Technical Appendix 7.4: Fish Survey Report

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Glenouther Wind Farm EIA Report

Wind Power North Four Limited

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Ayrshire Rivers Trust

Glenouther Wind Farm

Electrofishing Baseline Survey Report

2024

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1.0	Initial draft for review	C.Bryce - Biologist	S.Candlish – Fisheries Biologist

Summary

Ayrshire Rivers Trust completed five electrofishing surveys on the Swinzie Burn on behalf of MacArthur Green (now SLR Consulting) in 2024 as part of an Environmental Impact Assessment for the Proposed Development at Glenouther Moor. The results from these surveys will be used to assess the potential risk of the Proposed Development to freshwater fish populations and produce mitigation recommendations.

The key findings of the surveys were:

- Atlantic salmon (*Salmo salar)* were present at two of the five sites demonstrating that the Swinzie Burn supports a population of Atlantic salmon.
- Brown trout (*Salmo trutta*) were present at four of the five survey sites on the Swinzie Burn.
- No European eels (*Anguilla anguilla*) were recorded at any sites in 2024, however historic data indicates that European eels can access the Swinzie Burn.
- Within the Site, the Swinzie Burn contains instream habitats suitable for Atlantic salmon and trout spawning as well as habitats suitable for juvenile salmonids and European eels.
- No lamprey species (*Lampetra* spp. and *Petromyzon marinus*) were recorded or witnessed during the surveys, and there are no historic records of lamprey species within the Site.
- Habitat suitable for lamprey ammocoetes was recorded in the upper reaches of Swinzie Burn, and areas suitable for lamprey spawning were found downstream of site IASB4.

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1.Introduction

This technical appendix relates to the Proposed Development as defined in **Chapter 4: Development Description** of the EIA Report. The baseline conditions (drawn from desk-based sources only) and the effects of the Likely Grid Connection Route (as defined in **Chapter 4**) on Ecology is assessed in **Chapter 7: Ecology** of the EIA Report.

Ayrshire Rivers Trust (ART) was commissioned by MacArthur Green (now SLR Consulting) to survey for freshwater fish populations and habitats on watercourses near and within the Site of the proposed Glenouther Wind Farm (the Site) in East Ayrshire. The Proposed Development has the potential to adversely impact on the fish species and habitats of the watercourses that drain the Site, and impact on receptor watercourses downstream of the Proposed Development. The purpose of these surveys is to inform an Environmental Impact Assessment (EIA) of the Proposed Development and establish an ecological baseline to assess risks and potential impacts. These surveys also follow guidance by the Scottish Government in relation to monitoring watercourses for onshore wind farm developments[1] where possible.

All watercourses pertinent to the Proposed Development and report fall within the River Irvine catchment. The River Irvine is one of two major river catchments in Ayrshire that does not fall under the management and control of a District Salmon Fishery Board (DSFB). DSFB have statutory powers in relation to all matters and activities surrounding and affecting salmon populations within their district. The River Irvine catchment does fall within the management area of ART who provide professional management and ecological advice to landowners, stakeholders and angling interests in relation to all matters affecting the habitat and fishery. ART perform electrofishing surveys within the River Irvine catchment with permission and under licence from the Scottish Government's Marine Directorate.

Five electrofishing surveys were conducted either downstream or within the Site. Electrofishing surveys were completed to assess the fish habitat, fish species present and population densities. Fish habitat surveys were conducted at each electrofishing survey site and additional fish suitability target notes were made for the Swinzie Burn within the survey area.

1.1 Salmonid fish and fisheries

The River Irvine and its tributaries are known to support a number of aquatic UK Biodiversity Action Plan (BAP) species including, Atlantic salmon, brown trout, lamprey species, European eel, otter (*Lutra lutra*) and water vole (*Arvicola amphibious*).

Migratory salmonids; Atlantic salmon and brown/sea trout and other native fish populations commonly use freshwater habitats for breeding and development of early life-stages. Typically, juvenile salmon and migratory trout spend between one and three years in freshwater before migrating to sea as smolts. Salmon may spend between one and three years in the Atlantic Ocean before returning as mature fish to spawn within their natal river, at or close to their original hatching site. Sea trout differ from salmon in that they are part of a resident brown trout population and may spend less time at sea and, unlike salmon, remain in nearby inshore marine waters to feed during the marine life stages. The use of both marine and freshwater habitats during their life-cycle makes migratory salmonids vulnerable to loss in a wide range of habitats. Factors influencing survival may be extremely varied or river specific, for example physical obstructions to upstream migration, in river or

[1] Marine Scotland (2021). Monitoring watercourses in relation to onshore wind farm developments: generic monitoring programme. https://www.gov.scot/publications/monitoring-watercourses-in-relation-to-onshore-wind-farm-developments-generic-monitoring-programme/#page-top.

estuarine predation and water quality issues. Migratory fish species and resident populations are vulnerable throughout their range and during their transition between habitats.

1.2 Biodiversity

Other than Atlantic salmon and brown trout, native fish species such as Brook lamprey (*Lampetra planeri*), River lamprey (*Lampetra fluviatalis*), Sea lamprey (*Petromyzon marinus*), three-spined stickleback (*Gasterosteus aculeatus*), European eel and other species may also utilise freshwater habitats in and/or downstream of the survey areas. Other species have been introduced to the River Irvine catchment many of which survive and can threaten native species, these include gudgeon (*Gobio gobio*), tench (*Tinca tinca*) and stone loach (*Barbatula barbatula*). Fish and freshwater habitats also support a range of native flora and fauna and consequently mitigation to protect water resources for fish species is likely to benefit other biodiversity and conservation objectives.

