

# **Technical Appendix 5-4 Triturus Ltd Aquatic Baseline & Fisheries Assessment**

**EIAR – Volume 3**

**Muingmore Wind Farm**

SLR Project No.: 501.065301.00001

April 2026

# Fisheries assessment of the proposed Muingmore wind farm, Co. Mayo



Prepared by Triturus Environmental Ltd. for SLR Consulting Ltd.

**January 2024**

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## Table of contents

<b>1. Introduction</b>	<b>3</b>
1.1 Background	3
1.2 Fisheries asset of the survey area	3
<b>2. Methodology</b>	<b>5</b>
2.1 Study area	5
2.2 Fisheries assessment (electro-fishing)	10
2.3 Fisheries habitat appraisal	11
2.4 Biosecurity	11
<b>3. Results</b>	<b>12</b>
3.1 Sites in vicinity of the site boundary	12
3.2 GCR sites	27
3.3 TDR sites	55
<b>4. Discussion</b>	<b>69</b>
<b>5. References</b>	<b>71</b>

## 1. Introduction

### 1.1 Background

Triturus Environmental Ltd. were commissioned by SLR Consulting Ltd. to undertake a baseline fisheries assessment of riverine watercourses and lacustrine waterbodies in the vicinity of the proposed Muingmore wind farm project, inclusive of the proposed grid connection route (GCR) and turbine delivery route (TDR), located near Gweesalia, Co. Mayo (**Figure 2.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed project. In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the vicinity of the project, a catchment-wide electro-fishing survey across 50 no. riverine sites was undertaken (**Table 2.1; Figure 2.1**). A fisheries habitat appraisal of 4 no. small pond sites in vicinity of the site boundary was also undertaken. Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for fish of high conservation value that included salmonids, European eel (*Anguilla anguilla*) and lamprey (*Lampetra* sp.). The presence of these species, inclusive of important supporting habitat, would inform mitigation to minimise impacts as a result of the proposed wind farm project.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the proposed Muingmore wind farm site boundary and associated infrastructure (i.e. GCR). The surveys were undertaken on the 16<sup>th</sup>, 17<sup>th</sup>, 18<sup>th</sup> and 19<sup>th</sup> September 2023.

### 1.2 Fisheries asset of the survey area

Given the remote and minor nature of the watercourses within and adjoining the proposed site boundary (i.e. An Mhoing Mhór River, Doolough Stream, unnamed river and tributaries), fisheries data for was not available prior to this survey.

Tullaghan Bay, to which a small unnamed river draining the proposed site joins, supports a range of common transitional and estuarine species including flounder (*Platichthys flesus*), sand goby (*Pomatoschistus minutes*), 15-spined stickleback (*Spinachia spinachia*) and sprat (*Sprattus sprattus*) (CFB, 2009).

The GCR crossed a high number of minor tributaries of the Owenmore River which is known to support Atlantic salmon (*Salmo salar*) and both brown and sea trout (*Salmo trutta*). The Owenmore is a regionally important salmonid river and is ranked 16<sup>th</sup> nationally in terms of the accessible fluvial habitat to Atlantic salmon (McGinnity et al., 2003). The Owenmore is a noted recreational salmon and sea trout fishery (O'Reilly, 2009) and, after several years of failure, has met its conservation limit for Atlantic salmon since 2021 (TEGOS, 2023). In addition to salmonids, the Owenmore is also known to support European eel (*Anguilla anguilla*), minnow (*Phoxinus phoxinus*), three-spined stickleback (*Gasterosteus aculeatus*) and lamprey (*Lampetra* sp.) (Triturus 2022 data).

The River Deel (34D01) is crossed by the proposed TDR in Crossmolina, Co. Mayo (where proposed TDR works are required adjacent to the watercourse). The Deel is a designated salmonid watercourse

under the European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293/1988) and is a renowned recreational Atlantic salmon fishery. The river is also known to support brown trout, pike (*Esox lucius*), roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), European eel, three-spined stickleback (*Gasterosteus aculeatus*) and minnow (Kelly et al., 2012, 2009; O'Connor, 2004). The Deel supports spawning sea lamprey (*Petromyzon marinus*) as far upstream as Ballycarroon Falls (in relatively high densities), approximately 2.5km upstream of Crossmolina, with *Lampetra* sp. also present both upstream and downstream Crossmolina (O'Connor, 2004).

TDR works are also proposed adjacent to the Ballysodare (Ballisodare) River at Ballysodare, Co. Sligo. The Ballysodare River is known to support Atlantic salmon, brown trout, European eel; *Lampetra* sp., minnow, perch, pike, roach and three-spined stickleback (IFI 2010-2014 data). The river is of very high value as a recreational Atlantic salmon fishery.

Fisheries data for the other survey watercourses was not available prior to this proposed survey.

## 2. Methodology

### 2.1 Study area

A catchment-wide fisheries survey of 54 no. sites in the vicinity of the proposed Muingmore wind farm project, inclusive of the proposed GCR and TDR, was conducted on 15<sup>th</sup>, 16<sup>th</sup>, 17<sup>th</sup>, 18<sup>th</sup> and 19<sup>th</sup> September 2023 following notification to Inland Fisheries Ireland. The catchment wide approach ensured a robust overview of fisheries related constraints associated with the proposed project.

**Table 2.1** Location of  $n=54$  electro-fishing survey and fisheries appraisal sites in the vicinity of the proposed Muingmore wind farm, Co. Mayo

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
<b>Site boundary</b>					
A1	Unnamed river	n/a	Doolough	476621	821708
A2	Unnamed river	n/a	L1205 road crossing	476276	820290
B1	Unnamed river	n/a	Muingmore	477254	822741
B2	Unnamed river	n/a	Muingmore	476726	822456
B3	Unnamed river	n/a	Muingmore	477114	822551
B4	Unnamed stream	n/a	Muingmore	477522	822770
B5	Unnamed river	n/a	Tristia	477290	822433
B6	Unnamed river	n/a	L1206 road crossing	477615	821039
C1	An Mhoing Mhór River	33M23	Muingmore	477156	823702
C2	Doolough Stream	33D02	Muingmore	476448	824226
C3	Unnamed stream	n/a	Muingmore	476180	823731
C4	Doolough Stream	33D02	Muingmore	475540	824268
C5	Doolough Stream	33D02	L1205 road crossing	474976	824774
P1*	Pond	n/a	Doolough	476635	822197
P2*	Pond	n/a	Muingmore	476112	822824
P3*	Pond	n/a	Muingmore	475845	822946
P4*	Pond	n/a	Doolough	477354	821591
<b>GCR crossings</b>					
D1	Unnamed stream	n/a	Goolamore	480285	821634
D2	Goolamore River	33G12	Drumanaffrin	481247	822676
D3	Munhin River	33M03	Kilteany	482176	823361
D4	Unnamed river	n/a	Srahmore	484848	823084
D5	Ballybeg Stream	33B40	Srahanarry	486351	823100
D6	Srahanarry Stream	33S23	Srahanarry	487383	823093
D7	Bellanumera Stream	33B38	Briska	487539	822966
D8	Briska River	33B33	Briska	487705	822687
D9	Unnamed stream	n/a	Briska	487788	822587
D10	Unnamed stream	n/a	Briska	487844	822510
D11	Unnamed river	n/a	Briska	490185	822080

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
D12	Unnamed river	n/a	Largan More	490513	822401
D13	Unnamed river	n/a	Largan More	490568	822412
D14	Unnamed stream	n/a	Largan More	490739	822418
D15	Unnamed stream	n/a	Largan More	490894	822413
D16	Unnamed river	n/a	Largan More	491092	822422
D17	Unnamed stream	n/a	Largan More	491297	822394
D18	Unnamed stream	n/a	Largan More	491335	822381
D19	Unnamed stream	n/a	Largan Beg	491399	822356
D20	Unnamed stream	n/a	Largan Beg	491900	822061
D21	Unnamed stream	n/a	Largan Beg	491988	822011
D22	Unnamed stream	n/a	Tawnaghmore	493063	821706
D23	Unnamed stream	n/a	Tawnaghmore	493360	821686
D24	Unnamed river	n/a	Tawnaghmore	493659	821685
D25	Unnamed river	n/a	Ballymonnelly Bridge	493983	821377
D26	Unnamed stream	n/a	Killsallagh	495239	820469
D27	Killsallagh Stream	33K13	Killsallagh	495346	820428
D28	Unnamed stream	n/a	Killsallagh	495834	820410
D29	Unnamed stream	n/a	Bellacorick	496398	820409
D30	Unnamed stream	n/a	Bellacorick	496504	820323
<b>TDR nodes</b>					
E1	Moneynierin River	33M16	Moneynierin	497643	819577
E2	River Deel	34D01	Crossmolina Bridge	513655	817586
E3	Ballisodare River	35B05	Knoxspark	566745	829045
E4	Carrowgobbadagh Stream	35C95	Carrowgobbadagh	567482	830457
E5	Abbeylands Stream	36A15	Coolcholly	588235	862284
E6	Drumgowan Stream	37D49	Tullygallan	593620	875619
E7	Bogside River	37B26	Dunkineely	576176	875950

\* fisheries appraisal only

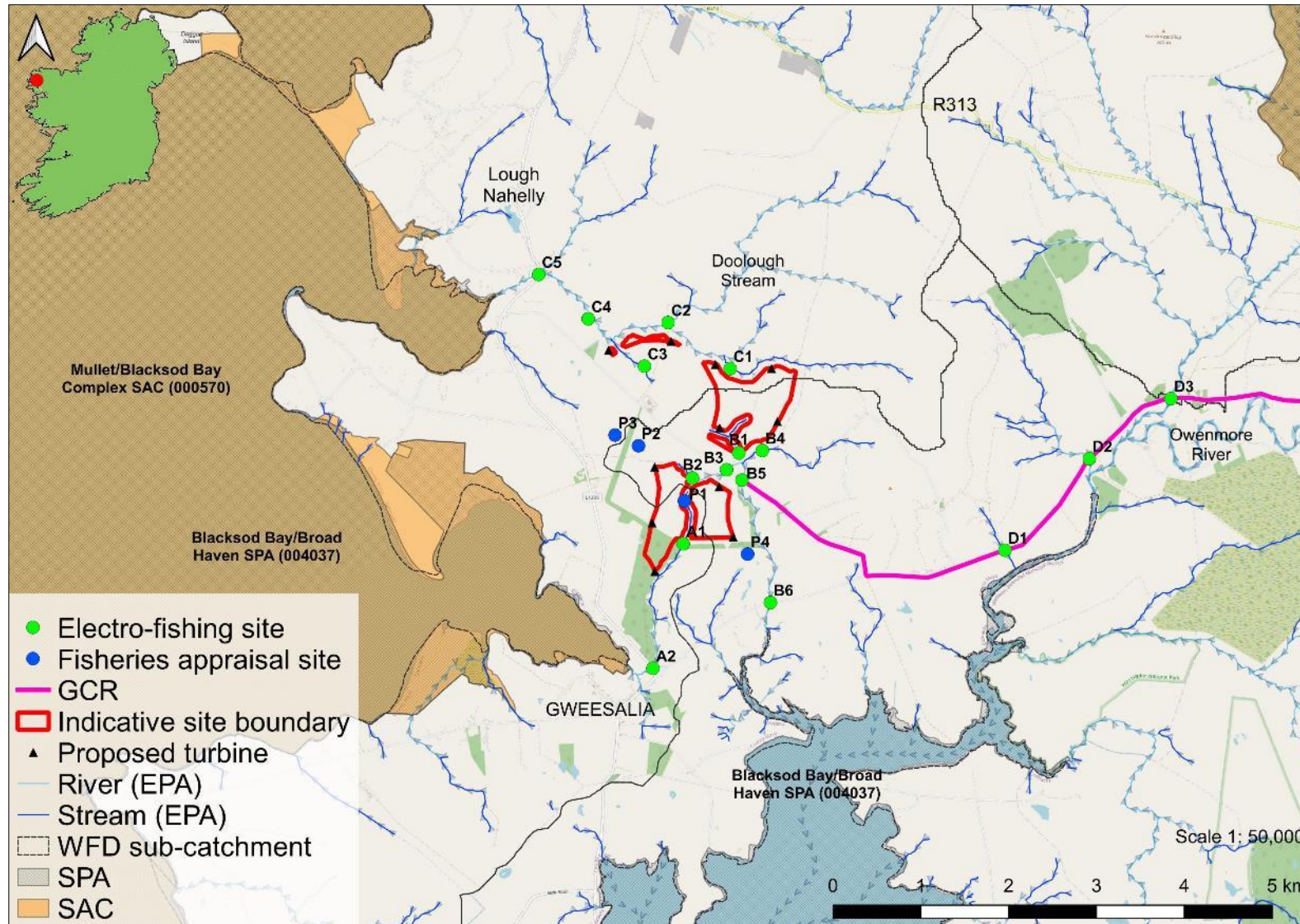


Figure 2.1 Overview of the electro-fishing & fisheries appraisal survey sites in the vicinity of the proposed Muingmore wind farm site boundary, Co. Mayo

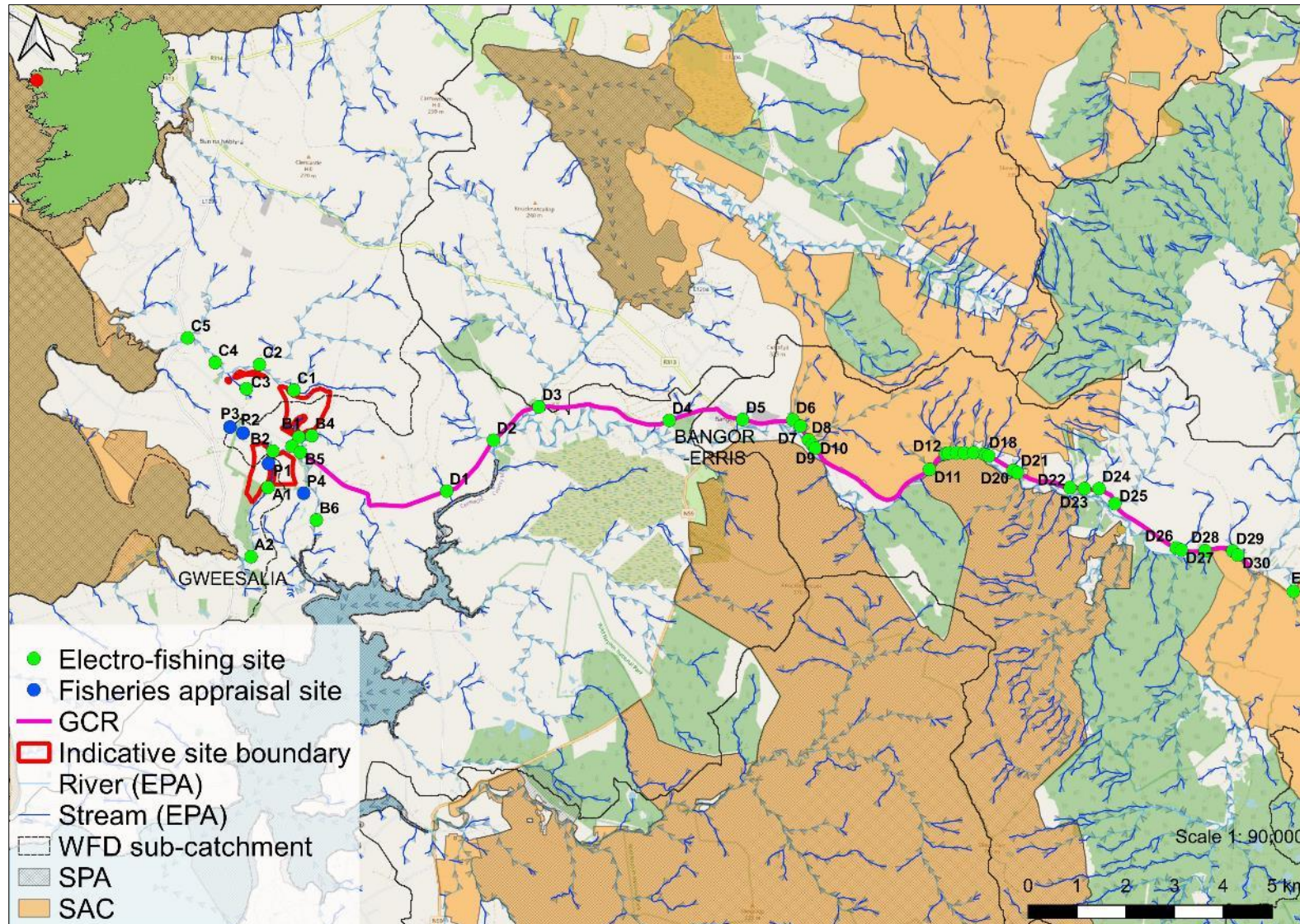


Figure 2.2 Overview of the electro-fishing survey sites in the vicinity of the proposed Muingmore wind farm GCR, Co. Mayo

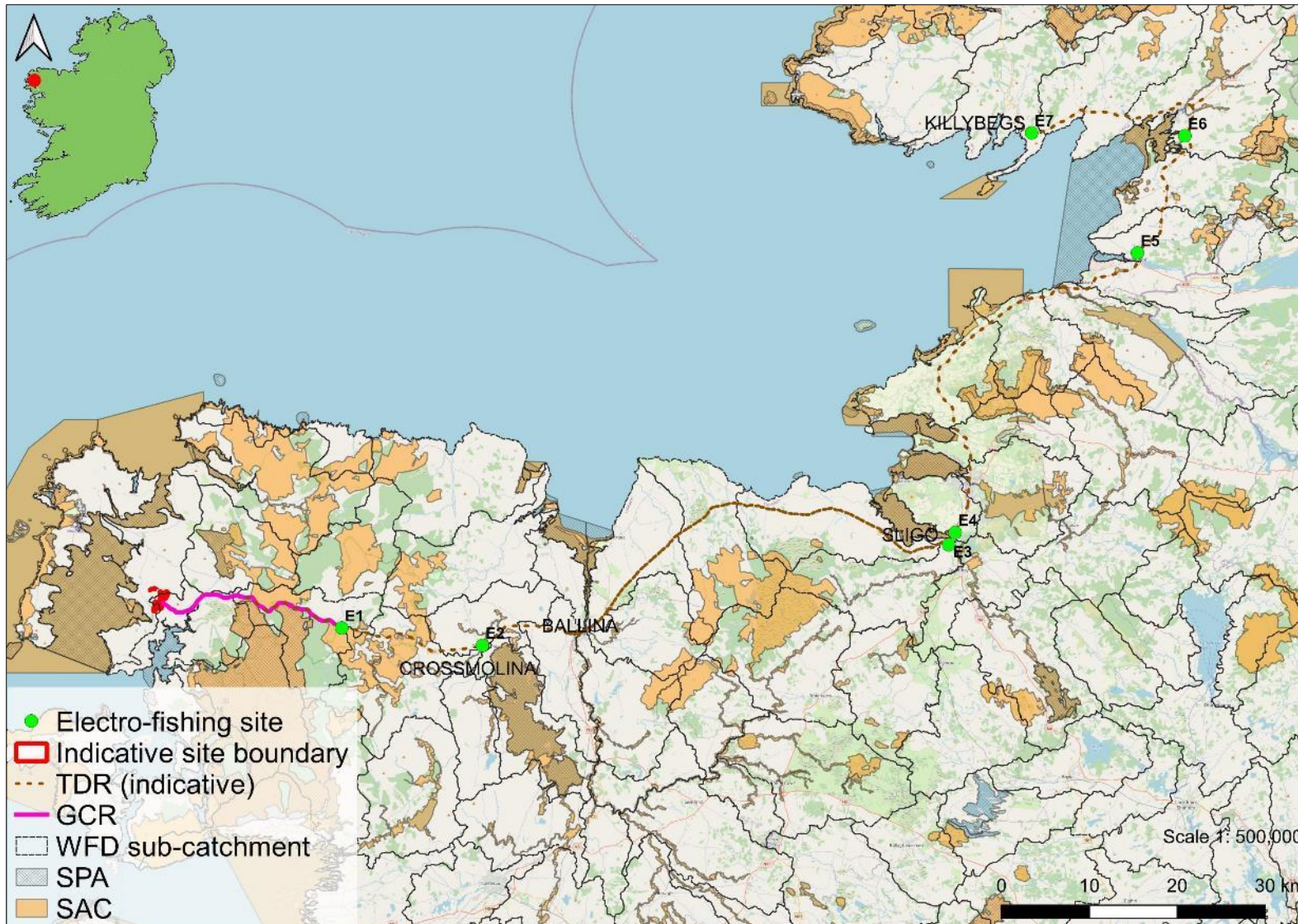


Figure 2.3 Overview of the electro-fishing survey sites in the vicinity of the proposed Muingmore wind farm TDR, Co. Mayo

## 2.2 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on riverine watercourses in the vicinity of the proposed Muingmore wind farm project in September 2023 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The catchment-wide electro-fishing (CWEF) survey was undertaken across 13 no. riverine sites, with a fisheries habitat appraisal completed at Lough na gCeann (see **Table 2.1, Figure 2.1**).

Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank. Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel was surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

### 2.2.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 40-75m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages. At certain sites with limited access (e.g. high average depths), it was more feasible to undertake electro-fishing for a 5-minute CPUE. Discrepancies in fishing effort (CPUE) between sites are provided in the results section (**Table 3.2**).

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the low conductivity waters of the sites (mostly igneous geologies) a voltage of 280-350v, frequency of 35-45Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

### 2.2.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in

sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, approx. 10-15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

### 2.3 Fisheries habitat appraisal

A fisheries habitat appraisal of all 54 no. sites was undertaken to establish the importance of the supporting habitats as nursery, spawning and or holding habitats. The appraisal surveys focused on evaluating the spawning, nursery and or holding habitat for salmonids and lamprey species but also considered European eel and other fish species. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.).

### 2.4 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Particular cognisance was given towards preventing the spread or introduction of crayfish plague (*Aphanomyces astaci*) (known from the catchment; Triturus 2022 data). Furthermore, staff did not undertake any work in a known crayfish plague catchment for a period of <72hrs in advance of the survey. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

### 3. Results

The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery, spawning and or holding habitat for salmonids, European eel, lamprey and other fish species. Scientific names are provided at first mention only. The results are summarised below with regards to sites in the vicinity of the wind farm site boundary and situated on the GCR and TDR.

#### 3.1 Sites in vicinity of the site boundary

##### 3.1.1 Site A1 – unnamed river, Doolough

No fish were recorded via electro-fishing at site A1 on an unnamed river (no EPA code) adjoining the site boundary. The site was not of fisheries value given its heavily modified and heavily silted nature.

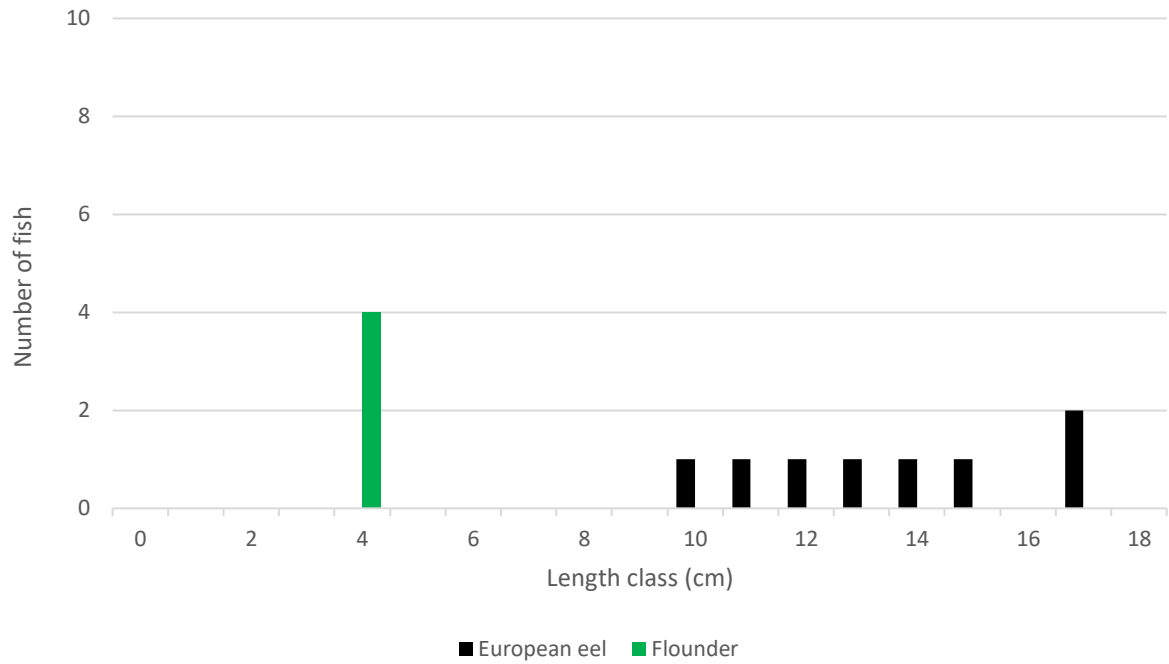


**Plate 3.1** Representative image of site A1 on an unnamed river, September 2023

##### 3.1.2 Site A2 – unnamed river, Doolough

European eel (*Anguilla anguilla*) ( $n=8$ ) and flounder (*Platichthys flesus*) ( $n=4$ ) were recorded via electro-fishing at site A2 on the lower, tidal reaches of an unnamed river (**Figure 3.1**).

The tidal channel was a good nursery for European eel and transitional fish (namely flounder) but did not support salmonid fish. The narrow channel was of poor suitability as a holding habitat for migratory salmonids (such as sea trout). There was no suitability for lamprey and the species was not recorded.



**Figure 3.1** Length frequency distribution recorded via electro-fishing at site A1, September 2023



**Plate 3.2** Representative image of site A2 on the tidal reaches of a small, unnamed river, September 2023

### 3.1.3 Site B1 – unnamed river, Muingmore

No fish were recorded via electro-fishing at site B1 on the upper reaches of a small unnamed tributary of Tullaghan Bay. The site was not of fisheries value given historical modifications, heavy siltation and poor flows.



**Plate 3.3** Representative image of site B1 on an unnamed Tullaghan Bay tributary, September 2023

#### 3.1.4 Site B2 – unnamed river, Muingmore

No fish were recorded via electro-fishing at site B2 on the upper reaches of a small unnamed tributary of Tullaghan Bay. The site was not of fisheries value given historical modifications, heavy siltation and poor flows.



**Plate 3.4** Representative image of site B2 on an unnamed Tullaghan Bay tributary, September 2023

### 3.1.5 Site B3 – unnamed river, Muingmore

No fish were recorded via electro-fishing at site B3 on a small unnamed tributary of Tullaghan Bay. The site was not of fisheries value given historical modifications, heavy siltation and poor flows.

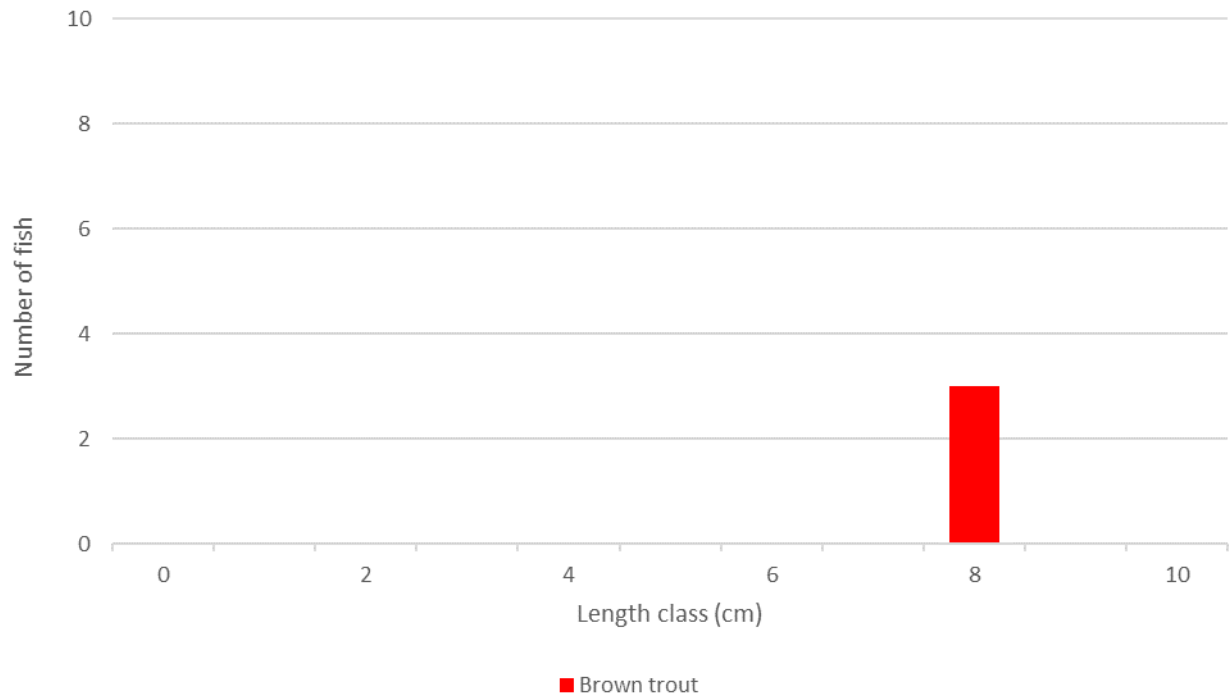


**Plate 3.5** Representative image of site B3 on an unnamed Tullaghan Bay tributary, September 2023

### 3.1.6 Site B4 – unnamed stream, Muingmore

Brown trout (*Salmo trutta*) ( $n=3$ ) was the only fish species recorded via electro-fishing at site B4 on a small unnamed tributary of Tullaghan Bay (**Figure 3.2**).

Given the stream's very small size and heavily modified nature it was only a poor quality brown trout nursery with a small population of 0+ fish recorded. The quality of salmonid spawning habitat was poor given the presence of heavily bedded boulder, cobble and scattered gravels with high siltation (by peat). The holding value for adult fish was poor given the very limited pool habitat. Despite some low suitability for European eel, none were recorded. The site was unsuitable for lamprey and the species was not recorded.



**Figure 3.2** Length frequency distribution recorded via electro-fishing at site B4, September 2023

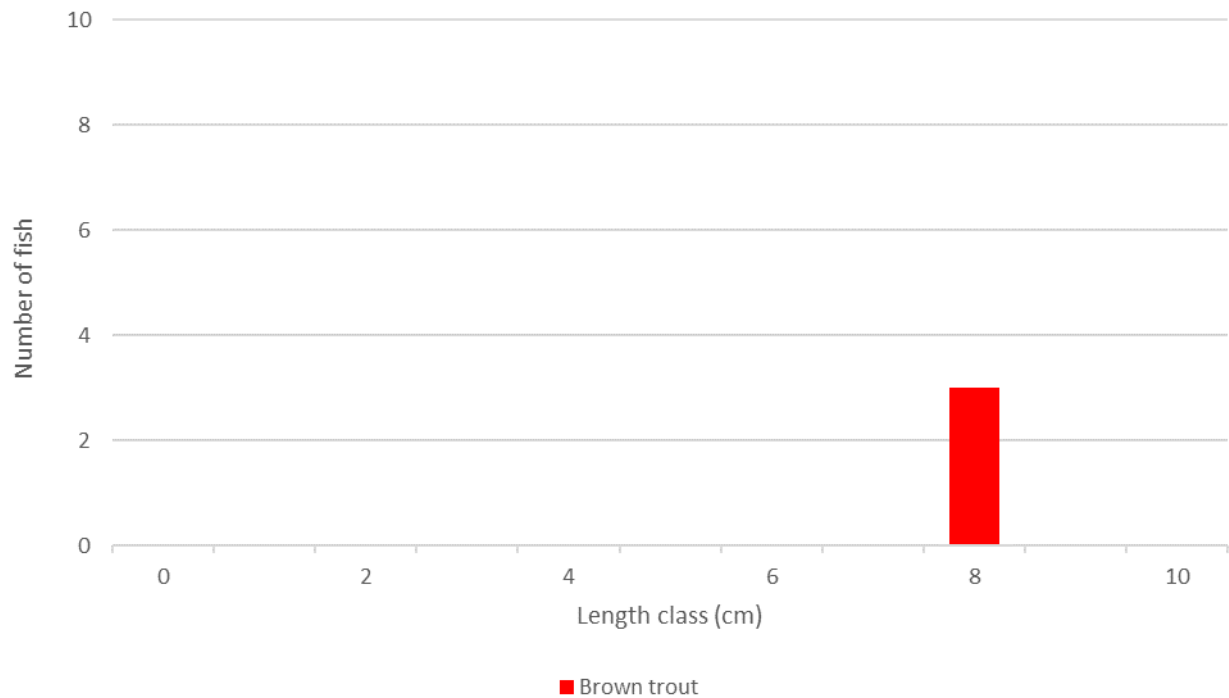


**Plate 3.6** Representative image of site B4 on an unnamed Tullaghan Bay tributary, September 2023

### 3.1.7 Site B5 – unnamed river, Tristia

Brown trout ( $n=20$ ) was the only fish species recorded via electro-fishing at site B5 on a small unnamed tributary of Tullaghan Bay (**Figure 3.3**).

