmon or trout to ascend. An area of 43.5 m^2 was electrofished with an average wetted width of 1.5 m. Instream cover was classified as 'moderate' standard. Under medium flow, 100% of the site was recorded as less than 20 cm deep, with 70% being less than 10 cm deep. Substrates were a mixture of bedrock (45%), cobbles (20%), pebbles (20%) gravel (10%) and boulders (5%). Flow types recorded were also varied, and the small change of gradient recorded through the site produced a dominance of faster flows (65% run/riffle types) and the rest was shallow glide. Decent bankside cover was available on both banks consisting of mostly draped vegetation and some undercut areas. There was very little canopy cover which was provided by one large oak tree at the top of the site. It was noted upon accessing the site that there is an impassable fish barrier just downstream of the site. A steep bedrock waterfall would be expected to stop migratory fish from accessing the site.

No fish species were present at this site.

Figure 8: Unnamed tributary of the River Dee, looking upstream

- *Site 6: Coom Burn*

Instream habitat of this burn was considered poor for parr sized fish. The area electrofished was 73.2 m^2. Under the low flow conditions, 50% of the channel was recorded at <10 cm deep and the other 50% was between 10 - 20 cm deep. The average width of the burn was 5.6 m. Instream substrate was an even distribution of 40% pebble, 40% cobble with small areas of gravel and sand. Substrates were noted as being stable, uncompacted and not silted with some spawning opportunities. The flow was noted as predominantly run (95%) with a small area of shallow glide at the top of the site. Bankside fish cover was limited with only small areas of root cover on each bankside and one undercut area on the left hand bank (looking downstream). There is 100% canopy cover provided by trees on both banks. The burn showed signs that it had historically been dredged with a straight and uniform channel, and flood banks on either side of the water.

Figure 9: Coom Burn, looking upstream

Salmon fry were present in a moderate density (>19.12 per 100 m^2 of water) however salmon parr were only recorded in a very low density (>1.37 per 100 m^2 of water). Five crayfish were caught within the site.

Figure 10: Salmon and trout fry and a salmon parr

North American signal crayfish of varying sizes were caught within this site which points

at a well-established, reproducing population within the burn.

Figure 11: Some of the crayfish caught in site 6

- *Site 7: Craigshinnie Burn*

Site 7 is situated on the Craigshinnie Burn, just downstream of opposite footpath, 70 m upstream of junction with the tributary.

Instream cover for fish was recorded as being of excellent standard due to the availability of cover created by large substrates instream. Wetted width averaged 3.8 m with an area of 62.4 m^2 being covered during the survey. Water depths were recorded up to 50 cm deep, with most water (55%) being between 21 and 30 cm deep. Water flows were characterised by smooth glide (45%) and run (30%) with some areas of riffle, shallow pool (10% combined) and some torrential flows (5%). The majority of substrates were recorded as pebble and cobble (80%), with some boulders (15%) and small pockets of gravel also present within the site. Very little bankside cover was available on the right bank with only 10% undercut cover present. The left bank provided some root cover and small areas of undercut banking. Canopy cover of 100% was provided by some alder and ash trees which shaded the site.

Figure 12: Craigshinnie Burn, looking upstream

Salmon fry and parr were absent from this site. Trout fry were present in a very high density (92.69 ± 26.47 fry per 100 m^2 of water) and trout parr were recorded in very high density (21.66 ± 8.37 per 100 m^2 of water).

One crayfish was also recorded but no other fish species were present.

Figure 13: Trout fry caught in Craigshinnie Burn

- *Site 8: Tributary of Craigshinnie Burn*

Site 8 is situated close to a small copse of trees and a public footpath.

Instream cover was of moderate standard. The wetted width averaged 1.6 m and an area of 64 m^2 was surveyed. Flows within the site were dominated by run (50%), with 20% of the site being riffle and 20% smooth glide. There were small areas of deep glide (5%) and some torrential flows were present. Depths of up to 40 cm deep were

recorded with most water lying between 11 and 30 cm deep (85%). A good range of substrate sizes were present within the site; the majority being cobbles and pebbles (together 60%), with some gravel and boulders also recorded. There were also significant areas of bedrock throughout the site. A high level of bankside cover was available for fish in the form of draped bankside vegetation and undercut banksides along both banks. No canopy cover shaded the site.