1.3 Monitoring Site Locations

The Proposed Development lies northeast of Stewarton within the River Irvine catchment. The River Irvine is one of six major rivers catchments in Ayrshire. It rises above Loudoun Hill on the boundary of East Ayrshire and Lanarkshire, from where it flows westwards for 45 km to Irvine Bay on the Firth of Clyde. It has a catchment area of >380 km^2 and is the second largest catchment of the Ayrshire rivers. It shares an extensive estuary with the River Garnock which is the only significant estuary in Ayrshire. The major tributaries include the Glen Water, Changue Burn, Cessnock Water, Fenwick Water, Craufurdland Water, Kilmarnock Water, Carmel Water and Annick Water. Principal land uses in the catchment area are agriculture, forestry and urban development with the largest settlements being Irvine, Kilmarnock, Stewarton, Galston, Newmilns and Darvel. The river has been significantly modified, particularly where it flows through urban areas with many weirs, culverts, retaining walls and extensive levies in the lower catchment.

The Swinzie Burn is the only named watercourse that flows through the Site. North of the Proposed Development lies the Corsehouse Reservoir, a man-made reservoir established in the 1970s. Two small unnamed burns drain the Proposed Development area into the Corsehouse Reservoir. Due to the size, location and historical modifications of these watercourses it is unlikely they support salmonids. From the reservoir flows the Corsehouse Burn which joins the Annick Water north-west of the Site. The Annick Water is the principal tributary of the River Irvine and has a catchment area of 65 km^2. The Swinzie Burn is a tributary of the Annick Water, and its sub-catchment is predominately used for agriculture and forestry.

Sites representative of the Swinzie Burn that lie within or downstream of the Proposed Development were surveyed to establish an ecological assessment for the EIA. From historic work carried out by ART, it is known that the Swinzie Burn is an important juvenile nursery area for salmonids with poor to excellent spawning habitat available. Substrates at the upper Swinzie Burn survey sites are dominated by high organic and peat interspersed with pockets of fine sand, gravel and pebble. Further downstream, south-west of the Site, substrates prove more diverse with areas of clean gravel, cobble and boulder deposited between or on top bedrock.

Details of the electrofishing sites are shown below in Table 1 and Figure 1[2].

[2] Note that Figure 1 was produced based upon an earlier iteration of the Site boundary, used at the time of field surveys.

Table 1: Details of the electrofishing survey sites

Site code	Purpose	Watercourse	Location	Grid ref (Easting, Northing)
IASB3	Electrofishing assessment for EIA, ecological baseline establishment	Swinzie Burn	Upstream of Clunch Road bridge	245969, 647353
IASB5	Electrofishing assessment for EIA, ecological baseline establishment	Swinzie Burn	Downstream of the Site	246803, 648187
IASB4	Electrofishing assessment for EIA, ecological baseline establishment	Swinzie Burn	Between two forestry coups where the Swinzie Burn turns to run westward	247373, 648397
IASB6	Electrofishing assessment for EIA, ecological baseline establishment	Swinzie Burn	Downstream of small unnamed tributary entering on the right-hand bank	248126, 648329
IASB7	Electrofishing assessment for EIA, ecological baseline establishment	Swinzie Burn	Most upstream site on the southern edge of the Site	248839, 648361

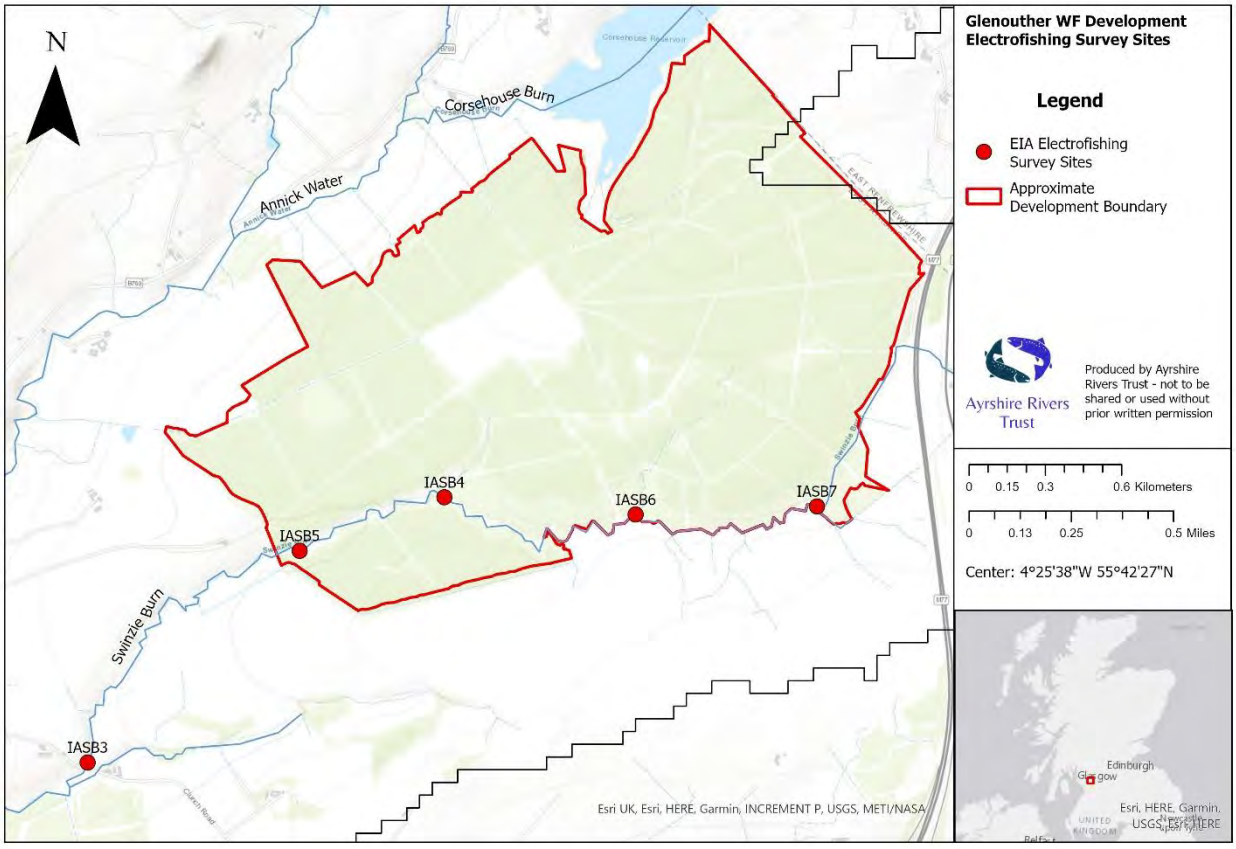

Figure 1: Overview of the electrofishing survey sites in relation to the Proposed Development

2. Methods

2.1 Fish monitoring

2.1.1 Background

ART is a full member of the Scottish Fisheries Coordination Centre (SFCC), which is an association of Scottish fisheries management organisations including Fisheries Management Scotland (FMS), Marine Directorate Science (formerly Marine Scotland Science), and the local District Salmon Fishery Boards. The electrofishing surveys carried out for this report were completed following SFCC protocols for this technique using SFCC accredited surveyors.