Despite historical drainage the stream was considered a good quality brown trout nursery given it supported a good density of mixed cohort trout. Spawning habitat was of moderate quality given the presence of mixed gravels in pool and deeper glide but was reduced because of siltation pressures. Despite some suitability for European eel, none were recorded (superior habitats present downstream). The site was of too high an energy to support lamprey and no soft sediment settlement areas supporting ammocoetes were present.



**Figure 3.3** Length frequency distribution recorded via electro-fishing at site B5, September 2023

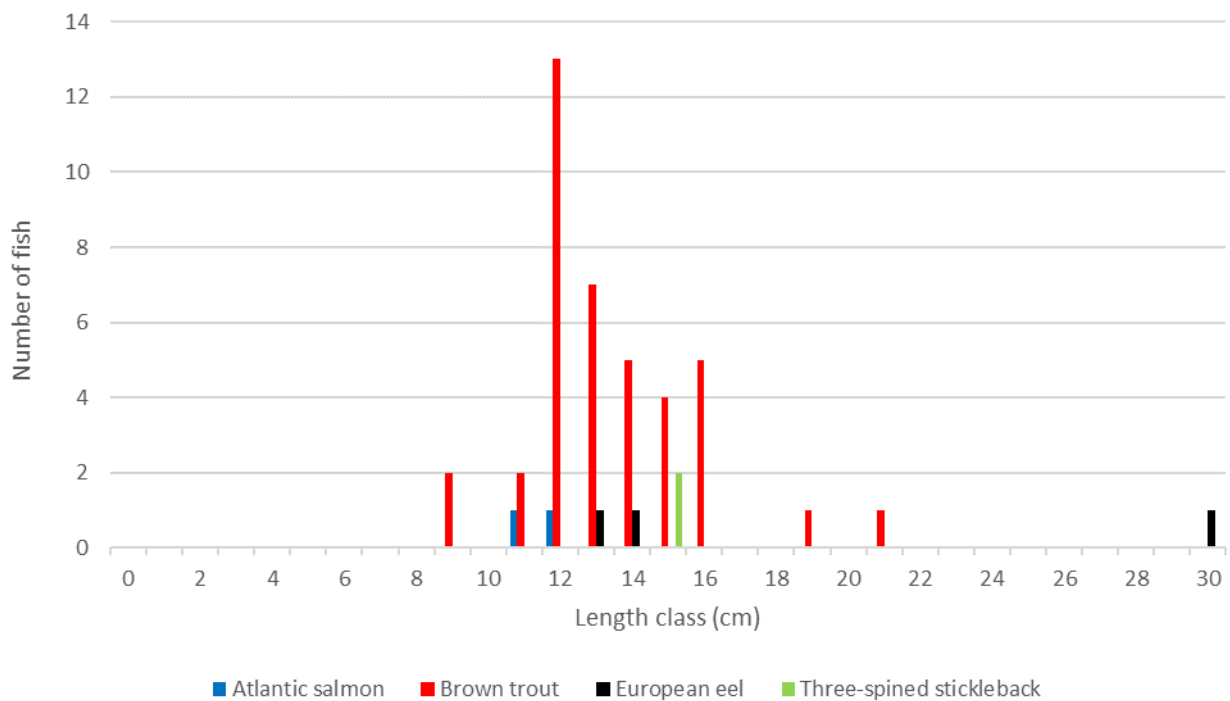


**Plate 3.7** Representative image of site B5 on an unnamed Tullaghan Bay tributary, September 2023

### 3.1.8 Site B6 – unnamed river, Doolough

Atlantic salmon (*Salmo salar*) ( $n=2$ ), brown trout ( $n=40$ ), European eel (*Anguilla anguilla*) ( $n=3$ ) and three-spined stickleback (*Gasterosteus aculeatus*) ( $n=1$ ) were recorded via electro-fishing at site B6 on the lower reaches of an unnamed tributary of Tullaghan Bay (**Figure 3.4**).

The site was a good quality salmonid nursery that supported a good density of trout and a low density of Atlantic salmon. The presence of deeper glide and a rocky bed provided refugia that were however compromised by siltation and eutrophication pressures in addition to historical drainage (i.e. deepening). Salmonid spawning habitat was of moderate quality, being reduced because of siltation and enrichment despite the presence of mixed gravels in deeper glide and pool pockets. Abundant deep glide provided good quality holding habitat for adult salmonids but would have improved with riparian tree cover (that was absent). The watercourse was a moderate quality eel nursery given the presence of deeper water with rocky refugia with a small population recorded present. The upland eroding site was unsuitable for lamprey and the species was not recorded present.



**Figure 3.4** Length frequency distribution recorded via electro-fishing at site B6, September 2023



**Plate 3.8** European eel recorded at site B6 on an unnamed Tullaghan Bay tributary, September 2023

### 3.1.9 Site P1 – pond, Doolough

Site P1 was located at a small 0.2ha elliptical pond adjacent to the proposed site boundary. Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had good suitability for a small brown trout population (despite an absence of inflowing watercourses) and also had high suitability for European eel given close proximity to nearby upland eroding streams and drainage channels. Both species were detected via eDNA sampling (**Appendix B**).



**Plate 3.9** Representative image of site P1, September 2023

### 3.1.10 Site P2 – pond, Muingmore

Site P2 was located at a small 0.35ha irregular-shaped pond adjacent to the proposed site boundary. Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had good suitability for European eel given close proximity to nearby upland eroding streams and drainage channels. Suitability for brown trout was poor given the shallow depths. Whilst brown trout were not recorded via eDNA sampling (thus considered absent), European eel were detected present (**Appendix B**).



**Plate 3.10** Representative image of site P2, September 2023

### 3.1.11 Site P3 – pond, Muingmore

Pond P3 was located at a small 0.4ha pond adjacent to (west of) site P2. Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had moderate suitability for brown trout and high suitability for European eel and both species were detected via eDNA sampling (**Appendix B**).



**Plate 3.11** Representative image of site P3, September 2023

### 3.1.12 Site P4 – pond, Doolough

Site P4 was located at a small 0.65ha pond adjacent to the proposed site boundary. Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had good suitability for brown trout and European eel and both species were detected via eDNA sampling (**Appendix B**).



**Plate 3.12** Representative image of site P4, September 2023

### 3.1.13 Site C1 – An Mhoing Mhór River, Muingmore

No fish were recorded via electro-fishing at site C1 on the Mhoing Mhór River (EPA code: 33M23), a tributary of the Doolough Stream adjacent to the site boundary. The river was not of fisheries value at this location given its heavily modified nature and siltation pressures.

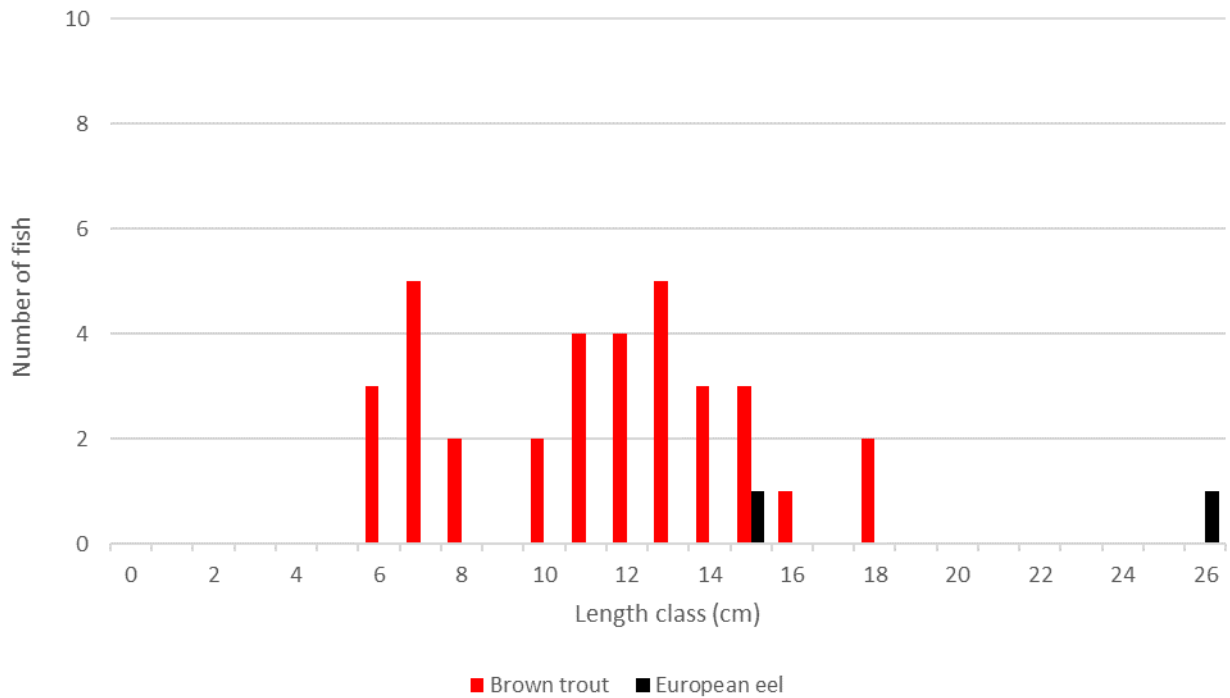


**Plate 3.13** Representative image of site C1 on the Mhoing Mhór River, September 2023

### 3.1.14 Site C2 – Doolough Stream, Muingmore

Good densities of brown trout ( $n=34$ ) and a low density of European eel ( $n=2$ ) were recorded via electro-fishing at site C2 on the Doolough Stream (33D02) adjacent to the site boundary (**Figure 3.5**).

The site was a good quality salmonid nursery despite historical drainage, siltation and enrichment pressures with a relatively high density of mixed cohort trout. Salmonid spawning habitat was moderate given the presence of mixed gravels in pool and deeper glide as with areas downstream (e.g. site C4) but was reduced because of siltation and enrichment pressures. Suitability for European eel was moderate with a small population of adults present. No soft sediment settlement areas suitable for lamprey ammocoetes were identified and the species was not recorded present.



**Figure 3.5** Length frequency distribution recorded via electro-fishing at site C2 on the Doolough Stream, September 2023



**Plate 3.14** Mixed cohort brown trout recorded at site C2 on the Doolough Stream, September 2023

### 3.1.15 Site C3 – unnamed stream, Muingmore

No fish were recorded via electro-fishing at site C3 on an unnamed tributary of the Doolough Stream adjacent to the site boundary (**Appendix A**). The site was not of fisheries value at this location given its ephemeral nature and historical modifications.

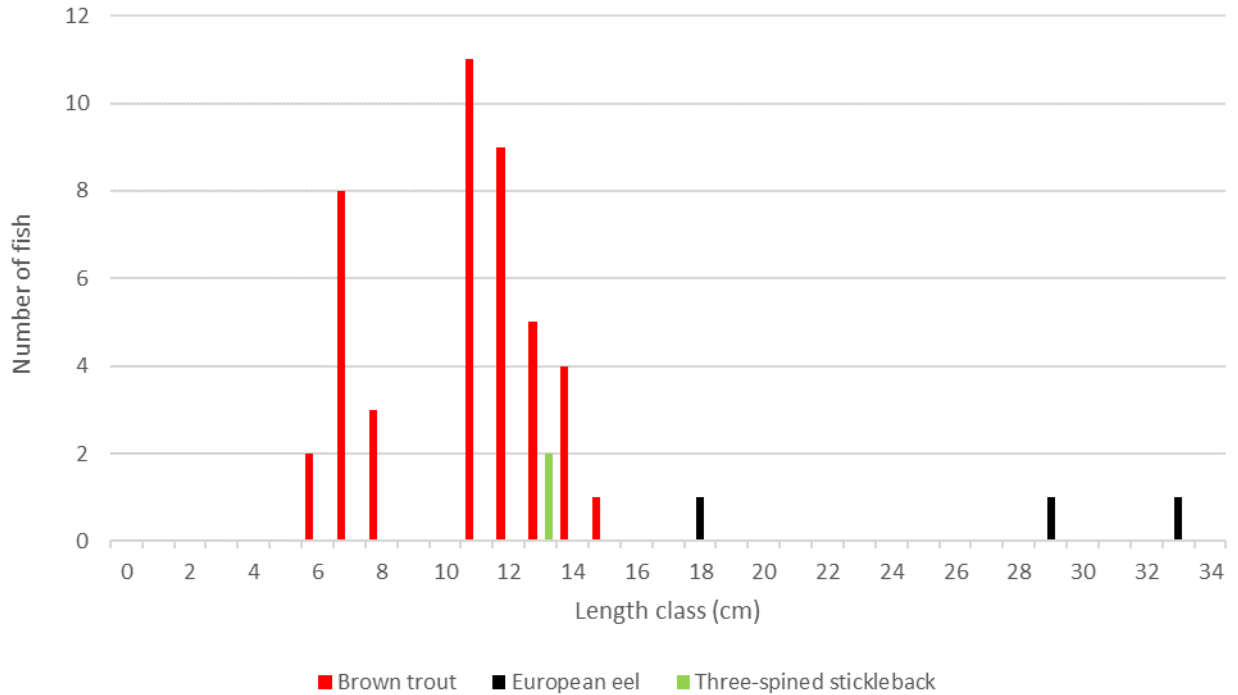


**Plate 3.15** Representative image of site C3 on an unnamed Doolough Stream tributary, September 2023

#### 3.1.16 Site C4 – Doolough Stream, Muingmore

A good density of brown trout ( $n=43$ ) and a low density of European eel ( $n=3$ ) with small numbers of three-spined stickleback ( $n=2$ ) were recorded via electro-fishing at site C4 on the Doolough Stream (33D02). The survey area was approximately 1.2km downstream of site C2 (**Figure 3.6**).

Despite historical drainage and siltation pressures, the site was a good quality salmonid nursery supporting as supported by the good density of juvenile trout. Localised pools and instream boulder provided valuable holding areas for adult salmonids although the quality of the holding habitat was poor overall (shallow water). Mixed gravels provided moderate quality salmonid spawning habitat, with the value reduced due to siltation. The site was of moderate value for European eel with a low density of adults recorded. No soft sediment settlement areas suitable for lamprey ammocoetes were identified and the species was not recorded.



**Figure 3.6** Length frequency distribution recorded via electro-fishing at site C4 on the Doolough Stream, September 2023

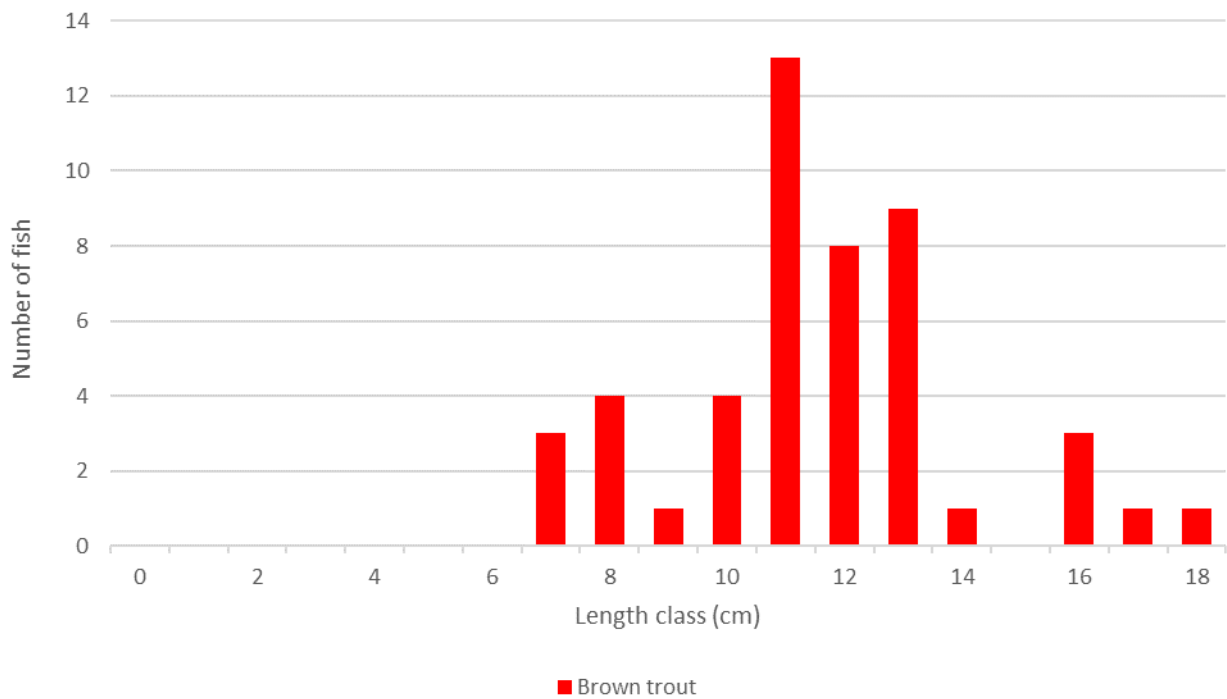


**Plate 3.16** Silver European eel recorded at site C4 on the Doolough Stream, September 2023

### 3.1.17 Site C5 – Doolough Stream, Muingmore

Brown trout ( $n=48$ ) was the only fish species recorded via electro-fishing at site C5 on the Doolough Stream (33D02) at the L1205 local road crossing approximately 0.9km downstream of site C4 (**Figure 3.7**).

The site was a good quality salmonid nursery supporting a relatively high density of juvenile trout. The presence of deeper glide and a rocky bed provided refugia but these were impacted by siltation and eutrophication pressures in addition to historical drainage (i.e. deepening). Salmonid spawning habitat was of moderate quality. Abundant deep glide provided good quality holding habitat for adult salmonids. The site was a moderate quality European eel nursery given the presence of deeper water with ample refugia but none were recorded. No soft sediment settlement areas suitable for lamprey ammocoetes were identified and the species was not recorded present.



**Figure 3.7** Length frequency distribution recorded via electro-fishing at site C5 on the Doolough Stream, September 2023



**Plate 3.17** Brown trout recorded at site C5 on the Doolough Stream, September 2023

## 3.2 GCR sites

### 3.2.1 Site D1 – unnamed stream, Goolamore

No fish were recorded via electro-fishing at site D1 on an unnamed tributary of the Owenmore River. The site was not of fisheries value at this location given the narrow channel width and depth and historical drainage pressures.

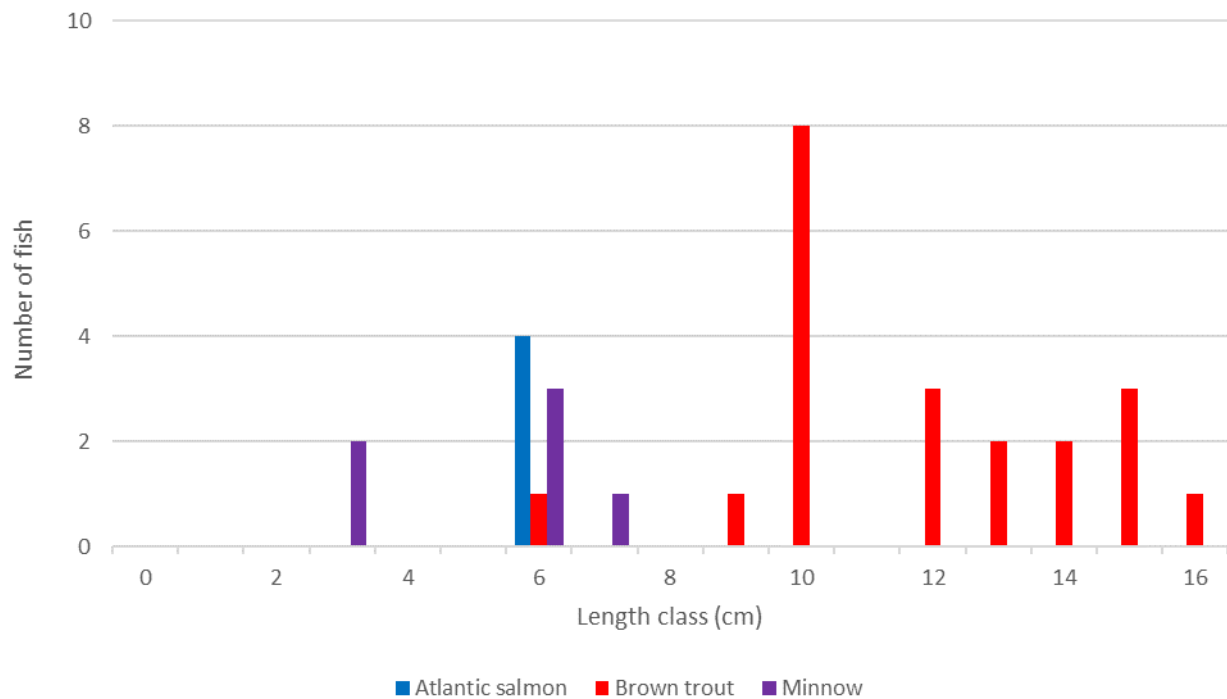


**Plate 3.18** Representative image of site D1 on an unnamed Owenmore tributary, September 2023

### 3.2.2 Site D2 – Goolamore River, Drumanaffrin

Atlantic salmon ( $n=4$ ), brown trout ( $n=21$ ) and minnow ( $n=6$ ) were recorded via electro-fishing at site D2 on the Goolamore River (33G12), a tributary of the Owenmore River (**Figure 3.8**).

The site was a moderate quality salmonid nursery given the stoney bed, shallow glide and pool habitat with mixed cohort populations present. Moderate quality salmonid spawning habitat was present in deeper glide and pool where mixed gravels (compromised by siltation pressures). Deeper glide and pool downstream of the road crossing provided some valuable holding habitat for adult salmonids. Soft sediment accumulations were shallow and flocculent and largely unsuitable for lamprey ammocetes (none recorded). While there some low suitability for European eel, none were recorded.



**Figure 3.8** Length frequency distribution recorded via electro-fishing at site D2 on the Goolamore River, September 2023

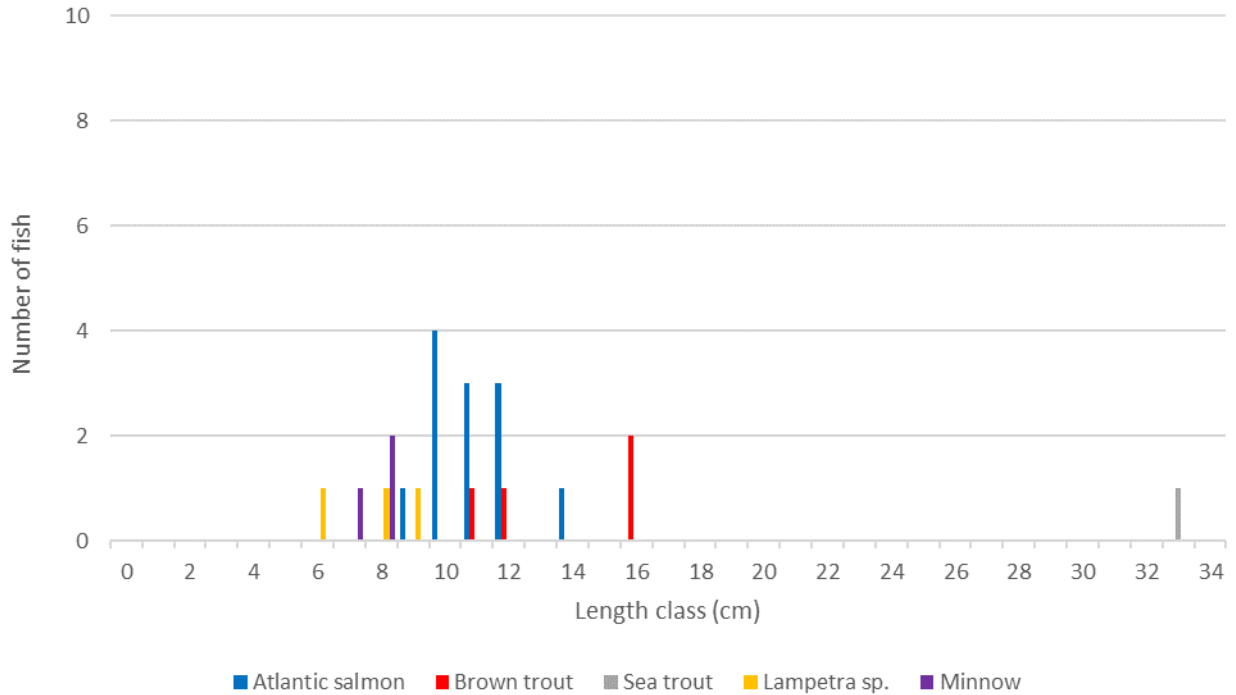


**Plate 3.19** Brown trout (top) and Atlantic salmon (bottom) of site D2 on the Goolamore River, September 2023

### 3.2.3 Site D3 – Munhin River, Kiltteany

Atlantic salmon ( $n=12$ ), brown trout ( $n=4$ ), sea trout ( $n=1$ ), lamprey (*Lampetra* sp.) ( $n=3$ ), minnow ( $n=3$ ) and flounder ( $n=3$ ) were recorded via electro-fishing at site D3 on the Munhin River (33M03), a major tributary of the Owenmore (**Figure 3.9**). This was the highest species diversity recorded during the survey.

The site was a good quality salmonid nursery (especially downstream of the bridge) given the stoney bed, shallow glide and riffle areas with macrophyte vegetation. The quality of spawning habitat for salmonid and lamprey was good given the presence of mixed gravels in deeper pool and glide. Holding habitat was also of good quality with deep pool and glide pockets. The site featured moderate quality lamprey nursery habitat in sands below the bridge cutwaters and in the channel margins - these areas supported a low density population of ammocoetes. While some good suitability for European eel existed (i.e. boulder and cobble refugia and deeper water) none were recorded.



**Figure 3.9** Length frequency distribution recorded via electro-fishing at site D3 on the Munhin River, September 2023



**Plate 3.20** Sea trout recorded at site D3 on the Munhin River, September 2023

### 3.2.4 Site D4 – unnamed river, Srahmore

No fish were recorded via electro-fishing at site D4 on an unnamed tributary of the Owenmore River. The site was of poor fisheries value given the narrow channel width and depth, poor flows and historical drainage pressures.



**Plate 3.21** Representative image of site D4 on an unnamed Owenmore River tributary, September 2023

### 3.2.5 Site D5 – Ballybeg Stream, Srahanarry

No fish were recorded via electro-fishing at site D5 on the Ballybeg Stream (33B40), a tributary of the Owenmore River. The site was of poor fisheries value given the narrow channel width and depth and poor flows.

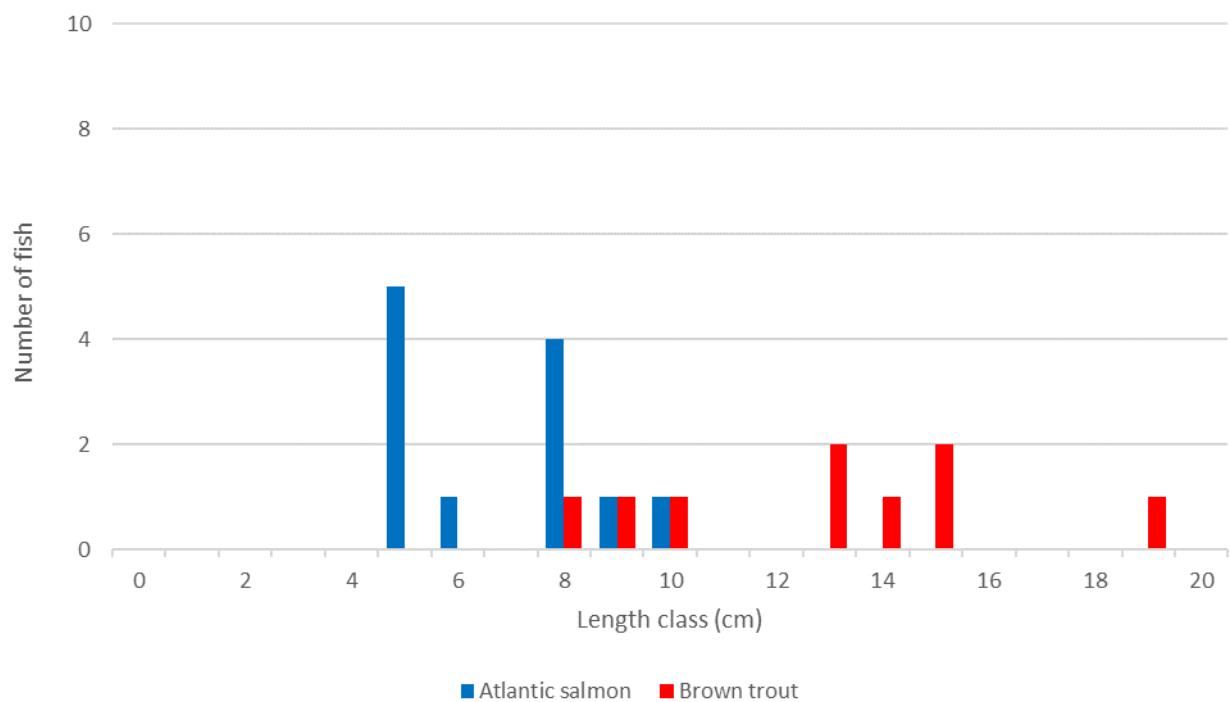


**Plate 3.22** Representative image of site D5 on the Ballybeg Stream, September 2023

### 3.2.6 Site D6 – Srahanarry Stream, Srahanarry

Atlantic salmon ( $n=12$ ) and brown trout ( $n=9$ ) were recorded via electro-fishing at site D6 on the Srahanarry Stream (33S23), a tributary of the Owenmore River (**Figure 3.10**).

The site was a good quality salmonid nursery given the stoney bed with riffle, glide and pool sequences that provided refugia and oxygenated water. Mixed gravels in deeper glide and pool (provided good quality salmonid spawning habitat. The site was a moderate quality holding habitat for adult salmonids (apart from the deep pool immediately below the N59 crossing, which was of higher value). The bridge crossing was considered a significant barrier to salmonids given the vertical 2m fall between the apron and the pool below. Despite some low suitability for European eel, none were recorded. The high energy channel was unsuitable for lamprey and none were recorded.



**Figure 3.10** Length frequency distribution recorded via electro-fishing at site D6 on the Srahanarry Stream, September 2023



**Plate 3.23** Juvenile salmonids recorded at site D6 on the Srahanarry Stream, September 2023

### 3.2.7 Site D7 – Bellanumera Stream, Briska

No fish were recorded via electro-fishing at site D7 on the Bellanumera Stream (33B38), a tributary of the Owenmore River. The site was of poor fisheries value given the narrow channel width and depth and poor flows.

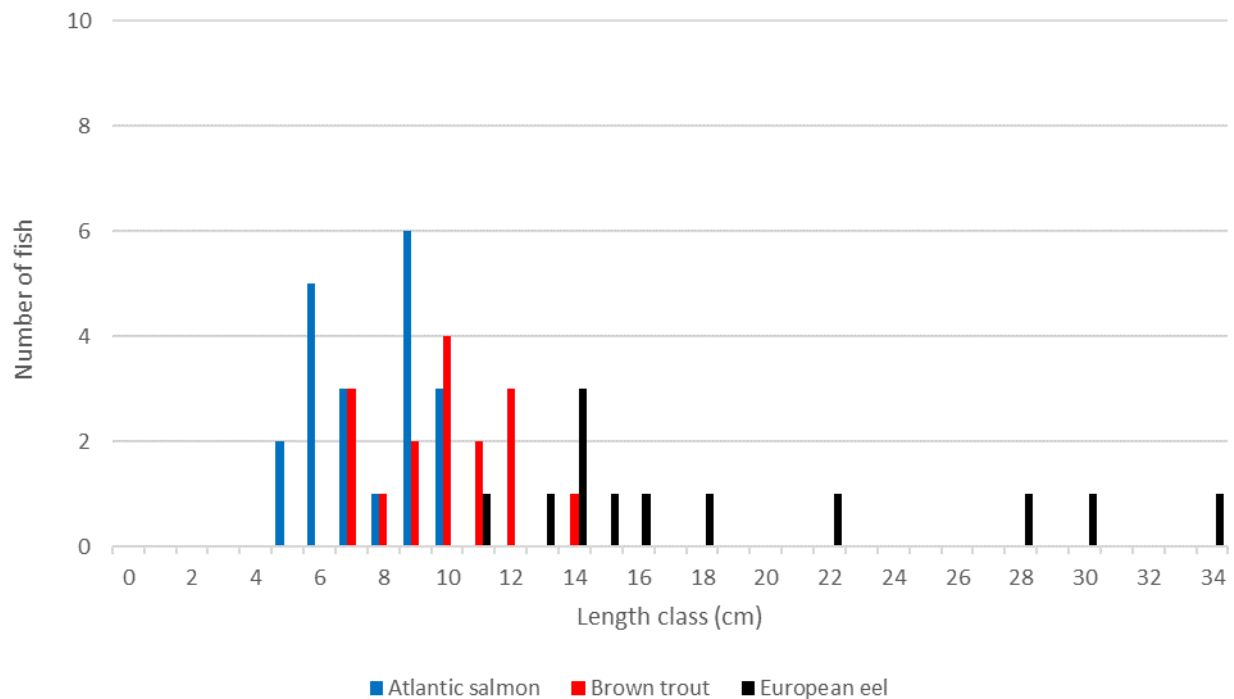


**Plate 3.24** Representative image of site D7 on the Bellanumera Stream, September 2023

### 3.2.8 Site D8 – Briska River, Briska

Atlantic salmon ( $n=20$ ), brown trout ( $n=16$ ) and European eel ( $n=12$ ) were recorded via electro-fishing at site D8 on the Briska River (33B33), a tributary of the Owenmore River (**Figure 3.11**).