Figure 14: Tributary of Craigshinnie Burn, looking downstream

Juvenile salmon were absent from this site. A very low density of trout fry (>1.56 per 100 m^2 of water) was recorded here alongside a low density of trout parr (4.69 per 100 m^2 of water). No other fish species were found at this site.

Figure 15: Trout fry and parr caught within site 8

- *Site 9: Tributary of Knocknairing Burn*

Site 9 is situated 150 m upstream of dyke along the road from where the ground flattens out. Further upstream for 24 m.

Instream habitats at site 9 were considered to be of good standard. Wetted width averaged 0.9 m and an area of 21.8 m^2 was surveyed. Instream substrates at this site were dominated by pebbles (55%) and cobbles (30%), with boulders (10%) and some gravel also recorded. Flows were dominated by run (50%) with some shallow and deep glide and riffle also recorded. The majority of water depths were under 10 cm deep (90%), with some water lying between 11 and 20 cm deep (10%). It was noted that there was quite a strong gradient throughout the site. There is a moderate level of bankside cover available (50% on each bank). This was in the form of draped bankside vegetation (bog myrtle) and undercut banksides along both banks. No canopy cover was present shading the site.

No fish were found at this site.

Figure 16: Tributary of Knocknairling Burn, looking upstream

- *Site 10: Knocknairling Burn*

Site 10 is situated just upstream of single standing alder at the edge of the old forestry - where there is a space in the trees.

Instream habitats in this site were considered to be of an excellent standard for parr sized fish. Wet width within the site averaged 4.8 m and the survey covered an area of 74.4 m^2 of water. Instream substrates were dominated by cobbles (50%) with the remainder of substrates composed of a boulder (20%), pebble (25%) and gravel mix. Few pockets of gravel provided limited spawning opportunities. Flows were dominated

by run (80%) but had some areas of shallow and deep glide (15% combined) and a little riffle (5%). Combined with the instream substrates, the site offered excellent quality juvenile habitats. Water depths were recorded up to 40 cm deep, with the majority of water lying between 11 and 30 cm deep (80%). A low percentage of bankside cover was available for fish in the form of draped bankside vegetation and undercut banksides. A low percentage of root cover was available on both banks also. Banksides were vegetated with old alder trees along both banks and some rowan trees and grasses. No canopy cover shaded the site.

Figure 17: Knocknairling Burn, looking upstream

Juvenile salmon were absent from this site. Trout fry and parr were both found in a moderate density; (fry >16.13 per 100 m^2 of water, parr >5.38 per 100 m^2 of water). No other species of fish were caught.

Figure 18: Trout fry and parr caught within site 10

- *Site 11: Darsalloch Burn*

Instream habitats in this site were considered to be of a good standard. The wet width within the site averaged 1.28 m and the survey covered an area of 19.2 m^2 of water. Substrates were dominated by boulders and cobbles (70% combined) with a pebble (10%), gravel (5%) and sand (15%) mix. Shallow glide (45%), run (30%) and riffle (20%) dominated the flow regime, with some deep glide and shallow pool also recorded. Water depths were recorded up to and over 50 cm deep, with the majority of water (65%) lying between 11 and 20 cm deep. Due to slightly elevated water levels at the time of survey a high level of bankside cover was available for fish in the form of draped bankside vegetation and undercut banks. Banksides were made up of mosses and boulders. A low percentage bankside cover was available with little areas of undercut banksides on both banks. 60% of the site was shaded by canopy cover and the coniferous forestry plantations were rooted approximately 10 to 15 m from the watercourse on each bank.

No fish were caught within this site.

