APPENDIX 6-2

Aquatic Baseline Report

Aquatic baseline report for Taurbeg Wind Farm Extension of Operational Life

Prepared by Triturus Environmental Ltd. for MKO

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by MKO to conduct baseline aquatic surveys to inform EIAR preparation for the Proposed Lifetime Extension located near Newmarket Co. Cork (**Figure 2.1**).

Undertaken on a catchment-wide scale, this report provides a baseline assessment of the aquatic ecology including fisheries and biological water quality, as well as protected species and habitats in the vicinity of the Site. Aquatic surveys were undertaken in July 2024.

1.2 Development description

A full description of the Proposed Project is provided in Chapter 4 of the Environmental Impact Assessment Report (EIAR) 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 Lifetime Extension were considered as part of the current assessment. A total of *n*=14 sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1** below). The courses and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

Survey sites were present on the Knockahorrea East River (EPA code: 23K33), Glennaknockane Stream (23G62), Glasheenanargid Stream (23G43), Glenacarney River (23G06) and unnamed tributary, Taurmore Stream (18T07), Owenkeal River (18O06), Inchatotane Stream (18I02) and the Glenlara River (18G08) (**Table 2.1**). The aquatic survey sites were located within the within the Feale_SC_010 and Dalua_SC_010 river sub-catchments. One proposed electro-fishing site was located within the Lower River Shannon SAC (002165), with 2 no. sites located within the Blackwater River (Cork/Waterford) SAC (002170). The survey area overlapped with the Feale and Munster Blackwater *Margaritifera* sensitive 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 were conducted on the 15th, 16th and 17th July 2024. Survey effort focused on both instream and riparian habitats at each aquatic sampling location and included a fisheries assessment (electro-fishing and fisheries habitat appraisal), white-clawed crayfish survey, macrophyte and aquatic bryophyte survey and biological water quality sampling (Q-sampling) (**Figure 2.1**). This holistic approach informed the overall aquatic ecological evaluation of each site/watercourse in context of the Proposed Lifetime Extension 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*=14 aquatic survey sites in the vicinity of the Site

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Knockahorrea East River	23K33	Taurbeg	522990	612256
A2	Glennaknockane Stream	23G62	Taurbeg	522901	612480
A3	Knockahorrea East River	23K33	Meentinny West	523248	613699
A4	Knockahorrea East River	23K33	Tooreennagrena	522084	615924
B1	Glasheenanargid Stream	23G43	Glasheenanargid	521465	611432
B2	Unnamed stream	n/a	Foiladaun	520997	612155
B3	Glenacarney River	23G06	Foiladaun	520834	612242
B4	Glenacarney River	23G06	Glenacarney Bridge	519077	614953
C1	Taurmore Stream	18T07	Taurmore	522306	609917
C2	Owenkeal River	18O06	Clashykinleen Bridge	524415	606611
D1	Inchatotane Stream	18I02	Taurmore	523821	610957
D2	Glenlara River	18G08	Gloun Dine Bridge	523777	610507
D3	Glenlara River	18G08	Glennamucklagh East	525227	609309
D4	Glenlara River	18G08	Ballyduane Bridge	527758	607292

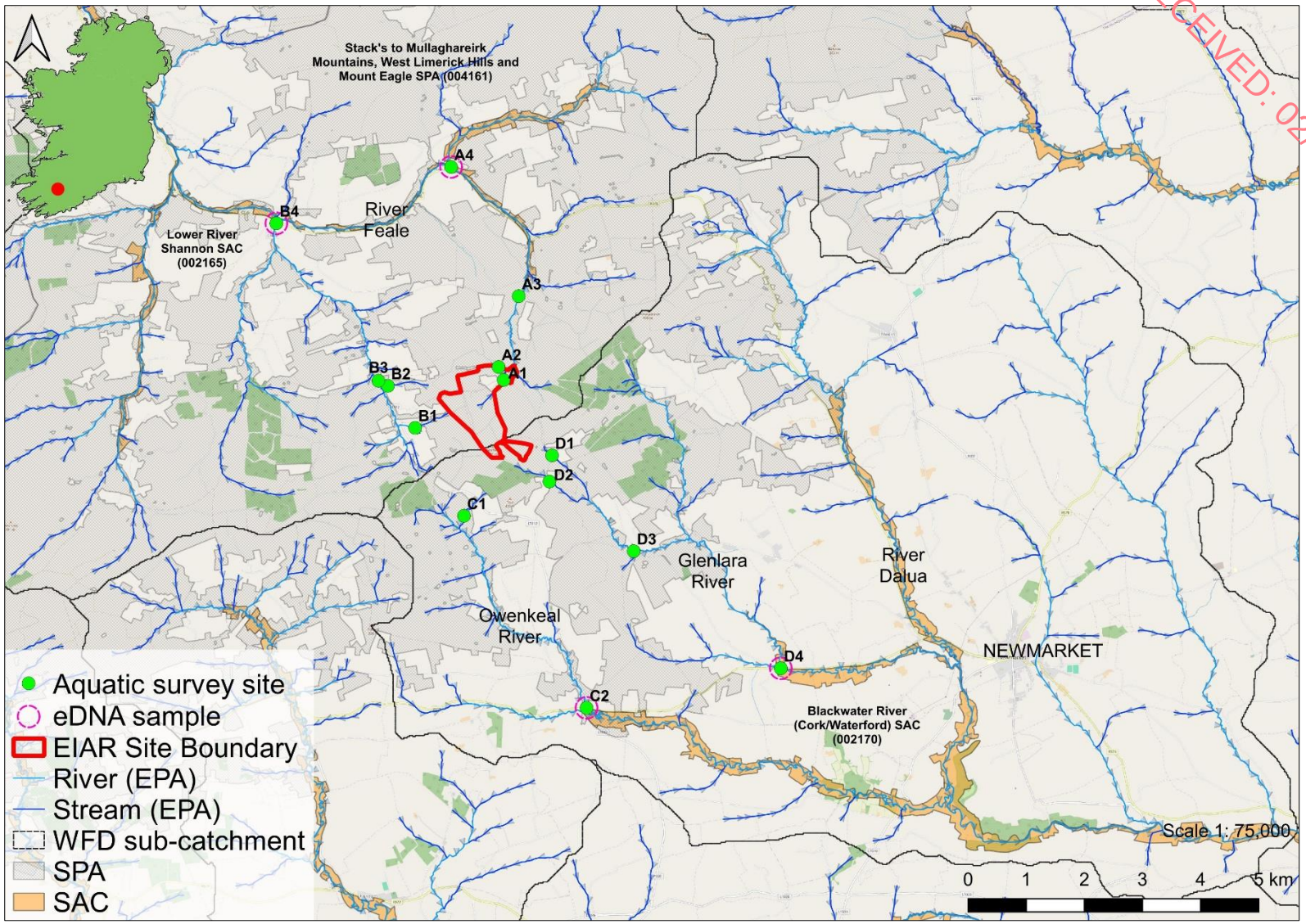

Figure 2.1 Overview of the aquatic survey sites in the vicinity of the Proposed Lifetime Extension

2.3 Fisheries assessment & habitat appraisal

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 Site in July 2024 (**Table 2.1, Figure 2.1; Appendix A**), 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 (CFB, 2008; CEN, 2003) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of all aquatic survey sites (**Table 2.1**) was undertaken to establish their importance for salmonid, lamprey, European eel 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 July 2024 under a National Parks and Wildlife (NPWS) open national licence (no. C20/2024), 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 (Gammell et al., 2021; Peay, 2003), water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider survey area was completed.

2.5 eDNA analysis

To further validate site surveys and to detect potentially cryptically-low populations of protected and or rare aquatic species within the study area, composite water samples were collected from the Knockahorrea East River (A4), Glenacarney River (B4), Owenkeal River (C2) and the Glenlara River (D4) in July 2024 (**Figure 2.1; Table 2.2**). These were analysed for freshwater pearl mussel (*Margaritifera margaritifera*), white-clawed crayfish (*Austropotamobius pallipes*) and crayfish plague (*Aphanomyces astaci*) environmental DNA (eDNA). The sites were strategically chosen to maximise longitudinal (instream) coverage within the catchment (i.e. facilitating a greater likelihood of species detection).

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)

The 14 no. riverine survey sites were assessed for biological water quality through Q-sampling in July 2024 (**Table 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 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 and or Irish Red list for vascular plants (Wyse-Jackson et al., 2016) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

2.8 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.).

2.9 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).

2.10 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. 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 existing Taurbeg Wind Farm is drained by the River Feale (to the north) and the Owenkeal River and Glenlara River (to the south), in addition to numerous tributaries of said channels, within the Feale_SC_010 and Dalua_SC_010 river sub-catchments. (**Table 2.1**). These watercourses are representative of smaller upland eroding channels (FW1; Fossitt, 2000) and larger lowland depositing (FW2) channels, respectively, and flow over Namurian shale, sandstone, siltstone and coal (Geological Survey of Ireland data).

3.2 Fisheries

Fisheries data for the survey watercourses was largely deficient. The Owenkeal River, a tributary of the River Dalua, is also known to support lamprey (*Lampetra* sp.) as well as sea lamprey (*Petromyzon marinus*) (King & Linnane, 2004), in addition to salmonids. The downstream-connecting River Feale is a designated salmonid watercourse under the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. 293/1988) and is currently meeting its conservation limit for both one sea-winter (1SW) and two sea-winter (2SW) Atlantic salmon (*Salmo salar*) (TEGOS, 2023). The river and wider catchment also supports brown/sea trout (*Salmo trutta*), lamprey (*Lampetra* sp.), European eel (*Anguilla anguilla*) and minnow (*Phoxinus phoxinus*) (Kelly et al., 2010; O'Connor, 2006). Fisheries data for the other survey watercourses was not available prior to this 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 (i.e. R11, R20, R21 & R30) identified a low number of records for rare and or protected aquatic species within the vicinity of the Site.

A significant population of freshwater pearl mussel (*Margaritifera margaritifera*) are known from the River Allow upstream of Kanturk (**Figure 3.1**), with a low number of records also available for the River Feale, with which the Site shares downstream hydrological connectivity (>20km instream distance) (data not shown). Pearl mussel are not known from any of the survey watercourses. **Please note** that a Stage 1 freshwater pearl mussel survey did not form part of the current baseline survey although the species was tested for via eDNA sampling.

A number of Annex II otter (*Lutra lutra*) records were available in the vicinity of the Site although most were historical only (i.e. 1980; data not shown). Contemporary records were available for the Owenkeal River (including at site C2) as well as the downstream connecting River Dalua and River Feale (NPWS, NBDC & Triturus data; **Figure 3.1**).

No NPWS records for macrophytes or aquatic bryophytes protected under the Flora (Protection) Order, 2022 were available for the respective grid squares.