The SFCC also provides electrofishing training to its members, and ART are qualified to lead and design electrofishing surveys to SFCC protocols. Wherever possible ART's surveys are therefore carried out to the standards required by the SFCC, and data are recorded using the agreed format. Surveys were conducted by team leader qualified and experienced members of staff. ART are licensed by Marine Directorate (formerly Marine Scotland) to undertake electrofishing in all the freshwaters including rivers and coastal burns throughout Ayrshire.

2.1.2 Techniques

Fish populations at each site were assessed using electrofishing. This is a widely used technique to examine freshwater fish communities. The method uses electricity to attract and stun fish, which allows operators to remove them from the water. The fish are transferred to a holding container until they have recovered and then anaesthetised using a mild solution of MS222 (Tricaine Methane Sulphonate). Each individual is then identified, measured and returned unharmed to the area from where they were captured.

Battery powered backpack equipment (Hans Grassl model #IG600 or Efish 500w Electro-Fishing Backpack system) was used to carry out each survey. Smooth Direct Current was used at all sites, to maximise catch efficiency, while minimising potential damage to fish and other wildlife.

In small watercourses, it is possible to cover the entire survey area accurately, and the number of fish captured can therefore be related to the wetted area of the site. All survey protocols were followed to SFCC standards.

2.1.3 Quantitative sites

All sites were sampled using an area-delimited survey, thus allowing fish densities to be calculated. To ensure that all fish have an equal chance of being caught, each survey run began at the downstream end of the section and moved back and forth across the wetted channel in an upstream direction ensuring every part of the wetted channel was covered. This approach was carried out three times (where fish numbers allowed), with a break in between each run to protect fish welfare. This electrofishing technique is referred to as a quantitative 3-run depletion survey, and ART followed all SFCC protocols for this technique.

From the results, salmon and trout were separated into year classes based on length frequency histograms. As fish grow at different rates between sites, this was repeated for each site individually. Where age classifications were unclear, they can be checked by examining the number of annual rings on scales taken from fish of a range of sizes. Fish densities were separated into fry and parr for the presentation of the results. Throughout this report the following notation has been used to distinguish fish year classes: salmonid fish less than one year old are recorded as 0+ year class or fry, whilst fish one year or older are recorded as 1++ or parr. Other fish species were counted and recorded. If there were sufficient fish present, absolute fish densities were calculated, together with a measure of statistical confidence, otherwise a minimum density estimate was used.

2.1.4 Habitat surveys

General habitat assessments that accompanied each electrofishing survey followed SFCC electrofishing methodology[3]; Appendix E. These differ slightly in their definition and use of terminology compared to the Fish Habitat Walkover Survey based on the Hendry and Cragg-Hine method (1997)[4] and align with the SFCC Walkover Habitat survey[5]. A modified approach was used to make notes of key and distinctive habitats within the watercourses outwith of the surveyed sections. Habitat definitions are provided in Appendix E.

2.1.5 Frequency of sampling

Annual fish surveys should be undertaken prior to the commencement of the Proposed Development, during the construction phase and for at least one year during the post-construction restoration period to comply with guidance provided by Marine Scotland[1].

3. Results

3.1 Fish Results and Classification

The results from surveys where fish densities are obtained are classified according to the SFCC Scottish national classification scheme which was derived using data from over 1600 Scottish sites covering the period 1997-2002[6]. This allows ART and the reader to interpret local populations in a Scotland-wide context. The national classes should be periodically revised as fish populations will inevitably change over time, even on a national scale.

Table 2: SFCC salmon fry and parr classification breakpoints

Salmon fry (no/100m^2)	Classification	Salmon parr (no/100 m^2)
0.0	Absent	0.0
< 4.7	E – Very Poor	< 2.6
4.7- < 10.3	D – Poor	2.6- < 5.1
10.3- < 20.3	C – Moderate	5.1- < 9.1
20.3- < 42.1	B – Good	9.1- < 15.8
> 42.1	A – Excellent	> 15.8

[3] SFCC (2024). Training manual. Team leader electrofishing. Scottish Fisheries Co-ordination Centre. Freshwater Fisheries Laboratory.
[4] Hendry, K. & Cragg-Hine, D. (1997). Restoration of Riverine Salmon Habitats. Fisheries Technical Manual 4, Environment Agency, Bristol.
[5] SFCC (2007). Habitat Surveys. Training course manual. Scottish Fisheries Co-ordination Centre. Freshwater Fisheries Laboratory. Revised August 2007.
[6] Godfrey, J.D. (2005). Site Condition Monitoring of Atlantic Salmon SACs. Report by the SFCC to Scottish Natural Heritage, Contract F02AC608.

Table 3: SFCC trout fry and parr classification breakpoints

Trout fry (no/100m^2)	Classification	Trout parr (no/100 m^2)
0.0	Absent	0.0
< 2.5	E – Very Poor	< 1.6
2.5- < 5.3	D – Poor	1.6- < 3.1
5.3- < 12.4	C – Moderate	3.1 - < 5.6
12.4- < 30.3	B – Good	5.6- < 10.4
> 30.3	A – Excellent	> 10.4

3.1.1 Electrofishing survey limitations

Electrofishing is a common means of obtaining data on fish populations[7]. The electrofishing techniques used by ART are specifically designed for assessing juvenile salmonid populations, therefore fish from other groups may not be quantified effectively.

