APPENDIX 1

AQUATIC BASELINE REPORT

Planning and Environmental Consultants

Slievegrine Renewable Energy Development, Co. Waterford

Aquatic Baseline Report

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1. INTRODUCTION

1.1 Background

Aquatic baseline surveys were conducted, and this Aquatic Baseline Report was prepared by MKO for the area within and in the vicinity of the Site. The Site measures approximately 1,450 hectares (ha). The Proposed Project is fully described in Section 4 of Chapter 4 of the EIAR.

Aquatic Baseline Surveys were undertaken in September and October 2025 and May 2026 within and in the vicinity of the Site. A desk study was undertaken between July 2025 and June 2026. This report provides a baseline assessment of the aquatic condition of the lands within and in the vicinity of the Site and acts as an aquatic baseline record to which future records and monitoring can be compared.

1.2 Statement of Authority

Aquatic Baseline Surveys were undertaken by Niamh Rowan (B.Sc.), Aran von der Geest Moroney (B.Sc.), Mark Whelan (B.Sc., M.Sc.) of MKO in September 2025. Dedicated Stage 1 and Stage 2 freshwater pearl mussel surveys were undertaken by Aran von der Geest Moroney, Kate O' Donnell (B.Sc.), Padraig Desmond (B.Sc.), Viorel Anitei (B.Sc.), Neansai O' Donovan (B.Sc.), and Pat Roberts (B.Sc., MCIEEM) in October 2025. Surveys of proposed Wind Farm watercourse crossings were conducted in May 2026 by Niamh Rowan and Emily Fair (B.Sc., M.Sc.).

This report has been prepared by Niamh Rowan supported by Mark Whelan and has been reviewed by Aran von der Geest Moroney. Mark, Niamh and Aran have extensive experience in undertaking ecological surveys and assessments for large-scale infrastructural projects such as wind farms, railways, roads and flood relief schemes.

1.3 Survey Locations

The aquatic baseline surveys for the Proposed Project took place predominantly in the vicinity of the upland area of Knocknahoola, Co. Waterford. Survey sites along watercourses draining to the north-northeast of Knocknahoola lie within the WFD catchment Colligan-Mahon (Catchment ID: 17), while survey sites along watercourses draining to the south-southwest lie within the WFD catchment Blackwater (Munster) (Catchment ID: 18). Proposed Wind Farm survey sites are shown in Figure 1-1, while survey sites for the Proposed Grid Connection watercourse crossings are shown in Figure 1-2. The location of proposed watercourse crossings within the Proposed Wind Farm site are shown in Figure 1-3.

1.3.1 Aquatic Baseline Study Area

The aquatic baseline Study Area consists of the Water Framework Directive (WFD) hydrological catchments and subcatchments in which the Proposed Wind Farm and the Proposed Grid Connection are located, as well as the wider Proposed Wind Farm site and Proposed Grid Connection site and the freshwater habitats therein. Focus has been placed on those watercourses which interact directly with the Proposed Project, and those watercourses which are located upstream and downstream of the Proposed Project. Therefore, the Study Area is defined as follows:

The freshwater habitats located within the Site, as well as freshwater habitats within select watercourses located upstream and downstream of the Site, as shown in Figure 1-1, Figure 1-2 and Figure 1-3.

A total of nineteen Proposed Wind Farm survey locations were selected across EPA watercourses for assessment within the Study Area (Table 1-1, Figure 1-1). Fourteen of the Proposed Wind Farm survey locations were located within the Goish subcatchment (EPA ID: 18_27), which is situated within the

wider WFD Blackwater (Munster) catchment. Five of the Wind Farm survey sites were located within the Colligan subcatchment (EPA ID: 17_6), situated within the WFD Colligan-Mahon catchment.

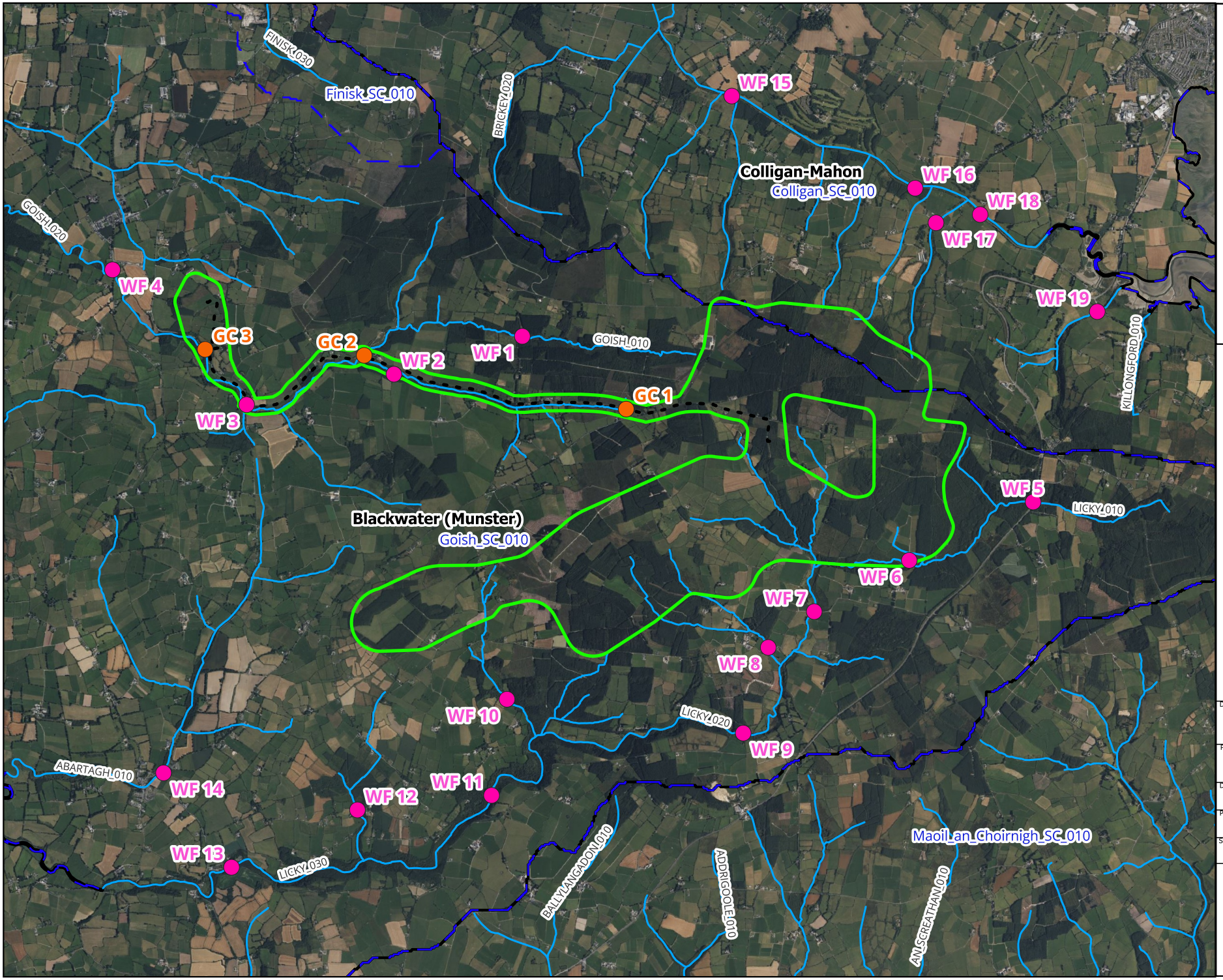
Three watercourse crossings (EPA mapped and unmapped rivers and streams) were identified along the Proposed Grid Connection site. A number of drains were identified along the Proposed 110kV Underground Cabling Route, which were not surveyed. Proposed Grid Connection survey sites were located within the Goish subcatchment (EPA ID: 18_27). Eight watercourse crossings located within the Proposed Wind Farm site were also surveyed. All watercourse crossing survey sites were located within the Goish subcatchment (EPA ID: 18_27).

Wet grassland (GS4), Improved agricultural land (GA1), and Conifer plantation (WD4) are the dominant habitats in the landscape surrounding the survey sites. Aquatic baseline surveys undertaken within the vicinity of the Site covered both low order, upper reach streams and downstream, high order rivers. Nomenclature for surveyed watercourses follows that of the Environmental Protection Agency (EPA).

Table 1-1. Locations of survey sites

Site no.	Watercourse	EPA name	EPA code	Hydrological catchment	Hydrological subcatchment	X (ITM)	Y (ITM)
Proposed Wind Farm survey sites							
WF 1	Goish_010	Goish	18G12	Blackwater (Munster)	Goish_SC_010	617044	589562
WF 2	Goish_010	Monagally_East	18M10			615504	589073
WF 3	Goish_010	Goish	18G12			613700	588710
WF 4	Goish_010	Goish	18G12			612074	590355
WF 5	Licky_010	Licky	18L01			623277	587533
WF 6	Licky_010	Licky	18L01			621772	586820
WF 7	Licky_010	Licky	18L01			620298	585641
WF 8	Licky_020	Móin_an_mBian	18M04			620018	585828
WF 9	Licky_020	Licky	18L01			619742	584715
WF 10	Licky_020	Carronadavderg	18C28			619742	585187
WF 11	Licky_020	Licky	18L01			616685	583990
WF 12	Licky_030	Grallagh_Lower	18G57			615074	583715
WF 13	Licky_030	Licky	18L01			613638	583148
WF 14	Abartagh_010	Abartagh	18A11			612683	584253
WF 15	Brickey_020	Brickey	17B01	Colligan-Mahon	Colligan_SC_010	619560	592490
WF 16	Brickey_020	Brickey	17B01			621841	591365
WF 17	Brickey_020	Twomile_Bridge	17T04			622046	590860
WF 18	Brickey_020	Brickey	17B01			622449	591200
WF 19	Killongford_010	Boherard 17	17B62			623897	589779
Proposed Wind Farm watercourse crossing sites							

Site no.	Watercourse	EPA name	EPA code	Hydrological catchment	Hydrological subcatchment	X (ITM)	Y (ITM)
IC 1	Unmapped watercourse			Blackwater (Munster)	Goish_SC_010	620448	588946
IC 2	Unmapped watercourse					621855	587837
IC 3	Unmapped watercourse					621757	587359
IC 4	Unmapped watercourse					621348	587476
IC 5	Unmapped watercourse					620648	587474
IC 6	Unmapped watercourse					619110	587328
IC 7	Unmapped watercourse					619111	587326
IC 8	Unmapped watercourse					616607	586223
Proposed Grid Connection survey sites							
GC 1	Goish_010	Monagally_East	18M10	Blackwater (Munster)	Goish_SC_010	618321	588668
GC 2	Goish_010	Goish	18G12			615125	589310
GC 3	Goish_010	Goish	18G12			613194	589391



Map Legend

- EIAR Boundary
- Proposed Grid Connection
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments
- WFD River Waterbodies
- Proposed Wind Farm Survey Locations
- Proposed Grid Connection Survey Locations

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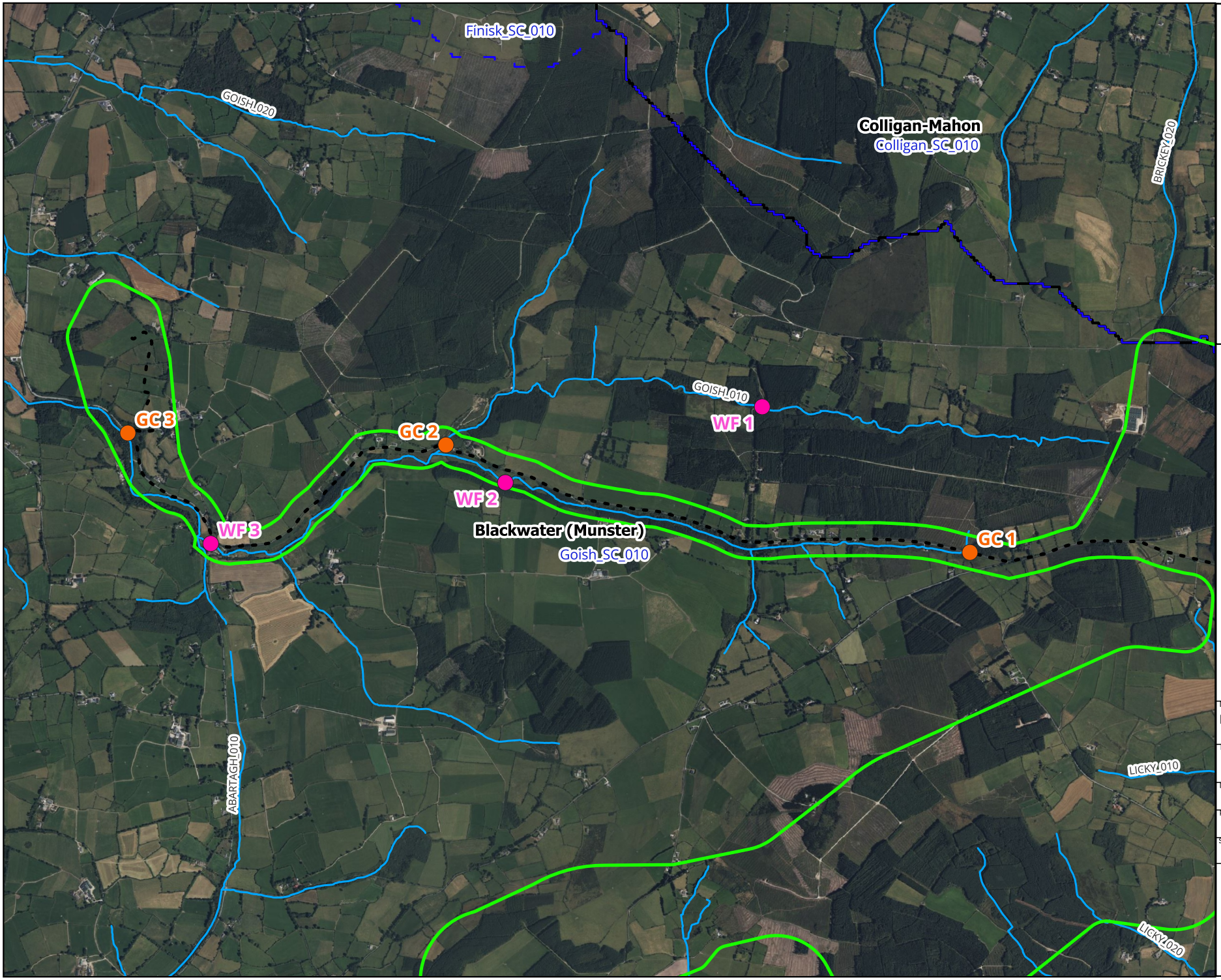
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Drawing Title: Proposed Wind Farm Survey Locations

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Project No.	**Drawing No.**
240740	Figure 1-1
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Map Legend

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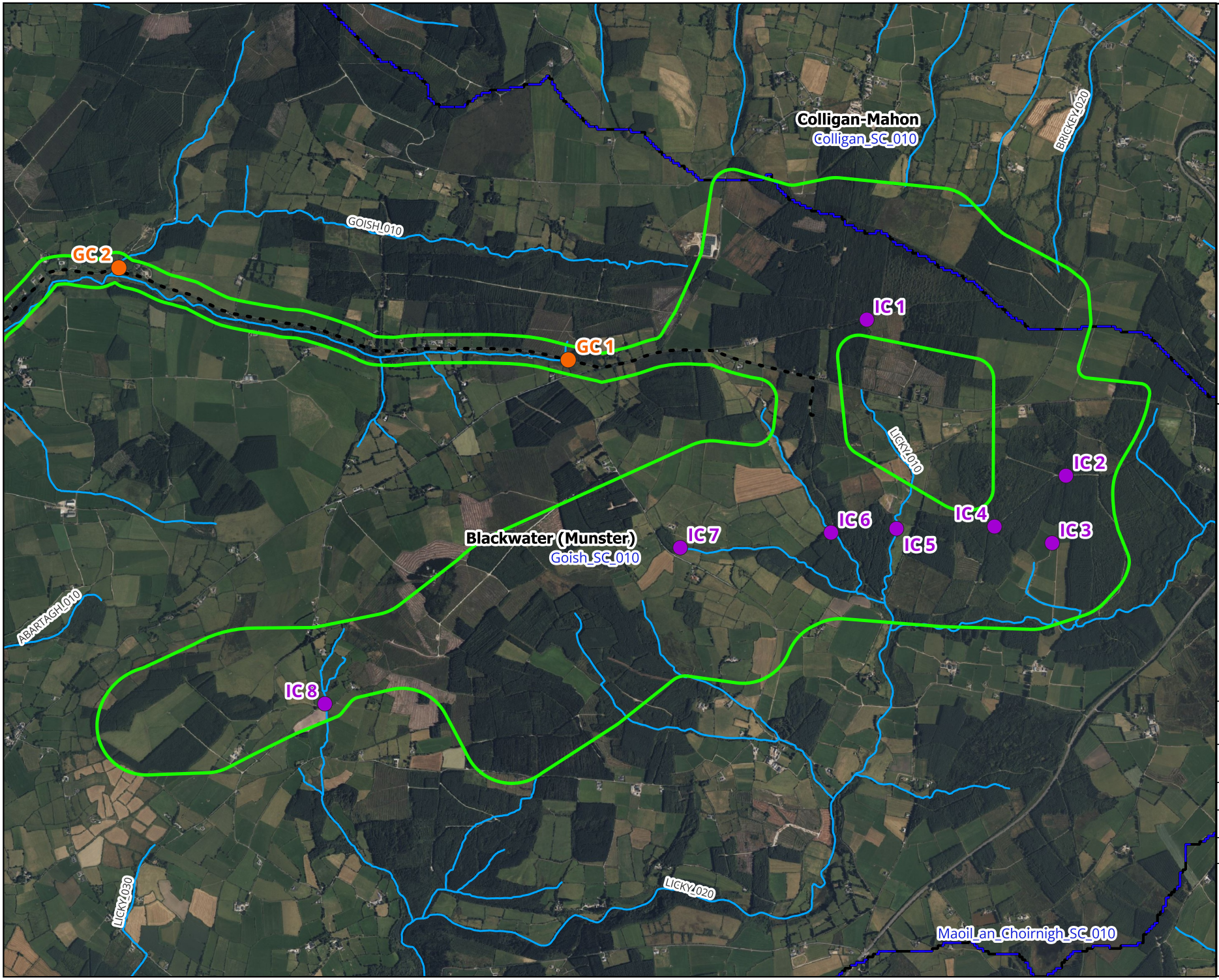
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Map Legend

- EIAR Boundary
- Proposed Grid Connection
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments
- WFD River Waterbodies
- Proposed Infrastructure Watercourse Crossing Survey Locations
- Proposed Grid Connection Survey Locations

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2. METHODOLOGIES

2.1 River Habitat Assessment

Aquatic habitat assessments were undertaken in order to determine the riverine habitat types present at each of the survey locations within and in the vicinity of the Site (as defined in Section 1.1). The survey design and methodologies were derived from current ecological best practice guidance documents. Habitats were classified in accordance with the national habitat classification system used in Ireland - A Guide to Habitats in Ireland (Fossitt, 2000).

Riverine habitat assessments were conducted utilising elements of the following methodologies and literature to characterise the selected sites along the watercourse:

- Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* (EA, 2003),
- *'Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (PE-ENV-01113)'* (TII, 2008),

All sites were assessed in terms of the following variables:

- Channel width and depth.
- Bank profiles, including bank height and riparian vegetative composition.
- Substrate type, listing substrate fractions in order of dominance.
- Flow type.
- Occurrence and abundance of instream macrophytes and aquatic bryophytes (DAFOR scale).
- Water clarity and colouration.
- Riparian vegetation composition.

The survey was devised to gather ecological baseline information including any habitat features that could potentially support protected Qualifying Interest species associated with EU designated sites within the wider area. In addition, surveys considered the potential presence of problematic invasive alien species, with an emphasis on Invasive Alien Species (IAS) listed on the First Schedule of the European Union (Invasive Alien Species) Regulations 2024 (S.I. No. 374 of 2024) and Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). The assessments have regard to the TII guidance document - *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (GE-ENV-01105)* (TII, 2020).

During the site visit, additional information on any other species of local biodiversity value occurring within the Site was recorded in order to provide a complete baseline understanding of the Site.

2.2 Fisheries Habitat Assessment

An assessment of the riverine habitats at each survey site was undertaken to determine the potential for watercourses within the Study Area (as defined in Section 1.3.1) to support fish species, including salmonids, lamprey species, and European eel, among other fish species likely to utilise watercourses within the Study Area.

Fisheries habitat assessments were conducted utilising elements of the following methodologies and literature to characterise the selected sites along the watercourse:

- Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003)
- Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000).

- Channels & Challenges. Enhancing Salmonid Rivers. Irish Freshwater Fisheries Ecology & Management Series (O'Grady, 2006)
- Life Cycle Unit method (Kennedy, 1984; O'Connor & Kennedy, 2002)
- NPWS Irish Wildlife Manuals lamprey surveys (O'Connor, 2004; O'Connor, 2006; and O'Connor, 2007)
- Evaluation of Habitat for Salmon and Trout. Department of Agriculture Fisheries Division. EU Salmonid Enhancement Programme (DOA-NI, 2005)
- Restoration of Riverine salmon habitats (Hendry, K. & Cragg-Hine, D., 1997)
- Ecology of the Atlantic Salmon, Conserving Natura 2000 Rivers (Hendry, K & Cragg-Hine, D., 2003)
- Habitat requirements of Atlantic salmon and brown trout in rivers and streams (Armstrong. J.D. et al., 2003)
- Ecology of the River, Brook, and Sea Lamprey (Maitland, 2003)
- Monitoring the River, Brook and Sea Lamprey, *Lampetra fluviatilis, L. planeri* and *Petromyzon marinus* (Harvey J. & Cowx I. 2003).
- The Eel: Biology and Management of Anguillid Eels (Tesch, F.W., 2007)

2.3 Electrofishing Surveys

Electrofishing operations for the purpose of forming baseline fisheries data of selected sites were undertaken upstream and downstream of the Proposed Wind Farm site, throughout the Study Area on the 1st, 23rd, 24th, and 25th of September 2025. Electrofishing was carried out under Section 14 Licence (Section 14 Authorisation Application under Section 14 of the Fisheries (Consolidation) Act 1959, as substituted by section 4 of the Fisheries (Amendment) Act 1962).

A 5-minute timed electrofishing survey was undertaken at each of the survey sites where feasible, to determine the presence or absence of fish species within the Study Area while adhering to best practice methodology (Electric Fishing in Wadeable Reaches, Central Fisheries Board (CFB, 2008)), as well as European standards for electrofishing (CEN, 2003). Two suitably qualified ecologists conducted electrofishing operations at the electrofishing locations shown in Figure 1-1, using an E-fish EF-500B-SYS Electric Fishing Backpack System.

Fish captured during electrofishing operations at each survey site were kept in a holding container with oxygenated water. Stress to fish via temperature and low oxygen levels was reduced via frequent freshwater changes and monitoring of water temperature within the holding container, ensuring temperatures of 20°C were not surpassed. All fish temporarily captured during the survey were identified to species level and measured. All fish temporarily captured were allowed to recover and subsequently returned to the watercourse in the vicinity of where they were collected.

Biosecurity measures were followed as per Section 2.8 below.

2.4 Macroinvertebrate Surveys

A two-minute kick-sample and stone-wash, as well as a one-minute hand search of larger substrata or organic material (e.g., submerged tree limbs/vegetation) were performed at each of the survey sites, as per methodology used by the Environmental Protection Agency (EPA) as part of the Water Framework Directive (WFD) River Monitoring Programme (Toner *et al.,* 2005).

Dislodged fauna were caught in a standard hand net (250 mm x 250 mm, 300 mm bag depth, 1 mm mesh size) situated downstream of the sampler disturbing the stream/riverbed substrate. The sampler moved upstream and across the channel while performing the kick-sample to ensure all microhabitats presents within the watercourse were surveyed. All material collected in the net was transferred via rinsing to a white heavy duty plastic tray (485 mm x 335 mm x 80 mm) filled with water for identification of macroinvertebrates in situ. Large stones and organic material within the sample such as

leaves, twigs, algae or bryophytes were examined for any macroinvertebrates present and subsequently removed from the tray.

Specimens present in the sample were identified to the lowest possible taxonomic level using the FBA Guide to Freshwater Invertebrates (Dobson et al., 2012). The Q-value system assigns macroinvertebrate taxonomic groups to one of five WFD status pollution sensitivity groups (from A, Most Pollution sensitive to E, Most Pollution Tolerant). The Q-value is calculated based on the relative abundance of Pollution Sensitive Group A and B taxa to Pollution Tolerant Group C, D and E taxa within the sample, and the surveyed stretch of watercourse is assigned an associated pollution status. The EPA Quality (Q)-Rating System is summarised in Table 2-1.

Table 2-1. EPA Quality (Q) Rating System.

Biotic Index	Quality Status	Quality Status	Quality Class	Condition
Q5, Q4-5	High	Unpolluted	Class A	Satisfactory
Q4	Good	Unpolluted	Class A	Satisfactory
Q3-4	Moderate	Slightly Polluted	Class B	Unsatisfactory
Q3, Q2-3	Poor	Moderately Polluted	Class C	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously Polluted	Class D	Unsatisfactory

2.5 Otter Surveys

Otter surveys were conducted as per TII (2008) guidelines *(Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (PE-ENV-01113))*. This involved a search for all otter signs, e.g., spraint, scat, prints, slides, trails, couches and holts both upstream and downstream of proposed survey sites. Within the Study Area, otter surveys were conducted 150 m upstream and downstream of all survey points. Due to the small-scale nature of works proposed to be undertaken along the Proposed 110kV Underground Cabling Route, as well as high levels of disturbance from existing roads, otter surveys were conducted in the vicinity of the Proposed Grid Connection survey sites. In addition to the width of the rivers, a 10 m riparian buffer (both banks) is considered to comprise part of the otter habitat (NPWS, 2009. Threat Response Plan: Otter (2009-2011)).

2.6 eDNA Surveys

The Proposed Wind Farm site (and wider Proposed Wind Farm site) is drained to the southwest by the Licky River within the wider Munster Blackwater catchment area. The Licky is part of the Blackwater River (Cork/Waterford) Special Area of Conservation [002170], with an identified population of freshwater pearl mussel *(Margaritifera margaritifera)* present within the River Licky. The Licky population is separated from the population of freshwater pearl mussel within the main channel of the Munster Blackwater by brackish water and a hydrological distance of ~30 km. Therefore, the freshwater pearl mussel present within the Licky are listed as a distinct population (Munster Blackwater-Licky population) within the European Communities Environmental Objectives (Freshwater Pearl Mussel) S.I. No. 296/2009.

Freshwater pearl mussel are protected in Ireland under the Wildlife Acts and the Habitats Directive (92/43/EEC) where they are designated under Annex II and V. White-clawed crayfish *(Austropotamobius pallipes)* is another freshwater species occurring in Ireland that are listed under the Wildlife Acts, as well as Annex II and V of the Habitats Directive. Given the potential ecological sensitivity and legislative protection afforded to both species, environmental DNA (eDNA) surveys for

freshwater pearl mussel and white-clawed crayfish were conducted at 12 of the survey sites located within the Goish_SC_010 subcatchment (Table 2-2).

Table 2-2. eDNA survey sites within and in the vicinity of the Proposed Wind Farm site.

eDNA Site Code	X (ITM)	Y (ITM)
eDNA 1 / WF 5	623277	587530
eDNA 2	621507	587277
eDNA 3 / WF 6	621768	586815
eDNA 4	620679	587585
eDNA 5	620395	587000
eDNA 6	618559	586341
eDNA 7 / WF 9	619749	584713
eDNA 8	617649	585343
eDNA 9 / WF 11	616680	583951
eDNA 10 / WF 1	617055	589547
eDNA 11 / WF 3	613695	588716
eDNA 12 (approx. 0.95 km upstream of WF 15)	618866	592990

To detect populations of freshwater pearl mussel or white-clawed crayfish within the Study Area, a composite water sample was collected from the watercourse at each of the selected eDNA survey sites in September 2025 and analysed for freshwater pearl mussel and white-clawed crayfish. eDNA sampling sites were strategically chosen to maximise longitudinal (instream) coverage within the subcatchments, facilitating the likelihood of species detection. eDNA survey sites were chosen based on their location within or in the vicinity of the Site, as well as known records of freshwater pearl mussel.

Each composite (~500 ml) water sample was collected from each watercourse, with 20 x 25 ml samples taken along the watercourse, for a representative geographic spread at the site. The composite sample was filtered and fixed on site using a sterile proprietary eDNA sampling kit. The sample was stored at room temperature and sent to the laboratory for analysis following return from site. Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence. Whilst an eDNA approach is not currently quantitative, the detection of the target species' DNA indicates the presence of the species at and/or upstream of the sampling point.

2.7 Freshwater Pearl Mussel Surveys

Stage 1 and 2 freshwater pearl mussel surveys were conducted, in accordance with the *Margaritifera margaritifera* Stage 1 and Stage 2 Survey Guidelines produced by the NPWS (Irish Wildlife Manual No. 12, Anon 2004), by ecologists from MKO under license number C264/2025 from the National Parks and Wildlife Services (NPWS).

The surveys were carried out on the 16th and 17th October 2025. Four stretches of the River Licky were selected, totalling approx. 4 km in length. Survey stretches were selected based on historic NPWS records for freshwater pearl mussel, and on the location of a positive freshwater pearl mussel eDNA result along the River Licky. Stretches of Stage 1 & 2 freshwater pearl mussel survey and the location of freshwater pearl mussel eDNA surveys, including the positive eDNA result, are shown in Figure 2-1.

Survey Areas 2, 3 and 4 consisted of 500 m survey stretches of the Lickey River, with one 500 m survey stretch within Survey Area 3 and 4 each, and two 500 m survey stretches within Survey Area 2. Survey

Area 1, with an approximate length of 2.2 km, was surveyed in its entirety due to the importance of this area for freshwater pearl mussel based on historical freshwater pearl mussel records.

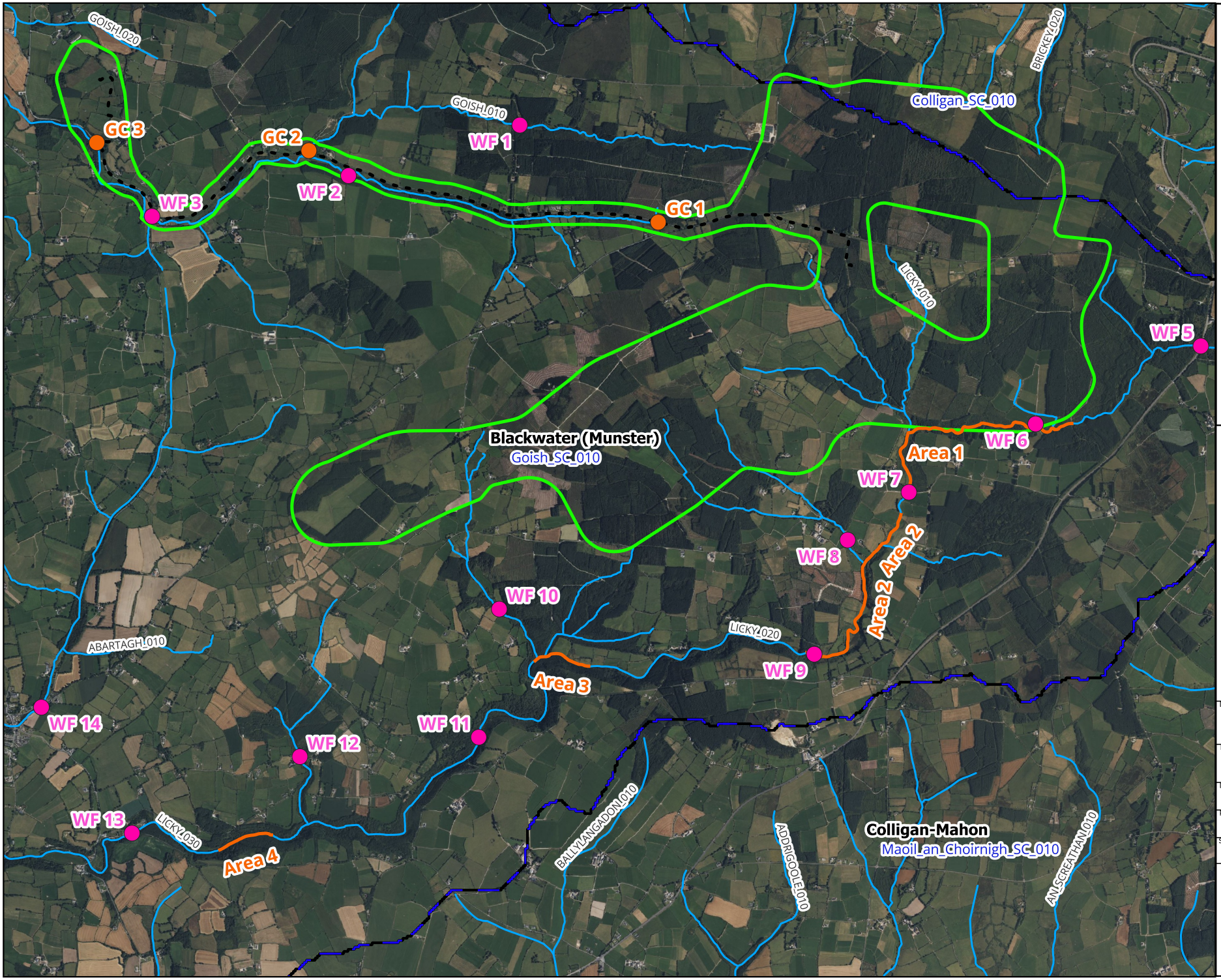
In order to determine suitable survey days a variety of meteorological websites were analysed (i.e., www.met.ie). Ideally surveys should be undertaken on sunny days, which aid and increase underwater visibility. Survey works should not be conducted during overcast days i.e. (more than 60% cloud cover) or at dawn or dusk (*Margaritifera margaritifera* Stage 1 and Stage 2 Survey Guidelines produced by the NPWS, Irish Wildlife Manual No. 12, Anon 2004). In addition, surveys should not be carried out after periods of heavy rain when there may be a high sediment loading in the river which may impair visibility. Surveys were undertaken in line with all above parameters, with no rainfall during surveys, no significant rainfall events prior to surveys, low cloud cover on average across surveys, and overall low water levels.

In accordance with the Pearl Mussel guidelines, there are no seasonal constraints with regard the timing of surveys. Survey periods are only limited to periods of suitable weather conditions with good underwater visibility. The survey was undertaken by the surveyors systematically searching the riverbed with the use of a bathyscope, working from downstream to upstream and covering all areas of the river channel. Within survey stretch 1 there were a number of areas of fallen tress across the channel. These usually caused no issues in survey effort, however in one area within the survey stretch a cluster of fallen trees prevented complete survey of a small area of watercourse (approx. 5-10 m).

Based on the above, no significant limitations to the survey were identified and it was considered that a comprehensive Stage 1 and 2 freshwater pearl mussel survey was conducted in line with the *Margaritifera margaritifera* Stage 1 and Stage 2 Survey Guidelines.

2.8 Biosecurity Measures

Biosecurity measures which were implemented followed *IFI Biosecurity Protocol for Field Survey Work*, (IFI, 2010). Due to increasingly prevalent spread of Crayfish plague in Ireland and to prevent the spread of aquatic invasive species, all equipment was scrubbed and cleaned prior to and post works with Virkon Aquatic. Additionally, all equipment was cleaned with Virkon Aquatic between survey sites when this involved upstream movement, inter-watercourse movement or inter-subcatchment movement. Any instance of invasive species was recorded and conveyed to IFI via electrofishing data returns.



Map Legend

- EIAR Boundary
- Proposed Grid Connection
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments
- WFD River Waterbodies
- Stage 1 & 2 Freshwater Pearl Mussel Survey Locations
- Proposed Wind Farm Survey Locations
- Proposed Grid Connection Survey Locations

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Drawing Title: Location of Stage 1 & 2 Freshwater Pearl Mussel Surveys

Project Title: Slievegrine Renewable Energy Development, Co. Waterford

Drawn By	Checked By
NR	AvdGM
Project No.	Drawing No.
240740	Figure 2-1
Scale	Date
1:45,000	11.09.2026

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3. DESK STUDY

A Desk Study was conducted to gather baseline information from publicly available sources and records on the aquatic habitats and aquatic dependent species within the vicinity of the survey area.

In preparation of the desk study, the following sources were used to gather information:

- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA, Water Framework Directive (WFD), Inland Fisheries Ireland.
- Review of OS maps and aerial photographs of the survey area.

3.1 EPA Water Quality

The EPA Envision map viewer was consulted most recently on 4th September 2026 regarding the water quality status and risk of the rivers which comprise the Proposed Wind Farm survey sites and Proposed Grid Connection survey sites.

Table 3-1 presents a summary of the waterbody WFD status for 2016-2021 and 2019-2024, and the WFD 3rd Cycle River Waterbodies Risk Projection, as well as details of the corresponding Proposed Wind Farm survey sites and Proposed Grid Connection survey sites. There were 14 EPA monitoring points within the vicinity of the Site (Table 3-2).

