

# Hill of Fare Wind Farm

## Technical Appendix 8.4

### Fish Study

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**Author** Wildlife Consulting

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**Ref**

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# **WLC 23043 Hill of Fare**

## **Fish Habitat Survey**

21/08/2023

Prepared By:



Wildlife Consulting Ltd | Ecology | Environmental Consultancy

Company Number: SC620396

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# 1 Introduction

## 1.1 Background

WildLife Consulting was commissioned by ITP Energised on behalf of their client RES. It presents detailed methodologies and results of desk studies and field surveys completed on 21<sup>st</sup> and 22<sup>nd</sup> June, 2023 to establish baseline conditions with regards to fisheries. In addition, opportunities for enhancements for fish fauna are also considered.

It is accompanied by Figure 1 which illustrates the location of the site, the fish habitat survey area and the locations of watercourses and sample points.

The following species of conservation significance are considered in this report:

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

## 1.2 Site Overview

The term 'site' in this report refers to the land within the red line application boundary as illustrated on Figure 1.

The site lies approximately 3km east of the village of Torphins in Aberdeenshire. The site largely comprises a mix of open moorland habitats, with smaller areas of conifer plantation.

A number of watercourses tribute through the site and eventually into the River Dee Special Area of Conservation (SAC) to the south of the site. In the north of the site lies the headwaters of the Gormack Burn and three minor watercourses and their feeder headwaters. The locations of all watercourses subject to fish habitat survey (FHS) are illustrated on Figure 1.

## 2 Desk Study

### 2.1 Methodology

A desk study was undertaken in 2023 to identify any classified waterbodies and existing fisheries records within the Site and surrounding area.

The following key sources were consulted:

- NatureScot's Site Link Website <https://sitelink.nature.scot/site/8363>;
- SEPA's River Basin Management Plan (<https://www.sepa.org.uk/data-visualisation/water-environment-hub>);
- JNCC's distribution of the Freshwater Pearl Mussel (<https://sac.jncc.gov.uk/species/S1029/>); and
- Dee District Salmon Fishery Board & River Dee Trust - River Dee 2020 – 2025 Fisheries Management Plan.

### 2.2 Results

The River Dee SAC lies 2.5km from the site boundary at its closest point and is designated on account of its Atlantic salmon *Salmo salar*, freshwater pearl mussel *Margaritifera margaritifera* and otter *Lutra lutra* populations.

The SAC Atlantic salmon population is assessed by NatureScot as currently 'Favourable Maintained', with freshwater pearl mussel assessed as 'Unfavourable No Change' and otter assessed as 'Favourable Declining'

The European Water Framework Directive (WFD) requires that surface waterbodies in member states are classified according to ecological status. SEPA's River Basin Management Plan website (<https://www.sepa.org.uk/data-visualisation/water-environment-hub>) confirms there are three classified watercourses within the survey area.

## 3 Field Survey

### 3.1 Methodology

A Fish Habitat Survey was completed on 21<sup>st</sup> and 22<sup>nd</sup> June, 2023. The survey was undertaken by Colin Nisbet. Colin is a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and is fully trained on Fish Habitat Survey as part of his Level 3 Management of Electrofishing Operations qualification as accredited by the Scottish Fisheries Coordination Centre (SFCC). He has been undertaking Fish Habitat Surveys for 17 years.

The survey area comprised sections of each watercourse within a 100m of the footprint of the development.

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

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

The watercourses within the site were systematically walked (including in-stream inspections where required) and the habitats mapped according to the classifications presented in Table 2.1 below.

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

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

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

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

Table 3-1: Fish river habitat classifications.