The site was a very good quality salmonid nursery given the stoney bed, riffle, glide and pool sequences that provided refugia and oxygenated water. Good quality spawning habitat was present locally good in the deeper glide and in pool where mixed gravels were present (improving upstream). The holding habitat quality was moderate (again improved upstream of the N59 crossing). The site was also a very important European eel nursery with a high density of eels recorded. The high energy site was unsuitable for lamprey and none were recorded.



**Figure 3.11** Length frequency distribution recorded via electro-fishing at site D8 on the Briska River, September 2023



**Plate 3.25** Adult European eel recorded at site D8 on the Briska River, September 2023

### 3.2.9 Site D9 – unnamed stream, Briska

No fish were recorded via electro-fishing at site D9 on an unnamed tributary of the Owenmore River. The site was of poor fisheries value given the narrow channel width and depth, poor flows and historical modifications.



**Plate 3.26** Representative image of site D9, September 2023

### 3.2.10 Site D10 – unnamed stream, Briska

No fish were recorded via electro-fishing at site D10 on an unnamed tributary of the Owenmore River. The site was of poor fisheries value given the narrow channel width and depth, poor flows and historical modifications.



**Plate 3.27** Representative image of site D10, September 2023

### 3.2.11 Site D11 – unnamed river, Briska

No fish were recorded via electro-fishing at site D11 on an unnamed tributary of the Owenmore River. The site was not of fisheries value given the narrow channel width and depth, poor flows and high natural gradients.



**Plate 3.28** Representative image of site D11, September 2023

### 3.2.12 Site D12 – unnamed river, Largan More

Site D12 on an unnamed tributary of the Owenmore River was dry at the time of survey. The high gradient, ephemeral channel was not of fisheries value.



**Plate 3.29** Representative image of site D12, September 2023 (dry channel)

### 3.2.13 Site D13 – unnamed river, Largan More

Site D13 on an unnamed tributary of the Owenmore River was dry at the time of survey. The high gradient, ephemeral channel was not of fisheries value.



**Plate 3.30** Representative image of site D13, September 2023 (dry channel)

### 3.2.14 Site D14 – unnamed stream, Largan More

Site D14 on an unnamed tributary of the Owenmore River was dry at the time of survey. The high gradient, ephemeral channel was not of fisheries value.



**Plate 3.31** Representative image of site D14, September 2023 (dry channel)

### 3.2.15 Site D15 – unnamed stream, Largan More

Site D15 on an unnamed tributary of the Owenmore River was dry at the time of survey. The high gradient, ephemeral channel was not of fisheries value.



**Plate 3.32** Representative image of site D15, September 2023

### 3.2.16 Site D16 – unnamed river, Largan More

Site D16 on an unnamed tributary of the Owenmore River was dry at the time of survey. The high gradient, ephemeral channel spilling over bedrock was not of fisheries value.



**Plate 3.33** Representative image of site D16, September 2023 (dry channel)

### 3.2.17 Site D17 – unnamed stream, Largan More

Site D17 on an unnamed tributary of the Owenmore River was dry at the time of survey. The high gradient, ephemeral channel was not of fisheries value.

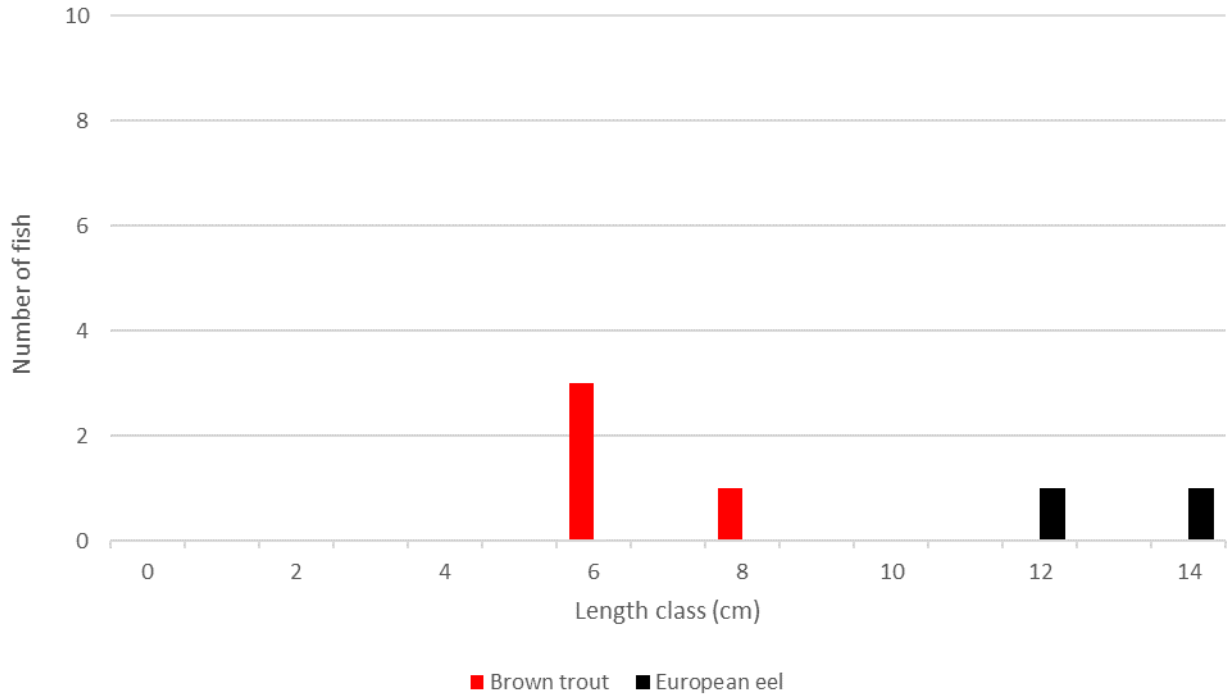


**Plate 3.34** Representative image of site D17, September 2023 (dry channel)

### 3.2.18 Site D18 – unnamed stream, Largan More

Brown trout ( $n=4$ ) and European eel ( $n=2$ ) were the only fish species recorded via electro-fishing at site D18 on an unnamed Owenmore River tributary (**Figure 3.12**).

The narrow, shallow, high gradient site was moderate quality nursery for salmonids and only a small population was recorded. Spawning habitat was localised and impacted by siltation pressures. The site was not of value as a holding area for adult salmonids. The stream was of moderate value for European eel given the presence of boulder, cobble and pool refugia with a low density of fish recorded. The high energy site was unsuitable for lamprey and none were recorded.



**Figure 3.12** Length frequency distribution recorded via electro-fishing at site D18 on an unnamed Owenmore River tributary, September 2023



**Plate 3.35** Juvenile European eel recorded at site D18, September 2023

### 3.2.19 Site D19 – unnamed stream, Largan Beg

Site D19 on an unnamed tributary of the Owenmore River was dry at the time of survey. The heavily modified, ephemeral drainage channel was not of fisheries value.



**Plate 3.36** Representative image of site D19, September 2023 (dry channel)

### 3.2.20 Site D20 – unnamed stream, Largan Beg

No fish were recorded via electro-fishing at site D20 on an unnamed Owenmore River tributary. The small, silted drainage channel featured no flows with stagnant pools of peaty water only at the time of survey and was unsuitable for resident fish.



**Plate 3.37** Representative image of site D20, September 2023

### 3.2.21 Site D21 – unnamed stream, Largan Beg

No fish were recorded via electro-fishing at site D21 on an unnamed Owenmore River tributary. The narrow, historically modified upland stream had no flows and stagnant shallow pools only at the time of survey and was unsuitable for resident fish.

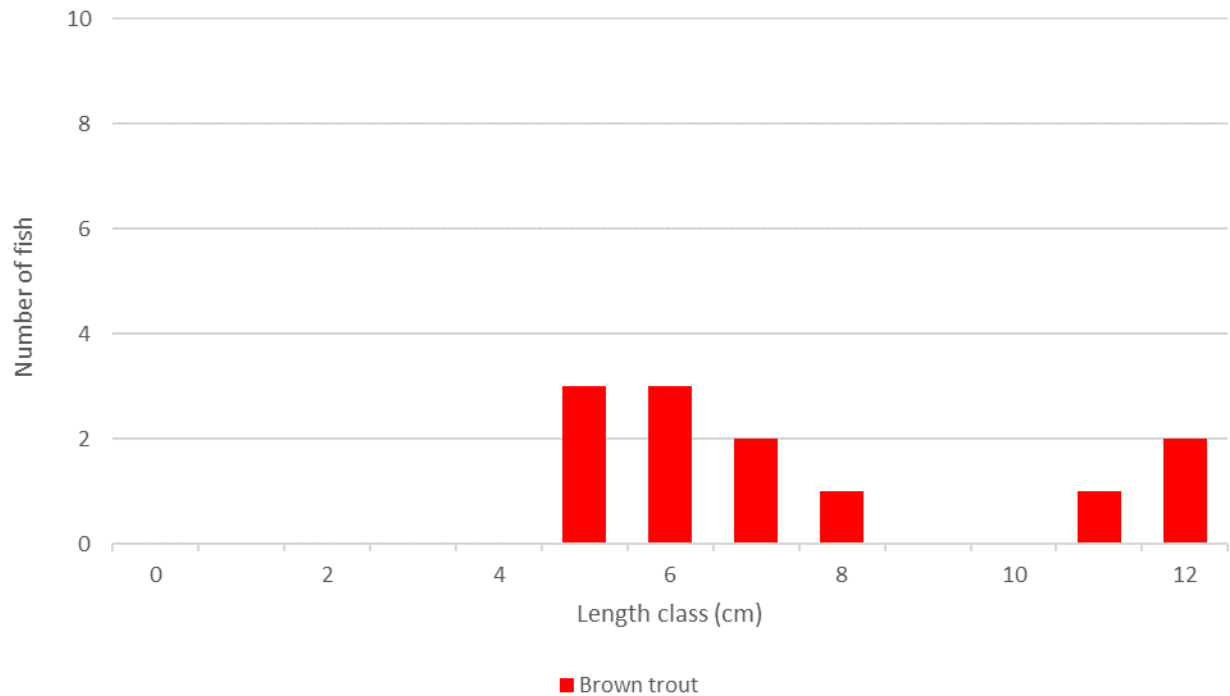


**Plate 3.38** Representative image of site D21, September 2023

### 3.2.22 Site D22 – unnamed stream, Tawnaghmore

Brown trout ( $n=12$ ) were the only fish species recorded via electro-fishing at site D22 on an unnamed Owenmore River tributary (**Figure 3.13**).

The meandering stream at this location was as a moderate quality salmonid nursery, supporting a small mixed cohort population. The presence of shallow glide and riffle with a rocky bed provided sufficient refugia habitat for juveniles. The spawning value was locally moderate being reduced by siltation pressures. The quality of holding habitat was poor given the absence of pool. The site offered some low value as a European eel nursery albeit none were recorded. The high energy, upland stream was unsuitable for lamprey.



**Figure 3.13** Length frequency distribution recorded via electro-fishing at site D22 on an unnamed Owenmore River tributary, September 2023



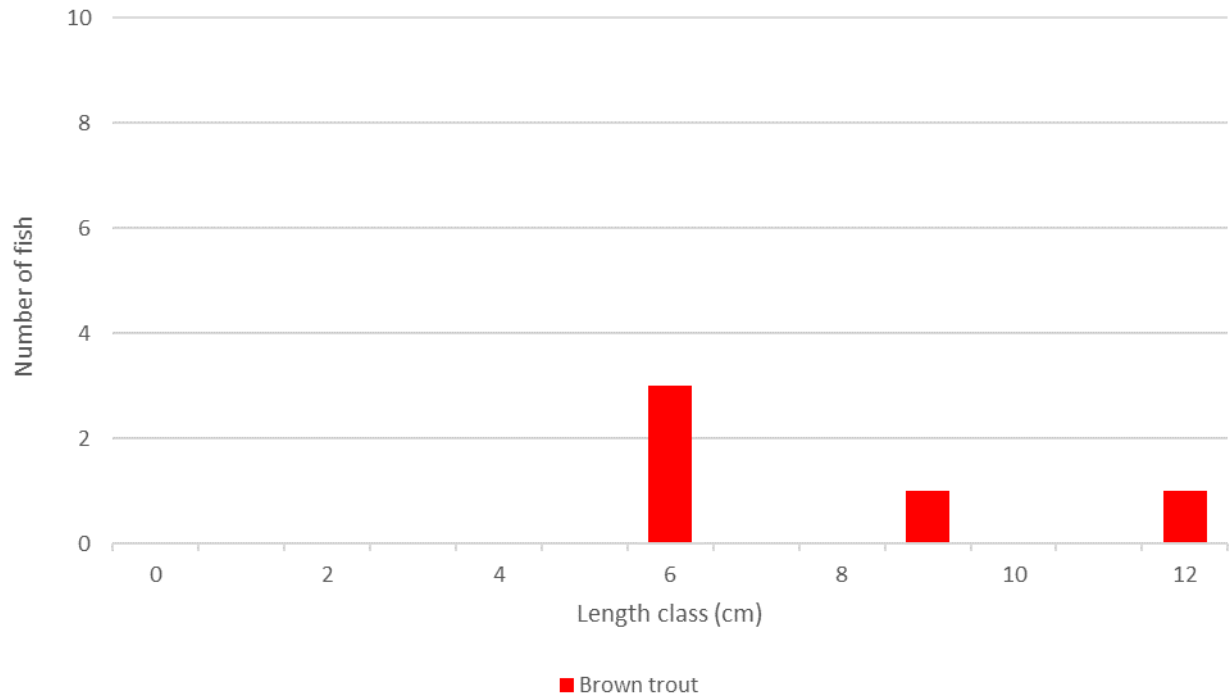
**Plate 3.39** Representative image of site D22, September 2023

### 3.2.23 Site D23 – unnamed stream, Tawnaghmore

Brown trout ( $n=5$ ) were the only fish species recorded via electro-fishing at site D23 on an unnamed Owenmore River tributary (**Figure 3.14**).

The site was a poor to moderate quality salmonid nursery give low summer flows and siltation

pressures. The spawning value of the site (moderate) was also reduced by siltation pressures. Holding habitat for adult salmonids was moderate given limited deeper pool habitat. The site was of some lower value for European eel (ample refugia) but none were recorded. The upland stream was unsuitable for lamprey.



**Figure 3.14** Length frequency distribution recorded via electro-fishing at site D23 on an unnamed Owenmore River tributary, September 2023

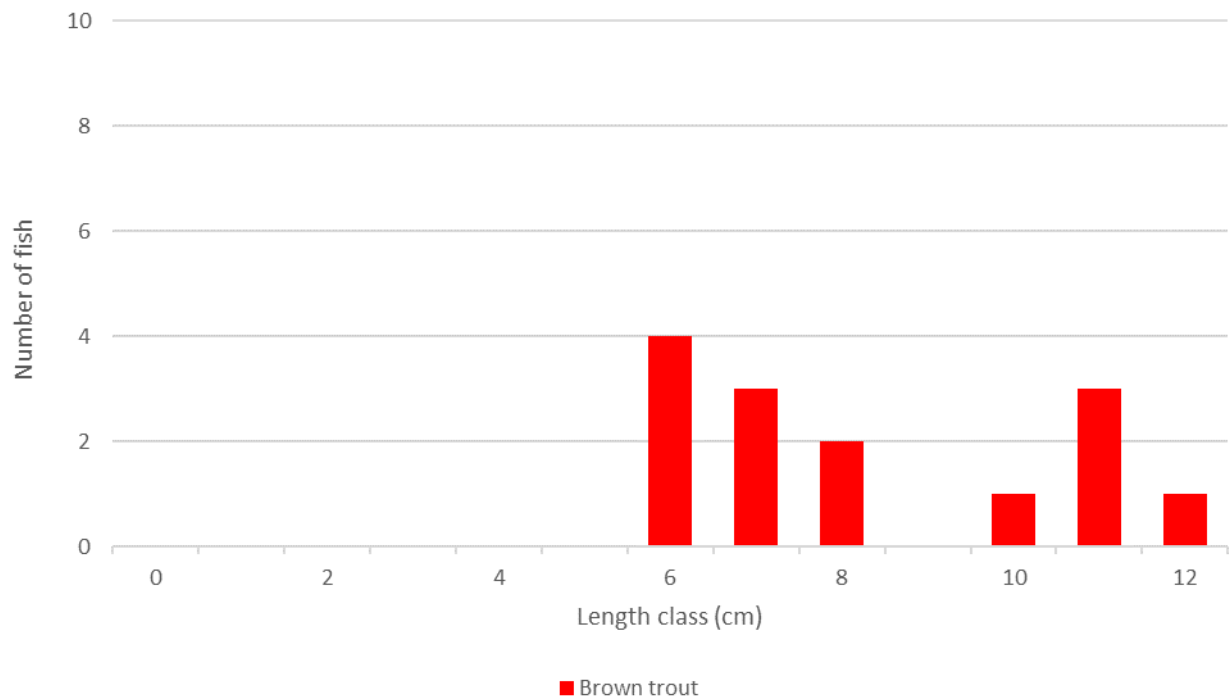


**Plate 3.40** Representative image of site D23, September 2023

### 3.2.24 Site D24 – unnamed river, Tawnaghmore

Brown trout ( $n=5$ ) were the only fish species recorded via electro-fishing at site D24 on an unnamed Owenmore River tributary (**Figure 3.15**).

The site was a moderate quality salmonid nursery with a moderate density mixed cohort population recorded. The presence of shallow glide and pools with a rocky bed provided sufficient refugia habitat for juveniles. The spawning value of the site (moderate) was reduced by siltation pressures. Holding habitat was good for upland brown trout given the presence of deeper pool habitat provided some good quality holding habitat for adult salmonids (trout only). The site was of some lower value for European eel (ample refugia) but none were recorded. The upland stream was unsuitable for lamprey.



**Figure 3.15** Length frequency distribution recorded via electro-fishing at site D24 on an unnamed Owenmore River tributary, September 2023

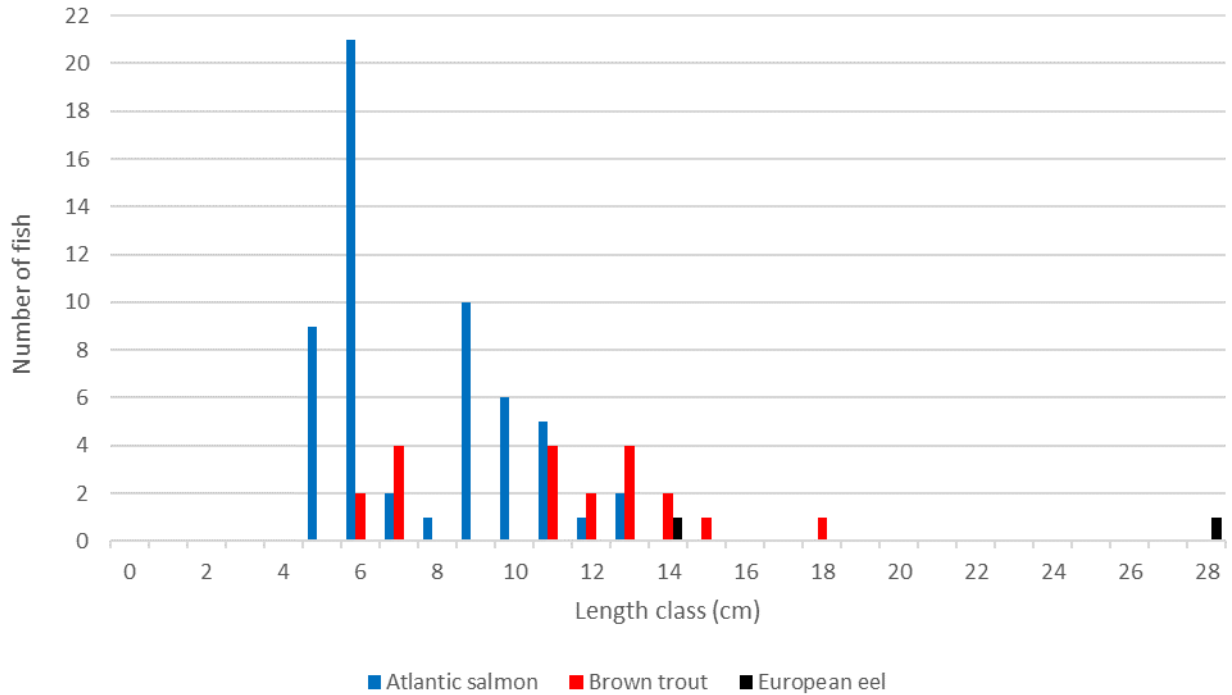


**Plate 3.41** Representative image of site D24, September 2023

### 3.2.25 Site D25 – unnamed river, Ballymonnelly Bridge

Atlantic salmon ( $n=57$ ), brown trout ( $n=20$ ) and European eel ( $n=2$ ) were recorded via electro-fishing at site D25 on an unnamed Owenmore River tributary (**Figure 3.16**).

The site was an excellent quality salmonid nursery, with high densities of Atlantic salmon and moderate densities brown trout present. Good quality spawning habitat was present locally in deeper pools and glide and the value was reduced only by siltation and enrichment pressures. The site was a moderate quality holding habitat only given a paucity of deeper glide and pool. Moderate quality European eel habitat was present by way of ample refugia, pool habitat and food resources and a small population was recorded. The high energy upland stream was unsuitable for lamprey and none were recorded.



**Figure 3.16** Length frequency distribution recorded via electro-fishing at site D25 on an unnamed Owenmore River tributary, September 2023



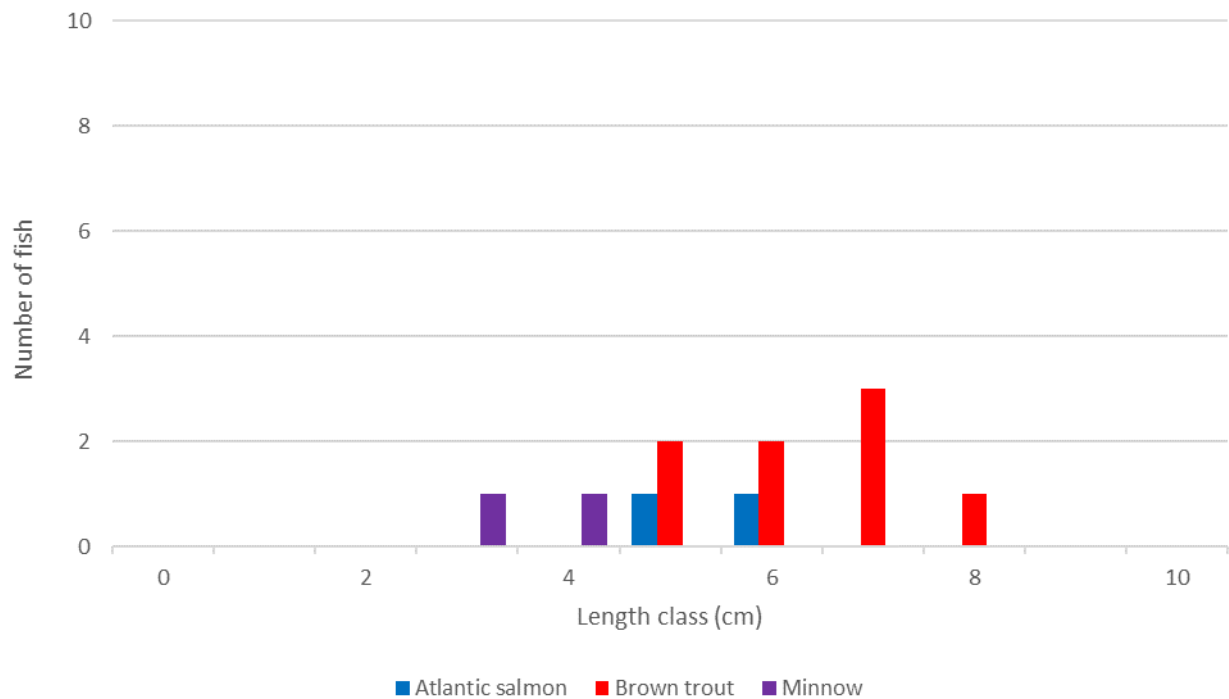
**Plate 3.42** Atlantic salmon parr recorded at site D25, September 2023

### 3.2.26 Site D26 – unnamed stream, Killsallagh

Atlantic salmon ( $n=2$ ), brown trout ( $n=8$ ) and minnow ( $n=2$ ) were recorded via electro-fishing at site D26 on an unnamed Owenmore River tributary (**Figure 3.17**).

The site was a moderate quality salmonid nursery given mixed coarse substrata and broken flow

patterns that provided refugia but only a small population of 0+ and 1+ fish was present. The site was of poor value as a salmonid spawning habitat due to limited suitable substrata (siltation pressures). The quality of holding habitat was also poor given the paucity of pools. Instream cobble and boulder refugia and prey resources provided some moderate suitability for European eel although the species was not recorded. The high energy upland stream was unsuitable for lamprey.



**Figure 3.17** Length frequency distribution recorded via electro-fishing at site D26 on an unnamed Owenmore River tributary, September 2023



**Plate 3.43** Representative image of site D26, September 2023

### 3.2.27 Site D27 – Killsallagh Stream, Killsallagh

Site D27 on the Killsallagh Stream (33K13), a tributary of the Owenmore River, was dry at the time of survey. The heavily modified, ephemeral channel was not of fisheries value.



**Plate 3.44** Representative image of site D27 on the Killsallagh Stream, September 2023 (dry channel)

### 3.2.28 Site D28 – unnamed stream, Killsallagh

Site D28 on an unnamed tributary of the Owenmore River was dry at the time of survey. The heavily modified, ephemeral drainage channel was not of fisheries value.

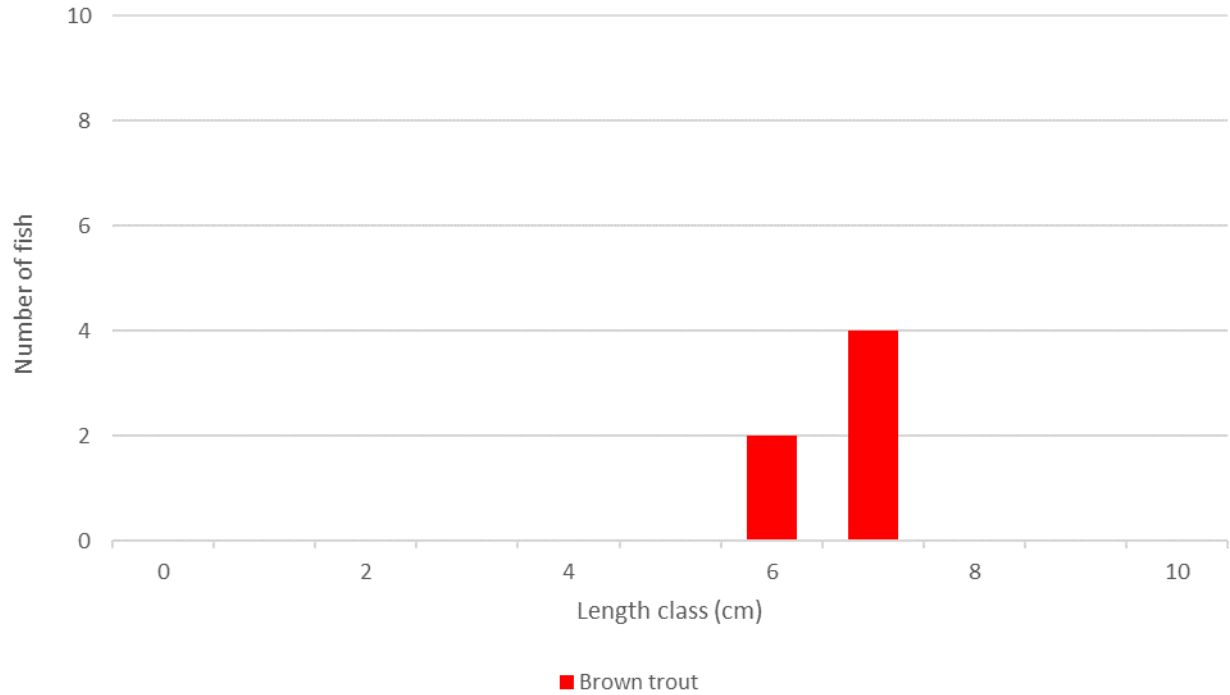


**Plate 3.45** Representative image of site D28, September 2023 (dry channel)

### 3.2.29 Site D29 – unnamed stream, Bellacorick

Brown trout ( $n=6$ ) were the only fish species recorded via electro-fishing at site D29 on an unnamed Owenmore River tributary (**Figure 3.18**).

The site was a poor to moderate quality salmonid nursery given the stream's small size and very low summer flows. However, the presence of mixed coarse substrata and broken flow patterns provided refugia for the small population of 0+ fish. Clean gravels were limited due to siltation and the site was of poor value as a spawning habitat. The value as a holding habitat was also poor given the paucity of pools. Despite some suitability for European eel (instream refugia), none were recorded. The upland stream was unsuitable for lamprey.



**Figure 3.18** Length frequency distribution recorded via electro-fishing at site D29 on an unnamed Owenmore River tributary, September 2023



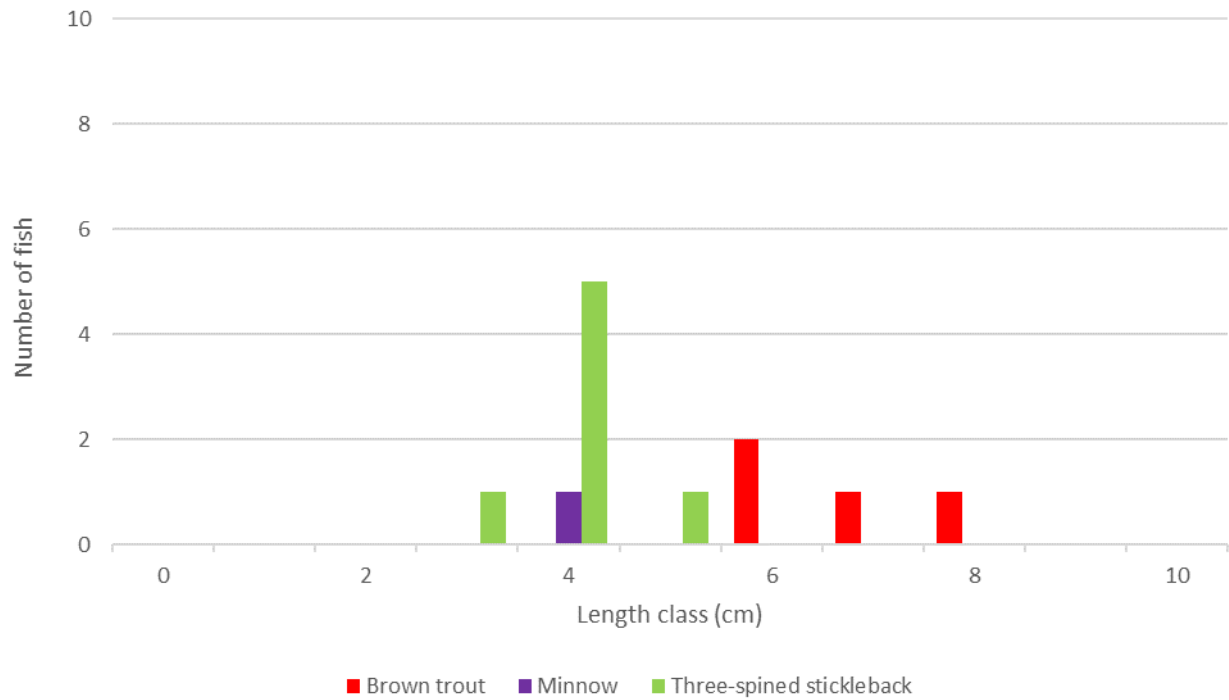
**Plate 3.46** Representative image of site D29, September 2023

### 3.2.30 Site D30 – unnamed stream, Bellacorick

Brown trout ( $n=4$ ), minnow ( $n=1$ ) and three-spined stickleback ( $n=7$ ) were recorded via electro-fishing at site D30 on an unnamed Owenmore River tributary (**Figure 3.19**).

The site was a poor to moderate quality salmonid nursery given the stream's small size and very low

summer flows. However, the presence of mixed coarse substrata and broken flow patterns provided refugia for the small population of 0+ fish. Clean gravels were limited due to siltation and filamentous algal cover (enrichment) and the site was of poor value as a spawning habitat. The value as a holding habitat was also poor given the paucity of pools. Despite some suitability for European eel (instream refugia), none were recorded. The upland stream was unsuitable for lamprey.