Table 3-1. WFD Status and Risk of surveyed watercourses within the vicinity of the Proposed Wind Farm site and Proposed Grid Connection site.

Survey sites	Watercourse	EPA name	EPA code	Catchment	Sub Catchment	Waterbody WFD Status for 2016-2021	Waterbody WFD Status for 2019-2024	WFD 3rd Cycle River Waterbodies Risk Projection
Proposed Wind Farm survey sites								
WF 1	Goish_010	Goish	18G12	Blackwater (Munster)	Goish_SC_010	Moderate	Moderate	At risk
WF 2	Goish_010	Monagally_East	18M10			Moderate	Moderate	At risk
WF 3	Goish_010	Goish	18G12			Moderate	Moderate	At risk
WF 4	Goish_010	Goish	18G12			Moderate	Moderate	At risk
WF 5	Licky_010	Licky	18L01			Good	Good	Not at risk
WF 6	Licky_010	Licky	18L01			Good	Good	Not at risk
WF 7	Licky_010	Licky	18L01			Good	Good	Not at risk
WF 8	Licky_020	Móin_an_mBian	18M04			Good	Good	Not at risk
WF 9	Licky_020	Licky	18L01			Good	Good	Not at risk
WF 10	Licky_020	Carronadavderg	18C28			Good	Good	Not at risk
WF 11	Licky_020	Licky	18L01			Good	Good	Not at risk
WF 12	Licky_030	Grallagh_Lower	18G57			Good	Good	Not at risk
WF 13	Licky_030	Licky	18L01			Good	Good	Not at risk
WF 14	Abartagh_010	Abartagh	18A11			Good	Good	Not at risk
WF 15	Brickey_020	Brickey	17B01			Poor	Poor	At risk

WF 16	Brickey_020	Brickey	17B01	Colligan-Mahon	Colligan_SC_010	Poor	Poor	At risk
WF 17	Brickey_020	Twomile_Bridge	17T04			Poor	Poor	At risk
WF 18	Brickey_020	Brickey	17B01			Poor	Poor	At risk
WF 19	Killongford_010	Boherard 17	17B62			Good	Good	Under review
Proposed Grid Connection survey sites								
GC 1	Goish_010	Monagally_East	18G12	Blackwater (Munster)	Goish_SC_010	Moderate	Moderate	At risk
GC 2	Goish_010	Goish	18G12			Moderate	Moderate	At risk
GC 3	Goish_010	Goish	18G12			Moderate	Moderate	At risk
Proposed Wind Farm watercourse crossing sites								
IC 1	Unmapped watercourse			Blackwater (Munster)	Goish_SC_010	–	–	–
IC 2	Unmapped watercourse					–	–	–
IC 3	Unmapped watercourse					Good	Good	Not at risk
IC 4	Unmapped watercourse							
IC 5	Licky_010	Knocknahoola	18K20			Good	Good	Not at risk
IC 6	Licky_010	Clashbrack	18C21			Good	Good	Not at risk
IC 7	Licky_010	Carronahyla	18C22			Good	Good	Not at risk
IC 8	Licky_020	Carronadavderg	18C28			Good	Good	Not at risk

Table 3-2. EPA Water Quality Data.

Watercourse	Sub Catchment	Sampling Station	Location	Sampling Year	Q-Value & Water Quality Status
Licky_010	Goish_SC_010	LICKY-Br S of Pulla [Station Code: RS18L010050]	E 223336.27, N 87469.66	2003	Q3-4 – Moderate
Licky_010		Br NE of Glenlicky [Station Code: RS18L010100]	E 220309, N 85541.7	2024	Q4 – Good
Licky_020		LICKY - Ford (Br) WNW of Kileys X-Rds [Station Code: RS18L010120]	E 219798.96, N 84657.43	2003	Q4 – Good
Licky_020		LICKY - Grallagh Br. [Station Code: S18L010150]	E 216736.3, N 83892.07	2024	Q4 – Good
Licky_020		Licky Br. [Station Code: RS18L010200]	E 213184, N 82729.4	2024	Q4-5 – High
Goish_010		Broken Br. [Station Code: RS18G120050]	E 215183, N 89258.6	2024	Q3-4 – Moderate
Goish_010		GOISH - Goish Br. [Station Code: RS18G120100]	E 213746.34, N 88658.08	1990	Q3-4 – Moderate
Goish_020		Br 2 km NW of Aglish. [Station Code: RS18G120300]	E 210564, N 91401.7	2024	Q3 – Poor

Goish_010		GOISH - Br N of Coolroe [Station Code: RS18G120200]	E 212109.49, N 90298.79	2003	Q3-4 – Moderate
Brickey_010	Colligan_SC_010	BRICKEY - Canty Br. [Station Code: RS17B010030]	E 217806.73, N 93696.17	1991	Q3 – Poor
Brickey_010		Knockmahon Br. [Station Code: RS17B010050]	E 218760, N 93350.6	2022	Q3 – Poor
Brickey_020		BRICKEY - Drehidatogher Br. [Station Code: RS17B010070]	E 218777.41, N 93216.82	1991	Q3 – Poor
Brickey_020		Br u/s Twomile Br. [Station Code: RS17B010090]	E 222141.15, N 91313.97	2019	Q3 – Poor
Brickey_020		Knockmahon Br. [Station Code: RS17B010050]	E 218760, N 93350.6	2025	Q3 – Poor

3.2 Salmonid River Status

Watercourses designated as Salmonid Waters under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations (1988) are those fresh waters classified under the first schedule, which are *'capable of supporting Salmon (Salmo salar), Trout (Salmo trutta), Char (Salvelinus) and Whitefish (Coregonus)'* species. There are no watercourses designated as Salmonid Waters within the immediate vicinity of the Site.

The nearest designated waterbody identified under S.I. No. 293/1988 is the River Bride [Waterford], which is a tributary of the River Blackwater. The section of the Bride which is designated under the Salmonid Waters classification is located approximately 11.2 km upstream of the Bride's confluence with the Blackwater. The River Bride meets the River Blackwater approximately 1.1 km downstream of the confluence between the River Blackwater and the River Goish, along which the Proposed Grid Connection watercourse crossings are located.

3.3 NPWS Data

3.3.1 Freshwater Pearl Mussel

The Site lies within the Munster Blackwater-Licky freshwater pearl mussel catchment of SAC populations listed under the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations of 2009-S.I. No. 296/2009 (Government of Ireland, 2009).

In 2005, the population of freshwater pearl mussel within the River Licky was estimated to be greater than 10,000 individuals (Ross, 2005). However, populations experienced a rapid and dramatic decrease within the coming years, and by 2009 the population had declined to approximately 4,700. No young or juvenile mussels were recorded in the Licky during monitoring in 2005 or 2009 and there was no evidence that recruitment had occurred in at least 12 years, with the smallest mussel in 2009 measuring 85.3 mm (DEHLG, 2010).

3.3.2 Annex I habitats

Distribution of the Annex I habitat *3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation* is mapped for the 10 km hectads in which the aquatic baseline Study Area is located (X 18, X19, X28, X29). The nearest incidence of the Annex I habitat *6430 Hydrophilous tall-herb swamp* is located approx. 4.2 km downstream of survey site WF 4, located along the Goish River.

There are no mapped instances of Annex I freshwater habitats occurring within the Site. The watercourses that drain from the Site flow into the Blackwater (Munster) estuary, which contains mapped instances of 'Mudflats and sandflats not covered by seawater at low tide [1140]', 'Perennial vegetation of stony banks [1220]' and the estuary habitat itself (Estuaries [1130]).

3.3.3 Flora (Protection) Order Macrophytes

Aquatic plant species protected under the Flora (Protection) Order (FPO) 2022 (S.I. No. 235/2022) were not recorded within the 10 km hectads in which the Proposed Project lies, or in any of the surface waters hydrologically connected to the Proposed Project.

3.4 Inland Fisheries Ireland

Inland Fisheries Ireland (IFI) WFD Fish Ecological Status: Rivers, Lakes and Transitional Waters dataset was queried via the IFI Open Data Portal Map viewer. Surveys were conducted by IFI as part of water sampling for the Water Framework Directive (WFD), on the Licky and Abartagh watercourses situated within the Goish subcatchment. Surveying conducted by IFI identified the presence of brown trout *(Salmo trutta),* sea trout *(Salmo trutta),* Atlantic salmon *(Salmo salar),* European eel *(Anguilla anguilla)* and three-spined stickleback *(Gasterosteus aculeatus)* and sites were assigned a WFD fish ecological status score, as summarised in Table 3-3 below.

Table 3-3. IFI Water Framework Directive Fish Ecological Status Data.

River Name	Site name	Species Present	Sampling Year	WFD Fish Ecological Status at site
Licky River	N25 Gorteen_A	› Brown trout *(Salmo trutta)* › European eel *(Anguilla anguilla)*	2018	Good
Licky River	Carrigeen_A	› Brown trout *(Salmo trutta)* › Atlantic salmon *(Salmo salar)*	2018	Good
Licky River	Br. NE of Glenlicky_B	› Brown trout *(Salmo trutta)* › Atlantic salmon *(Salmo salar)* › European eel *(Anguilla anguilla)*	2018, 2022	Moderate
Licky River	Grallagh Br._A	› Brown trout *(Salmo trutta)* › Atlantic salmon *(Salmo salar)* › European eel *(Anguilla anguilla)*	2018	N/A (no status given)
Licky River	Kilgabriel SW_A	› Brown trout *(Salmo trutta)* › Sea trout (Salmo trutta) › Atlantic salmon (Salmo salar) › Flounder *(Platichthys flesus)*	2018	Moderate
Licky River	Ballyheeny Br._A	› Brown trout *(Salmo trutta)* › Atlantic salmon *(Salmo salar)* › Flounder *(Platichthys flesus)* › Three-spined stickleback *(Gasterosteus aculeatus)*	2018	Moderate
Licky (Creegagh) River (Abartagh,EPA classification)	d/s Coolbooa Graveyard	› Brown trout *(Salmo trutta)* › Three-spined stickleback *(Gasterosteus aculeatus)*	2018	Moderate

4. FIELD SURVEY RESULTS

4.1 Aquatic Survey Results

Aquatic Baseline Surveys undertaken in the vicinity of the Proposed Wind Farm site included:

- River habitat assessment,
- Fisheries habitat assessment,
- Electrofishing surveys,
- Macroinvertebrate surveys,
- Otter Surveys,
- Kingfisher suitability assessment,
- eDNA surveys at certain locations.

Aquatic Baseline Surveys undertaken along the Proposed Grid Connection site included:

- River habitat assessment,
- Fisheries habitat assessment,
- Macroinvertebrate surveys,
- Kingfisher suitability assessment,
- Otter Surveys.

Sections 4.1.1, 4.1.2, and 4.1.3 summarise survey findings at each survey site in the Study Area (as defined in Section 1.3.1).

Electrofishing and biological water quality surveys were unable to be completed at survey site WF 18, as a result of deep water and soft, unconsolidated riverbed substrates precluding safe access to the river. No significant constraints or limitations in gathering information were encountered.

Appendix I presents a collated record of species found at each survey locations where electrofishing was conducted.

Appendix II presents a collated record of the Q-Values assigned across all survey sites.

4.1.1 Proposed Wind Farm site survey sites

4.1.1.1 Wind Farm survey site 1 (WF 1) (eDNA survey site 10)

Survey site WF 1 was located along the upper reaches of the Goish watercourse (EPA code: 18G12). Properties of the watercourse at this survey site are provided in Table 4-1 and representative photographs of the survey site are shown in Plate 4-1, Plate 4-2 and Plate 4-3.

Table 4-1 Properties of the watercourse at survey site WF 1.

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	1.5			
Average Wet Width (m)	1–1.5, 4 m at vehicle crossing point			
Flow	Moderate-fast			
Colouration	No distinct colouration			
Clarity	Clear when undisturbed			
Bank height (m)	LHB	0.4-0.8	RHB	0.4-0.8
Dominant Substrates	Bedrock: 10% Boulder (>128 mm): 30%			

	Cobble (>32–128 mm): 40% Gravel (8–32 mm): 10% Silt (<0.25 mm): 10% (localised at ford crossing)
Substratum Condition	Compacted in more naturalised stretches of watercourse

The watercourse at WF 1 represented a section of Eroding/Upland River (FW1) characterised by cobble and boulder dominant channel substrate along a slight gradient, with small bedrock and boulder steps along the surveyed stretch. The channel profile was largely naturalised at the upstream and downstream survey extents, with a highly modified section of watercourse in the form of a vehicle/livestock ford crossing passing through the watercourse.

Within the more naturalised sections of watercourse, channel substrate consisted of boulder outcrops and cobbles, with isolated patches of interstitial gravels. Flow patterns consisted primarily of moderate-fast velocity riffle, often braided overtop exposed channel substrates across the channel. Overall water depth was shallow (0.15 m) with small pools throughout bedrock and boulder steps. Contrastingly, the section of watercourse through the ford crossing exhibited silt-covered fine channel substrate and occasional coarser substrate, with slow, shallow flow and a reduction in gradient across the ford. Water was clear when undisturbed, with no apparent colouration, but exhibited a high degree of siltation underfoot across the ford. Channel substrate was relatively silt free throughout the more naturalised sections of this watercourse.

The ford crossing represented the widest point of the channel (approx. 4 m wide), with the channel becoming more laterally confined (approx. 1 wide) and heavily encroached by dense willow and bramble Scrub (WS1) upstream and downstream of the ford crossing. Abundant willow, bramble and bracken *(Pteridium aquilinum)* at times tunnelled the watercourse, with frequently encroaching and hawthorn also present. Habitats throughout the wider vicinity consisted predominantly of Conifer plantation (WD4).

Rooted macrophytes were absent from the watercourse, with abundant macrophyte coverage on boulder substrates, including *Rhynchostegium riparioides, Chiloscyphus polyanthos* and *Riccardia sp.*

Due to the presence of ongoing channel disturbance in the form of the ford crossing, combined with the naturally laterally confined bedrock and boulder step profile, the watercourse at survey site WF 1 offered limited fisheries potential for all fish species, with the exception of *Moderate* juvenile salmonids nursery habitat and juvenile European eel habitat. Varied channel substrate composition and associated flow pattern diversity either side of the ford crossing combined with undercut bank features and encroaching bankside vegetation, providing this localised moderate nursery habitat. In particular, the most suitable refugia for salmonid fry and parr, as well as juvenile eel, was present in the stretch of watercourse upstream of the ford crossing.

5-minute semi-quantitative electrofishing spanning from downstream to upstream of the ford crossing showed juvenile salmonids and eel either side of the ford crossing, suggesting that the ford, while frequently disturbed and highly modified, does not pose a complete barrier to fish.

The absence of any significant areas of clean, mobile gravels amongst otherwise compacted or bedrock channel substrate saw *Poor* spawning habitat for salmonid or lamprey species. Lack of suitable depth also saw an absence of any significant supporting habitat for adult salmonids. With the exception of frequently disturbed fine sediment beds through the centre of the ford crossing, silt and fine gravel beds

required for lamprey ammocoete and spawning habitat were largely absent from the surveyed stretch and therefore assessed as *Poor*.



Plate 4-1. A representative photo of the ford crossing at Survey Site WF 1.

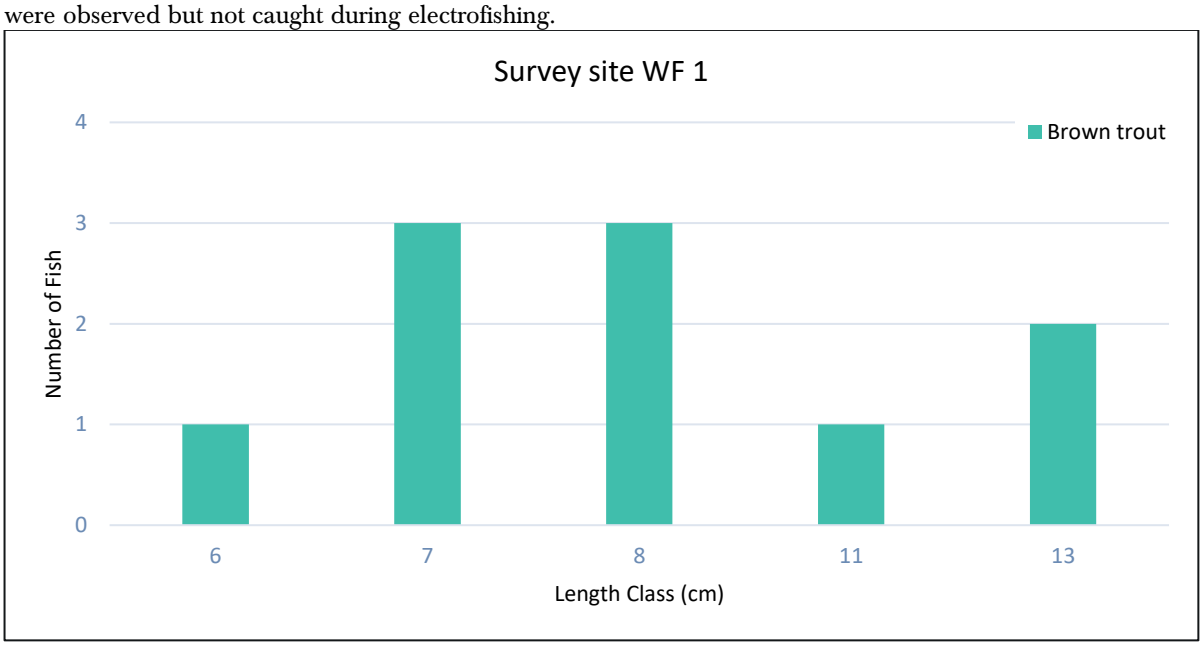


Plate 4-2. A representative photo of the downstream survey extent at Survey Site WF 1.



Plate 4-3. A representative photo of more naturalised stretches of watercourse at Survey Site WF 1.

Results of the 5-minute electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-1 and Table 4-2. In addition, two European eel and two brown trout were observed but not caught during electrofishing.



Plot 4-1 Number of fish per length class at survey site WF 1.

Table 4-2 Electrofishing results at survey site WF 1.

Species	Length (cm)
Brown trout *(Salmo trutta)*	8.3
Brown trout *(Salmo trutta)*	7.0
Brown trout *(Salmo trutta)*	13.0

Brown trout *(Salmo trutta)*	7.0
Brown trout *(Salmo trutta)*	6.8
Brown trout *(Salmo trutta)*	8.0
Brown trout *(Salmo trutta)*	7.5
Brown trout *(Salmo trutta)*	13.0
Brown trout *(Salmo trutta)*	11.5
Brown trout *(Salmo trutta)*	8.0

Kick-sampling was carried out in areas of cobble riffle upstream and downstream of the ford crossing. Biological water quality based on Q-sampling was calculated as **Q3 – Poor** for survey site WF 1. 'Very Pollution Sensitive' Group A were absent from the sample, while 'Moderately Pollution Sensitive' Group B taxa (of which, there were 8 individuals across two taxonomic groups) represented ~19% of the sample. Group C 'Pollution Tolerant' taxa represented ~79% of the sample, dominated by *Chironomidae.* Group D 'Very Pollution Tolerant' taxa were absent from the sample, while Group E 'Most Pollution Tolerant' sample were represented by an individual *Chironomus sp.* Results of kick-sampling at survey site WF 1 are summarised in Table 4-3.

Table 4-3. Results of the macroinvertebrate sample at survey site WF 1.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	Glossosomatidae	6
	Sericostomatidae	2
Group C – Pollution Tolerant	*Ancylus fluviatilis*	1
	Baetis rhodani/atlanticus	6
	Chironomidae	8
	Dicranota sp.	2
	Elmidae	6
	Gammarus sp.	5
	Hydropsyche sp.	1
	Rhyacophila sp.	3
	Simuliidae	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	*Chironomus sp.*	1

4.1.1.2 Wind Farm survey site 2 (WF 2)

Survey site WF 2 was located along the Monagally East watercourse (EPA code: 18M10, IG Ref.: X 15541 89048). The surveyed stretch was approx. 440 m upstream of the confluence between the Monagally East watercourse and the Goish. Properties of the watercourse at this survey site are provided in Table 4-4 and a representative photograph of the survey site is shown in Plate 4-4.

Table 4-4 Properties of the watercourse at survey site WF 2.

Properties	Record			
Average Depth (m)	0.25			
Average Bank Width (m)	2-2.2			
Average Wet Width (m)	1.8–2.2			
Flow	Moderate			
Colour	None			
Clarity	Clear			
Bank height (m)	LHB	0.5	RHB	0.5
Dominant Substrates	Boulder: 5% Cobble (>32–128 mm): 50% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):10%			

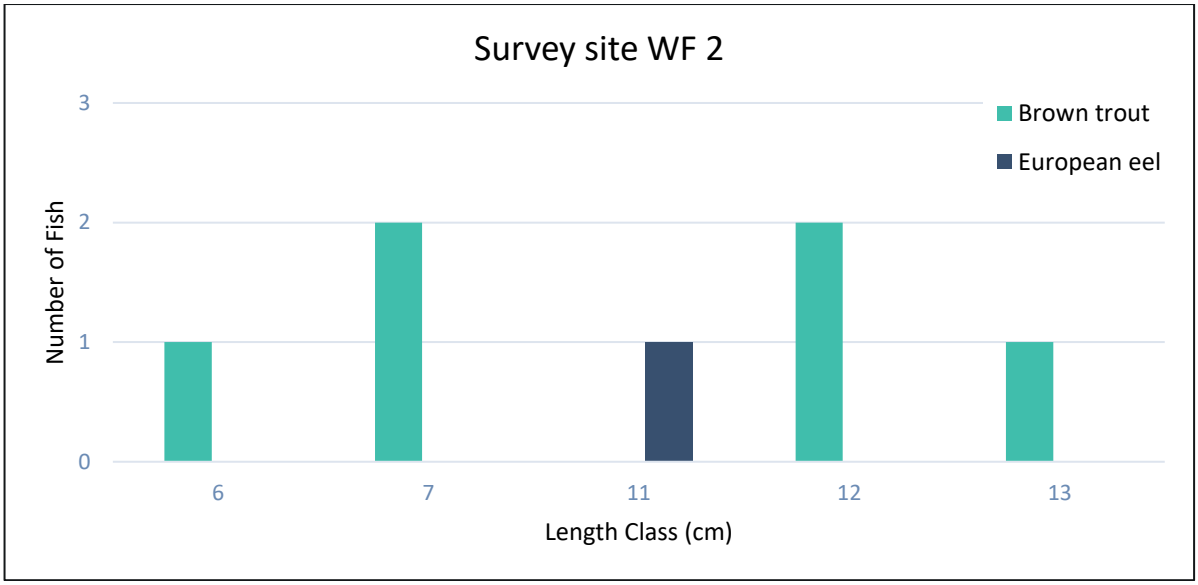
	Silt (<0.25 mm): 20%
Substratum Condition	Loose, cobble–dominant substratum with deposits of silt enveloping substrates in areas of low flow.

Substrate composition along this stretch of Eroding/upland river (FW1) consisted predominantly of cobble, with occasional boulder and gravel throughout. The surveyed section of watercourse was bisected by a cattle ford (Plate 4-5), which consisted of low-gradient, poached access points on both banks. The watercourse across the cattle ford consisted of a slow-flowing pool, with abundant overlying siltation. Instream habitats upstream and downstream of the ford consisted of step features, cobble riffle and moderate velocity glide. Silt deposits occurred within areas of reduced flow at the channel margins downstream of the historic cattle access point. The surveyed stretch was heavily shaded at points by encroaching willow *(Salix* spp.), hawthorn *(Crataegus monogyna)* and sycamore *(Acer pseudoplatanus)* which was present on both banks.

Encroaching Treelines (WL2) were intermixed within bramble-dominant *(Rubus fructicosus agg.)* Scrub (WS1), which formed much of the immediate riparian buffer along both banks and transitioned into agricultural pastural classed as Wet grassland (GS4) along the right-hand bank, and Mixed broadleaved woodland (WD1) along the left-hand bank. Marginal vegetation consisted of wild angelica *(Angelica sylvestris)*, hogweed *(Heracleum sphondylium)* and common knapweed *(Centaurea nigra).* Instream, fool's-water-cress *(Helosciadium nodiflorum)* and common water-starwort *(Callitriche stagnalis)* occurred occasionally marginally in areas of slower flow and were most prominent at the historic cattle access point.

Salmonid and lamprey species spawning habitat was assessed as *Poor–Moderate*. While interstitial gravels provided some, albeit limited, spawning habitat, the watercourse was dominated by coarser substrate. Occasional marginal silt deposits throughout areas of slower flow provided some locally suitable conditions for juvenile lamprey. However given the limited area and distribution of fine sediment beds and the dominance of larger, coarse substrates, the watercourse at survey site WF 2 was assessed as *Poor* in terms of lamprey nursery habitat. Cobble-dominant riffles provided adequate depth and refugia for juvenile salmonids, and as such survey site WF 2 was assessed as *Good* in terms of salmonid nursery habitat. Encroaching trees and submerged root structures throughout areas of glide provided localised shading and cover for adult salmonids. However, given the limited occurrence of such refugia and the generally shallow depth (<0.25 m) this surveyed stretch of the Goish was limited to an assessment of *Poor* in terms of adult salmonid habitat. Marginal refugia provided by woody debris, encroaching treelines, undercut bank features and instream refugia provided by varied channel substrate provided locally *Good* European eel habitat.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-2 and Table 4-5. In addition to the European eel and six brown trout which were captured and returned, two trout were missed (seen but not captured) during the electrofishing survey.



Plot 4-2 Number of fish per length class at survey site WF 2.

Table 4-5 Electrofishing results at survey site WF 2.

Species	Length (cm)
Brown trout (*Salmo trutta*)	12
Brown trout (*Salmo trutta*)	12
Brown trout (*Salmo trutta*)	13
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	6
European eel *(Anguilla anguilla)*	11.5

Kick-sampling was carried out in areas of riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3-4 - Moderate** for survey site WF 2. Pollution Sensitive Group A and B taxa (of which there were 18 individuals spanning two taxonomic groupings) represented ~38% of the sample, with the Group B cased caddis Glossosomatidae being the most abundant taxon within the sample as a whole. The sample was composed predominantly of Group C 'Pollution Tolerant' taxa, which represented ~62% of the macroinvertebrate sample. Group D 'Very' taxa were represented by a single naidid worm. 'Most' Pollution tolerant' taxa Group E were absent from the sample. Results of kick-sampling at survey site WF 2 are summarised in Table 4-6.

Table 4-6. Results of macroinvertebrates sample at survey site WF 2.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	Perlidae (early instar)	3
Group B – Moderately Pollution Sensitive	Glossosomatidae	15
Group C – Pollution Tolerant	*Rhyacophila* sp.	3
	Hydropsyche sp.	12
	Polycentropus sp.	1
	Gammarus sp.	6
	Ancylus fluviatilis	4
	Dicranota sp.	1
	Lumbriculidae	1
	Hydrachnidia	1
Group D – Very Pollution Tolerant	Naididae	1
Group E – Most Pollution Tolerant	-	-



Plate 4-4. A representative photo of survey site WF 2, taken from the downstream extent of the electrofishing survey.



Plate 4-5. A representative photo of the cattle ford at survey site WF 2, facing upstream.

4.1.1.3 Wind Farm Survey Site 3 (WF 3) (eDNA survey 11)

Survey site WF 3 was located along the Goish watercourse (EPA code: 18G12), approximately 1.76 km downstream of survey site WF 2. Properties of the watercourse at this survey site are provided in Table 4-7 and representative photographs of the survey site are shown in Plate 4-6, Plate 4-7, and Plate 4-8.

Table 4-7 Properties of the watercourse at survey site WF 3.

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	4			
Average Wet Width (m)	3.3			
Flow	Moderate			
Colour	None			
Clarity	Clear			
Bank height (m)	LHB	0.7	RHB	1.0
Dominant Substrates	Boulder (>128 mm): 30% Cobble (>32–128 mm): 30% Gravel (8–32 mm): 20% Silt (<0.25 mm): 10%			
Substratum Condition	Semi-compacted, with slight siltation evident enveloping substratum in pools			

This stretch of Eroding/upland river (FW1) was historically straightened and bisected by a single-span stone arch road bridge with an associated uniform, stone bridge apron which spanned the wetted width of the channel. Fly tipping evident both instream and throughout the riparian zone. The watercourse upstream of the bridge consisted of a continuous, slightly silted and slow-flowing pool interspersed with instream Large Woody Debris (LWD). Downstream of the bridge, microhabitats consisted largely of boulder-cobble steps and repeating sequences of riffle and glide. A water abstraction pipe entered the waterway from the left-hand bank immediately upstream of the bridge The left-hand bank downstream of the bridge was reinforced with boulders to a height of ~0.7 m (Plate 4-8).

The left-hand bank consisted of a residential garden (classed as Amenity grassland (GA2)), with little-to-no vegetative buffer present. Habitats along the right-hand bank consisted of bramble and bracken Scrub (WS1) transitioning into a Treeline (WL2) consisting of sycamore, ash *(Fraxinus excelsior)*, horse chestnut *(Aesculus hippocastanum)* and hawthorn. Surrounding habitats beyond the treeline on the right-hand bank consisted of Improved agricultural grassland (GA1). Water-crowfoot (*Ranunculus* sp.) was present occasionally throughout areas of glide. Emergent vegetation consisted of fool's-water-cress , watercress, greater water-moss *(Fontinalis antipyretica)* and *Chiloscyphus polyanthos.*

Cobble and boulder dominant substrate limited the suitable areas of salmonid & lamprey spawning habitat, as the gravels present were of a coarser variant occupied interstitial spaces between larger substrates. Therefore, spawning habitat was assessed as *Poor–Moderate*. Variable channel substrate composition and patches of water-crowfoot provided suitable refugia for juvenile (and where water depth reached 0.25 m) and adult salmonids, and as such, salmonid nursery & holding habitat were assessed as *Good* and *Moderate,* respectively. The instream boulders present provided *Moderate* intermittent and limited suitable refugia for eel. The wetted area of the stone apron was assessed as *Poor* in terms of habitat suitability for all assessed fish species, with the occurrence of instream LWD providing an isolated area of refugia. While fine sediments were present interstitially between coarser substrate, well structured, extensive areas of fine sediment beds required for optimal lamprey ammocoete nursery habitat were absent, with lamprey nursery habitat assessed as *Poor.*

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-3 and Table 4-8. 32 brown trout of various life stages were captured while surveying at this location.



Plot 4-3 Number of fish per length class at survey site WF 3.

Table 4-8 Electrofishing results at survey site WF 3.

Species	Length (cm)
Brown trout (*Salmo trutta*)	19
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	16
Brown trout (*Salmo trutta*)	23
Brown trout (*Salmo trutta*)	13
Brown trout (*Salmo trutta*)	14
Brown trout (*Salmo trutta*)	14
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	14
Brown trout (*Salmo trutta*)	4
Brown trout (*Salmo trutta*)	10
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	9.5
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	14
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	12
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	10
Brown trout (*Salmo trutta*)	10
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	10
Brown trout (*Salmo trutta*)	10
Brown trout (*Salmo trutta*)	12
Brown trout (*Salmo trutta*)	9

Kick-sampling was carried out in areas of riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3-4 – Moderate** for survey site WF 3. One 'Very Pollution Sensitive' Group A taxon was present, (a single *Ecdyonurus* sp.), with the 'Moderately Pollution Sensitive' Group B taxon, Glossosomatidae being dominant in the sample, representing ~54% of the total sample. Group C 'Pollution Tolerant' taxa were the most diverse grouping present within the sample, with 8 different taxonomic groups identified, which constituted ~43% of the total sample. One Group D 'Very Pollution Tolerant' taxon was present, while no Group E 'Most Pollution Tolerant' taxa were identified within the sample. The results of macroinvertebrate sampling at survey site WF 3 are presented in Table 4-9.

Table 4-9 Results of macroinvertebrates sample at survey site WF 3.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus* sp.	1
Group B – Moderately Pollution Sensitive	Glossosomatidae	38
Group C – Pollution Tolerant	*Baetis rhodani /atlanticus*	1
	Chironomidae	4
	Gammarus sp.	3
	Simuliidae	2
	Hydropsyche sp.	1
	Ancylus fluviatilis	13
	Rhyacophila sp.	5
	Tipulidae	1
Group D – Very Pollution Tolerant	Naididae	*1*
Group E – Most Pollution Tolerant	-	-



Plate 4-6 A representative photo of the upstream extent of survey site WF 3.



Plate 4-7 A representative photo of the downstream extent of survey site WF 3.



Plate 4-8. A representative photo of Survey Site WF 3 looking upstream toward the single-span stone arch bridge. Instream Large woody debris (LWD) and reinforcement along the left-hand bank can be seen.

4.1.1.4 Wind Farm Survey Site 4 (WF 4)

Survey site WF 4 was located on the Goish watercourse (EPA code: 18G12). The features of the watercourse at this survey site are provided in Table 4-10 and representative photographs of the survey site are shown in Plate 4-9 and Plate 4-10.

Table 4-10 Properties of the watercourse at survey site WF 4.

Properties	Record			
Average Depth (m)	0.05–0.2			
Average Bank Width (m)	4			
Average Wet Width (m)	3.2			
Flow	Moderate			
Colour	None			
Clarity	Clear, silt plumes when disturbed underfoot			
Bank height (m)	LHB	0.3–0.6	RHB	0.1–0.3
Dominant Substrates	Cobble (>32–128 mm): 60% Gravel (8–32 mm): 10% Sand (0.25–2 mm): 10% Silt (<0.25 mm): 20%			
Substratum Condition	Semi compacted and cobble-dominant, with silt beds evident at the downstream extent.			

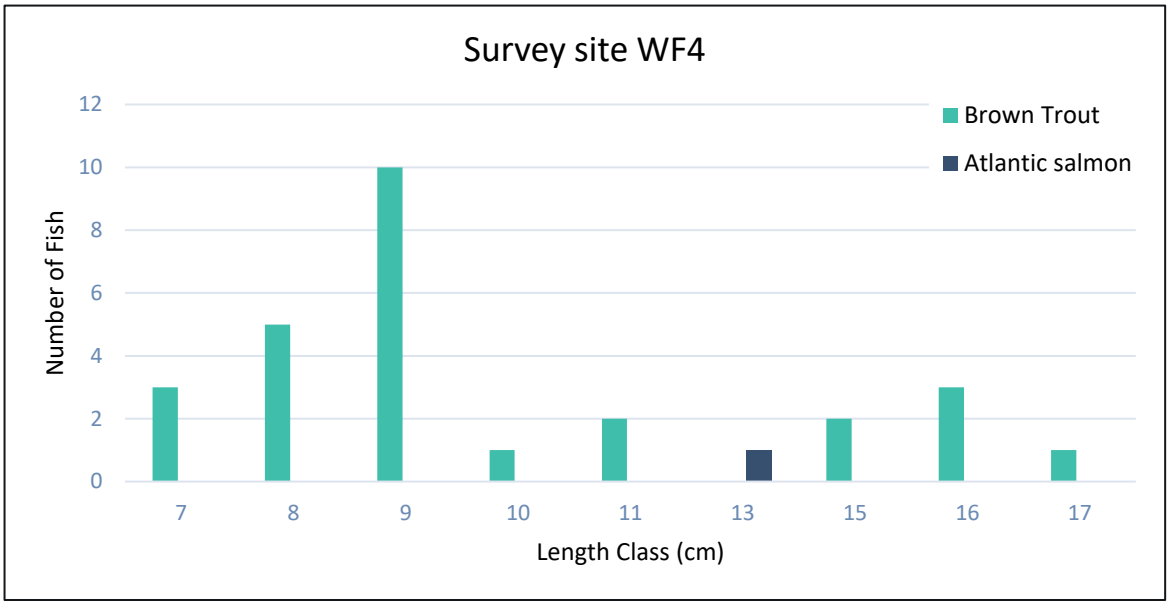
This stretch of Eroding/upland river (FW1) was located immediately downstream of a six-spanned stone arch bridge. The river flowed through the left-most arch, while all other arches contained vegetated earth. The upstream survey extent displayed substrate consisting largely of cobbles with interstitial gravels and sand. Slight siltation was evident overlying substrate, particularly in marginal areas with lower flow. Microhabitat composition consisted of low-gradient riffles and glides, the latter of which was most predominant at the upper extent. At the lower extent of the surveyed location, a more prominent silt coating occupied much of the wetted width, creating silt plumes which remained readily in suspension when disturbed underfoot. Much of the upper extent of the left-hand bank was heavily poached, with evidence of historic cattle access from the surrounding pasture likely contributing to the abundant siltation present at the lower visited extent. At the mid-section of the surveyed extent, some partially eroded concrete blocks partially formed the left-bankside, with some eroded, boulder-sized concrete deposits present instream along the margins of the right bank. Nutrient enrichment was evident throughout this section of watercourse as indicated by the abundant growth of instream *Ranunculus* spp. which occupied much of the wetted width, being most prominent at the lower visited extent (Table 4-10). Directly adjacent to the watercourse situated on the right-hand bank was a wastewater treatment plant (WwTP), however there were no immediate and evident discharges or pipes feeding into the watercourse at this location during the time of survey.