Cat.	Habitat Type	Description	Species Suitability
<b>1</b> <b>1a</b> <b>1b</b> <b>1c</b>	<b>Unsuitable</b> <b>Steep &gt; 10% gradient</b> <b>6-10% gradient</b> <b>Other – ephemeral, shallow drains, dry beds</b>	Usually 1 <sup>st</sup> – 2 <sup>nd</sup> order watercourses with steep gradient, ≥6% slopes (often substantially greater), abundant bedrock, lack of fixed substrates, high velocity ( <i>e.g.</i> headwaters/rivulets). Also includes less steep ephemeral stretches ( <i>e.g.</i> headwater sources), shallow drains and modified watercourses with dry beds.	No productive fish habitat, although some species may migrate through these areas (also refer to 7. Rapids) depending on whether they represent a migration barrier.
<b>2</b> <b>2a</b> <b>2b</b>	<b>Spawning Habitat</b> <b>Salmonids</b> <b>Lamprey</b>	Stable “gravels” of minimum 15-30 cm depth, optimal 20-30 mm, not compacted or with excessive silt/sands (<20% by weight) for salmonids. Lamprey spawning habitat where “gravels” include sands. Often at tail end of pools or upstream ends of riffle-runs ensuring oxygenated substrate. Can also be found at end of weir pools.	Spawning habitat - Atlantic salmon ( <i>c.</i> 9 m <sup>2</sup> per pair) and sea/brown trout; lamprey.
<b>3</b>	<b>Riffle</b>	Shallow (< 20 cm) and fast flowing, with upstream-facing wavelets which are unbroken (although often some broken water), with substrate dominated by gravel and cobbles.	Fry (0+) habitat – Atlantic salmon/ brown trout/sea trout.
<b>4</b> <b>4a</b> <b>4b</b>	<b>Run</b> <b>Shallow (&lt; 0.5 m deep)</b> <b>Deep (&gt;0.5 m deep)</b>	Generally deeper (20-40 cm) and less steep bed compared to riffle, with substrate of boulders, cobbles and gravels. Usually disturbed, rippled surface. Often located immediately downstream of riffle.	Mixed salmonid juvenile habitat. Fry (0+) & Par (1+) habitat - Atlantic salmon/ brown trout/sea trout.
<b>5</b> <b>5a</b> <b>5b</b>	<b>Glide</b> <b>Shallow (&lt;0.5 m deep)</b> <b>Deep (&gt; 0.5 m deep)</b>	Shallow gradient stretches with smooth laminar flow with little surface turbulence and generally > 30 cm deep; water flow is silent. Often located below pool.	European eel; non-productive salmonid habitat, although may provide some shelter for adults.
<b>6</b> <b>6a</b> <b>6b</b> <b>6c</b>	<b>Pool</b> <b>Plunge/Scour pool</b> <b>Meander pool</b> <b>Weir/bridge pool</b>	No perceptible flow, eddying and usually > 100 cm deep. Substrate with high proportion of sand and silts. Often located on the outside of meanders, but includes natural scour or plunge pools and artificial weir pools.	Adult refugia Atlantic salmon, sea/brown trout, European eel.
<b>7</b> <b>7a</b> <b>7b</b> <b>7c</b>	<b>Rapids</b> <b>Steep - &gt;10% gradient</b> <b>Moderate - 6-10% gradient</b> <b>Low - &lt;6% gradient</b>	Sections of relatively steep gradient with fast currents and turbulence, with mixed flow types, including free-fall, chutes and broken, with obstructions such as large boulders, rock outcrops and falls.	Negative feature for migratory species and may pose a migratory barrier; elvers and eels limited to velocity of <0.5 m/sec and 2.0 m/sec respectively; lamprey to 2 m/sec.
<b>8</b> <b>8a</b> <b>8b</b>	<b>Banks of fine sediment of silts and sands</b> <b>Optimal</b> <b>Sub-optimal</b>	Limited flow (sometimes back-flow) allowing deposition of silts/sands, not anoxic, with/without riparian trees. Optimal habitat is stable fine sediment and sand ≥15 cm deep with some organic detritus. Sub-optimal habitat includes small areas of deposited silts/sands behind boulders.	Lamprey ammocoete nursery and adult refuge.
<b>9</b> <b>9a</b> <b>9b</b> <b>9c</b> <b>9d</b> <b>9e</b>	<b>Vegetation features</b> <b>Riparian trees (tunnel)</b> <b>Flow constriction</b> <b>Aquatic macrophytes</b> <b>Emergent</b>	Closed woodland canopy forming tunnel vegetation.  In-stream emergent, boulders.  Stands of aquatic and floating vegetation.  Stands of emergent (usually marginal) vegetation.	Tunnel riparian trees may be negative feature for salmonids, although tree roots and fallen trees may provide refugia for Atlantic salmon/ brown trout/sea trout and European eel.  Aquatics/emergents provide cover for fish, particularly juveniles.

Cat.	Habitat Type	Description	Species Suitability
	<b>macrophytes Large woody debris</b>	LWD forming dams, etc.	
<b>10</b>	<b>Obstructions to migration</b>	Impassable waterfalls, rapids, flow constrictions, weirs, bridge sills, culverts, shallow braided river sections, pollution preventing upstream migration.	All migratory species; impassability varies between species. Leaping ability: <3.7 m Atlantic salmon; <1.81 m trout; European eel and lamprey none.
<b>11</b> <b>11a</b> <b>11b</b> <b>11c</b>	<b>Other features</b> <b>Side channel</b> <b>Backwater</b> <b>Artificial channel</b>	Includes other channel features, with side channel (connected to main channel) and backwaters. Artificial channels may comprise either man-made banks and/or beds.	Side channel/backwater often important refugia for juveniles. Artificial channels have limited diversity and are often non-productive fish habitat.