Figure 19: Darsalloch Burn looking upstream

- *Site 12: Pultarson Burn, Black Water of Dee*

Instream habitats in this site were considered to be of a good standard. Wetted width averaged 1.9 m and an area of 59.22 m^2 was surveyed. Substrates were dominated by boulders (65%), with the remainder of substrates comprising of cobbles and pebbles (20% combined). Some areas of bedrock were found within the site also (15%). Water depths were recorded up to 40 cm deep, with the majority of water (80%) lying under 20 cm deep. The site had a good mix of flows with run covering 30% of the site, smooth glide and riffle both covering 20% each and the remaining flow split between deep pool, shallow pool and deep glide (10% each). Both banksides provided good levels of fish cover comprised of predominantly draped bankside vegetation and undercut banksides. There is some root cover on the left bank and some marginal vegetation on the right bank. Only 10% of the site was shaded by canopy cover.

No fish were caught within this site.

Figure 20: Pultarson Burn, looking upstream

- *Site 13: Mid Burn, Black Water of Dee*

Site 13 is situated upstream of a forest track, along a ride and in an open area of bracken.

Instream habitats at this site were considered to be of a moderate standard. Wetted width averaged 1.2 m and an area of 33.8 m^2 was surveyed. Substrates within this site were dominated by cobbles and boulders (together 80%), with pebbles, gravel and sand (20% combined) comprising the remainder of substrates. Water depths were recorded up to and over 40 cm deep, with the majority of water (75%) lying between 11 and 30 cm deep. Flows within the site were dominated by deep glide (50%) and run (30%) with some riffle and smooth glide (10% each) also recorded. A large amount of bankside cover was available for fish in the form of undercut banksides and draped bankside vegetation. Bankside vegetation comprised predominantly of bracken. No canopy cover shaded the site. No fish were caught within this site.

Figure 21: Mid Burn, looking upstream

- *Site 14: Acre Burn, Black Water of Dee*

Site 14 is situated downstream of a forest track.

This site provided no fish habitat and was similar to a raised bog. Very water logged grass with no water flow. It was not possible to undertake electrofishing here.

Figure 22: Acre Burn, looking downstream

- *Site 15: Unnamed tributary of Acre Burn, Black Water of Dee*

Site 15 is situated downstream of a culvert and is a turbulent area in an open section, downstream of willow trees.

Instream habitats in this site were considered to be of moderate standard. The wet width within the site averaged 1.1 m and the survey covered an area of 26.6 m^2 of water. Substrates were dominated by cobbles and boulders (70% combined) with small areas of pebbles. The remaining substrate was made up of silt and thick moss. It was considered that this watercourse potentially dries up in summer months. Shallow glide (35%) and run (30%) dominated the flow regime, with some riffle, deep glide and areas of deep pool also recorded. Water depths were recorded up to and over 50 cm deep, with the majority of water (60%) lying between 21 and 40 cm deep. High levels of bankside cover was available for fish in the form of draped bankside vegetation and undercut banks. Two small willows hang over the site creating a low level of canopy cover. The surrounding land has second rotation forestry planted on it.

No fish were present within this site.

Figure 23: Tributary of Acre Burn, looking upstream

- *Site 16: Clachrum Burn*

Site 16 is situated on the Clachrum Burn which is a tributary of the Black Water of Dee. Surrounding land use is second rotation conifer forest plantation. There was no fish habitat present and the flow runs through grass in places.

No fish were present within this site.

Figure 24: Clachrum Burn, area of burn displaying no flow within the site

- *Site 17: Black Water of Dee*

Site 17 is situated on the Black water of Dee by Slogarie Island, downstream of Stroan Loch.

Instream habitat at this site was considered to be of moderate standard. Wetted width

averaged 11.9 m with 144.8 m^2 area being covered in the survey. Cobbles dominated substrates (60%), with boulders and pebbles comprising the remainder of substrates. There were small areas of bedrock also. Flows within the site were dominated by run and riffle (together 90%) with some shallow glide and torrential water also recorded. Water depths recorded were up to 50 cm deep, with most water lying between 21 and 40 cm deep (85%). A low level of bankside cover was available for fish on the right bank in the form of draped vegetation (10%). On the left bank there was significantly more cover in the form of undercut banks and draped vegetation. Only 5% of the site was shaded by trees.