The survey sites chosen were selected to be representative of the general habitat type present in the Swinzie Burn sub-catchment and to include a range of flow and substrate types (if appropriate). If the site selected is representative of the local habitat, the survey should provide a robust estimate of local populations. However, it is possible that if fish populations are low or have clumped distribution, the survey data may not sample the full fish population in that area. It is considered impossible to capture all fish present within a site therefore, whilst the failure to capture fish at a site may indicate that the population is absent, it cannot be assumed that they are not present elsewhere in the watercourse or catchment. For the purposes of this report and the classification tables, where a fish species has not been recorded at an electrofishing site, they will be classified as absent.

Depletion sampling, where fish are removed from a site in a series of successive electrofishing runs, are used to provide an estimate of the total fish population present. The rate of decline in each run and the total number of fish captured are used to estimate fish stocks. However, if fish numbers are low (less than 40 per site) the confidence limits will be large and the depletion estimates will be unreliable[8]. In instances where absolute densities cannot be calculated, the 1-run minimum density estimate will be provided.

[7] SEERAD (Scottish Executive Environment and Rural Affairs Department) (2007). Agricultural facts and figures. The Scottish Government pdf 2.
[8] Schnute, J. (1983). A new approach to estimating populations by the removal method. Canadian Journal of Fisheries and Aquatic Sciences 40: 2153_2169.

3.2 Fish survey results

All surveys were completed in low- medium water level conditions and during daylight hours.

Table 4: Results from electrofishing surveys including SFCC classifications for the Proposed Development

Where available, calculations of absolute densities are given, along with confidence limits (in brackets), otherwise minimum densities are suppled and denoted by #.
*Codes for salmon and trout 0+ = fry, 1++ = parr (one year and older fish).
** Codes for other fish species are, E = European eel, M = Minnow, SL= Stone loach, SB = 3-spined stickleback, L = Lamprey species. Numbers in brackets indicate number category for each species.

Site Code	Watercourse	Date	Fish densities (No/100 m²)				Other fish species **
			Salmon*		Trout*		
			0+	1++	0+	1++	
IASB3	Swinzie Burn	09/10/2024	#1.0	0	35.2 (+/- 4.3)	2.1 (+/- 1.4)	SL (11-100), M (1-10)
IASB5	Swinzie Burn	09/10/2024	#1.2	0	25.3 (+/- 2.5)	#2.5	M (11-100), SB (1-10)
IASB4	Swinzie Burn	10/10/2024	0	0	23.5 (+/- 2.4)	0	M (11-100)
IASB6	Swinzie Burn	31/07/2024	0	0	#1.4	#1.4	-
IASB7	Swinzie Burn	31/07/2024	0	0	0	0	M (1-10), SB (1-10)
# Minimum density estimate used, insufficient data to generate confidence limits							

3.2.1 Results & Discussion

The purpose of these surveys is to inform an EIA of the Proposed Development and establish an ecological baseline to assess risks and potential impacts of the Proposed Development on instream habitat and fish species. Known absence/presence and distribution of key freshwater fish species is available in Appendix C.

Monitoring Sites

IASB3

Site IASB3 is the most downstream electrofishing survey site and is located outside of the Site (Figure 1). This site offers moderate instream cover, diverse substrates and water depths and flow types more suitable for salmonid fry. During the time of the survey, exposed river substrates were covered with moss and some submerged substrates were coated with algae, likely due to a lack of shade and nutrient enrichment from livestock.

Atlantic salmon fry numbers were classed as 'very poor' with only a minimum density estimate of 1.0 per 100 m^2 calculated. No salmon parr were recorded and as such were classed as 'absent' from this site. Historic electrofishing data from 2014 (conducted using the same methodology by ART) classed Atlantic salmon fry as 'poor', and salmon parr as 'absent' for this site. The results from 2024 classed trout fry numbers as 'excellent' with a density estimate of 35.2 fry per 100 m^2. Trout parr numbers were classed as 'poor' with a density estimate of only 2.1 parr per 100 m^2. Immediately upstream of the survey site were areas suitable for salmonid spawning (245978,647373; 245985,647449). The fry results would indicate that these spawning areas or others upstream of this site are utilised by both salmon and trout.

Common minnow (*Phoxinus phoxinus*) and stone loach were the only other fish species recorded during the survey. Historic electrofishing records indicate that eels can access and will use this stretch of the watercourse, however eels were not recorded at this site in 2024.

Livestock have uninhibited access to the watercourse and its riverbanks in this stretch as there is no livestock fencing or restrictions in place. As such both riverbanks suffer from livestock poaching and intensive grazing

which has left the riparian zones devoid of trees and diverse native vegetation (Figures 3-5). Due to this there is excess silt and sediment entering the watercourse which was noted during the habitat survey. Fortunately, the impact is localised and hasn't resulted in compaction of the substrates.

No habitat suitable for Lamprey ammocoetes was present on site.

The Swinzie Burn between its confluence with the Annick Water and the Site has been identified as a high priority area for riparian tree planting. Marine Directorate created models to predict rivers that were the hottest, most sensitive to climate change and where riparian woodland would reduce maximum river temperatures the most and then used this information to prioritise river catchments for riparian tree planting.

IASB5

Site IASB5 is downstream of the Site. This stretch has been historically modified resulting in poor habitat diversity. The water depth and substrate made this site more suitable to salmonid fry. As this site is located between two mature conifer forestry blocks, the riparian zone has been left open with no native tree species present. Consequently, the surrounding area is dominated by grasses and tall herbs that provide little benefit to fish species. Water quality at this location was good and the instream cover was classed as 'moderate'.