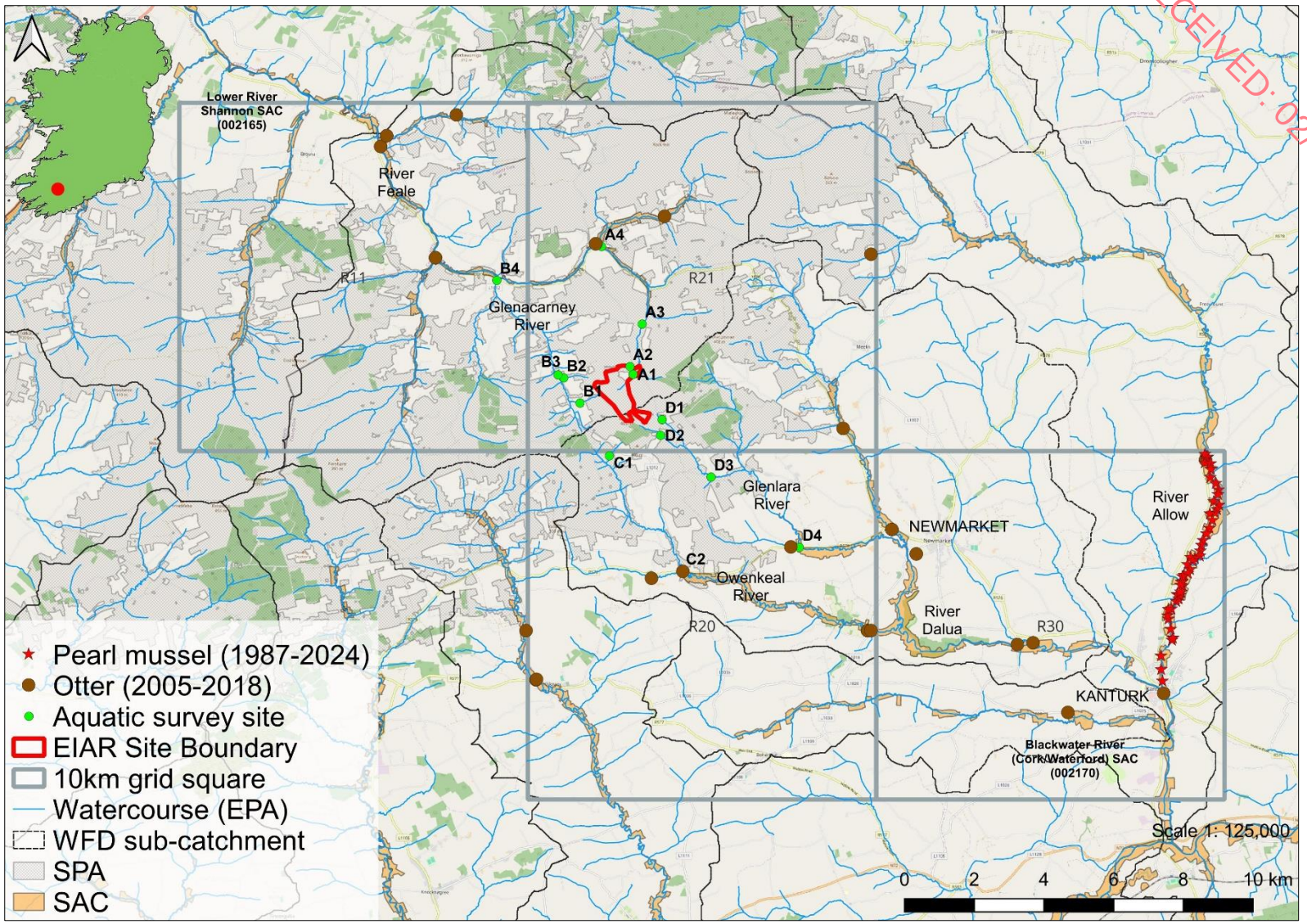

Figure 3.1 Selected protected aquatic species records in the vicinity of the Site (source: Triturus, NPWS & NBDC data, 1987-2024)

4. Results of aquatic surveys

The following section summarises each of the *n*=14 survey sites in terms of aquatic habitats, physical characteristics and overall value for fish and macrophyte/aquatic bryophyte communities. Please refer to **Appendix A** (fisheries assessment report) for more detailed fisheries results. Biological water quality (Q-sample) results are also summarised for each riverine sampling site and presented in full in **Appendix B**. 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**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in July 2024.

4.1 Aquatic survey site results

4.1.1 Site A1 – Knockahorrea East River, Taurbeg

Site A1 was located on the uppermost reaches of the Knockahorrea Stream (EPA code: 23K33) at a local road crossing (single masonry arch) adjacent to the existing Taurbeg wind farm site entrance. The small upland spate stream (FW1; Fossitt, 2000) flowed over a moderate gradient in an incised channel and suffered from low flows at the time of survey. The stream was 1-1.5m wide (channel up to 2.5m) and 0.05-0.1m deep with only very localised deeper areas to 0.25m. The flow profile comprised small cascades and riffles with localised glide and pool. The substrata were dominated by compacted angular cobble and boulder with mixed gravels. However, these were heavily covered with abundant iron oxidising bacterial films (near 100% cover). Siltation was also high. Macrophytes were absent. However, cover of bryophytes was locally high with abundant *Scapania undulata*. *Thamnobryum alopecurum* was frequent on larger substrata and steep banks. The narrow stream was shaded by mature oak (*Quercus petraea*), sycamore (*Acer psuedoplatanus*), hazel (*Corylus avella*na) and grey willow (*Salix cinerea*). Downstream of the bridge the stream was bordered immediately by mature sitka spruce (*Picea sitchensis*) (WD4) with bramble (*Rubus fruticosus* agg.) and bilberry (*Vaccinium myrtillus*) in the understories. The site was also bordered locally by wet grassland (GS4).

Brown trout (*Salmo trutta*) was the only fish species recorded via electro-fishing at site A1 (**Appendix A).** The Knockahorrea East River was of very low fisheries value given low summer flows and high coverage of iron-oxidising bacterial films. However, despite a near absence of suitable spawning habitat, a single juvenile trout was recorded. There was no suitability for white-clawed crayfish or lamprey. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3/0 (poor status)** (**Appendix C**). However, it should be noted that a toxic effect was suspected (*x*/0 denotation as per Toner et al., 2005), with very heavy cover of iron oxidising bacteria and an extremely low number of live macro-invertebrates present. 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 A1 was of **local importance (higher value) (Table 4.4).**

Plate 4.1 Representative image of site A1 on the Knockahorrea East River showing very heavy iron oxidising bacterial cover, July 2024

4.1.2 Site A2 – Glennaknockane Stream, Taurbeg

Site A2 was located on the uppermost reaches of the Glennaknockane Stream (23G62) at a local road crossing (single masonry arch) adjacent to the Proposed Lifetime Extension. The small upland spate stream (FW1) flowed over a moderate gradient in an incised channel (V-shaped valley) and suffered from low flows at the time of survey. The stream was <1m wide and 0.05-0.1m deep with only very localised deeper areas to 0.2m. The flow profile comprised small cascades over peat and riffles with localised glide and rare pool. The substrata were dominated by compacted angular cobble and boulder with mixed gravels. However, these were heavily covered with abundant floc[1], silt and iron oxidising bacterial films. Siltation was also high with frequent bank scours contributing to the sediment loads. Macrophytes were absent. However, the bryophyte *Scapania undulata* was present locally with *Pellia epiphylla* on the banks. The narrow channel was often heavily encroached by scrub vegetation with abundant grey willow, bramble, gorse (*Ulex europaeus*), bilberry and ferns. The site was bordered by mature sitka spruce plantations (WD4).

No fish were recorded via electro-fishing at site A2 (**Appendix A).** The site was of very low fisheries value given low summer flows, siltation and high coverage of iron-oxidising bacterial films, in addition to its location in the upper reaches of the catchment. However, given some physical suitability, the site may be utilised by salmonids under higher flows (e.g. winter). 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 **Q4 (good status)** (**Appendix C**). No macro-invertebrate species of conservation value greater than 'least concern', according to national

[1] 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)

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 A2 was of **local importance (lower value) (Table 4.4).**

Plate 4.2 Representative image of site A2 on the Glennaknockane Stream, July 2024

4.1.3 Site A3 – Knockahorrea East River, Meentinny West

Site A3 was located on the Knockahorrea East River (23K33) at a forestry track crossing approximately 1.6km downstream of site A1. The upland eroding spate channel (FW1) was natural in character, with frequent meanders in a naturally incised (often undercut) channel with banks of 1-2m in height. The river was 2-2.5m wide and 0.1-0.2m deep. The profile comprised riffle and shallow glide with localised shallow pool. The substrata were dominated by cobble and boulder with localised mixed gravels. Sand accumulations were present but rare along depositing margins. Siltation was low overall with locally high cover of floc. Given the high energy nature of the site, macrophytes were absent. However, bryophyte coverage was high with frequent *Fontinalis squamosa*, *Rhynchostegium riparioides* and some *Hygroamblystegium* sp. *Racomitrium aciculare* was present on boulder tops. The filamentous rhodophyte *Torularia atrum* was present locally. The liverworts *Pellia* sp. and *Lunularia cruciata* were present on muddy banks. The scrubby banks supported abundant rushes (*Juncus* sp.) with bramble, gorse and abundant grey willow. The site was bordered by mature sitka spruce (WD4) with recolonising clear-fell (WS5) adjoining the channel and valley escarpments.

Atlantic salmon (*Salmo salar*) and brown trout were the only fish recorded via electro-fishing at site A3 (**Appendix A**). Despite evident water quality impacts (land use pressures), the site was of high value as a salmonid habitat, supporting a high density of mixed cohort juvenile Atlantic salmon. Spawning habitat by way of mixed gravels and cobble was widespread (better suited to salmon than trout) with abundant instream refugia providing good quality nursery habitat. Siltation reduced the spawning

value of the site. Holding habitat was sparse given the natural site characteristics although suitability would improve during higher water levels. Despite some suitability for and evident access for European eel, none were recorded (although densities in such habitats are naturally low). There was no suitability for white-clawed crayfish or lamprey. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good 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), the aquatic ecological evaluation of site A3 was of **local importance (higher value) (Table 4.4).**

Plate 4.3 Representative image of site A3 on the Knockahorrea East River, July 2024

4.1.4 Site A4 – Knockahorrea East River, Tooreennagrena

Site A4 was located on the lowermost reaches of the Knockahorrea East River (23K33) at a local road crossing in Rockchapel village, c.100m upstream of the River Feale confluence. The upland eroding spate channel (FW1) had been modified historically in the vicinity of the bridge (some bank works/clearance but recovered) but retained a good semi-natural character. The high energy river was 3-4m wide and 0.1-0.3m deep. The profile comprised small cascades over boulder and bedrock with shallow glide and localised small pool. The substrata were dominated by bedrock with compacted boulder and localised cobble. Finer gravels were present locally with sand accumulations along depositing margins and pool slacks. Siltation was low overall although cover of floc was high throughout with frequent filamentous algae indicative of enrichment. Whilst macrophytes were absent given high flow rates, aquatic bryophytes coverage was high with abundant *Rhynchostegium riparioides* and frequent *Chiloscyphus polyanthos*. *Fontinalis squamosa* was also present but rare and boulder tops supported occasional *Brachythecium rivulare*. *Pellia* sp. was present on the banks. The green algae *Lemanea fluviatilis* was locally frequent on submerged rocks. The shallow site was well-

shaded by intermittent treelines of ash (*Fraxinus excelsior*) and grey willow which provided valuable thermal refugia. The narrow riparian zones were dominated by scrub (WS1) with abundant bramble, meadowsweet (*Filipendula ulmaria*) and localised valerian (*Valeriana officinalis*). The site was bordered by improved pasture (GA1) and residential areas (GA2/BL3).

Atlantic salmon and brown trout were the only fish recorded via electro-fishing at site A4 (**Appendix A**). The site was of good value for salmonids supporting a high density of mixed cohort salmon and lesser numbers of brown trout. The site was of highest value as a salmonid nursery with frequent cobble and boulder refugia providing high quality habitat. Whist present, spawning habitat was highly localised with the bed dominated by compacted larger substrata and bedrock. Local bank scours and occasional deeper pools provided some holding areas for adult salmonids although the value of these areas would be naturally higher under higher water levels. The high energy site was unsuitable for lamprey, with no suitable nursery areas present. Despite some potential for European eel, none were recorded. There was no suitability for white-clawed crayfish or lamprey. An old otter spraint site was recorded on a ledge under the bridge (ITM 522068, 615917).