The agricultural pasture which occupied the land to the right of the surveyed stretch was characteristic of Wet grassland (GS4). To the right, a laterally thin Scrub (WS1) buffer consisting largely of bramble and gorse *(Ulex europaeus)* separated the watercourse from the Buildings and artificial surfaces (BL3) land use under which the WwTP and the gravel roadway which led to it was classed. Other emergent and riparian vegetation consisted of ash, beech *(Fagus sylvatica)*, alder *(Alnus glutinosa)*, broad-leaved dock *(Rumex obtusifolius),* water-starwort *(Callitriche* spp.), fool's-water-cress and watercress.

The sporadic occurrence of suitable interstitial gravels provided some limited spawning habitat for salmonids, which was thus assessed as being of *Poor–Moderate* suitability. Given the finer nature of these interstitial sediments, with some unconsolidated sands and silts present particularly at the lower extent, but the dominance of coarse substrate within the channel, lamprey species spawning and nursery habitat was assessed as *Poor–Moderate*. The cobble-dominant riffle & glide microhabitat typology was supported by instream *Ranunculus* spp. to provide adequate refugia for juvenile salmonids, thus providing *Good* salmonid nursery habitat. Along the margins of the left-hand bank, some eroded concrete blocks created boulder-sized deposits instream, which occasionally occurred

alongside glides of increased depth (~0.25 m), providing locally *Good* salmonid holding and eel habitat where such features occurred.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-4 and Table 4-11. In addition to the five trout which were successfully captured and released, two salmonids (likely brown trout) were missed (seen but not captured) during the electrofishing survey.



Plot 4-4. Number of fish per length class at survey site WF 4

Table 4-11 Electrofishing results at site WF 4.

Species	Length (cm)
Brown trout (*Salmo trutta*)	16
Brown trout (*Salmo trutta*)	16
Brown trout (*Salmo trutta*)	15
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	14.7
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	9.2
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	16.8
Brown trout (*Salmo trutta*)	10.2
Brown trout (*Salmo trutta*)	15.5
Brown trout (*Salmo trutta*)	11
Brown trout (*Salmo trutta*)	11
Brown trout (*Salmo trutta*)	8.5
Brown trout (*Salmo trutta*)	9.8
Brown trout (*Salmo trutta*)	8.4
Brown trout (*Salmo trutta*)	17.3
Brown trout (*Salmo trutta*)	8.3
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	7.6
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	8.5
Brown trout (*Salmo trutta*)	9.5
Brown trout (*Salmo trutta*)	9.4

Brown trout (*Salmo trutta*)	9.2
Brown trout (*Salmo trutta*)	9.3
Atlantic Salmon *(Salmo salar)*	13.5
Three-spined Stickleback *(Gasterosteus aculeatus)* (10 individuals)	4-5

Kick-sampling was carried out in areas of pool, riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**. 'Very Pollution Sensitive' Group A taxa were completely absent from the sample. However, 'Moderately Pollution Sensitive' Group B taxa were numerous, with Glossosomatidae representing ~46% of the total sample. The sample was composed predominantly of Group C 'Pollution Tolerant' taxa (~53%), of which *Gammarus* sp. and *Ancylus fluviatilis* were the most abundant. 'Very' and 'Most Pollution tolerant' Groups D and E were absent from the sample. Results of kick-sampling are presented below in Table 4-12.

Table 4-12 Results of macroinvertebrate sample at site WF 4.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	Glossosomatidae	26
	Sericostomatidae	1
Group C – Pollution Tolerant	*Baetis rhodani /atlanticus*	2
	Ancylus fluviatilis	10
	Gammarus sp.	13
	Rhyacophila sp.	2
	Polycentropus sp.	1
	Bithynia sp.	1
	Hydropsyche sp.	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-9. A representative photo of the view toward the upstream extent of survey site WF 4, facing upstream towards the stone road bridge. Poaching of the right-hand bank is visible.



Plate 4-10. A representative photo of the downstream extent of survey site WF 4, facing upstream. Abundant water-crowfoot growth and siltation was evident.

4.1.1.5 Wind Farm Survey Site 5 (WF 5) (eDNA survey site 1)

Survey site WF 5 was located within the headwaters of the Licky River (EPA code: 18L01). Properties of the watercourse at this survey site are provided in Table 4-13 below and representative photographs of the survey site are shown in Plate 4-11 and Plate 4-12.

Table 4-13 Properties of the watercourse at survey site WF 5.

Properties	Record
Average Depth (m)	0.1 m, with average depth upstream of bridge apron 0.5 m
Average Bank Width (m)	1.5 at upper extent, 3 m at lower extent
Average Wet Width (m)	0.5–3.2
Flow	Slow-Moderate
Colour	Brown-orange staining when bed was disturbed, otherwise clear
Clarity	Slight turbidity
Bank height (m)	LHB 1 RHB 0.8
Dominant Substrates	Boulder (>128 mm): 5% Cobble (>32–128 mm): 65% Gravel (8–32 mm): 10% Fine gravel (2–8 mm):10% Silt (<0.25 mm): 10%
Substratum Condition	Semi-compacted

The surveyed stretch of Eroding/upland river (FW1) at Survey Site WF 5 was bisected by a single-span, concrete arch road bridge, with an associated concrete bridge apron (Plate 4-13). Upstream of the road bridge the channel was laterally confined (~0.5 m wetted width), with continuous slow-flowing pool (~0.5 m depth). Channel width increased (~3.5 m wetted width) and water depth decreased (0.1 m average depth) across the concrete bridge apron, which displayed abundant algal growth. Moving downstream of the bridge, channel width decreased, with consequently increased flow velocity moving from the bridge apron into boulder-cobble riffle-step sequences. An outflow pipe was noted along the right-hand bank downstream of the bridge.

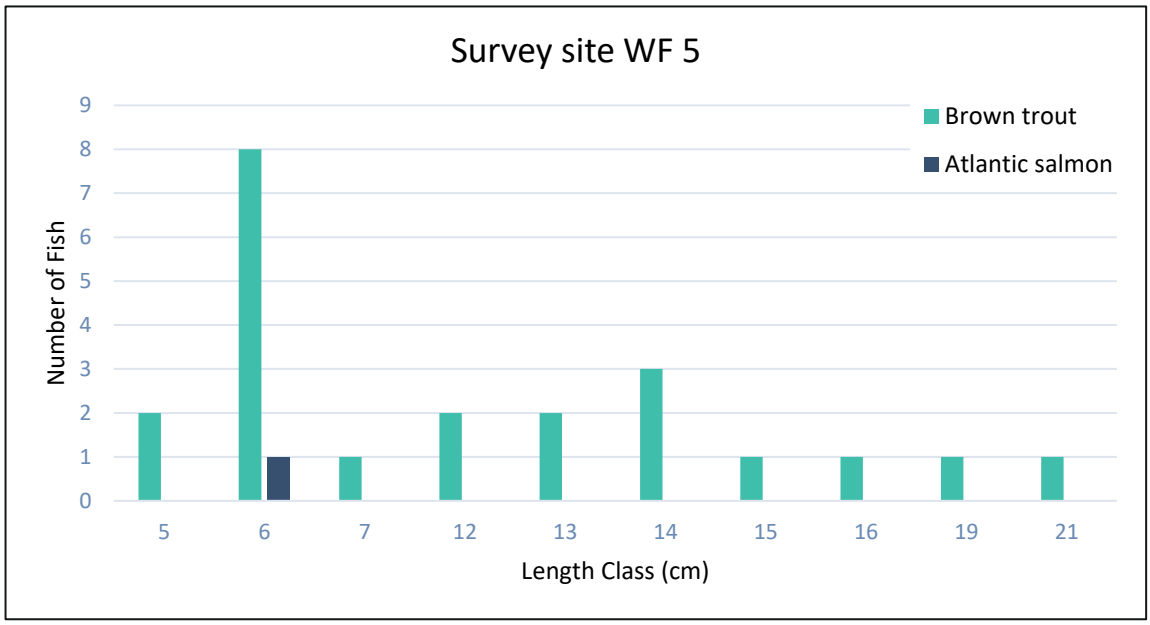
Downstream of this higher-energy section of watercourse, instream habitat returned to that similar to upstream of the bridge, with low velocity pool and glide. Marginal siltation was evident along this stretch. Channel morphology at the downstream survey extent showed evidence of historic resectioning and straightening, with a uniform channel profile. A brown-orange gelatinous film typical of iron-oxidising bacteria covered channel substrate, most prominently in slow-flow areas. These deposits were easily disturbed and remained readily in suspension.

Upstream of the bridge, habitats extending from both banks consisted of bramble, gorse and bracken Scrub (WS1). Other riparian vegetation included rosebay willowherb *(Chamaenerion angustifolium)*, great willowherb *(Epilobium hirsutum),* purple-loosestrife *(Lythrum salicaria*), figwort *(Scrophularia nodosa)*, nipplewort *(Lapsana communis),* and marsh woundwort *(Stachys palustris)*. Downstream of the bridge, the watercourse was further encroached with bramble and willow scrub. Wider land-use extending from the watercourse consisted of Conifer plantation (WD4).

Slow-flowing pools and glides and iron oxide deposits covering substrate limited the provision of suitable spawning habitat for salmonids and lamprey species to *Poor* overall. However, the area of cobble-dominant riffle immediately downstream of the apron provided locally *Moderate* habitat, as some suitable interstitial gravels were present. Fine sediment beds, while present at the downstream survey extent, were similarly coated with iron-oxide deposits and therefore lamprey nursery habitat was assessed as *Poor*. Encroaching scrub and riffle habitat provided *Good* nursery habitat where it occurred locally downstream of the bridge, while deep pool and undercut banks upstream of the bridge provided locally *Good* salmonid holding habitat. Sporadic boulders and shaded, undercut banks present throughout the surveyed stretch may provide *Moderate* refugia for eel , particularly upstream of

the bridge. The presence of the shallowly wetted, raised bridge apron likely poses a barrier to upstream fish passage.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-5 and Table 4-14. Brown trout of various age classes and one juvenile Atlantic salmon were captured throughout the survey.



Plot 4-5. Number of fish per length class at survey site WF 5.

Table 4-14 Electrofishing results at survey site WF 5.

Species	Length (cm)
Brown trout *(Salmo trutta)*	21.8
Brown trout (*Salmo trutta*)	19.4
Brown trout (*Salmo trutta*)	15
Brown trout (*Salmo trutta*)	14.6
Brown trout (*Salmo trutta*)	14.9
Brown trout (*Salmo trutta*)	13
Brown trout (*Salmo trutta*)	14.4
Brown trout (*Salmo trutta*)	12.3
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	16.5
Brown trout (*Salmo trutta*)	13.9
Brown trout (*Salmo trutta*)	12.4
Brown trout (*Salmo trutta*)	6
Brown trout (*Salmo trutta*)	6.6
Brown trout (*Salmo trutta*)	6.4
Brown trout (*Salmo trutta*)	6.1
Brown trout (*Salmo trutta*)	6.9
Brown trout (*Salmo trutta*)	6.2
Brown trout (*Salmo trutta*)	5.8
Brown trout (*Salmo trutta*)	6.4
Brown trout (*Salmo trutta*)	6.4
Brown trout (*Salmo trutta*)	5.9
Atlantic Salmon *(Salmo salar)*	6.6

Kick-sampling was carried out in areas of riffle and glide. Macroinvertebrate diversity was low, with five taxa present within the sample. The Q rating assigned to survey site WF 5 was assigned **Q3 - Poor**, on

the basis that Group A 'Very Pollution Sensitive' were absent from the sample, and the Group B 'Moderately Pollution Sensitive' taxa occurred in low numbers. Group C 'Pollution Tolerant 'taxa represented the dominant group (~90%) of which *Ancylus fluviatilis* was the most abundant (22 individuals). Results of the macroinvertebrate survey conducted at site WF 5 are presented in Table 4-15.

Table 4-15. Results of macroinvertebrates sample at survey site WF 5.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	Glossosomatidae	1
	Sericostomatidae	2
Group C – Pollution Tolerant	*Ancylus fluviatilis*	22
	Simuliidae	2
	Gammarus sp.	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-11. A representative photo of the laterally constricted, slow-flowing upstream extent of survey site WF 5.



Plate 4-12. A representative photo of the downstream extent of survey site WF 5.



Plate 4-13. The Licky at survey site WF 5 exhibiting a uniform and shallow hydromorphological profile as it traverses the apron beneath the road bridge which bisected the visited extent.

4.1.1.6 Wind Farm Survey Site 6 (WF 6) (eDNA survey site 3)

Survey site WF 6 was located on the River Licky, approximately 2 km downstream of survey site WF 5 (EPA code: 18L01). Properties of the watercourse at this survey site are provided in Table 4-16 and representative photographs of the survey site are shown in Plate 4-14 and Plate 4-15.

Table 4-16 Properties of the watercourse at survey site WF 6.

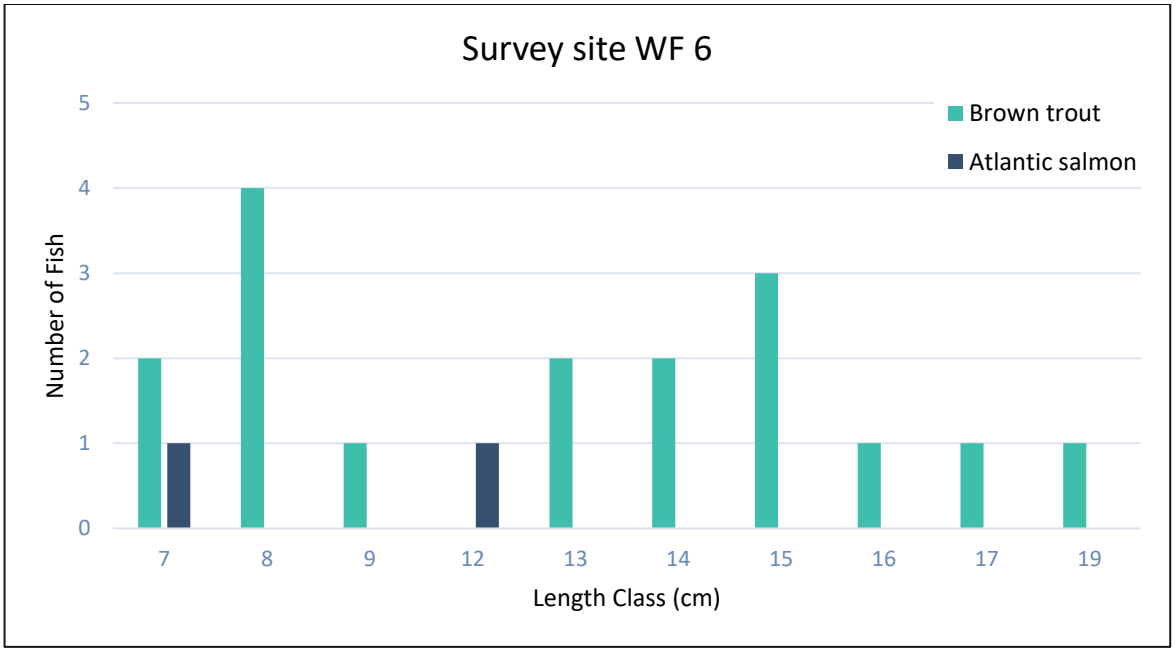
Properties	Record
Average Depth (m)	0.35
Average Bank Width (m)	2.0
Average Wet Width (m)	1.6
Flow	Moderate
Colour	None
Clarity	Clear
Bank height (m)	LHB 1.7 RHB 1.5
Dominant Substrates	Cobble (>32–128 mm): 30% Gravel (8–32 mm): 50% Fine gravel (2–8 mm):10% Silt (<0.25 mm): 10%
Substratum Condition	Compacted gravel which was predominantly of a coarser variety

Substrate composition at the stretch of Eroding/upland river (FW1) at WF 6 was dominated by coarse gravels. The watercourse profile was largely uniform, with some evidence of historical modification. At the upstream survey extent, the watercourse passed beneath a narrow concrete farm bridge, with areas of scour in excess of 2 m sloping from the depositional left-hand bank to the right-hand bank. Fine sediment accumulated along the left-hand bank, while deep pool along the right-hand bank continued upstream of the bridge. Downstream of the bridge, microhabitats consisted largely of sequences of riffle and glide, with occasional pool along undercut banks. Channel substrate transitioned from gravel-dominant to cobble-dominant moving toward the downstream survey extent. Silt deposits occurred marginally, with siltation overlying coarser substrate throughout pools.

Habitats extending from the riparian zone consisted of bramble dominant Scrub (WS1), interspersed with willow and hawthorn trees. Habitats extending beyond the right-hand bank consisted of mosaic Wet grassland (GS4) Improved agricultural grassland (GA1) which was representative of habitats in the wider vicinity. Riparian vegetation included nettle, common lady fern *(Athyrium filix-femina)*, broad-leaved dock, meadow buttercup *(Ranunculus acris)*, creeping buttercup *(Ranunculus repens)* and foxglove *(Digitalis purpurea)*, while watercress and water-pepper *(Persicaria hydropiper*) were present marginally. Water-crowfoot was present occasionally throughout areas of glide.

Substrate composition was considered suitable to support lamprey and salmonid spawning at this location. However, the compacted nature of substrate limited overall spawning habitat suitability, which was assessed as *Poor–Moderate*. Fine sediment beds at glide and pool margins provided *Moderate* localised lamprey species nursery habitat where they occurred at the downstream survey extent. Instream refugia arising from varied channel substrate and water-crowfoot coverage cobble within areas provided *Good* salmonid nursery habitat and *Moderate* European eel habitat. Undercut banks shaded by encroaching vegetation and the area of deep scour at the bridge provided suitable refugia for adult salmonids, with the site being assessed as *Good* in terms of adult salmonid holding habitat.

Results of the timed qualitative electrofishing survey conducted at this site (using methodologies described in Section 2.3 are presented in Plot 4-6 and Table 4-17. Atlantic salmon and brown trout were captured during the electrofishing survey at this location.



Plot 4-6 Number of fish per length class at survey site WF 6.

Table 4-17 Electrofishing results at survey site WF 6.

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	12.9
Atlantic salmon *(Salmo salar)*	7.2
Brown trout *(Salmo trutta)*	19.5
Brown trout *(Salmo trutta)*	14
Brown trout *(Salmo trutta)*	15.4
Brown trout *(Salmo trutta)*	7.3
Brown trout *(Salmo trutta)*	9.1
Brown trout *(Salmo trutta)*	15.2
Brown trout *(Salmo trutta)*	8.1
Brown trout *(Salmo trutta)*	8.1
Brown trout *(Salmo trutta)*	15
Brown trout *(Salmo trutta)*	17.2
Brown trout *(Salmo trutta)*	16.3
Brown trout *(Salmo trutta)*	8.4
Brown trout *(Salmo trutta)*	13.8
Brown trout *(Salmo trutta)*	14.4
Brown trout *(Salmo trutta)*	13.7
Brown trout *(Salmo trutta)*	8.5
Brown trout *(Salmo trutta)*	7.3

Kick-sampling was carried out in areas of riffle and glide. Macroinvertebrate diversity was moderate, with ten different taxonomic groups recorded during the survey. The Q rating assigned to survey site WF 6 was assigned **Q3-4 - Moderate**, on the basis that Group A 'Very Pollution Sensitive' and Group B 'Moderately Pollution Sensitive' taxa were present, albeit in low numbers, while Group C 'Pollution Tolerant 'taxa represented the dominant grouping (~69%). One 'Very Pollution Tolerant' Group D taxon was present within the sample. Results of the macroinvertebrate survey conducted at site WF 6 are presented in Table 4-18.

Table 4-18. Results of macroinvertebrate sampling at survey site WF 6.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	Perlidae (early instar)	2
Group B – Moderately Pollution Sensitive	Glossosomatidae	5

Group C – Pollution Tolerant	*Ancylus fluviatilis*	5
	Simuliidae	5
	Gammarus sp.	1
	Hydropsyche sp.	1
	Baetis rhodani /atlanticus	5
	Hydrachnidia	1
Group D – Very Pollution Tolerant	*Naididae*	1
Group E – Most Pollution Tolerant	-	-



Plate 4-14. A representative photo of the upstream extent of survey site WF 6.



Plate 4-15. The downstream extent of survey site WF 6, where encroaching scrub and instream Ranunculus spp. are visible.

4.1.1.7 Wind Farm Survey Site 7 (WF 7)

Survey site WF 7 was located on the River Licky (EPA code: 18L01), approximately 100 m downstream of the confluence between the An Mhoing Bheag watercourse and the Licky. Properties of the watercourse at this survey site are provided in Table 4-19. Plate 4-16 and Plate 4-17 show representative photographs of the survey site.

Table 4-19 Properties of the watercourse at survey site WF 7.

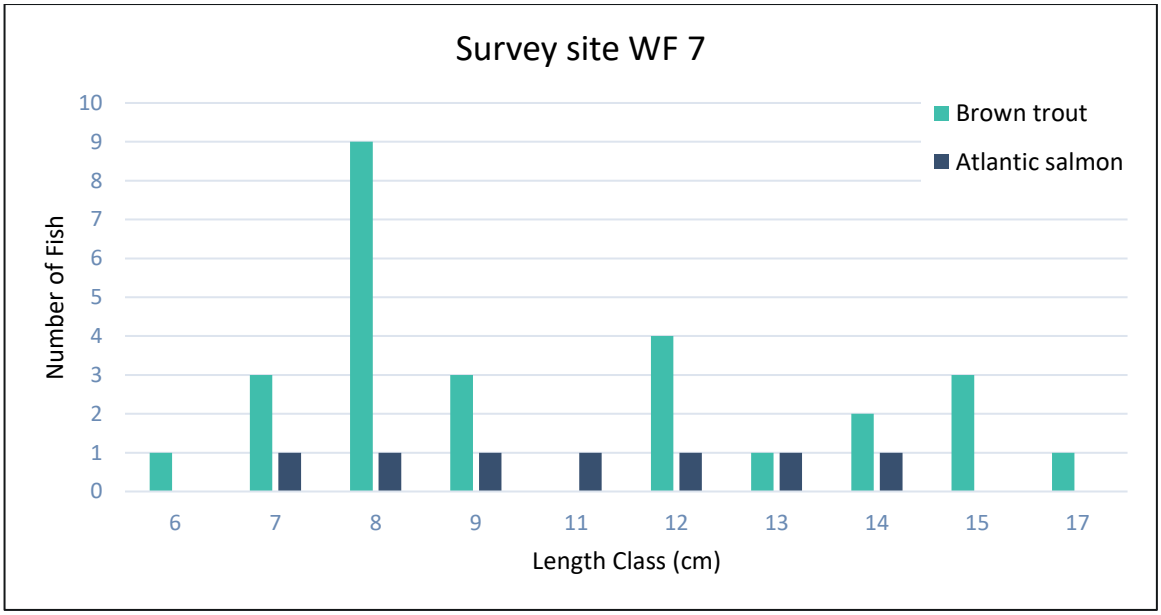
Properties	Record			
Average Depth (m)	0.1–0.4			
Average Bank Width (m)	4.5			
Average Wet Width (m)	2.5–3			
Flow	Moderate			
Colour	Clear			
Clarity	Very clear			
Bank height (m)	LHB	1.5	RHB	2.0
Dominant Substrates	Boulder (>128 mm): 30% Cobble (>32–128 mm): 45% Gravel (8–32 mm): 10% Fine gravel (2–8 mm):10% Sand (0.25–2 mm): 5%			
Substratum Condition	Semi-compacted			

This surveyed stretch of Eroding/upland river (FW1) displayed a variable profile of microhabitats, consisting of fast-flowing, boulder- and cobble-dominant riffle and glide and slower flowing pool, particularly in the vicinity of the single-span stone arch bridge at the downstream survey extent. Water crow-foot *(Ranunculus sp.)* was abundant. Fine sediments ranging from sands to coarse gravels occupied the interstitial spaces between boulder and cobble-dominant substratum, However distinct deposits of exclusively fine sediment beds were largely absent from this stretch of watercourse. Depth within areas of riffle and glide ranged from 0.1 – 0.2 m, increasing to ~0.40 m throughout pools.

Habitats along the riparian zone consisted primarily of bramble and bracken Scrub (WS1), with common hogweed, wild angelica and ivy *(Hedera helix)* throughout. The First and Third schedule invasive Himalayan balsam *(Impatiens glandulifera)* was also present along the right-hand bank. Habitats extending beyond the immediate right- and left-hand banks consisted of Improved agricultural grassland (GA1) and Mixed conifer woodland (WD3), respectively. In addition to water-crowfoot, instream and emergent vegetation consisted of fool's-water-cress, watercress, hemlock water-dropwort *(Oenanthe crocata)* and amphibious bistort *(Persicaria amphibia)*.

Salmonid and lamprey species spawning was assessed as *Moderate,* owing to the occurrence of localised suitable spawning gravels interstitially between boulders and cobbles. The lack of fine sediment beds limited lamprey species nursery habitat, which was therefore assessed as *Poor* status. Substrate diversity within areas of riffle and glide and the occurrence of patches of water-crowfoot provided suitable instream cover, which provided *Good* nursery habitat for salmonids. Undercut banks along areas of slow-velocity glide and pools provided locally *Good* adult salmonid holding habitat where it occurred. Instream and marginal refuge provided by high substrate diversity, macrophyte cover and marginal undercut and overhang features provided *Moderate–Good* European eel habitat.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-7 and Table 4-20. Brown trout and Atlantic salmon were captured during the survey conducted at this survey site.



Plot 4-7 Number of fish per length class at survey site WF 7.

Table 4-20 Electrofishing results at survey site WF 7.

Species	Length (cm)
Brown trout (*Salmo trutta*)	17.4
Brown trout (*Salmo trutta*)	14
Brown trout (*Salmo trutta*)	15.4
Brown trout (*Salmo trutta*)	12.4
Brown trout (*Salmo trutta*)	15.4
Brown trout (*Salmo trutta*)	15.1
Brown trout (*Salmo trutta*)	12.7
Brown trout (*Salmo trutta*)	14.7
Brown trout (*Salmo trutta*)	13.5
Brown trout (*Salmo trutta*)	8.8
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	8.6
Brown trout (*Salmo trutta*)	7.7
Brown trout (*Salmo trutta*)	8.8
Brown trout (*Salmo trutta*)	8.4
Brown trout (*Salmo trutta*)	8.9
Brown trout (*Salmo trutta*)	9.2
Brown trout (*Salmo trutta*)	9.3
Brown trout (*Salmo trutta*)	9.2
Brown trout (*Salmo trutta*)	8.8
Brown trout (*Salmo trutta*)	7.6
Brown trout (*Salmo trutta*)	12.7
Brown trout (*Salmo trutta*)	8.6
Brown trout (*Salmo trutta*)	8.4
Brown trout (*Salmo trutta*)	8.9
Brown trout (*Salmo trutta*)	8.4
Brown trout (*Salmo trutta*)	6.8
Atlantic Salmon *(Salmo salar)*	11.5
Atlantic Salmon *(Salmo salar)*	14
Atlantic Salmon *(Salmo salar)*	13.5
Atlantic Salmon *(Salmo salar)*	12.9
Atlantic Salmon *(Salmo salar)*	8.3

Atlantic Salmon *(Salmo salar)*	9.2
Atlantic Salmon *(Salmo salar)*	7.6

Kick-sampling was carried out in areas of riffle and glide. Survey location WF 7 was assigned a Q-value of **Q 3-4 Moderate**, on the basis that Group A 'Very Pollution Sensitive' and Group B 'Moderately Pollution Sensitive' taxa constituted ~53% of the sample, where there was one Group A taxon '*Ecdyonurus* sp.' present, with the Group B taxon Glossosomatidae being the most abundant. Group C taxa were numerous (~46%) of which *Gammarus* sp. was the most abundant. Results of the kick-sample are summarised in Table 4-21.

Table 4-21. Results of macroinvertebrates sample at survey site WF 7.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus* sp.	1
Group B – Moderately Pollution Sensitive	Sericostomatidae	2
	Glossosomatidae	20
	Limnephilidae	1
Group C – Pollution Tolerant	*Serratella ignita*	2
	Gammarus sp.	10
	Simuliidae	1
	Chironomidae	1
	Pediciidae	*2*
	Diptera	*1*
	Hydropsyche sp.	*4*
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-16. A representative photo of the upstream extent of Survey site WF 7, facing upstream.



Plate 4-17. An abundance of instream Ranunculus sp. within an area of glide and riffle at survey site WF 7.

4.1.1.8 Wind Farm Survey Site 8 (WF 8)

Survey site WF 8 was located on the Móin an mBian watercourse, approximately 0.27 km upstream of the confluence between the Móin an mBian and the River Licky (EPA code:18M04). Properties of the watercourse at this survey site are provided in Table 4-22. Plate 4-18 shows a representative photograph of the survey site.

Table 4-22 Properties of the watercourse at survey site WF 8.

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	1.2			
Average Wet Width (m)	1.2			
Bank height (m)	LHB	1.8	RHB	1.8
Flow	Moderate flow			
Colour	None			
Clarity	Clear			
Dominant Substrates	Cobble (>32–128 mm): 40% Gravel (8–32 mm): 30% Fine gravel (2–8 mm):20% Silt (<0.25 mm): 10%			
Substratum Condition	Semi-compacted			

This small second-order Eroding/upland river (FW1) measured an average of 1.2 m in wet width and 0.1 m in depth, with both left and right banks rising to approximately 1.8 m. Flow at the time of survey was moderate and water clarity was clear. Channel morphology at this location was relatively uniform, comprising a shallow, straightened section of channel with a simple planform. The survey reach was bisected by a vehicle ford, which contributed to localised substrate disturbance, as evidenced by slight siltation overlying channel substrate in the vicinity of the ford. Substrate condition was semi-compacted, with a microhabitat profile consisting of unbroken cobble-step riffle sequences downstream of the ford. Upstream, dense encroachment by willow (*Salix* spp.) heavily shaded the channel. Silt deposits were present occasionally at the channel margins.

The downstream survey extent was similarly encroached by dense Scrub (WS1), with habitats extending beyond this consisting of Wet grassland (GS4) along both banks. Bankside vegetation consisted of bracken, marsh woundwort, foxglove, yellow pimpernel *(Lysimachia nemorum)*, marsh willowherb *(Epilobium palustre)*, hoary willowherb *(Epilobium parviflorum)*, primrose *(Primula sp.)*, brooklime *(Veronica beccabunga)*, soft rush *(Juncus effusus)*, hardshield fern *(Polystichum aculeatum)* and the First and Third Schedule invasive Himalayan balsam. Submerged and emergent vegetation consisted of watercress and water starwort *(Callitriche* sp.*)*

Salmonid and lamprey species spawning habitat at WF 8 was assessed as *Poor* as a result of the semi-compacted nature of channel bed substrate throughout encroached stretches of watercourse, and ongoing disturbance in the form of a ford crossing through the watercourse. Salmonid nursery throughout cobble riffle and step features was assessed as *Moderate,* while salmonid holding habitat was assessed as *Poor* due to a lack of continuous sufficient water depth for adult salmonid fish. Marginal areas of undercut banks and overhanging vegetation, in conjunction with cobble riffle features, provided some *Poor–Moderate* localised European eel habitat. With the exception of silt deposits at the channel margins and throughout the extensively disturbed ford crossing, silt beds suitable for lamprey ammocoete nursery were largely absent and assessed as *Negligible–Poor.*

Results of the qualitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-8 and Table 4-23. As a result of the dense encroachment of willows and associated inaccessibility immediately upstream of the ford, the electrofishing survey at this location was limited to a time of 2 minutes and 30 seconds. Brown trout were captured during the electrofishing survey at WF 8.



Plot 4-8 Number of fish per length class at survey site WF 8.

Table 4-23 Electrofishing results at survey site WF 8.

Species	Length (cm)
Brown trout (*Salmo trutta*)	7.7
Brown trout (*Salmo trutta*)	9
Brown trout (*Salmo trutta*)	7.6
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	7.9
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	7.6

Kick-sampling was carried out at survey site WF 8 in areas of riffle and glide. Total abundance was notably low, with 17 individuals spanning 9 taxa constituting the entirety of the sample. The Q rating assigned to survey site WF 8 was **Q3 - Poor**, on the basis that Group A 'Very Pollution Sensitive' taxa were absent from the sample, while only one Group B 'Moderately Pollution Sensitive' individual was present. Group C taxa represented the dominant grouping of which *Chironomidae* was the most abundant. Results of the kick-sample are summarised in Table 4-24.

Table 4-24 Results of macroinvertebrate sampling at survey site WF 8.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	Glossosomatidae	1
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	1
	Tipuilidae	2
	Lumbriculidae	1
	Hydrachnidia	3
	Rhyacophila sp.	2
	Chironomidae	5
	Simuliidae	1
	Ancylus fluviatilis	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-18. A representative photo of the downstream extent of survey site WF 8.

4.1.1.9 Wind Farm Survey Site 9 (WF 9) (eDNA survey site 7)

Survey site WF 9 was present along the River Licky (EPA code: 18L01). Properties of the watercourse at this survey site are provided in Table 4-25. Plate 4-19, Plate 4-20 and Plate 4-21 show representative photographs of the survey site.

Table 4-25. Properties of the watercourse at survey site WF 9.

Properties	Record			
Average Depth (m)	0.2–0.65			
Average Bank Width (m)	5			
Average Wet Width (m)	5			
Bank height (m)	LHB	2.5	RHB	1.9
Flow	Moderate flow			
Colour	Highly coloured brown humic staining			
Clarity	Slightly turbid			
Dominant Substrates	Boulder (>128 mm): 30% Cobble (>32–128 mm): 30% Gravel (8–32 mm): 20% Fine gravel (2–8 mm):5% Silt (<0.25 mm): 15%			
Substratum Condition	Semi-compacted			

The watercourse at WF 9 represented a section of naturally sinuous Eroding /Upland River (FW1), characterised by repeating riffle-glide flow patterns. Sections of loose interstitial gravels and fine gravels throughout shallower riffle were most prominent in the immediate downstream vicinity of the three-span concrete farm bridge, with more compacted boulder and cobble-dominant substrate in areas of deeper, slower flowing glide, particularly at the downstream survey extent. Instream macrophyte coverage was high, with abundant mats of water crow-foot throughout the surveyed stretch, at times completely covering channel bed substrate.

Flow was predominantly fast across cobble and gravel riffle, which exhibited a gentle gradient, with slower flowing glide and at times marginal backwater pools along the concave bends of meanders at the downstream extent. Marginal backwater pools were often found in conjunction with overhanging and instream willow *(Salix sp.)* trees, with a high degree of marginal deadwood both from native willow species from the left-hand bank and surrounding non-native Conifer plantation (WD4) habitat which, which extended along the right-hand bank up to the bank line. No native riparian buffer existed between conifer plantation and the watercourse along the right-hand bank, and at several points, the bank exhibited exposed roots and boulder, with several actively eroding sections of the sheer-faced earth bank (approx. 1.6 m in height).

Water was slightly yellow in colouration and clear when undisturbed throughout riffle. However, channel substrate in the vicinity of conifer plantation and collapsed sections of bank exhibited a heavy degree of siltation and high floc and algal coverage overtop cobble and boulder substrates.

In addition to abundant water crowfoot coverage and filamentous green algae covering channel substrate, other instream macrophyte growth included occasional patches of fool's-water-cress and water starwort *(Callitriche sp.)*, as well as marginal stands of branched bur-reed *(Sparganium erectum).* Bankside vegetation included nettle, great willowherb, hedge bindweed, meadow buttercup, ribwort plantain *(Plantago lanceolata)* and the First and Third Schedule Invasive species Himalayan balsam.

In addition to the three-span concrete bridge structure and associated raised bridge apron, other bank modifications included concrete reinforcement along both banks in the upstream and downstream vicinity of the bridge. Upstream of the bridge, the watercourse exhibited a more channelised profile, with markedly less instream vegetation.

Areas of shallow gravels in the downstream vicinity of bridge structure provided localised *Moderate* salmonid and lamprey spawning habitat. Outside of these faster areas of riffle flow, gravel and cobble substrate was overlain with siltation and a high degree of floc and filamentous green algae coverage, limiting suitable spawning habitat elsewhere. Suitable lamprey ammocoete nursery habitat in the way of well structure fine silt and sand beds was largely absent from the survey stretch, with channel substrate dominated by either short stretches of cobble and gravel riffle or areas of semi-compacted boulder. Therefore, lamprey nursery habitat was assessed as *Negligible–Poor.*

Salmonid nursery habitat was assessed overall as *Good*, particularly in areas of riffle with varied channel substrate sizes and associated flow pattern diversity, in conjunction with abundant water crowfoot coverage. Salmonid holding habitat was *Moderate–Good*, with the highest quality adult salmonid habitat throughout areas of sufficiently deep glide and pool toward the mid-point of the survey extent. Areas of slower flowing pool in particular provided adequate instream refuge amongst larger boulder substrate and encroaching treelines and deadwood. These same areas of wood debris throughout areas of deep, marginal pool and backwater, provided *Excellent* holding habitat for adult European eel, while riffle well sheltered by macrophyte coverage provided good elver habitat.