One Atlantic salmon fry was recorded at this site (Figure 10), resulting in a minimum density estimate of 1.2 per 100 m^2 and classification of 'very poor'. While the numbers were very poor, it is encouraging that Atlantic salmon are still able to access and successfully spawn in this stretch of the Swinzie Burn considering their declining numbers. No salmon parr were recorded during this survey. Trout fry numbers were classed as 'good' with a density estimate of 25.3 fry per 100 m^2 indicating good spawning success and overwinter survival. Trout parr numbers were low with a minimum density estimate of 2.5 parr and a classification of 'poor'. The results are reflective of the habitat available within the survey site which favoured fry. Downstream of the survey site, there were areas of deeper water (>30 cm), including pool and run-riffle habitats with better bankside cover which is likely utilised by salmonid parr.

Minnows and three-spined sticklebacks were the only other fish species recorded. There was no habitat within the survey area that was deemed suitable for Lamprey species.

IASB4

Site IASB4 is on the south-west edge of the Site. Like site IASB5, site IASB4 is surrounded by conifer forestry plantation, meaning the riparian zone is dominated by grasses and lacks native tree species. While the water quality was good, the instream cover was defined as 'moderate' due to a lack of larger substrate (e.g. boulders), tree roots and woody debris. Bedrock comprised a larger proportion of the riverbed compared to the lower sites, and it was noted that the substrates present were often deposited on top of bedrock making these areas less suitable for salmonid spawning. Moss growing on exposed substrates was a common feature throughout.

Both Atlantic salmon fry and parr were absent from this site at the time of the survey. Trout fry were present in good numbers, with a density estimate of 23.5 fry per 100 m^2. Trout parr were absent from this site, however the instream habitat, flow type and average water depth were more suited to fry at the time of the survey.

Between site IASB5 and IASB4, the substrate composition is made up of bedrock, often forming small steps, and a mix of gravel, pebble, cobble and boulder. While bedrock steps could potentially act as natural barriers to the upstream migration of trout, the vertical height was small and would be negligible with higher water levels. Throughout this section of the burn there is a series of riffles, runs and pools, with shallow (<30 cm) and deep (>30 cm) glides being the dominate habitat type. Habitat suitable for salmonid spawning, salmonid fry, salmonid parr and mixed juvenile salmonid were present (Figures 14-15, 23-24).

IASB6

Site IASB6 is situated along the southern edge of the Site and located approximately 1100 m upstream of site IASB4. The characteristics of this site differ significantly when compared to the three lower sites, with 100 % of the substrate being made up of high organic and peat. Water depth in this stretch was predominately >40 cm with some areas exceeding >50 cm, and as such the only flow type present was deep pool (>30 cm) or shallow pool (<30 cm). While this site also lacked any tree cover, the bankside offered shelter in the form of undercut banks, draped vegetation and vegetation rooted in the stream bed/bank (excluding fully aquatic vegetation). The high organic substrate, deep water and instream vegetation created difficult surveying conditions however ART are confident that no fish were missed.

No Atlantic salmon were recorded and only two trout were caught during this survey meaning only a single electrofishing run was conducted. For both trout fry and parr minimum density estimates of 1.4 per 100 m^2 were produced, resulting in a classification of 'very poor' for both life stages. No other fish species were recorded. There was no habitat within the survey area that was deemed suitable for Lamprey species.

IASB7

Site IASB7 is the most upstream site on the Swinzie Burn and is in the south-eastern edge of the Site. The survey site was overgrown with dense bankside and instream vegetation (Figures 19 & 20) creating difficult surveying conditions. Water depth was shallow (<30 cm) and flow type was predominately shallow pool with some shallow margins. The substrate was more diverse than site IASB6, with some fine natural silt, sand and gravel present amongst high organic. Instream fish cover was poor, however instream vegetation and draped bankside vegetation would offer fish shelter. No salmonids were recorded at this site with only low numbers of minnows and three-spined sticklebacks present. While this site is not deemed suitable for salmonids, it was the only survey site that had suitable habitat for lamprey ammocoetes as silt and sand made up to 40 % of the substrate composition with organic detritus present. The survey did not record any lamprey species; however, the technique and equipment settings used were not suited for surveying lamprey species. As there was no perceivable flow in the site, each electrofishing sweep covered a shorter area which likely would have disturbed or attracted lamprey had they been present.

4. Recommendations

Without appropriate mitigation and pollution control measures, the Proposed Development has the potential to adversely affect the fish habitat and fish populations within and downstream of the Proposed Development. It is recommended that good practice guidelines are strictly adhered to for each component of the Proposed Development (forestry felling, infrastructure construction, new water crossings, water management). The recommendations provided below are not exhaustive and it is the responsibility of the developer and contractor to ensure that they comply with legislation (Appendix C) and conditions provided by the planning authority, SEPA, NatureScot and any other statutory consultee.

- All instream work must be scheduled to avoid the migration, spawning, egg incubation and emergence period of salmonids. The exclusion period is October to May (SEPA).
- Forestry operations should follow 'UKFS Guidelines on Forests and Water' which describe how to comply with the requirements to protect the water environment.
- Detailed supplementary guidance can be found in Forestry and Land Scotland's (formerly Forestry Commission) 'Managing Forest operations to protect the water environment' (2019) document.
- Following approval by the planning authority an ecological baseline should be established which includes aquatic fish, macroinvertebrate and water quality sampling to comply with Marine Directorate

(formerly Marine Scotland) (2021) 'Monitoring watercourses in relation to onshore wind farm development: generic monitoring programme'. It is recommended that sites on the Annick Water, north of the Proposed Development are included within this monitoring programme.