## 3.2 Results

Environmental data from all surveyed sample points (1a-8e) including channel dimensions, gradient and substrate composition, are presented on Annex 1. Photographs from the sample points are given in Annex 2.

### 3.2.1 W1- The Landerberry Burn – Sample Point 1a

Watercourse W1 is the Landerberry Burn. The Landerberry Burn is an unclassified watercourse, which tributates through the site in an easterly direction.

Watercourse W1 lies on a shallow to moderate gradient. The watercourse has numerous blockages present resulting from large woody debris from recent felling operations, which presents a barrier to migratory fish.

The substrates present in W1 contain elements of finer stone (pebble and sandy gravels), which are suitable for young salmonids. However, given the presence of woody debris, it is considered that in its present condition, the watercourse is unlikely to support migratory fish and may support small numbers of non-migratory fish only.

### 3.2.2 W2 – Unnamed Watercourse – Sample Point 2a

This watercourse has been subject to modification (straightening) in the past and also acts as a field boundary feature. It flows down a shallow to moderate slope and contains a range of substrates of varying proportions, over which runs a run/riffle flow. The presence of any downstream barriers is unknown, but it appears to be suitable for supporting low numbers of migratory and non-migratory fish fauna.

### 3.2.3 W3 – Unnamed watercourse – Sample Points 3a and 3b

These are essentially shallow, peaty headwaters, with a channel that is often indistinct and considered to be ephemeral in nature. This watercourse is of negligible value for fish fauna.

### 3.2.4 W4 – Gormack Burn – Sample Points 4a-4e

The Gormack Burn is a SEPA classified watercourse, which is currently assessed as being of 'Bad' overall quality resulting from past modifications from urban and rural in management practices.

The tributaries of the Gormack Burn are largely typical of upland headwaters and are likely ephemeral in nature. They are dominated by peat substrates within the channel and lie over steep gradients. These tributaries are considered to be of limited suitability for fish fauna.

### 3.2.5 Headwater of Cluny Burn Upper Catchment – Sample Point 5a

The Cluny Burn Upper Catchment is a SEPA classified watercourse, which is most recently assessed as having an overall condition of 'Poor' quality, with diffuse pollution (from agricultural run-off) cited as the key negative pressure affecting this watercourse.



The section of the Cluny Burn Upper Catchment that lies within the survey area comprises a short section of a single peaty headwater, that lies within a steep gradient. This section of this watercourse is considered to be of negligible suitability for fish fauna.

### *3.2.6 Headwaters of the Blacklinn Burn – Sample Points 6a and 6b*

Sample points 6a and 6b were taken on two headwaters of the Blacklinn Burn, which form within the western extent of the site. Both of these headwaters are unclassified.

These watercourses are both shallow, peaty headwaters, which flow down steep terrain within the survey area. The section of these watercourse that lie within the survey area are considered to be of negligible suitability for fish fauna.

### *3.2.7 Headwater of the Burn of Cluny – Sample point 7a*

This headwater of the Burn of Cluny originates at the southern extent of the 100m buffer zone outwith the south of the site. It is not a classified watercourse and has been subject to reprofiling (straightening) in the past. The small section of this watercourse that lies within the survey area has a mixture of substrate types within the channel ranging from boulder, cobble and pebble, to peat. The small section that lies within the survey area, flows down moderately steep terrain (6-10% gradient), which in with its minor nature, reduces its suitability for fish fauna. Having said that, it is possible that small numbers of fish are present.

### *3.2.8 Burn of Corrichie and Headwaters – Sample Points 8a-8e*

The Burn of Corrichie is a SEPA classified watercourse which has an overall status of 'Good' and is assessed as having 'High' access for fish migration.

The tributaries covered by sample points 8a and 8b of the Burn of Corrichie that lie within the survey area are dominated by peat substrates. The tributary covered by sample point 8a is slightly more substantial and may support small numbers of non-migratory fish (migratory fish are unlikely due to the presence of woody debris recorded further downstream). The tributary covered by Sample Point 8b very minor and likely to be ephemeral in nature.

The tributaries covered by Sample Point 8d and the main stem of the Burn of Corrichie (Sample Points 8c and 8e typically more substantial, but are still of a minor nature. They flow over shallow gradients (around 2-4%) within the survey area and there are a range of substrates present within the channels. They are considered to be suitable for small numbers of fish fauna, although their suitability for supporting migratory fish is hampered by the presence of woody debris in some areas, likely resulting in barrier effects to migration.