Plate 4-19. A representative photo of the upstream survey extent at WF 9.

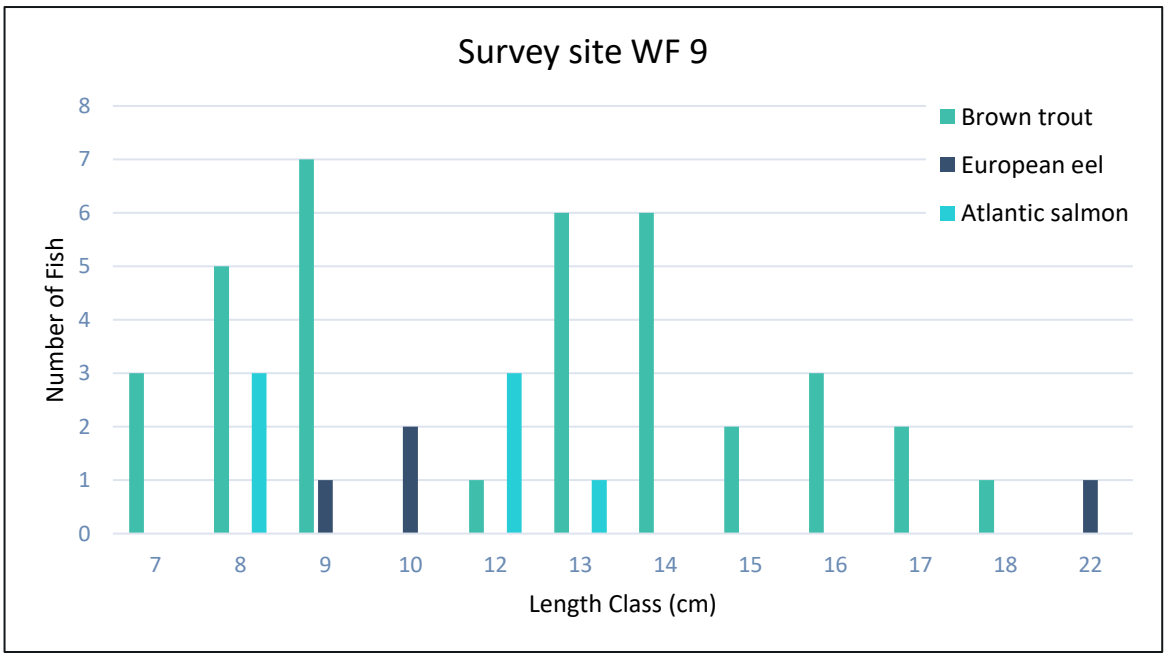


Plate 4-20. A representative photo of slower flowing glide in the mid-section of the survey extent at WF 9.



Plate 4-21. A representative photo of the downstream survey extent at WF 9, with Himalayan balsam along the left-hand bank.

Results of the 5-minute electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-9 and Table 4-26. Atlantic salmon, brown trout and European eel were caught at WF 9, with brown trout of multiple age classes representing the majority of fish caught, followed by Atlantic salmon, and four European eel ranging from 9 cm to 22 cm.



Plot 4-9 Number of fish per length class at survey site WF 9.

Table 4-26. Electrofishing results at survey site WF 9.

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	12.5

Atlantic salmon *(Salmo salar)*	8.0
Atlantic salmon *(Salmo salar)*	8.1
Atlantic salmon *(Salmo salar)*	13.0
Atlantic salmon *(Salmo salar)*	12.5
Atlantic salmon *(Salmo salar)*	8.7
Atlantic salmon *(Salmo salar)*	12.5
Brown trout *(Salmo trutta)*	8.3
Brown trout *(Salmo trutta)*	16.5
Brown trout *(Salmo trutta)*	8.4
Brown trout *(Salmo trutta)*	17.4
Brown trout *(Salmo trutta)*	13.0
Brown trout *(Salmo trutta)*	9.0
Brown trout *(Salmo trutta)*	9.0
Brown trout *(Salmo trutta)*	9.0
Brown trout *(Salmo trutta)*	15.0
Brown trout *(Salmo trutta)*	8.5
Brown trout *(Salmo trutta)*	9.0
Brown trout *(Salmo trutta)*	12.0
Brown trout *(Salmo trutta)*	9.0
Brown trout *(Salmo trutta)*	14.0
Brown trout *(Salmo trutta)*	14.8
Brown trout *(Salmo trutta)*	13.8
Brown trout *(Salmo trutta)*	9.0
Brown trout *(Salmo trutta)*	8.5
Brown trout *(Salmo trutta)*	14.3
Brown trout *(Salmo trutta)*	13.8
Brown trout *(Salmo trutta)*	9.3
Brown trout *(Salmo trutta)*	14.0
Brown trout *(Salmo trutta)*	8.4
Brown trout *(Salmo trutta)*	13.4
Brown trout *(Salmo trutta)*	13.3
Brown trout *(Salmo trutta)*	7.4
Brown trout *(Salmo trutta)*	13.4
Brown trout *(Salmo trutta)*	17.4
Brown trout *(Salmo trutta)*	15.8
Brown trout *(Salmo trutta)*	18.0
Brown trout *(Salmo trutta)*	14.5
Brown trout *(Salmo trutta)*	7.7
Brown trout *(Salmo trutta)*	7.9
Brown trout *(Salmo trutta)*	14.3
Brown trout *(Salmo trutta)*	16.9
Brown trout *(Salmo trutta)*	16.0
European eel *(Anguilla anguilla)*	10.0
European eel *(Anguilla anguilla)*	10.0
European eel *(Anguilla anguilla)*	9.0
European eel *(Anguilla anguilla)*	22.0

Kick-sampling was carried out in areas of gravel and cobble riffle downstream of the bridge. Biological water quality based on Q-sampling was calculated as **Q4 – Good** for survey site WF 9. 'Very Pollution Sensitive' Group A were represented by 10 individuals across three taxa, while 'Moderately Pollution Sensitive' Group B taxa (of which there were 9 individuals across two taxonomic groups) represented ~14% of the sample. Group C 'Pollution Tolerant' taxa represented ~76% of the sample, dominated by *Gammarus sp.* Group D 'Very Pollution Tolerant' taxa were represented by an individual in one taxon,

while Group E 'Most Pollution Tolerant' was absent from the sample. Results of kick-sampling at survey site WF 9 are summarised in Table 4-27.

Table 4-27. Results of the macroinvertebrate sample at survey site WF 9.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus sp.*	10
Group B – Moderately Pollution Sensitive	Baetidae *(ex. B. rhodani/atlanticus)*	1
	Glossosomatidae	7
	Leuctra sp.	1
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	9
	Chironomidae	3
	Dicranota sp.	3
	Dysticidae	1
	Elmidae	8
	Gammarus sp.	13
	Hydrachnidia	1
	Hydropsyche sp.	7
	Philopotamus sp.	3
	Rhyacophila sp.	2
	Serratella ignita	3
	Simuliidae	9
Group D – Very Pollution Tolerant	Naididae	1
Group E – Most Pollution Tolerant	-	-

4.1.1.10 Wind Farm Survey Site 10 (WF 10)

Survey site WF 10 was located on the Carronadavderg watercourse (EPA code: 18C28). Properties of the watercourse at this survey site are provided in Table 4-28. Plate 4-22 and Plate 4-23 show representative photographs of the survey site.

Table 4-28 Properties of the watercourse at survey site WF 10.

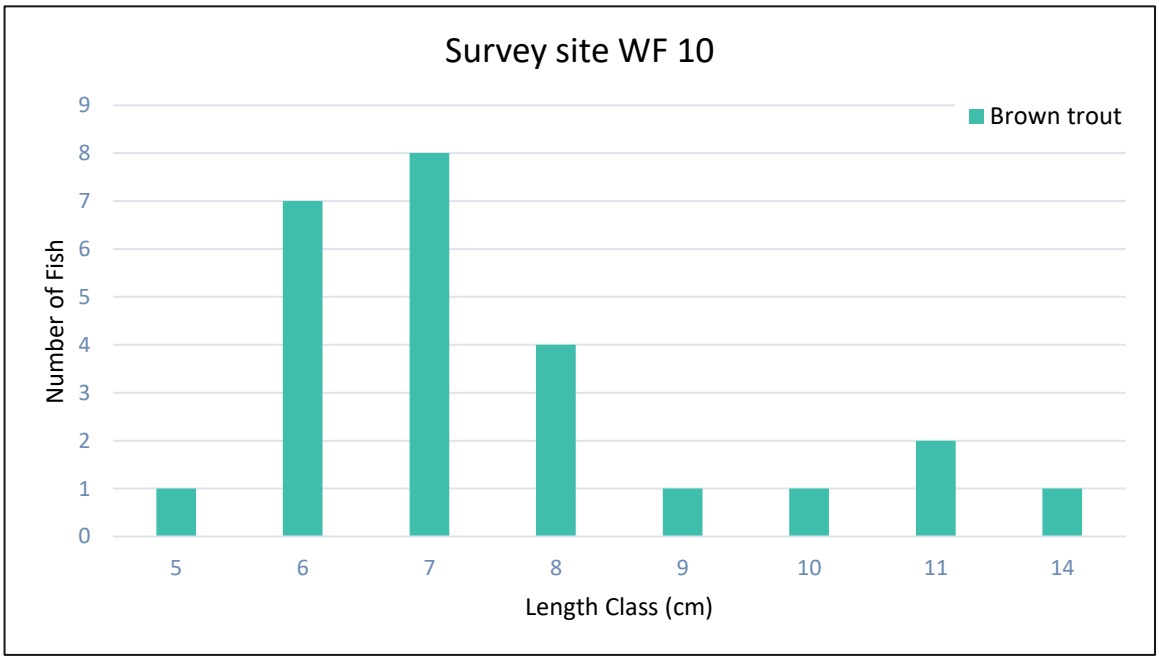
Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	2.2			
Average Wet Width (m)	2			
Bank height (m)	LHB	0.5	RHB	0.5
Flow	Moderate flow			
Colour	No colour			
Clarity	Clear			
Dominant Substrates	Boulder (>128 mm): 10% Cobble (>32–128 mm): 60% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):5% Silt (<0.25 mm): 10%			
Substratum Condition	Semi-compacted			

This surveyed stretch of Eroding/Upland River (FW1) at WF 10 was characteristic of a low-order stream, consisting predominantly of shallow (~0.15 m) cobble-step riffles with intermittent boulders. Two separate vehicle/livestock fords bisected the watercourse approx. 10 m apart from each other. Substrate throughout the fords consisted of finer sediments, with overlying siltation evident. Manure was also present through one of the ford crossings. Flow velocity was also reduced at these crossing points,. Marginal vegetation provided little shading of the channel at the downstream survey extent, while a sitka spruce *(Picea sitchensis)* Conifer Plantation (WD4) provided extensive shading over the entire wetted width at the upstream extent.

Habitats along the immediate riparian zone consisted primarily of bramble and gorse Scrub (WS1). The wider vegetation assemblage included creeping buttercup, soft rush, wild angelica, bracken fern, soft rush, birds-foot trefoil *(Lotus corniculatus),* common marsh-bedstraw *(Galium palustre),* bitter-cress *(Cardamine impatiens),* willowherb *(Epilobium* sp.) and herb-robert *(Geranium robertianum).* Habitats beyond this consisted of Wet grassland (GS4) and Improved agricultural grassland (GA1).

The dominance of cobbles and overlying siltation limited salmonid and lamprey spawning, which was assessed as *Poor.* Cobble-step riffle formations which occupied the downstream extent provided suitably sized substrate and variable flow patterns, representing *Good* nursery habitat for salmonids. The occurrence of some finer sediments in the immediate vicinity of the ford may provide some suitable juvenile lamprey habitat. However given that these areas may be trafficked by livestock and/or vehicles, lamprey nursery habitat was assessed as *Poor.* Salmonid holding habitat was assessed as *Poor,* given the lack of any significant depth or areas of suitable refugia for adult salmonids. Interstitial spaces which were sporadically present between deposits of larger cobbles was of *Moderate* suitability for eel. However, refugia was depth-limited and infrequent in it's occurrence throughout the surveyed stretch.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-10 and Table 4-29. Brown trout of various age classes were the sole species recorded over the course of the survey.



Plot 4-10 Number of fish per length class at survey site WF 10.

Table 4-29 Electrofishing results at survey site WF 10.

Species	Length (cm)
Brown trout (*Salmo trutta*)	14.9
Brown trout (*Salmo trutta*)	7.9
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	7.6
Brown trout (*Salmo trutta*)	11.5
Brown trout (*Salmo trutta*)	10.6
Brown trout (*Salmo trutta*)	6
Brown trout (*Salmo trutta*)	9.5
Brown trout (*Salmo trutta*)	8.9
Brown trout (*Salmo trutta*)	8.7
Brown trout (*Salmo trutta*)	11.7
Brown trout (*Salmo trutta*)	6.7

Brown trout (*Salmo trutta*)	6.3
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	7.6
Brown trout (*Salmo trutta*)	5.9
Brown trout (*Salmo trutta*)	7.1
Brown trout (*Salmo trutta*)	6.4
Brown trout (*Salmo trutta*)	8.4
Brown trout (*Salmo trutta*)	7.5
Brown trout (*Salmo trutta*)	6.3
Brown trout (*Salmo trutta*)	6.4
Brown trout (*Salmo trutta*)	8.7
Brown trout (*Salmo trutta*)	6.9
Brown trout (*Salmo trutta*)	7.3

Kick-sampling was carried out in areas of riffle and glide. The Q rating assigned to survey site WF 10 was **Q3-4 Moderate**, on the basis that Group A 'Very Pollution Sensitive' taxa were present in low numbers, whereas Group B 'Moderately Pollution Sensitive' taxa were numerous (~39%). Group C taxa represented the dominant grouping (~58%) of which *Ancylus fluviatilis* were the most abundant taxa. Results of macroinvertebrate sampling at survey site WF 10 are presented in Table 4-30.

Table 4-30 Results of macroinvertebrate sampling at survey site WF 10.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	Perlidae . (early instar)	2
Group B – Moderately Pollution Sensitive	Glossosomatidae	24
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	4
	Rhyacophila sp.	1
	Elmidae	3
	Chironomidae	*3*
	Ancylus fluviatilis	*22*
	Hydrachnidia	*3*
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-22. Downstream extent of the survey site WF 10.



Plate 4-23. Upstream extent of survey site WF 10.



Plate 4-24. Dual fords which bisected the Carronadavderg at the surveyed location, where poaching was present at the downstream crossing (top image).

4.1.1.11 Wind Farm Survey Site 11 (WF 11) (eDNA survey site 9)

Survey site WF 11 was located on the Licky watercourse. (EPA code: 18L01). Properties of the watercourse(s) at this survey site are provided in Table 4-31. Plate 4-25 and Plate 4-26 show representative photographs of the survey site.

Table 4-31 Properties of the watercourse at survey site WF 11.

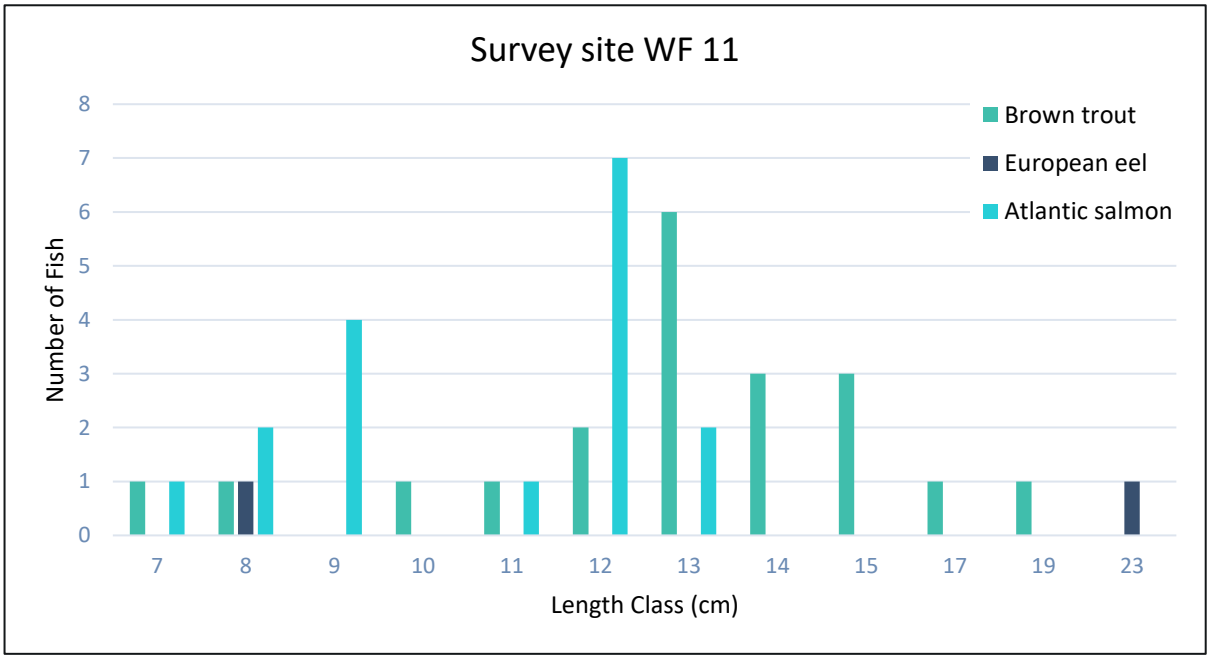
Properties	Record
Average Depth (m)	0.2–0.6
Average Bank Width (m)	4–6
Average Wet Width (m)	4–6
Bank height (m)	LHB 3 RHB 2
Flow	Moderate flow
Colour	None
Clarity	Clear when undisturbed
Dominant Substrates	Bedrock: 30% Boulder (>128 mm): 40% Cobble (>32–128 mm): 20% Gravel (8–32 mm): 10% Silt (>2 mm): Some localised deposits
Substratum Condition	Compacted boulders, with some localised siltation evident upstream of the bridge

The watercourse at survey site WF 11 represented stretch of Eroding/upland river (FW1) located on the River Licky. Substrate was dominated by boulders on top of bedrock, with some interstitial cobbles and gravels between boulders. Small, localised deposits of gravel were present sporadically throughout eddy flow downstream of larger instream boulders. Flow patterns upstream of a two-span stone arch stone bridge consisted of deep, slow flowing glide and pool (up to 0.6 m), transitioning into moderate-fast velocity riffle and glide, with deeper pool (0.5 m) following boulder-step sequences. Gradient perceptibly increased downstream of the bridge. An island comprising cobble and boulder occupied the area beneath the left span of the bridge, and extended downstream for approximately 20 m. The watercourse primarily flowed to the right of the cobble and boulder island, with only a narrow (~1.5 m width) shallow channel along the left-hand side of the island. Substrate was locally silted in areas of slower flow upstream of the bridge.

The bankside vegetation profile consisted largely of Scrub (WS1) habitat on the left-hand bank upstream of the bridge, whereas downstream the vegetation profile consisted of Mixed-broadleaved Woodland (WD1) on both banks. Woodland habitat occupied much of the right-hand bank and provided significant shading from encroaching willow, horse chestnut, sycamore and beech trees. Emergent and riparian vegetation consisted of fool's-water-cress , creeping buttercup, common marsh-bedstraw, wood dock *(Rumex sanguineus)* cow parsley *(Anthriscus sylvestris)*, marsh thistle *(Cirsium palustre)* and greater woodrush *(Luzula sylvatica).* Instream, greater water-moss grew submerged on some boulders, whereas *Ranunculus* sp. was moderately common within areas of glide downstream of the bridge. Dominating the scrub along the immediate riparian zone of the left-hand bank upstream of the bridge was the first and third-scheduled invasive Himalayan balsam (Plate 4-27).

Salmonid and lamprey spawning habitat was assessed as *Poor* due to limited occurrence of gravels, while lamprey nursery habitat was assessed as *Poor,* with fine gravels and sands being largely absent from the surveyed stretch particularly downstream of the bridge. The moderate gradient, moderate to fast velocity and the significant mean depth limited this visited stretch to an assessment of *Moderate* in terms of salmonid nursery habitat. Alternatively, these microhabitat conditions were of *Excellent* suitability in the provision of holding features for adult salmonids, aided by the provision of large boulders and a deeper pool which lay upstream of the bridge. The occurrence of interstitial cobbles between larger boulders and bedrock planes likely provided suitable refugia for eel where they occurred, and as such survey site WF 11 was assessed as *Good* in terms of eel habitat.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-11 and Table 4-32. Brown trout and salmon of various age classes and two eels were recorded over the course of the survey.



Plot 4-11 Number of fish per length class at survey site WF 11.

Table 4-32 Electrofishing results at survey site WF 11.

Species	Length (cm)
Brown trout (*Salmo trutta*)	17.6
Brown trout (*Salmo trutta*)	13.7
Brown trout (*Salmo trutta*)	14
Brown trout (*Salmo trutta*)	13.5
Brown trout (*Salmo trutta*)	15.4
Brown trout (*Salmo trutta*)	19.2
Brown trout (*Salmo trutta*)	15.4
Brown trout (*Salmo trutta*)	15.6
Brown trout (*Salmo trutta*)	14.6
Brown trout (*Salmo trutta*)	13.7
Brown trout (*Salmo trutta*)	14.2
Brown trout (*Salmo trutta*)	13.2
Brown trout (*Salmo trutta*)	12.7
Brown trout (*Salmo trutta*)	13.6
Brown trout (*Salmo trutta*)	13
Brown trout (*Salmo trutta*)	12
Brown trout (*Salmo trutta*)	7.8
Brown trout (*Salmo trutta*)	11.4
Brown trout (*Salmo trutta*)	10.7
Brown trout (*Salmo trutta*)	8.5
Atlantic Salmon *(Salmo salar)*	9.4
Atlantic Salmon *(Salmo salar)*	12
Atlantic Salmon *(Salmo salar)*	13.1
Atlantic Salmon *(Salmo salar)*	12.9
Atlantic Salmon *(Salmo salar)*	11.9
Atlantic Salmon *(Salmo salar)*	9.4
Atlantic Salmon *(Salmo salar)*	12.5

Atlantic Salmon *(Salmo salar)*	7
Atlantic Salmon *(Salmo salar)*	12.5
Atlantic Salmon *(Salmo salar)*	12.9
Atlantic Salmon *(Salmo salar)*	8.4
Atlantic Salmon *(Salmo salar)*	12.8
Atlantic Salmon *(Salmo salar)*	12.4
Atlantic Salmon *(Salmo salar)*	13
Atlantic Salmon *(Salmo salar)*	9
Atlantic Salmon *(Salmo salar)*	9.2
Atlantic Salmon *(Salmo salar)*	8.8
European eel *(Anguilla anguilla)*	8
European eel *(Anguilla anguilla)*	23

Kick-sampling was carried out in areas of riffle and glide. The Q rating assigned to survey site WF 11 was **Q4 - Good**, on the basis that Group A 'Very Pollution Sensitive' taxa were common, while the Group B 'Moderately Pollution Sensitive' taxa constituted the dominant grouping (~75%). The abundance of 'Pollution Tolerant' Group C taxa was low, and constituted two individuals of different taxonomic groups (*Hydropsyche* sp. and *Baetis rhodani*). No Group D or Group E taxa were present within the sample. The low abundance of species and low abundance of each present taxon was likely due to the boulder and bedrock substrate over much of the reach. The results of macroinvertebrate sampling at survey site WF 11 are presented in Table 4-33.

Table 4-33 Results of macroinvertebrate sampling at survey site WF 11.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus* sp.	3
Group B – Moderately Pollution Sensitive	Glossosomatidae	15
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	1
	Hydropsyche sp.	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-25. The downstream-facing extent of survey site WF 11.



Plate 4-26. The upstream extent of survey site WF 11.



Plate 4-27. Dense stands of invasive Himalayan balsam dominate the vegetation profile on the left-hand bank, upstream of the bridge.

4.1.1.12 Wind Farm Survey Site 12 (WF 12)

Survey site WF 12 was located on the Grallagh Lower watercourse within the Licky catchment (EPA code: 18G57). Properties of the watercourse at this survey site are provided in Table 4-34. Plate 4-28 shows a representative photograph of the survey site.

Table 4-34 Properties of the watercourse at survey site WF 12.

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	0.9			
Average Wet Width (m)	0.8			
Bank height (m)	LHB	0.3	RHB	0.5
Flow	Slow			
Colour	None			
Clarity	Clear			
Dominant Substrates	Bedrock: 40% Boulder (>128 mm): 30% Cobble (>32–128 mm): 20% Gravel (8–32 mm): 5% Silt (>2 mm): 5%			
Substratum Condition	Loose, with slight to moderate siltation evident at points			

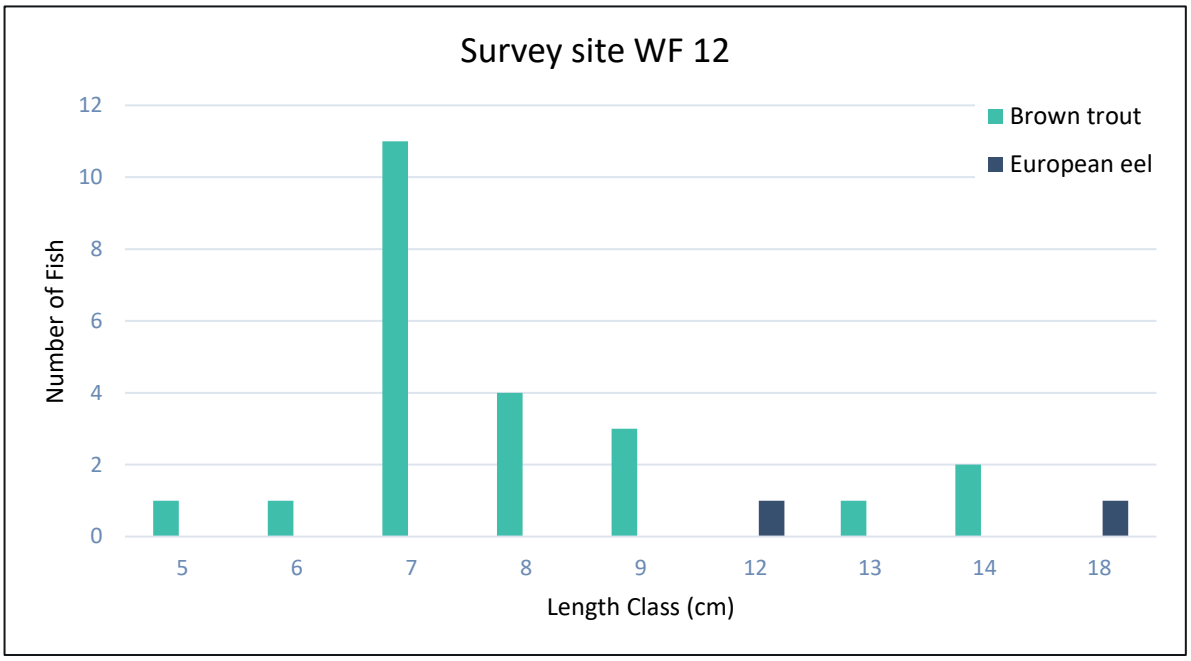
This visited stretch of Eroding/upland river (FW1) consisted of a laterally constricted, bedrock-dominant stream order 2 watercourse, with a very shallow average depth (~0.1 m), with some limited slightly deeper pools (~0.2 m) occurring intermittently. The gradient of the watercourse was high, with some high bedrock steps evident (~0.3 m) particularly at the lower visited extent, which likely limits migration significantly, particularly under conditions of reduced flow. Boulders and cobbles with some limited interstitial gravels occurred throughout the surveyed stretch, with some areas of slight to moderate siltation evident throughout the shallow pools which occurred intermittently throughout the bedrock-boulder step formation which represented much of the hydromorphological profile of this visited section of watercourse. Some fly tipping was evident instream, likely dumped from the adjacent roadway which was present to the right-hand side of the watercourse. At the time of visiting, the water level was low. However, the occurrence of jammed woody debris which occurred at points along with the presence of a manmade silt fence (located at the upper extent, Plate 4-29) indicated that the water level does rise significantly on the Grallagh Lower.

The river traversed through a narrow valley consisting of a sparse Mixed broadleaved woodland (WD1) consisting largely of beech, which was bordered to the right by a steep embankment separating it from the adjacent Buildings and artificial surfaces (BL3) roadway. At the uppermost extent, the immediate right-hand bank consisted of Wet grassland (GS4), with some intermittent Scrub (WS1) occurring on the left-hand bank. Riparian vegetation consisted of wild angelica, bracken fern, hardshield fern, harts-tongue fern *(Asplenium scolopendrium),* hard fern *(Blechnum spicant)*, rush *(Juncus sp.)* and meadow fox-tail *(Alopecurus pratensis)*. Submerged and emergent vegetation consisted of opposite-leaved golden-saxifrage *(Chrysosplenium oppositifolium)* and water figwort *(Scrophularia auriculata).* The bryophyte *Riccardia sp.* was also present, growing on instream boulders.

The bedrock and boulder dominant substrate at this surveyed location with little finer gravels was of *Negligible-Poor* suitability for salmonid and lamprey spawning and lamprey species nursery suitability. The occurrence of some pools intermittently which contained boulder and cobble was of sufficient composition to provide *Moderate* suitable habitat for juvenile salmonid nursery habitat. This laterally constricted and shallow channel was, at the time of visiting, largely unsuitable for eel and adult salmonids, and as such habitat suitability in terms of eel and salmonid holding was assessed as *Poor.* However, given the aforementioned indicators (vegetative debris and the silt fence) it is likely that the water level within this watercourse is usually higher, which likely act to widen and thus deepen the

wetted area, providing additional suitable habitat for European eel under these conditions and likely improve longitudinal connectivity for all fish species.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-12 and Table 4-35. Brown trout within the length class of 7 cm to 14 cm and two eels were captured during electrofishing at survey site WF 12.



Plot 4-12 Number of fish per length class at survey site WF 12.

Table 4-35 Electrofishing results at survey site WF 12.

Species	Length (cm)
Brown trout (*Salmo trutta*)	8.3
Brown trout (*Salmo trutta*)	13.1
Brown trout (*Salmo trutta*)	7.3
Brown trout (*Salmo trutta*)	7.4
Brown trout (*Salmo trutta*)	9.2
Brown trout (*Salmo trutta*)	7.2
Brown trout (*Salmo trutta*)	9.6
Brown trout (*Salmo trutta*)	7.4
Brown trout (*Salmo trutta*)	7
Brown trout (*Salmo trutta*)	14
Brown trout (*Salmo trutta*)	7.6
Brown trout (*Salmo trutta*)	9.2
Brown trout (*Salmo trutta*)	14.3
Brown trout (*Salmo trutta*)	7.9
Brown trout (*Salmo trutta*)	7.4
Brown trout (*Salmo trutta*)	8.2
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	8.6
Brown trout (*Salmo trutta*)	5.7
Brown trout (*Salmo trutta*)	7.4
Brown trout (*Salmo trutta*)	7.7
Brown trout (*Salmo trutta*)	6.5
Brown trout (*Salmo trutta*)	7.7
European eel *(Anguilla anguilla)*	18
European eel *(Anguilla anguilla)*	12

Kick-sampling was carried out in areas of riffle and pool. Macroinvertebrate diversity and abundance was moderate and low, respectively. The Q rating assigned to survey site WF 12 was **Q3-4 - Moderate**, on the basis that Group A 'Very Pollution Sensitive' taxa and Group B 'Moderately Pollution Sensitive' taxa were both present in fair numbers. Group C taxa represented the dominant grouping (~66%) of which *Gammarus* sp. and Chironomidae were the most abundant. Results of the kick-sample at site WF 12 are presented in Table 4-36.

Table 4-36 Results of macroinvertebrate sampling at survey site WF 12.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus* sp.	4
Group B – Moderately Pollution Sensitive	Sericostomatidae	4
	Limnephilidae	1
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	4
	Gammarus sp.	8
	Chironomidae	6
	Lumbriculidae	1
	Philopotamus sp.	1
	Hydropsyche sp.	2
	Nematomorpha	1
Group D – Very Pollution Tolerant	Naididae	1
Group E – Most Pollution Tolerant	-	-



Plate 4-28. The downstream extent of the survey site WF 12 facing upstream.



Plate 4-29. Silt fence present amongst wet grassland on the left-hand bank at the upper extent of survey site WF 12.

4.1.1.13 Wind Farm Survey Site 13 (WF 13)

Survey site WF 13 was located on the mainstem of the River Licky (EPA code: 18L01). The survey site was situated approximately 1.85 km downstream of the confluence between the Grallagh Lower watercourse and the River Licky. Properties of the watercourse at this survey site are provided in Table 4-37. Plate 4-30 and Plate 4-31 show representative photographs of the survey site.

Table 4-37 Properties of the watercourse at survey site WF 13.

Properties	Record			
Average Depth (m)	0.25–0.5			
Average Bank Width (m)	5–6			
Average Wet Width (m)	5–6			
Bank height (m)	LHB	1.3	RHB	1.3
Flow	Moderate			
Colour	None			
Clarity	Clear			
Dominant Substrates	Boulder (>128 mm): 20% Cobble (>32–128 mm): 70% Gravel (8–32 mm): 10%			
Substratum Condition	Semi-compacted			

This visited stretch of Eroding/upland river (FW1) comprised a fast-riffle dominant flow which occurred over cobbles at the lowermost surveyed extent, which comprised the area directly upstream of a dual-span masonry and metal bridge. There were some limited deposits of gravels which were of a coarser variety which occurred within the interstitial spaces between cobbles. Upstream of this riffle flow regime, a deep (up to ~0.7 m), slow-moving continuous pool occupied the wetted width, with a substrate composition of boulder and cobble with some exposed bedrock. The upper extent of the visited area was characterised by the cobble-step riffle formation which occurred at the head of the

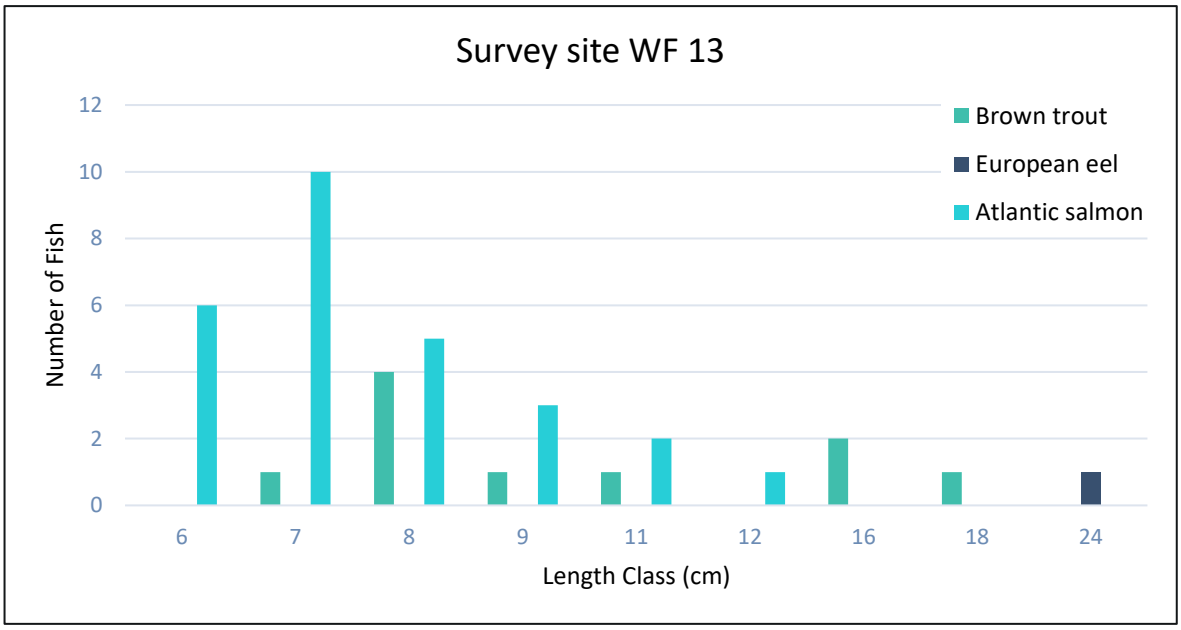
aforementioned pool. Significant shading was provided by the trees which were present on both banks at the upper extent, of which some root systems extended into the wetted channel.

At the time of visiting, scour repair works appeared to take place on the bridge which was located at the downstream survey extent. A raised cobble platform for machinery occupied the right-side of the channel and right-hand bridge span in the vicinity of works. A cobble and earth slope was also observed downstream of the bridge extending from the left-hand bank. Water was being pumped from the right-hand side of the channel back into the watercourse downstream of the bridge.