**Figure 3.19** Length frequency distribution recorded via electro-fishing at site D30 on an unnamed Owenmore River tributary, September 2023



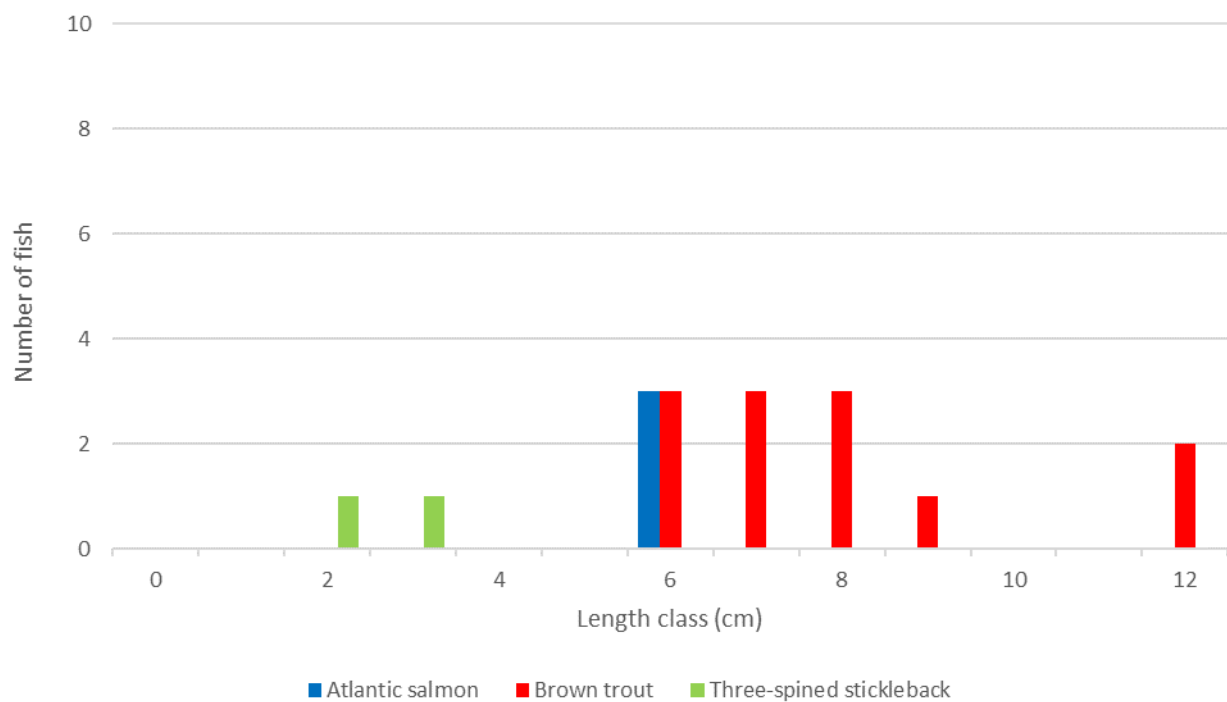
**Plate 3.47** Representative image of site D30, September 2023

### 3.3 TDR sites

#### 3.3.1 Site E1 - Moneynierin River, Moneynierin

Atlantic salmon ( $n=3$ ), brown trout ( $n=12$ ) and three-spined stickleback ( $n=2$ ) were recorded via electro-fishing at site E1 on the Moneynierin River (33M16), Owenmore River tributary (**Figure 3.20**).

The site was a moderate quality salmonid nursery with a small population of trout recorded. The quality of the nursery habitat was reduced by siltation and enrichment pressures. The spawning value was locally moderate in deeper pools and glide being reduced only by siltation and enrichment pressures. Moderate quality holding habitat was present in localised deeper glide and pool habitat. Despite some low suitability for European eel (instream refugia), none were recorded. The upland stream was unsuitable for lamprey and none were recorded.



**Figure 3.20** Length frequency distribution recorded via electro-fishing at site E1 on the Moneynierin River, September 2023

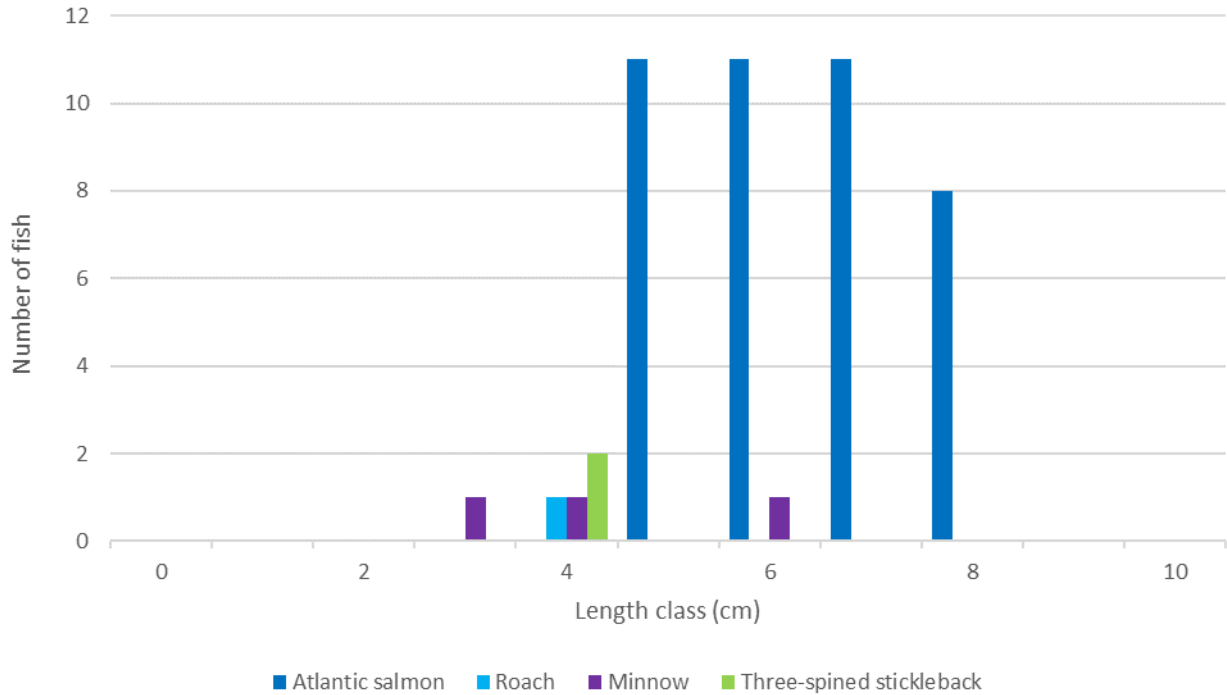


**Plate 3.48** Juvenile brown trout recorded at site E1 on the Moneynierin River, September 2023

### 3.3.2 Site E2 – River Deel, Crossmolina Bridge

Atlantic salmon ( $n=41$ ), minnow ( $n=3$ ), roach (*Rutilus rutilus*) ( $n=1$ ) and three-spined stickleback ( $n=2$ ) were recorded via electro-fishing at site E2 on the River Deel (34D01) at Crossmolina Bridge (**Figure 3.21**).

The site was considered a good quality salmonid nursery given the stoney bed, riffle, glide and pool sequences that provide refugia and oxygenated water during normal flows. This was supported by the presence of a mixed cohort salmonid population present in stagnant (low summer flow) pools. Good quality spawning habitat was present in deeper glide and pool where mixed gravels are utilised during the autumn and winter (pers. obs.). The quality of holding habitat was moderate in vicinity of the bridge but improves locally in deeper pool (e.g. downstream of the meander). The site was a good quality European eel habitat given abundant refugia and prey resources. The river at this location of too high an energy for lamprey.



**Figure 3.21** Length frequency distribution recorded via electro-fishing at site E2 on the River Deel, September 2023

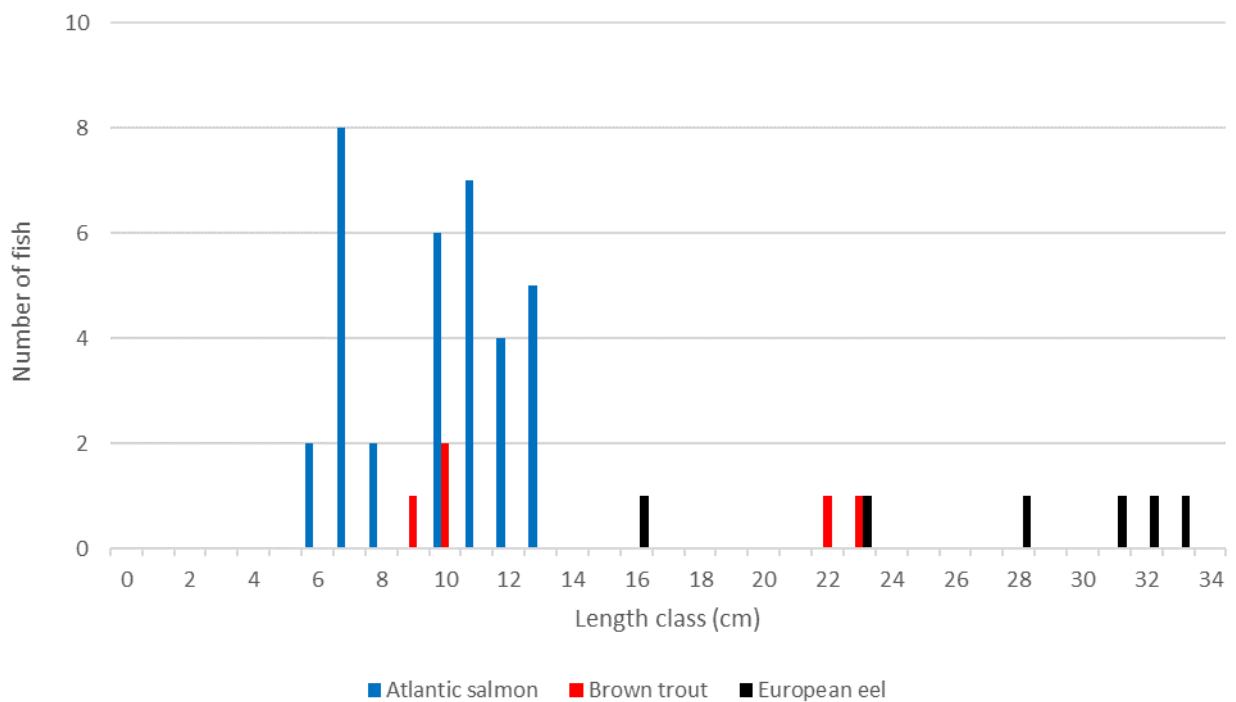


**Plate 3.49** Atlantic salmon parr recorded from stagnant pools at site E2 on the River Deel, September 2023

### 3.3.3 Site E3 - Ballisodare River, Knoxspark

Atlantic salmon ( $n=34$ ), brown trout ( $n=5$ ) and European eel ( $n=7$ ) were recorded via electro-fishing at site E3 on the Ballisodare River (35B05) (**Figure 3.22**).

The site was a very good quality salmonid nursery given the rocky bed with a natural flow profile of riffle, glide and pool sequences. This provided very good quality refugia and oxygenated water benefitting the mixed cohort salmonid population that was dominated by Atlantic salmon. Good quality spawning habitat was present locally in deeper glide and pool downstream of the bridge where mixed gravels occurred. The site was a high quality holding habitat for adult salmonids and also a very good quality European eel habitat given abundant refugia and prey resources. This was also supported by the presence of numerous adult silver eels (including a particularly large individual of 65cm). The site was of too high an energy for lamprey in the accessible survey areas but some soft sediment areas supporting ammocoetes may be present downstream of the bridge along the river margins in water too deep to electro-fish.



**Figure 3.22** Length frequency distribution recorded via electro-fishing at site E3 on the Ballisodare River, September 2023 (\*not shown is a 65cm European eel)

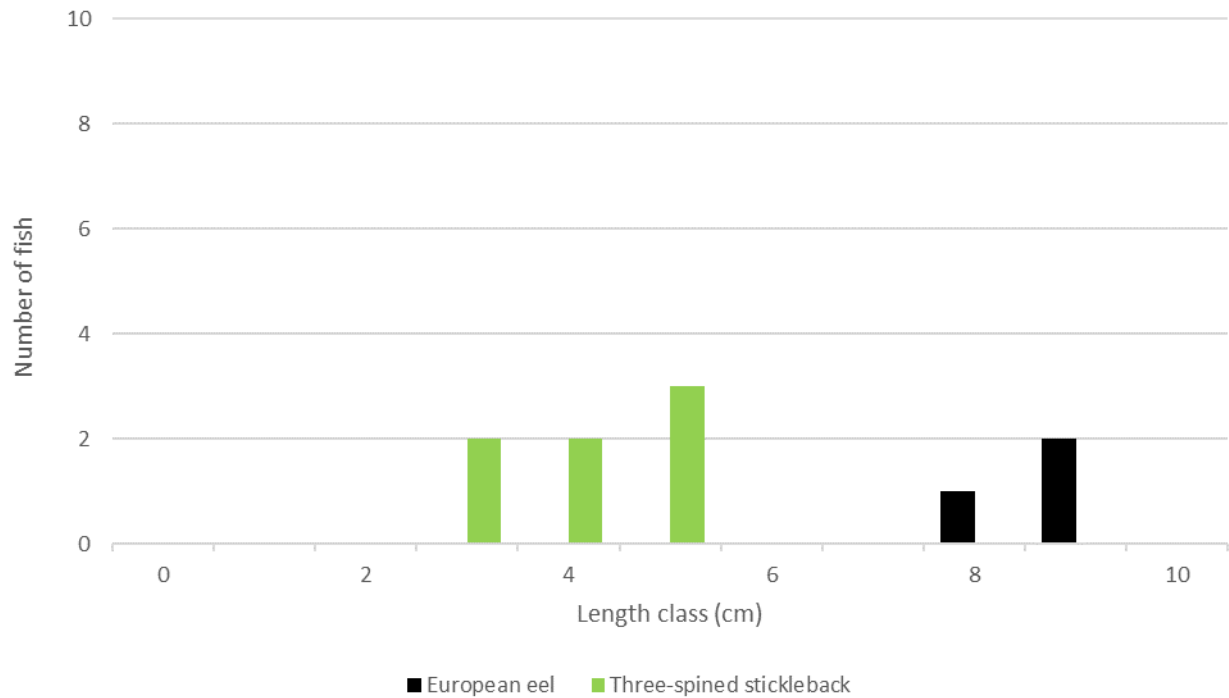


**Plate 3.50** Adult brown trout recorded at site E3 on the Ballisodare River, September 2023

#### 3.3.4 Site E4 - Carrowgobbadagh Stream, Carrowgobbadagh

European eel ( $n=3$ ) and three-spined stickleback ( $n=7$ ) were the only fish species recorded via electro-fishing at site E4 on the tidal reaches of the Carrowgobbadagh Stream (35C95) (**Figure 3.23**).

The heavily modified site was a poor quality habitat for salmonids given the heavily enriched nature of the channel with profuse growth of pondweeds and soft silty bed and none were recorded present. The site was, however, a very good quality European eel nursery given soft sediment bed for burial by elvers, high macrophyte cover and abundant food resources with a moderate density population recorded. The site had some value for lamprey ammocoetes (e.g. soft sediment burial habitat) albeit spawning habitat was absent and no ammocoetes were recorded.



**Figure 3.23** Length frequency distribution recorded via electro-fishing at site E4 on the Carrowgobbadagh Stream, September 2023



**Plate 3.51** Juvenile European eel recorded at site E4 on the Carrowgobbadagh Stream, September 2023

### 3.3.5 Site E5 – Abbeylands Stream, Coolcholly

No fish were recorded via electro-fishing at site E5 on the Abbeylands Stream (36A15). The stream was not of fisheries value at this location given its heavily modified nature, siltation, small size and

very limited (low summer) flows.



**Plate 3.52** Representative image of site E5 on the Abbeylands Stream, September 2023

### 3.3.6 Site E6 – Drumgowan Stream, Tullygallan

Site E6 on the Drumgowan Stream (37D49) was dry at the time of survey. The heavily modified, U-shaped ephemeral channel was not of fisheries value.

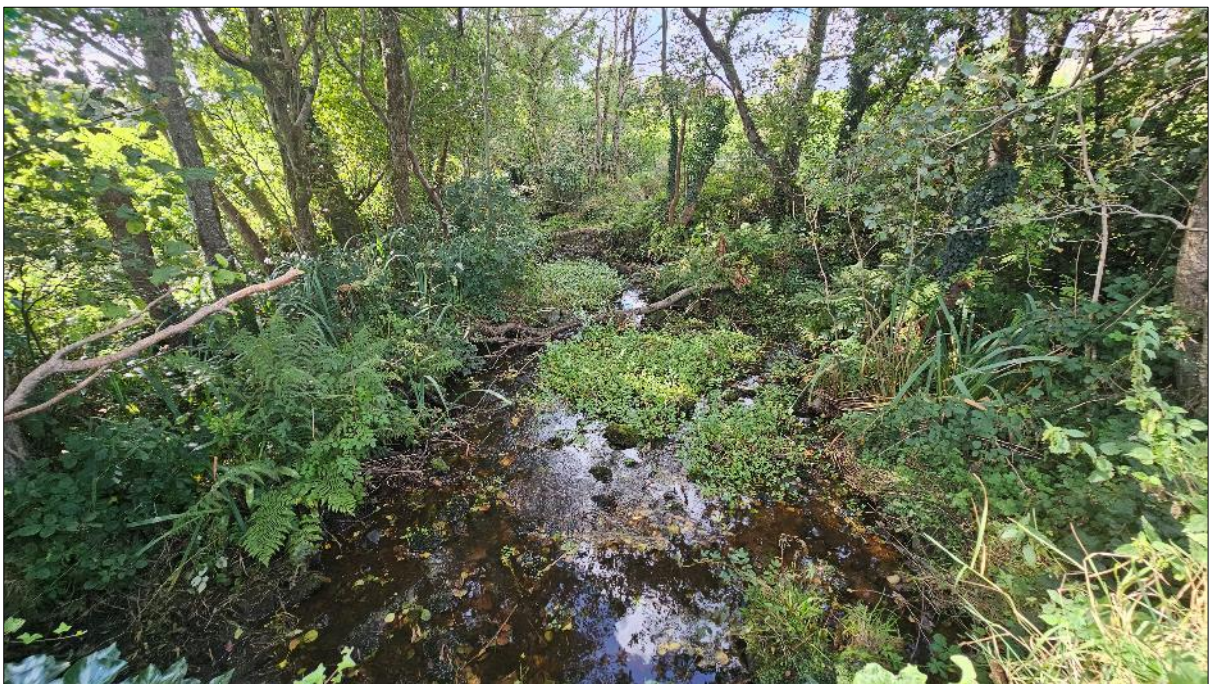


**Plate 3.53** Representative image of site E6 on the Drumgowan Stream, September 2023

### 3.3.7 Site E7 – Bogside River, Dunkineely

Despite some low suitability for salmonids, no fish were recorded via electro-fishing at site E7 on the Bogside River (37B26).

The high gradient river at this location was a poor quality nursery for salmonids given the small size and very low flows. The heavily bedded boulder, cobble and scattered coarse gravel substrata were exposed to high siltation and were not of value as salmonid spawning habitat. Shallow pools were not of value as holding areas for adult salmonids. The site was a poor quality European eel habitat despite close proximity to the sea, with limited refugia. There were no soft sediment accumulations present capable of supporting lamprey ammocoetes.



**Plate 3.54** Representative image of site E7 on the Bogside River, September 2023

**Table 3.1** Relative abundance of fish species of higher conservation value recorded per survey site in the vicinity of the proposed Muingmore wind farm, September 2023

Site	Watercourse	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Other species
<b>Sites in vicinity of site boundary</b>						
A1	Unnamed river	No fish recorded				
A2	Unnamed river				Medium	Flounder
B1	Unnamed river	No fish recorded				
B2	Unnamed river	No fish recorded				
B3	Unnamed river	No fish recorded				
B4	Unnamed stream		Low			
B5	Unnamed river		Medium			
B6	Unnamed river		High		Low	Three-spined stickleback
C1	An Mhoing Mhór River	No fish recorded				
C2	Doolough Stream		High		Low	
C3	Unnamed stream	No fish recorded				
C4	Doolough Stream		High		Low	Three-spined stickleback
C5	Doolough Stream		Very high			
P1	Pond		eDNA		eDNA	
P2	Pond		eDNA		eDNA	
P3	Pond				eDNA	
P4	Pond		eDNA			
<b>GCR crossings</b>						
D1	Unnamed stream	No fish recorded				
D2	Goolamore River		Medium			Minnow
D3	Munhin River	Medium	Low	Low		Sea trout, flounder, minnow
D4	Unnamed river	No fish recorded				
D5	Ballybeg Stream	No fish recorded				
D6	Srahanarry Stream	Medium	Low			
D7	Bellanumera Stream	No fish recorded				
D8	Briska River	Low	Medium		High	
D9	Unnamed stream	No fish recorded				
D10	Unnamed stream	No fish recorded				
D11	Unnamed river	No fish recorded				

Site	Watercourse	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Other species
D12	Unnamed river	No fish recorded				
D13	Unnamed river	No fish recorded				
D14	Unnamed stream	No fish recorded				
D15	Unnamed stream	No fish recorded				
D16	Unnamed river	No fish recorded				
D17	Unnamed stream	No fish recorded				
D18	Unnamed stream		Low		Low	
D19	Unnamed stream	No fish recorded				
D20	Unnamed stream	No fish recorded				
D21	Unnamed stream	No fish recorded				
D22	Unnamed stream		Medium			
D23	Unnamed stream		Low			
D24	Unnamed river		Medium			
D25	Unnamed river	Very high	Medium		Low	
D26	Unnamed stream	Low	Low			Minnow
D27	Kilsallagh Stream	No fish recorded				
D28	Unnamed stream	No fish recorded				
D29	Unnamed stream		Low			
D30	Unnamed stream		Low			Minnow, three-spined stickleback
<b>TDR nodes</b>						
E1	Moneynierin River	Low	Low			Three-spined stickleback
E2	River Deel	High				Minnow, roach, three-spined stickleback
E3	Ballisodare River	High	Low		Medium	
E4	Carrowgobbadagh Stream				Low	Three-spined stickleback
E5	Abbeylands Stream	No fish recorded				
E6	Drumgowan Stream	No fish recorded				
E7	Bogside River	No fish recorded				





Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m <sup>2</sup> )	Fish density per m <sup>2</sup>								
				Atlantic salmon	Brown trout	Sea trout	Lampetra sp.	European eel	Three-spined stickleback	Flounder	Minnow	Roach
D15	Unnamed stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D16	Unnamed river	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D17	Unnamed stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D18	Unnamed stream	5	100	0.000	<b>0.040</b> (n=4)	0.000	0.000	<b>0.020</b> (n=2)	0.000	0.000	0.000	0.000
D19	Unnamed stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D20	Unnamed stream	5	15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D21	Unnamed stream	5	10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D22	Unnamed stream	5	100	0.000	<b>0.120</b> (n=12)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D23	Unnamed stream	5	50	0.000	<b>0.100</b> (n=5)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D24	Unnamed river	5	150	0.000	<b>0.093</b> (n=14)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D25	Unnamed river	10	200	<b>0.285</b> (n=57)	<b>0.100</b> (n=20)	0.000	0.000	<b>0.010</b> (n=2)	0.000	0.000	0.000	0.000
D26	Unnamed stream	5	100	<b>0.020</b> (n=2)	<b>0.080</b> (n=8)	0.000	0.000	0.000	0.000	0.000	<b>0.020</b> (n=2)	0.000
D27	Kilsallagh Stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D28	Unnamed stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D29	Unnamed stream	5	100	0.000	<b>0.060</b> (n=6)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D30	Unnamed stream	5	100	0.000	<b>0.040</b> (n=4)	0.000	0.000	0.000	<b>0.070</b> (n=7)	0.000	<b>0.010</b> (n=1)	0.000
<b>TDR nodes</b>												
E1	Moneynierin River	5	120	<b>0.025</b> (n=3)	<b>0.100</b> (n=12)	0.000	0.000	0.000	<b>0.017</b> (n=2)	0.000	<b>0.008</b> (n=1)	0.000



## 4. Discussion

The watercourses in the vicinity of the proposed Muingmore wind farm site boundary and turbine array were typically heavily modified lowland channels (straightened, deepened, realigned) draining blanket bog with high rates of siltation (from peat escapement). The proposed GCR crossed a large number of small upland eroding watercourses (most of which were Owenmore River tributaries) that were typically high gradient and suffered from low summer flows. Whilst the TDR crossed a very high number of watercourses, only a low number were surveyed given their proximity to proposed TDR nodes (works areas) - most were small, upland eroding channels. Over of the riverine survey sites (27 of 50) did not support fish at the time of survey given poor quality fisheries habitats or dry, ephemeral channels. A high number of watercourses crossed by the GCR were of high gradient and inherently unsuitable for resident fish, with widespread low summer flows (or indeed no water flows) in these spate channels.

A fish species assemblage typical of Ireland's north-west, namely Atlantic salmon, brown trout, sea trout, European eel, lamprey (*Lampetra* sp.), three-spined-stickleback, minnow and flounder were recorded during the electro-fishing survey (**Table 3.1**). Whilst a number of high conservation value fish species were present in the survey area, Atlantic salmon and European eel were restricted in their distributions, with sea trout and lamprey (*Lampetra* sp.) recorded from single site only.

Although brown trout were relatively widespread in the survey area inclusive of the GCR (recorded at 23 no. sites), Atlantic salmon were more localised and recorded from a total of 10. no sites. These included an unnamed Tullaghan Bay tributary (B6), Goolamore River (D2), Munhin River (D3), Srahanarry Stream (D6), Broska River (D8), unnamed Owenmore tributaries (D25, D26), Moneynierin River (E1), River Deel (E2) and the Ballisodare River (E3) (**Table 3.1**). Sites D8, D25, E2 and E3 were particularly high quality salmonid nurseries, especially for Atlantic salmon, and supported the highest densities recorded during the survey (**Table 3.2**).

Fish populations in vicinity of the site boundary were dominated by brown trout with Atlantic salmon recorded only from the lower reaches of an unnamed Tullaghan Bay tributary (site B6). The Doolough Stream was of high value for brown trout although despite suitability for anadromous sea trout, none were recorded in vicinity of the proposed site. Sea trout were only recorded from site D3 on the Munhin River, a major tributary of the Owenmore River. Many survey sites provided sub-optimal salmonid habitat given siltation (peat escapement), eutrophication and hydromorphological pressures, in addition to steep gradients which reduce the productivity of such watercourses (Wood & Budy, 2009; O'Grady, 2006; Amiro, 1993). As would be expected for higher-gradient, spate channels and watercourses with intermittent or seasonal flows, the quality of salmonid spawning, nursery and holding habitat typically improved in the lower gradient and lower reaches of the surveyed watercourses. Pond sites P1, P3 and P4 in vicinity of the proposed site boundary also supported brown trout (detected via eDNA sampling). While there were no inflowing/outflowing channels or hard substrata for traditional salmonid spawning sites, brown trout can support self-sustaining lacustrine populations in oligotrophic peatland lakes provided wind action sufficiently oxygenates the littorals (Arostegui & Quinn, 2019).

Lamprey (*Lampetra* sp.) were recorded from only a single site on the Munhin River (D3) during the survey, where a low density of ammocoetes (0.5 per m<sup>2</sup>) were present in sand accumulations near the road crossing (**Plate 4.1**). This near absence of lamprey reflected the poor habitat suitability in the survey area where watercourses were generally either historically modified peat channels (e.g. near site boundary) and or high energy, higher gradient spate channels. Such conditions reduce the extent of fine gravels required for spawning (Dawson et al., 2015; Rooney et al., 2013; Lasne et al., 2010) and discourage the deposition of fine, organic-rich sediment  $\geq 5\text{cm}$  in depth generally required by larval *Lampetra* spp. (Aronsoo & Virkkala, 2014; Goodwin et al., 2008; Gardiner, 2003). Peat-dominated substrata (i.e., humic deposits), such as those typically found in the vicinity of the proposed site boundary, do not provide suitable burial/burrowing habitat complexity or structure for larvae (ammocoetes) given their invariably fine and flocculent nature (pers. obs.).

European eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020). Eel were recorded (in typically low abundances) from a total of 9 no. riverine sites on an unnamed river (A2), an unnamed Tullaghan Bay tributary (B6), Doolough Stream (C2, C4), Briska River (D8), unnamed Owenmore River tributary (D18, D25), Ballisodare River (E3) and the Carrowgobbadagh Stream (E4) (**Table 3.1**). These sites provided deeper water and a greater complexity of refugia (e.g. boulder, macrophyte beds etc.) favoured by the species (Laffaille et al., 2003). Whilst many riverine sites found not to support eel were located in close proximity to the sea and accessible to eel, the species often shows preference for the lowermost, lower gradient reaches of watercourses and estuarine habitats (Degerman et al., 2019; Arai et al., 2006; Moriarty, 2003). Eel were also detected via eDNA sampling at pond sites P1, P2 and P3 where high quality eel habitats were present.



**Plate 4.1** *Lampetra* sp. ammocoetes recorded from site D3 on the Munhin River, September 2023, September 2023

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Triturus Environmental Ltd.

42 Norwood Court,

Rochestown,

Co. Cork,

T12 ECF3.

# Aquatic baseline report for the proposed Muingmore wind farm, Co. Mayo



Prepared by Triturus Environmental Ltd. for SLR Consulting Ltd.

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## Table of contents

<b>1. Introduction</b>	<b>4</b>
1.1 Background	4
1.2 Project description	4
<b>2. Methodology</b>	<b>5</b>
2.1 Selection of watercourses for assessment	5
2.2 Aquatic site surveys	5
2.3 Fisheries assessment (electro-fishing)	11
2.4 White-clawed crayfish survey	11
2.5 eDNA analysis	11
2.6 Biological water quality (Q-sampling)	12
2.7 Pond macro-invertebrate communities	12
2.8 Macrophytes and aquatic bryophytes	12
2.9 Otter signs	13
2.10 Aquatic ecological evaluation	13
2.11 Biosecurity	13
<b>3. Desktop review</b>	<b>14</b>
3.1 Survey area description	14
3.2 Fisheries asset of the survey area	14
3.3 Protected aquatic species	15
<b>4. Results of aquatic surveys</b>	<b>17</b>
4.1 Sites in vicinity of the site boundary	17
4.2 White-clawed crayfish	35
4.3 eDNA analysis	35
4.4 Invasive aquatic species	35
4.5 Biological water quality (macro-invertebrates)	35
4.6 Pond macro-invertebrate communities	36
4.7 Aquatic ecological evaluation	41
<b>5. Discussion</b>	<b>52</b>
5.1 Fisheries	52
5.2 Annex I aquatic habitats	52
5.3 Crayfish plague detection	53
5.4 Otter	53
5.5 Macro-invertebrates	53
<b>6. References</b>	<b>55</b>
7. Appendix A – fisheries assessment report	58

8. Appendix B – eDNA analysis lab report	59
9. Appendix C – Macro-invertebrates (biological water quality)	65
10. Appendix D – aquatic survey site summaries for GCR & TDR sites	74

## 1. Introduction

### 1.1 Background

Triturus Environmental Ltd. were commissioned by SLR Consulting Ltd. to conduct baseline aquatic and fisheries surveys to inform EIA preparation for the proposed Muingmore wind farm project, located near Gweesalia, Co. Mayo (**Figure 2.1**). Undertaken on a catchment-wide scale, this report provides a baseline assessment of the aquatic ecology including fisheries, biological water quality, protected species and habitats in the vicinity of the proposed project, inclusive of the grid cable route (GCR). Aquatic surveys were undertaken in September 2023.

### 1.2 Project description

A full description of the proposed project will be provided in any Environmental Impact Assessment Report (EIA) used to support consenting applications.

## 2. Methodology

### 2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed wind farm project were considered as part of the current assessment. This included sites in vicinity of the proposed turbine array and site boundary (17 no. sites) in addition to watercourse crossings of the proposed grid cable route (GCR) and watercourses adjacent to turbine delivery route (TDR) nodes (37 no. sites). Thus, a total of 54 no. sites were selected for detailed aquatic assessment (see **Table 2.1**, **Figure 2.1 & 2.2** below). The flow paths and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

In the vicinity of the proposed site boundary, aquatic survey sites were present on the Mhoing Mhór River (EPA code: 33M23), Doolough Stream (33D02) and a number of unnamed watercourses, in addition to 4 no. pond sites (**Table 2.1**). These aquatic survey sites were located within the Owenmore[Mayo]\_SC\_030 and Glencastle\_SC\_010 river sub-catchments in hydrometric area 33 (Blacksod-Broadhaven). The proposed GCR primarily followed the existing N59 road between Bangor Erris and Bellacorick, crossing a high number of tributaries of the Owenmore River (**Table 2.1**). A low number of additional survey sites on the Moneynierin River (33M16), River Deel (34D01), Ballisodare River (35B05), Abbeylands Stream (36A15), Drumgowan Stream (37D49) and the Bogside River (37B26) were also surveyed given their proximity to TDR nodes (proposed works areas).

Please note this aquatic report should be read in conjunction with the final Environmental Impact Assessment Report (EIAR) prepared for the proposed project. More specific aquatic methodology is outlined below and in the appendices of this report.