Figure 25: Black Water of Dee at site 17, looking upstream

Salmon fry were present in a very low density (>0.69 per 100 m^2 of water) however no parr were found. Trout fry were recorded in a low density (>6.22 per 100 m^2 of water), alongside a very low density of trout parr (>0.69 per 100 m^2 of water). Two crayfish were also caught within the site.

Figure 26: Trout and salmon fry caught within the site

- *Site 18: Unnamed burn, Black Water of Dee*

Instream habitats at this site were considered to be of a good standard. Wetted width averaged 1.3 m and an area of 49.01 m^2 was surveyed. Substrates within this site were dominated by cobbles (55%) and the remaining substrates were made up of pebbles (20%) and boulders (15%), with small areas of bedrock and pockets of gravel. Water depths were recorded up to and over 50 cm deep, with the majority of water (90%) lying below 40 cm deep. Flows within the site were dominated by run and smooth glide (80% combined) with some areas of riffle, deep glide and deep pools present. A good level of bankside cover was available for fish in the form of undercut banksides and draped bankside vegetation. No canopy cover shaded the site.

No fish were found within this site.

Figure 27: Unnamed burn at site 18, looking upstream

- *Site 19: Kennick Burn*

Site 19 is situated on Kennick Burn, downstream of the picnic area.

Instream habitats were considered to be of a good standard at this site. Wetted width averaged 4.5 m and an area of 67.6 m^2 was surveyed. Cobbles and pebbles together dominated substrates within this site (70%) with some boulders (15%), and gravel (15%) also recorded. A range of flow types were recorded but a shallow glide and run regime (together 80%) dominated. The remainder of flows were characterised by riffle and deep pool. Water depths of up to 40 cm deep were recorded, with the majority of water (80%) lying between 11 and 30 cm deep. Only a moderate level of bankside cover was available for fish, comprised primarily of undercut banksides and draped bankside vegetation with some root and rock cover available. 80% of the site was shaded by mature conifers.

Figure 28: Kennick Burn, looking upstream

Salmon fry and parr were absent from this site.

Trout fry were recorded in a moderate density (>17.77 per 100 m^2 of water) alongside a high density of trout parr (>8.88 per 100 m^2 of water).

Figure 29: Trout fry and parr from site 19

No non-salmonid fish species were recorded in this site.

- *Site 20: Camelon Burn, Black Water of Dee*

Site 20 was situated on Camelon Burn within the Black Water of Dee catchment.

Instream habitats at this site were considered to be of a poor standard. Wetted width averaged 1.2 m and an area of 26.4 m^2 was surveyed. Substrates were dominated by sand (70%), with some areas of gravel and pebbles (30% combined). Water depths were recorded up to and over 50 cm deep, with the majority of water (80%) lying between 21 and 50 cm deep. Flows within the site were deep glide (50%) and smooth glide (50%). Moderate bankside cover was present along the left bank however a low level of cover was present along the left bank in the form of undercut banks and overhanging vegetation. 80% canopy cover directly shaded the site although the site was not classed as being over-shaded.

No salmonids were present at this site. One three-spined stickleback was found within the site.

Figure 30: Camelon Burn, looking upstream

- *Site 21: Outlet of Bargratton Loch*

Site 21 was situated 100 m downstream of the Bargratton Loch outflow and began at a watergate. Instream cover was classified as moderate and made up primarily of vegetation. Wetted width averaged 1.3 m and an area of 15.8 m^2 was surveyed. Instream substrates at this site were entirely made up of peat. Flows were dominated by deep glide (95%) with areas of run also recorded (5%). The majority of water depths were between 31 and 40 cm deep (95%) with some areas of shallower water present. There was a very high level of bankside cover available (95% on each bank) in the form of draped bankside vegetation. 20% of the site was shaded by overhanging trees and vegetation.

No fish were present at this site.

Figure 31: Outlet of Bargratton Loch, looking upstream

- *Site 22: Unnamed burn, Dee*

Site 22 is situated across fields under an existing pylon.