- Immediately prior to any new water crossings being installed or upgraded, fish rescues should be scheduled in and conducted regardless of the size of watercourse.
- New or upgraded water crossings should follow SEPA's "Engineering in the water environment: good practice guide. River Crossings" guidance and ensure that new water crossing do not become an obstacle to fish migration. Perched outfalls, insufficient water depth and/or high-water velocities through culverts are common problems that can cause habitat fragmentation. This is of particular importance for resident brown trout who carry out local migrations to access different habitats for refuge and as part of their life cycle.
- Visual assessments of the watercourse (downstream of onsite works) should be carried out daily to ensure pollution is not entering the Swinzie Burn. Silt protection measures should be regularly checked for their effectiveness, especially following periods of heavy rain. Recent pollution incidents in Ayrshire have been caused due to irregular checks and failed silt protection following heavy rain.
- Water management plans should consider all potential avenues for pollution to enter watercourses and have appropriate pollution controls and silt mitigation measures in place prior to commencement of works.
- Any biodiversity enhancements required by the National Planning Framework 4 should consider riparian tree planting in the lower reaches of the Swinzie Burn catchment. ART can provide additional recommendations that would support the biodiversity policy criteria should the Proposed Development be approved.
- Biosecurity protocols should be established to ensure that Invasive non-native species (INNS) are not introduced. Monthly checks during the growing season of Japanese knotweed *(Fallopoa japonica)*, giant hogweed (*Heracleum mantegazzianum*), Himalayan balsam (*Impatiens glandulifera*) and American skunk cabbage (*Lysichiton americanus*) should be carried out within the Proposed Development.
- In accordance with Marine Directorate electrofishing licence requirements local District Salmon Fishery Boards (should they exist) and Fisheries/Rivers Trusts should be informed at least one week in advance of any activity covered by this licence.

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6. Appendix

6.1 Appendix A – Site Photographs

Figure 2: Site IASB3 – Looking upstream

Figure 3: Site IASB3 – Looking downstream

Figure 4: Site IASB3 – Looking upstream towards a small natural waterfall

Figure 5: Site IASB3 – Atlantic salmon (top) and trout (bottom) fry recorded during the survey

Figure 6: Site IASB5 – Looking upstream towards the top limit of the survey site

Figure 7: Site IASB5 – Looking downstream within the survey boundaries

Figure 8: Site IASB5 – Looking upstream from within the survey site

Figure 9: Site IASB5 – Trout fry (top) and salmon fry (bottom) recorded during survey

Figure 10: Site IASB5 – Trout parr

Figure 11: Site IASB4 – Looking upstream from the bottom of the survey site

Figure 12: Site IASB4 – Looking downstream

Figure 13: Site IASB4 – Looking upstream with surrounding landscape

Figure 14: Instream habitat between IASB5 and IASB4

Figure 15: Instream habitat between IASB5 and IASB4

Figure 16: Site IASB6 – Looking upstream – Lack of flow and area of deep water

Figure 17: Site IASB6 – Instream vegetation creating difficult surveying conditions

Figure 18: Site IASB6 – Trout fry (top) and trout parr (bottom) recorded during the survey

Figure 19: Site IASB7 – Significant instream vegetation and a low flow rate

Figure 20: Site IASB7 – Significant instream vegetation created difficult surveying conditions

Figure 21: Site IASB7 – Surrounding landscape

Figure 22: Site IASB7 – Significant instream vegetation created difficult surveying conditions

Figure 23: Instream habitat between IASB5 and IASB4 – Looking downstream

Figure 24: Instream habitat between IASB5 and IASB4 - looking downstream – glide dominate flow type

6.2 Appendix B – Obstacles to fish migration

Details relating to the known obstacles to fish migration within the Annick Water sub-catchment are presented within Table 5 and Figures 25-28. All distance measurements are taken from where the Site crosses the Swinzie Burn (648171, 246713). The barriers are ordered from upstream to downstream. This information has been sourced from the Scottish Environment Protection Agency (SEPA) "Obstacles to Fish migration" database[9] and ART barrier database, and SNIFFER report[10]. Photos provided are owned by ART and not to be used, shared, replicated or sold without prior written permission from ART.

Table 5: Known obstacles to fish migration within the Annick Water sub-catchment area

Barrier Type	Location	Grid ref (Easting)	Grid ref (Northing)	Permeability	Notes
Waterfall	Swinzie Burn- downstream of Site	245940	245940	Passable under certain conditions. No fish pass is present.	Immediately upstream of survey site IASB3.
Weir (Old mill weir)	Annick Water and Clerkland Burn - downstream of Site	242369	646125	At low water levels, the weir presents as a complete barrier to the upstream migration of adult salmon and trout, and partial barrier to downstream migration. Upstream migration of adult salmon and trout is dependent on the water conditions over this obstacle. As such this weir should be considered a partial/temporal barrier. Considered a complete barrier to the upstream migration of adult lamprey (due to hydraulic head). No fish pass present.	Not on the SEPA 'Obstacles to fish migration' database. SNIFFER assessment conducted by Ayrshire Rivers Trust in 2013. The weir spans across two watercourses; the Annick Water and Clerkland Burn, with the confluence immediately downstream of the weir.
Weir (Stewarton weir)	Annick Water - downstream of Site	245940	645884	Passable under certain conditions. No fish pass is present.	Likely to restrict passage under low flow conditions.
Weir (Lainshaw weir)	Annick Water- downstream of Site	241262	645255	Passable under certain conditions. No fish pass is present. Salmon, trout, eels and lamprey affected.	Vertical weir deemed redundant. Known as the Lainshaw weir.

9 https://marine.gov.scot/maps/1746#:~:text=Obstacles%20to%20Fish%20Passage%20(SEPA%20WMS)%20contains%20information%20on%20the,to%20fish%20under%20certain%20conditions.

10 Ayrshire Rivers Trust (2013). SNIFFER barrier assessment of an old mill weir, Stewarton.

Figure 25: Small natural waterfall - Swinzie Burn

Figure 26: Old mill weir, Stewarton - Annick Water

Figure 27: Stewarton weir, Stewarton - Annick Water

Figure 28: Lainshaw weir - Annick Water

6.3 Appendix C – Freshwater species information and distribution

ART conducted a desk-based review of the known presence/absence and distribution of the following fish species within the Annick Water sub-catchment: Atlantic salmon, brown/Sea trout, European eel, brook lamprey, river lamprey and sea lamprey.