### 2.2 Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the proposed project were conducted on the 15<sup>th</sup>, 16<sup>th</sup>, 17<sup>th</sup>, 18<sup>th</sup> and 19<sup>th</sup> September 2023. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Table 2.1**). Surveys at each of these sites included a fisheries assessment (electro-fishing and or fisheries habitat appraisal), white-clawed crayfish survey, macrophyte and aquatic bryophyte survey and (where suitable) biological water quality sampling (Q-sampling) and macro-invertebrate sweep sampling. This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed project and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth, channel form) including associated evidence of historical drainage

- Substrate type and relative condition, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition and bordering land use practices

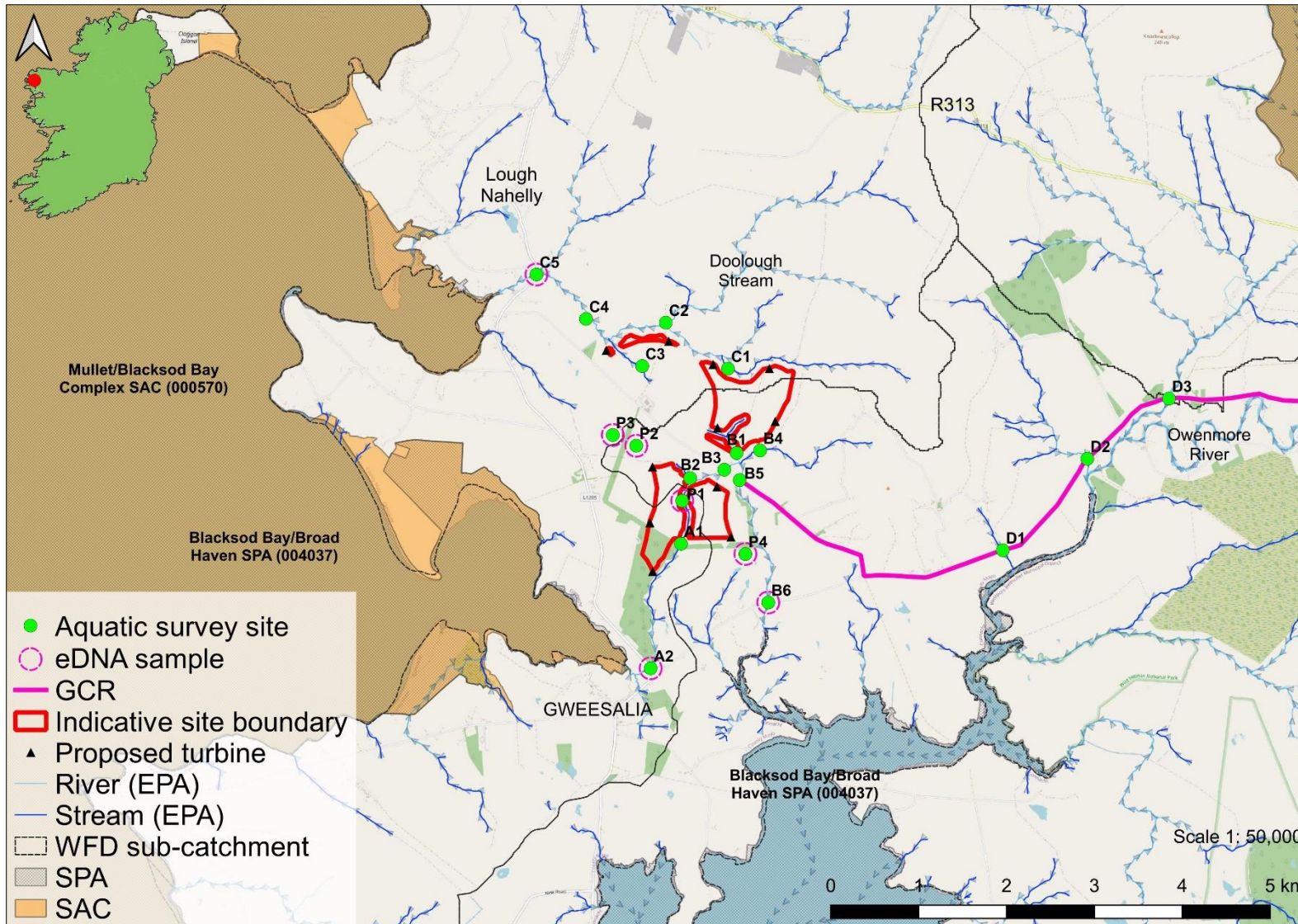
**Table 2.1** Location of  $n=54$  aquatic survey sites in the vicinity of the proposed Muingmore wind farm project, Co. Mayo

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
<b>Site boundary</b>					
A1	Unnamed river	n/a	Doolough	476621	821708
A2*	Unnamed river	n/a	L1205 road crossing	476276	820290
B1	Unnamed river	n/a	Muingmore	477254	822741
B2	Unnamed river	n/a	Muingmore	476726	822456
B3	Unnamed river	n/a	Muingmore	477114	822551
B4	Unnamed stream	n/a	Muingmore	477522	822770
B5	Unnamed river	n/a	Tristia	477290	822433
B6*	Unnamed river	n/a	L1206 road crossing	477615	821039
C1	An Mhoing Mhór River	33M23	Muingmore	477156	823702
C2	Doolough Stream	33D02	Muingmore	476448	824226
C3	Unnamed stream	n/a	Muingmore	476180	823731
C4	Doolough Stream	33D02	Muingmore	475540	824268
C5*	Doolough Stream	33D02	L1205 road crossing	474976	824774
P1†	Pond	n/a	Doolough	476635	822197
P2†	Pond	n/a	Muingmore	476112	822824
P3†	Pond	n/a	Muingmore	475845	822946
P4†	Pond	n/a	Doolough	477354	821591
<b>GCR crossings</b>					
D1	Unnamed stream	n/a	Goolamore	480285	821634
D2	Goolamore River	33G12	Drumanaffrin	481247	822676
D3	Munhin River	33M03	Kilteany	482176	823361
D4	Unnamed river	n/a	Srahanmore	484848	823084
D5	Ballybeg Stream	33B40	Srahanarry	486351	823100
D6	Srahanarry Stream	33S23	Srahanarry	487383	823093
D7	Bellanumera Stream	33B38	Briska	487539	822966
D8	Briska River	33B33	Briska	487705	822687
D9	Unnamed stream	n/a	Briska	487788	822587
D10	Unnamed stream	n/a	Briska	487844	822510
D11	Unnamed river	n/a	Briska	490185	822080
D12	Unnamed river	n/a	Largan More	490513	822401
D13	Unnamed river	n/a	Largan More	490568	822412
D14	Unnamed stream	n/a	Largan More	490739	822418
D15	Unnamed stream	n/a	Largan More	490894	822413

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
D16	Unnamed river	n/a	Largan More	491092	822422
D17	Unnamed stream	n/a	Largan More	491297	822394
D18	Unnamed stream	n/a	Largan More	491335	822381
D19	Unnamed stream	n/a	Largan Beg	491399	822356
D20	Unnamed stream	n/a	Largan Beg	491900	822061
D21	Unnamed stream	n/a	Largan Beg	491988	822011
D22	Unnamed stream	n/a	Tawnaghmore	493063	821706
D23	Unnamed stream	n/a	Tawnaghmore	493360	821686
D24	Unnamed river	n/a	Tawnaghmore	493659	821685
D25	Unnamed river	n/a	Ballymonnelly Bridge	493983	821377
D26	Unnamed stream	n/a	Killsallagh	495239	820469
D27	Killsallagh Stream	33K13	Killsallagh	495346	820428
D28	Unnamed stream	n/a	Killsallagh	495834	820410
D29	Unnamed stream	n/a	Bellacorick	496398	820409
D30	Unnamed stream	n/a	Bellacorick	496504	820323
<b>TDR nodes</b>					
E1	Moneynierin River	33M16	Moneynierin	497643	819577
E2	River Deel	34D01	Crossmolina Bridge	513655	817586
E3	Ballisodare River	35B05	Knoxspark	566745	829045
E4	Carrowgobbadagh Stream	35C95	Carrowgobbadagh	567482	830457
E5	Abbeylands Stream	36A15	Coolcholly	588235	862284
E6	Drumgowan Stream	37D49	Tullygallan	593620	875619
E7	Bogside River	37B26	Dunkineely	576176	875950

\* eDNA sampling for freshwater pearl mussel, white-clawed crayfish & crayfish plague

teDNA sampling for brown trout, European eel & smooth newt



**Figure 2.1** Overview of the aquatic survey sites in the vicinity of the proposed Muingmore wind farm site boundary, Co. Mayo

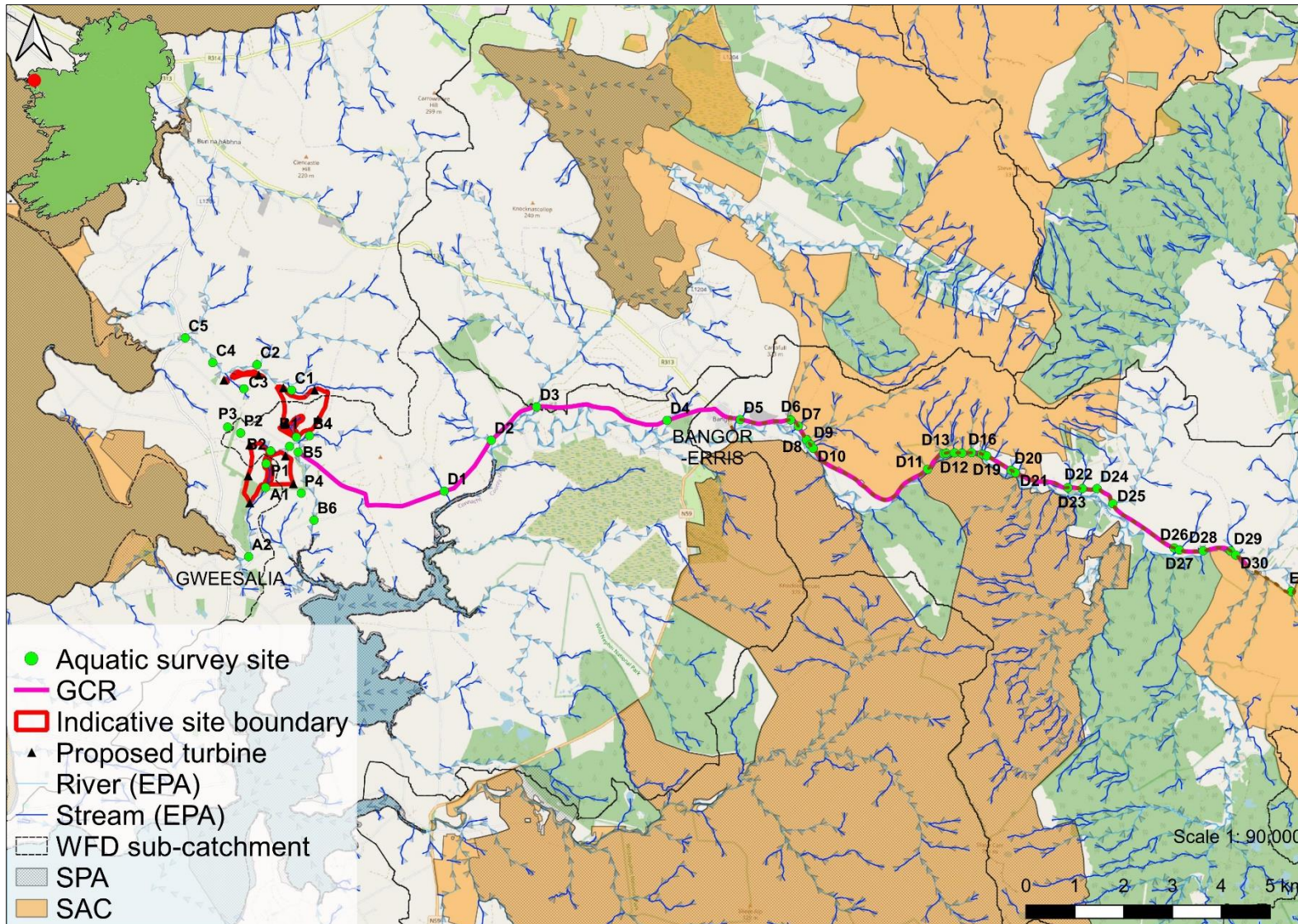


Figure 2.2 Overview of the aquatic survey sites in the vicinity of the proposed Muingmore wind farm GCR, Co. Mayo

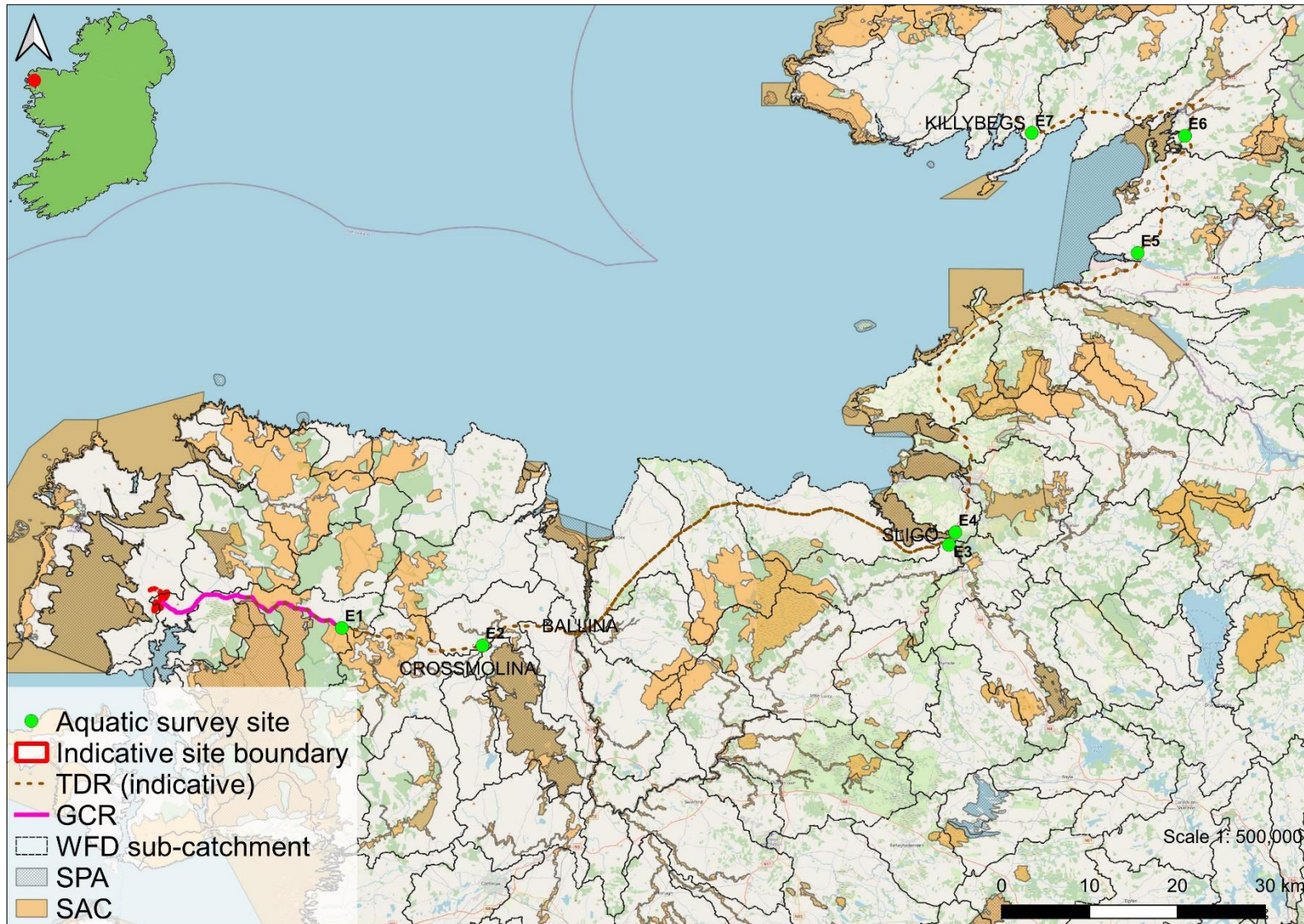


Figure 2.3 Overview of the aquatic survey sites in the vicinity of the proposed Muingmore wind farm TDR, Co. Mayo

### 2.3 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the proposed Muingmore wind farm in September 2023 following notification to Inland Fisheries Ireland, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The survey was undertaken in accordance with best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of the aquatic survey sites was undertaken to establish their importance for salmonid, lamprey, European eel (*Anguilla anguilla*) and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites. For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix A**.

### 2.4 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in September 2023 under a National Parks and Wildlife (NPWS) open national licence (no. C24/2023), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2023), to capture and release crayfish to their site of capture. As per Inland Fisheries Ireland aquatic biosecurity recommendations, the crayfish sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical habitat attributes while mustelid spraint was also examined for remains where present. Additionally, a desktop review of crayfish records within the wider survey area was also completed.

### 2.5 eDNA analysis

Composite water samples were collected from two unnamed rivers (sites A2 & B6) and the Doolough Stream (C5) in September 2023 to detect for the presence of freshwater pearl mussel (*Margaritifera margaritifera*), white-clawed crayfish and crayfish plague (*Aphanomyces astaci*). The eDNA sampling was undertaken to detect cryptically-low populations of these species should they occur in the study area. The sites were strategically chosen to maximise longitudinal (instream) coverage within the catchment (i.e. facilitating a greater likelihood of species detection) (**Figure 2.1**). Pond sites P1, P2, P3 and P4 were also sampled during September 2023 and analysed for brown trout (*Salmo trutta*), European eel and smooth newt (*Lissotriton vulgaris*).

In accordance with laboratory guidance, a composite (500ml) water sample was collected from the sampling point, maximising the geographic spread at the site (20 x 25ml samples at each site), thus increasing the chance of detecting the target species' DNA. 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 with 48 hours of collection. A total of  $n=12$  qPCR replicates were analysed for the site. Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence (termed qPCR No Threshold, or qPCR NT).

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. Please refer to **Appendix B** for full eDNA laboratory analysis methodology.

## 2.6 Biological water quality (Q-sampling)

A total of 40 no. riverine survey sites<sup>1</sup> were assessed for biological water quality through Q-sampling in September 2023 (**Figure 2.1**). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification to species level. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.2**). Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

**Table 2.2** Reference categories for EPA Q-ratings (Q1 to Q5) (Toner et al., 2005)

Q value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

## 2.7 Pond macro-invertebrate communities

Pond sites P1, P2, P3 and P4 were sampled for macro-invertebrates via sweep netting in September 2023. A standard pond net (250mm width, mesh size 500µm) was used to sweep macrophytes and submerged vegetation to capture macro-invertebrates. The net was also moved along the lake/pond bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was employed. To ensure appropriate habitat coverage, the sampling period was also divided amongst the range of meso-habitats present at the survey sites to get a representative sample for sub-habitats.

## 2.8 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the survey sites, with specimens collected (by hand or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species listed under the Flora (Protection) Order, 2022, Irish Red lists for vascular plants (Wyse-Jackson et al.,

<sup>1</sup> Of the 50 no. riverine survey sites, 10 no. sites (D12, D13, D14, D15, D16, D17, D19, D27, D28 & E6) were dry at the time of survey

2016) and bryophytes (Lockhart et al., 2012) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculus fluitantis* and *Callitriche-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

## 2.9 Otter signs

The presence of otter (*Lutra lutra*) was determined through the recording of otter signs within 150m radius of each survey site. Notes on the age and location of signs (ITM coordinates) were made, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.).

## 2.10 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

## 2.11 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Within each sub-catchment, surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Care was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). Furthermore, staff did not undertake any work in a known crayfish plague catchment for a period of <72hrs in advance of the survey. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

### 3. Desktop review

#### 3.1 Survey area description

The proposed Muingmore wind farm site was located in an area of cutover bog near Gweesalia, Co. Mayo within the North-western River Basin District (**Figure 2.1**). The proposed GCR followed the existing road network, primarily along the N59 between Bangor-Erris and Bellacorick, with the TDR extending along the public road network for some 100km from the site boundary to Killybegs, Co. Donegal (**Figure 2.2**). The proposed wind farm site is drained by a number of small, heavily modified lowland watercourses (FW2; Fossitt, 2000) and drainage channels (FW4) present in a landscape dominated by lowland blanket bog and coniferous afforestation. The area is underlain by Neoproterozoic schist and gneiss (Geological Survey of Ireland data). Whilst not located within a European site, the watercourses within and adjoining the site boundary share hydrological connectivity with the Mullet/Blacksod Bay Complex SAC (000470) and Blacksod Bay/Broad Haven SPA (004037).

#### 3.2 Fisheries asset of the survey area

Given the remote and minor nature of the watercourses within and adjoining the proposed site boundary (i.e. An Mhoing Mhór River, Doolough Stream, unnamed river and tributaries), fisheries data for was not available prior to this survey.

Tullaghan Bay, to which a small unnamed river draining the proposed site joins, supports a range of common transitional and estuarine species including flounder (*Platichthys flesus*), sand goby (*Pomatoschistus minutes*), 15-spined stickleback (*Spinachia spinachia*) and sprat (*Sprattus sprattus*) (CFB, 2009).

The GCR crossed a high number of minor tributaries of the Owenmore River which is known to support Atlantic salmon (*Salmo salar*) and both brown and sea trout (*Salmo trutta*). The Owenmore is a regionally important salmonid river and is ranked 16<sup>th</sup> nationally in terms of the accessible fluvial habitat to Atlantic salmon (McGinnity et al., 2003). The Owenmore is a noted recreational salmon and sea trout fishery (O'Reilly, 2009) and, after several years of failure, is currently meeting its conservation limit for Atlantic salmon since 2021 (TEGOS, 2023). In addition to salmonids, the Owenmore is also known to support European eel (*Anguilla anguilla*), minnow (*Phoxinus phoxinus*), three-spined stickleback (*Gasterosteus aculeatus*) and lamprey (*Lampetra* sp.) (Triturus 2022 data).

The River Deel (34D01) is crossed by the proposed TDR in Crossmolina, Co. Mayo (where proposed TDR works are required adjacent to the watercourse). The Deel is a designated salmonid watercourse under the European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293/1988) and is a renowned recreational Atlantic salmon fishery. The river is also known to support brown trout, pike (*Esox lucius*), roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), European eel, three-spined stickleback (*Gasterosteus aculeatus*) and minnow (Kelly et al., 2012, 2009; O'Connor, 2004). The Deel supports spawning sea lamprey (*Petromyzon marinus*) as far upstream as Ballycarroon Falls (in relatively high densities), approximately 2.5km upstream of Crossmolina, with *Lampetra* sp. also present both upstream and downstream Crossmolina (O'Connor, 2004).

TDR works are also proposed adjacent to the Ballysodare (Ballisodare) River at Ballysodare, Co. Sligo. The Ballysodare River is known to support Atlantic salmon, brown trout, European eel; *Lampetra* sp., minnow, perch, pike, roach and three-spined stickleback (IFI 2010-2014 data). The river is of very high value as a recreational Atlantic salmon fishery.

Fisheries data for the other survey watercourses was not available prior to this proposed survey.

### 3.3 Protected aquatic species

A comprehensive desktop review of available data from the National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC), Inland Fisheries Ireland (IFI), Botanical Society of Britain and Ireland (BSBI), National Crayfish Plague Surveillance Programme (NCPSP), Environmental Protection Agency (EPA) and Triturus databases for the 10km grid squares containing and adjoining the project and associated GCR (i.e. F71, F72, F82 & F92) identified records for only a low number of rare and or protected aquatic species.

Records for otter (*Lutra lutra*) were widespread in the respective grid squares, with a concentration of records for the Owenmore River and two records (2005 & 2010) for the Doolough Stream at survey site C5 (**Figure 3.1**) (NPWS & NBDC data, 2005-2023).

The River Deel, crossed by the proposed TDR (not within the aforementioned grid squares), supports a significant freshwater pearl mussel (*Margaritifera margaritifera*) population, with counts estimated at >100,000 adults by Moorkens & Killeen (2009) (data not shown). Over 1000 mussels were recorded in the vicinity of Crossmolina as part of the River Deel (Crossmolina) Drainage Scheme in 2017 (Ryan Hanley, 2018).

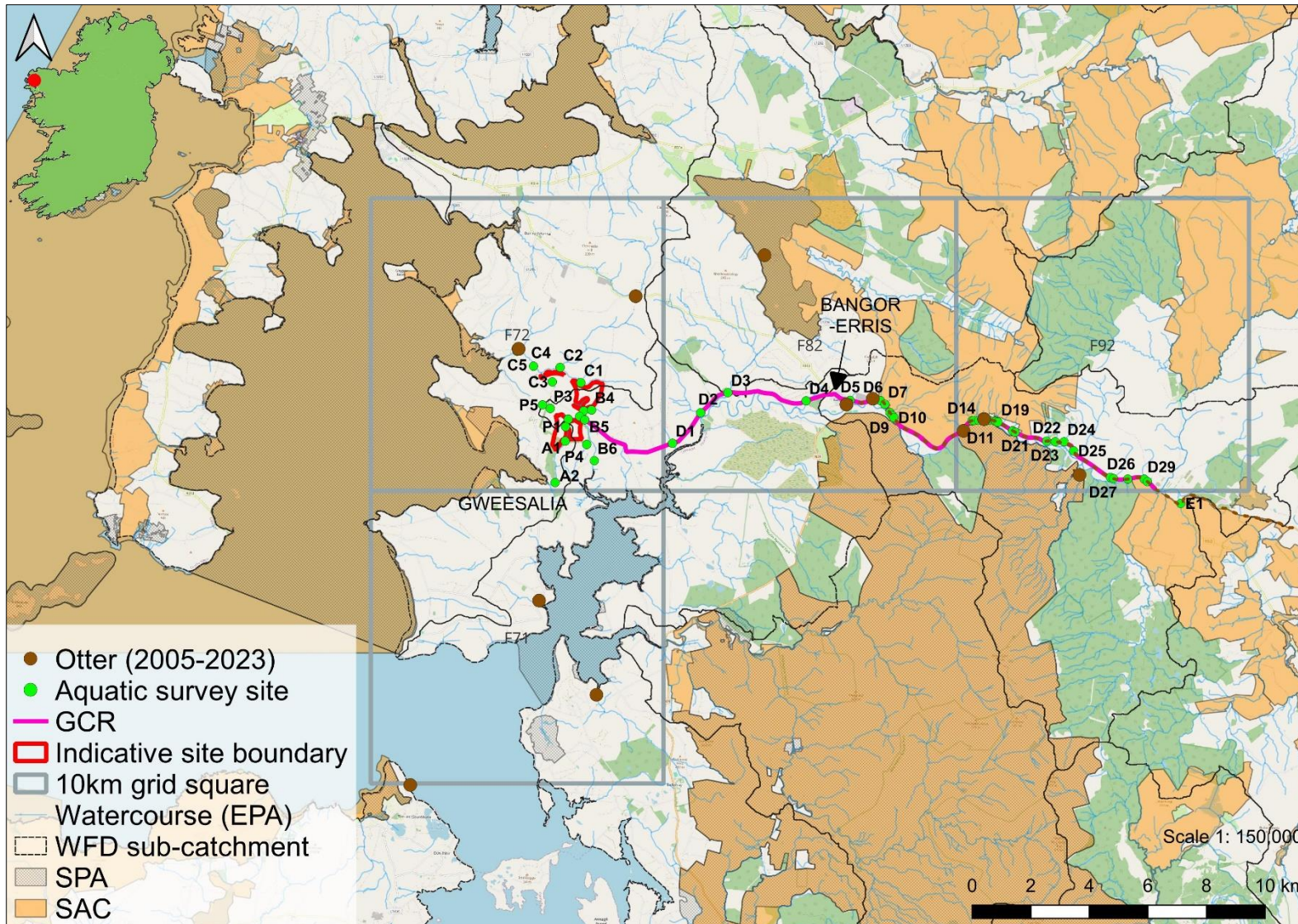


Figure 3.1 Otter records in the vicinity of the proposed project (source: NPWS, NBDC & Triturus data, 2005-2023)

## 4. Results of aquatic surveys

The following section summarises the 17 no. freshwater survey sites in vicinity of the proposed site boundary while the 37 no. sites crossed by the proposed GCR and TDR nodes are summarised in **Appendix D**.

Biological water quality (Q-sample) and lacustrine sweep sampling results for each survey site are provided in **Appendix C**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Please refer to **Appendix A** (fisheries assessment report) for more detailed fisheries results. A summary of the fish species recorded at each survey site is provided in **Table 4.2**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.3**. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.4**.

### 4.1 Sites in vicinity of the site boundary

#### 4.1.1 Site A1 – unnamed river, Doolough

Site A1 was located on an unnamed river (no EPA code) adjoining the site boundary, approximately 400m downstream of its source near pond site P1. The small lowland peat river (FW2) had been historically deepened and realigned to facilitate land drainage for adjoining conifer plantations. The channel was 0.5m wide and 0.2-0.3m deep with 1m high banks. The profile was of slow-flowing glide and the bed was composed entirely of soft, flocculent peat/silt. Due to high shading and high peat staining, macrophytes were absent although some lesser spearwort (*Ranunculus flammula*) was present along the steep channel margins. Aquatic bryophytes were absent. The site was bordered by mature lodgepole pine (*Pinus contorta*) plantations (WD4) and wet semi-improved grassland (GA1) along the access track.

No fish were recorded via electro-fishing at site A1 (**Appendix A**). The site was not of fisheries value given its heavily modified and heavily silted nature. There was no suitability for white-clawed crayfish and the species was not recorded during the survey. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix C)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site A1 was of **local importance (lower value) (Table 4.4)**.



**Plate 4.1** Representative image of site A1 on an unnamed river, September 2023

#### 4.1.2 Site A2 – unnamed river, Doolough

Site A2 was located on the lower, tidal reaches of an unnamed river at a local road crossing, approximately 1.6km downstream of site A1. The small, semi-natural tidal channel (CW3) was 1-1.5m wide and between 0.1-0.4m deep with bank heights of 1-1.3m. The profile was dominated by slow-flowing deeper glide (tidal in nature). The substrata comprised small boulder and cobble with mixed gravels downstream of the bridge that were heavily silted. With the exception of localised common reed (*Phragmites australis*), the site did not support macrophytes or aquatic bryophytes due to the tidal nature of the channel and high turbidity. The open grassy riparian areas supported red fescue grass (*Festuca rubra*) with scattered sea plantain (*Plantago maritima*) and wild angelica (*Angelica sylvestris*). Scurvy grass (*Cochlearia officinalis*) was present on the muddy exposed banks at low tide. The tidal channel was bordered by upper saltmarsh (CM2) and cutover bog (PB4).

European eel (*Anguilla anguilla*) and flounder (*Platichthys flesus*) were recorded via electro-fishing at site A2 (**Appendix A**). The tidal channel was a good nursery for European eel and transitional fish such as flounder (*Platichthys flesus*) but did not support salmonid fish. The narrow channel was of poor suitability as a holding habitat for migratory salmonids (such as sea trout). There was no suitability for lamprey (*Lampetra* spp.) or white-clawed crayfish. No freshwater pearl mussel or white-clawed crayfish were detected via eDNA sampling (**Table 4.1**). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Red-listed European eel, the aquatic ecological evaluation of site A2 was of **local importance (higher value) (Table 4.4)**.



**Plate 4.2** Representative image of site A2 on the tidal reaches of a small, unnamed river, September 2023

#### 4.1.3 Site B1 – unnamed river, Muingmore

Site B1 was located on the upper reaches of a small unnamed tributary of Tullaghan Bay adjacent to the proposed site boundary. The small lowland peat channel (FW2) had been straightened and deepened historically with a resulting deep trapezoidal channel. The river was 0.5m wide and between 0.3-0.8m deep with peat stained water. The river had 2-2.5m high banks at grade with the adjoining semi-improved grassland. The river at this location was stagnant at the time of survey (no flows). The substrata were composed exclusively of soft peat with floc<sup>2</sup>. Macrophytes were limited to localised common water starwort (*Callitriche stagnalis*). Aquatic bryophytes were not present. The riparian areas supported scattered grey willow (*Salix cinerea*) and mature sitka spruce (*Picea sitchensis*) growing in the semi-improved wet pasture (GA1) bordering the site.

No fish were recorded via electro-fishing at site B1 (**Appendix A**). The site was not of fisheries value given historical modifications, heavy siltation and poor flows. There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix C)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

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<sup>2</sup> floc is defined as an aggregation of (mostly dead) organic material, mainly from algae and diatoms, but also with potential origins from decaying macrophytes and associated decomposers (bacteria and fungi) (Moorkens & Killeen, 2020)

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site B1 was of **local importance (lower value) (Table 4.4)**.



**Plate 4.3** Representative image of site B1 on an unnamed Tullaghan Bay tributary, September 2023

#### 4.1.4 Site B2 – unnamed river, Muingmore

Site B2 was located on the upper reaches of a small unnamed tributary of Tullaghan Bay adjacent to the proposed site boundary (separate watercourse from that at site B1). The small lowland peat channel (FW2) had been deepened and realigned historically to facilitate bog drainage. The river was 0.5m wide and between 0.2-0.3m deep with stagnant pools of peat stained water. The river had 2m high banks at grade with the adjoining species-poor lowland blanket bog (PB3). The substrata were composed exclusively of soft peat. Due to high peat staining, macrophytes and aquatic bryophytes were not present. Terrestrial encroachment was high with abundant rushes (*Juncus* spp.) and creeping bent (*Agrostis stolonifera*) instream. The site was bordered by bramble (*Rubus fruticosus* agg.) and dense bracken (*Pteridium aquilinum*) scrub that graded into adjoining species-poor blanket bog habitat with young conifer plantations downstream.