This site held no instream habitat suitable for parr sized fish. The area electrofished was 20.4 m^2. Under the low flow conditions, 100% of the channel was recorded at <10 cm deep. The average width of the burn was 0.8 m. Instream substrate was entirely composed of silt with 100% instream vegetation. The flow was noted as a mix of smooth glide (50%) and run (50%). There was 100% bankside fish cover made up entirely of marginal vegetation and there was no canopy cover available.

There were no fish present at this site.

Figure 32: Unnamed burn, Dee catchment

- *Site 23: Unnamed burn, Dee*

Site 23 was located parallel to the road past Argrennan Mains.

This site held no instream habitat for parr sized fish and was classed as a ditch. Substrates were made up of 100% silt and the flow regime was a combination of smooth glide (70%) and run (30%). Under the low flow conditions, 90% of the channel was recorded at <10 cm deep. There was 100% fish cover available on the left bank provided by marginal rooted vegetation however the right bank had no fish cover. 60% of the site was shaded by an ash and a hawthorn hedge.

No fish were present within this site.

Figure 33: Unnamed burn, Dee catchment

Table 3: Results from the 2017 electrofishing survey for Kendoon – Tongland OHL Project -"*where only the number appears, a Zippin estimation could not be carried out. In these cases the number represents a minimum estimate of fish density per 100 m^2). Traffic light colour coding represents sensitivity of sites, with red indicating fish are present and thus sensitive and green showing no fish were present).*

Site Code	Watercourse	Site Location	Grid Ref	Survey Date	Presence Of Other Species	Area Fished (m²)	Density per 100m² *				Sensitivity
							Salmon Fry (0+)	Salmon Parr (1+ and older)	Trout Fry (0+)	Trout Parr (1+ and older)	
1	Water of Ken	Bouldery riffle 10 m d/s footbridge, u/s from junction.	260376 587621	10/10	Loach x 5 Minnow x 1	119.1	0	0	>7.56	>0.84	Fish
2	Unnamed burn	D/s of A701, between two large over hanging trees, d/s of small bridge.	260404 586210	27/09	None	14.5	0	0	0	0	No Fish
3	Water of Ken	D/s of dam.	260543 584951	27/09	Minnow x 5 Loach x 3	335.4	0	0	>0.30	0	Fish
4	Polharrow Burn	D/s of road bridge, from bend to falls.	260331 584344	27/09	Loach x 3	100	34.72 ± 6.11	>1.0	>4.0	0	Fish
5	Unnamed burn	U/s of gate at top of rocky road, u/s of A701.	260734 583000	27/09	None	43.5	0	0	0	0	No Fish
6	Coom Burn	Along footpath, five minute walk from bridge.	260904 580587	27/09	None	73.2	>19.12	>1.37	>1.37	0	Fish
7	Craigshinnie Burn	D/s of opposite footpath, 70 m u/s of junction with tributary.	260345 579553	27/09	None	62.4	0	0	92.69 ± 26.47	21.66 ± 8.37	Fish
8	Tributary of Craigshinnie Burn	Close to small copse of trees and public footpath.	260388 579413	27/09	None	64	0	0	>1.56	>4.69	Fish
9	Tributary of Knocknairling Burn	150 m u/s of dyke along road, from where ground flattens out, u/s for 24 m.	261310 577626	27/09	None	21.78	0	0	0	0	No Fish
10	Knocknairling Burn	U/s of single standing alder at edge of old forestry- space in trees.	261373 577352	27/09	None	74.4	0	0	>16.13	>5.38	Fish
11	Darsalloch Burn	In mature forest, not far from forest ride, d/s of forest track.	260687 576414	04/10	None	19.2	0	0	0	0	No Fish
12	Pultarson Burn	Adjacent to forest and dry stone dyke.	261033 575303	04/10	None	59.22	0	0	0	0	No Fish
13	Mid Burn	U/s of forest track, along ride and in open area of bracken.	261781 573225	04/10	None	33.88	0	0	0	0	No Fish
14	Acre Burn	D/s of forest track. Not a proper burn, marshy area.	262903 571995	04/10	None	N/A	0	0	0	0	No Fish
15	Acre Burn un-named tributary	D/s of culvert and turbulent area, in open section, d/s of willows.	263225 571779	04/10	None	26.6	0	0	0	0	No Fish
16	Clachrum Burn	D/s of forest track, adjacent to dry stone dyke.	264450 571020	10/10	None	N/A	0	0	0	0	No Fish
17	Blackwater of Dee	D/s of Stroan Loch, tail end of Slogarie Island.	265373 569189	10/10	None	144.8	>0.69	0	>6.22	>0.69	Fish
18	Unnamed burn (runs past slogarie)	U/s of watergate, adjacent to forest	264648 567243	10/10	None	49.01	0	0	0	0	No Fish
19	Kennick Burn	D/s of picnic area.	266137 565137	12/10	None	67.6	0	0	>17.77	>8.88	Fish
20	Camelon Burn	Top of wood.	267705 563295	13/10	1 x 3 Spined stickleback	26.4	0	0	0	0	Non-salmonids fish present
21	Outlet of Bargratten Loch	U/s of watergate, 100 m d/s of loch.	268863 561925	04/10	None	15.8	0	0	0	0	No Fish
22	Unnamed burn	Across fields, under existing pylon.	270080 557640	13/10	None	20.4	0	0	0	0	No Fish
23	Unnamed burn	Parallel to road past Argrennan Mains.	269865 556698	13/10	None	10	0	0	0	0	No Fish