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 (including Atlantic salmon) and utilisation by otter, the aquatic ecological evaluation of site A4 was of **local importance (higher value) (Table 4.4).**

Plate 4.4 Representative image of site A4 on the Knockahorrea East River, July 2024

4.1.5 Site B1 – Glasheenanargid Stream, Glasheenanargid

Site B1 was located on the uppermost reaches of the Glasheenanargid Stream (23G43), a Glenacarney River tributary, near the Site. The small upland eroding stream (FW1) flowed over a moderate gradient (steeper upstream and downstream) in a deep V-shaped valley and incised channel. The stream was typically <1.5m wide and 0.05-0.1m deep. The profile comprised cascades and riffle with the substrata dominated by loose angular slate, cobble and boulder. Mixed gravels were present locally but these were heavily silted. Livestock poaching was present near the survey site, with frequent bank scouring also contributing to siltation. Macrophytes were limited to occasional hemlock water dropwort (*Oenanthe crocata*) and rare watercress (*Nasturtium officinale*). Given a mobile bed, aquatic bryophyte coverage was low with some *Scapania undulata* and *Racomitrium aciculare* present on more stable substrata. The presence of abundant floc instream was indicative of eutrophication. Riparian shading was high with frequent tunnelling of the narrow, steep channel. Grey willow, rosebay willowherb (*Chamaenerion angustifolium*), bracken (*Pteridium aquifolium*) and ferns dominated the riparian zones. The site was also bordered by historical rock quarry areas and semi-improved pasture (GA1).

No fish were recorded via electro-fishing at site B1 (**Appendix A**). The stream at this location was of poor fisheries value given its diminutive size, shallow depths, water quality pressures and location in the uppermost reaches of the catchment with inherent fish access issues. 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 **Q3-4 (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 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 4.5 Representative image of site B1 on the Glasheenanargid Stream, July 2024

4.1.6 Site B2 – unnamed stream, Foiladaun

Site B2 was located on an unnamed Glenacarney River tributary at the L1012 road crossing, c.100m upstream of the Glenacarney River confluence. The narrow upland stream (FW1) had been historically deepened and locally realigned. It flowed over a high gradient in a deeply incised channel with a short low gradient section in vicinity of the bridge. The stream was <1m wide and 0.05-0.1m deep with a profile of riffle and shallow glide between natural cascades. Water levels were low at the time of survey. The substrata were dominated by mixed, mobile gravels and small cobble with only scattered small boulder. Silt accumulations were present locally in rare pool areas. Given the very narrow width and high bank shading, macrophytes were limited to rare watercress along channel margins. Aquatic bryophyte coverage was low with occasional *Racomitrium aciculare* and *Chiloscyphus polyanthos.* The stream was heavily tunnelled by scrub vegetation dominated by bramble, *Cotoneaster* sp., ferns and rank grasses with scattered ash and grey willow only. The site was bordered by semi-improved pasture (GA1) and scrub.

No fish were recorded via electro-fishing at site B2 (**Appendix A**). The stream at this location was of poor fisheries value given its diminutive size, shallow depths and high gradients. However, given the close proximity to the Glenacarney River, there would be some low potential for seasonal migration of fish from downstream areas (e.g. in winter, under higher 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**). 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 4.6 Representative image of site B2 on an unnamed Glenacarney River tributary, July 2024

4.1.7 Site B3 – Glenacarney River, Foiladaun

Site B3 was located on the Glenacarney River (23G06) at a local road crossing (large box culvert tagged onto old masonry arch). Despite historical bank clearance near the bridge, the upland spate channel (FW1) flowed over a low gradient in a largely natural incised channel with frequent meanders. The river was 2-2.5m wide and 0.1-0.3m deep with up to half of the channel bed exposed at the time of survey. The flow profile was dominated by riffle and shallow glide over angular boulder and cobble, with a low frequency of pool. The substrata comprised mobile angular cobble and boulder with localised bedrock. Mixed gravels were present locally but sparse. Siltation was moderate overall given livestock poaching pressures. Silt accumulations with clay and mixed sand were present near these access areas. Macrophyte cover was low with locally frequent hemlock water dropwort and rare watercress and water starwort (*Callitriche* sp.). Aquatic bryophyte coverage was relatively high with abundant *Rhynchostegium riparioides* in addition to frequent *Chiloscyphus polyanthos*. *Racomitrium aciculare* was occasional on boulder tops. Both *Fontinalis antipyretica* and *Fontinalis squamosa* were present but both were rare. The narrow channel was lined by abundant scrub comprising hemlock water dropwort, hogweed (*Heracleum sphondylium*), wild angelica (*Angelica sylvestris*), bracken, bramble, fuchsia (*Fuchsia magellanica*), hawthorn (*Crataegus monogyna*) and grey willow. The site was bordered by improved pasture (GA1) with mature and often wide riparian buffers.

Atlantic salmon and brown trout were the only fish recorded via electro-fishing at site B3 (**Appendix A**). Despite evident water quality impacts (land use pressures), the site was of high value as a salmonid habitat, supporting a high density of juveniles. Abundant cobble and boulder, although often partially bedded, offered high quality refugia for juveniles. Areas of smaller cobble and mixed gravels between boulder and larger cobble provided good quality spawning habitat although siltation pressures reduced the quality of this habitat. Holding habitat was sparse given the natural site characteristics

although suitability would improve during higher water levels (e.g. bank scours, localised pools). Despite some suitability for and evident access for European eel, none were recorded (although densities in such habitats are naturally low). Soft sediment accumulations were sub-optimal for lamprey ammocoetes and there was no suitable spawning habitat identified. 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**). 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), the aquatic ecological evaluation of site B3 was of **local importance (higher value) (Table 4.4).**

Plate 4.7 Representative image of site B3 on the Glenacarney River, July 2024

4.1.8 Site B4 – Glenacarney River, Glenacarney Bridge

Site B4 was located on the lowermost reaches of the Glenacarney River (23G06) at Glenacarney Bridge, approximately 100m upstream of the River Feale confluence. The large upland spate river (FW1) was natural in character and flowed over a moderate gradient. The river was 5-7m wide and 0.2-0.6m deep, with locally deeper areas to 1.2m. The flow profile comprised natural cascades over bedrock with associated (frequent) plunge pool. Swift glide and riffle was present in between. Plunge pool was frequent. The substrata were dominated by boulder and cobble with frequent siliceous bedrock. Small areas of mixed gravels were present in pool slacks and interstitially. Siltation was low overall (flocculent) although cover of floc was high. Filamentous algal cover was low but nevertheless present. Given the bed conditions and high flow rates, macrophytes were limited to marginal stands of hemlock water dropwort and rare water starwort (*Callitriche* sp.) sprawling on the littorals. Aquatic bryophyte coverage was high with abundant *Fontinalis squamosa* and locally frequent

Rhynchostegium riparioides. On boulder tops *Racomitrium aciculare* was also locally frequent. The liverwort *Chiloscyphus polyanthos* was present locally in shaded pockets. The narrow riparian zones supported mature scrub vegetation with grey willow and ash. The site was bordered by semi-improved pasture (GA1) with wet grassland (GS4) fringes.

Atlantic salmon and brown trout were the only fish species recorded via electro-fishing at site B4 (**Appendix A**). The site was of high value for salmonids and supported a relatively high density of mixed cohort salmon and trout. The site was of highest value as a nursery with abundant flow refugia and also a rocky bed that provided high quality nursery habitat. Plunge pools associated with bedrock cascades also offered high quality holding areas for adult salmonids. Good quality spawning habitat was localised in glide areas between cascades. However, siltation and enrichment pressures reduced the value. Despite some good suitability for European eel, none were recorded. The high energy site was unsuitable for lamprey, with no suitable nursery areas present. There was no suitability for white-clawed crayfish. Neither species were recorded. No otter signs were recorded at the survey area.

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 (including Atlantic salmon), the aquatic ecological evaluation of site B4 was of **local importance (higher value) (Table 4.4).**

Plate 4.8 Representative image of site B4 on the Glenacarney River at Glenacarney Bridge, July 2024

4.1.9 Site C1 – Taurmore Stream, Taurmore

Site C1 was located on the Taurmore Stream (18T07), a tributary of the Owenkeal River, south of the Site. The small upland stream (FW1) flowed over a steep gradient in a V-shaped valley with banks of up to 3m in height. The stream had been historically realigned in vicinity of forestry plantations and passed under a forestry track via a perched pipe culvert. The stream suffered from low summer flows at the time of survey and was <1m wide and 0.05-0.1m deep with a flow profile of riffle and shallow glide over cascades. The substrata comprised mixed mobile gravels and angular cobble and boulder. Siltation was high with heavy floc cover indicative of enrichment. Cover of iron oxidising bacteria was also high. The narrow channel was heavily shaded and often tunnelled with abundant grey willow, fuchsia, gorse and grasses, resulting in an absence of macrophytes. Aquatic bryophytes were limited to rare *Scapania undulata* and *Pellia* sp. The site was bordered immediately by immature sitka spruce plantations (WS2).

No fish were recorded via electro-fishing at site C1 (**Appendix A**). The stream at this location was not of fisheries value given its diminutive size, shallow depths, historical modifications, water quality pressures, high gradients and location in the upper reaches of the catchment. 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**). 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 4.9 Representative image of site C1 on Taurmore Stream, July 2024

4.1.10 Site C2 – Owenkeal River, Clashykinleen Bridge

Site C2 was located on the lower reaches of the Owenkeal River (18O06) at Clashykinleen Bridge. The upland spate channel (FW1) had been historically straightened and deepened in vicinity of the twin arch masonry bridge with intermittent old retaining walls along both banks. The river suffered from low summer flows at the time of survey with up to half of the bed exposed. The flow profile comprised slow-flowing glide with localised pool and rare riffle (although this increased downstream of bridge). The substrata were dominated by rounded cobble and boulder with more localised areas of mixed gravels. Sand accumulations (with some silt content) were present in depositing margins and pool slacks. Given low summer flows, the cover of floc was high (but likely low during higher water flows). Large woody debris contributed to improved habitat heterogeneity. Given high shading and bed conditions, macrophytes were limited to very occasional water mint (*Mentha aquatica*) and hemlock water dropwort on exposed cobble bars. Aquatic bryophyte coverage was relatively low with occasional *Chiloscyphus polyanthos* and *Rhynchostegium riparioides*. *Thamnobryum alopecurum* was present on the bridge abutments and steep rocky banks. Cover of filamentous algae was low but nonetheless present, despite high shading (indicating some enrichment). The river was lined by narrow but mature treelines dominated by sycamore and alder (*Alnus glutinosa*) with non-native montbretia (*Crocosmia* x *crocosmiiflora*). The site was bordered by broad-leaved woodland (WD1), residential areas (BL3) and improved pasture (GA1).

Atlantic salmon, brown trout and European eel (*Anguilla anguilla*) were recorded via electro-fishing at site C2 (**Appendix A**). The site was of good value for salmonids although supported only moderate densities of salmon and trout, likely reflecting low summer flows. Abundant cobble and boulder provided high quality refugia for juveniles (although reduced value due to low flows). Undercut banks (scours) offered some value as holding areas for adult salmonids although these were typically shallow in nature. Some good quality salmonid spawning habitat was present locally. The high energy site was largely unsuitable for lamprey with no nursery habitat present. Suitability for European eel was good with a high frequency of instream refugia. However, only a single individual was recorded. There was no suitability for white-clawed crayfish and the species was not recorded during the survey. A regular otter spraint site was recorded on the bridge ledge on the westernmost (dry) arch (ITM 524412, 606617).

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 location of the site within the Blackwater River (Cork/Waterford) SAC (002170), the aquatic ecological evaluation of site C2 was of **international importance (Table 4.4).**

Plate 4.10 Representative image of site C2 on the Owenkeal River, July 2024

4.1.11 Site D1 – Inchatotane Stream, Taurmore

Site D1 was located on the Inchatotane Stream (18I02) at a local road crossing to the south-east of the Site. The small upland stream (FW1) had been historically realigned and deepened in vicinity of coniferous forestry plantations and was dry at the time of survey, with no standing water in the high gradient ephemeral channel. The dry bed was composed of mobile angular cobble and gravels with scattered boulder. The absence of aquatic vegetation suggested the channel was typically dry for much of the year. The steep banks supported abundant scrub vegetation including gorse, bramble, bilberry and grey willow. A heavy infestation of invasive Japanese knotweed (*Reynoutria japonica*) was present within and along the channel downstream of the road crossing. The site was bordered by improved pasture (GA1) and mature coniferous forestry (WD4).