Salmonid spawning habitat was assessed as *Moderate*, owing to the limited gravels and overall coarseness of substrate which occurred throughout the surveyed stretch, and the dominance of boulder and cobble towards the upper extent of the visited stretch. Lamprey spawning habitat was assessed as *Poor–Moderate* due to some interstitial siltation, while an absence of extensive fine sediment beds (with the exception of occasional marginal siltation) saw overall *Poor* lamprey ammocoete nursery habitat. High channel substrate variability and associated fast flowing riffle flow patterns provided high-quality salmonid nursery habitat assessed as *Good*, particularly upstream of the bridge outside of the works area. Continuous deep water in areas of glide and marginal pool and backwater (up to 0.8 m deep) provided *Good–Excellent* adult salmonid holding habitat, with submerged root structures, boulder complexes and overhanging tree limbs providing instream refugia assessed as *Good* European eel.

The immediate riparian zone immediately adjacent to the bridge consisted of Scrub (WS1), which was composed largely of nettle, bramble, blackthorn *(Prunus Spinosa)* and stands of the First and Third schedule invasive Himalayan balsam. Upstream, habitat composition on both banks consisted of Mixed broadleaved woodland (WD1), largely comprising alder, sycamore, ash and hawthorn, which provided significant shading over the channel.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-13 and Table 4-38. Brown trout, juvenile Atlantic salmon and eel were captured during the electrofishing survey at this location. Atlantic salmon were abundant at this site, with 27 individuals ranging in length class from 6.5 cm to 12.5 cm captured throughout the survey.



Plot 4-13 Number of fish per length class at survey site WF 13.

Table 4-38 Electrofishing results at survey site WF 13.

Species	Length (cm)
Brown trout (*Salmo trutta*)	18
Brown trout (*Salmo trutta*)	16
Brown trout (*Salmo trutta*)	16.3
Brown trout (*Salmo trutta*)	8.3
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	9.5
Brown trout (*Salmo trutta*)	8.3
Brown trout (*Salmo trutta*)	11
Brown trout (*Salmo trutta*)	8
Brown trout (*Salmo trutta*)	7.4
Atlantic Salmon *(Salmo salar)*	9
Atlantic Salmon *(Salmo salar)*	7
Atlantic Salmon *(Salmo salar)*	11.9
Atlantic Salmon *(Salmo salar)*	11.8
Atlantic Salmon *(Salmo salar)*	7
Atlantic Salmon *(Salmo salar)*	8
Atlantic Salmon *(Salmo salar)*	7.5
Atlantic Salmon *(Salmo salar)*	9
Atlantic Salmon *(Salmo salar)*	8
Atlantic Salmon *(Salmo salar)*	8
Atlantic Salmon *(Salmo salar)*	6.5
Atlantic Salmon *(Salmo salar)*	7.5
Atlantic Salmon *(Salmo salar)*	7
Atlantic Salmon *(Salmo salar)*	7
Atlantic Salmon *(Salmo salar)*	8
Atlantic Salmon *(Salmo salar)*	7.4
Atlantic Salmon *(Salmo salar)*	6.8
Atlantic Salmon *(Salmo salar)*	6.9
Atlantic Salmon *(Salmo salar)*	12.5
Atlantic Salmon *(Salmo salar)*	9.3
Atlantic Salmon *(Salmo salar)*	7.5
Atlantic Salmon *(Salmo salar)*	7.6
Atlantic Salmon *(Salmo salar)*	6.6
Atlantic Salmon *(Salmo salar)*	6.9
Atlantic Salmon *(Salmo salar)*	6.8
Atlantic Salmon *(Salmo salar)*	8
Atlantic Salmon *(Salmo salar)*	7.1
European eel *(Anguilla anguilla)*	24

Kick-sampling was carried out in areas of riffle and glide. Macroinvertebrate richness and abundance was observed to be low, with eight individuals spanning four taxonomic groupings identified. Survey site WF 13 was assigned a Q value of **Q3 - Poor**, owing to the absence of 'Very Pollution Sensitive' Group A taxa, and the limited occurrence of 'Moderately Pollution Sensitive' Group B and 'Pollution Tolerant' Group C taxa. The results of macroinvertebrate sampling at site WF 13 are presented in Table 4-39
below.

Table 4-39. Results of macroinvertebrate sampling at survey site WF 13.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	Glossosomatidae	4
	Sericostomatidae	1
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	1

	Simuliidae	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-30. The upstream extent of survey site WF 13.



Plate 4-31. The downstream extent of survey site WF 13, where repair works were taking place along the river.

4.1.1.14 Wind Farm Survey Site 14 (WF 14)

Survey site WF 14 was located on the Abartagh watercourse (EPA code:18A11). The survey site was situated approximately 2.7 km upstream of the convergence of the Abartagh with the estuarine waters of the lower Licky. Properties of the watercourse at this survey site are provided in Table 4-40. Plate 4-32 and Plate 4-33 show representative photographs of the survey site.

Table 4-40 Properties of the watercourse at survey site WF 14.

Properties	Record
Average Depth (m)	0.15
Average Bank Width (m)	3.5
Average Wet Width (m)	2.8
Bank height (m)	LHB 1 RHB 1
Flow	Moderate
Colour	None
Clarity	Clear when undisturbed
Dominant Substrates	Boulder (>128 mm): 10% Cobble (>32–128 mm): 60% Gravel (8–32 mm): 25% Fine gravel (2–8 mm):5% Silt (<0.25 mm): 10%, more considerably downstream
Substratum Condition	Loose, heavily silted at the downstream extent.

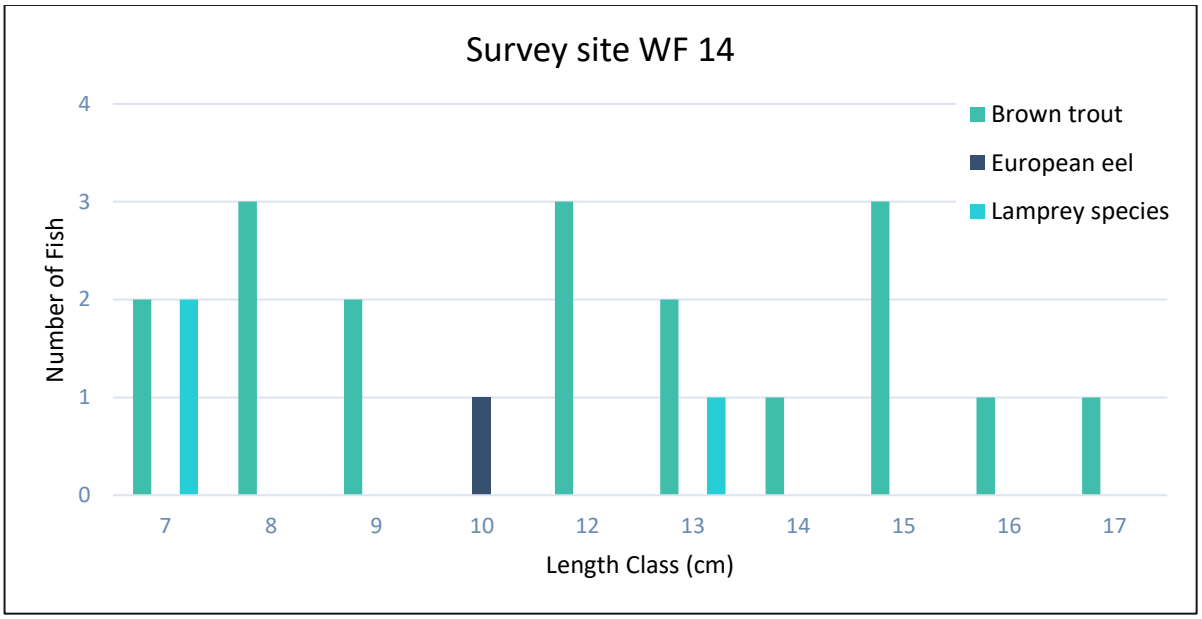
This visited stretch of Eroding/upland river (FW1) was located immediately downstream of a newly constructed/upgraded single-span concrete road bridge, in which the watercourse was culverted beneath. Directly downstream of the bridge, a historic cattle ford was evident leading from the surrounding agricultural pasture. At this extent, microhabitat composition was characterized by a sequence of low-gradient cobble-step riffle formations, of which some gravels ranging in composition from fine to coarse occupied the interstitial space. Some very slight siltation was evident here within the marginal areas of the wetted channel, slightly coating the substrate. Microhabitat composition changed to favour the reduced flow which occurred with downstream movement, as the lower extent comprised heavily silted pools which were interspersed between areas of riffle and glide. At the downstream extent, historic cattle access to the watercourse from the left-hand bank was evident from the exposed cobbles and slightly poached bank. The channel lacked any significant and consistent shading, however some sporadic trees provided some areas of localised shade in this otherwise exposed section of the Abartagh watercourse. Throughout the surveyed section, five separate plastic inflow pipes were observed meeting the watercourse from its banks (Plate 4-34). At the time of visiting, there was no active discharge emanating into the watercourse from these pipes.

The surrounding land on both banks consisted of Improved agricultural grassland (GA1), whereas at the lower visited extent a Scrub (WS1) buffer occupied the right-hand bank. Emergent and riparian vegetation consisted of nettle, bramble, marsh woundwort, brooklime, fool's-water-cress , creeping thistle *(Cirsium arvense), and* common ragwort *(Jacobaea vulgaris)*. The aquatic bryophyte *Rhynchostegium riparioides* was also present in marginal wetted areas of the channel, occasionally present on boulders.

Although there were suitable gravels of varying size occurring in areas of riffle, overlying siltation was common overtop and interstitially between gravels, thus likely limiting oxygenation. Theresfore, this surveyed stretch was assessed as *Poor-Moderate* suitability for salmonid and lamprey spawning. Given the cobble and boulder riffle-step sequences, this surveyed stretch was assessed as *Good* in terms of juvenile salmonid nursery habitat. Silt deposits present marginally within pool and glide at the downstream extent of this location, provided lamprey nursery habitat assessed as *Moderate–Good*. The increased depth and encroaching root systems from occasional riparian trees within some pools provided locally *Good* holding habitat for adult salmonids and European eel. However, the shallow,

riffle-dominant microhabitat composition throughout the surveyed stretch as a whole limited the provision of extensive suitable refugia, limiting holding habitat for salmonids and eel to *Moderate*.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-14 and Table 4-41. 18 brown trout ranging in length class from 7.5 cm to 17.9 cm were captured, in addition to three juvenile lamprey and one eel.



Plot 4-14 Number of fish per length class at survey site WF 14.

Table 4-41 Electrofishing results at survey site WF 14.

Species	Length (cm)
Brown trout (*Salmo trutta*)	16.9
Brown trout (*Salmo trutta*)	8.5
Brown trout (*Salmo trutta*)	13.9
Brown trout (*Salmo trutta*)	17.9
Brown trout (*Salmo trutta*)	15.5
Brown trout (*Salmo trutta*)	12.9
Brown trout (*Salmo trutta*)	13.9
Brown trout (*Salmo trutta*)	14.2
Brown trout (*Salmo trutta*)	15.1
Brown trout (*Salmo trutta*)	15.8
Brown trout (*Salmo trutta*)	9.4
Brown trout (*Salmo trutta*)	12.4
Brown trout (*Salmo trutta*)	12.9
Brown trout (*Salmo trutta*)	7.4
Brown trout (*Salmo trutta*)	9.6
Brown trout (*Salmo trutta*)	8.5
Brown trout (*Salmo trutta*)	7.5
Brown trout (*Salmo trutta*)	8.9
Lamprey sp. *(Lampetra* sp.)	13.5
Lamprey sp. *(Lampetra* sp.)	7
Lamprey sp. *(Lampetra* sp.)	7
European eel *(Anguilla anguilla)*	10

Kick-sampling was carried out in areas of riffle and glide. Site WF 14 was assigned a Q value of **Q3 – Poor**. Group A 'Very Pollution Sensitive' and Group B 'Moderately Pollution Sensitive' were absent,

whereas 'Pollution Tolerant' Group C taxa constituted the near entirety (~99%) of the sample. *Simuliidae* were the most abundant taxon, constituting (~68%) of the sample. Results of the kick-sample at survey site WF 14 are presented in Table 4-42.

Table 4-42 Results of macroinvertebrate sampling at survey site WF 14.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani /atlanticus*	11
	Gammarus sp.	10
	Hydropsyche sp.	18
	Chironomidae	13
	Lumbriculidae	1
	Simuliidae	130
	Elmidae	1
	Rhyacophila sp.	6
Group D – Very Pollution Tolerant	Naididae	1
Group E – Most Pollution Tolerant	-	-



Plate 4-32. The upstream extent of survey site WF 14, facing downstream.



Plate 4-33. The downstream extent of survey site WF 14, facing upstream. The image shows a riffle formation leading into a shallow, heavily silted pool, and a bare bank to the right-side of the image indicating historic livestock access.



Plate 4-34. A selection of the inflow pipes encountered throughout the visited survey site on the Abartagh watercourse.

4.1.1.15 Wind Farm Survey Site 15 (WF 15) (eDNA survey site 12)

Survey site WF 15 was located on the Brickey watercourse within the Colligan-Mahon subcatchment (EPA code:17B01). Properties of the watercourse at this survey site are provided in Table 4-43. Plate 4-35 and Plate 4-36 show representative photographs of the survey site.

Table 4-43 Properties of the watercourse(s) at survey site WF 15.

Properties	Record			
Average Depth (m)	0.55			
Average Bank Width (m)	5			
Average Wet Width (m)	4			
Bank height (m)	LHB	2	RHB	3.2
Flow	Very slow			
Colour	None			
Clarity	Clear when undisturbed			
Dominant Substrates	Cobble (>32–128 mm): 5% Gravel (8–32 mm): 5% Fine gravel (2–8 mm): 10% Silt (<0.25 mm): 80%			
Substratum Condition	Heavily silted, underlying substrate was compacted			

This visited stretch of Depositing/lowland River (FW2) was characterised by extensive historical channel modification. The channel planform was uniformly straight, indicating channelisation and straightening had taken place. A moderately deep (~0.55 m) uniform wetted area and the presence of a raised embankment on the right-hand bank indicated potential historic dredging. Silt enveloped the bed of the watercourse, forming dense deposits at points which created silt plumes which remained in suspension when disturbed underfoot. In areas of reduced siltation, some compacted cobble and gravel was present with silt occupying the interstitial spaces. Microhabitat composition was characterised by a near-continuous, slow-moving pool, which uniformly occupied the channel.

Along the embankment which occupied the right-hand bank was a Scrub (WS1) buffer, which led into an unpaved track characteristic of Spoil and bare ground (ED2). On the left bank, a Treeline (WL2) separated the watercourse from the surrounding agricultural pasture. Riparian and emergent vegetation consisted of willow, beech, nettle, ivy, and great willowherb. Instream, the channel was heavily vegetated, with a vegetation profile consisting of fool's-water-cress , watercress, common duckweed *(Lemna minor)*, ivy-leaved duckweed *(Lemna trisulca)*, and water-crowfoot *(Ranunculus* sp.).

The extensive siltation and uniformly deep and slow-flowing continuous pool provided *Negligible* salmonid and lamprey spawning habitat, as there were no suitable microhabitats of gravel-based riffle. Although some suitable shaded refugia were provided by the extensive vegetation instream, the lack of flow diversity and larger instream substrates determined salmonid nursery and holding habitat to be of *Poor* status at this survey site. Given the extensive silt beds and low velocity, but lack of significant spawning areas within the vicinity, this surveyed location was of *Moderate* potential nursery habitat for lamprey. Given the lack of suitable spawning area within the vicinity, it is unlikely that this habitat is utilised by juvenile lamprey. The lack of coarser substrates left little suitable features for eel, and as such this site was assessed as *Poor* eel habitat.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-15 and Table 4-44. A single brown trout constituted the entirety of fish captured during the electrofishing survey at this location. However, four three-spined sticklebacks *(Gasterosteus aculeatus)* were recorded during the macroinvertebrate kick sample at this survey site.



Plot 4-15 Number of fish per length class at survey site WF 15.

Table 4-44 Electrofishing results at survey site WF 15.

Species	Length (cm)
Brown trout (*Salmo trutta*)	9.3

Kick-sampling was carried out in areas of pool. Site WF 15 was assigned a Q value of **Q3 – Poor**. Group A 'Very Pollution Sensitive' were absent, whereas Group B 'Moderately Pollution Sensitive' taxa, 'Pollution Tolerant' Group C taxa and 'Very Pollution Tolerant' Group D taxa constituted the entirety of the sample. *Gammarus* sp. was the most abundant taxon, constituting ~37% of total abundance. Results of the kick-sample at survey site WF 15 are presented in Table 4-45.

Table 4-45 Results of macroinvertebrate sampling at survey site WF 15.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	Sericostomatidae	3
	Glossosomatidae	5
	Limnephilidae	1
Group C – Pollution Tolerant	*Gammarus* sp.	11
	Chironomidae	4
	Elmidae	1
Group D – Very Pollution Tolerant	*Asellus aquaticus*	2
	Ampullaceana balthica	1
	Glossiphonia complanata	1
Group E – Most Pollution Tolerant	-	-



Plate 4-35. A representative photo of survey site WF 15, facing upstream. Extensive instream vegetation is visible to the right of the image, whereas the high, embanked section of likely historically dredged material is visible to the left.



Plate 4-36. The heavily vegetated downstream extent of survey site WF 15, where watercress, fool's-water-cress and duckweed occupy a significant proportion of the wetted width.

4.1.1.16 Wind Farm Survey Site 16 (WF 16)

Survey site WF 16 was located on the River Brickey, approximately 2.5 km downstream of survey site WF 15 (EPA code: 17B01). Properties of the watercourse at this survey site are provided in Table 4-46. Plate 4-37 shows a representative photograph of the survey site.

Table 4-46 Properties of the watercourse(s) at survey site WF 16.

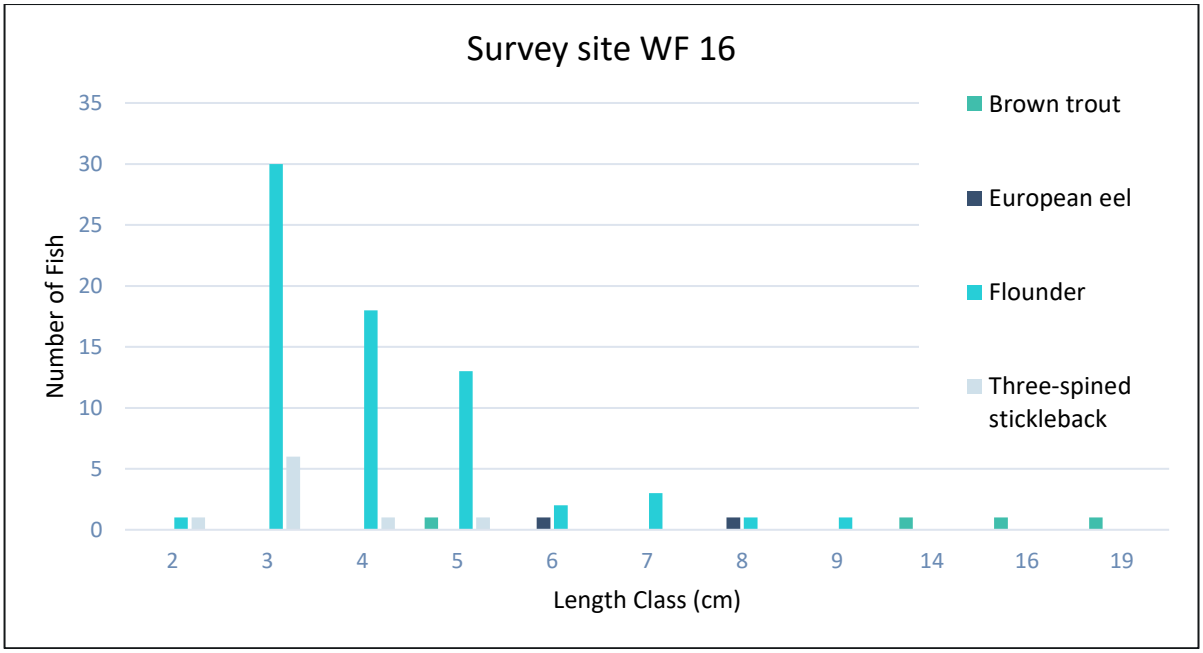
Properties	Record
Average Depth (m)	0.3
Average Bank Width (m)	6.7
Average Wet Width (m)	5
Bank height (m)	LHB 2 RHB 3.2
Flow	Very slow
Colour	None
Clarity	Clear when undisturbed
Dominant Substrates	Cobble (>32–128 mm): 20% Gravel (8–32 mm): 5% Fine gravel (2–8 mm): 5% Silt (<0.25 mm): 70%
Substratum Condition	Heavily silted, underlying cobble loose and unconsolidated

This profile of the visited stretch of Depositing/lowland River (FW2) at survey site was similar to that of WF 15, in that it was historically channelised and straightened into a uniformly deep and slow-flowing watercourse. This section of watercourse was slightly wider (~1 m) and shallower (~0.3 m) on average compared to survey site WF 15, and substrate composition differed slightly, with an increase in cobbles. However, silt still comprised the dominant substrate overlying coarser cobbles. Although depth was reduced overall, there were some depressions of deep (~0.6 m) water which occurred primarily towards the centre of the channel.

Along the embankment which occupied the right-hand bank was a Scrub (WS1) buffer, which led into an unpaved track characteristic of Spoil and bare ground (ED2). Surrounding land use on the right-hand bank consisted of Improved agricultural grassland (GA1). On the left bank, a Treeline (WL2) separated the watercourse from a golf course (Improved amenity grassland GA2). Riparian and emergent vegetation consisted of gorse, bramble, Willow sp., hedge bindweed *(Calystegia sepium)* and hemlock water-dropwort *(Oenanthe crocata)*. Instream, the channel was moderately vegetated, with a vegetation profile consisting of watercress and water crow-foot *(Ranunculus* sp.). Notably, there were extensive growths of filamentous algae enveloping submerged Water crow-foot within the channel.

The Fishery habitat assessment of survey site WF 16 was largely similar to that of survey site WF 15. The extensive siltation and uniformly deep and slow-flowing continuous pool provided *Negligible* salmonid and lamprey spawning habitat, as there were no suitable microhabitats of finer gravels devoid of siltation. The lack of flow diversity and particularly oxygenated riffles determined salmonid nursery habitat to be of *Poor* status at this survey site. Instream, there were some suitable shaded refugia provided by Water-crowfoot, providing localised *Moderate* adult salmonid holding habitat where it occurred. Similarly to site WF 15, this surveyed location was of *Good* potential nursery habitat for lamprey, however given the lack of suitable spawning area within the vicinity it is unlikely that this habitat is utilised by juvenile lamprey. There was a slight increase in the provision of larger cobbles at this location relative to the upstream site of WF 15, which provided some but limited suitable refugia for eel. Therefore, survey site WF 16 was assessed as *Moderate* in terms of eel habitat.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-16 and Table 4-47. An abundance of flounder (69 individuals) as well as brown trout, eel, and three-spined stickleback were captured during the electrofishing survey at this location.



Plot 4-16 Number of fish per length class at survey site WF 16.

Table 4-47 Electrofishing results at survey site WF 16.

Species	Length (cm)
Brown trout (*Salmo trutta*)	19.2
Brown trout (*Salmo trutta*)	5.8
Brown trout (*Salmo trutta*)	16
Brown trout (*Salmo trutta*)	14.5
Flounder *(Platichthys flesus)*	8.7
Flounder *(Platichthys flesus)*	5.7
Flounder *(Platichthys flesus)*	4.1
Flounder *(Platichthys flesus)*	5.6
Flounder *(Platichthys flesus)*	5
Flounder *(Platichthys flesus)*	3.5
Flounder *(Platichthys flesus)*	4.9
Flounder *(Platichthys flesus)*	9
Flounder *(Platichthys flesus)*	5.1
Flounder *(Platichthys flesus)*	4.2
Flounder *(Platichthys flesus)*	6
Flounder *(Platichthys flesus)*	5.5
Flounder *(Platichthys flesus)*	4.6
Flounder *(Platichthys flesus)*	3.8
Flounder *(Platichthys flesus)*	5.5
Flounder *(Platichthys flesus)*	6.5
Flounder *(Platichthys flesus)*	3.6
Flounder *(Platichthys flesus)*	4.7
Flounder *(Platichthys flesus)*	3.4
Flounder *(Platichthys flesus)*	3.9
Flounder *(Platichthys flesus)*	7.1
Flounder *(Platichthys flesus)*	4.6
Flounder *(Platichthys flesus)*	4.5
Flounder *(Platichthys flesus)*	5.6
Flounder *(Platichthys flesus)*	7.5
Flounder *(Platichthys flesus)*	5
Flounder *(Platichthys flesus)*	3.8

Flounder *(Platichthys flesus)*	5.7
Flounder *(Platichthys flesus)*	4
Flounder *(Platichthys flesus)*	5.1
Flounder *(Platichthys flesus)*	3.4
Flounder *(Platichthys flesus)*	4.5
Flounder *(Platichthys flesus)*	7.5
Flounder *(Platichthys flesus)*	3.1
Flounder *(Platichthys flesus)*	5.8
Flounder *(Platichthys flesus)*	4.6
Flounder *(Platichthys flesus)*	3.2
Flounder *(Platichthys flesus)*	3.6
Flounder *(Platichthys flesus)*	4
Flounder *(Platichthys flesus)*	5
Flounder *(Platichthys flesus)*	3.6
Flounder *(Platichthys flesus)*	4
Flounder *(Platichthys flesus)*	3.5
Flounder *(Platichthys flesus)*	2.9
Flounder *(Platichthys flesus)*	3
Flounder *(Platichthys flesus)*	4.2
Flounder *(Platichthys flesus)*	3.3
Flounder *(Platichthys flesus)*	3.3
Flounder *(Platichthys flesus)*	4
Flounder *(Platichthys flesus)*	4.1
Flounder *(Platichthys flesus)*	4.2
Flounder *(Platichthys flesus)*	3.4
Flounder *(Platichthys flesus)*	3.3
Flounder *(Platichthys flesus)*	3.6
Flounder *(Platichthys flesus)*	4.1
Flounder *(Platichthys flesus)*	3.5
Flounder *(Platichthys flesus)*	3.4
Flounder *(Platichthys flesus)*	3.9
Flounder *(Platichthys flesus)*	3.9
Flounder *(Platichthys flesus)*	3.9
Flounder *(Platichthys flesus)*	3.5
Flounder *(Platichthys flesus)*	3.5
Flounder *(Platichthys flesus)*	3.1
Flounder *(Platichthys flesus)*	3.6
Flounder *(Platichthys flesus)*	3.5
Flounder *(Platichthys flesus)*	3.1
Flounder *(Platichthys flesus)*	3.3
Flounder *(Platichthys flesus)*	2.9
Flounder *(Platichthys flesus)*	3.1
Three-spined stickleback *(Gasterosteus aculeatus)*	3
Three-spined stickleback *(Gasterosteus aculeatus)*	5.9
Three-spined stickleback *(Gasterosteus aculeatus)*	4.3
Three-spined stickleback *(Gasterosteus aculeatus)*	3.6
Three-spined stickleback *(Gasterosteus aculeatus)*	2.7
Three-spined stickleback *(Gasterosteus aculeatus)*	3
Three-spined stickleback *(Gasterosteus aculeatus)*	3.5
Three-spined stickleback *(Gasterosteus aculeatus)*	3.5
Three-spined stickleback *(Gasterosteus aculeatus)*	3
European eel *(Anguilla anguilla)*	8
European eel *(Anguilla anguilla)*	6.5

Kick-sampling was carried out in areas of pool. Site WF 16 was assigned a Q value of **Q3 – Poor**. Macroinvertebrate diversity was noted to be moderate, with 10 separate taxa identified. Group A 'Very Pollution Sensitive' taxa were absent from the sample, whereas Group B 'Moderately Pollution Sensitive' taxa represented the dominant grouping (~73%), of which the cased caddis Glossosomatidae was the most abundant. A variety of Group C 'Pollution Tolerant' and Group D 'Very Pollution Tolerant' taxa were also present within the sample. Results of the macroinvertebrate survey at this location are presented in Table 4-48.

Table 4-48 Results of macroinvertebrate sampling at survey site WF 16.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	Sericostomatidae	6
	Glossosomatidae	37
	Limnephilidae	5
Group C – Pollution Tolerant	*Gammarus* sp.	4
	Hydrachnidia	4
	Elmidae	1
	Potamopygrus antipodarum	1
Group D – Very Pollution Tolerant	*Aselus aquaticus*	3
	Ampullaceana balthica	2
	Glossiphonia complanata	2
Group E – Most Pollution Tolerant	-	-



Plate 4-37. A representative photo of survey site WF 16, facing downstream.

4.1.1.17 Wind Farm Survey Site 17 (WF 17)

Survey site WF 17 was located on the Two-mile Bridge watercourse within the Colligan-Mahon subcatchment, situated approximately 0.48 km upstream of where the Two-mile Bridge converges with the mainstem of the River Brickey (EPA code: 17T04). Properties of the watercourse at this survey site are provided in Table 4-49. Plate 4-38 and Plate 4-39 show representative photographs of the survey site.

Table 4-49 Properties of the watercourse at survey site WF 17.

Properties	Record
Average Depth (m)	0.05–0.1
Average Bank Width (m)	1.2
Average Wet Width (m)	1
Bank height (m)	LHB 1–3 RHB 3
Flow	Moderate-Fast
Colour	None
Clarity	Clear when undisturbed
Dominant Substrates	Bedrock: 50% Boulder: 10% Cobble (>32–128 mm): 25% Gravel (8–32 mm): 5% Silt (<0.25 mm): 10%
Substratum Condition	Highly compacted, silt plumes when disturbed

This visited stretch of Eroding/upland River (FW1) consisted of a narrow and shallow watercourse occurring over moderate-gradient bedrock planes, which were covered in a thin layer of finer cobbles and gravels at points. Larger instream boulders occurred sporadically throughout the channel, whereas some siltation was evident coating the shallow pools that interspersed the riffle-dominant microhabitat compositions. The water was clear and lacked colour when undisturbed, however silt plumes readily arose and remained in suspension when the silt deposits were trod underfoot. The visited section was framed at its lower extent by a stone road bridge, under which the watercourse was culverted through a narrow and shallow arch (Plate 4-40). Immediately upstream of this bridge, the channel was heavily encroached by bramble which grew from the left-hand bank, obscuring the watercourse for approximately 10 m channel length. Upstream of this bramble, the watercourse was largely unrestricted, however was shaded significantly from the canopy of trees which were situated within the small valley in which the stream traversed. Within the upper visited extent, the watercourse flowed adjacent to the steep and high earthen right-hand bank, of which bedrock planes were occasionally visible.

The watercourse was surrounded by a mosaic of Scrub (WS1) and Mixed broadleaved woodland (WD1). The riparian vegetation profile consisted of hawthorn, blackthorn, sycamore, holly *(Ilex aquifolium)*, Cypress *(Cupressus* sp.*)*, hart's-tongue fern, bracken fern, ivy, nettle and herb-robert. Outside of the small valley which bordered the stream on either side, the surrounding land use consisted of private dwellings (classed as Buildings and artificial Surfaces (BL3)).

This narrow, bedrock and cobble-dominant section of the Two-mile Bridge watercourse had very limited occurrences of suitable beds of finer gravels to support salmonid and lamprey spawning, and as such was assessed as *Poor* in both regards. The occurrence of some cobble and boulder and the moderate gradient riffle-dominant microhabitat regime was of a suitable composition to support some but limited potential densities of juvenile salmonids, and as such this surveyed stretch was assessed as *Moderate* in terms of salmonid nursery habitat suitability. Although there were some deposits of finer silts, they were of limited depth and usually present coating larger substrate types. As such, this survey site provided was assessed as *Poor* in terms of lamprey nursery habitat. The shallow (~0.05 – 0.1 m) depth of the channel left little suitable area for adult salmonids, being of *Negligible–Poor* salmonid holding suitability. The limited cobble and boulder present provided some but limited suitable refugia for smaller eel throughout the surveyed stretch, being *Moderate* overall in terms of eel suitability.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-17 and Table 4-50. Two eels constituted the entirety of the capture. One salmonid, likely a trout, was missed (seen but not captured) during the survey.



Plot 4-17 Number of fish per length class at survey site WF 17.

Table 4-50 Electrofishing results at survey site WF 17.

Species	Length (cm)
European eel *(Anguilla anguilla)*	6
European eel *(Anguilla anguilla)*	8

Kick-sampling was carried out in areas of riffle and pool. Macroinvertebrate abundance and richness was noted to be low, with nine individuals spanning four taxonomic groups observed. Site WF 17 was assigned a Q value of **Q3 – Poor**. Group A 'Very Pollution Sensitive' and Group B 'Moderately Pollution Sensitive' taxa were absent, whereas Group C 'Pollution Tolerant' taxa represented the entirety of the sample. Results of the kick-sample at survey site WF 17 are presented in Table 4-51.

Table 4-51 Results of macroinvertebrate sampling at survey site WF 17.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Ancylus fluviatilis*	1
	Chironomidae	4
	Baetis rhodani /atlanticus	1
	Simuliidae	3
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-38. The downstream extent of survey site WF 17, facing upstream.



Plate 4-39. The upstream extent of survey site WF 17, facing downstream.



Plate 4-40. The Two Mile Bridge watercourse traversing through a small arched culvert at the lower extent of survey site WF 17.

4.1.1.18 Wind Farm Survey Site 18 (WF 18)

Survey site WF 18 was located on the Brickey watercourse within the Colligan-Mahon subcatchment, in the immediate vicinity of the confluence between the Two-mile Bridge and the River Brickey (EPA code:17B01). Properties of the watercourse at this survey site are provided in Table 4-52. Plate 4-41 and Plate 4-42 show representative photographs of the survey site.

Due to prohibitive depths (in excess of 1.2 m) and a further layer of soft, unconsolidated fine channel bed substrates, the watercourse at survey site at WF 18 could not be electrofished or kick sampled.

Table 4-52. Properties of the watercourse at survey site WF 18.

Properties	Record			
Average Depth (m)	1.2			
Average Bank Width (m)	4.5			
Average Wet Width (m)	4.0			
Bank height (m)	LHB	1.4–3.5	RHB	1.0–3.5
Flow	Slow			
Colour	Slightly white			
Clarity	Slightly turbid (cloudy white)			
Dominant Substrates	Boulder (>128 mm): 10% Cobble (>32–128 mm): 5% Gravel (8–32 mm): 5% Fine gravel (2–8 mm):10% Sand (0.25–2 mm): 35% Silt (<0.25 mm): 35%			
Substratum Condition	Loose silt and sand substrates			

Channel substrate consisted primarily of loose, fine substrates with visible levels of turbidity (cloudy, milky hue) even when undisturbed. Fly tipping was abundant through the watercourse in the vicinity of survey site WF 18. Flow patterns throughout deep pool and glide were predominantly slow and at times imperceptible. The watercourse exhibited evidence of historic channelisation, with a straight channel profile and high, steep sided embankments, particularly at the downstream survey extent. In the vicinity of a single span stone arched bridge, bank heights at the immediate bank line ranged from 1.0–1.4 m high, within a wider U-shaped ravine which reached heights of up to 3.5 m. Earthen banks faces were bare and/or resectioned along sections of the survey stretch

The channel was intermittently shaded in the immediate upstream and downstream vicinity of the bridge, with Treelines (WL2) of ash (with ash dieback), alder and willow *(Salix spp.),* with occasional overhanging tree limbs and bows and areas of woody debris accumulation. Contrastingly, the channel was largely unshaded at the downstream survey extent, with only a narrow riparian buffer between surrounding Improved agricultural grassland (GA1) along the left-hand bank. Habitats extending from the right-hand bank consisted of road classed as Buildings and artificial surfaces (BL3) and almost continuous Scrub (WS1) consisting of bramble and hedge bindweed along the steep embankments.

Marginal vegetation was dense but uniform, consisting of reed canary grass, nettle, ivy and willowherb *(Epilobium sp.)* on the bank tops, with occasional emergent fool's-water-cress and submerged occasional patches of water starwort *(Callitriche sp.).* Instream macrophytes were largely absent through the centre of the channel. White, silt-like residue was present on marginal and emergent vegetation at the high-water line.

The absence of any continuous areas of clean, mobile gravels saw an absence of any significant suitable spawning habitat for salmonid or lamprey species. With the exception of occasional boulders, fly tipping or occasional marginal macrophytes, instream refuge required for juvenile salmonid fish was assessed as *poor*, particularly in areas of unshaded channel at the downstream survey extent. Despite the presence of fine sediment channel substrate, silt beds were littered with fly tipping and detritus, with likely anoxic conditions throughout this highly modified stretch of watercourse providing poor lamprey ammocoete nursery habitat. Sufficient depth for adult salmonids was present along the survey stretch. However, lack of instream refuge (with the exception of limited areas of woody debris coverage and isolated boulders), slow-imperceptible flow patterns and overall modification of the watercourse limited optimal salmonid holding habitat to *Poor–Moderate*. European eel habitat through this deeper water was assessed as *Poor–Moderate* .



Plate 4-41. A representative photo of the downstream view of survey site WF 18.