4.1.3 Site sensitivity results

Tables 5 and 6 show each site and group them into similar sensitivity ratings.

A total of 13 of the sites surveyed were classified as being ‘green’.

One site was classified as being ‘amber’.

A total of 10 sites which were surveyed were classified as being ‘red’.

Table 5: Showing all sites within survey rated very or moderately sensitive

Site Code	Watercourse	Grid Reference	Sensitivity	Species Found
1	Water of Ken	260376 587621	Fish	Salmonids Stone Loach Minnow
3	Water of Ken	260543 584951	Fish	Salmonids
4	Polharrow Burn	260331 584344	Fish	Salmonids, Stoneloach
6	Coom Burn	260904 580587	Fish	Salmonids; Crayfish
7	Craigshinnie Burn	260345 579553	Fish	Salmonids; Crayfish
8	Tributary of Craigshinnie Burn	260388 579413	Fish	Trout
10	Knocknairling Burn	261373 577352	Fish	Salmonids
17	Black Water of Dee	265373 569189	Fish	Salmonids, Crayfish
19	Kennick Burn	266137 565137	Fish	Salmonids
20	Camelon Burn	267705 563295	Non-salmonids only present	Three spined stickleback

Table 6: Showing all sites within survey which were considered to have a low sensitivity rating

Site Code	Watercourse	Grid Reference	Sensitivity
2	Unnamed burn	260404 586210	**No Fish**
5	Unnamed burn	260734 583000	**No Fish**
9	Tributary of Knocknairling Burn	261310 577626	**No Fish**
11	Darsalloch Burn	260687 576414	**No Fish**
12	Pultarson Burn	261033 575303	**No Fish**
13	Mid Burn	261781 573225	**No Fish**
14	Acre Burn	262903 571995	**No Fish**
15	Acre Burn unnamed tributary	263225 571779	**No Fish**
16	Clachrum Burn	264450 571020	**No Fish**
18	Unnamed burn (runs past Slogarie)	264648 567243	**No Fish**
21	Outlet of Bargratten Loch	268863 561925	**No Fish**
22	Un-named burn	270080 557640	**No Fish**
23	Un-named burn	269865 556698	**No Fish**

5 CONCLUSIONS OF SURVEY

A total of 23 watercourses along the route of the new overhead line (OHL) were identified, from a desk top study, as potentially supporting fish populations. It was considered important to know whether these watercourses supported fish populations or not. If they do then they would need to be considered as 'sensitive' due to the potential for the OHL works to impact on these fish and their habitats. The data collected during these fish surveys both informs the project design to ensure adequate mitigation measures can be put into place and also provides baseline survey data to allow future monitoring to be compared to.