## 4 Summary and Opportunities for enhancement

The watercourses within the site either drain to the south eventually into the River Dee catchment, or to the north into minor watercourses and the headwaters of the Gormack Burn. The River Dee SAC lies 2.5km from the site boundary at its closest point. There are three SEPA classified watercourses that lie within the survey area (upper reaches of classified sections only in all three instances). The Cluny Burn Upper Catchment ('Poor' overall quality), The Gormack Burn ('Bad' overall quality) and Burn of Corrichie ('Good' overall quality). All three SEPA classified watercourses are considered to have 'High' access for fish migration at the wider level, but at the site level the Burn of Corrichie is adversely affected by barriers from woody debris, as is the unclassified Landerberry Burn. The steep terrain is also a limiting factor on some of the watercourses for fish migration suitability, as are the minor peaty headwaters that comprise much of the reaches of the sections of the watercourses within the survey area. Having said that there is connectivity to the SAC from the southern site watercourses and control of surface water run-off will therefore be especially important at this site.

Specific freshwater pearl mussel surveys have not been undertaken and no freshwater pearl mussels were recorded during the survey. Habitat for this species (fast flowing sections over gravel beds) is also very limited within the survey area.

Among impacts to fish fauna identified in Dee District Salmon Fishery Board & River Dee Trust Fisheries Management Plan, those considered to be particularly relevant at the site level is the presence of woody debris from commercial felling and riparian habitat management – where much of the bankside habitat is devoid of trees, with much of the survey area resulting a lack of cover for fish fauna.

It is advised the Habitat Management Plan (HMP) for the project includes target areas for new riparian habitat management and consultation with the Dee District Salmon Fishery Board & River Dee Trust and landowner should also consider suitable locations for new riparian planting, to provide areas of bankside cover, but not overshadowing. This would be best provided by planting of local broadleaved species of local provenance, such as oak *Quercus* sp, alder *Alnus glutinosa* hazel, rowan *Sorbus aucuparia*, willow *Salix* spp. or birch *Betula* spp. This would benefit areas previously surrounded by commercial conifer plantation once the current coups are scheduled for felling. Targeted removal of woody debris from watercourses should also be undertaken to increase suitability for migratory fish.

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

## 5 REFERENCES

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# ANNEX 1: ENVIRONMENTAL DATA

**Table A1: Environmental data from Sample Points**

Location			Substrate Composition (%)							Channel Information				Habitat Type
Easting	Northing	Sample No/ Photo	Bed-rock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4 – 64 mm	Gravel 2 – 4 mm	Coarse sand 0.5 – 2 mm	Peat/fine sand/silt <0.5 mm	Av. Wetted Width (m)	Av. Depth (m)	Turbidity (1 [clear]-3[turbid])	Channel Gradient (%)	
373301	803823	1a	0	0	60	20	10	10	0	1	0.25	1	4-5	2a, 3, 4, 9e
373937	803217	2a	15	25	30	20	5	5	0	0.75	0.25	1	3-4	3, 4a
371006	803992	3a	0	10	0	0	0	0	90	0.25	0.12	1	>10	1c
370935	802942	3b	0	0	0	0	0	0	100	0.25	0.1	1	>10	1c
368591	803421	4a	0	0	0	0	0	0	100	0.25	0.1	1	6-10	1c
368461	803419	4b	0	0	0	0	0	0	100	0.3	0.15	1	6-10	1c
368526	803626	4c	0	0	10	10	0	0	80	0.25	0.15	1	6-10	1c
368944	803954	4d	0	0	0	0	0	0	100	0.35	0.25	1	6-10	1c
369136	803901	4e	0	20	35	30	10	5	0	0.7	0.25	1	>10	3, 4a
367092	803507	5a	0	0	0	0	0	0	100	0.2	0.1	1	>10	1c
366745	802698	6a	0	0	0	0	0	0	100	0.2	0.2	1	>10	1c
366858	802574	6b	0	0	0	0	0	0	100	0.35	0.25	1	>10	1c
369287	800933	7a	0	20	25	20	5	0	30	0.25	0.15	1	6-10	1c
370763	802602	8a	0	0	0	0	0	0	100	0.6	0.2	1	3-4	4, 5
369535	802425	8b	0	0	0	0	0	0	100	0.25	0.15	1	5	1c
369695	802280	8c	0	15	25	35	20	5	0	0.45	0.2	1	3-4	1c, 4a, 9e
369899	802194	8d	0	10	45	35	10	0	0	0.7	0.3	1	2-3	4, 5
370242	802398	8e	0	30	40	20	10	0	0	1	0.2	1	3-4	3, 4a, 9e