Given the dry nature of the stream at the time of survey, it was not possible to undertake electro-fishing. The ephemeral channel was therefore not of value to fish. No otter signs were recorded in vicinity of the site. As the seasonal stream at the time of survey, it was not possible to collect a biological water quality sample.

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).**

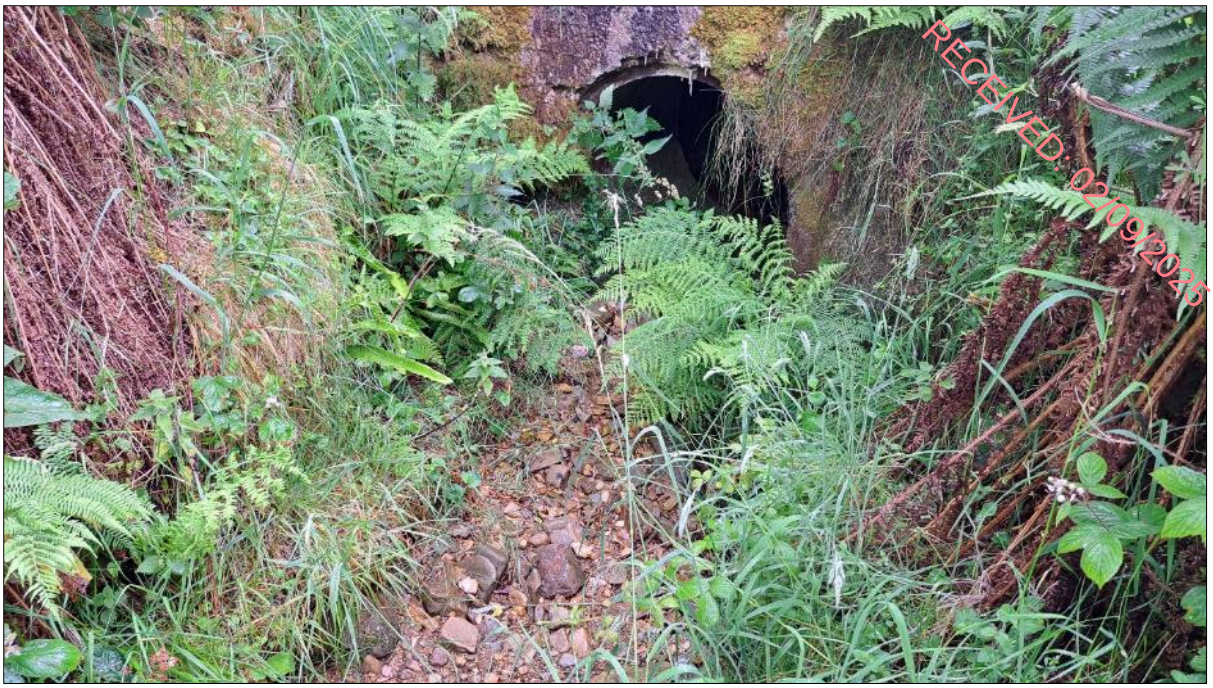

Plate 4.11 Representative image of site D1 on the Inchatotane Stream, July 2024 (dry, ephemeral channel)

4.1.12 Site D2 – Glenlara River, Gloun Dine Bridge

Site D2 was located on the uppermost reaches of the Glenlara River (18G08) at Gloun Dine Bridge. The upland eroding spate channel (FW1) flowed under a local road via a perched pipe culvert before falling over a moderate gradient in a semi-natural, meandering channel. Some historical bank works had occurred locally (strengthening on meanders) but recovery was evident. The river was 1-2m wide and 0.05-0.15m deep at the time of survey. The profile comprised cascades over bedrock and mobile angular cobble and boulder with associated small plunge pools. Fine to medium gravels and sands were present interstitially and along depositing margins. Given the high energy nature and high shading, macrophytes were absent. However, the bryophytes *Marsupella emarginata*, *Rhynchostegium riparioides* and *Hygroamblystegium* sp. were present on more stable substrata. The stream flowed through a mature block of mixed woodland (WD3) with mature pine (*Pinus* sp.) and sycamore. The channel had scoured peaty banks supporting a well-developed moss and fern community, with scattered fuchsia. Beyond the immediate riparian fringe the Glenlara River was bordered by mature coniferous afforestation (WD4) which was being actively felled/thinned at the time of survey.

Brown trout was the only fish species recorded via electro-fishing at site D2 (**Appendix A**). The small upland river was of moderate value to salmonids, supporting a low density of mixed cohort trout (adults and juveniles). The shallow, high energy site was of only moderate value as a salmonid nursery, with the paucity of deeper pool reducing the value as holding habitat. The dominance of bedrock and larger substrata provided poor opportunities for salmonid spawning, although small areas of mixed gravels were present locally. Despite some low suitability, no European eel were recorded which was largely reflective of the location in the upper reaches of the watercourse. There was no suitability 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 **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 D2 was of **local importance (higher value) (Table 4.4).**

Plate 4.12 Representative image of site D2 on the Glenlara River at Gloun Dine Bridge, July 2024

4.1.13 Site D3 – Glenlara River, Glennamucklagh East

Site D3 was located on the upper reaches of the Glenlara River (18G08) at a local road crossing, approximately 2km downstream of site D2. The upland eroding channel (FW1) was natural and meandering in character, flowing over a low gradient under a local road via a single arch masonry bridge with an associated perched, degrading apron. The river was 2-2.5m wide and varied from 0.1-0.7m deep, with a good variety of instream habitats. The flow profile comprised a mix of riffle, shallow glide, deeper glide and pools. The substrata were dominated by cobble and mixed gravels with locally frequent boulder. Sand accumulations with a high organic content were present along depositing margins and in pool slacks. Siltation was moderate overall with a particularly high cover of floc indicative of enrichment pressures. Macrophytes were limited to occasional water mint, hemlock water dropwort with lesser spearwort (*Ranunculus flammula*) along the littorals. Aquatic bryophyte coverage was also low with occasional *Fontinalis antipyretica* and *Rhynchostegium riparioides*. *Fontinalis squamosa* was recorded as rare with occasional *Pellia epiphylla* on the river banks. The filamentous rhodophyte species *Torularia atrum* was particularly abundant on shallow cobble. Filamentous algae was present (2%), further indicating enrichment. The riparian zones supported dense scrub vegetation with abundant grey willow. The site was bordered by diverse wet grassland (GS4) and mature coniferous afforestation (WD4) upstream.

Brown trout was the only fish species recorded via electro-fishing at site D3 (**Appendix A**). The small upland river was of considerable value to salmonids, supporting a good density of juveniles with a low number of adults. Good habitat heterogeneity provided suitability for both juveniles (nursery) and adults (holding). Small localised areas of mixed gravels (mostly upstream of road crossing) provided good quality salmonid spawning habitat although the value was compromised by siltation. Despite some suitability for European eel, none were recorded. The upland higher energy character of the Glenlara River was unsuitable for lamprey populations and the species was not recorded. There was no suitability for white-clawed crayfish given unsuitable geology (none 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, the aquatic ecological evaluation of site D3 was of **local importance (higher value) (Table 4.4).**

Plate 4.13 Representative image of site D3 on the Glenlara River, July 2024

4.1.14 Site D4 – Glenlara River, Ballyduane Bridge

Site D4 was located on the lower reaches of the Glenlara River (18G08) at Ballyduane Bridge, approximately 4.5km downstream of site D3. The medium-sized upland eroding sandstone channel (FW1) was natural and meandering in character, flowing over a low gradient. The river was 3-5m wide and 0.1-0.4m deep, with locally deeper pool to 1.2m. The flow profile comprised a variety of riffle, shallow glide and pool with deeper glide present upstream of the bridge. The substrata were dominated by bryophyte-rich boulder and cobble (mostly bedded) and mixed gravels and sands locally frequent. Bedrock, forming pools, was present locally. Siltation was moderate overall, despite the upland eroding conditions. The cover of floc and filamentous algae was low. Hemlock water dropwort

was abundant along channel margins and instream. Water mint and branched bur-reed (*Sparganium erectum*) were occasional. The site supported a high cover of aquatic bryophytes with abundant *Fontinalis antipyretica*, *Fontinalis squamosa*, *Rhynchostegium riparioides* and *Chiloscyphus polyanthos*. *Hygrohypnum luridum*, *Fissidens* sp. and *Pellia* sp. were also present locally. The red algal species *Torularia atrum* was present but rare. The river was lined by mature but narrow treeline buffers dominated by willow and alder. The site was bordered by grassland (GS2), scrub (WS1) and in the wider landscape improved pasture (GA1).

Atlantic salmon, brown trout, European eel and stone loach (*Barbatula barbatula*) were recorded via electro-fishing at site D4 (**Appendix A**). The site was of high value for salmonids, supporting a high density of juvenile salmon in addition to a lower density of mixed cohort trout. This reflected the variety of instream habitats present (i.e. riffle, glide & pool). The site was of highest value as a salmonid nursery with abundant bryophyte-rich cobble and boulder providing instream flow refugia. Locally areas of mixed gravels and smaller, more mobile cobble offered good quality salmonid spawning habitat. Deeper glide and pool, particularly with scoured banks or overhanging vegetation, provided good quality holding habitat for adult salmonids. Good quality European eel habitat was present although only a low density were recorded. The upland characteristics were unsuitable for lamprey overall, despite the presence of localised organic-rich sand accumulations. There was no suitability for white-clawed crayfish given unsuitable geology. Two otter spraint sites were present on ledges under the road bridge (ITM 527755, 607295 & 527758, 607296).

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 location of the site within the Blackwater River (Cork/Waterford) SAC (002170), the aquatic ecological evaluation of site D4 was of **international importance (Table 4.4).**

Plate 4.14 Representative image of site D4 on the Glenlara River at Ballyduane Bridge, July 2024

4.2 White-clawed crayfish survey

No white-clawed crayfish were recorded via hand-searching or sweep netting of instream refugia and no crayfish remains were identified in otter spraint sites recorded during the survey. This species is not known to be present in the wider survey area given largely unsuitable water chemistry and geographical isolation (Demers et al., 2005; Lucy & McGarrigle, 1987).

4.3 eDNA analysis

No freshwater pearl mussel, white-clawed crayfish or crayfish plague eDNA was detected in composite water samples collected from the Knockahorrea East River, Glenacarney River, Owenkeal River or Glenlara River (0 positive qPCR replicates out of 12, respectively) (**Table 4.1; Appendix C**). These results were considered as evidence of the species' absence at and or upstream of the sampling locations.

Table 4.1 eDNA results in the vicinity of the Proposed Lifetime Extension (positive qPCR replicates out of 12 in parentheses)

Site	Watercourse	Freshwater pearl mussel	White-clawed crayfish	Crayfish plague
A4	Knockahorrea East River	Negative (0/12)	Negative (0/12)	Negative (0/12)
B4	Glenacarney River	Negative (0/12)	Negative (0/12)	Negative (0/12)
C2	Owenkeal River	Negative (0/12)	Negative (0/12)	Negative (0/12)
D4	Glenlara River	Negative (0/12)	Negative (0/12)	Negative (0/12)

4.4 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 a total of 13 no. wetted riverine sites[2] in July 2024 (**Appendix B**).

Sites A2 on the Glennaknockane Stream and A3 on the Knockahorrea River achieved **Q4 (good status)** water quality and thus met the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). This was based on the occurrence of at least one group A taxa in fair numbers (5% of total sample abundance), namely the stoneflies *Nemurella picteti* and *Isoperla grammatica*, respectively.