No fish were recorded via electro-fishing at site B2 (**Appendix A**). The site was not of fisheries value given historical modifications, heavy siltation and poor flows. There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix C)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site B2 was of **local importance (lower value) (Table 4.4)**.



**Plate 4.4** Representative image of site B2 on an unnamed Tullaghan Bay tributary, September 2023

#### 4.1.5 Site B3 – unnamed river, Muingmore

Site B3 was located on a small unnamed tributary of Tullaghan Bay at a local road crossing approximately 500m downstream of site B2. The small lowland peat channel (FW2) had been deepened and realigned historically to facilitate bog drainage. The river was 1m wide and between 0.1-0.2m deep with a profile of very slow-flowing glide. The substrata were composed exclusively of soft peat. The site supported occasional common water starwort and blue-water speedwell (*Veronica anagallis-aquatica*). The peaty banks supported the liverwort *Pellia epiphylla*. The site was bordered by bramble and dense bracken scrub that graded into adjoining wet semi-improved pasture (GA1).

No fish were recorded via electro-fishing at site B3 (**Appendix A**). The site was not of fisheries value given historical modifications, heavy siltation and poor flows. There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status) (Appendix C)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site B3 was of **local importance (lower value) (Table 4.4)**.



**Plate 4.5** Representative image of site B3 on an unnamed Tullaghan Bay tributary, September 2023

#### 4.1.6 Site B4 – unnamed stream, Muingmore

Site B4 was located on a small unnamed tributary of Tullaghan Bay. The small lowland peat channel (FW2) had been deepened and realigned historically through adjoining blanket bog. The deeply incised U-shaped channel was 1m wide and between 0.1-0.2m deep with bank heights of up to 2m. The profile was of swift flowing glide with very localised pool. The substrata comprised heavily bedded boulder with cobble and localised mixed gravels that had high siltation (peat). The channel was too deeply incised and shaded to support macrophyte plants. However, the channel supported the liverwort *Scapania undulata* on instream boulder with *Pellia* sp. and *Fissidens crassipes* on the peaty banks. The riparian areas supported dense bramble and gorse (*Ulex europaeus*) scrub. The site was bordered by lowland blanket bog (PB2) and mature conifer plantations (WD4).

Brown trout (*Salmo trutta*) was the only fish species recorded via electro-fishing at site B4 (**Appendix A**). Given the stream's very small size and heavily modified nature it was only a poor quality brown trout nursery with a small population of 0+ fish recorded. The quality of salmonid spawning habitat was poor given the presence of heavily bedded boulder, cobble and scattered gravels with high siltation (by peat). The holding value for adult fish was poor given the very limited pool habitat. Despite some low suitability for European eel, none were recorded. The site was unsuitable for lamprey or white-clawed crayfish. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix C)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site B4 was of **local importance (higher value) (Table 4.4)**.



**Plate 4.6** Representative image of site B4 on an unnamed Tullaghan Bay tributary, September 2023

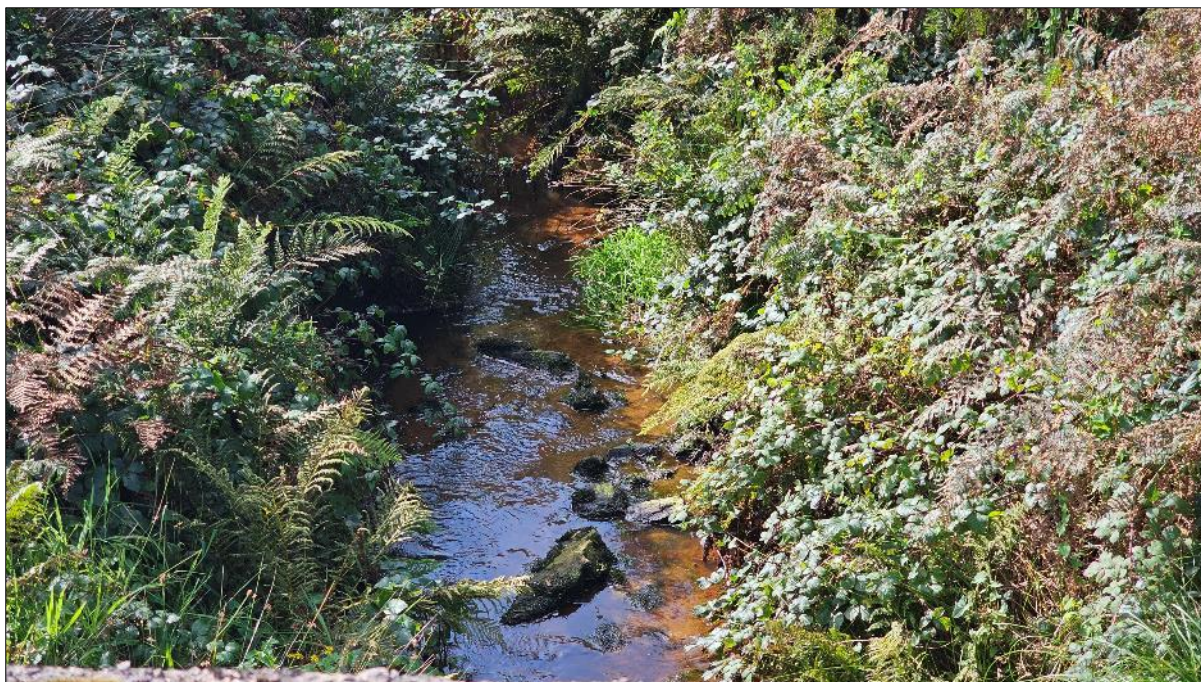
#### 4.1.7 Site B5 – unnamed river, Tristia

Site B1 was located on a small unnamed tributary of Tullaghan Bay at a local road crossing approximately 300m downstream of site B1. The small lowland peat channel (FW2) had been deepened historically but retained a sinuous profile through the adjoining peatland habitat. The heavily peat-stained spate river was 2-2.5m wide and 0.2-0.6m deep with 1.5m high banks. The profile was of slow-flowing glide with localised riffle and pool. The substrata comprised small boulder and cobble with mixed gravels that were heavily silted (peat) with high cover of floc and blankets of iron-oxidising bacteria. Macrophytes were limited to occasional common water starwort and branched-bur-reed (*Sparganium erectum*). Aquatic bryophytes were not present. The riparian areas supported localised bramble and bracken scrub. The site was bordered by degraded lowland blanket bog (PB2) and mature conifer plantations (WD4).

Brown trout was the only fish species recorded via electro-fishing at site B5 (**Appendix A**). Despite historical drainage the stream was considered a good quality brown trout nursery given it supported a good density of mixed cohort trout. Spawning habitat was of moderate quality given the presence of mixed gravels in pool and deeper glide but was reduced because of siltation pressures. Despite some suitability for European eel, none were recorded (superior habitats present downstream). The site was of too high an energy to support lamprey and no soft sediment settlement areas supporting ammocoetes were present. While some low potential for white-clawed crayfish existed given the stoney bed and deeper water, none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix C)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site B5 was of **local importance (higher value)** (Table 4.4).



**Plate 4.7** Representative image of site B5 on an unnamed Tullaghan Bay tributary, September 2023

#### 4.1.8 Site B6 – unnamed river, Doolough

Site B6 was located on the lower reaches of an unnamed tributary of Tullaghan Bay at a local road crossing, approximately 1.6km downstream of site B5. The river at this location represented an upland eroding peatland channel (FW1) that had been historically deepened through adjoining lowland blanket bog. The river was 2m wide and was between 0.1m to 0.7m deep with bank heights of 1-1.2m. The profile was dominated by slow-flowing deeper glide with very localised riffle and pool (given historical drainage works). The substrata comprised small boulder and cobble with mixed gravels that were heavily silted (peat) with high cover of filamentous algae and floc (c. 70%). The site supported abundant common water starwort with the moss species *Fontinalis antipyretica* being frequent on instream boulders. The open riparian areas with scattered bramble, gorse and iris (*Iris pseudacorus*) that graded into bordering degraded lowland blanket bog (PB2).

Atlantic salmon (*Salmo salar*), brown trout, European eel and three-spined stickleback (*Gasterosteus aculeatus*) were recorded via electro-fishing at site B6 (**Appendix A**). The site was a good quality salmonid nursery that supported a good density of trout and a low density of Atlantic salmon. The presence of deeper glide and a rocky bed provided refugia that were however compromised by siltation and eutrophication pressures in addition to historical drainage (i.e. deepening). Salmonid spawning habitat was of moderate quality, being reduced because of siltation and enrichment despite the presence of mixed gavel in deeper glide and pool pockets. Abundant deep glide provided good quality holding habitat for adult salmonids but would have improved with riparian tree cover which was absent from the river. The watercourse was a moderate quality eel nursery given the presence of deeper water with rocky refugia with a small population recorded present. The high energy river was

unsuitable for lamprey given no depositional areas for ammocoetes. While some low potential for white-clawed crayfish existed given the stoney bed and deeper water, no crayfish were recorded present. This was also supported by an absence of white-clawed crayfish in eDNA sampling (**Table 4.1**). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and Red-listed European eel, the aquatic ecological evaluation of site B6 was of **local importance (higher value)** (**Table 4.4**).



**Plate 4.8** Representative image of site B6 on an unnamed Tullaghan Bay tributary, September 2023

#### 4.1.9 Site P1 – pond, Doolough

Site P1 was located at a small 0.2ha elliptical pond adjacent to the proposed site boundary. The pond featured shallow, quaking margins and depths of 1-2.2m with peat-stained water. The substrata were composed entirely of soft silt (peat). The pond was heavily vegetated with frequent white water-lily (*Nymphae alba*), bog pondweed (*Potamogeton polygonifolius*) and bulrush (*Typha latifolia*). Water forget-me-not (*Myosotis scorpioides*) and bladderwort (*Utricularia* sp.) were recorded as rare. The quaking margins supported abundant *Sphagnum* mosses, mostly *S. cuspidatum*, with marsh cinquefoil (*Comarum palustre*), bog bean (*Menyanthes trifoliata*), wild angelica (*Angelica sylvestris*) and marsh pennywort (*Hydrocotyle vulgaris*). The pond was considered representative of the Annex I habitat 'Natural dystrophic lakes and ponds [3160]'. The site was bordered by scrubby grey willow and degraded lowland blanket bog (PB2).

Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had good suitability for a small brown trout population (despite an absence of inflowing

watercourses) and also had high suitability for European eel given close proximity to nearby upland eroding streams and drainage channels. Indeed, both species were detected via eDNA sampling (**Table 4.1**). Despite good suitability for smooth newt, the species was not detected via eDNA sampling. There was no suitability for white-clawed crayfish and the species was not recorded during surveys. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via sweep sampling (**Appendix C**).

Given the presence of salmonids and Red-listed European eel (eDNA), in addition to Annex I acid oligotrophic lake habitat [3160], the aquatic ecological evaluation of site P1 was of **county importance** (**Table 4.4**).



**Plate 4.9** Representative image of site P1, September 2023

#### 4.1.10 Site P2 – pond, Muingmore

Site P2 was located at a small 0.35ha irregular-shaped pond adjacent to the proposed site boundary. The pond comprised two small basins connected via a narrow channel. The pond had shallow, quaking margins and depths of 0.3-1.1m with peat-stained water. The substrata were composed entirely of soft silt (peat). The shallow pond was heavily vegetated with frequent white water-lily and occasional bog pondweed and bulbous rush (*Schoenus bulbosus*). Bulrush, bottle sedge (*Carex rostrata*) and spike rush (*Eleocharis palustris*) were also occasional in the margins. *Sphagnum cuspidatum* and *S. capillifolium* were abundant in the quaking margins. The pond was considered representative of the Annex I habitat ‘Natural dystrophic lakes and ponds [3160]’. The site was bordered by degraded lowland blanket bog (PB2) with mature coniferous plantations to the west (WD4).

Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had good suitability for European eel given close proximity to nearby upland eroding streams

and drainage channels. Suitability for brown trout was poor given the shallow depths. Whilst brown trout were not recorded via eDNA sampling (thus considered absent), European eel were detected (**Table 4.1**). Despite good suitability for smooth newt, the species was not detected via eDNA sampling. There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep sampling (**Appendix C**).

Given the presence of Red-listed European eel (eDNA), in addition to Annex I acid oligotrophic lake habitat [3160], the aquatic ecological evaluation of site P2 was of **county importance (Table 4.4)**.



**Plate 4.10** Representative image of site P2, September 2023

#### 4.1.11 Site P3 – pond, Muingmore

Pond P3 was located at a small 0.4ha pond adjacent to (west of) site P2. The pond had a complex margin with numerous small peninsulas and bays. The margins were gently sloping and the pond ranged from 0.6-1.5m in depth with a bed composed entirely of deep soft sediment (peat) with a high cover of floc and diatomaceous masses. The water was peat-stained. The shallow basin supported abundant white water-lily and floating bur-reed (*Sparganium angustifolium*). Occasional bulbus rush, spike rush and Red-listed pipewort (*Eriocaulon aquaticum*) were present in the margins with the littorals dominated by *Sphagnum cuspidatum*. Bladderwort (*Utricularia* sp.) was rare. The pond was considered representative of the Annex I habitat 'Natural dystrophic lakes and ponds [3160]' (but not oligotrophic isoetid lake habitat [3110] due to fragmented distribution of indicator species). The site was bordered by lowland blanket bog (PB2) with mature coniferous afforestation (WD4) to the east.

Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had moderate suitability for brown trout and high suitability for European eel and both species were detected via eDNA sampling (**Table 4.1**). The heavily vegetated pond was suitable for

smooth newt although none were recorded by sweep sampling or eDNA sampling. There was no suitability for white-clawed crayfish and the species was not recorded present. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep sampling (**Appendix C**).

Given the presence of salmonids and Red-listed European eel (eDNA), in addition to Annex I acid oligotrophic lake habitat [3160], the aquatic ecological evaluation of site P4 was of **county importance (Table 4.4)**.



**Plate 4.11** Representative image of site P3, September 2023

#### 4.1.12 Site P4 – pond, Doolough

Site P4 was located at a small 0.65ha pond adjacent to the proposed site boundary. The pond had a complex margin with numerous small peninsulas and bays. The margins were steep and the pond ranged from 1.4-2.5m in depth with a bed composed entirely of deep soft sediment (peat). The water was peat-stained. Given this and relatively high depths, macrophyte cover was low in the open water areas with rare white-water lily. However, the littorals supported locally frequent bulbous rush and Red-listed pipewort with abundant floating bur-reed on the shelf zone of the shallower southern shore. Bog pondweed and bog bean stands were scattered, with bladderwort (*Utricularia* sp.) recorded as rare. Free-floating agglomerations of *Sphagnum cuspidatum* were present along the margins. Based on the criteria outlined by O'Connor (2015), the macrophyte community locally dominated by pipewort was considered representative of the Annex I habitat 'Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]'. The site was bordered by lowland blanket bog (PB2) with mature coniferous afforestation (WD4) to the north.

Electro-fishing was not undertaken at the lacustrine site. However, a fisheries appraisal indicated that the pond had good suitability for brown trout and European eel and both species were detected via eDNA sampling (**Table 4.1**). The pond was largely unsuitable (low macrophyte cover, too deep) to support smooth newt and none were recorded by sweep sampling or eDNA sampling. There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep sampling (**Appendix C**).

Given the presence of salmonids (eDNA) and Red-listed pipewort, in addition to the Annex I Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]', the aquatic ecological evaluation of site P4 was of **county importance (Table 4.4)**.



**Plate 4.12** Representative image of site P4, September 2023

#### 4.1.13 Site C1 – An Mhoing Mhór River, Muingmore

Site C1 was located on the Mhoing Mhór River (EPA code: 33M23), a tributary of the Doolough Stream, adjacent to the site boundary. The lowland depositing peat channel had been deepened historically to facilitate land drainage for adjoining conifer plantations. The river was 0.5m wide and between 0.2-0.3m deep with bank heights of 1.5-2m. The profile was dominated by slow-flowing glide with the substrata comprised entirely of soft peat. Due to high shading and peat-staining, macrophytes were absent. The peaty banks supported the liverwort *Pellia epiphylla*, a species common a wet river banks. The site bordered by degraded lowland blanket bog (PB2) and mature conifer plantations (WD4).

No fish were recorded via electro-fishing at site C1 (**Appendix A**). The river was not of fisheries value at this location given its heavily modified nature and siltation pressures. There was no suitability for white-clawed crayfish and the species was not recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix C)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site C1 was of **local importance (lower value) (Table 4.4)**.



**Plate 4.13** Representative image of site C1 on the Mhoing Mhór River, September 2023

#### 4.1.14 Site C2 – Doolough Stream, Muingmore

Site C2 was located on the Doolough Stream (33D02) adjacent to the site boundary. The lowland depositing stream (FW2) had been historically straightened and deepened through adjoining blanket bog and improved grassland but retained some semi-natural features. The peat-stained stream was 2-3m wide and between 0.2-0.8m deep with banks of 1.5-2m in height. The profile comprised riffle and glide sequences with occasional pool. The substrata were dominated by heavily silted mixed gravels with localised small boulder and cobble. Cover of filamentous algae and floc was high (c.30-40%), indicating significant enrichment. Macrophyte growth was limited to sparse bog pondweed. No aquatic bryophytes were recorded. The site was bordered by degraded blanket bog (PB2) and semi-improved grassland (GA1).

Brown trout and European eel were the only fish species recorded via electro-fishing at site C2 (**Appendix A**). The site was a good quality salmonid nursery despite historical drainage, siltation and enrichment pressures with a relatively high density of mixed cohort trout. Salmonid spawning habitat was moderate given the presence of mixed gravels in pool and deeper glide as with areas downstream (e.g. site C4) but was reduced because of siltation and enrichment pressures. Suitability for European eel was moderate (cobble refugia and sufficiently deep) with a small population of adults present. No soft sediment settlement areas suitable for lamprey ammocoetes were present and the species was

not recorded. While some low potential for white-clawed crayfish existed given instream refugia and deeper water, none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix C)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and Red-listed European eel, the aquatic ecological evaluation of site C2 was of **local importance (higher value) (Table 4.4)**.



**Plate 4.14** Representative image of site C2 on the Doolough Stream, September 2023

#### 4.1.15 Site C3 – unnamed stream, Muingmore

Site C3 was located on an unnamed tributary of the Doolough Stream adjacent to the site boundary. The U-shaped lowland depositing peat channel (FW2) had been historically deepened throughout and did not feature flowing water at the time of survey. The stream was 1m wide with stagnant pools of water to 0.1m in depth. The substrata were comprised entirely of soft peat. The site supported abundant watercress (*Nasturtium* agg.) with high levels of terrestrial encroachment by creeping bent grass (*Agrostis stolonifera*).

No fish were recorded via electro-fishing at site C3 (**Appendix A**). The site was not of fisheries value at this location given its ephemeral nature and historical modifications. There was no suitability for white-clawed crayfish and the species was not recorded present. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix C)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than

'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site C3 was of **local importance (lower value) (Table 4.4)**.



**Plate 4.15** Representative image of site C3 on an unnamed Doolough Stream tributary, September 2023

#### 4.1.16 Site C4 – Doolough Stream, Muingmore

Site C4 was located on the Doolough Stream (33D02) approximately 1.2km downstream of site C2. The lowland depositing stream (FW2) had been historically deepened through adjoining blanket bog and improved grassland but retained some semi-natural features with frequent meanders in a sinuous channel. The peat-stained stream was 2-3m wide and between 0.2-0.6m deep with banks of 1.5-2m in height. The profile comprised slow-flowing glide with localised riffle and pool. The substrata were dominated by heavily silted mixed gravels with localised small boulder and cobble. These had a moderate cover (c.20%) of filamentous algae and floc. Macrophyte growth was limited to occasional bog pondweed. Aquatic bryophyte coverage was low although some *Pellia epiphylla* and *Scapania undulata* were present locally. The site was bordered by degraded blanket bog (PB2).

Brown trout, European eel and three-spined stickleback were recorded via electro-fishing at site C4 (**Appendix A**). Despite historical drainage and siltation pressures, the site was a good quality salmonid nursery supporting a relatively high density of juvenile trout. Localised pools and instream boulder provided valuable holding areas for adult salmonids although the quality of the holding habitat was poor overall (shallow water). Mixed gravels provided moderate quality salmonid spawning habitat, with the value reduced due to siltation. The site was of moderate value for European eel with a low density of adults recorded. No soft sediment settlement areas suitable for lamprey ammocoetes were identified. While some low potential for white-clawed crayfish existed given instream refugia and deeper water, none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status) (Appendix C)**. No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and Red-listed European eel, the aquatic ecological evaluation of site C4 was of **local importance (higher value) (Table 4.4)**.



**Plate 4.16** Representative image of site C4 on the Doolough Stream, September 2023

#### 4.1.17 Site C5 – Doolough Stream, Muingmore

Site C5 was located on the Doolough Stream (33D02) at the L1205 local road crossing approximately 0.9km downstream of site C4. The lowland depositing peatland stream (FW2) had been historically deepened through adjoining lowland blanket bog and bordering improved grassland habitats. The stream was 2-4m wide and between 0.2-0.8m deep with a semi-natural profile and bank heights of 1-1.2m. The profile comprised riffle and glide sequences with occasional pool. The substrata were dominated by heavily silted mixed gravels with localised small boulder and cobble. As per upstream, cover of filamentous algae and floc was high (c.40%), indicating significant enrichment. Macrophyte growth was limited to sparse bog pondweed. No aquatic bryophytes were recorded. The site was bordered by degraded blanket bog (PB2) and semi-improved grassland (GA1). Blanket growth of iron-oxidising bacteria was also present upstream of the bridge in the channel margins. The site supported occasional common water starwort and alternate water-milfoil (*Myriophyllum alterniflorum*) with the moss species *Fontinalis antipyretica* also being occasional on instream boulders. Water horsetail (*Equisetum fluviatile*) and branched bur-reed (*Sparganium erectum*) were also present locally. The open banks supported bramble and gorse that graded into degraded lowland blanket bog (PB2) and improved pasture (GA1).

Brown trout was the only fish species recorded via electro-fishing at site C5 (**Appendix A**). The site was a good quality salmonid nursery supporting a relatively high density of juvenile trout. The presence of

deeper glide and a rocky bed provided refugia but these were impacted by siltation and eutrophication pressures in addition to historical drainage (i.e. deepening). Salmonid spawning habitat was of moderate quality. Abundant deep glide provided good quality holding habitat for adult salmonids. The site was a moderate quality European eel nursery given the presence of deeper water with ample refugia but none were recorded. No soft sediment settlement areas suitable for lamprey ammocoetes were identified. While some low potential for white-clawed crayfish existed given instream refugia and deeper water, none were recorded. No white-clawed crayfish or freshwater pearl mussel were detected via eDNA sampling (**Table 4.1**). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (moderate status) (Appendix C)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and Red-listed European eel, the aquatic ecological evaluation of site C5 was of **local importance (higher value) (Table 4.4)**.



**Plate 4.17** Representative image of site C5 on the Doolough Stream, September 2023

## 4.2 White-clawed crayfish

No white-clawed crayfish were recorded via hand-searching or sweep netting of instream refugia during the survey of 54 no. survey sites. Furthermore, no crayfish were detected via eDNA sampling of the Doolough Stream or two unnamed watercourses in vicinity of the proposed site boundary (**Table 4.1**). These findings were in keeping with the known absence of the species in the wider Owenmore[Mayo]\_SC\_030 and Glencastle\_SC\_010 river sub-catchments (**Figure 3.1**).

## 4.3 eDNA analysis

In keeping with the known historical distribution of the species in the survey area (**Figure 3.1**), no freshwater pearl mussel or white-clawed eDNA was detected in an unnamed river (site A2), unnamed river (B6) or Doolough Stream (C5) (0 positive qPCR replicates out of 12; **Table 4.1, Appendix C**). However, the invasive pathogen crayfish plague (*Aphanomyces astaci*) was detected at all 3 no. riverine sampling locations (**Table 4.1**).

Brown trout eDNA was detected in pond sites P1, P3 and P4 (1 positive replicates out of 12, respectively). European eel eDNA was detected at sites P1, P2 and P3 (12, 12 & 2 positive replicates out of 12, respectively (**Table 4.1**). Despite some habitat suitability, no smooth eDNA was detected in the 4 no. pond sites during the survey.

## 4.4 Invasive aquatic species

With the exception of crayfish plague (above), no aquatic invasive species were recorded during the September 2023 surveys.

## 4.5 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 40 no. riverine sites<sup>3</sup> in September 2023 (**Appendix C**).

A total of 11 no. sites on the Munhin River (D3), Ballybeg River (D5), Srahanarry Stream (D6), unnamed Owenmore River tributaries (D4, D11, D22, D23, D24, D25), Moneynierin River (E1) and the Ballisodare River (E3) achieved **Q4 (good status)** (**Figures 4.1, 4.2 & 4.3**). This was given the presence of the EPA group A (most pollution sensitive) species such as the flattened mayfly *Rhithrogena semicolorata* and stonefly *Protonemura meyeri* in fair numbers (5-10% of total abundance) (**Appendix C**).

A total of 10 no. sites on an unnamed Tullaghan Bay tributary (B3), Doolough Stream (sites C4 & C5), Bellanumera Stream (D7), Briska River (D8), unnamed Owenmore River tributaries (D18, D26, D29 & D3) and the River Deel (E2) achieved **Q3-4 (moderate status)** given the presence of EPA group A mayflies *Ecdyonurus dispar* or *Heptagenia sulphurea* and or stoneflies *Protonemura meyeri* or *Nemoura cinerea* in low numbers (<5%), respectively (**Appendix C**).

With the exception of site E4 (see below), the remaining sites (i.e. A1, A2, B1, B2, B4, B5, B6, C1, C2, C3, C5, D1, D2, D9, D10, D20, D21 & E7) achieved **Q2-3 or Q3 (poor status)** based on a dominance of

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<sup>3</sup> A total of 10 no. sites (D12, D13, D14, D15, D16, D17, D19, D27, D28 & E6) were dry at the time of the survey. Four no. sites (P1, P2, P3 & P4) were ponds and thus were not suitable for Q sampling.

EPA group C species, including the mayfly *Baetis rhodani*, freshwater shrimp (*Gammarus duebeni*) and New Zealand mud snail (*Potamopyrgus antipodarum*) (**Appendix C**). These sites did not support any group A species and an absence of or only low numbers of group B species such as the stonefly *Leuctra hippopus*.

Site E4 on the Carrowgobbadagh River (adjacent to TDR works) achieved **Q2 (bad status)** based on the dominance of highly pollution tolerant group D and E taxa (**Appendix C**). However, the tidal channel was largely unsuitable for Q-sampling given a lack of riffle areas and this rating was therefore tentative (as per Toner et al., 2005).

Many of the Q-ratings recorded in September 2023, particularly higher gradient channels along the GCR, were tentative only due to low summer flows (i.e. absence of riffle or glide habitat).

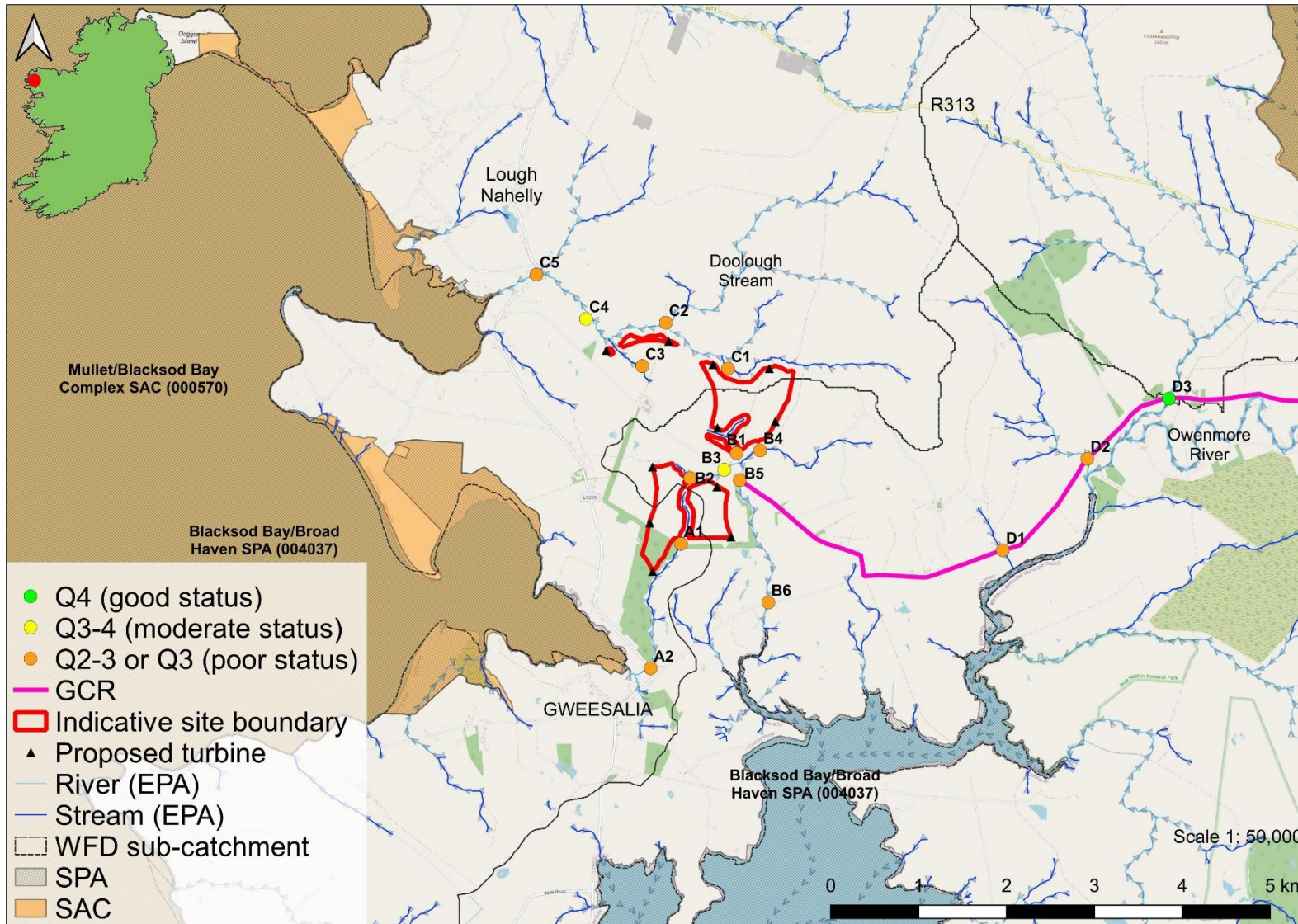
#### 4.6 Pond macro-invertebrate communities

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the composite sweep samples collected from sites P1, P2, P3 or P4 in September 2023.

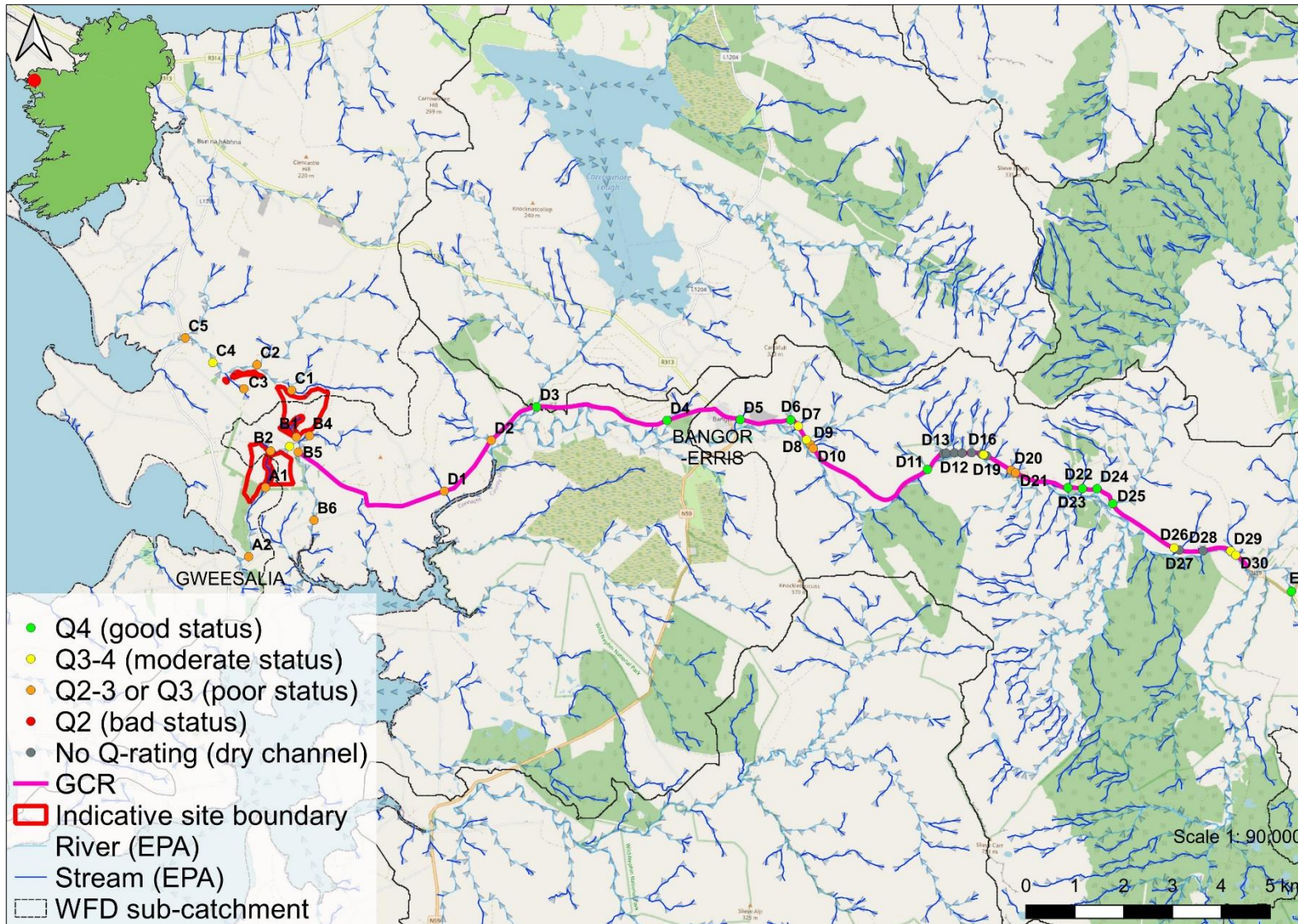
The pond samples were dominated by a typical assemblage of oligotrophic lacustrine taxa such as damselfly larvae (Coenagrionidae), lesser water boatman (*Corixa punctata*), backswimmers (*Notonecta viridis*), phantom midge larvae (Chaoboridae) and biting midge larvae (*Chironomus* spp.) (**Appendix C**).