This data has been drawn from ART electrofishing database, and pre-existing habitat and fisheries reports. **Data provided here is for the Proposed Development only and not to be used, shared, replicated or sold without prior written permission from ART.**

Atlantic salmon

Salmon populations in Great Britain have declined between 30-50 % since 2005 and are expected to fall 50-80 % between 2010-2015[11]. As such Atlantic salmon in Great Britian were reassessed by the IUCN Red List of Threatened Species in December 2023 and reclassified from 'Least Concern' to Endangered'.

The management of existing and emerging pressures to improve the conservation status of wild salmon has been identified as a priority action under Objective 4 of the Scottish Biodiversity Delivery Plan 2024-2030. Encompassed within this plan is the Scottish Wild Salmon Strategy which sets out the vision, objectives and priority themes for action to protect and support the recovery of wild Atlantic salmon populations in Scotland[12]. Atlantic salmon is protected under Annex II (animal and plant species of community interest whose conservation requires the designation of special areas of conservation) and Annex V (animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures) of the Habitats Directive.

Atlantic salmon is protected under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.

Under section 23, sub-section 1, Paragraph (a) it is an offence to:

- Knowingly take, injure or destroy young salmon (alevin, fry, parr or smolt) and spawning beds.

Under section 23, sub-section 2, paragraph (a) and (b) it is an offence to:

- Knowingly injure or disturb any salmon spawn; or
- Disturb any spawning bed or any bank or shallow in which the spawn of salmon may be.

Under section 23, sub-section 3 it is an offence to:

- Obstruct or impede salmon in their passage to any such bed, bank or shallow during the annual close time.

Brown/Sea trout

While brown trout and sea trout are the same species, they differ in their life history strategies. Brown trout complete their entire life cycle in freshwater whereas sea trout are anadromous and migrate to sea to mature. Due to this difference, the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 applies to each

[11] Darwall, W.R.T. & Noble, R.A. (2023). Salmo salar (Great Britain subpopulation). The IUCN Red List of Threatened Species 2023: e.T213546282A213546288. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T213546282A213546288.en.
[12] Marine Directorate (2022). Scottish wild salmon strategy. https://www.gov.scot/publications/scottish-wild-salmon-strategy/pages/1/.

form differently. The sea trout populations across Scotland have declined dramatically, with rod catches in 2023 being the fifth lowest since 1952[13]. Trout is a UK Biodiversity Action Plan priority fish species.

Brown/sea trout in the River Irvine catchment (including the Annick Water) are protected under the West Strathclyde Protection Order 1988 (SI 1988/1516). This act prohibits fishing for or taking freshwater fish in inland waters of the Strathclyde region without legal consent.

European eel

European eels are classified as 'Critically endangered' by the IUCN Red List of Threatened Species following significant declines since the early 1980s. In the North Sea, the recruitment index series for glass eels (a life stage of European eels) fell to 0.5 % in 2023 and 1.1 % in 2024 of the recruitment between 1960-1979[14]. Similarly, the data series for yellow eels (a life stage of European eels) showed a recruitment level of just 11.4 % in 2023.

In European Union waters, European eel stocks, fisheries and pressures are regulated under Council Regulation (EC) No 1100/2007, which sets out measures for the recovery of European eels[14]. In Scotland, fishing for eels is prohibited without licence under the Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008. European eels are a UK Biodiversity Action Plan priority fish species.

Lamprey Species – Brook Lamprey, River Lamprey & Sea Lamprey

All three species of Lamprey native to the UK are protected under Annex II of the EU Habitats Directive, Appendix III of the Bern Convention and are a UK Biodiversity Action Plan priority fish species. Brook lamprey are afforded further protection under Annex V of the EU Habitats Directive. All three species migrate within the freshwater environment however brook lamprey are the only species to complete their lifecycle entirely in freshwater. Both river lamprey and sea lamprey spend a portion of their lifecycle at sea before returning to freshwater to spawn. All three species spawn in spring to early summer.

Table 6: Fish species presence and distribution information

Watercourse reach	Fish Species Presence / Absence					
	Atlantic salmon	Brown trout	European eel	Brook lamprey	River lamprey	Lamprey spp. (undefined)
Swinzie Burn (upstream of natural waterfall)	Present	Present	Absent	Absent	Absent	Absent
Swinzie Burn (Between natural waterfall and Swinzie Burn confluence with Annick Water)	Present	Present	Present	Absent	Absent	Absent
Annick Water (between Swinzie Burn confluence with Annick Water and the old mill weir)	Present	Present	Present	Absent	Absent	Absent
Annick Water (between the old mill weir and Lainshaw weir)	Present	Present	Present	Absent	Absent	Absent

[13] Marine Directorate (2024). Scottish salmon and sea trout fishery statistics 2023.
[14] International Council for the Exploration of the Sea (ICES). (2024). Joint EIFAAC/ICES/GFCM Working group on Eels (WGEEL). ICES Scientific Reports. Vol 6. Issue 90.

Annick Water (downstream of Lainshaw weir to Annick Water confluence)	Present	Present	Present	Present	Absent	Present

It is considered impossible to capture all fish present within a site therefore, whilst the failure to capture fish at a site may indicate that the population is absent, it cannot be assumed that they are not present elsewhere in the watercourse or catchment. For the purposes of this section of the report 'absent' means that ART have no records of this fish species within the specified section. The potential for future populations should be considered when developing an environmental management plan.

Freshwater pearl mussel (*Margaritifera margaritifera*)

Freshwater pearl mussels are categorised as 'Critically Endangered' on the IUCN Red List of Threatened Species in Europe. No country in Europe has a 'favourable conservation' status for Freshwater pearl mussel.

Freshwater pearl mussels are protected under Schedule 5 of the Wildlife and Countryside Acy 1981 (as amended). It is an offence to intentionally or recklessly:

- kill, injure or take any wild animal included in Schedule 5 - Freshwater Pearl Mussels;
- possess or control, sell, offer for sale or transport for the purpose of sale any live or dead animal included in Schedule 5 or any part of, or anything derived from, such an animal;
- damages or destroys any structure or place which any wild animal specified in Schedule 5 uses for shelter or protection;
- disturbs any such animal while it is occupying a structure or place which it uses for shelter or protection.