A total of 7 no. sites on the Knockahorrea River (4), Glasheenanargid Stream (B1), Glenacarney River (B3, B4) and unnamed tributary (B2) and the Glenlara River (D3, D4) achieved **Q3-4 (moderate status)** water quality (**Figure 4.1**). Despite the presence of EPA group A species such as *Ecdyonurus dispar,*

[2] Site D1 on the Inchatotane Stream was dry at the time of survey and thus it was not possible to collect a biological water quality sample.

Electrogena lateralis, Heptagenia sulphurea and *Isoperla grammatica*, these were only recorded in low numbers (<5% of total sample) and thus did not meet the qualifying criteria for good status as set out by Toner et al. (2005).

The remaining 4 no. sites (i.e. A1, C1, C2 & D2) achieved **Q3 (poor status)** based on an absence of group A species, low numbers of group B species and a dominance of group C species, particularly the mayfly *Baetis rhodani*, Hydropsychid caddis and Simuliidae larvae (**Appendix B**). A toxic effect was suspected on the Knockahorrea East River at site A1 where a very high cover of iron oxidising bacteria resulted in an extremely low abundance of macro-invertebrates (*n*=5) and a subsequent Q-rating of **Q3/0**.

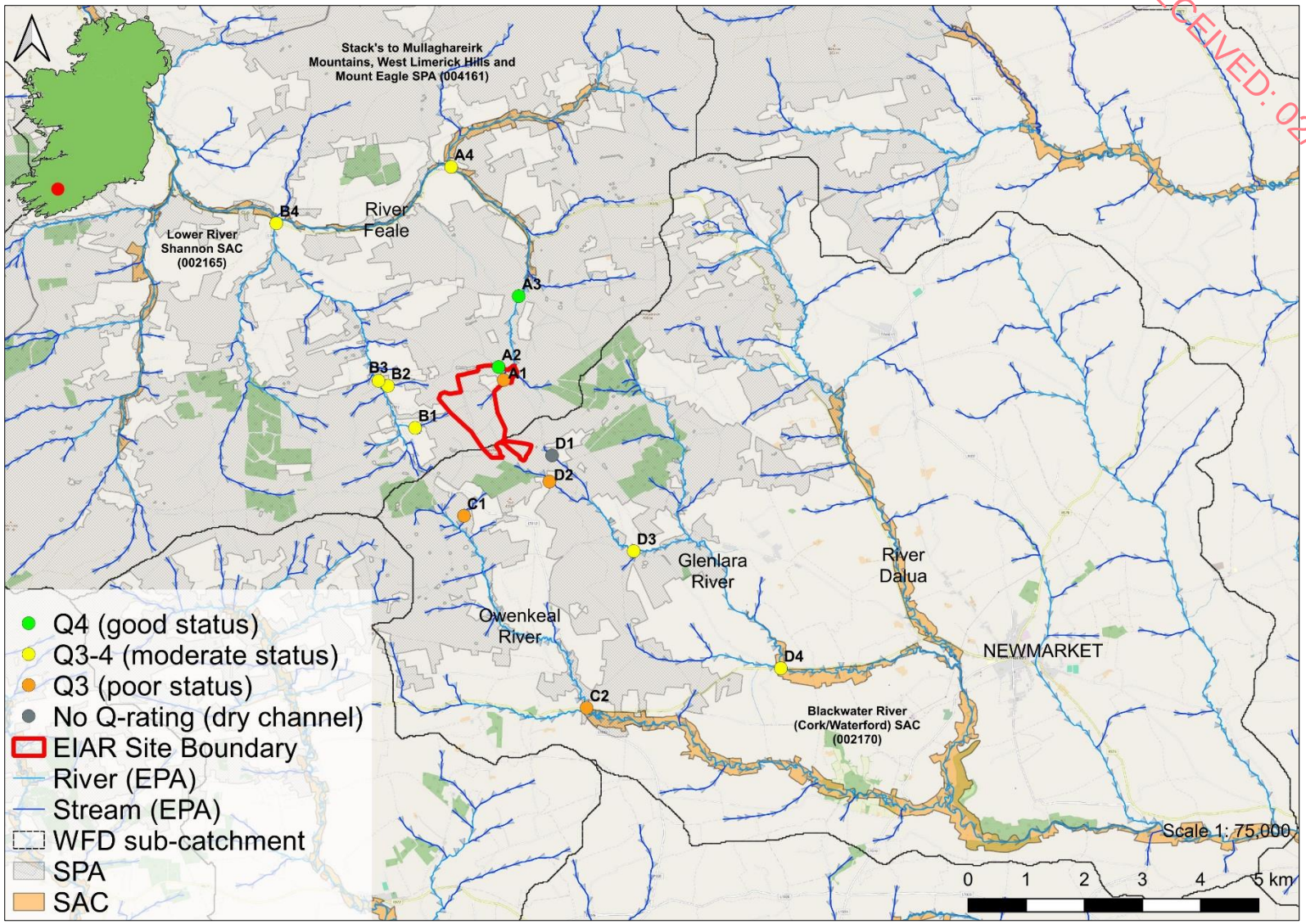

Figure 4.1 Overview of the biological water quality status in the vicinity of the Site, July 2024

Table 4.2 Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the vicinity of the Site, July 2024

Site	Watercourse	Atlantic salmon	Brown trout	European eel	Other species
A1	Knockahorrea East River		Low		
A2	Glennaknockane Stream				No fish recorded
A3	Knockahorrea East River	High	Medium		
A4	Knockahorrea East River	Very high	Medium		
B1	Glasheenanargid Stream				No fish recorded
B2	Unnamed stream				No fish recorded
B3	Glenacarney River	High	High		
B4	Glenacarney River	High	Medium		
C1	Taurmore Stream				No fish recorded
C2	Owenkeal River	Medium	Medium	Low	
D1	Inchatotane Stream				No fish recorded – dry channel
D2	Glenlara River		Low		
D3	Glenlara River		Medium		
D4	Glenlara River	High	Medium	Low	Stone loach

Conservation value: Atlantic salmon (*Salmo salar*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. Atlantic salmon are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations 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). With the exception of the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout and coarse fish species have no legal protection in Ireland.

Table 4.3 Summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the Site, July 2024

Site	Watercourse	White-clawed crayfish	Otter signs[3]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
A1	Knockahorrea East River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
A2	Glennaknockane Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
A3	Knockahorrea East River	None recorded	No signs recorded	None recorded	None recorded	None recorded	**Atlantic salmon**
A4	Knockahorrea East River	None recorded	**Old spraint site**	None recorded	None recorded	None recorded	**Atlantic salmon**
B1	Glasheenanargid Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
B2	Unnamed stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
B3	Glenacarney River	None recorded	No signs recorded	None recorded	None recorded	None recorded	**Atlantic salmon**
B4	Glenacarney River	None recorded	No signs recorded	None recorded	None recorded	None recorded	**Atlantic salmon**
C1	Taurmore Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
C2	Owenkeal River	None recorded	**Regular spraint site**	None recorded	None recorded	None recorded	**Atlantic salmon, European eel**
D1	Inchatotane Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D2	Glenlara River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D3	Glenlara River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D4	Glenlara River	None recorded	**Two spraint sites**	None recorded	None recorded	None recorded	**Atlantic salmon, European eel**

Conservation value: Eurasian otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). Atlantic salmon and sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations 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).

[3] Otter signs within 150m of the survey site

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

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
A1	Knockahorrea East River	23K33	**Local importance (higher value)**	Brown trout recorded
A2	Glennaknockane Stream	23G62	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q4 (good status) water quality
A3	Knockahorrea East River	23K33	**Local importance (higher value)**	Atlantic salmon & brown trout recorded
A4	Knockahorrea East River	23K33	**Local importance (higher value)**	Atlantic salmon, brown trout & otter recorded
B1	Glasheenanargid Stream	23G43	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3-4 (moderate status) water quality
B2	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3-4 (moderate status) water quality
B3	Glenacarney River	23G06	**Local importance (higher value)**	Atlantic salmon & brown trout recorded
B4	Glenacarney River	23G06	**Local importance (higher value)**	Atlantic salmon & brown trout recorded
C1	Taurmore Stream	18T07	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality
C2	Owenkeal River	18O06	**International importance**	Located within the Blackwater River (Cork/Waterford) SAC (002170)
D1	Inchatotane Stream	18I02	Local importance (lower value)	No aquatic species or habitats of high conservation value; dry, ephemeral stream
D2	Glenlara River	18G08	**Local importance (higher value)**	Brown trout recorded
D3	Glenlara River	18G08	**Local importance (higher value)**	Brown trout recorded
D4	Glenlara River	18G08	**International importance**	Located within the Blackwater River (Cork/Waterford) SAC (002170)

Conservation value: Eurasian otter (*Lutra lutra*) and Atlantic salmon (*Salmo salar*) 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. Atlantic salmon are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. 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). Apart from the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout have no legal protection in Ireland.

5. Discussion

The watercourses in the vicinity of the Proposed Lifetime Extension were typically small, upland eroding spate channels with a good degree of naturalness and habitat heterogeneity. However, land use and water quality pressures were present in both the Feale_SC_010 and Dalua_SC_010 river sub-catchments, with eutrophication and siltation evident. Despite this, a number of a high conservation value aquatic species were recorded including Atlantic salmon, European eel and otter. The majority of sites were of at least **local importance (higher value)** in terms of their aquatic ecology (**Table 4.4**). Sites on the Owenkeal River (C2) and Glenlara River (D4) were of **international importance** by virtue of their location within the Blackwater River (Cork/Waterford) SAC (002170), a site designated for a number of aquatic qualifying interests including Atlantic salmon and otter. The highest value watercourses in terms of aquatic ecology were the larger Knockahorrea east River, Glenacarney River, Owenkeal River and Glenlara River.

No white-clawed crayfish nor rare or protected macro-invertebrates, macrophytes or aquatic bryophytes were recorded during the survey. A Stage 1 freshwater pearl mussel survey was beyond the scope of the current survey. However pearl mussel were not detected from the Knockahorrea East, Glenacarney, Owenkeal River or Glenlara rivers via eDNA sampling (**Appendix B**) and overall suitability appeared low or absent in the survey area.

5.1 Fisheries

A typically low diversity of fish species for Cork sandstone catchments was recorded during the electro-fishing survey. This included Atlantic salmon, brown trout, European eel and stone loach (**Table 4.1**). A total of 5 no. sites (A2, B1, B2, C1 & D1) did not support resident fish at the time of survey and these were located in the upper reaches of the respective watercourses.

Salmonid populations were widespread in vicinity of the Site. Of the 9 no. sites supporting fish, brown trout were recorded at all of them. Atlantic salmon were present at 6 no. sites on the Knockahorrea East River (site A3, A4), Glenacarney River (B3, B4), Owenkeal River (C2) and Glenlara River (D4). These four watercourses provided the most important salmonid habitat in the survey area which was supported by more optimal nursery and spawning conditions as reflected by the fish abundances (**Appendix A**). No lamprey ammocoetes were recorded during targeted electro-fishing. Primarily this reflected the spate nature of the survey watercourses that limited the presence of soft sediment nursery habitat (**Appendix A**). Red-listed European eel were only recorded (in low densities) from site C2 on the Owenkeal River. The paucity of eel recorded during the electro-fishing surveys was considered to reflect a combination sub-optimal habitat (high energy/spate watercourses) and distance from marine habitats (**Appendix A**).

5.2 Otter

Despite some good foraging suitability elsewhere (e.g. Glenacarney River), otter signs (spraints) were only recorded at 3 no. sites on the Knockahorrea East River (A4), Owenkeal River (C2) and Glenlara River (D4). The paucity of signs was considered to mainly reflect the higher energy, higher gradient and or small, shallow nature of many survey watercourses. Such channels generally provide more restricted, stochastic prey resources and reduced foraging opportunities for otter compared with

lower-gradient, larger watercourses with greater prey resources (Triturus data; Sittenthaler et al., 2019; Scorpio et al., 2016; Remonti et al., 2009). Furthermore, most survey sites were located at elevations >200m ASL and otter occurrence is known to be negatively correlated with increasing elevation (Brazier & Macklin, 2020; Hong et al., 2020; Reid et al., 2013), primarily due to impacts on foraging. No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in July 2024.