## ANNEX 2: PHOTOGRAPHIC PLATES

1a



2a



3a



3b





4a



4b



4c



4d



4e



5a



6a



6b



7a



8a



8b



8c



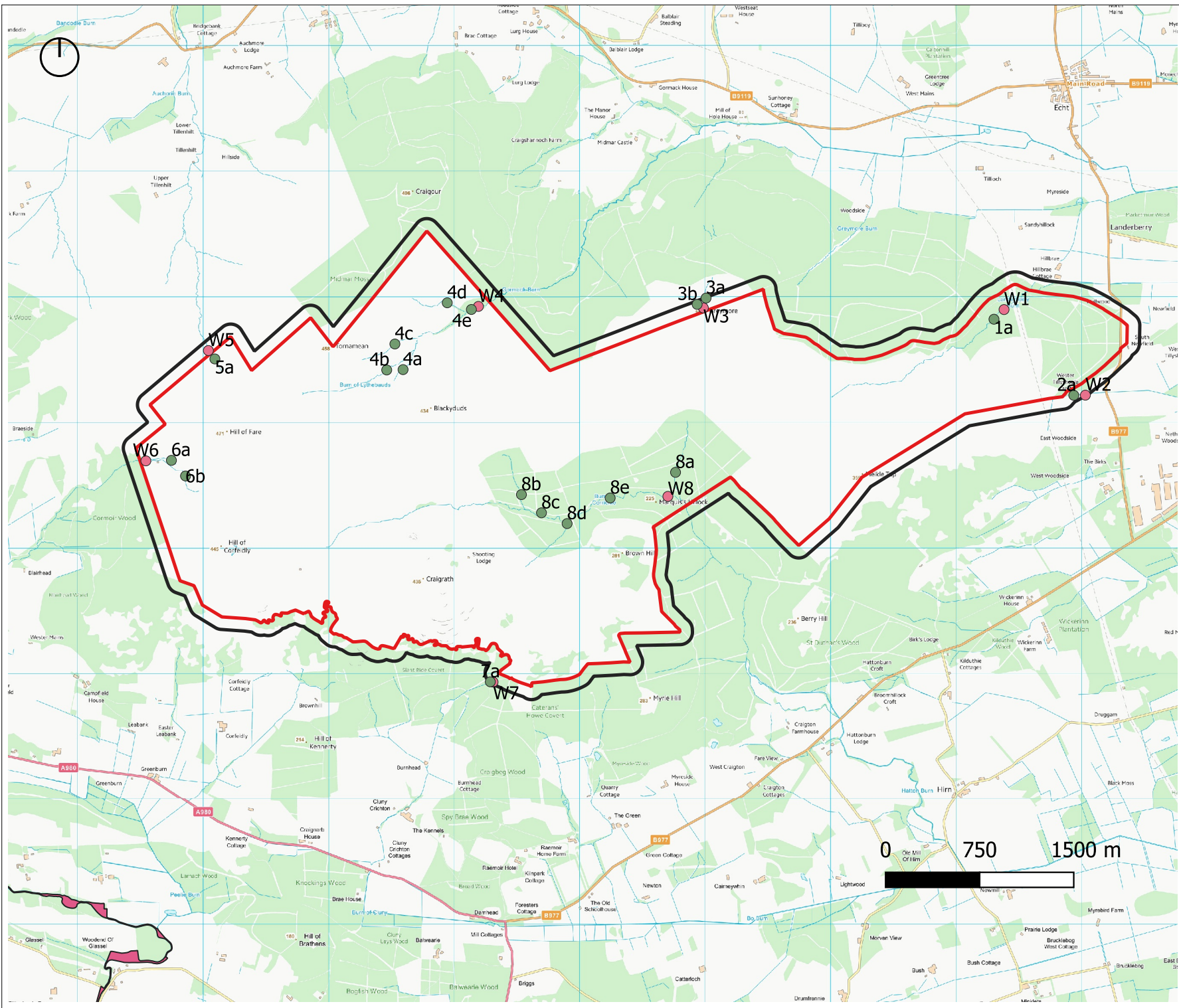
8d



8e








### LEGEND

- Site Boundary
- Fish Habitat Survey Area
- River Dee SAC
- Watercourses
- Sample points

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Technical Appendix 8.4 - Fish Habitat Survey Report

Figure 1 - Watercourses and Sample Points

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