There is no evidence of Freshwater pearl mussels being present within the River Irvine catchment.

6.4 Appendix D – Invasive Non-Native Species (INNS) Distribution

INNS are considered one of the biggest threats to biodiversity worldwide after habitat destruction. INNS are species that have been introduced and can cause harm or damage to local biodiversity, natural environments, our health, the economy or the way we live. Invasive non-native plant species commonly found in Scotland are Japanese knotweed, giant hogweed, Himalayan balsam and American skunk cabbage.

Under the Wildlife and Countryside Act 1981, section 14 it is an offence to:

- plant, or otherwise causes to grown, any plant in the wild at a place out with its native range.

Under the Wildlife and Countryside Act native range is defined as 'the locality to which the animal or plant of that type is indigenous and does not refer to any locality to which that type of animal or plant has been imported (whether intentionally or otherwise) by any person'.

ART carry out INNS control and management of all four species and as such are experienced in identifying and surveying for these species. During the electrofishing and fish habitat surveys, our staff made additional notes on the presence/absence of INNS.

Within the Site, no INNS were recorded along the riparian zone of the Swinzie Burn, nor were any recorded on the access tracks used.

6.5 Appendix E – General habitat survey definitions

Habitat and site data collection follows the SFCC team leader electrofishing general method guidelines. Relevant components and definitions from the Electrofishing Team Leader manual have been provided below.

Left and Right bank are determined when facing downstream.

Instream Cover

Instream cover for salmonids aged one year or older:

None – No over – Stream bed composed entirely of fine uniform particles (silt, sand, gravel, pebbles) or continuous hard surfaces (bedrock or concrete).

Poor – Little cover- Stream bed composed predominantly of fine to medium particles (gravel, pebbles and cobbles), little or no cover from aquatic vegetation.

Moderate – Moderate cover- Stream composed of a mix of particle sizes (gravel to boulders) and/or with some areas of Good cover substrate (pebbles, cobbles and boulders), which may or may not have some aquatic vegetation cover.

Good – Good cover- Stream composed mainly of medium to large size substrate (pebbles, cobbles and boulders) and/or with some aquatic vegetation cover.

Excellent – Excellent cover- Stream composed predominantly of large size substrate (cobbles and boulders) and/or with extensive aquatic vegetation cover.

Substrate type

Table 7: SFCC Substrate type definitions

High Organic	Very fine organic matter, include peat substrate and thick leaf cover on stream bed in this category.
Silt	Fine, sticky, mostly inorganic material, individual particles invisible.
Sand	Fine, inorganic particles, <2mm diameter, individual particles visible
Gravel	2-16mm diameter
Pebble	16-64mm diameter
Cobble	64-256mm diameter
Boulder	>256mm diameter
Bedrock	Continuous rock surface
Obscured	Anything that can obscure the riverbed and cannot be moved for inspection. Include areas that cannot be seen because of water depth or colour

Compacted substrates

Compaction of the substrate is evaluated by digging into the riverbed using your foot. If it freely moves, it is considered uncompacted. A compacted substate is when the riverbed is cemented by fine particles and very difficult or impossible to move with your foot.

Flow types

Table 8: SFCC Flow type definitions

SM	Still marginal	<10cm deep, water still or eddying, no waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent.
DP	Deep pool	≥30 cm deep, water flow slow, eddying, no waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent.
SP	Shallow pool	<30cm deep, water flow slow, eddying, no waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent
DG	Deep glide	≥30 cm deep, water flow moderate/fast; waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent.
SG	Shallow glide	<30 cm deep, water flow moderate/fast; waves form behind a 2-3 cm wide rule is placed in the current, smooth surface appearance, water flow is silent.
RU	Run	Water flow fast, unbroken standing waves at surface; water flow is silent.
RI	Riffle	Water flow fast, broken standing waves at surface; water flow is audible.
TO	Torrent	White water, water flow noisy, difficult to distinguish substrate, associated with steep gradient.

Scottish Fisheries Coordination Centre (2024). Training Manual, Team Leader Electrofishing.

Table 9: Walkover fish habitat survey definitions (Hendry & Cragg-Hine, 1997)

Habitat type	Characteristics and definition
Salmonid spawning habitat including silted spawning habitat	Stable gravel up to 30cm in depth that is not compacted or contains excessive silts. Substrate size of 80mm to 100mm is optimal. Silted spawning habitats are compacted and contain excess silt preventing easy movement of substrate.
Fry (0+) habitat	Shallow (<20cm) fast flowing water associated with riffle-run habitats with substrates dominated by pebble (16-64mm) and cobble (64-256mm)
Parr (1+) habitat	Deeper (20-40cm) fast flowing water associated with riffle-run habitats with substrates composed of pebble (16-64mm), cobble (64-256mm) and boulder (>256mm)
Mixed juvenile salmonid habitat	A mix of fry and parr habitat, suited to both age classes in combination. Deeper, faster, larger substrate areas used by parr, and the shallower, slower, smaller substrate areas used by fry
Glides	Smooth laminar flow with little surface turbulence and generally greater than 30cm in depth
Pools	No perceptible flow and usually greater than 1m deep.
Flow constriction	Where physical features provide a narrowing of the channel resulting in increased velocity and depth (often combined with a localised increase in gradient and bedrock substrates)
Obstacles to fish migration	A structure or item identified as a potential obstruction to fish passage at certain water heights (e.g. waterfalls, weirs, bridge aprons, shallow braided river sections preventing upstream migration during low flows, culverts)
Lamprey spawning habitat	Stable gravel up to 30cm deep that is not compacted or contains excessive silt. Moderate to fast flowing water.
Ammocoete habitat	Areas of stable silt and sand (>20cm depth), shallow with low velocity and organic detritus (twigs, leaf litter) present. SFCC (2007)