5.3 Biological water quality & pressures

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from a total of 13 no. wetted riverine sites in July 2024 (**Appendix B**), i.e. none of greater than Least Concern.

Only two sites on the Glennaknockane Stream (A2) and Knockahorrea River (A3) achieved **Q4 (good status)** water quality, with all other sites failing to meet the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC). Impacts to water quality from forestry and land drainage (hydromorphology) are known to be the primary threats to water quality in the wider survey area (EPA data) and these pressures were also observed during the site surveys. Eutrophication, contributing to a high bed cover of floc that was present in both of the sub-catchments surveyed.

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7. Appendix A – Fisheries assessment report

Please see accompanying fisheries assessment report

Fisheries assessment of Taurbeg Wind Farm Extension of Operational Life

Triturus

Prepared by Triturus Environmental Ltd. for MKO

November 2024

Please cite as:

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by MKO to undertake a baseline fisheries assessment of riverine watercourses in the vicinity of the Proposed Lifetime Extension located near Newmarket, Co. Cork (**Figure 2.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the Proposed Lifetime Extension. In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses in vicinity of the Site, a catchment-wide electro-fishing survey across 14 no. riverine sites was undertaken (**Table 2.1; Figure 2.1**). Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for fish of high conservation value that included salmonids, lamprey (*Lampetra* sp.) and European eel (*Anguilla anguilla*). Other species of lower conservation value were also recorded. The presence and or absence of fish populations and or associated supporting habitat would help inform impact assessment and any subsequent mitigation for the Proposed Lifetime Extension.

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 an electro-fishing survey in the vicinity of the Proposed Lifetime Extension. The surveys were undertaken on the 15th, 16th and 17th July 2024.

1.2 Fisheries (desktop review)

Fisheries data for the survey watercourses was largely deficient. The Owenkeal River, a tributary of the River Dalua, is also known to support lamprey (*Lampetra* sp.) as well as sea lamprey (*Petromyzon marinus*) (King & Linnane, 2004), in addition to salmonids.

The downstream-connecting River Feale is a designated salmonid watercourse under the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. 293/1988) and is currently meeting its conservation limit for both one sea-winter (1SW) and two sea-winter (2SW) Atlantic salmon (*Salmo salar*) (TEGOS, 2023). The river and wider catchment also supports brown/sea trout (*Salmo trutta*), lamprey (*Lampetra* sp.), European eel (*Anguilla anguilla*) and minnow (*Phoxinus phoxinus*) (Kelly et al., 2010; O'Connor, 2006).

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

2. Methodology

2.1 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 Site in July 2024 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The electro-fishing survey was undertaken across 14 no. riverine sites (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).

2.1.1 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 approximately 30-50m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages.

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 to moderate conductivity waters of the sites a voltage of 240-300v, frequency of 35-40Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

2.1.2 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, approximately 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).

2.2 Fisheries habitat appraisal

A fisheries habitat appraisal of all 14 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.).

2.3 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. 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.

Table 2.1 Location of *n*=14 electro-fishing and fisheries appraisal sites in the vicinity of the Site

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Knockahorrea East River	23K33	Taurbeg	522990	612256
A2	Glennaknockane Stream	23G62	Taurbeg	522901	612480
A3	Knockahorrea East River	23K33	Meentinny West	523248	613699
A4	Knockahorrea East River	23K33	Tooreennagrena	522084	615924
B1	Glasheenanargid Stream	23G43	Glasheenanargid	521465	611432
B2	Unnamed stream	n/a	Foiladaun	520997	612155
B3	Glenacarney River	23G06	Foiladaun	520834	612242
B4	Glenacarney River	23G06	Glenacarney Bridge	519077	614953
C1	Taurmore Stream	18T07	Taurmore	522306	609917
C2	Owenkeal River	18O06	Clashykinleen Bridge	524415	606611
D1	Inchatotane Stream	18I02	Taurmore	523821	610957
D2	Glenlara River	18G08	Gloun Dine Bridge	523777	610507
D3	Glenlara River	18G08	Glennamucklagh East	525227	609309
D4	Glenlara River	18G08	Ballyduane Bridge	527758	607292

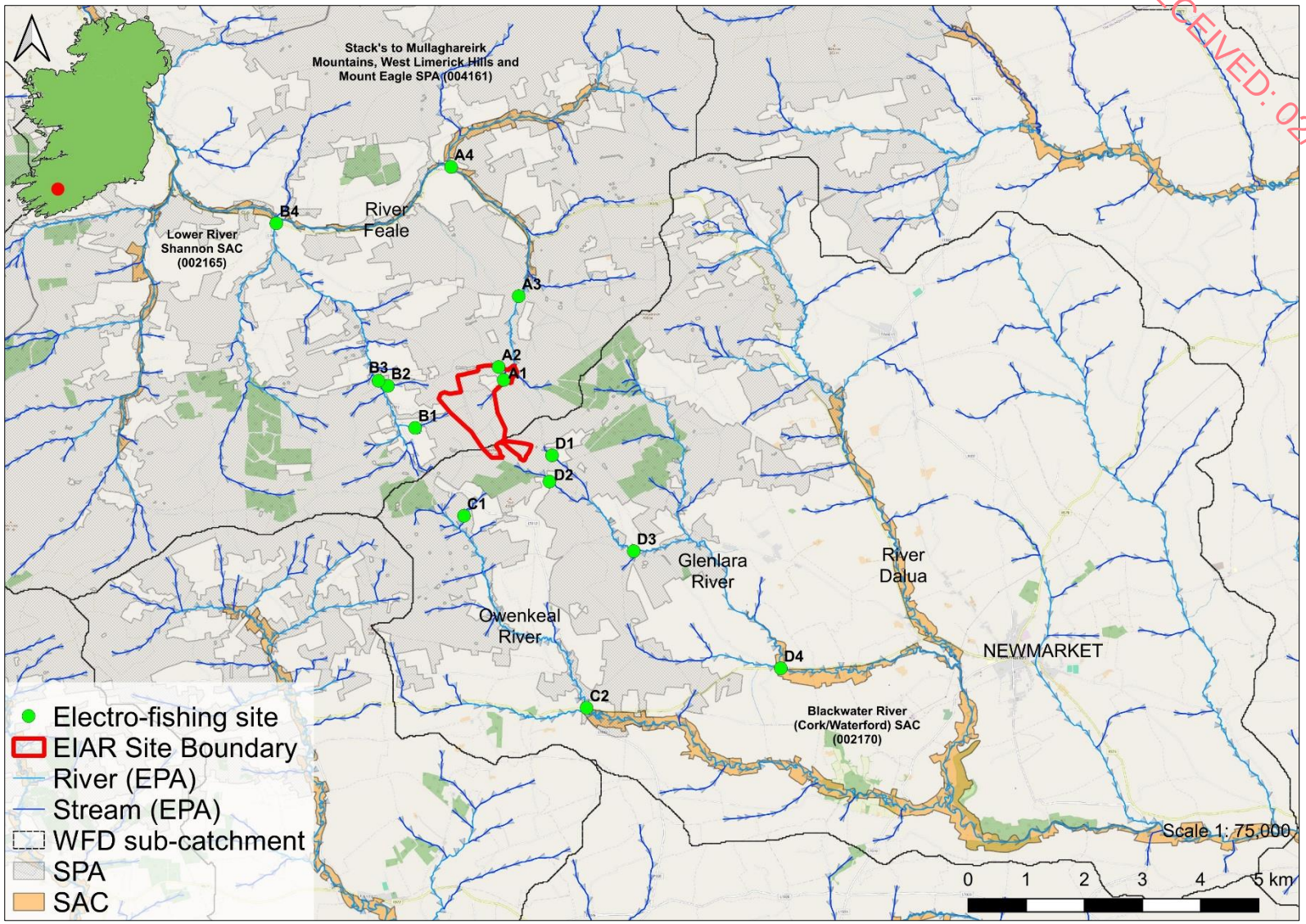

Figure 2.1 Overview of the electro-fishing & fisheries appraisal survey sites in the vicinity of the Site

3. Results

A catchment-wide fisheries survey of 14 no. sites in the vicinity of the Site was conducted on the 15th, 16th and 17th July 2024 following notification to Inland Fisheries Ireland. 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.

3.1 Fisheries assessment & appraisal

3.1.1 Site A1 – Knockahorrea East River, Taurbeg

Brown trout (*Salmo trutta*) (*n*=1) was the only fish species recorded via electro-fishing at site A1 on the uppermost reaches of the Knockahorrea Stream (EPA code: 23K33) (**Figure 3.1**).

The site was of very low fisheries value given low summer flows and high coverage of iron-oxidising bacterial films. However, despite a near absence of suitable spawning habitat, a single juvenile trout was recorded. There was no suitability for white-clawed crayfish or lamprey. No otter signs were recorded in vicinity of the site.

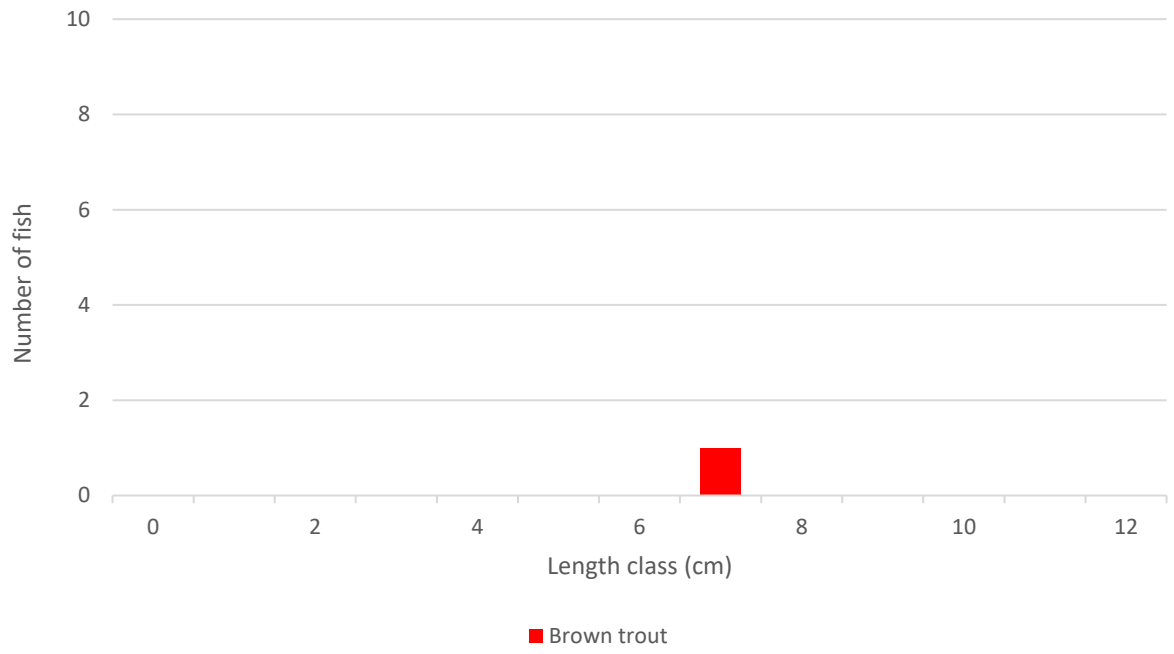

Figure 3.1 Length frequency distribution recorded via electro-fishing at site A1, July 2024

Plate 3.1 Representative image of site A1 on the Knockahorrea East River showing very heavy iron oxidising bacterial cover, July 2024

3.1.2 Site A2 – Glennaknockane Stream, Taurbeg

No fish were recorded via electro-fishing at site A2 on the uppermost reaches of the Glennaknockane Stream (23G62). The site was of very low fisheries value given low summer flows, siltation and high coverage of iron-oxidising bacterial films, in addition to its location in the upper reaches of the catchment. However, given some physical suitability, the site may be utilised by salmonids under higher flows (e.g. winter).