The electrofishing surveys found that 13 of the watercourses surveyed were classified as having 'green' sensitivity, i.e. did not support fish in the vicinity of the OHL works, and thus were not considered to be sensitive for fisheries (Table 6).

The other 10 sites (Table 5) were found to be supporting fish populations and thus were considered sensitive from a fisheries point of view. One site was considered as 'amber' sensitivity as it was found to support a low population of three-spined sticklebacks. This species is not protected, does not support fisheries and is relatively tolerant to pollution.

Nine sites were described as 'red' sensitivity due to their fish populations. In these watercourses it is important to ensure that their fish populations, habitats and water quality are protected during the OHL works. Trout were found at all nine sites. Juvenile Atlantic salmon were also found at three of the sites. The presence of juvenile salmonids (trout and / or salmon) are of particular interest. These species are important as they support fisheries within the catchment and are covered by a range of legislation and Directives. The River Dee Atlantic salmon population has been categorised by the Scottish Government and Marine Scotland as a '3' which means that there are concerns that fish numbers are low and measures are required to protect stocks until they recover to sustainable numbers. On category 3 rivers anglers are not allowed to kill any adult salmon they catch. Any mortality of juvenile salmon would reduce the number of return adult salmon in future years.

Stone loach and minnows were found at some of the sites too.

Three of the sites were also found to contain North American signal crayfish. This is an invasive non-native species of great concern due to their impacts on native biodiversity and economic damage. It will be important to ensure that there is no risk of spreading Signal crayfish from these sites to other watercourses during the OHL works.

The electrofishing survey has identified the watercourses which support fish populations in the vicinity of the OHL works. It is important to consider potential impacts which the nearby works could have on these sensitive environments. It has been reported that no instream works will take place on any watercourses during the OHL works including new culverts or culvert replacement. This will help to reduce some of the potential risks. Section 6 of this report highlights some of the potential effects that the OHL could have on surrounding sensitive watercourses and discusses general mitigation. It is important to note that GFT have not been provided with detailed proposed method statements regarding how work will be undertaken or seen the planned road access network when compiling this report.

All watercourses which have an Amber or Red sensitivity rating for their fish populations should be monitored 'during construction' and 'post construction' of the OHL. This is standard practice for large scale construction works and allows any problems to be identified quickly and further mitigation put into place if required.

6 POTENTIAL EFFECTS AND MITIGATION RECOMMENDATIONS

6.1 Magnitude of potential effects

The magnitude of potential effects on the fish populations during construction works can be wide ranging (see Table 7). For example, in the worst-case scenario, large scale mortality to fish populations can be caused or important instream habitat, such as spawning gravels, irreversibly damaged. Fish movement may also be disturbed and this may have the effect of limiting the full use of available habitat or their health may be affected. Some effects may influence fish populations to limit their feeding times, indirectly encourage them to move downstream into already overpopulated areas, or cause areas of spawning habitat to become unused. However, effects such as disturbance may only be short term. It is unlikely, as long as adequate mitigation measures are in place, that the proposed OHL works should impact significantly on the surrounding fish populations or their habitats.

Table 7: Magnitude of potential effects on fish populations

Magnitude of Potential Effects	Definition
High	Direct mortality of fish species including the egg stage. Total loss of food resource. Irreversible damage to instream/riparian habitats, in particular, salmonid spawning areas. Blocking migratory fish movements. Long-term displacement of fish populations.
Moderate	Reduction in level of food resource. Limited damage to instream/riparian habitats. Hindering migratory fish movements. Short-term displacement of fish populations. Changes to hydrology.
Low	Detectable but minor, short-term changes to fish populations, water quality and instream habitat. Water quality standards reduced slightly but not enough to impact upon fish populations present.
Negligible	Unquantifiable change to fish populations, water quality or instream habitat.