Plate 4-42. A representative photo of the upstream view of survey site WF 18.

4.1.1.19 Wind Farm Survey Site 19 (WF 19)

Survey site WF 19 was located on the short coastal Boherard 17 watercourse, which flowed into the Brickey approximately 0.37 km downstream from the survey site (EPA code:17B62). Properties of the watercourse at this survey site are provided in Table 4-53. Plate 4-43 and Plate 4-44 show representative photographs of the survey site.

Table 4-53 Properties of the watercourse at survey site WF 19.

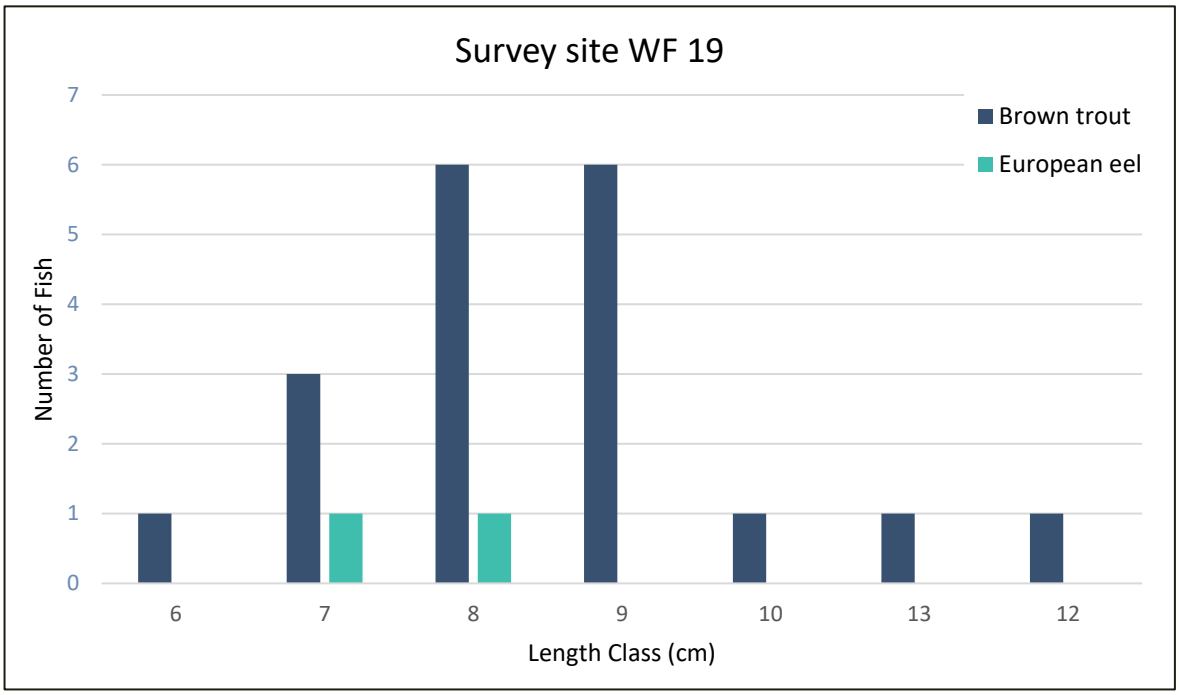
Properties	Record
Average Depth (m)	0.15
Average Bank Width (m)	1.7
Average Wet Width (m)	1
Bank height (m)	LHB 2 RHB 1.4
Flow	Moderate-Fast
Colour	None
Clarity	Clear
Dominant Substrates	Boulder (>128 mm): 10% Cobble (>32–128 mm): 70% Gravel (8–32 mm): 15% Fine gravel (2–8 mm): 5%
Substratum Condition	Semi-compacted at lower extent, compacted cobbles at upper extent

This surveyed stretch of Eroding/upland River (FW1) consisted of a narrow channel with a moderate gradient. The lowermost extent of the surveyed stretch was characterised by a densely overgrown channel, with encroaching bank scrub and abundant instream growth of watercress and fool's-watercress. Microhabitat composition here consisted largely of riffles and highly vegetated, slow-moving pools, which transitioned to a riffle-step formation upstream. At this upper survey extent, encroaching bank vegetation and instream macrophytes were reduced. Substrate composition throughout the surveyed area consisted largely of cobbles with some interstitial gravels, ranging in in condition from semi-compacted to compacted. Channel depth was typically shallow (~ 0.15 m) but some vegetated pools at the lower extent were slightly deeper (~0.2 m).

Riparian habitat at the downstream extent consisted of a Scrub (WS1) buffer on the right-hand bank, with habitat extending from the left-hand bank more characteristic of Wet grassland (GS4). The riparian and marginal vegetation profile consisted of gorse, willow, bramble, hoary willowherb and knapweed.

Some deposits of finer sediments within the interstitial spaces in between semi-compacted larger cobbles were of *Poor–Moderate* suitability in terms of salmonid spawning habitat, with the dominance of coarser substrates being of *Poor* suitability for lamprey spawning. The abundance of cobbles, particularly at the upper extent where they occurred in riffle-step formations provided *Good* salmonid nursery habitat, whereas the limitation of finer sediments and the compacted nature of substrate determined this surveyed stretch to be of *Negligible* suitability for lamprey nursery habitat. Compaction similarly limited suitability for eel within this stretch of the Boherard 17 watercourse, determining it to be of *Poor–Moderate* status. The short, coastal nature of this watercourse was laterally constricted and depth-limited throughout this visited stretch, thus being of *Poor* suitability in terms of holding habitat provision for adult salmonids.

Results of the 5-minute semi-quantitative electrofishing survey conducted at this site (using methodologies described in Section 2.3) are presented in Plot 4-18 and Table 4-54. 21 brown trout and two eels were captured during the electrofishing survey at this location.



Plot 4-18 Number of fish per length class at survey site WF 19.

Table 4-54. Electrofishing results at survey site WF 19.

Species	Length (cm)
European eel *(Anguilla anguilla)*	7
European eel *(Anguilla anguilla)*	8
Brown trout *(Salmo trutta)*	7.5
Brown trout *(Salmo trutta)*	8.6
Brown trout *(Salmo trutta)*	9.7
Brown trout *(Salmo trutta)*	13.9
Brown trout *(Salmo trutta)*	8.6
Brown trout *(Salmo trutta)*	9
Brown trout *(Salmo trutta)*	12.5
Brown trout *(Salmo trutta)*	10.1
Brown trout *(Salmo trutta)*	9.3
Brown trout *(Salmo trutta)*	7.6
Brown trout *(Salmo trutta)*	6.5
Brown trout *(Salmo trutta)*	8.3
Brown trout *(Salmo trutta)*	8.1
Brown trout *(Salmo trutta)*	9
Brown trout *(Salmo trutta)*	8.3
Brown trout *(Salmo trutta)*	7.9
Brown trout *(Salmo trutta)*	9.2
Brown trout *(Salmo trutta)*	9.1
Brown trout *(Salmo trutta)*	8.3
Brown trout *(Salmo trutta)*	10.2
Brown trout *(Salmo trutta)*	8.4

Kick-sampling was carried out in areas of riffle. Site WF 19 was assigned a Q value of **Q3-4 – Moderate**. There was one single Group A 'Very Pollution Sensitive' taxon identified, while Group B 'Moderately Pollution Sensitive' taxa constituted a third (~33%) of the total abundance. Group C 'Pollution Tolerant' taxa represented the dominant macroinvertebrate constituent, representing ~64% of total abundance, of which Chironomidae were the most numerous (10 individuals). Results of the kick-sample at survey site WF 19 are presented in Table 4-55.

Table 4-55. Results of macroinvertebrate sampling at survey site WF 19.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecydonurus* sp.	1
Group B – Moderately Pollution Sensitive	Glossosomatidae	6
	Sericostomatidae	4
	Leuctra sp.	4
Group C – Pollution Tolerant	*Baetis rhodani /atlanticus*	2
	Chironomidae	10
	Gammarus sp.	6
	Simuliidae	1
	Tipulidae	2
	Elmidae	3
	Hydropsyche sp.	1
	Dicranota sp.	1
	Philopotamus sp.	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-43. The upstream extent of survey site WF 19, facing upstream. A dense, bramble-dominant scrub can be seen to the left of the image, whereas to the right a cattle track separates the watercourse from the surrounding agricultural pasture.



Plate 4-44. The downstream extent of survey site WF 19, facing downstream. An abundance of instream watercress can be seen growing throughout the wetted channel.

4.1.2 Proposed Wind Farm watercourse crossing locations within the Site

Eight Proposed Wind Farm watercourse crossing locations within the Site were surveyed to establish the aquatic baseline of these crossing points. Surveys included fisheries and river habitat assessment, otter survey and Q-value sampling.

4.1.2.1 Crossing 1 (IC 1)

Proposed Wind Farm watercourse crossing location 1 was located south of the Proposed Turbine 3 (T3) location. Properties of the watercourse at this survey site are provided in Table 4-56.

Table 4-56. Properties of the watercourse at survey site IC 1.

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	0.5			
Wet Width (m)	0.5			
Flow	Imperceptible upstream of existing road, moderate downstream of road			
Colour	Highly orange-brown			
Clarity	Clear when undisturbed downstream of the road			
Bank height (m)	LHB	0.5 upstream of the road crossing, 1.5 downstream of the road crossing	RHB	0.5 upstream of the road crossing, 1.5 downstream of the road crossing
Dominant Substrates	Boulder (>128 mm): 35% Cobble (>32–128 mm): 50% Gravel (8–32 mm): 5% Fine gravel (2–8 mm):5% Silt (<0.25 mm): 5%			
Substratum Condition	Compacted			

The watercourse in the immediate vicinity of the proposed Wind Farm crossing location represented a stretch of highly modified watercourse with almost imperceptible flow and pooling water. Water colouration at the existing road crossing was highly orange-brown in colour and the watercourse was heavily vegetated instream with ground flora from the surrounding Conifer plantation (WD4) (Plate 4-45). Natural stoned-based substrates were largely absent from the upstream survey extent. Bankside vegetation both upstream and downstream of the existing road included bramble, soft rush, gorse, ling heather, hard fern, purple moor-grass *(Molinia caerulea)* and *Sphagnum spp.* moss.

Downstream of the existing road crossing, the watercourse represented a more naturalised stretch narrow Eroding/Upland River (FW1). Flow patterns represented more naturalised stretches of riffle over a slight gradient, with repeating sequences of boulder step-pool features, with heavily compacted channel substrate, dominated by immobile cobbles, throughout the survey stretch. All channel substrate was also covered with an overlying layer of filamentous green algae (FGA). Channel depth was largely very shallow (approx. 0.05 m) across riffle, with limited areas of slightly deeper pool amongst boulder outcrops (approx. 0.2 m) (Plate 4-46).

Overall, potential fisheries habitat was limited by the historically modified nature of the watercourse upstream of the existing road crossing, and by the laterally confined channel morphology and encroaching nature of surrounding conifer plantation habitat downstream of the road crossing. The absence of any continuous, clean, mobile gravel beds saw a lack of significant suitable spawning habitat for salmonid or lamprey species. Salmonid nursery habitat was assessed overall as *Poor* given the limited instream refugia. Areas of riffle habitat were oftentimes very shallow and exposed, with the exception of areas of deeper, more sheltered pool features along the gradient downstream of the bridge

and overhanging bank vegetation which provided some sheltered nursery habitat along sections of undercut bank. Holding habitat for both adult salmonid fish and European eel was also assessed overall as *Poor* given the lack of any continuous, suitably deep water. Suitable habitat for lamprey ammocoetes in the way of fine sediment beds was absent.

Table 4-57. Results of macroinvertebrate sampling at survey site IC 1.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	Nemouridae	2
Group B – Moderately Pollution Sensitive	Limnephilidae	2
Group C – Pollution Tolerant	Chironomidae	3
	Dysticidae (larvae)	2
	Gyrinidae	5
Group D – Very Pollution Tolerant	–	–
Group E – Most Pollution Tolerant	–	–

Kick-sampling was carried out in areas of riffle where present. Site IC 1 was assigned a Q value of **Q3–4 – Moderate**, on the basis that a single taxon from 'Very Pollution Sensitive' Group A and a single taxon from 'Moderately Pollution Sensitive' Group B were represented by "few" numbers relative to the sample. 'Pollution Tolerant' Group C taxa represented ~57% of the sample. Group D 'Very' and 'Most Pollution Tolerant' taxa were absent from the sample. Species diversity and abundance were poor at this location. Results of the kick-sample at survey site IC 1 are presented in Table 4-57.



Plate 4-45. A representative picture of the upstream survey extent at Proposed Wind Farm crossing location 1.



Plate 4-46. A representative picture of the downstream survey extent at survey site IC 1.

4.1.2.2 Crossing 2 (IC 2)

Proposed Wind Farm watercourse crossing location 2 was located north of the proposed T12 location along an existing forestry track amid Conifer Plantation (WD4). Properties of the watercourse at this survey site are provided in Table 4-58.

Table 4-58. Properties of the watercourse at survey site IC 2.

Properties	Record			
Average Depth (m)	0.05–0.15			
Average Bank Width (m)	0.4			
Average Wet Width (m)	0.4–1.0			
Flow	Moderate			
Colour	No distinct colouration			
Clarity	Clear when undisturbed			
Bank height (m)	LHB	0.5–2.0	RHB	0.5–2.0
Dominant Substrates	Boulder (>128 mm): 15% Cobble (>32–128 mm): 15% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):40% Silt (<0.25 mm): 15%			
Substratum Condition	Loose			

The watercourse at survey site IC 2 represented a narrow, laterally confined Eroding/Upland River (FW1) which was culverted below an existing forestry road access track. The watercourse was culverted via a single pipe raised approx. 0.4 m from the channel bed. In the vicinity of the pipe culvert, the riverbanks and bed were slightly scoured, and the channel width measured approx. 1.0 m at the widest point. The channel profile narrowed to approx. 0.4 m for much of the upstream and downstream survey stretch, with the watercourse shaded and at points encroached by bankside willow trees *(Salix sp.)*. In particular, the stretch of watercourse upstream of the forestry track was tunnelled along much of its length.

Channel substrate consisted primarily of fine, loose gravels, with coarser boulders and cobbles strewn occasionally throughout. A higher concentration of boulder and cobbles were present in the immediate downstream vicinity of the culvert. Flow patterns consisted primarily of repeating sequences of shallow riffle and short stretches of glide, with an area of shallow pool downstream of the pipe culvert (measuring approx. 0.15 m at the deepest point at the time of survey). Water was clear when undisturbed, with an overlying layer of siltation in the vicinity of the scour pool downstream of the forestry track crossing.

Earthen banks ranged from 2.0 m high in the vicinity of the road crossing to approx. 0.5 m along much of the remaining survey stretch. Banks were undercut at several points, with bare exposed earth on the bank faces. Bank face vegetation included *Pellia sp.* liverworts, while bank side vegetation included gorse, marsh thistle, hard fern, bramble, wild angelica, ivy and creeping buttercup, with a buffer of encroaching willow treeline between the watercourse and surrounding sitka spruce Conifer plantation (WD4).

Despite the presence of areas of loose gravels and fine gravels in the downstream vicinity of the forestry access track, salmonid and lamprey spawning habitat were assessed overall as *Poor* given the overlying silt in areas of more mobile gravels, the laterally confined, encroached channel profile and the presence of a barrier to fish migration in the form of a pipe culvert. Salmonid nursery habitat was assessed overall as *Poor–Moderate* , with limited areas of refuge in the way of undercut banks and sheltered areas of riffle in the more laterally confined sections of channel. Salmonid holding habitat and adult European eel was largely absent due to a lack of suitable water depth, with the exception of slightly deeper water in the immediate downstream vicinity of the culvert. Fine sediment beds in the way of silt and sand were absent from the survey stretch upstream and downstream of the area of scour, with some fine sediment accumulations within the scour pool providing *Poor* lamprey ammocoete habitat. Overall, fisheries habitat was limited by the impacts of channel modification in the form of culverting and surrounding forestry pressures.

Table 4-59. Results of macroinvertebrate sampling at survey site IC 2.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	–	–
Group B – Moderately Pollution Sensitive	–	–
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	7
	Dicranota sp.	1
	Gammarus sp.	6
	Hydropsyche sp.	1
	Lumbriculidae	1
	Philopotamidae	2
	Polycentropodidae	2
Group D – Very Pollution Tolerant	Naididae	2
Group E – Most Pollution Tolerant	–	–

Kick-sampling was carried out in areas of riffle where present. Site IC 2 was assigned a Q value of **Q3 – Poor**, on the basis that 'Very Pollution Sensitive' and 'Moderately Pollution Sensitive' Group A and B

taxa were absent from the sample. The sample comprised seven 'Pollution Tolerant' Group C taxa and one 'Very Pollution Tolerant' Group D taxon *(Naididae)*. Results of the kick-sample at survey site IC 2 are presented in Table 4-59.



Plate 4-47. A representative photo of survey site IC 2 in the immediate downstream vicinity of the raised pipe culvert.

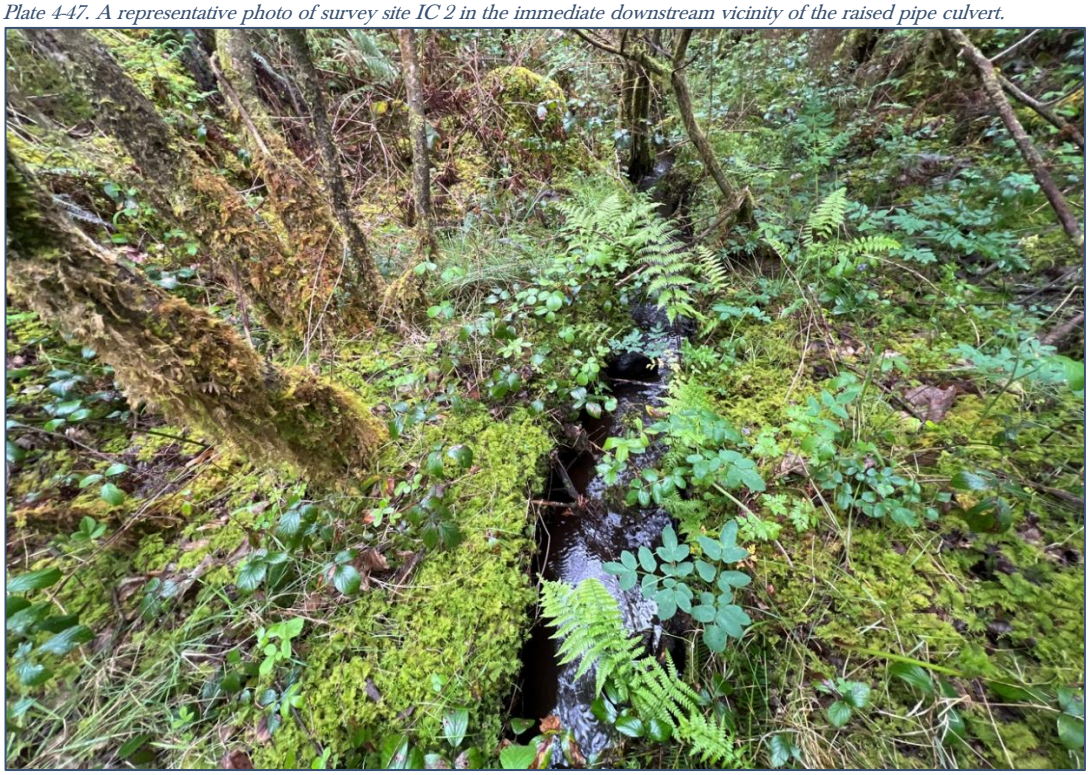


Plate 4-48. A representative photo of the narrow, laterally confined and encroached stretch of watercourse further downstream of the existing forestry access track at survey site IC 2.

4.1.2.3 Crossing 3 (IC 3)

Proposed Wind Farm watercourse crossing location 3 was located at the southwest base of the hardstand of T12. Properties of the watercourse at this survey site are provided in Table 4-60.

Table 4-60. Properties of the watercourse at survey site IC 3.

Properties	Record			
Average Depth (m)	0.1–0.5			
Average Bank Width (m)	0.5			
Average Wet Width (m)	0.5			
Flow	Moderate			
Colour	Slightly brown			
Clarity	Clear when undisturbed			
Bank height (m)	LHB	2.0–2.5	RHB	1.5–2.0
Dominant Substrates	Cobble (>32–128 mm): 70% Gravel (8–32 mm): 10% Fine gravel (2–8 mm):10% Silt (<0.25 mm): 10%			
Substratum Condition	Compacted			

The watercourse at survey site IC 3 represented a narrow, modified stretch of historically Eroding/Upland River (FW1) which was laterally confined within steep, V-shaped banks. The banks featured a minimal riparian buffer, consisting primarily of gorse, hawthorn and eared willow *(Salix aurita)* between the watercourse and surrounding Improved agricultural grassland (GA1) used for pasture. Other bankside vegetation consisted of abundant wild angelica, soft rush, bramble, lesser celandine *(Ficaria verna)*, creeping buttercup, meadow buttercup, sweet vernal grass, hogweed, early dog violet *(Viola reichenbachiana)*, perennial rye grass *(Lolium perenne),* great willowherb, common daisy *(Bellis perennis)*, mouse-eared chickweed*(Cerastium fontanum)* and clover *(Trifolium sp.).*

An existing internal field track passed over the channel, with the watercourse culverted below the track via two pipes. Flow patterns predominantly consisted of shallow riffle, with the exception of an area of deeper pool (approx. 0.5 m deep) directly downstream of the raised pipe culvert. Water was slightly brown in colour and clear when undisturbed. However, overlying siltation was evident when disturbed underfoot. Channel substrate consisted primarily of compacted cobbles with interstitial gravels and fine gravels and overlying siltation throughout.

Fisheries habitat was limited to overall *Poor* salmonid nursery, provided amongst areas of shallow riffle adjacent to encroaching bankside vegetation. The watercourse at survey site IC 3 provided no sufficient depth for salmonid holding or adult European eel habitat, as well as no significant suitable salmonid or lamprey spawning habitat in the way of clean, loose gravel beds. The dominance of compacted cobbles with only a superficial layer of overlying siltation similarly limited the availability of suitable lamprey ammocoete habitat, with no fine sediment beds suitable for juvenile burrowing lamprey. Areas of more sheltered riffle and the isolated area of deeper water downstream of the pipe culvert provided some localised *Poor* juvenile eel habitat, if accessible throughout downstream culverts along the course of the watercourse.



Plate 4-49. A representative photo of the upstream survey extent of the watercourse at survey site IC 3.



Plate 4-50. A representative photo of the 2-pipe culvert present at survey site IC 3.



Plate 4-51. A representative photo of the downstream survey extent at IC 3.

Table 4-61. Results of macroinvertebrate sampling at survey site IC 3.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Rhithrogena sp.*	4
Group B – Moderately Pollution Sensitive	Limnephilidae	7
	Sericostomatidae	5
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	50
	Chironomidae	13
	Dicranota sp.	3
	Elmidae	3
	Gammarus sp.	20
	Hydropsyche sp.	6
	Philopotamidae	1
	Polycentropodidae	6
	Serratella ignita	8
	Turbellaria	1
Group D – Very Pollution Tolerant	Naididae	1
Group E – Most Pollution Tolerant	–	–

Kick-sampling was carried out in areas of riffle where present. Site IC 3 was assigned a Q value of **Q3–4 – Moderate**, on the basis that a single taxon from 'Very Pollution Sensitive' Group A and two taxa from 'Moderately Pollution Sensitive' Group B were represented by "few" numbers relative to the sample. 'Pollution Tolerant' Group C taxa represented ~87% of the sample. 'Very Pollution Tolerant' Group D was represented by a single taxon, while 'Most Pollution Tolerant' Group E taxa were absent from the sample. Results of the kick-sample at survey site IC 3 are presented in Table 4-61.

4.1.2.4 Crossing 4 (IC 4)

Proposed Wind Farm watercourse crossing location 4 was located at the north of T11. Properties of the watercourse at this survey site are provided in Table 4-62.

Table 4-62. Properties of the watercourse at survey site IC 4.

Properties	Record			
Average Depth (m)	0.1–0.3			
Average Bank Width (m)	0.5			
Average Wet Width (m)	0.5			
Flow	Moderate			
Colour	No distinct colouration			
Clarity	Clear when undisturbed			
Bank height (m)	LHB	0.5–0.75	RHB	3.0
Dominant Substrates	Boulder (>128 mm): 15% Cobble (>32–128 mm): 60% Gravel (8–32 mm): 10% Fine gravel (2–8 mm):10% Silt (<0.25 mm): 5%			
Substratum Condition	Semi-compacted			

The watercourse at survey site IC 4 represented an Eroding/Upland River (FW1) with an overall naturally meandering channel profile. The watercourse was subject to an existing culvert under a forestry access track in the form of two pipes raised from the channel bed (Plate 4-52), with an associated area of scour pool directly downstream of the culvert. Channel depth throughout the scour pool was approx. 0.3 m, with shallower sequences of repeating riffle and glide along much of the survey stretch downstream of the culvert.

Channel substrate along the survey stretch consisted of gravels and fine gravels throughout the scour pool, grading into semi-compacted cobble-dominant substrate, with opposite marginal features of cobble banks and bank undercuts along alternating convex and concave meanders. Siltation was largely absent from the more naturalised stretches of channel, while overlying silt was evident over gravels in areas of scour downstream of the culvert.

The channel was well shaded and at times encroached at the most downstream survey extent with overhanging willow trees and gorse. Other bankside vegetation included overhanging bramble, gorse and bracken, occasional hard fern, wild angelica, great willowherb, common vetch *(Vicia sativa)*, cocks foot *(Dactylis glomerata),* silverweed *(Potentilla anserina)*, meadowsweet and horsetail *(Equisetum sp.)*. Bryophytes included marginal growths of *Kindbergia praelonga.*

The scour pool downstream of the culvert provided an isolated area of localised *Moderate* salmonid holding habitat throughout an otherwise shallow watercourse. However, repeating sequences of riffle with high substrate diversity and associated flow pattern variability provided salmonid nursery habitat assessed as *Good* and localised *Moderate–Good* juvenile European eel habitat. Spawning for both lamprey and salmonid species was assessed as *Poor* due to the overall compacted nature of cobble-dominant channel substrate, with only an overlying superficial layer of suitably sized gravels. Fine sediment beds in the vicinity of the scour pool provided some limited lamprey ammocoete habitat. However overall lamprey nursery habitat was assessed as *Poor* as a result of the repeating step formations along a slight gradient, which may impeded lamprey access to otherwise isolated fine sediment beds.



Plate 4-52. A representative photo of the double pipe culvert present at survey site IC 4.



Plate 4-53. A representative photo of survey site IC 4.

Table 4-63. Results of macroinvertebrate sampling at survey site IC 4.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	Early instar Plecoptera	2
Group B – Moderately Pollution Sensitive	Glossosomatidae	2
Group C – Pollution Tolerant	*Gammarus sp*	6
	Hydrachnidia	2
Group D – Very Pollution Tolerant	–	–
Group E – Most Pollution Tolerant	–	–

Kick-sampling was carried out in areas of riffle. Site IC 4 was assigned a Q value of **Q3–4 – Moderate**, on the basis that a single taxon from 'Very Pollution Sensitive' Group A and 'Moderately Pollution Sensitive' Group B were represented in small numbers relative to the sample. Although 'Pollution Tolerant' Group C taxa represented ~67% of the sample, diversity and abundance were overall both low. 'Very Pollution Tolerant' Group D and 'Most Pollution Tolerant' Group E taxa were absent from the sample. Species diversity and abundance were poor at this location. Results of the kick-sample at survey site IC 4 are presented in Table 4-63.

4.1.2.5 Crossing 5 (IC 5)

Proposed Wind Farm watercourse crossing location 5 was located along a section of new proposed road southeast of T9. Properties of the watercourse at this survey site are provided in Table 4-64.

Table 4-64. Properties of the watercourse at survey site IC 5.

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	1–2			
Average Wet Width (m)	1.5			
Flow	Fast			
Colour	No distinct colouration			
Clarity	Very clear			
Bank height (m)	LHB	1.5	RHB	0.7
Dominant Substrates	Boulder (>128 mm): 20% Cobble (>32–128 mm): 50% Gravel (8–32 mm): 10% Fine gravel (2–8 mm):10% Silt (<0.25 mm): 10%			
Substratum Condition	Semi- compacted			

The watercourse at survey site IC 5 represented a naturalised stretch of Eroding/Upland River (FW1). Flow patterns consisted of repeating sequences of moderate velocity glide and fast flowing, shallow, cobble-dominant riffle with occasional boulder strewn throughout. While fine sediment beds were present marginally and interstitial gravels were present between cobbles, channel substrate was dominated by coarser substrate types.

The channel was well shaded with a treeline of ash, hawthorn and willow along the left-hand bank. Other vegetation included dense marginal and emergent stands of hemlock water-dropwort, as well as bankside gorse, bramble, nettle, hogweed, bracken, soft rush, brittle bladder-fern *(Cystopteris fragilis),* herb-robert, wild angelica, creeping buttercup, meadow buttercup, cocks' foot, creeping thistle and cleavers. *Chiloscyphus polyanthos* was present on substrates throughout the watercourse.

The watercourse at survey site IC 5 provided salmonid nursery habitat assessed as *Locally Good* as a result of the high instream habitat complexity. Channel substrate variability was high, providing associated flow pattern variability across repeating sequences of riffle and glide. Areas of undercut

bank, overhanging vegetation and areas of woody debris accumulation provided marginal complexity and shelter which also provided suitable habitat for European eel, also assessed as *Locally Good*. Although some marginal fine sediments provided *Localised Moderate* habitat for lamprey ammocoetes, these areas of suitable juvenile lamprey nursery were isolated amongst areas of otherwise coarse, compacted substrates. Spawning habitat for lamprey and salmonid species was assessed as *Poor* given the dominance of coarse, immobile substrates.

Table 4-65. Results of macroinvertebrate sampling at survey site IC 5.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Siphonoperla torrentium*	3
	Rhithrogena sp.	3
Group B – Moderately Pollution Sensitive	Glossosomatidae	7
	Sericostomatidae	2
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	*6*
	Chironomidae	*6*
	Dicranota sp.	*5*
	Elmidae (larvae and adult)	*6*
	Philopotamidae	*1*
	Serratella ignita	*3*
	Turbellaria	*1*
Group D – Very Pollution Tolerant	Naididae	7
Group E – Most Pollution Tolerant	–	–

Kick-sampling was carried out in areas of riffle. Site IC 5 was assigned a Q value of **Q3–4 – Moderate**, on the basis that at least one taxon from 'Very Pollution Sensitive' Group A was present in fair numbers, 'Pollution Tolerant' Group C taxa represented 70% of the sample, while 'Very Pollution Tolerant' Group D was represented by a single taxon in common numbers relative to the sample. 'Most Pollution Tolerant' Group E taxa were absent from the sample. Results of the kick-sample at survey site IC 5 are presented in Table 4-65.



Plate 4-54. A representative photo of the upstream extent of survey site IC 5.



Plate 4-55. A representative photo of the downstream extent of survey site IC 5.

4.1.2.6 Crossing 6 (IC 6)

Proposed Wind Farm watercourse crossing location 6 was located along a section of existing road southeast of T9. Properties of the watercourse at this survey site are provided in Table 4-66.

Table 4-66. Properties of the watercourse at survey site IC 6.

Properties	Record			
Average Depth (m)	0.1–0.3			
Average Bank Width (m)	1.5			
Average Wet Width (m)	1–1.5			
Flow	Fast			
Colour	No distinct colouration			
Clarity	Very clear			
Bank height (m)	LHB	1–1.5	RHB	0.7
Dominant Substrates	Boulder (>128 mm): 30% Cobble (>32–128 mm): 30% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):15% Sand (0.25–2 mm): 5% Silt (<0.25 mm): 5%			
Substratum Condition	Compacted			

The watercourse at survey site IC 6 represented a stretch of Eroding/Upland River (FW1) with a natural channel profile. Flow patterns consisted of repeating cobble-dominant riffle with boulder steps along a slight gradient. Water was fast flowing and shallow across riffle sequences (up to 0.15 m) with pools up to 0.3 m behind boulder steps and in areas of scour downstream of the double pipe culvert, through which the watercourse was culverted under an existing forestry road. Siltation was largely absent from the survey stretch, with the exception of some superficial fine sediments in areas of slower flowing pool downstream of the culvert. Water was clear with no distinct colouration.

While the upstream of the culvert was also largely natural, the channel was more laterally confined, with less riparian vegetation. The pipe culverts were raised from the channel bed and installed on an incline, with shallow flow through the pipes. Downstream of the culverts, the channel was more heavily encroached with a high degree of shading provided by marginal willow, gorse and bramble Scrub (WS1).

The watercourse had a high degree of instream habitat diversity, with varied channel substrate sizes and variable flow patterns across repeating riffle and glide and pool-step features. Salmonid nursery habitat was therefore assessed overall as *Good*, although the pipe culvert may act as a barrier to fish during periods of normal flow such as at the time of survey. European eel habitat was also assessed as *Good,* particularly in areas of slower, sheltered marginal flow and throughout pools along the survey stretch. While there was some suitable holding depth for adult salmonid fish downstream of the culvert, this was isolated in the wider context of the watercourse and so assessed as *Poor–Moderate.* Fine sediment beds required for lamprey nursery habitat were absent from the survey stretch, with only superficial siltation in the scour pool downstream of the culvert. Salmonid and lamprey spawning habitat were assessed as *Poor* given the coarse and compacted nature of substrates.



Plate 4-56. A representative photo of the upstream extent of survey site IC 6.



Plate 4-57. A representative photo of the downstream extent of survey site IC 6.

Kick-sampling was carried out in areas of riffle where present. Site IC 6 was assigned a Q value of **Q4 – Good** on the basis that at least one taxon from 'Very Pollution Sensitive' Group A was present in reasonable numbers. 'Pollution Tolerant' Group C taxa represented ~66% of the sample, with high diversity and abundance. 'Very Pollution Tolerant' Group D and 'Most Pollution Tolerant' Group E taxa were absent from the sample. Results of the kick-sample at survey site IC 6 are presented in Table 4-67.

Table 4-67. Results of macroinvertebrate sampling at survey site IC 6.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	Chloroperlidae	2
	Rhithrogena sp.	11
	Nemouridae	2
Group B – Moderately Pollution Sensitive	Glossosomatidae	5
	Leuctra sp.	4
***Group C** – Pollution Tolerant*	*Baetis rhodani/atlanticus*	10
	Chironomidae	*18*
	Dicranota sp.	*2*
	Elmidae	*5*
	Gammarus sp.	*3*
	Hydrachnidia	*6*
	Philopotamidae	*2*
	Polycentropodidae	*1*
Group D – Very Pollution Tolerant	–	–
Group E – Most Pollution Tolerant	–	–



Plate 4-58. A representative photo of the raised pipe culvert at survey site IC 6.

4.1.2.7 Crossing 7 (IC 7)

Proposed Wind Farm watercourse crossing location 7 was located along a section of new proposed road northeast of T15. Properties of the watercourse at this survey site are provided in Table 4-68.

Table 4-68. Properties of the watercourse at survey site IC 7.

Properties	Record			
Average Depth (m)	0.05–0.15			
Average Bank Width (m)	1.5–3.0 (in areas of poaching)			
Average Wet Width (m)	1.5			
Flow	Moderate			
Colour	No distinct colouration			
Clarity	Clear when undisturbed			
Bank height (m)	LHB	0.1–1.0	RHB	1.75
Dominant Substrates	Boulder (>128 mm): 30% Cobble (>32–128 mm): 20% Gravel (8–32 mm): 20% Fine gravel (2–8 mm):20% Silt (<0.25 mm): 10%			
Substratum Condition	Loose			

The watercourse at survey site IC 7 represented a stretch of Eroding/Upland River (FW1) which was subject to active livestock poaching along the right-hand bank. Channel substrate consisted of frequent boulder outcrops interspersed with small areas of gravel and fine gravel beds. Water was shallow, particularly in the vicinity of the area of livestock poaching, with riffle-dominant flow patterns throughout boulder and cobble. The watercourse had a slight gradient, which was particularly evident upstream of the point of livestock access with sequential boulder steps and shallow pools.

Outside of the area of poaching, which was largely cleared of vegetation, the channel was encroached with overhanging willow trees and bramble. Other bankside vegetation included gorse, bracken, hard fern, creeping buttercup, and sweet vernal grass. Boulder outcrops displayed high bryophyte coverage,

including swan's neck thyme moss *(Mnium hornum), Chiloscyphus polyanthos*, Smaller Lattice-moss *(Cinclodotus fontinaloides)* and *Hookeria sp.*

While areas of loose gravels were present between boulder outcrops, gravels were limited in area and overlain with silt in the vicinity of livestock poaching. These areas may be used opportunistically in the context of steeper gradient and inaccessible barriers further upstream but salmonid and lamprey spawning was assessed overall as *Poor* but locally moderate.