Plate 3.2 Representative image of site A2 on the Glennaknockane Stream, July 2024

3.1.3 Site A3 – Knockahorrea East River, Meentinny West

High numbers of Atlantic salmon (*Salmo salar*) (*n*=53) and moderate numbers of brown trout (*n*=14) were recorded via electro-fishing at site A3 on the Knockahorrea East River (23K33). This survey area was situated approximately 1.6km downstream of site A1 (**Figure 3.2**).

Despite evident water quality impacts (land use pressures), the site was of high value as a salmonid habitat, supporting a high density of mixed cohort juvenile Atlantic salmon. Spawning habitat was of good quality despite siltation pressures with abundant mixed gravels and cobble (particularly suited to salmon). The abundant instream refugia inclusive of large cobble also provided good quality nursery habitat. Holding habitat was sparse given the natural site characteristics although suitability would improve during higher water levels. Despite suitability for European eel with no known significant barriers, the species was not recorded present.

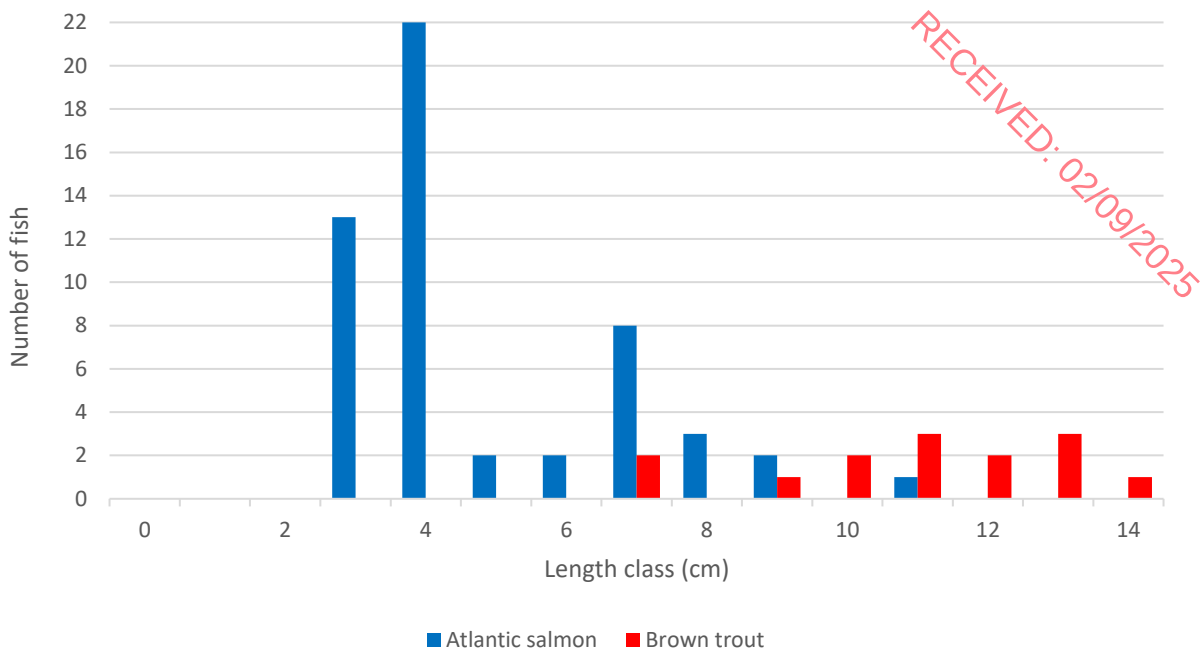

Figure 3.2 Length frequency distribution recorded via electro-fishing at site A3, July 2024

Plate 3.3 Mixed cohort Atlantic salmon parr recorded at site A3 on the Knockahorrea East River, July 2024

3.1.4 Site A4 – Knockahorrea East River, Tooreennagrena

Very high densities of Atlantic salmon (*n*=87) and moderate densities of brown trout (*n*=12) were recorded via electro-fishing at site A4 on the lowermost reaches of the Knockahorrea East River (23K33) (**Figure 3.3**).

The site was of very good value for salmonids in light of the high density of mixed cohort salmon recorded in addition to lesser numbers of brown trout. The site was of highest value as a salmonid nursery with frequent cobble and boulder refugia providing high quality habitat. Whist present, spawning habitat was highly localised with the bed dominated by compacted larger substrata and bedrock. Local bank scours and occasional deeper pools provided some holding areas for adult salmonids although the value of these areas would be naturally higher under higher water levels. The high energy site was unsuitable for lamprey, with no suitable nursery areas present (none recorded). Despite some potential for European eel, none were recorded.

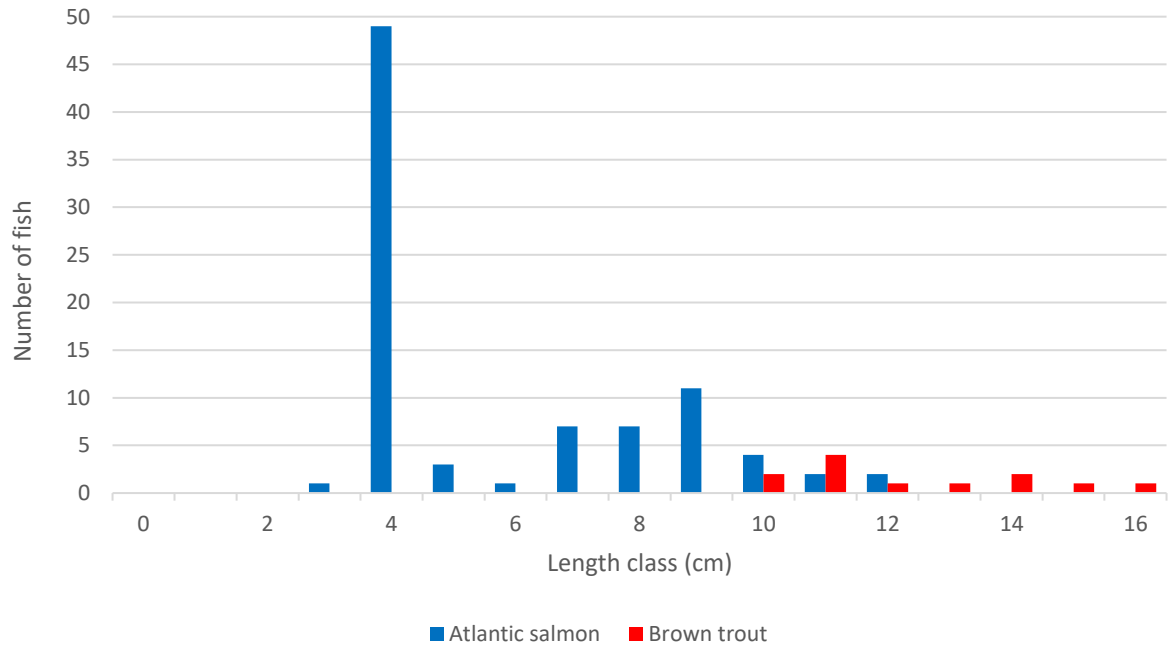

Figure 3.3 Length frequency distribution recorded via electro-fishing at site A4, July 2024

Plate 3.4 0+ Atlantic salmon were abundant at site A4 on the Knockahorrea East River, July 2024

3.1.5 Site B1 – Glasheenanargid Stream, Glasheenanargid

No fish were recorded via electro-fishing at site B1 in the uppermost reaches of the Glasheenanargid Stream (23G43), a Glenacarney River tributary. The stream at this location was of poor fisheries value given its diminutive size, shallow depths, siltation pressures and location in the uppermost reaches of the catchment with poor access to migratory fish.

Plate 3.5 Representative image of site B1 on the Glasheenanargid Stream, July 2024

3.1.6 Site B2 – unnamed stream, Foiladaun

No fish were recorded via electro-fishing at site B2 on an unnamed Glenacarney River tributary. The stream at this location was of poor fisheries value given its diminutive size, shallow depths and high gradients. However, given the close proximity to the Glenacarney River, there would become low potential for seasonal migration of fish from downstream areas (e.g. in winter, under higher flows).

Plate 3.6 Representative image of site B2 on an unnamed Glenacarney River tributary, July 2024

3.1.7 Site B3 – Glenacarney River, Foiladaun

High densities of both Atlantic salmon (*n*=42) and brown trout (*n*=47) were recorded via electro-fishing at site B3 on the Glenacarney River (23G06) (**Figure 3.4**).

Despite evident water quality impacts (land use pressures from agriculture), the site was of high value as a salmonid habitat, supporting a high density of juvenile fish. Abundant cobble and boulder, although often partially bedded, offered high quality refugia for juveniles. Areas of smaller cobble and mixed gravels between boulder and larger cobble provided good quality spawning habitat although siltation pressures reduced the quality of this habitat. Holding habitat was sparse given the natural site characteristics although suitability would improve during higher water levels (e.g. bank scours, localised pools). Despite some suitability for and evident access for European eel, none were recorded (although densities in such habitats are naturally low). Soft sediment accumulations were sub-optimal for lamprey ammocoetes and there was no suitable spawning habitat identified. The species was not recorded present.

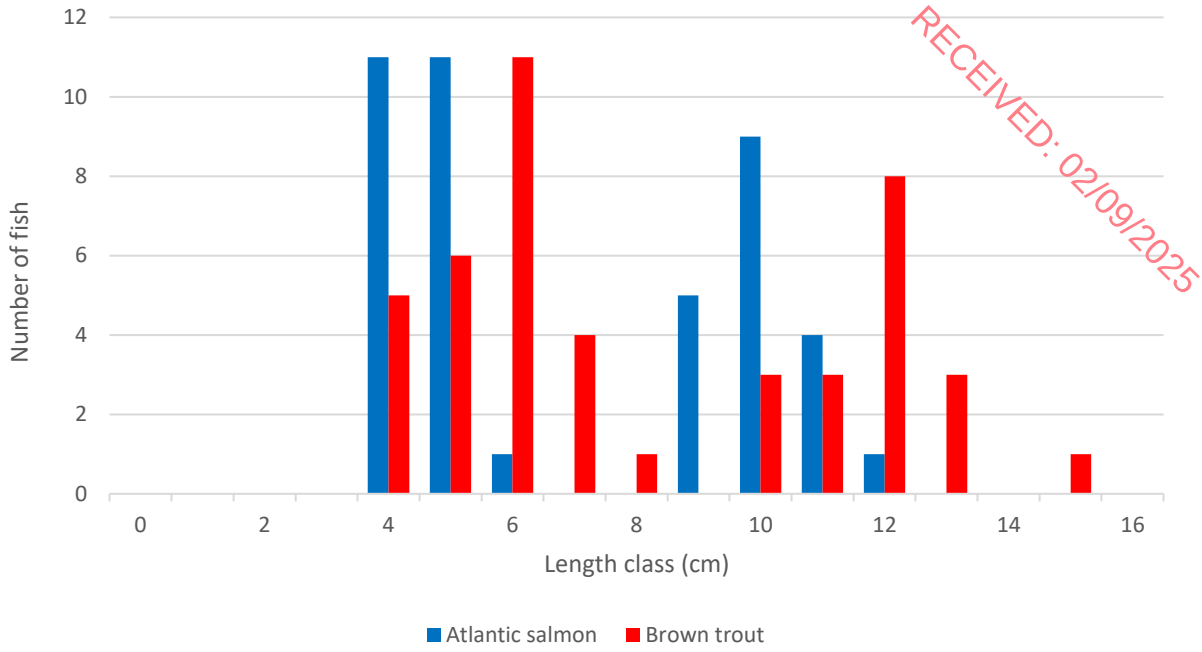

Figure 3.4 Length frequency distribution recorded via electro-fishing at site B3, July 2024

Plate 3.7 Mixed cohort brown trout recorded at site B3 on the Glenacarney River, July 2024

3.1.8 Site B4 – Glenacarney River, Glenacarney Bridge

High densities of Atlantic salmon (*n*=40) and moderate densities of brown trout (*n*=16) were recorded via electro-fishing at site B4 on the lowermost reaches of the Glenacarney River (23G06) at Glenacarney Bridge, approximately 100m upstream of the River Feale confluence (**Figure 3.5**).