**Table 4.1** eDNA results in the vicinity of the proposed Muingmore wind farm, Co. Mayo (positive qPCR replicates out of 12 in parentheses)

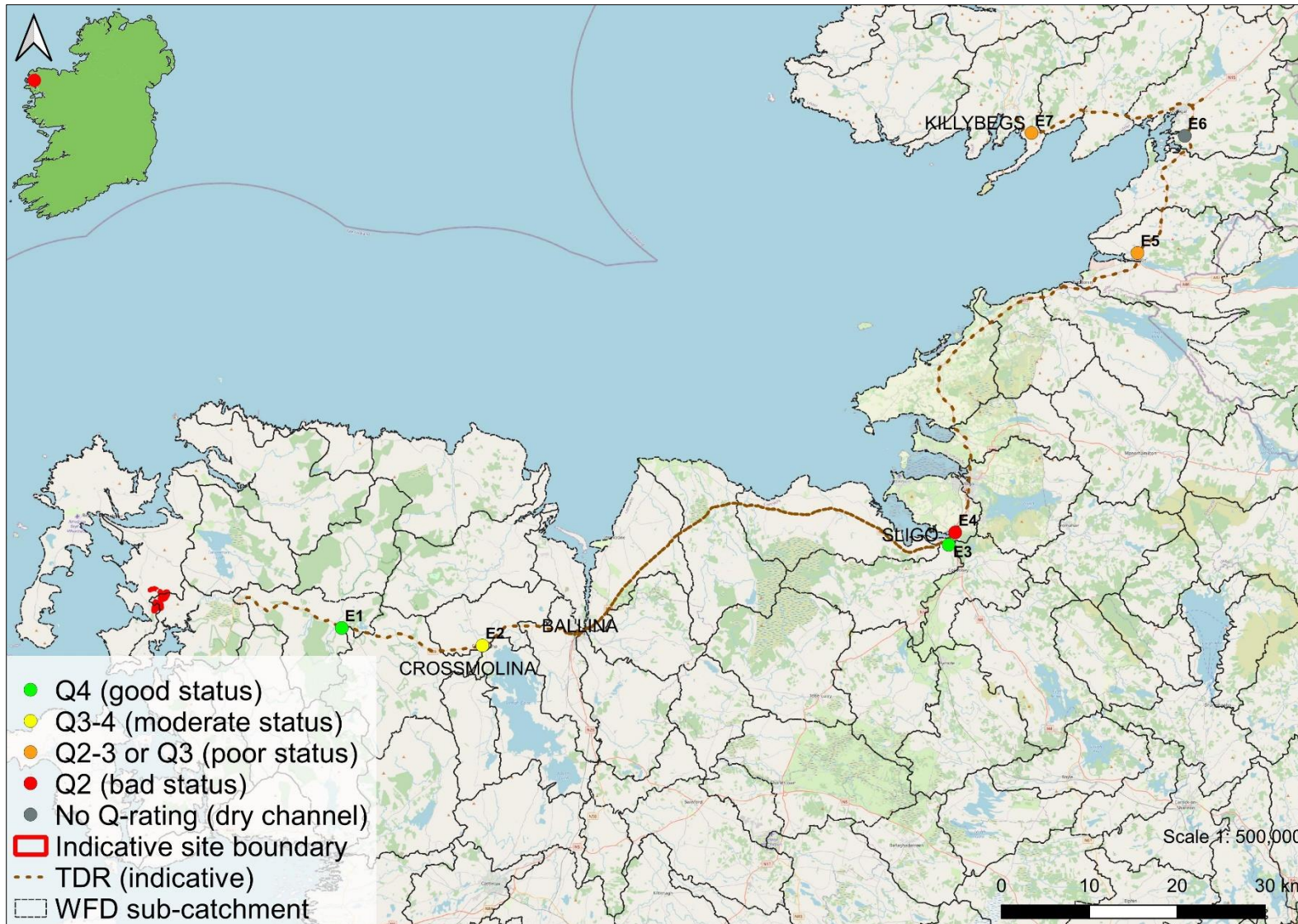
Site	Watercourse	Freshwater pearl mussel	White-clawed crayfish	Crayfish plague	Brown trout	European eel	Smooth newt
A2	Unnamed river	Negative (0/12)	Negative (0/12)	<b>Positive (12/12)</b>	n/a	n/a	n/a
B6	Unnamed river	Negative (0/12)	Negative (0/12)	<b>Positive (11/12)</b>	n/a	n/a	n/a
C5	Doolough Stream	Negative (0/12)	Negative (0/12)	<b>Positive (12/12)</b>	n/a	n/a	n/a
P1	Pond	n/a	n/a	n/a	<b>Positive (1/12)</b>	<b>Positive (12/12)</b>	Negative (0/12)
P2	Pond	n/a	n/a	n/a	Negative (0/12)	<b>Positive (12/12)</b>	Negative (0/12)
P3	Pond	n/a	n/a	n/a	<b>Positive (1/12)</b>	<b>Positive (2/12)</b>	Negative (0/12)
P4	Pond	n/a	n/a	n/a	<b>Positive (1/12)</b>	Negative (0/12)	Negative (0/12)



**Figure 4.1** Overview of the biological water quality status in the vicinity of the proposed Muingmore wind farm, September 2023



**Figure 4.2** Overview of the biological water quality status in the vicinity of the proposed Muingmore wind farm GCR, September 2023



**Figure 4.3** Overview of the biological water quality status in the vicinity of the proposed Muingmore wind farm TDR, September 2023

## 4.7 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of desktop review (i.e., presence of fish of conservation value), fisheries habitat assessments, the presence of protected or rare invertebrates (e.g. white-clawed crayfish), environmental DNA analysis, the presence of rare macrophytes and aquatic bryophytes and or associated representations of Annex I habitats. Furthermore, biological water quality status also informed the aquatic evaluation (**Table 4.4**).

Sites E2 on the River Deel and E3 on the Ballisodare River were evaluated as **international importance** given their locations within the River Moy SAC (002298) and Unshin River SAC (001898), respectively.

Sites P1, P2, P3 were evaluated as **county importance** given the presence of a macrophyte community representative of the Annex I habitat 'Natural dystrophic lakes and ponds [3160]'. Site P4 was also of **county importance** as it supported abundant pipewort, a near threatened red-listed macrophyte (Wyse-Jackson et al. 2016) and a macrophyte community representative of the Annex I habitat 'Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]'. Site D3 on the Munhin River was also evaluated as **county importance** due to the presence of several fish species of high conservation value (i.e. salmon and lamprey) and Q4 (good status) water quality and the fact that the river serves as an important ecological corridor between several European sites (e.g. Carrowmore Lake SAC and Blacksod Bay/Broad Haven SPA).

A total of 22 no. sites in vicinity of the site boundary (A2, B4, B5, B6, C2, C4 & C5), GCR (D2, D4, D5, D6, D8, D18, D22, D23, D24, D25, D26, D29 & D30) and TDR (E1 & E4) were evaluated as **local importance (higher value)** in terms of their aquatic ecology. This evaluation was due to the presence of fish species of high conservation value, otter and or Q4 (good status) water quality (**Table 4.4**).

The remaining sites 25 no. sites (i.e. sites A1, B1, B2, B3, C1, C3, D1, D7, D9, D10, D11, D12, D13, D14, D15, D16, D17, D19, D20, D21, D27, D28, E5, E6 & E7) were evaluated as **local importance (lower value)** given an absence of aquatic species or habitats of high conservation value and less than good status water quality.

**Table 4.2** Relative abundance of fish species of higher conservation value recorded per survey site in the vicinity of the proposed Muingmore wind farm, September 2023

Site	Watercourse	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Other species
<b>Sites in vicinity of site boundary</b>						
A1	Unnamed river	No fish recorded				
A2	Unnamed river				Medium	Flounder
B1	Unnamed river	No fish recorded				
B2	Unnamed river	No fish recorded				
B3	Unnamed river	No fish recorded				
B4	Unnamed stream		Low			
B5	Unnamed river		Medium			
B6	Unnamed river		High		Low	Three-spined stickleback
C1	An Mhoing Mhór River	No fish recorded				
C2	Doolough Stream		High		Low	
C3	Unnamed stream	No fish recorded				
C4	Doolough Stream		High		Low	Three-spined stickleback
C5	Doolough Stream		Very high			
P1	Pond		eDNA		eDNA	
P2	Pond		eDNA		eDNA	
P3	Pond				eDNA	
P4	Pond		eDNA			
<b>GCR crossings</b>						
D1	Unnamed stream	No fish recorded				
D2	Goolamore River		Medium			Minnow
D3	Munhin River	Medium	Low	Low		Sea trout, flounder, minnow
D4	Unnamed river	No fish recorded				
D5	Ballybeg Stream	No fish recorded				
D6	Srahanarry Stream	Medium	Low			
D7	Bellanumera Stream	No fish recorded				
D8	Briska River	Low	Medium		High	
D9	Unnamed stream	No fish recorded				
D10	Unnamed stream	No fish recorded				
D11	Unnamed river	No fish recorded				

Site	Watercourse	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Other species
D12	Unnamed river	No fish recorded				
D13	Unnamed river	No fish recorded				
D14	Unnamed stream	No fish recorded				
D15	Unnamed stream	No fish recorded				
D16	Unnamed river	No fish recorded				
D17	Unnamed stream	No fish recorded				
D18	Unnamed stream		Low		Low	
D19	Unnamed stream	No fish recorded				
D20	Unnamed stream	No fish recorded				
D21	Unnamed stream	No fish recorded				
D22	Unnamed stream		Medium			
D23	Unnamed stream		Low			
D24	Unnamed river		Medium			
D25	Unnamed river	Very high	Medium		Low	
D26	Unnamed stream	Low	Low			Minnow
D27	Kilsallagh Stream	No fish recorded				
D28	Unnamed stream	No fish recorded				
D29	Unnamed stream		Low			
D30	Unnamed stream		Low			Minnow, three-spined stickleback
<b>TDR nodes</b>						
E1	Moneynierin River	Low	Low			Three-spined stickleback
E2	River Deel	High				Minnow, roach, three-spined stickleback
E3	Ballisodare River	High	Low		Medium	
E4	Carrowgobbadagh Stream				Low	Three-spined stickleback
E5	Abbeylands Stream	No fish recorded				
E6	Drumgowan Stream	No fish recorded				
E7	Bogside River	No fish recorded				

**Table 4.3** Summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the proposed Muingmore wind farm, September 2023

Site	Watercourse	Freshwater pearl mussel	White-clawed crayfish	Otter signs <sup>4</sup>	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
<b>Sites in vicinity of site boundary</b>			None recorded	No signs	Not present	None recorded	None recorded	None recorded
A1	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
A2	Unnamed river	Negative eDNA result at site	None recorded; negative eDNA result at site	No signs	Not present	None recorded	None recorded	None recorded
B1	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
B2	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
B3	Unnamed river		None recorded; negative eDNA result at site	No signs	Not present	None recorded	None recorded	None recorded
B4	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
B5	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
B6	Unnamed river	Negative eDNA result at site	None recorded; negative eDNA result at site	No signs	Not present	None recorded	None recorded	None recorded
C1	An Mhoing Mhór River		None recorded; negative eDNA result at site	No signs	Not present	None recorded	None recorded	None recorded
C2	Doolough Stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
C3	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
C4	Doolough Stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
C5	Doolough Stream	Negative eDNA result at site	None recorded; negative eDNA result at site	No signs	Not present	None recorded	None recorded	None recorded
P1	Pond		None recorded	No signs	<b>Acid oligotrophic lake [3160]</b>	None recorded	None recorded	<b>European eel (eDNA)</b>

Site	Watercourse	Freshwater pearl mussel	White-clawed crayfish	Otter signs <sup>4</sup>	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
P2	Pond		None recorded	No signs	Acid oligotrophic lake [3160]	None recorded	None recorded	European eel (eDNA)
P3	Pond		None recorded	No signs	Acid oligotrophic lake [3160]	Pipewort ( <i>Eriocaulon aquaticum</i> )	None recorded	European eel (eDNA)
P4	Pond		None recorded	No signs	Acid oligotrophic lake [3160]; oligotrophic isoetid lake [3110]	Pipewort ( <i>Eriocaulon aquaticum</i> )	None recorded	None recorded
<b>GCR crossings</b>								
D1	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D2	Goolamore River		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D3	Munhin River		None recorded	No signs	Not present	None recorded	None recorded	Atlantic salmon, <i>Lampetra</i> sp., sea trout
D4	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D5	Ballybeg Stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D6	Srahanarry Stream		None recorded	No signs	Not present	None recorded	None recorded	Atlantic salmon
D7	Bellanumera Stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D8	Briska River		None recorded	No signs	Not present	None recorded	None recorded	Atlantic salmon, European eel
D9	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D10	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D11	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D12	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D13	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D14	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded

Site	Watercourse	Freshwater pearl mussel	White-clawed crayfish	Otter signs <sup>4</sup>	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
D15	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D16	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D17	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D18	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	<b>European eel</b>
D19	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D20	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D21	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D22	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D23	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D24	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D25	Unnamed river		None recorded	No signs	Not present	None recorded	None recorded	<b>Atlantic salmon, European eel</b>
D26	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	<b>Atlantic salmon</b>
D27	Kilsallagh Stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D28	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D29	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
D30	Unnamed stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
<b>TDR nodes</b>							None recorded	
E1	Moneynierin River		None recorded	No signs	Not present	None recorded	None recorded	<b>Atlantic salmon</b>
E2	River Deel		None recorded	No signs	Not present	None recorded	None recorded	<b>Atlantic salmon</b>
E3	Ballisodare River		None recorded	<b>2 no. spraint sites</b>	<b>Floating river vegetation [3260]</b>	None recorded	None recorded	<b>Atlantic salmon</b>

Site	Watercourse	Freshwater pearl mussel	White-clawed crayfish	Otter signs <sup>4</sup>	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
E4	Carrowgobbadagh Stream		None recorded	No signs	<b>Floating river vegetation [3260]</b>	None recorded	None recorded	None recorded
E5	Abbeylands Stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
E6	Drumgowan Stream		None recorded	No signs	Not present	None recorded	None recorded	None recorded
E7	Bogside River		None recorded	No signs	Not present	None recorded	None recorded	None recorded

**Conservation value:** Eurasian otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive') and are protected under the Irish Wildlife Acts 1976-2023. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Atlantic salmon and sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. Apart from the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout and coarse fish species have no legal protection in Ireland.

<sup>4</sup> Otter signs within 150m of the survey site

**Table 4.4** Aquatic ecological evaluation summary of the Muingmore wind farm survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
<b>Sites in vicinity of site boundary</b>				
A1	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
A2	Unnamed river	n/a	<b>Local importance (higher value)</b>	Red-listed European eel recorded
B1	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
B2	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
B3	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
B4	Unnamed stream	n/a	<b>Local importance (higher value)</b>	Brown trout recorded
B5	Unnamed river	n/a	<b>Local importance (higher value)</b>	Brown trout recorded
B6	Unnamed river	n/a	<b>Local importance (higher value)</b>	Atlantic salmon, brown trout & Red-listed European eel recorded
P1	Pond	n/a	<b>County importance</b>	Annex I oligotrophic lake habitat [3160] present
P2	Pond	n/a	<b>County importance</b>	Annex I oligotrophic lake habitat [3160] present
P3	Pond	n/a	<b>County importance</b>	Annex I oligotrophic lake habitat [3160] present
P4	Pond	n/a	<b>County importance</b>	Annex I oligotrophic isoetid lake habitat [3110] & near threatened pipewort present
C1	An Mhoing Mhór River	33M23	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
C2	Doolough Stream	33D02	<b>Local importance (higher value)</b>	Brown trout & Red-listed European eel recorded
C3	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
C4	Doolough Stream	33D02	<b>Local importance (higher value)</b>	Brown trout & Red-listed European eel recorded

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
C5	Doolough Stream	33D02	<b>Local importance (higher value)</b>	Brown trout & Red-listed European eel recorded
<b>GCR sites</b>				
D1	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D2	Goolamore River	33G12	<b>Local importance (higher value)</b>	Atlantic salmon & brown trout recorded
D3	Munhin River	33M03	<b>County importance</b>	Atlantic salmon, brown trout, sea trout & lamprey ( <i>Lampetra</i> sp.) recorded; Q4 (good status) water quality
D4	Unnamed river	n/a	<b>Local importance (higher value)</b>	Q4 (good status) water quality
D5	Ballybeg Stream	33B40	<b>Local importance (higher value)</b>	Q4 (good status) water quality
D6	Srahanarry Stream	33S23	<b>Local importance (higher value)</b>	Atlantic salmon & brown trout recorded; Q4 (good status) water quality
D7	Bellanumera Stream	33B38	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3-4 (moderate status) water quality (tentative rating)
D8	Briska River	33B33	<b>Local importance (higher value)</b>	Atlantic salmon, brown trout & Red-listed European eel recorded
D9	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D10	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D11	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D12	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D13	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D14	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D15	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D16	Unnamed river	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
D17	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D18	Unnamed stream	n/a	<b>Local importance (higher value)</b>	<b>Brown trout &amp; Red-listed European eel recorded</b>
D19	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D20	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D21	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D22	Unnamed stream	n/a	<b>Local importance (higher value)</b>	<b>Brown trout recorded; Q4 (good status) water quality</b>
D23	Unnamed stream	n/a	<b>Local importance (higher value)</b>	<b>Brown trout recorded; Q4 (good status) water quality (tentative rating)</b>
D24	Unnamed river	n/a	<b>Local importance (higher value)</b>	<b>Brown trout recorded; Q4 (good status) water quality</b>
D25	Unnamed river	n/a	<b>Local importance (higher value)</b>	<b>Atlantic salmon, brown trout &amp; Red-listed European eel recorded; Q4 (good status) water quality</b>
D26	Unnamed stream	n/a	<b>Local importance (higher value)</b>	<b>Atlantic salmon &amp; brown trout recorded</b>
D27	Kilsallagh Stream	33K13	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D28	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
D29	Unnamed stream	n/a	<b>Local importance (higher value)</b>	<b>Brown trout recorded</b>
D30	Unnamed stream	n/a	<b>Local importance (higher value)</b>	<b>Brown trout recorded;</b>
<b>TDR sites</b>				
E1	Moneynierin River	33M16	<b>Local importance (higher value)</b>	<b>Atlantic salmon &amp; brown trout recorded; Q4 (good status) water quality</b>
E2	River Deel	34D01	<b>International importance</b>	<b>Located within River Moy SAC (002298)</b>
E3	Ballisodare River	35B05	<b>International importance</b>	<b>Located within the Unshin River SAC (001898)</b>

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
E4	Carrowgobbadagh Stream	35C95	<b>Local importance (higher value)</b>	Red-listed European eel recorded
E5	Abbeylands Stream	36A15	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q2-3 (poor status) water quality (tentative rating)
E6	Drumgowan Stream	37D49	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral channel)
E7	Bogside River	37B26	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)

**Conservation value:** Eurasian otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive') and are protected under the Irish Wildlife Acts 1976-2023. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Atlantic salmon and sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. Apart from the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout and coarse fish species have no legal protection in Ireland.

## 5. Discussion

The watercourses in the vicinity of the proposed Muingmore wind farm project (inclusive of the GCR & TDR) were typically heavily modified lowland channels (straightened, deepened, realigned) draining blanket bog or higher gradient/higher energy upland channels (prone to spate). Significant siltation (primarily from peat escapement), and less so eutrophication, was evident throughout much of the survey area. This, coupled with low summer flows, reduced the aquatic value of many survey watercourses. Nevertheless, over half of the survey sites were evaluated of at least **local importance (higher value)** in terms of their aquatic ecology given the presence of fish of high conservation value and or Q4 (good status) water quality (**Table 4.4**). Sites P1, P2, P3 and P4 were evaluated as **county importance** given the presence of Annex I aquatic habitats. Sites E2 on the River Deel and E3 on the Ballisodare River were evaluated as **international importance** given their locations within the River Moy SAC (002298) and Unshin River SAC (001898), respectively.

### 5.1 Fisheries

A fish species assemblage typical of Ireland's north-west – namely Atlantic salmon, brown trout, sea trout, European eel, lamprey (*Lampetra* sp.), three-spined-stickleback, minnow and flounder - were recorded during the electro-fishing survey (**Table 4.2**). Although brown trout were relatively widespread in the survey area inclusive of the GCR (recorded at 23 no. sites), Atlantic salmon were more localised and recorded from a total of 10. no sites on an unnamed Tullaghan Bay tributary (B6), Goolamore River (D2), Munhin River (D3), Srahanarry Stream (D6), Broska River (D8), unnamed Owenmore tributaries (D25, D26), Moneynierin River (E1), River Deel (E2) and the Ballisodare River (E3) (**Appendix A**). Fish populations in vicinity of the site boundary were dominated by brown trout with Atlantic salmon recorded only from the lower reaches of an unnamed Tullaghan Bay tributary (site B6). Sea trout were recorded from a single site on the Munhin River (D3). Lamprey (*Lampetra* sp.) were also recorded from a single site only (Munhin River at site D3) and this restricted distribution reflected the poor habitat suitability in the survey area (i.e. higher energy and heavily silted peat channels; **Appendix A**). European eel were recorded in typically low abundances from a total of 9 no. riverine sites on an unnamed river (A2), an unnamed Tullaghan Bay tributary (B6), Doolough Stream (C2, C4), Briska River (D8), unnamed Owenmore River tributary (D18, D25), Ballisodare River (E3) and the Carrowgobbadagh Stream (E4), in addition to pond sites P1, P2 and P3 (eDNA only) (**Table 3.1**). The restricted distribution of European eel in the survey area was also primarily due sub-optimal habitat (**Appendix A**). Of the riverine survey sites, 27 of 50 in total did not support fish at the time of survey given poor quality fisheries habitats or dry, ephemeral channels.

### 5.2 Annex I aquatic habitats

The Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitriche-Batrachion* (low water level during summer) or aquatic mosses [3260]' (commonly referred to as floating river vegetation, FRV) was recorded at sites E3 on the Ballisodare River and E4 on the Carrowgobbadagh Stream (adjacent to proposed TDR works). Whilst not representing a diverse example of the habitat, the tidal reaches of the heavily modified Carrowgobbadagh Stream (E4) supported abundant macrophytes including several FRV indicators such as *Callitriche stagnalis*, *Potamogeton* sp. & *Ranunculus* sp. (EC, 2013). The Ballisodare River (E4)

supported floating river vegetation primarily due to the presence of indicator *Ranunculus* sp. and *Fontanalis antipyretica*.

Three pond sites (P1, P2, P3 & P4) (in vicinity of the site boundary) corresponded the Annex I habitat 'Natural dystrophic lakes and ponds [3160]'. Annex I acid oligotrophic lakes are typically associated with small lakes and ponds in Atlantic and upland blanket bog, and wet heath (Gray et al., 2022; O'Connor, 2015) and are considered species-poor botanically with a community characterised by bryophytes of the genus *Sphagnum* and sustain the *Utricularietalia* phytosociological order (EC, 2013). In Ireland, this lake habitat has been broadly interpreted as 'species poor lake and pond systems dominated by *Sphagnum* mosses and restricted to blanket bogs and wet heaths' (O'Connor, 2015). Whilst the margins of sites P1, P2 and P3 were dominated by *Sphagnum* species such as *S. cuspidatum*, site P4 was more representative of the Annex I oligotrophic isoetid lake habitat [3110] with species including bog pondweed, bladderwort (*Utricularia* sp.), bulbous rush and locally abundant Red-listed pipewort, a Red-listed, near-threatened species in Ireland with a limited distribution (Wyse-Jackson et al., 2016). However, the co-occurrence of both habitats is common in Ireland (Evans, 2006).

### 5.3 Crayfish plague detection

No white-clawed crayfish were recorded through hand searching of instream refugia during the surveys, or via eDNA sampling, thus supporting the absence of historical and contemporary records from the Blacksod-Broadhaven hydrometric area (33) and much of the survey area (with the exception of the River Deel & Ballisodare River; NPWS & NCPSP<sup>4</sup> data). This absence is primarily due to low alkalinities and unsuitable geologies for the species (Demers et al., 2005; Lucy & McGarrigle, 1987).

However, the invasive pathogen crayfish plague was detected via eDNA sampling at all 3 no. sampling riverine locations in vicinity of the proposed wind farm site boundary despite the absence of crayfish (**Table 4.1**). Crayfish plague had previously been detected in hydrometric area 33 by Triturus using eDNA sampling in the Owenmore River (near Bellacorick) and Ballinglen River catchments in 2022. Crayfish plague is listed at one of the world's 100 worst invasive species (GISD, 2022; Lowe et al., 2000) and is becoming highly prevalent across Ireland.

### 5.4 Otter

Although suitable foraging habitat was widespread, otter signs were only recorded (within 150m of the survey sites) at a single site on the Ballisodare River (E3), where 2 no. spraint sites (and anal jelly) were recorded under the N59 road bridge. The paucity of signs throughout the survey area, inclusive of the site boundary and GCR, was considered to mainly reflect the smaller, higher-energy, high gradient nature of most survey watercourses which generally provide more restricted, stochastic prey resources and reduced foraging opportunities for otter compared with lower-gradient, larger watercourses (Scorpio et al., 2016; Remonti et al., 2009). Furthermore, predation by otter (and hence habitat utilisation) in small salmonid tributaries is highly seasonal and closely linked to adult migrations in the autumn and winter periods (Sittenthaler et al., 2019; Carss et al., 1990). No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in September 2023.

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<sup>4</sup> National Crayfish Plague Surveillance Programme

## 5.5 Macro-invertebrates

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the samples taken from 50 no. riverine or 4 no. pond sites (**Appendix C**). Whilst a low number of sites (11 no. but none within vicinity of the proposed site boundary or turbine array; **Figure 4.1**) achieved **Q4 (good status)**, the majority of sampling sites failed to meet the target good status ( $\geq Q4$ ) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC). Siltation and less so eutrophication of the watercourses (primarily from peat escapement but also agriculture & forestry) was noted during the surveys and is known to be the primary threat to water quality in the survey area (EPA data), in addition to hydromorphological modifications.

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## 7. Appendix A – fisheries assessment report

Please see accompanying fisheries assessment report

## 8. Appendix B – eDNA analysis lab report

**Folio No:** E19345  
**Report No:** 1  
**Client:** Triturus Environmental Ltd  
**Contact:** Bill Brazier

## TECHNICAL REPORT

### ANALYSIS OF ENVIRONMENTAL DNA IN WATER FOR AQUATIC SPECIES DETECTION

#### 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

**Date sample received in laboratory:** 20/10/2023  
**Date results reported:** 26/10/2023  
**Matters affecting result:** None

**TARGET SPECIES:** Brown (Sea) Trout  
*(Salmo trutta)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1692	P1 – Pond, Muingmore WF	-	Pass	Pass	Pass	Positive	1/12
FK1691	P3 - Pond, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1687	P4 - Pond, Muingmore WF	-	Pass	Pass	Pass	Positive	1/12
FK1695	P5 – Pond, Muingmore WF	-	Pass	Pass	Pass	Positive	1/12



Forensic Scientists and Consultant Engineers  
 SureScreen Scientifics Division Ltd, Morley Retreat, Church Lane, Morley, Derbyshire, DE7 6DE, UK  
 Tel: +44 (0)1332 292003 Email: scientific@surescreen.com  
 Company Registration No. 08950940

Page 1 of 5

## Crayfish plague (*Aphanomyces astaci*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1608	A2 – Unnamed river, Muingmore WF	-	Pass	Pass	Pass	Positive	12/12
FK1611	B6 – Unnamed river, Muingmore WF	-	Pass	Pass	Pass	Positive	11/12
FK1615	C5 – Doolough Stream, Muingmore WF	-	Pass	Pass	Pass	Positive	11/12

## European eel (*Anguilla anguilla*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1692	P1 – Pond, Muingmore WF	-	Pass	Pass	Pass	Positive	12/12
FK1691	P3 - Pond, Muingmore WF	-	Pass	Pass	Pass	Positive	12/12
FK1687	P4 - Pond, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1695	P5 – Pond, Muingmore WF	-	Pass	Pass	Pass	Positive	2/12

## Freshwater pearl mussel (*Margaritifera margaritifera*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1608	A2 – Unnamed river, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1611	B6 – Unnamed river, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1615	C5 – Doolough Stream, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12



## Smooth Newt (*Lissotriton vulgaris*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1692	P1 – Pond, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1691	P3 - Pond, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1687	P4 - Pond, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1695	P5 – Pond, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12

## White-clawed crayfish (*Austropotamobius pallipes*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1608	A2 – Unnamed river, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1611	B6 – Unnamed river, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12
FK1615	C5 – Doolough Stream, Muingmore WF	-	Pass	Pass	Pass	Negative	0/12

If you have any questions regarding results, please contact us: [ForensicEcology@surescreen.com](mailto:ForensicEcology@surescreen.com)

Reported by: Jennifer Higginbottom

Approved by: Lauryn Jewkes



Forensic Scientists and Consultant Engineers  
 SureScreen Scientifics Division Ltd, Morley Retreat, Church Lane, Morley, Derbyshire, DE7 6DE, UK  
 Tel: +44 (0)1332 292003 Email: [scientifics@surescreen.com](mailto:scientifics@surescreen.com)  
 Company Registration No. 08950940

Page 3 of 5

## **METHODOLOGY**

The samples detailed above have been analysed for the presence of target species eDNA following scientifically published eDNA assays and protocols which have been thoroughly tested, developed and verified for use by SureScreen Scientifics.

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 species 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 risk of contamination. 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 and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.



## **INTERPRETATION OF RESULTS**

- SIC: Sample Integrity Check [Pass/Fail]**  
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.
- DC: Degradation Check [Pass/Fail]**  
Analysis of the spiked DNA marker to see if there has been degradation 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.
- IC: Inhibition Check [Pass/Fail]**  
The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected, samples are purified and re-analysed. 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 at the sampling location.
- 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.