Areas of watercourse adjacent to undercut banks with higher substrate variability provided *Locally Moderate* salmonid nursery. Limited areas of slightly deeper water in conjunction with encroaching willows and woody debris providing European eel habitat assessed as *Poor–Moderate,* although overall shallow depth limited habitat for eel. Holding habitat for adult salmonids was similarly limited by the absence of continuous, suitably deep pool or glide. While siltation overtop channel substrate was present, well-structured fine sediment beds required for lamprey ammocoete burrowing were absent from the survey stretch.

Table 4-69. Results of macroinvertebrate sampling at survey site IC 7.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	–	–
Group B – Moderately Pollution Sensitive	Glossosomatidae	120
	Sericostomatidae	7
Group C – Pollution Tolerant	*Baetis rhodani/atlanticus*	3
	Chironomidae	*13*
Group D – Very Pollution Tolerant	*Naididae*	4
Group E – Most Pollution Tolerant	–	–

Kick-sampling was carried out in areas of riffle where present. Site IC 7 was assigned a Q value of **Q3 – Poor**, on the basis that 'Very Pollution Sensitive' Group A were absent from the sample. 'Moderately Pollution Sensitive' Group B taxa represented ~86% of the sample, with *Glossosomatidae* considered to be represented in excessive numbers. 'Pollution Tolerant' Group C taxa represented ~11% of the sample, with low diversity and abundance. 'Very Pollution Tolerant' Group D was represented by a single taxon in low numbers, while 'Most Pollution Tolerant' Group E taxa were absent from the sample. Results of the kick-sample at survey site IC 7 are presented in Table 4-69.

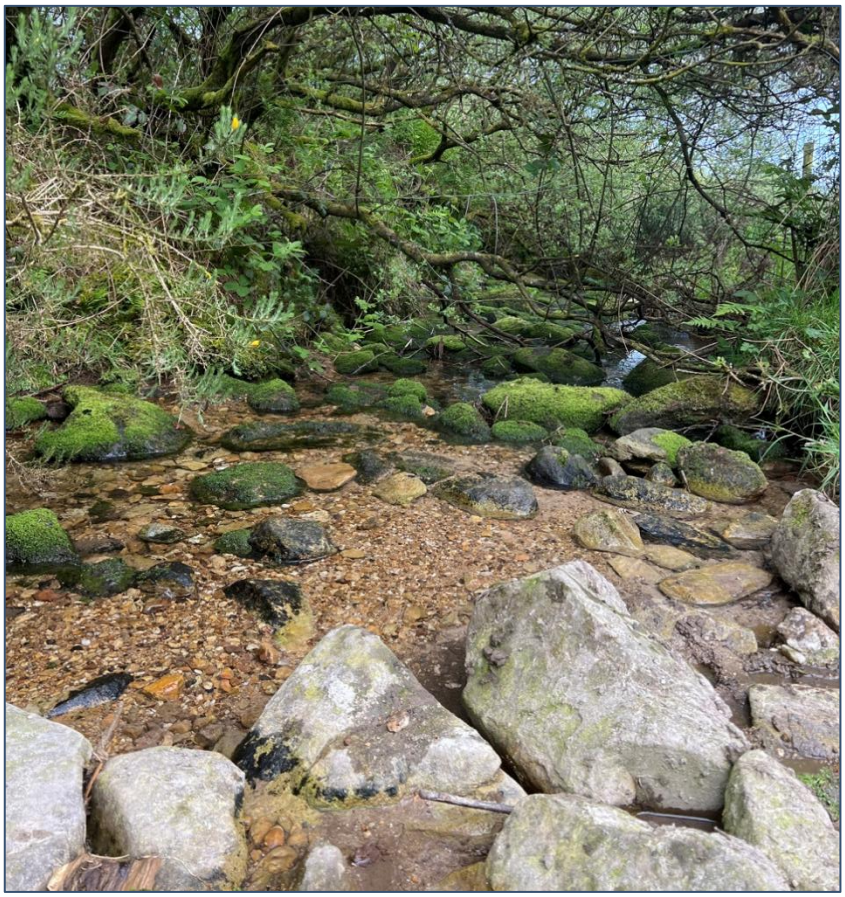


Plate 4-59. A representative photo of the downstream extent of survey site IC 7.



Plate 4-60. A representative photo of the upstream extent of survey site IC 7.



Plate 4-61. A representative photo of active poaching along the right-hand bank at survey site IC 7.

4.1.2.8 Crossing 8 (IC 8)

Proposed Wind Farm watercourse crossing location 8 was located along a section of new proposed road east of T23. Properties of the watercourse at this survey site are provided in Table 4-70.

Table 4-70. Properties of the watercourse at survey site IC 8.

Properties	Record			
Average Depth (m)	0.0.5–0.25			
Average Bank Width (m)	1.0			
Average Wet Width (m)	0.5–1.0			
Flow	Moderate			
Colour	No distinct colouration			
Clarity	Clear when undisturbed			
Bank height (m)	LHB	0.1–0.5	RHB	1.5
Dominant Substrates	Boulder (>128 mm): 5% Cobble (>32–128 mm): 50% Gravel (8–32 mm): 15% Fine gravel (2–8 mm): 15% Silt (<0.25 mm): 15%			
Substratum Condition	Compacted			

The watercourse at survey site IC 8 represented a narrow, laterally confined Eroding/Upland River (FW1) with historic livestock poaching along both banks. The watercourse exhibited a natural profile of a headwater stream, with the exception of a manmade rock ramp which was located across the width of the channel. The rock ramp appeared to divert water to a secondary channel which extended from the

right-hand bank of the main channel. Water diverted into this secondary channel was fed into a plastic pipe which ran from along the field margin toward the road (Plate 4-62, Plate 4-64, Plate 4-65).

Channel substrate consisted primarily of cobble with interstitial gravels. An overlying layer of siltation was particularly evident behind the artificial rock ramp. Flow patterns consisted primarily of riffle, with sequences of both artificial step and pool created by the rock ramp, and natural step-pool features in steeper gradient sections of watercourse downstream of this. Water was clear when undisturbed, with no apparent colouration.

Marginal and emergent vegetation included fool's-water-cress and amphibious bistort, with bankside vegetation including bramble, soft rush, creeping buttercup, curly dock *(Rumex crispus),* nettle, bird's-foot trefoil, water plantain *(Alisma plantago-aquatica),* Yorkshire fog and white clover. Bankside vegetation between the watercourse and surrounding Improved agricultural grassland (GA1) habitat, which extended from the right- and left-hand banks, was minimal.

Overall fisheries habitat was limited by the narrow, laterally confined nature of the watercourse and instream modification. The watercourse did not provide sufficient depth for suitable salmonid holding habitat (max depth behind the artificial rock ramp of 0.25 m, but otherwise 0.05–0.1 m across cobble riffle). Cobble riffle adjacent to undercut banks and overhanging vegetation provided *Moderate* salmonid nursery. Due to the compacted and coarse nature of channel substrate, salmonid and lamprey spawning habitat was assessed as *Poor.* Fine sediments where present were isolated in nature and of superficial depth, with lamprey ammocoete nursery being assessed as *Poor* for this site.

Table 4-71. Results of macroinvertebrate sampling at survey site IC 8.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus sp.*	2
	Rhithrogena sp.	25
	Nemouridae	3
Group B – Moderately Pollution Sensitive	Glossosomatidae	9
	Sericostomatidae	3
	Alainites muticus	1
Group C – Pollution Tolerant	*Baetis rhodani*	15
	Gammarus sp.	17
	Hydropsyche sp.	2
	Lumbriculidae	1
	Philopotamidae	2
	Polycentropodidae	2
	Serratella ignita	5
	Simuliidae	2
	Turbellaria	2
Group D – Very Pollution Tolerant	–	–
Group E – Most Pollution Tolerant	–	–

Kick-sampling was carried out in areas of riffle where present. Site IC 8 was assigned a Q value of **Q4 – Good** on the basis that at least one taxon from 'Very Pollution Sensitive' Group A was present in reasonable numbers. 'Pollution Tolerant' Group C taxa represented ~54% of the sample, with high diversity and abundance. 'Very Pollution Tolerant' Group D and 'Most Pollution Tolerant' Group E taxa were absent from the sample. Results of the kick-sample at survey site IC 8 are presented in Table 4-71.



Plate 4-62. A representative photo of survey site IC 8, showing the manually placed rock ramp which diverted flow into the pipe which extended as a secondary channel from the right-hand bank.



Plate 4-63. A representative photo of survey site IC 8, showing the manmade rock ramp created to divert water to a secondary channel from the right-hand bank of the main channel.



Plate 4-64. A representative photo of the watercourse being diverted into the pipe.



Plate 4-65. A representative photo of the pipe into which the watercourse was diverted.

4.1.3 Proposed Grid Connection site Survey Locations

4.1.3.1 Grid Connection Survey Site 1 (GC 1)

Survey site GC 1 was located on the Monagally East watercourse, which is a tributary of the Goish (EPA code: 18M10). Properties of the watercourse at this location are presented in Table 4-72. Plate 4-66, Plate 4-67 and Plate 4-68 show representative photographs of the survey site.

Table 4-72 Properties of the watercourse at survey site GC 1.

Properties	Record
Average Depth (m)	0.05–0.1
Average Bank Width (m)	0.8
Average Wet Width (m)	0.75
Bank height (m)	LHB 0.2 RHB 0.2
Flow	Moderate
Colour	None
Clarity	Clear
Dominant Substrates	Cobble (>32–128 mm): 75% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):10%
Substratum Condition	Semi-compacted

This stretch of Eroding/upland river (FW1) was located within the headwaters of the Goish catchment area, approximately 120 m downstream of the mapped source of the Monagally East watercourse. Watercourse characteristics at this location largely represented features typical of a laterally constrained (~0.75 m wetted width) and shallow (~0.05–0.1 m) first-order stream. Water condition was clear and had a slight brown colouration, whereas the cobble-dominant substrate was semi-compacted and did not migrate easily when trod underfoot. Some gravels ranging in size from coarse to fine did occur occupying the interstitial spaces between cobbles, however there was a lack of well-defined deposits. The lower extent was framed by a cobble riffle-step sequence which flowed into a square (~ 0.5 m in width) culvert, through which this section of the Monagally East traversed beneath a roadway. A smaller secondary side channel met the Monagally East from its left-hand bank immediately upstream of the culvert. Further upstream, riffle sequences were interrupted by two separate slow-flowing and shallow pools created by small woody debris, which were lined with leaf litter likely originating from the moderately dense coverage of encroaching willow. There was some evidence of historic fly tipping in the channel at this visited extent upstream of the bridge.

The riparian habitat on both banks consisted of a mosaic of Scrub (WS1) and Mixed broadleaved woodland (WD2), which had a vegetation profile consisting of willow, hawthorn, bramble, Bracken fern, hard fern, soft rush, creeping buttercup and spear thistle *(Cirsium vulgare*). The stands of trees were most prominent on the right-hand bank, providing significant shading.

Given the semi-compacted cobble-dominant substrate profile, this surveyed location was assessed as *Poor* in terms of suitability for salmonid and lamprey spawning. The absence of deposits of finer sediments left little opportunity in the provision of lamprey nursery habitat, and as such this site was assessed as *Negligible* in this regard. The cobble riffle-step sequences were of *Good* suitability for the provision of salmonid nursery and eel habitat, aided by some refugia provided for by the encroaching trees. Given the shallow and laterally constrained nature of the watercourse, this first order stream was assessed as *Poor* in terms of salmonid holding suitability.

Kick-sampling was carried out in areas of pool and riffle. Survey location GC1 was assigned a Q-value of **Q3 – Poor**, on the basis that Group A 'Very Pollution Sensitive' taxa were absent from the sample, whereas Group C 'Pollution Tolerant' taxa represented the dominant constituent. Group B 'Moderately

Pollution Sensitive' taxa were numerous, constituting ~39% of the sample. Results of the macroinvertebrate survey at this location are presented in Table 4-73.

Table 4-73 Results of macroinvertebrate sampling at survey site GC 1.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Leuctra* sp. (early instars)	6
	Limnephilidae	1
	Glossosomatidae	2
	Goeridae	2
	Sericostomatidae	2
Group C – Pollution Tolerant	Simuliidae	1
	Gammarus sp.	10
	Dicranota sp.	1
	Rhyacophila sp.	1
	Hydropsyche sp.	3
	Philopotamus sp.	3
	Lumbriculidae	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-66. The upstream extent of survey site GC 1, facing upstream.



Plate 4-67. The downstream extent of survey site GC 1, facing downstream.



Plate 4-68. The Monagally East watercourse as it traverses through a square culvert beneath a roadway at the lower extent of survey site GC 1.

4.1.3.2 Grid Connection Survey Site 2 (GC 2)

Survey location GC 2 was located on the Goish watercourse, ~0.07 km upstream of the confluence between the Goish and the Monagally East watercourses (EPA Code:18G12). Properties of the watercourse at this location are presented in Table 4-74. Representative photographs of the watercourse at this survey site are presented in Plate 4-69 and Plate 4-70.

Table 4-74 Properties of the watercourse at survey site GC 2.

Properties	Record			
Average Depth (m)	0.35			
Average Bank Width (m)	3			
Average Wet Width (m)	2.7			
Bank height (m)	LHB	0.4–1.2	RHB	0.4
Flow	Moderate			
Colour	Slightly brown			
Clarity	Clear			
Dominant Substrates	Boulder (>128 mm): 5% Cobble (>32–128 mm): 30% Gravel (8–32 mm): 50% Fine gravel (2–8 mm):5% Silt (>2 mm): 10%			
Substratum Condition	Loose and unconsolidated, some siltation in pool margins			

This visited stretch of Eroding/upland river (FW1) had a moderately sized hydromorphological profile given its upland location, with an average width of ~2.7 m and an average depth of ~0.35 m at the time of visiting. The surveyed stretch was bisected by a single-span stone arch roadbridge, beneath which lay a deeper pool (~0.5 m), with evident siltation coating the gravels deposited along the wetted section adjacent to the right-hand bank. Upstream and downstream of the bridge, instream microhabitats consisted of cobble and coarse gravel riffle and glide formations, with boulders occurring throughout. Substrate condition was loose and unconsolidated, with well-defined deposits of gravels readily migrating when trod underfoot.

The left-hand bank both upstream and downstream of the bridge consisted of agricultural pasture representing a mosaic of Wet grassland (GS4) and Improved agricultural grassland (GA1), of which there was no vegetative buffer. There was some evidence of historic poaching of the left-hand bank both upstream and downstream. The right-hand bank consisted of a Scrub (WS1) habitat, in which some encroaching grey willow *(Salix cinerea*) provided moderate localised marginal shading. The riparian vegetation profile consisted of bracken fern, ivy, soft rush, and the non-native montbretia *(Crocosmia × crocosmiiflora)*.

The gravel deposits present provided locally *Good* salmonid and lamprey spawning habitat in areas of riffle and glide, however, gravels beds present at glide margins were slightly silted, limiting their suitability for spawning. However, these unconsolidated finer deposits present provided locally *moderate* lamprey nursery habitat where they occurred in marginal areas of the channel, and overall *Poor* nursery habitat for lamprey. The cobble-gravel riffle and glide formations interspersed with boulders were of a sufficient composition to provide *Good* salmonid nursery habitat, aided by the shading provided adjacent to the right-hand bank by encroaching willow. Glides present were of a sufficient depth to provide refugia for adult salmonids, whereas the deeper pool lined with some cobble located beneath the bridge was also suitable in composition to provide adequate refugia for adult salmonids and indeed eel. Therefore, survey site GC 2 was assessed as *Good* in terms of salmonid holding and eel habitat suitability.

Kick-sampling was carried out in areas of riffle and glide. Macroinvertebrate diversity was moderate, with ten separate taxa identified. GC 2 was assigned a water quality status of **Q4 - Good**, on the basis that Group A 'Very Pollution Sensitive' taxa were common (~17%), Group B 'Moderately Pollution

Sensitive' taxa were numerous, whereas Group C 'Pollution Tolerant' taxa were the most abundant, comprising ~55% of the sample. No Group D or Group E taxa were present within the macroinvertebrate sample at this location. Results of the macroinvertebrate survey are presented in Table 4-75.

Table 4-75 Results of macroinvertebrate sampling at survey site GC 2.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecydonurus* sp.	8
Group B – Moderately Pollution Sensitive	Glossosomatidae	3
	Goeridae	10
Group C – Pollution Tolerant	*Rhyacophila* sp.	3
	Hydropsyche sp.	3
	Gammarus sp.	6
	Simuliidae	7
	Polycentropus sp.	1
	Baetis rhodani /atlanticus	6
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-69. The upstream extent of survey site GC 2, facing upstream, where a riffle-glide sequence can be seen instream, and a poached area of bank is visible to the right of the image.



Plate 4-70. The downstream extent of survey site GC2, facing downstream. A well-defined riffle step sequence can be seen in the centre of the image.

4.1.3.3 Grid Connection Survey Site 3 (GC 3)

Survey site GC 3 was located on the Goish watercourse, approximately 1.03 km downstream of survey site WF 3 (EPA Code: 18G12). Properties of the watercourse at this location are provided for in Table 4-76, and a representative photograph of the site is presented in Plate 4-71 and Plate 4-72.

Table 4-76 Properties of the watercourse at survey site GC 3.

Properties	Record			
Average Depth (m)	0.015–0.2			
Average Bank Width (m)	5			
Average Wet Width (m)	4			
Bank height (m)	LHB	0.5	RHB	1.7
Flow	Moderate			
Colour	None			
Clarity	Clear			
Dominant Substrates	**Upstream extent** Cobble (>32–128 mm): 60% Gravel (8–32 mm): 30% Sand (0.25–2 mm): 5% Silt (>0.25 mm): 5%		**Downstream extent** Bedrock: 40% Boulder (>128 mm): 40% Cobble (>32–128 mm): 10% Gravel(8–32 mm): 10%	
Substratum Condition	Loose and unconsolidated			

This surveyed stretch of Eroding/Upland River (FW1) was characterised by a transition in its hydromorphological profile with downstream movement. The upstream extent was framed by a large, vegetated earthen island by which the primary flow of the watercourse traversed to the left. The right side of this island was framed by a smaller (~1 m width) slow-flowing channel which was extensively silted. Substrate composition at this upper extent was cobble-dominant with some interstitial gravels, whereas sands and silt were present in small relative amounts within marginal areas of reduced flow. A

secondary, smaller island was present approximately 30 m downstream of the larger island, by which the primary flow traversed to the right, whereas to the left of the island ran a slow-flowing, shallow secondary channel. Microhabitats at this upper extent were characteristic of low-moderate gradient riffle and cobble sequences with some areas of pool. Downstream of the smaller aforementioned island, the morphology of the watercourse shifted to a sequence of bedrock and boulder-step formations occurring at a moderate gradient, with deeper (~0.5 m) pools often interspersing step sequences. Within marginal areas of these deeper pools were some well-defined sections of coarser gravels.

Along the immediate riparian zone on both banks, a Scrub (WS1) buffer separated the watercourse from the adjacent disused track consistent with a classification of Recolonising Bare Ground (ED3). The scrub buffer on the left-hand bank transitioned to a Conifer Woodland (WD2) predominantly composed of sitka spruce. Riparian and emergent vegetation consisted of sycamore, bramble, nettle, bracken fern, non-native montbretia, fool's-water-cress , watercress and duckweed *(Lemna* sp.). Instream, water crow-foot (*Ranunculus* sp.) occurred occasionally throughout areas of glide. Situated on the smaller aforementioned island was a large and well-established stand of the 3rd schedule invasive Japanese knotweed *(Reynoutria japonica,* Plate 4-73), which was otherwise absent from the survey site.

The interstitial gravels occurring within riffles at the upper extent and well-defined gravel deposits occurring within areas of pool were of *Moderate* provision in terms of salmonid and lamprey spawning habitat. Some areas of sand and silt deposits present within glide margins and within the secondary channels separated by the islands were of some suitability in terms of lamprey nursery habitat, but overall lamprey nursery was assessed as *Poor.* The cobble-dominant riffles and glides with occasional instream water crow-foot provided suitable, well-oxygenated refugia for juvenile salmonids, thus being of *Good* suitability in terms of nursery habitat. The pools interspersed with boulder at the downstream extent of the survey site were of locally *Good* suitability for both adult salmonid and indeed eel.

Kick-sampling was carried out in areas of riffle. Survey location GC 3 was assigned a Q-value of **Q4 – Good**. One Group A 'Very Pollution Sensitive' taxon was recorded, common within the sample. Group B 'Moderately Pollution Sensitive' taxa were common within the sample, and Group C 'Pollution Tolerant' taxa were the most abundant. No Group D or Group E taxa were present within the macroinvertebrate sample at this location. Results of macroinvertebrate sampling at survey site GC 3 are presented in Table 4-77.

Table 4-77 Results of macroinvertebrate sampling at survey site GC 3.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecydonurus* sp.	13
Group B – Moderately Pollution Sensitive	Goeridae	13
	Glossosomatidae	2
	Sericostomatidae	1
Group C – Pollution Tolerant	Simuliidae	3
	Baetis rhodani /atlanticus	11
	Gammarus sp.	10
	Hydropsyche sp.	4
	Rhyacophila sp.	2
	Polycentropus sp.	2
	Philopotamus sp.	2
	Elmidae	4
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-



Plate 4-71. A representative photo of the upstream extent of survey site GC 3.



Plate 4-72. A representative photo of the downstream extent of survey site GC 3.



Plate 4-73. A well-established stand of Japanese knotweed (Reynoutria japonica) present at survey site GC 3.

4.2 eDNA Results

Environmental DNA (eDNA) surveys were undertaken at 12 no. locations in the vicinity of the Proposed Wind Farm site (Table 2-2). Survey locations were chosen to maximise the chance of detecting eDNA from target species, to estimate the approximate extent of their presence, where detected, and inform on the need for dedicated freshwater pearl mussel *(Margaritifera margaritifera)* or white-clawed crayfish surveys.

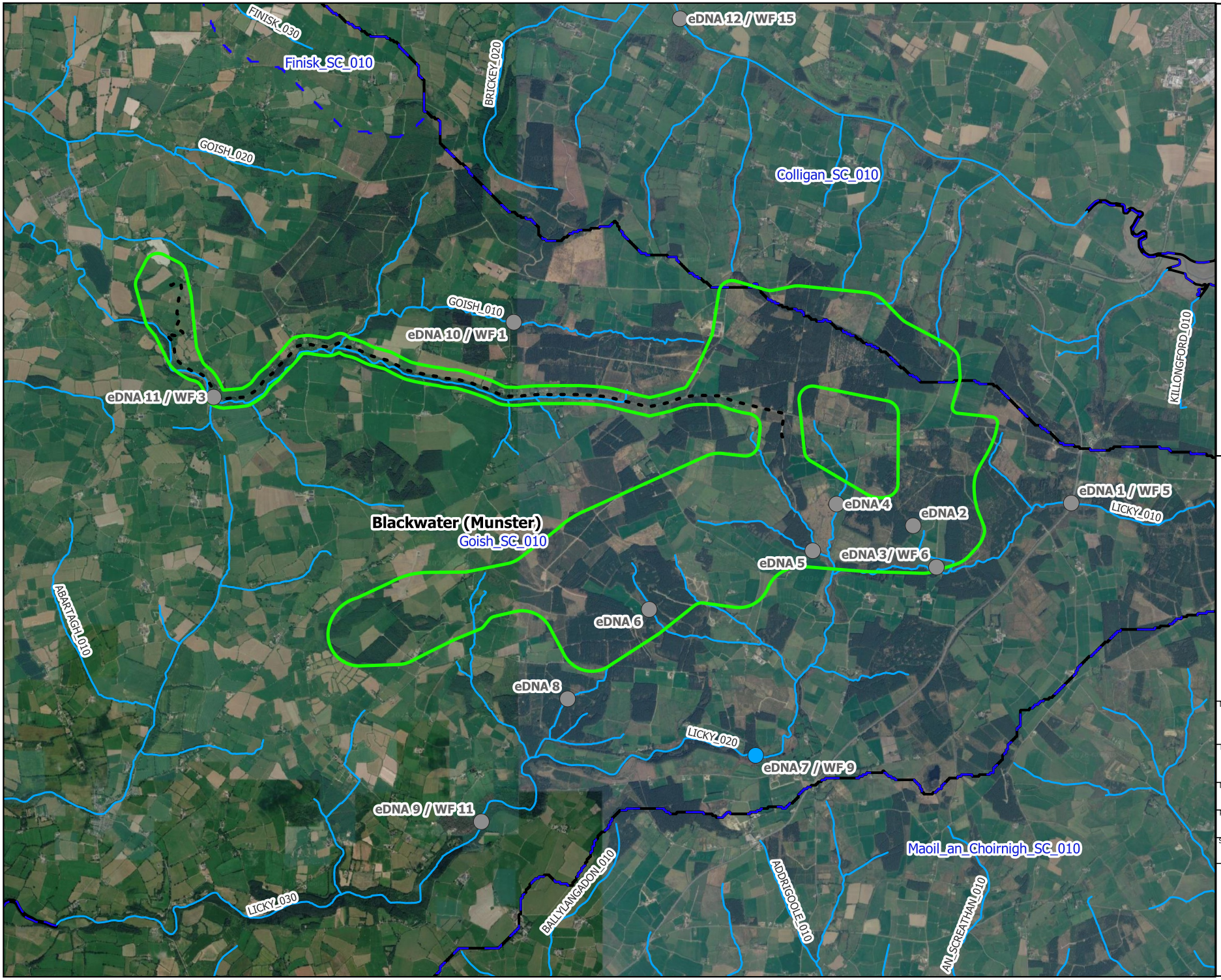
White-clawed crayfish were not detected at any of the survey sites; freshwater pearl mussel were detected at 1 no. survey site (eDNA 7 / WF 9). A summary of eDNA results can be found in Table 4-78 below and in Appendix III.

Site descriptions for eDNA survey sites not located at or in the vicinity of Proposed Wind Farm site survey locations are provided in this section below.

eDNA survey results are shown in Figure 4-1.

Table 4-78. A summary of eDNA survey results in the vicinity of the Proposed Wind Farm site.

eDNA Site Code	Freshwater Pearl Mussel (*Margaritifera margaritifera*)	White-clawed crayfish (*Austropotamobius pallipes*)
eDNA 1 / WF 5	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 2	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 3 / WF 6	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 4	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 5	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 6	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 7 / WF 9	**Positive – 6/12 replicates**	Negative - 0/12 replicates
eDNA 8	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 9 / WF 11	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 10 / WF 1	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 11 / WF 3	Negative - 0/12 replicates	Negative - 0/12 replicates
eDNA 12 (approx. 0.95 km upstream of WF 15)	Negative - 0/12 replicates	Negative - 0/12 replicates



Map Legend

- EIAR Boundary
- Proposed Grid Connection
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments
- WFD River Waterbodies

Freshwater Pearl Mussel eDNA Survey Location

- Positive FPM eDNA Results
- Negative FPM eDNA Results

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Drawing Title
Freshwater Pearl Mussel eDNA Survey Results

Project Title
Slievegrine Renewable Energy Development, Co. Waterford

Drawn By	Checked By
NR	AvdGM
Project No.	Drawing No.
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4.2.1 eDNA survey site 2

eDNA survey site 2 was located along an unmapped tributary of the River Licky (IG Ref: X 21558 87239). The watercourse at this site represented a stretch of historically modified Eroding/Upland River (FW1) subject to land pressures from Conifer plantation (WD4) and intensive Improved agricultural grassland (GA1) extending from the right- and left-hand banks, respectively. Properties of the watercourse at this survey site are provided in Table 4-79. Plate 4-74, Plate 4-75 and Plate 4-76 show representative photographs of the survey site at eDNA survey site 2.

Table 4-79. Properties of the watercourse at survey site eDNA survey site 2.

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	1.0			
Average Wet Width (m)	0.8			
Bank height (m)	LHB	1.5–2.5	RHB	1.2
Flow	No perceptible flow in shallowly/negligibly wetted sections, moderate flow in more naturalised sections			
Colour	No distinct colouration			
Clarity	Clear when undisturbed			
Dominant Substrates	Boulder (>128 mm): 20% Cobble (>32–128 mm): 30% Gravel (8–32 mm): 10%% Fine gravel (2–8 mm):10% Silt (>0.25 mm): 30% (overlying coarse channel substrate)			
Substratum Condition	Semi-compacted at lower extent, compacted cobbles at upper extent			



Plate 4-74. A representative photo of an unwetted, historically modified stretch of watercourse at eDNA survey site 2



Plate 4-75. A representative photo of poached sections of watercourse present intermittently along the survey stretch at eDNA survey site 2.



Plate 4-76. A representative photo of a stretch of the watercourse at eDNA survey site 2 with more naturalised channel substrate but bank poaching present.

The survey stretch at eDNA survey site 2 consisted of straightened, completely dry or negligibly wetted sections of laterally constricted channel, as well as sections of watercourse with more moderate flow and

more naturalised cobble and boulder dominant channel substrate. Where wetted, the water was still shallow (approx. 0.1 m deep). Overlying siltation persisted throughout wetted sections of the watercourse at this site, as well as abundant organic matter, detritus and floc over cobble and boulder substrate, particularly in areas of livestock poaching, which were present intermittently along the survey stretch.

Bankside vegetation consisted of bent grass *(Agrostis sp.)*, sweet vernal-grass *(Anthoxanthum odoratum)* and wild angelica, with a continuous Hedgerow (WL1) of gorse and bramble and willow *(Salix sp.)* Scrub (WS1) along the right-hand bank, which encroached into the channel and tunnelled much of the watercourse. Instream macrophytes were absent in flowing sections of watercourse, with mats of water mint present in the negligibly wetted sections at the upstream extent.

Negligibly wetted sections of watercourse provided overall poor fisheries habitat along the surveyed stretch of watercourse at eDNA survey site 2. More naturalised sections of moderate velocity riffle flow provided localised *moderate* salmonid nursery habitat, while lack of sufficient depth saw an absence of any significant salmonid holding habitat. The cobble and boulder dominant substrate in wetted sections of watercourse were considered too compacted and overlain with silt for significant salmonid or lamprey spawning habitat. Fine sediment beds, where present, were isolated and at areas of poached watercourse margins, providing *poor* lamprey ammocoete nursery habitat.

4.2.2 eDNA survey site 4

eDNA survey site 4 was located along the Knocknahoola, a tributary of the River Licky (EPA Code: 18K20, IG Ref: X 20715 87475). The watercourse at eDNA survey site 4 represented a stretch of historically modified Eroding/Upland River (FW1) subject to active livestock access and poaching into the watercourse from both the right- and left-hand banks. Properties of the watercourse at this survey site are provided in Table 4-80. Plate 4-77 and Plate 4-78 show representative photographs of the survey site at eDNA survey site 4.

Table 4-80. Properties of the watercourse at survey site eDNA survey site 4.

Properties	Record
Average Depth (m)	0.1
Average Bank Width (m)	1.0 (0.5 at sections of tunnelled watercourse, 3.0 in areas of poached banks)
Average Wet Width (m)	0.8
Bank height (m)	LHB 0.1–1.8 RHB 0.1–1.8
Flow	Slow, shallow riffle
Colour	No distinct colouration
Clarity	Clear when undisturbed
Dominant Substrates	Boulder (>128 mm): 30% Cobble (>32–128 mm): 30% Gravel (8–32 mm): 10% Fine gravel (2–8 mm):10% Silt (>0.25 mm): 20% (overlying coarse channel substrate)
Substratum Condition	Compacted

Channel substrate consisted primarily of compacted boulder and cobble with a high degree of siltation and organic matter, particularly in the vicinity of the livestock crossing between field boundaries. Silt was easily disturbed and remained readily in suspension. When undisturbed, water was otherwise clear. Earthen banks in the vicinity of livestock access were heavily poached and sloping into the watercourse, with the channel shallowly wetted and coarse channel substrate largely exposed. Channel margins were not clearly defined in areas of poaching, and the watercourse at the section was largely unshaded.

Upstream and downstream of the areas of livestock poaching, the watercourse exhibited a more naturalised, albeit still modified channel profile which was similarly shallowly wetted and markedly

more tunnelled, with encroaching bramble and gorse along the both right- and left-hand banks trailing into the watercourse. Additional bankside vegetation included willow *(Salix sp.)* and hawthorn. Rooted macrophytes were absent instream from the survey stretch.

Shallow, moderate velocity riffle was braided across the channel in the vicinity of livestock poaching, with a more laterally confined channel within the tunnelled stretch of watercourse at the downstream survey extent. A black abstraction pipe was also noted running through the watercourse at this location.

Fisheries habitat along this stretch of watercourse was limited to *Poor–Moderate* salmonid nursery habitat among more wetted and sheltered sections downstream of the areas of heavy livestock poaching. Water depth was not sufficient for adult salmonid habitat, while the dominance of compacted cobbles and boulders overlain with silt saw an absence of any significantly suitable salmonid or lamprey spawning habitat. Marginal silt beds were present largely in areas of active disturbance along poached sections of watercourse and therefore were unsuitable for optimal lamprey ammocoete nursery habitat.



Plate 4-77. A representative photo of the upstream survey extent at eDNA survey site 4, with evidence of livestock poaching.



Plate 4-78. A representative photo of the downstream survey extent at eDNA survey site 4.

4.2.3 eDNA survey site 5

eDNA survey site 5 was located along the Clashbrack, a tributary of the River Licky (EPA Code: 18C21, IG Ref: X 20437 86963). The watercourse at eDNA survey site 5 represented a stretch of Eroding/Upland River (FW1). The composite eDNA sample was taken downstream and upstream of a confluence of two watercourses (Clashbrack and Carronahyla, EPA Code: 18C22), arising within surrounding Conifer plantation (WD4) habitat. Due to active felling activities, eDNA sampling was conducted at and upstream of the confluence. Properties of the watercourse at this survey site are provided in Table 4-81. Plate 4-79 and Plate 4-80 show representative photographs of the survey site at eDNA survey site 5.

Table 4-81. Properties of the watercourse at survey site eDNA survey site 5.

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	1.6			
Average Wet Width (m)	1.2			
Bank height (m)	LHB	0.6–1.8	RHB	0.6–1.8
Flow	Moderate velocity riffle			
Colour	No distinct colouration			
Clarity	Very clear when undisturbed			
Dominant Substrates	Boulder (>128 mm): 15% Cobble (>32–128 mm): 45% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):5% Sand (0.25–2 mm): 15% Silt (>0.25 mm): 5% (overlying coarse channel substrate)			
Substratum Condition	Semi-compacted			

The watercourse at eDNA survey site 5 consisted of a narrow watercourse laterally confined between high-sided earthen banks, which were vegetated with bramble, gorse, willow *(Salix sp.)* and bracken,

which trailed into the watercourse at several points. While overhanging vegetation provided some marginal shading to the watercourse, and bramble-dominant surrounding Scrub (WS1) habitat tunnelled other sections, treelines were absent from this stretch of watercourse.

Channel substrate consisted primarily of compacted cobble and boulder substrates with isolated patches of interstitial gravels, and filamentous green algae growing atop coarser substrate. Rooted macrophytes were absent from the survey stretch, while *Chiloscyphus sp.* and *Rhynchostegium riparioides* bryophytes were present on substrate.

Flow patterns consisted predominantly of fast flowing riffle, with some areas of slower flowing and backwater pool along the concave banks of meanders along the largely naturally sinuous profile of this stretch of watercourse. Substrate displayed a slight degree of overlying siltation, which cleared quickly via swift flow when disturbed. In contrast to surrounding modified habitats (Conifer plantation, Spoil and bare ground, ED2 and Recolonising bare ground, ED3), the watercourse profile itself was largely unmodified in the stretch surveyed for eDNA composite sampling. However, a black abstraction pipe was observed running through the watercourse from the right-hand bank.

Interstitial gravels where present were clean and mobile, and in conjunction with cobbles may provide some, albeit opportunistic, spawning habitat for salmonid and lamprey species. However, it is pertinent to consider barriers to migratory fish throughout the river system in the wider vicinity of the Proposed Wind Farm site. Salmonid nursery throughout areas of riffle which consisted of well varied substrate and in conjunction with marginal vegetative shelter, provided moderate salmonid nursery, as well as European eel. Adult salmonid habitat was somewhat limited by overall shallow watercourse depth (with the exception of isolated, slightly deeper pools). Fine sediment beds suitable for lamprey ammocoete nursery were largely absent from this survey stretch.



Plate 4-79. A representative photo of the watercourse at eDNA survey site 5.



Plate 4-80. A representative photo of the confluence of the two watercourses at eDNA survey site 5.

4.2.4 eDNA survey site 6

eDNA survey site 6 was located along Móin_an_mBian (EPA Code: 18M04), a tributary of the River Licky (IG Ref: X 18605 86306). Properties of the watercourse at this survey site are provided in Table 4-82. Plate 4-81 and Plate 4-82 show representative photographs of the survey site at eDNA survey site 6.

Table 4-82. Properties of the watercourse at survey site eDNA survey site 6.