The most significant potential impacts are discussed briefly below:

6.1.1 Elevated levels of suspended silt

The construction and use of the required new road network, upgrading of existing roads and the construction of pylon bases will require earth moving works. These works will result in areas of disturbed ground and spoil heaps which will lack a layer of protective stabilising vegetation and thus, could easily be washed into surrounding watercourses. Therefore, the main potential impact to the freshwater environment from these works will be raised levels of suspended silt within the water column.

The effect of this increased silt on fisheries can be extremely damaging. Direct effects on fish include, in the worst cases, respiration problems due to clogged gill rakers / gill filaments. The settlement of fine sediments on spawning gravels can reduce water flow and thus oxygen transfer to egg and alevin life stages of salmonids whilst they are buried in 'redds' (typically September – March). Spawning beds can be damaged by siltation at any time of year as gravels may become 'cemented' by the settling fine particles, causing problems when fish try to spawn the following autumn. In addition, raised turbidity levels may affect fish feeding through them not being able to see food items, mortality of the

aquatic invertebrate population, reduced productivity and modifying substrate habitat by an infilling of the smaller voids used for shelter by small fish and aquatic invertebrates.

The most sensitive time of year for salmonids is between September and May. Spawning of trout may start as early as late September, with salmon starting roughly a month later but they may go on until early January. The eggs will develop in constructed 'redds' until they hatch as alevins. The alevins will remain hidden in the gravel, gaining nourishment from their yolk sac, until they swim up into the overhead water column between February and May, depending on water temperatures. The downstream migration of salmon and sea trout smolts will take place roughly between April and May annually and great care must be taken not to damage or hinder these important fish.

Adequate silt control measures will be required when works take place close to sensitive watercourses. Management of dirty water leaving access routes and work sites must be considered carefully to ensure it cannot enter directly into watercourses, even during heavy rainfall. Works which potentially could cause siltation issues into salmon and trout supporting watercourses should avoided salmonid spawning times e.g. September to May.

6.1.2 Hindering fish access

When building any crossing point over a watercourse it is important to ensure free passage to fish both in an upstream and downstream direction (interfering with the free passage of migratory salmonids is illegal (Salmon (Fish Passes and Screens) (Scotland) Regulations 1994)). Some fish species (including salmon and trout) undertake migration as an essential part of the lifecycle. It has been reported that no new crossing points are planned during the OHL project so this potential impact will not be considered further. If any crossing points, particularly culverts, do need to be replaced during the OHL project then it is important to discuss these with fisheries experts and SEPA prior to their construction.

6.1.3 Water pollution

When any substantial work programme is being undertaken with mechanical equipment near a watercourse, there is always the risk of pollution of nearby watercourses. In particular, oil and fuel, either leaking from faulty or damaged equipment or spillage during refueling can enter watercourses and cause problems such as fish kills. These potential issues can be addressed by fuelling away from watercourses, having oil containment booms on site, and ensure adequate maintenance and checks of equipment is undertaken.

6.1.4 Spread of invasive non-native species

As North American signal crayfish have been identified as being present in some of the watercourses along the OHL route it will be necessary to ensure a high standard of biosecurity is followed by all contractors working on site. If no instream works are undertaken then this will minimise the potential risks. GFT advise that a specific biosecurity plan is compiled for all works close to water courses containing North American signal crayfish to advise on identifying them and to consider potential risks and how to address them.

6.1.5 Forest harvesting

It is not clear how much forest felling is required for the OHL works but conifer felling may cause water quality problems.

It is recognised that the short-term release of nitrate that can follow the large-scale harvesting at some forest sites may pose an additional acidification threat within acid sensitive areas. Some parts of the Dee catchment are considered as suffering from surface

water acidification including the Black Water of Dee. The Forests and Water Guidelines Fourth Edition (2003) provides information (using a decision tree) on whether the forestry authorities require a site impact assessment before issuing a felling licence. Research suggests that effects of harvesting on stream acidity is hard to notice if 20% or less of a catchment is felled over a three year period.

Large scale harvesting operations may also cause significant siltation problems in surrounding watercourses. Again the Forests and Water Guidelines provide usual advice regarding requirements during forestry operations to minimise silt losses.

APPENDIX 1: LOCATION OF ELECTROFISHING SITES