## 9. Appendix C – Macro-invertebrates (biological water quality)

**Table 8.1** Macro-invertebrate Q-sampling results for riverine sites in the vicinity of the proposed wind farm site boundary, September 2023 (\* = tentative rating)

Group	Family	Species	A1	A2	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	EPA class
Plecoptera	Nemouridae	<i>Nemoura cinerea</i>					1							1		A
Plecoptera	Leuctridae	<i>Leuctra fusca</i>												1	1	B
Plecoptera	Leuctridae	<i>Leuctra hippopus</i>						1	4	7				3	4	B
Trichoptera	Goeridae	<i>Silo pallipes</i>													1	B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>					1									B
Trichoptera	Limnephilidae	sp. indet. (early instar)								2						B
Trichoptera	Rhyacophilidae	<i>Rhyacophila dorsalis</i>							2							B
Odonata	Coenagrionidae	sp. indet.	6			6							2			B
Odonata	Libellulidae	<i>Sympetrum</i> sp.	2			1										B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>		1				1	29	45		18		17	10	C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>			1	1										C
Trichoptera	Polycentropodidae	<i>Polycentropus kingi</i>						3								C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>		17	1			3					1	1	8	C
Coleoptera	Dytiscidae	Dytiscidae larva		1	18			1	1				2			C
Coleoptera	Dytiscidae	<i>Dytiscus dimidiatus</i>					1									C
Coleoptera	Dytiscidae	<i>Hygrotus inaequalis</i>				1										C
Coleoptera	Dytiscidae	<i>Ilybius fuliginosus</i>			1											C
Coleoptera	Dytiscidae	<i>Oreodytes sanmarkii</i>												1	1	C
Coleoptera	Dytiscidae	<i>Oreodytes septentrionalis</i>												1		C
Coleoptera	Dytiscidae	<i>Stictotarsus duodecimpustulatus</i>								2		1				C
Coleoptera	Elmidae	<i>Elmis aenea</i>								1						C
Coleoptera	Elmidae	<i>Limnius volckmari</i>						1					1		1	C
Coleoptera	Elmidae	<i>Oulimnius tuberculatus</i>					1					1				C
Coleoptera	Gyrinidae	Gyrinidae larva													2	C
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>	2		1	1	1									C

Group	Family	Species	A1	A2	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	EPA class
Coleoptera	Hydrophilidae	<i>Anacaena globulus</i>	1													C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.			2		1				8		15	1	4	C
Diptera	Culicidae	sp. indet.			1		1						2			C
Diptera	Dixidae	sp. indet.	1		1											C
Diptera	Pediciidae	<i>Dicranota</i> sp.							1						2	C
Diptera	Simuliidae	sp. indet.							2	1		26		4	16	C
Diptera	Tipuliidae	sp. indet.	1													C
Hemiptera	Corixidae	<i>Hesperocorixa linnaei</i>											3			C
Hemiptera	Corixidae	<i>Hesperocorixa sahlbergi</i>	1			1										C
Hemiptera	Hydrometridae	<i>Hydrometra stagnorum</i>	1												1	C
Hemiptera	Gerridae	<i>Gerris</i> sp.									8					C
Hemiptera	Notonectidae	Notonectidae nymph			1											C
Hemiptera	Veliidae	<i>Velia caprai</i>	1													C
Hemiptera	Veliidae	Veliidae nymph			1		1						1			C
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>					2			10		4	4		4	C
Arachnida	Hydrachnidiae	sp. indet.													1	C
Gastropoda	Lymnaeidae	<i>Ampullacaena balthica</i>										4	1	1	18	D
Mollusca	Sphaeriidae	sp. indet.	4		4								2			D
Crustacea	Asellidae	<i>Asellus aquaticus</i>			8		1									D
Hirudinidae	Glossiphoniidae	<i>Glossiphonia complanata</i>								3		1			1	D
Diptera	Chironomidae	<i>Chironomus</i> spp.		1	8			8			2				1	E
Annelidae	Oligochaeta	sp. indet.							1						2	n/a
Malacostraca	Crangonidae	<i>Crangon crangon</i>		1												n/a
<b>Abundance</b>			<b>20</b>	<b>21</b>	<b>48</b>	<b>11</b>	<b>11</b>	<b>18</b>	<b>40</b>	<b>71</b>	<b>18</b>	<b>55</b>	<b>34</b>	<b>31</b>	<b>78</b>	
<b>Q-rating</b>			*Q3	*Q3	*Q3	*Q3	*Q3-4	Q2-3	Q3	Q3	*Q3	Q3	*Q3	Q3-4	Q3	
<b>WFD status</b>			Poor	Poor	Poor	Poor	Mod	Poor	Poor	Poor	Poor	Poor	Poor	Mod	Poor	

**Table 8.2a** Macro-invertebrate Q-sampling results for riverine sites in the vicinity of the proposed wind farm GCR, September 2023 (\* = tentative rating)

Group	Family	Species	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D18	D20	EPA class
Ephemeroptera	Heptageniidae	<i>Heptagenia sulphurea</i>			6					1						A
Plecoptera	Chloroperlidae	<i>Siphonoperla torrentium</i>						1								A
Plecoptera	Nemouridae	<i>Protonemura meyeri</i>					5	16	2				4	1		A
Plecoptera	Nemouridae	<i>Nemoura cinerea</i>				7										A
Plecoptera	Perlodidae	<i>Isoperla grammatica</i>											1			A
Ephemeroptera	Baetidae	<i>Alainites muticus</i>									1					B
Plecoptera	Leuctridae	<i>Leuctra fusca</i>							1	1		1				B
Plecoptera	Leuctridae	<i>Leuctra hippopus</i>	1					5			4	12	3	1		B
Trichoptera	Goeridae	<i>Silo pallipes</i>		1										1		B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>								1						B
Trichoptera	Limnephilidae	sp. indet. (early instar)												1		B
Trichoptera	Psychomyiidae	<i>Tinodes waeneri</i>										1				B
Trichoptera	Rhyacophilidae	<i>Rhyacophila dorsalis</i>		1									1			B
Hemiptera	Aphelocheiridae	<i>Aphelocheirus aestivalis</i>			11	1										B
Odonata	Coenagrionidae	sp. indet.				11										B
Odonata	Libellulidae	<i>Sympetrum</i> sp.				1										B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	1	5	3		40	1	3	10		23	2			C
Trichoptera	Hydropsychidae	<i>Diplectrona felix</i>	3					1			1		2	1		C
Trichoptera	Hydropsychidae	<i>Hydropsyche instabilis</i>			10	2	1									C
Trichoptera	Philopotamidae	<i>Philopotamus montanus</i>									24	2				C
Trichoptera	Philopotamidae	<i>Wormaldia occipitalis</i>					2	3					4			C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>						2			4		2	1		C
Trichoptera	Polycentropodidae	<i>Polycentropus kingi</i>													2	C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	7	11	4	10			2	2	7	3		6	11	C
Coleoptera	Dytiscidae	<i>Stictotarsus duodecimpustulatus</i>				1										C

Group	Family	Species	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D18	D20	EPA class
Coleoptera	Elmidae	<i>Elmis aenea</i>		1					1					1		C
Coleoptera	Elmidae	<i>Limnius volckmari</i>	2	11	7			1								C
Coleoptera	Elmidae	<i>Oulimnius tuberculatus</i>						1								C
Coleoptera	Scirtidae	Scirtidae larva										1				C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.				3	1	2	4		1				2	C
Diptera	Culicidae	sp. indet.				1	1									C
Diptera	Pediciidae	<i>Dicranota</i> sp.	2	1		1	2		1							C
Diptera	Simuliidae	sp. indet.		7		1	5	3			3	7	2	1		C
Diptera	Tipuliidae	sp. indet.									1				1	C
Hemiptera	Gerridae	<i>Gerris</i> sp.													8	C
Hemiptera	Veliidae	Veliidae nymph		2							1					C
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>	9	9	6	4	2	1	1	6				11		C
Arachnida	Hydrachnidiae	sp. indet.					1									C
Hirudinidae	Piscicolidae	<i>Piscicola</i> sp.												1		C
Gastropoda	Lymnaeidae	<i>Ampullacaena balthica</i>			4	1										D
Hirudinidae	Glossiphoniidae	<i>Glossiphonia complanata</i>			4											D
Diptera	Chironomidae	<i>Chironomus</i> spp.				1			1							E
Annelidae	Oligochaeta	sp. indet.	3	1	1		1	1						2		n/a
<b>Abundance</b>			<b>28</b>	<b>50</b>	<b>56</b>	<b>45</b>	<b>61</b>	<b>38</b>	<b>16</b>	<b>21</b>	<b>47</b>	<b>50</b>	<b>21</b>	<b>28</b>	<b>24</b>	
<b>Q-rating</b>			Q3	Q3	Q4	Q4	Q4	Q4	*Q3-4	Q3-4	*Q3	*Q3	Q4	Q3-4	*Q3	
<b>WFD status</b>			Poor	Poor	Good	Good	Good	Good	Mod	Mod	Poor	Poor	Good	Mod	Poor	

**Table 8.2b** Macro-invertebrate Q-sampling results for riverine sites in the vicinity of the proposed wind farm GCR, September 2023 (\* = tentative rating)

Group	Family	Species	D21	D22	D23	D24	D25	D26	D29	D30	EPA class
Ephemeroptera	Ephemeridae	<i>Ephemera danica</i>		9	15	10	26	14	11	19	A
Ephemeroptera	Heptageniidae	<i>Ecdyonurus dispar</i>				1					A
Ephemeroptera	Heptageniidae	<i>Rhithrogena semicolorata</i>					3				A
Plecoptera	Chloroperlidae	<i>Siphonoperla torrentium</i>					1				A
Plecoptera	Perlodidae	<i>Isoperla grammatica</i>				1				8	A
Ephemeroptera	Baetidae	<i>Alainites muticus</i>		1	1	1				3	B
Plecoptera	Leuctridae	<i>Leuctra hippopus</i>	2	9	9	16	10	2	12	9	B
Trichoptera	Sericostomatidae	<i>Sericostoma personatum</i>			4	7	5		2	3	B
Hemiptera	Aphelocheiridae	<i>Aphelocheirus aestivalis</i>			2			1	5	1	B
Ephemeroptera	Ephemerellidae	<i>Serratella ignita</i>					1				C
Trichoptera	Hydropsychidae	<i>Hydropsyche instabilis</i>							1	1	C
Trichoptera	Hydropsychidae	<i>Hydropsyche siltalai</i>	4	1			2			2	C
Trichoptera	Philopotamidae	<i>Wormaldia occipitalis</i>					1				C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>	1	2					3		C
Trichoptera	Polycentropodidae	<i>Polycentropus kingi</i>		1			1		2	2	C
Coleoptera	Dytiscidae	<i>Oreodytes septentrionalis</i>						1			C
Coleoptera	Elmidae	<i>Elmis aenea</i>		8		8		16	6	5	C
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>								1	C
Coleoptera	Scirtidae	Scirtidae larva							1		C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	1				1			1	C
Diptera	Culicidae	sp. indet.		1					1		C
Diptera	Limoniidae	<i>Antocha</i> sp.		9	15	10	26	14	11	19	C
Diptera	Pediciidae	<i>Dicranota</i> sp.				1					C
Diptera	Tipuliidae	sp. indet.					3				C
Hemiptera	Corixidae	<i>Hesperocorixa linnaei</i>					1				C

Group	Family	Species	D21	D22	D23	D24	D25	D26	D29	D30	EPA class
Hemiptera	Gerridae	<i>Gerris</i> sp.				1				8	C
Hemiptera	Notonectidae	Notonectidae nymph		1	1	1				3	C
Hemiptera	Veliidae	Veliidae nymph	2	9	9	16	10	2	12	9	C
Hirudinidae	Glossiphoniidae	<i>Glossiphonia complanata</i>			4	7	5		2	3	D
Diptera	Chironomidae	<i>Chironomus</i> spp.			2			1	5	1	E
<b>Abundance</b>			<b>8</b>	<b>40</b>	<b>37</b>	<b>56</b>	<b>85</b>	<b>36</b>	<b>47</b>	<b>58</b>	
<b>Q-rating</b>			*Q3	Q4	Q4	Q4	Q4	Q3-4	Q3-4	Q3-4	
<b>WFD status</b>			Poor	Good	Good	Good	Good	Mod	Mod	Mod	

**Table 8.3** Macro-invertebrate Q-sampling results for riverine sites in the vicinity of the proposed wind farm TDR, September 2023 (\* = tentative rating)

Group	Family	Species	E1	E2	E3	E4	E5	E7	EPA class
Ephemeroptera	Ephemeridae	<i>Ephemera danica</i>			3				A
Ephemeroptera	Heptageniidae	<i>Ecdyonurus dispar</i>	6		2				A
Ephemeroptera	Heptageniidae	<i>Heptagenia sulphurea</i>	2	1	3				A
Plecoptera	Nemouridae	<i>Protonemura meyeri</i>	5						A
Ephemeroptera	Baetidae	<i>Alainites muticus</i>	1					1	B
Plecoptera	Leuctridae	<i>Leuctra fusca</i>	5					1	B
Trichoptera	Hydroptilidae	<i>Ithytrichia</i> sp.			1				B
Trichoptera	Odontoceridae	<i>Odontocerum albicorne</i>	1						B
Trichoptera	Rhyacophilidae	<i>Rhyacophila dorsalis</i>		1	3			1	B
Trichoptera	Sericostomatidae	<i>Sericostoma personatum</i>						1	B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	18		5				C
Ephemeroptera	Ephemerellidae	<i>Serratella ignita</i>	1		1				C
Trichoptera	Hydropsychidae	<i>Hydropsyche instabilis</i>	1						C
Trichoptera	Hydropsychidae	<i>Hydropsyche siltalai</i>	1		1				C
Trichoptera	Philopotamidae	<i>Chimarra marginata</i>			17				C




Group	Family	Species	E1	E2	E3	E4	E5	E7	EPA class
Trichoptera	Philopotamidae	<i>Wormaldia occipitalis</i>						3	C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>						1	C
Trichoptera	Polycentropodidae	<i>Polycentropus kingi</i>					1	1	C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	2		3			19	C
Coleoptera	Dytiscidae	<i>Nebrioporus depressus</i>		1					C
Coleoptera	Elmidae	<i>Elmis aenea</i>	2		2			2	C
Coleoptera	Elmidae	<i>Limnius volckmari</i>	1						C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.					2		C
Diptera	Pediciidae	<i>Dicranota</i> sp.	1						C
Diptera	Simuliidae	sp. indet.	5		3				C
Diptera	Tipuliidae	sp. indet.					5		C
Hemiptera	Veliidae	Veliidae nymph						2	C
Gastropoda	Bithyniidae	<i>Bithynia tentaculata</i>			3				C
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>	1	8					C
Gastropoda	Planorbidae	<i>Planorbis planorbis</i>			1				C
Gastropoda	Lymnaeidae	<i>Ampullacaena balthica</i>		1		277			D
Crustacea	Asellidae	<i>Asellus aquaticus</i>		2	1	4	4		D
Hirudinidae	Glossiphoniidae	<i>Glossiphonia complanata</i>					2		D
Diptera	Chironomidae	<i>Chironomus</i> spp.				8		1	E
<b>Abundance</b>			<b>53</b>	<b>14</b>	<b>49</b>	<b>289</b>	<b>14</b>	<b>33</b>	
<b>Q-rating</b>			Q4	Q3-4	Q4	*Q2	Q2-3	Q3	
<b>WFD status</b>			Good	Mod	Good	Bad	Poor	Poor	





**Table 8.4** Macro-invertebrate Q-sampling results for pond sites P1, P2, P3 & P4, September 2023 (listed in order of abundance)





Group	Family	Species	P1	P2	P3	P4
Odonata	Coenagrionidae	sp. indet.	23	22	44	15
Diptera	Chaoboridae	sp. indet.	9	9		1
Hemiptera	Corixidae	<i>Corixa punctata</i>	7			
Hemiptera	Notonectidae	<i>Notonecta viridis</i>	7	6		
Diptera	Chironomidae	<i>Chironomus</i> spp.	4	3	9	2
Mollusca	Lymnaeidae	<i>Ampullacaena balthica</i>	4	3		
Diptera	Dixidae	sp. indet.	2			
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>	2	1		1
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	1		3	
Hemiptera	Corixidae	<i>Callicorixa praeusta</i>	1	1		
Hemiptera	Corixidae	<i>Sigara</i> sp.	1			
Odonata	Libellulidae	<i>Sympetrum</i> sp.	1		7	
Coleoptera	Dytiscidae	<i>Hygrotus inaequalis</i>		1		
Coleoptera	Dytiscidae	<i>Ilybius fuliginosus</i>		1		
Coleoptera	Gyrinidae	<i>Gyrinus aeratus</i>			1	
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>				1
Diptera	Ceratopogonidae	sp. indet.			3	
Diptera	Culicidae	sp. indet.		1		
Ephemeroptera	Leptophlebiidae	<i>Paraleptoplebia</i> sp.			1	1
Hemiptera	Corixidae	<i>Hesperocorixa moesta</i>			2	
Mollusca	Sphaeriidae	sp. indet.		7		
Trichoptera	Leptoceridae	<i>Triaenodes bicolor</i>			1	
<b>Abundance</b>			<b>62</b>	<b>55</b>	<b>71</b>	<b>21</b>





## 10. Appendix D – aquatic survey site summaries for GCR & TDR sites




**Table 10.1** Summary of GCR and TDR aquatic survey sites, September 2023





Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
<b>GCR crossings</b>						
D1	Unnamed stream	Historically deepened & realigned stream (FW2). 0.5m wide, 0.1-0.2m deep. Slow-flowing glide & riffle with no pool. Bedded boulder, cobble & mixed gravels with moderate siltation. No macrophytes due to shading with occasional <i>Rhynchostrigium riparioides</i> . Bordered by GA1 habitat.	Not of fisheries value due to small size & depths. No fish recorded.	Q3 (poor status)	Local importance (lower value)	
D2	Goolamore River (33G12)	Historically deepened lowland river (FW2) with semi-natural profile of slow-flowing glide & pool. 3m wide & 0.1-0.4m deep. Heavily silted boulder, cobble & mixed gravels. No macrophytes due to shading with abundant <i>Fontinalis antipyretica</i> & <i>Rhynchostrigium riparioides</i> . Bordered by wet GA1 habitat.	Atlantic salmon, brown trout & minnow recorded.  Moderate quality salmonid spawning, nursery & holding habitat.	Q3 (poor status)	<b>Local importance (higher value)</b>	
D3	Munhin River (33M03)	Large semi-natural lowland tributary of Owenmore River. 8-10m wide and 0.2-1.6m deep with profile of riffle, glide & pool. Abundant mixed gravels & sand with small boulder & cobble. Moderate siltation. Occasional <i>Potamogeton</i> sp., <i>Myriophyllum alterniflorum</i> , <i>Callitriche hamulata</i> & <i>Sparganium erectum</i> with frequent <i>Fontinalis antipyretica</i> . Bordered by wet GA1 habitat.	Atlantic salmon, brown trout, sea trout, lamprey ( <i>Lampetra</i> sp.), minnow & flounder recorded.  Good quality salmonid habitat with sub-optimal lamprey habitat.	Q4 (good status)	<b>Local importance (higher value)</b>	





Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
D4	Unnamed river	Historically straightened & deepened lowland tributary (FW2) of Owenmore River. 1m wide & 0.05-0.1m deep with poor flows. Riffle & stagnant pools. Small boulder with cobble & heavily silted gravels. No macrophytes or aquatic bryophytes. Bordered by GA1 and WD4 habitat.	Not of fisheries value due to small size, shallow depths & poor flows. No fish recorded.	Q4 (poor status)	<b>Local importance (higher value)</b>	
D5	Ballybeg Stream (33B40)	Historically realigned lowland tributary (FW2) of Owenmore River. 1.5m wide & 0.05m deep with poor flows & much of bed exposed (dry). Small boulder & cobble with mixed gravels. No macrophytes or aquatic bryophytes. Bordered by BL3 habitat (Bangor Erris).	Not of fisheries value due to small size, shallow depths & poor flows. No fish recorded.	Q4 (poor status)	<b>Local importance (higher value)</b>	
D6	Srahanarry Stream (33S23)	Semi-natural upland spate tributary (FW1) of Owenmore River. 1.5-3m wide & 0.1-0.5m deep with boulder cascades. Boulder & cobble with localised mixed gravels. Moderate siltation. No macrophytes but occasional <i>Fontinalis antipyretica</i> , <i>Scapania undulata</i> & <i>Brachythecium rivulare</i> . Bordered by GA1 habitat.	Atlantic salmon & brown trout recorded.  Good quality salmonid nursery & spawning habitat. Culvert was a significant barrier to fish passage.	Q4 (poor status)	<b>Local importance (higher value)</b>	
D7	Bellanumera Stream (33B38)	Historically realigned upland stream (FW1) with low summer flows. 0.5m wide & 0.05m deep. Exposed small boulder & cobble with coarse gravels, moderate siltation. No macrophytes or aquatic bryophytes. Bordered by wet GA1 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q3-4 (moderate status) (tentative rating)	Local importance (lower value)	





Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
D8	Briska River	Semi-natural, high-energy upland spate tributary (FW1) of Owenmore River. 2.5-3m wide & 0.1-0.4m deep. Boulder cascades with boulder, cobble & mixed gravels with moderate siltation. No macrophytes but occasional <i>Fontinalis antipyretica</i> & <i>Rhynchostegium riparioides</i> . Bordered by GA1 habitat.	Atlantic salmon, brown trout & European eel recorded.  Very good quality salmonid nursery & good quality spawning habitat. High value eel nursery.	Q3-4 (moderate status)	<b>Local importance (higher value)</b>	
D9	Unnamed stream	Historically deepened & realigned upland tributary (FW1) of Owenmore River. 0.5m wide & 0.05m with poor flows. Small boulder & cobble with localised coarse gravels. Moderate siltation. No macrophytes or aquatic bryophytes. Bordered by GA1 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q3 (poor status) (tentative rating)	Local importance (lower value)	
D10	Unnamed stream	Historically deepened upland tributary (FW1) of Owenmore River. 0.5m wide & 0.05-0.2m deep. Boulder cascades with low flows & shallow glide. Semi-dry bed with cobble & localised coarse gravels, moderate siltation. No macrophytes but occasional <i>Brachythecium rivulare</i> . Bordered by GA1 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q3 (poor status) (tentative rating)	Local importance (lower value)	
D11	Unnamed river	High gradient, seasonal upland tributary (FW1) of Owenmore River. 1-1.5m wide & 0.05m deep. Sinuous profile with cascades & localised pool with angular cobble & boulder. No macrophytes or aquatic bryophytes. Bordered by GA1 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q3 (poor status) (tentative rating)	Local importance (lower value)	




Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
D12	Unnamed river	Very high gradient, ephemeral upland tributary (FW1) of Owenmore River. 2m wide & dry at the time of survey. Large boulder & cobble bed. No macrophytes or aquatic bryophytes. Bordered by GA1 habitat.	Not of fisheries value due to ephemeral (dry) nature.	n/a (dry channel)	Local importance (lower value)	
D13	Unnamed river	Very high gradient, ephemeral upland tributary (FW1) of Owenmore River. 1m wide & dry at the time of survey. Large boulder & cobble bed. No macrophytes or aquatic bryophytes.	Not of fisheries value due to ephemeral (dry) nature.	n/a (dry channel)	Local importance (lower value)	
D14	Unnamed stream	Very high gradient, ephemeral upland tributary (FW1) of Owenmore River. 1m wide & dry at the time of survey. Large boulder & cobble bed. No macrophytes or aquatic bryophytes.	Not of fisheries value due to ephemeral (dry) nature.	n/a (dry channel)	Local importance (lower value)	
D15	Unnamed stream	Very high gradient, ephemeral upland tributary (FW1) of Owenmore River. 1m wide & dry at the time of survey. Large boulder & cobble bed. No macrophytes or aquatic bryophytes.	Not of fisheries value due to ephemeral (dry) nature.	n/a (dry channel)	Local importance (lower value)	




Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
D16	Unnamed river	Very high gradient, ephemeral upland tributary (FW1) of Owenmore River. 2m wide & dry at the time of survey. Large boulder & cobble bed. No macrophytes or aquatic bryophytes.	Not of fisheries value due to ephemeral (dry) nature.	n/a (dry channel)	Local importance (lower value)	
D17	Unnamed stream	Very high gradient, ephemeral upland tributary (FW1) of Owenmore River. 1m wide & dry at the time of survey. Large boulder & cobble bed. No macrophytes or aquatic bryophytes.	Not of fisheries value due to ephemeral (dry) nature.	n/a (dry channel)	Local importance (lower value)	
D18	Unnamed stream	High gradient, upland tributary (FW1) of Owenmore River in incised valley. 1.5-2m wide & 0.1-0.3m deep. Boulder cascades with boulder, cobble & mixed gravels with light siltation. No macrophytes or aquatic bryophytes. Bordered by WN2 habitat.	Brown trout & European eel recorded.  Moderate quality salmonid & eel nursery.	Q3-4 (moderate status)	<b>Local importance (higher value)</b>	
D19	Unnamed stream	Ephemeral U-shaped, 2m wide drainage channel (FW4) tributary of Owenmore River, dry at the time of survey. No macrophytes or aquatic bryophytes. Bordered by GA1 habitat.	Not of fisheries value due to ephemeral (dry) nature.	n/a (dry channel)	Local importance (lower value)	

Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
D20	Unnamed stream	U-shaped drainage channel (FW4) tributary of Owenmore River, 0.5m wide with no flows & stagnant pools of peaty water. Peat bed (no hard substrata). No macrophytes or aquatic bryophytes. Bordered by GA1 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q3 (poor status) (tentative rating)	Local importance (lower value)	
D21	Unnamed stream	Historically straightened & deepened upland tributary (FW1) of Owenmore River. 0.5m wide with stagnant shallow water (no flows). Boulder & cobble bed with iron-oxidising bacteria. No macrophytes but <i>Scapania undulata</i> locally. Bordered by wet GA1 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q3 (poor status) (tentative rating)	Local importance (lower value)	
D22	Unnamed stream	Meandering upland tributary (FW1) of Owenmore River. 1-1.5m wide & 0.05-0.15m deep. Riffle & glide with boulder, cobble & bedded, heavily silted mixed gravels. <i>Veronica beccabunga</i> along margins with <i>Rhynchostegium riparioides</i> & <i>Hygrohypnum ochraceum</i> . Bordered by wet GA1 & WD4.	Brown trout recorded. Moderate quality salmonid nursery & spawning habitat, no holding.	Q4 (good status)	<b>Local importance (higher value)</b>	
D23	Unnamed stream	High gradient upland tributary (FW1) of Owenmore River. 1-1.5m wide & 0.1-0.3m deep with low flows. Boulder cascades with glide & pool. Boulder, cobble & bedded, heavily silted mixed gravels. No macrophytes but <i>Rhynchostegium riparioides</i> on boulders. Bordered by wet GA1.	Brown trout recorded. Moderate quality salmonid nursery, spawning & holding habitat.	Q4 (good status) (tentative rating)	<b>Local importance (higher value)</b>	

Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
D24	Unnamed river	High gradient upland tributary (FW1) of Owenmore River. 2m wide & 0.1-0.4m deep with low flows. Boulder cascades with cobble & bedded, heavily silted mixed gravels. No macrophytes but <i>Chiloscyphus polyanthos</i> & <i>Rhynchostegium riparioides</i> on boulders. Bordered by wet GA1 & WS1.	Brown trout recorded.  Moderate quality salmonid nursery & spawning habitat with good quality holding.	Q4 (good status)	<b>Local importance (higher value)</b>	
D25	Unnamed river	Moderate gradient upland tributary (FW1) of the Owenmore River. 2-4m wide and 0.2-0.4m deep. Boulder cascades with local riffle-glide-pool sequences. Boulder, cobble & silted mixed gravels. No macrophytes but frequent <i>Rhynchostegium riparioides</i> . Bordered by wet GA1 & WS1.	Atlantic salmon, brown trout & European eel recorded.  Excellent quality salmonid nursery with good quality spawning & moderate quality holding habitat. Moderate value for eel.	Q4 (good status)	<b>Local importance (higher value)</b>	
D26	Unnamed stream	Historically deepened & straightened upland tributary (FW1) of Owenmore River. 1.5m wide & 0.1-0.2m deep. Shallow glide with riffle & localised pool. Boulder, cobble & mixed gravels with high filamentous algal cover & moderate siltation. No macrophytes but abundant <i>Rhynchostegium riparioides</i> & <i>Fontinalis antipyretica</i> . Bordered by GA1.	Atlantic salmon, brown trout & minnow recorded.  Moderate quality salmonid nursery & spawning with poor holding habitat.	Q3-4 (moderate status)	<b>Local importance (higher value)</b>	
D27	Kilsallagh Stream (33K13)	Ephemeral U-shaped, 0.5m wide drainage channel (FW4) tributary of Owenmore River, dry at the time of survey. No macrophytes or aquatic bryophytes. Bordered by GA1 habitat.	Not of fisheries value due to ephemeral (dry) nature	n/a (dry channel)	Local importance (lower value)	

Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
D28	Unnamed stream	Ephemeral U-shaped, 2m wide drainage channel (FW4) tributary of Owenmore River, dry at the time of survey. No macrophytes or aquatic bryophytes. Bordered by GA1 habitat.	Not of fisheries value due to ephemeral (dry) nature	n/a (dry channel)	Local importance (lower value)	
D29	Unnamed stream	Historically deepened & straightened upland tributary (FW1) of Owenmore River. 1-1.5m wide & 0.1-0.2m deep. Shallow glide with riffle & localised pool. Boulder, cobble & coarse gravels with moderate siltation. No macrophytes but abundant <i>Rhynchosygium riparioides</i> . Bordered by GA1.	Brown trout recorded. Poor to moderate quality salmonid nursery & spawning with poor holding habitat.	Q3-4 (moderate status)	<b>Local importance (higher value)</b>	
D30	Unnamed stream	Historically deepened & straightened upland tributary (FW1) of Owenmore River. 1m wide & 0.1-0.2m deep. Shallow glide with riffle & localised pool. Boulder, cobble & heavily bedded coarse gravels with moderate siltation. <i>Veronica beccabunga</i> , <i>Apium nodiflorum</i> & <i>Iris psuedacorus</i> with but abundant <i>Brachythecium rivulare</i> . Bordered by GA1.	Brown trout, minnow & three-spined stickleback recorded. Poor quality salmonid habitat overall.	Q3-4 (moderate status)	<b>Local importance (higher value)</b>	
<b>TDR nodes</b>						
E1	Moneynierin River (33M16)	Upland eroding river (FW1), 2-3m wide & 0.1-0.4m deep. Riffle, glide & pool with boulder, cobble & mixed gravels. High filamentous algal cover. <i>Sparganium erectum</i> , <i>Myriophyllum alterniflorum</i> & <i>Juncus bulbosus</i> instream with <i>Carex rostrata</i> . Bordered by PB2.	Atlantic salmon, brown trout & three-spined stickleback recorded. Moderate quality salmonid spawning, nursery & holding habitat.	Q4 (good status)	<b>Local importance (higher value)</b>	

Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
E2	River Deel (34D01)	Large, semi-natural lowland karstic limestone river (FW1) with low seasonal flows at time of survey. 35m wide & 0.2-0.5m deep with frequent stagnant pools (no flows). Boulder & cobble bed with locally frequent <i>Fontinalis antipyretica</i> and <i>Cinclidotus fontinaloides</i> . Bordered by BL3 habitat (Crossmolina)	Atlantic salmon, roach, minnow & three-spined stickleback recorded.  Good quality salmonid nursery & spawning habitat, moderate quality holding (under normal flows). Unsuitable for lamprey. Freshwater pearl mussel known upstream.	Q3-4 (moderate status)	<b>International importance (located within River Moy SAC)</b>	
E3	Ballisodare River (35B05)	Large, semi-natural lowland river (FW2), 30m wide & 0.2-1.5m deep. Riffle, glide & pool with boulder, cobble & mixed gravels. Moderate siltation. Occasional <i>Ranunculus</i> sp., <i>Schoenoplectus lacustris</i> , <i>Sparganium erectum</i> & <i>Apium nodiflorum</i> with frequent <i>Fontinalis antipyretica</i> , <i>Rhynchostegium riparioides</i> and occasional <i>Chiloscyphus polyanthos</i> & <i>Cinclidotus fontinaloides</i> . Bordered by BL3 habitat.	Atlantic salmon, brown trout & European eel recorded.  Very good quality salmonid nursery & holding habitat with good quality spawning. High value for eel.  2 no. otter spraint sites	Q4 (good status)	<b>International importance (located within Unshin River SAC)</b>	
E4	Carrowgobbadagh Stream (35C95)	Historically deepened & straightened tidal channel (CW3) downstream of attenuation pond. 3m wide & 1-2m deep. Soft silt bed with abundant macrophytes, <i>Callitriche stagnalis</i> , <i>Potamogeton</i> sp. & <i>Ranunculus</i> sp. (Annex I 3260). Abundant filamentous algae. Bordered by BL3 habitat.	European eel & three-spined stickleback recorded.  Poor quality salmonid habitat but of high value as an eel nursery.	Q2 (bad status) (tentative rating)	<b>Local importance (higher value)</b>	

Site no.	Watercourse (EPA code)	Site characteristics	Fisheries summary	Biological water quality	Ecological evaluation	Representative site image
E5	Abbeylands Stream (36A15)	U-shaped drainage channel tributary (FW4) of Abbey River. 0.5m wide & 0.1-0.2m deep with very low flows at time of survey. Deep silt bed with marginal <i>Apium nodiflorum</i> . Bordered by WS1 & WL2 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q2-3 (poor status)	Local importance (lower value)	
E6	Drumgowan Stream (37D49)	Ephemeral U-shaped, 0.5m wide drainage channel (FW4) tributary of Owenmore River, dry at the time of survey. No macrophytes or aquatic bryophytes. Bordered by BL3 & GA2 habitat.	Not of fisheries value due to ephemeral (dry) nature	n/a (dry channel)	Local importance (lower value)	
E7	Bogside River (37B26)	Historically deepened & realigned lowland river (FW2). 1-1.5m wide & 0.1-0.2m deep with slow-flowing glide & occasional pool. Heavily bedded boulder, cobble & coarse gravels with high siltation. <i>Apium nodiflorum</i> in margins with occasional <i>Fontinalis antipyretica</i> & <i>Chiloscyphus polyanthos</i> . Bordered by GS4 habitat.	Not of fisheries value due to small size, depths & poor flows. No fish recorded.	Q3 (poor status)	Local importance (lower value)	



Triturus Environmental Ltd.

42 Norwood Court,

Rochestown,

Co. Mayo,

T12 ECF3.