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	1.0			
Average Wet Width (m)	1.0			
Bank height (m)	LHB	0.9	RHB	0.9
Flow	Slow flowing riffle, standing water in pool directly downstream of pipe culvert			
Colour	Slightly yellow			
Clarity	Clear when undisturbed			
Dominant Substrates	Boulder (>128 mm): 40% Cobble (>32–128 mm): 20% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):15% Silt (>0.25 mm): 10%			
Substratum Condition	Loose			

The watercourse at eDNA survey site 6 represented a highly modified stretch of Eroding/Upland River (FW1), with a narrow, laterally confined profile which has likely been straightened. The watercourse was culverted via a plastic pipe under an agricultural/forestry track, with several sequential potential barriers to aquatic fauna in the form of a boulder weir (approx. 0.5 m high), fly tipping strewn across the channel and the pipe culvert itself.

Flow in the immediate downstream vicinity of the pipe culvert consisted of an impounded, heavily silted pool, with moderate-velocity riffle flow interspersed with slower flowing glide throughout the more laterally confined sections of watercourse further downstream. While substrates in the pool downstream of the culvert consisted primarily of silt, with organic matter and fly tipping, channel substrates further downstream consisted of compacted boulder and cobble, with interstitial gravels. Channel substrate was overlain with silt along much of the survey stretch. In addition to straightening of the watercourse, a black abstraction pipe was observed throughout the watercourse.

Surrounding habitats consisted of a forestry buffer zone consisting of (Mixed) broadleaved woodland (WD1), which extended into surrounding sitka spruce Conifer plantation (WD4). Bankside vegetation included bramble, hard fern and hard shield fern, while tree species consisted primarily of alder, beech and willow *(Salix sp.)*. Rooted instream macrophytes were absent along the survey stretch, with *Pellia sp.* and *Hookeria sp.* along the resectioned earthen banks, which exhibited frequent undercut features.

Given the highly modified nature of the watercourse, in combination with the slight gradient, persistent barriers and unsuitable substrates and siltation, salmonid and lamprey species spawning habitat was assessed as poor at this survey site. Barriers along the watercourse at this survey site posed a potential issue for passage of all fish species. Areas of aerated riffle, in combination with shelter provided but undercut banks and fallen deadwood provided some localised moderate salmonid nursery, and European eel habitat in areas of slightly deeper, shaded flow. Lack of sufficient depth (with the exception of the silted pool downstream of the culvert) saw an absence of any significant holding habitat for adult salmonids, while lack of silt beds (again with the exception of the immediate downstream vicinity of the culvert) saw a lack of any significant suitable lamprey ammocoete habitat.



Plate 4-81. A representative photo of eDNA survey site 6.



Plate 4-82. A representative photo of the downstream survey extent at eDNA survey site 6.

4.2.5 eDNA survey site 8

eDNA survey site 8 was located along the Moyng (EPA Code: 18M18), a tributary of the River Licky (IG Ref: X 17699 85307). Properties of the watercourse at this survey site are provided in Table 4-83. Plate 4-83 and Plate 4-84 show representative photographs of the survey site at eDNA survey site 8.

Table 4-83. Properties of the watercourse at survey site eDNA survey site 8.

Properties	Record			
Average Depth (m)	0.05			
Average Bank Width (m)	1.2–1.4			
Average Wet Width (m)	1.0			
Bank height (m)	LHB	0.2–0.6	RHB	0.2–0.8
Flow	Moderate velocity riffle			
Colour	No distinct colouration			
Clarity	Clear when undisturbed			
Dominant Substrates	Boulder (>128 mm): 15% Cobble (>32–128 mm): 30% Gravel (8–32 mm): 15% Fine gravel (2–8 mm):15% Silt (>0.25 mm): 25%			
Substratum Condition	Compacted			

The watercourse at eDNA survey site 8 represented a highly modified stretch of Eroding/Upland River (FW1), with a narrow, laterally confined profile amid steep, sloping banks vegetated with bracken, hard shield fern and bramble. The watercourse at eDNA survey site 8 was culverted by two concrete pipes under a forestry road and was well shaded by surrounding treelines of (Mixed) broadleaved woodland

(WD1), consisting of alder and willow *(Salix sp.)*, which acted as a buffer between areas of sitka spruce Conifer plantation (WD4) which dominated much of the surrounding landscape.

Upstream of the 2-pipe culvert, the watercourse was heavily encroached with bramble Scrub (WS1), meadowsweet and wild angelica, with a high degree of tunnelling and shading to the watercourse. In addition to the 2-pipe culvert and historical straightening, the watercourse was littered with fly tipping, with collapsed stone upstream of the culvert.

Channel substrate, consisting predominantly of cobble, was covered with an overlying layer of siltation, although water was relatively clear when undisturbed, with no apparent colouration. Flow patterns consisted primarily of riffle, which was particularly shallow upstream of the under-road culvert. Instream rooted macrophytes were absent, with *Riccardia sp.* bryophytes on the steep earthen banks.

Salmonid and lamprey spawning habitat were largely absent from the watercourse at eDNA survey site 8, given the high degree of siltation, shallow depth, barriers to fish migration and the limited presence of only interstitial gravels between otherwise compacted cobbles and boulder. Nursery was also poor, given the absence of flow refuge throughout the shallow riffle, with substrates often exposed. Encroaching bankside vegetation and undercut banks provided some marginal refuge for nursery age salmonid fish and eel, although water depth was insufficient to support this. Similarly, inadequate depth limited any significant suitable holding habitat for adult salmonid fish. Well-structured fine sediment beds required for lamprey ammocoete nursery were absent from the survey stretch, with only a superficial layer of silt overlying coarser substrates.



Plate 4-83. A representative photo of the double pipe culvert located at eDNA survey site 8.



Plate 4-84. A representative photo of the watercourse downstream of the culvert crossing at eDNA survey site 8.

4.3 Otter Survey Results

All visited aquatic survey sites were surveyed for signs of otter *(Lutra lutra)*, including holts and couches, as well as evidence of potential otter presence/habitat utilisation in the area, including spraints, prints, feeding remains and slides.

Several watercourse crossings (WF 1, WF 10 and WF 12) were considered to provide poor otter habitat due to a combination of channel modification, shallow water depths, steep upland gradients, frequent disturbance from vehicle ford crossings, and extensive encroachment by bankside vegetation. Survey sites WF 17 and WF 19 offered limited suitability, with restricted foraging opportunities as a result of shallow water levels, although some opportunistic commuting potential was present at WF 17. WF 19 was largely limited in commuting potential due to the highly encroached nature of both bankside and instream vegetation.

Moderate habitat suitability was recorded at a number of locations where conditions supported commuting activity, but where foraging opportunities were constrained by channel modification or localised disturbance. WF 2 was considered to provide moderate, opportunistic habitat, with suitability reduced in areas where the channel became heavily encroached. WF 14 also provided moderate commuting and foraging habitat despite channel modification, particularly in the vicinity of the bridge crossing where shallow water conditions prevailed. Along the River Brickey (WF 15, WF 16 and WF 18), habitat generally supported commuting and foraging activity while the presence of high-sided banks may locally restrict accessibility for otter.

Good quality otter habitat was identified at WF 3, WF 6, WF 7, WF 11 and WF 13. These locations provided more suitable commuting and foraging conditions, as a result of more naturalised channel morphology, adequate water depth, varied riparian vegetation cover which did not encroach continuity of the watercourse and improved habitat connectivity. In particular, WF 11 and WF 13 represented largely naturalised and well-shaded river corridors, although temporary disturbance from instream works were noted at WF 13 during the survey. WF 6 was also considered valuable due to its connectivity with the downstream River Licky, despite the surrounding agricultural landscape.

Both fresh and old otter spraint (Plate 4-85), as well as otter prints (Plate 4-86) were identified in the vicinity of survey site WF 7 along the River Licky. Potential otter slides were also identified in the vicinity of survey site WF 9 (Plate 4-87) and survey site WF 18 (Plate 4-88) along the Licky and Brickey rivers, respectively, with high-quality commuting and foraging habitat throughout each of these rivers.

No otter holts or couches were identified in or within the vicinity of the Proposed Wind Farm site or Proposed Wind Farm crossings, or in the vicinity of Proposed Grid Connection watercourse crossing sites at the time of survey. No other otter signs were identified at the time of survey.



Plate 4-85. A representative photo of fresh otter spraint identified at survey site WF 7.



Plate 4-86. A representative photo of an otter print identified at WF 7.



Plate 4-87. A representative photo of a potential otter slide identified at survey site WF 9.



Plate 4-88. A representative photo of a potential otter slide identified at survey site WF 18.

4.4 Kingfisher Survey Results

All WF and GC sites were surveyed for signs of kingfisher *(Alcedo atthis)* within the immediate vicinity of each survey site, as well as upstream and downstream of each site. Surveying was conducted to detect any kingfisher activity, identify any burrows present, and assess the given location in terms of suitable supporting habitat features (feeding perches, suitable burrow habitat, fishery potential).

Heavily encroached, often shallow and modified upland watercourses at survey sites WF 1, WF 10, WF 12 and WF 19 provided poor fisheries habitat and connectivity for foraging and commuting kingfisher. While survey sites such as WF 2 and WF 8 offered bankside vegetation, the channel and banks were often encroached with dense scrub growth, limiting both commuting connectivity for kingfisher, as well as potential suitable burrowing habitat in the way of exposed earthen banks. Survey site WF 5 provided some suitable foraging habitat but was constrained in terms of potential commuting habitat in the way of an under-road bridge and encroaching scrub and conifer plantation habitat upstream and downstream of the bridge, respectively. Survey site WF 14 provided some areas of moderate foraging habitat along areas of deeper pool with associated perching habitat. However, stretches of exposed watercourse with low, poached banks limited foraging, commuting and burrowing habitat for kingfisher.

Conversely, survey site WF 4 lacked any bankside vegetation and was largely exposed, with low, poached banks providing virtually no perching or burrowing habitat for kingfisher in the upstream vicinity of the bridge.

Similar to otter, survey sites WF 3, WF 6, WF 7, WF 11 and WF 13 provided higher levels of habitat connectivity and higher quality fisheries habitat to provide overall good commuting and foraging habitat for kingfisher.

While banks at survey site WF 9 did not provide significant suitable burrowing habitat for kingfisher, with the right-hand bank densely vegetated with conifer plantation, and the left-hand bank consisting partially of reinforced concrete, densely vegetated bramble scrub and exposed cobble banks, areas of deeper flow with moderate-good fisheries habitat provided suitable areas of kingfisher foraging habitat.

3 kingfishers were observed commuting along the watercourse at WF 18, approx. 0.1 m downstream of the bridge. The River Brickey provided overall high-quality commuting and foraging habitat, with limited burrowing habitat along the survey stretch due to densely vegetated bank faces. Tree limbs and bows in the vicinity of the bridge provided suitable perches for kingfisher foraging.

4.5 Freshwater Pearl Mussel Survey Results

Stage 1 and Stage 2 freshwater pearl mussel surveys were carried out in line with methodologies described in Section 2.7 of this report. Four sections of the Lickey River, denoted as Survey Areas 1, 2, 3, and 4 were surveyed for the presence and abundance of freshwater pearl mussel. The location of Survey Areas 1, 2, 3, and 4 were informed by NPWS historical freshwater pearl mussel data and eDNA results.

Appendix IV (Confidential Appendix) presents the locations of freshwater pearl mussel recorded within the areas surveyed.

4.5.1 Survey Area 1

Area 1 constituted an approx. 2.3 km reach of the River Lickey where there were historical NPWS freshwater pearl mussel records. During eDNA surveys, positive freshwater pearl mussel eDNA were recorded downstream of Area 1 (within Area 2), and negative freshwater pearl mussel eDNA were recorded within the upper extents of Area 1 and upstream of Area 1.

All freshwater pearl mussel recorded during surveys undertaken in October 2025 were identified within Area 1, and within an approx. 1 km stretch of the River Lickey. Survey Area 1 is located directly south and downstream of the Proposed Wind Farm site. A total of 127 live freshwater pearl mussel were recorded during the surveys, with an additional 2 dead shells recorded throughout the survey. Freshwater pearl mussel were found alone (Plate 4-89), in small clusters (Plate 4-90), and semi-continually across stretches of watercourse, but never in large or dense beds or accumulations. All freshwater pearl mussel recorded during the surveys were recorded along approx. 1 km of the River Lickey. Freshwater pearl mussel were recorded primarily in glide sections of the River Lickey but also within pools. While no freshwater pearl mussel were handled or measured (outside the scope of a Stage 1 and Stage 2 assessment), almost all mussels were visually assessed to be large and mature, with only a very small proportion assessed as comparatively younger due to being approximately half the size of other mussels they occurred with.

The Lickey River throughout Area 1 was described as an Eroding/Upland River (FW1) and was typified by riffle-glide-pool sequences, channel and wetted widths between 3 and 4 m, overall shallow water depths (average depth 0.2–0.3 m with some sections up to 0.6 m), moderate-fast flow, and predominantly coarse substrate composed of boulder, cobble and large gravels. Fine gravel, sand and silt sediment deposits accumulated throughout pools and along the depositing bends of meanders. Instream vegetation was occasional to rare across the entire surveyed extent, with higher coverage of instream macrophytes (*Ranunculus, Callitriche* and *Potamogeton* species) towards the downstream extent of survey Area 1. Bankside habitat consisted of a Conifer Plantation (WD4), Scrub (WS1) and a range of grassland habitats including agricultural grassland (GA1), dry meadows and grassy verges (GS2), and wet grassland (GS4). The majority of freshwater pearl mussel were recorded within sections of the river with Conifer Plantation (WD4) growing along both banks. At the time of the surveys, forestry drains and occasionally tributaries flowing into the River Lickey caused local siltation of the channel. Large areas of suitable substrate and flow conditions remain within Survey Area 1. Representative pictures of the River Lickey within Area 1 are shown in Plate 4-91 – Plate 4-94.

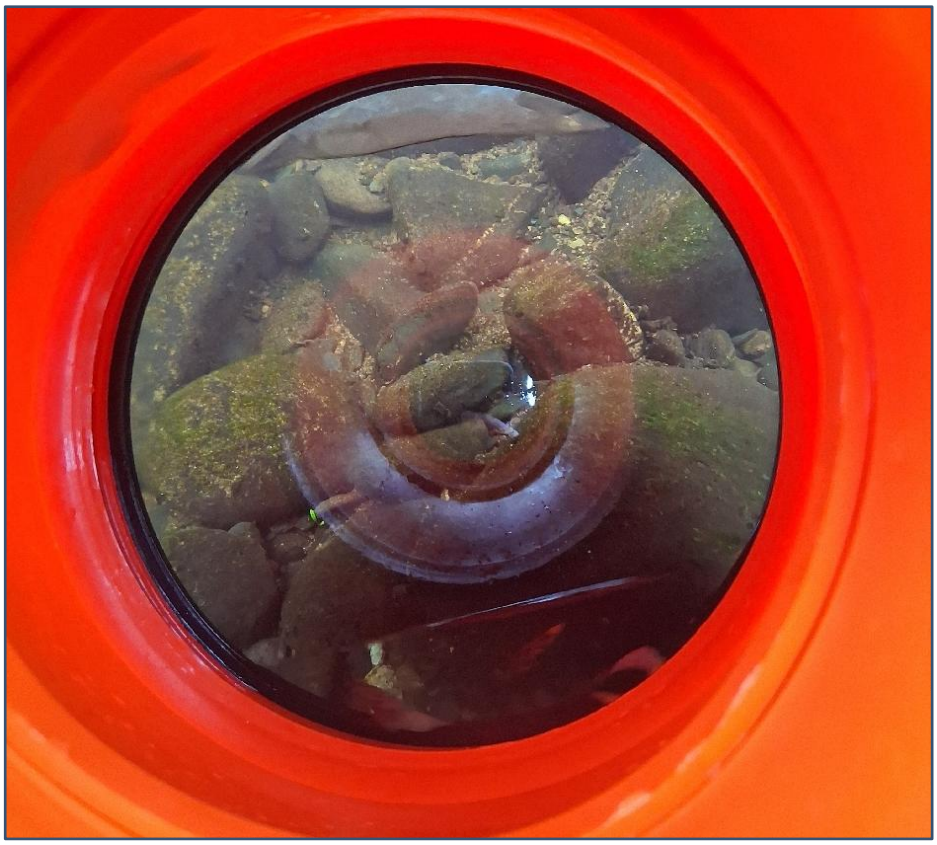


Plate 4-89 Lone and furthest downstream freshwater pearl mussel in Area 1.



Plate 4-90 Group of 5no. freshwater pearl mussel within Area 1.



Plate 4-91 River Lickey within the downstream extent of Area 1.



Plate 4-92 River Lickey within the mid extent of Area 1 where freshwater pearl mussel were recorded.



Plate 4-93 River Lickey within Area 1 adjacent to agricultural grassland.



Plate 4-94 Upstream extent of the River Lickey within Area 1 characterised by a deep pool at a forestry road crossing.

4.5.2 Survey Area 2

The Lickey River throughout Area 2 was described as an Eroding/Upland River (FW1). Area 2 comprised two 500 m reaches of the River Lickey, from a larger 2 km reach, south-east of the Proposed Wind Farm site. There were no historical NPWS records identified within this area, however, eDNA surveys undertaken within Area 2 were positive for freshwater pearl mussel eDNA. Representative pictures of the River Lickey within Area 2 are shown in Plate 4-95, Plate 4-96, and Plate 4-97.

The downstream of the two Area 2 reaches was bordered primarily by mature conifer plantation (WD4) and agricultural land use (Wet grassland (GS4)). *Ranunculus* spp. cover was abundant in downstream sections of the survey area and absent upstream, with floc and algal coverage abundant throughout, indicating a level of nutrient enrichment within the watercourse. Substrate was dominated by cobble and large gravel (60% combined), with lower proportions of fine gravels and boulder, and with sand comprising approx. 30% of the substrate. Water clarity was high when undisturbed and velocity was fast. The channel in this area had a wet width of 3 m, and a channel width of 4 m. The river was in low flow, with water depth averaging 0.6 m, with reaches of shallower water averaging 0.15 m. The invasive alien species, Himalayan balsam was present along the riverbanks within this survey area and further upstream (Plate 4-98). A bridge structure intersected this survey area with both instream and bank modifications as a result.

The upstream of the two sections of Survey Area 2 were bordered primarily by agricultural land use (Wet grassland (GS4), Improved agricultural grassland (GA1)), while willow, bramble and gorse dominated scrub (WS1) extended along the left-hand bank at the downstream survey extent of Area 2. Water was very clear at the downstream end of the survey area but became turbid further upstream due to siltation arising from cattle access to the river. In the areas of cattle access, the riverbank was highly eroded. Filamentous algae coverage was excessive near the upstream extent of the survey area, likely due to nutrient enrichment. *Ranunculus* sp. and *Myriophyllum* sp. were also common within the channel. Substrate was dominated by cobble and gravel, with areas compacted and semi-compacted. The river was in low flow, with water depth averaging 0.3 m, wet width averaging 3–4 m and an average bank width of 4 m.

While some conditions within Area 2 were suitable for freshwater pearl mussel, the evident enrichment pressure, siltation pressure, and compaction recorded limited the overall suitability of the watercourse in its current condition for freshwater pearl mussel.



Plate 4-95. Downstream extent of Survey Area 2.



Plate 4-96. Bridge with Survey Area 2 and high macrophyte coverage in the foreground.



Plate 4-97 Upstream extent of Survey Area 2 with cattle instream.



Plate 4-98 Himalayan balsam within Survey Area 2.

4.5.3 Survey Area 3

Area 3 constituted a 500 m reach of the River Lickey where there were historical NPWS freshwater pearl mussel records. eDNA samples were undertaken upstream and downstream of this survey area on the River Lickey, with positive eDNA results recorded upstream of this area (within Survey Area 2) and negative eDNA results recorded downstream of this site. No freshwater pearl mussel were recorded during surveys of Area 3.

The Lickey River throughout Area 3 was described as an Eroding/Upland River (FW1). The River Lickey in this survey area was typified by boulder and cobble dominated substrate. Silt and finer

sediments were typically confined to the outer margins where flow was slower. Aquatic macrophytes were very rare throughout the survey area. Flow patterns consisted primarily of riffle and glide, with occasional pool. The channel at this survey area was typically 6–10 m wide, and 0.2–1.2 m deep. The majority of survey area was highly shaded by both broadleaved and conifer woodland, with large steep banks on the right-hand bank of the channel. Areas of suitable habitat for freshwater pearl mussel remain within the channel with no signs of excessive siltation or pressure from macrophytes. A representative picture of the River Lickey within Area 3 is shown in Plate 4-99.



Plate 4-99 A representative photo of the River Lickey within Area 3.

4.5.4 Survey Area 4

Area 4 was the most downstream survey site and occurred over an area of 500 m, where there were historical NPWS freshwater pearl mussel records. No freshwater pearl mussel were recorded during surveys of Area 4.

The Lickey River throughout Area 4 was described as an Eroding/Upland River (FW1). The River Lickey in this survey area was typified by boulder and cobble dominated substrate. Silt and finer sediments were typically confined to the outer margins where flow was slower. A stretch of approx. 10 m was dominated by bedrock substrate. Aquatic macrophytes were very rare throughout the survey area, only occurring occasionally. Flow patterns consisted predominantly of riffle and glide with occasional pool. Large boulders created small cascades and chute flow where they occurred in close proximity to each other. The channel at this survey area was typically 6–10 m wide, and 0.2–1.2 m deep. The majority of survey area was highly shaded by both broadleaved and conifer woodland on steep banks. Areas of suitable habitat for freshwater pearl mussel remain within the channel with no signs of excessive siltation or pressure from macrophytes. A representative picture of the River within Area 4 is shown in Plate 4-100.



Plate 4-100 A representative photo of the River Lickey within Survey Area 4.

5. DISCUSSION

5.1 Proposed Wind Farm site survey sites Aquatic Baseline Discussion

Watercourses surveyed for the Proposed Wind Farm survey sites consisted primarily of Eroding/upland Rivers (FW1), with several survey sites located along the mainstem River Licky. Three sites (WF 15, 16 and 18) were located along the River Brickey, classed as a Depositing/Lowland River (FW2). Habitats surrounding the survey sites consisted primarily of Improved Agricultural Grassland (GA1), Wet Grassland (GS4), and Conifer plantation (WD4).

Survey sites constituted a diverse range of watercourses, spanning first and second order streams comprising typical headwater profiles with moderate gradients and bedrock and step-pool features (WF 1, WF 12), to larger order watercourses located within the lower extent of the catchment (WF 7, WF 9, WF 11, WF 13). The upland sites exhibited a diverse array of substrate and microhabitat characteristics, ranging from a locally dominant bedrock stream occurring over a moderate gradient (WF 1) to watercourses traversing pasture on both banks with a cobble and gravel-dominant riffle-step formations (WF 2, WF 3, WF 10, WF 14).

Upland sites on the River Goish (WF 1, WF 2) typically had semi-compacted, boulder, cobble or bedrock-dominant substrates, which limited fishery potential in terms of spawning and accessible nursery habitat for salmonids. Absence of fine sediments in these upland sites saw a lack of significant suitable nursery habitat for lamprey ammocoetes in particular. However, these sites were assessed as having at least *Moderate* fishery potential in some regard, reflected by results of electrofishing surveys at these sites which found brown trout and European eel. The watercourses with the highest overall fisheries suitability were located along the mainstem River Licky (WF 7, WF 9, WF 11 and WF 13), with salmonid holding habitat and European eel habitat assessed as *Good–Excellent*, although the dominance of coarser substrates and deeper water limited optimal spawning habitat at these sites.

Juvenile Atlantic salmon fry and parr were caught during electrofishing surveys at sites WF 4, WF 5, WF 6, WF 7, WF 9, WF 11 and WF 13, with the highest density of Atlantic salmon caught at survey site WF 13. European eel were caught at survey sites WF 2, WF 9, WF 11, WF 12, WF 13, WF 14, WF 16, WF 17 and WF 19, with the highest density caught at survey site WF 9. Lamprey *sp.* were caught at survey site WF 14 only, while Flounder were caught in high density at survey site WF 16 only. Brown trout were caught at all electrofishing sites but one (WF 17); Survey site WF 18 was not electrofished due to prohibitive depths.

Channel modifications and pressures encountered at the survey sites included vehicle or livestock ford crossings (WF 1, WF 2, WF 8, WF 9, WF 10, WF 14), livestock poaching (WF 4), raised bridge aprons acting as barriers to fish (WF 5), instream gravel/cobble banks (WF 11) and an instance of instream works (WF 13).

Invasive species encountered during surveys included stands of Himalayan balsam at survey sites WF 7, WF 8, WF 9, WF 11 and WF 13.

Water quality within the WF sites ranged from Q3 – Poor (WF 1, WF 4, WF 5, WF 8, WF 13, WF 14, WF 15, WF 16 and WF 17), to Q3–4 – Moderate (WF 2, WF 3, WF 6, WF 7, WF 10, WF 12, WF 19) to Q4 – Good (WF 9, WF 11). The vast majority of locations were not achieving Good water quality status, which shows evidence of catchment wide water quality pressures.

Fresh and old otter spraint, as well as otter prints were identified in the vicinity of survey site WF 7 along the River Licky. Potential otter slides were also identified in the vicinity of survey site WF 9 and WF 18 along the Licky and Brickey rivers, respectively, with high-quality commuting and foraging

habitat throughout each of these rivers. No otter holts or couches were identified in the vicinity of the Wind Farm survey sites at the time of survey.

3 no. kingfisher were observed commuting along the Brickey River in the vicinity of survey site WF 18. No kingfisher burrows were identified at any survey site.

The Site is located partially within the Munster Blackwater-Licky Catchment of SAC populations of freshwater pearl mussel, listed in S.I. 296 of 2009, with historic data for freshwater pearl mussel along the River Licky, most recently surveyed in 2005. eDNA surveys for freshwater pearl mussel conducted throughout the Study Area showed a positive result at survey site WF 9 along the River Licky, with Stage 1 and 2 freshwater pearl mussel surveys subsequently conducted under licence from the NPWS. Surveys were conducted along four stretches of the River Licky, with 127 live mussels and 2 no. dead mussels identified in Area 1. No other live mussels were identified in survey areas 2, 3 or 4, with enrichment and siltation pressures, as well as substrate compaction, evident in the latter areas of survey.

eDNA surveys showed no positive records of white-clawed crayfish at any of the sites surveyed for eDNA, which can be inferred as evidence of their absence at or upstream of these survey sites.

Sites surveyed at eight points of Proposed Wind Farm watercourse crossing within the Site largely consisted of narrow, laterally confined and historically modified Eroding/Upland Rivers (FW1), which were often subject to anthropogenic pressures from surrounding conifer plantations and agricultural land uses.

Watercourses at survey sites IC 1, IC 2 and IC 3 showed evidence of historic straightening and/or dredging, with overall limited instream habitat for all fish species. Survey sites IC 4, IC 5 and IC 6 represented stretches of more naturalised upland streams, with locally good salmonid nursery habitat and European eel habitat. Survey site IC 7 was subject to ongoing livestock poaching, while the watercourse at IC 8 had a manmade rock ramp which diverted the watercourse into a secondary channel via a half-pipe. All watercourses at points of proposed crossings within the Proposed Wind Farm site were subject to existing culverting.

Water quality within the IC sites ranged from Q4 – Good (IC 6, IC 8) to Q3–4 – Moderate (IC 1, IC 3, IC 4 and IC 5) to Q3 – Poor (IC 2, IC 7).

No signs of otter or kingfisher were identified at the Proposed Wind Farm watercourse crossing survey sites.

5.2 Proposed 110kV Underground Cabling Route Aquatic Baseline Discussion

Watercourses surveyed along the Proposed 110kV Underground Cabling Route consisted of stretches of Eroding/upland Rivers (FW1), with survey sites located along the Goish River. Habitats surrounding the survey sites consisted primarily of Improved Agricultural Grassland (GA1) and Conifer plantation (WD4).

The three survey sites located along the Proposed 110kV Underground Cabling Route provided overall *Good* salmonid nursery habitat, with survey site GC 2 providing particularly high-quality instream habitat for brown trout and Atlantic salmon fry and parr. While survey site GC 1 was constrained in terms of shallow depth for salmonid holding habitat and European eel habitat, survey sites GC 2 and GC 3 provided *Good* fisheries potential for adult life cycle stages for both salmonid and eel.

In terms of channel modifications, survey site GC 1 was culverted, while GC 2 showed evidence of historic poaching along the banks. Invasive species encountered during surveys included stands of Japanese knotweed at survey site GC 3.

Water quality within the GC sites ranged from Q4 – Good (GC 2, GC 3) to Q3–4 – Moderate (GC 1).

No signs of otter or kingfisher were identified at the Proposed 110kV Underground Cabling Route survey sites.

6. CONCLUSION

This report provides a comprehensive baseline of the aquatic habitats throughout the Site, as well as throughout the aquatic baseline Study Area. Several watercourses provided high-quality aquatic habitat for both fish and aquatic mammal and bird species. Sensitive aquatic receptors were identified during aquatic baseline surveys, most notably freshwater pearl mussel observed in the River Licky downstream of the Site during dedicated Stage 1 and Stage 2 freshwater pearl mussel surveys. As such, aquatic ecological receptors will be considered throughout the ecological impact assessment in Chapter 6 of the EIAR, to which this aquatic baseline report acts as an appendix.

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APPENDIX I

FISH SPECIES RECORDED DURING ELECTROFISHING SURVEYS

Appendix I: Electrofishing species records at survey locations in the vicinity of the Proposed Wind Farm						
Survey Location	Fish Species					
	European eel *(Anguilla anguilla)*	Brown trout *(Salmo trutta)*	Atlantic salmon *(Salmo salar)*	Flounder *(Platichthys flesus)*	Lamprey *(Lampetra sp.)*	Three-spined stickleback *(Gasterosteus aculeatus)*
WF 1	–	10	–	–	–	–
WF 2	1	6	–	–	–	–
WF 3	–	32	–	–	–	–
WF 4	–	27	1	–	–	10
WF 5	–	22	1	–	–	–
WF 6	–	17	2	–	–	–
WF 7	–	27	7	–	–	–
WF 8	–	7	–	–	–	–
WF 9	4	36	7	–	–	–
WF 10	–	25	–	–	–	–
WF 11	2	20	17	–	–	–
WF 12	2	23	–	–	–	–
WF 13	1	10	27	–	–	–
WF 14	1	18	–	–	3	–
WF 15	–	1	–	–	–	–
WF 16	2	4	–	69	–	9
WF 17	2	–	–	–	–	–
WF 18	Not electrofished due to prohibitive depth					
WF 19	2	19	–	–	–	–

APPENDIX II

Q-VALUES AT ALL SURVEY LOCATIONS

Appendix II: Q-Values at all Survey Locations (Proposed Wind Farm and Proposed Grid Connection Underground Cable Route)	
Survey Location	Q-Value and WFD Status
Proposed Wind Farm	
WF 1	Q3 – Poor
WF 2	Q3 - 4 – Moderate
WF 3	Q3 - 4 – Moderate
WF 4	Q3 – Poor
WF 5	Q3 – Poor
WF 6	Q3 - 4 – Moderate
WF 7	Q3 - 4 – Moderate
WF 8	Q3 – Poor
WF 9	Q4 – Good
WF 10	Q3 - 4 – Moderate
WF 11	Q4 – Good
WF 12	Q3 - 4 – Moderate
WF 13	Q3 – Poor
WF 14	Q3 – Poor
WF 15	Q3 – Poor
WF 16	Q3 – Poor
WF 17	Q3 – Poor
WF 18	Not kick-sampled due to prohibitive depth
WF 19	Q3 - 4 – Moderate
Proposed Grid Route	
GC 1	Q3 – Poor
GC 2	Q4 – Good
GC 3	Q4 – Good
Proposed Infrastructure Watercourse Crossings	
IC 1	Q3 - 4 – Moderate
IC 2	Q3 – Poor
IC 3	Q3 - 4 – Moderate
IC 4	Q3 - 4 – Moderate
IC 5	Q3 - 4 – Moderate
IC 6	Q4 – Good
IC 7	Q3 – Poor
IC 8	Q4 – Good
IC 9	Not surveyed due to inaccessibility
IC 10	Not surveyed due to inaccessibility

APPENDIX III

PROPOSED WIND FARM SITE eDNA RESULTS

Folio No:	4085-2025
Purchase Order:	240740-d
Contact:	MKO
Issue Date:	23.09.2025
Received Date:	09.09.2025

eDNA Report

Technical Report

SureScreen Scientifics

Folio No: 4085-2025
Purchase Order: 240740-d
Contact: MKO
Issue Date: 23.09.2025
Received Date: 09.09.2025

SureScreen Scientifics

eDNA Analysis

Summary

When aquatic organisms inhabit a waterbody such as a pond, lake or river they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm the presence or absence of the target species within the waterbody.

Results

Lab ID	Site Name	OS Reference	Target Species	Sample Integrity Check	Result	Positive Replicates
FK2335	Slievegrine-eDNA 12 / WF 15	52.088505, -7.724713	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3211	Slievegrine-eDNA 8	52.019819, -7.742851	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3245	Slievegrine-eDNA 9 / WF 11	52.007377, -7.757035	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0

			(Austropotamobius pallipes)			
FK3250	Slievegrine-eDNA 1 / WF 5	52.039302, -7.660685	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3251	Slievegrine-eDNA 3 / WF 6	52.007377, -7.757035	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3252	Slievegrine-eDNA 2	52.037064, -7.686511	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3253	Slievegrine-eDNA 10 / WF 1	52.057635, -7.751395	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3254	Slievegrine-eDNA 11 / WF 3	52.050211, -7.8000300	Freshwater pearl mussel	Pass	Negative	0

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			(Margaritifera margaritifera)			
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3246	Slievegrine-eDNA 7 / WF 9	52.014097, -7.712344	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Positive	6
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3247	Slievegrine-eDNA 6	52.028766, -7.729527	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3248	Slievegrine-eDNA 5	52.034603, -7.702988	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
FK3249	Slievegrine-eDNA 4	52.039267, -7.698960	Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
			White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0

Folio No:	4085-2025
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Matters affecting result: none

Reported by:Vanessa Hind

Approved by: Lauryn Jewkes

Folio No:	4085-2025
Purchase Order:	240740-d
Contact:	MKO
Issue Date:	23.09.2025
Received Date:	09.09.2025

Methodology

Samples have been analyzed for the presence of target species eDNA following readily available and scientifically published eDNA assays and protocols.

The analysis is conducted in two phases. The sample first goes through an extraction process where the filter is incubated in order to obtain any DNA within the sample. The extracted sample is then tested via real-time PCR (also called q-PCR) for each of the selected target species. This process uses species-specific molecular markers (known as primers) to amplify a select part of the DNA, allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines amplification and detection of target DNA into a single step. With qPCR, fluorescent dyes specific to the target sequence are used to label targeted PCR products during thermal cycling. The accumulation of fluorescent signals during this reaction is measured for fast and objective data analysis. The primers used in this process are specific to a part of mitochondrial DNA only found in each individual species. Separate primers are used for each of the species, ensuring no DNA from any other species present in the water is amplified. If target species DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If target DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent the risk of false positive and false negative results. True positive controls, negative controls, and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared. Stages of the analysis are also conducted in different buildings at our premises for added security. SureScreen Scientifics Ltd is ISO9001 accredited and participates in Natural England's proficiency testing scheme for GCN eDNA testing.

Interpretation of Results

Sample Integrity Check:

Laboratory Arrival:

When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results. Any samples which fail this test are rejected and eliminated before analysis.

Degradation and Inhibition check:

Analysis of the spiked DNA marker to see if there has been degradation or inhibition of the kit or sample, between the date it was made to the date of analysis. Degradation of the spiked DNA marker may indicate a risk of false negative results. If inhibition is detected, samples are purified and re-analyzed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result:

Presence of eDNA (Positive/Negative/Inconclusive)

Positive: DNA was identified within the sample, indicative of species presence within the sampling location at the time the sample was taken or within the recent past.

Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for species presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. Even a score as low as 1/12 is declared positive. 0/12 indicates negative species presence.

Negative: eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of species absence, however, does not exclude the potential for species presence below the limit of detection.

Inconclusive: Controls indicate inhibition or degradation of the sample, resulting in the inability to provide conclusive evidence for species presence or absence.

APPENDIX IV

CONFIDENTIAL APPENDIX – FRESHWATER PEARL MUSSEL STAGE 1 & 2 SURVEY RESULTS

NOT FOR PUBLIC DISSEMINATION

APPENDIX V

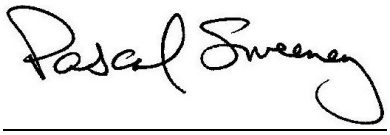
Sweeney Consultancy Review Statement

Sweeney Consultancy
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05 October, 2026

Re: Slievegrine Freshwater Pearl Mussel Review

I wish to confirm that I have reviewed the documentation relation to Freshwater Pearl Mussels in the planning application for a proposed windfarm at Slievegrine. The survey methodology and population assessment, as presented for this protected species is correct. Potential threats to the species from the proposed development have been fully assessed and adequate mitigation measures proposed. I am therefore fully satisfied that the development, as proposed in the planning application, will not negatively impact the Freshwater Pearl Mussel population of the River Licky.



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