The site was of high value for salmonids and supported a relatively high density of mixed cohort salmon and trout. The site was of highest value as a nursery with abundant flow refugia and frequent

cobble and boulder providing high quality nursery areas. Plunge pools associated with bedrock cascades offered high quality holding areas for adult salmonids. Good quality spawning habitat was localised in glide areas between cascades. However, siltation and enrichment pressures reduced the spawning value. Despite some good suitability for European eel, none were recorded. The high energy site was unsuitable for lamprey and the species was not recorded present.

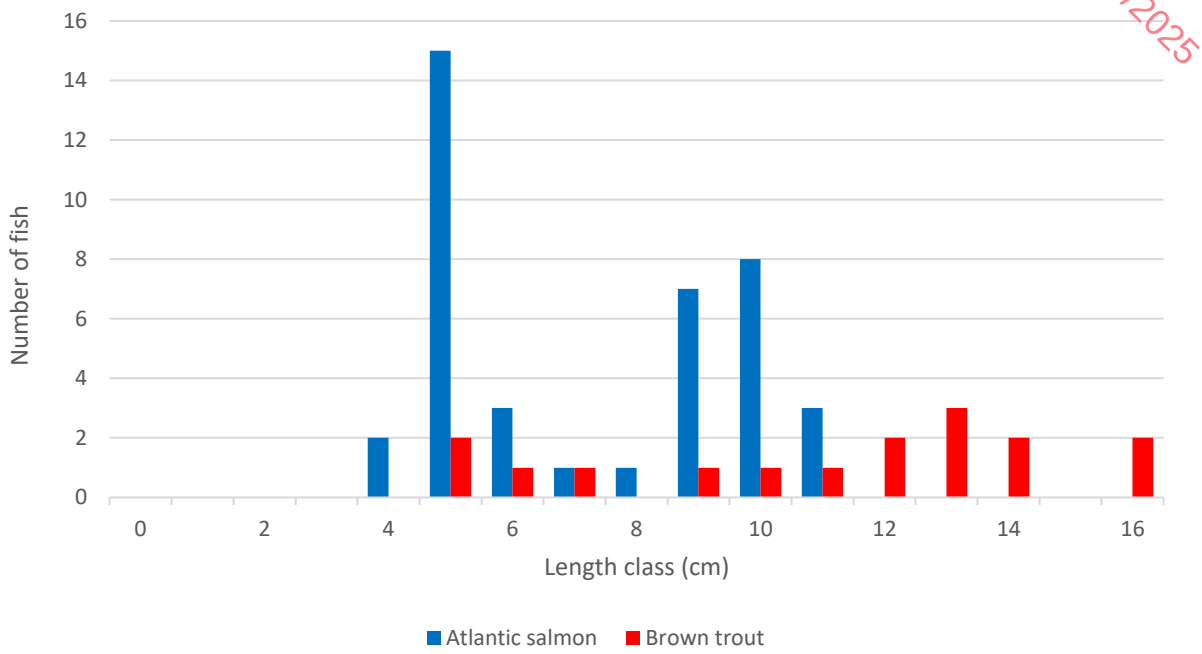

Figure 3.5 Length frequency distribution recorded via electro-fishing at site B4, July 2024

Plate 3.8 Atlantic salmon (top) and brown trout (bottom) recorded at site B4 on the Glenacarney River July 2024

3.1.9 Site C1 – Taurmore Stream, Taurmore

No fish were recorded via electro-fishing at site C1 on the Taurmore Stream (18T07), a tributary of the Owenkeal River. The stream at this location was not of fisheries value given its diminutive size, shallow depths, historical modifications, water quality pressures, high gradients and location in the upper reaches of the catchment.

Plate 3.9 Representative image of site C1 on Taurmore Stream, July 2024

3.1.10 Site C2 – Owenkeal River, Clashykinleen Bridge

Moderate densities of Atlantic salmon (*n*=26) and brown trout (*n*=29) with low numbers of European eel (*Anguilla anguilla*) (*n*=1) were recorded via electro-fishing at site C2 on the lower reaches of the Owenkeal River (18O06) at Clashykinleen Bridge (**Figure 3.6**).

The site was of good value for salmonids although supported only moderate densities of salmon and trout, likely reflecting low summer flows. Abundant cobble and boulder provided high quality refugia for juveniles (although reduced value due to low flows). Undercut banks (scours) offered some value as holding areas for adult salmonids although these were typically shallow in nature. Some good quality salmonid spawning habitat was present locally. The high energy site was largely unsuitable for lamprey with no nursery (soft sediment burial) habitat present. Suitability for European eel was good with a high frequency of instream refugia. However, only a single individual was recorded.

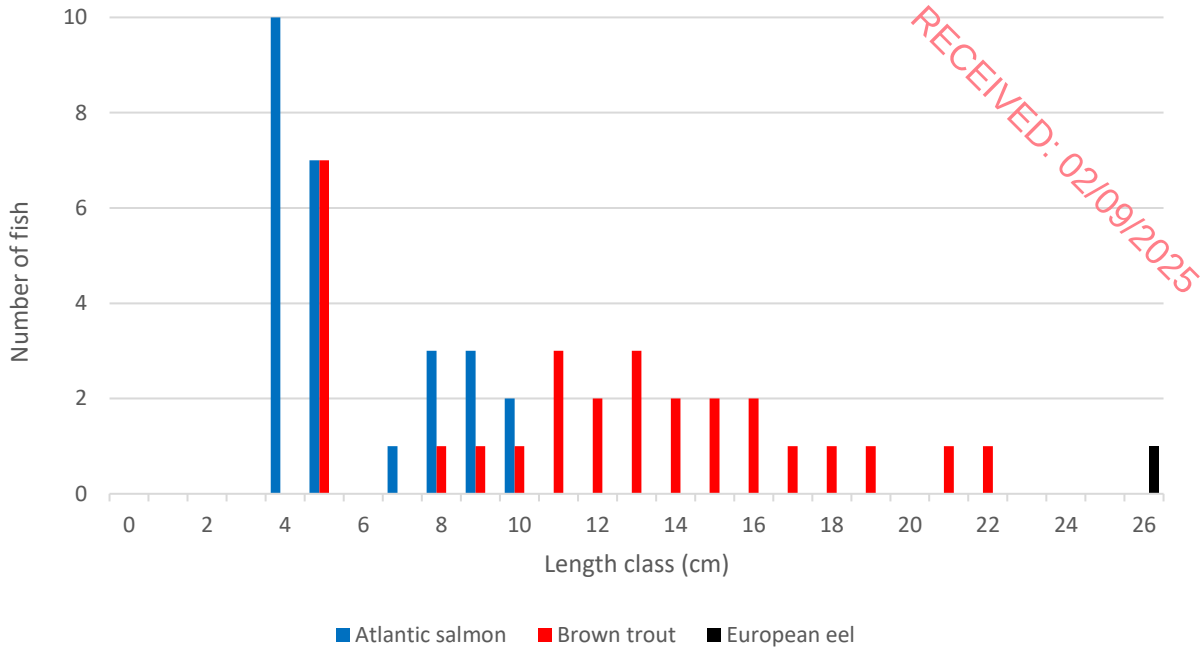

Figure 3.6 Length frequency distribution recorded via electro-fishing at site C2, July 2024

Plate 3.10 Adult brown trout recorded at site C2 on the Owenkeal River, July 2024

3.1.11 Site D1 – Inchatotane Stream, Taurmore

Site D1 was located on the Inchatotane Stream (18I02) at a local road crossing to the south-east of the Site. The small upland stream (FW1) was dry at the time of survey, with no standing water in the high gradient ephemeral channel. The channel was therefore of no fisheries value.

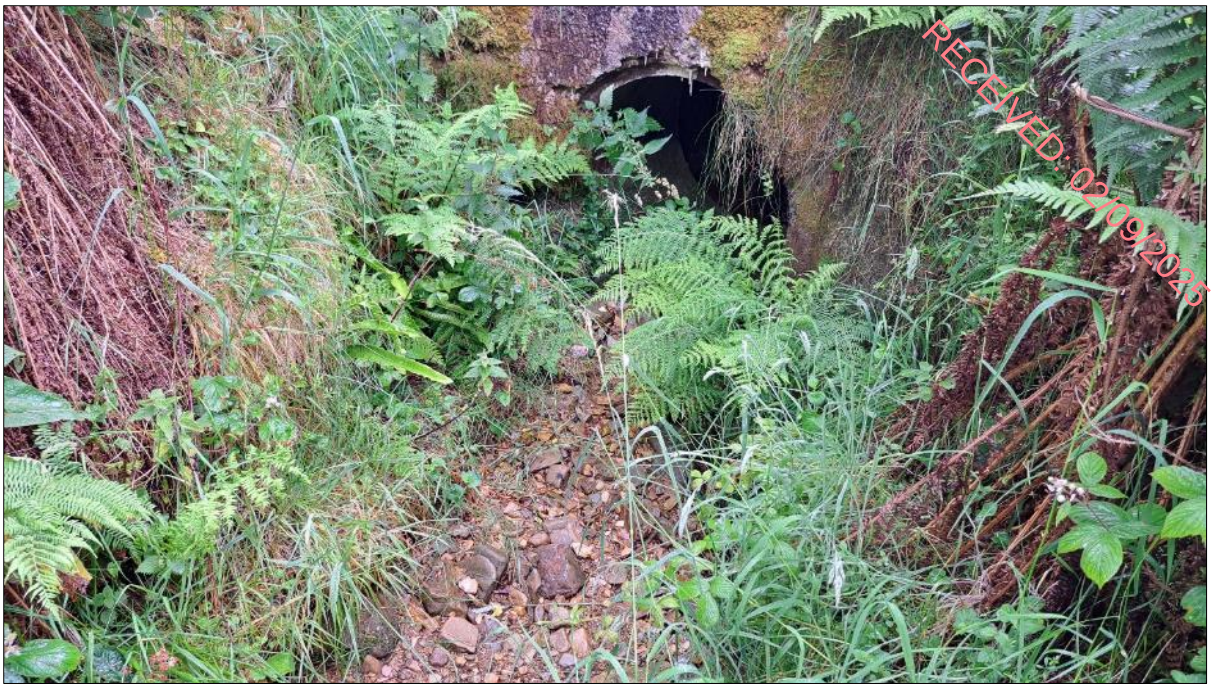

Plate 3.11 Representative image of site D1 on the Inchatotane Stream, July 2024 (dry, ephemeral channel)

3.1.12 Site D2 – Glenlara River, Gloun Dine Bridge

Low densities of brown trout (*n*=7) was the only fish species recorded via electro-fishing at site D2 on the uppermost reaches of the Glenlara River (18G08) at Gloun Dine Bridge (**Figure 3.7**).

The small upland river was of moderate value to salmonids overall as it supported a low density of mixed cohort trout (adults and juveniles). The shallow, high energy site was of only moderate value as a salmonid nursery, with the paucity of deeper pool reducing the value as holding habitat. The dominance of bedrock and larger substrata provide poor opportunities for salmonid spawning, although small areas of mixed gravels were present locally. Despite some low suitability, no European eel were recorded which was largely reflective of the location in the upper reaches of the watercourse. There was no suitability for lamprey and the species was not recorded present.

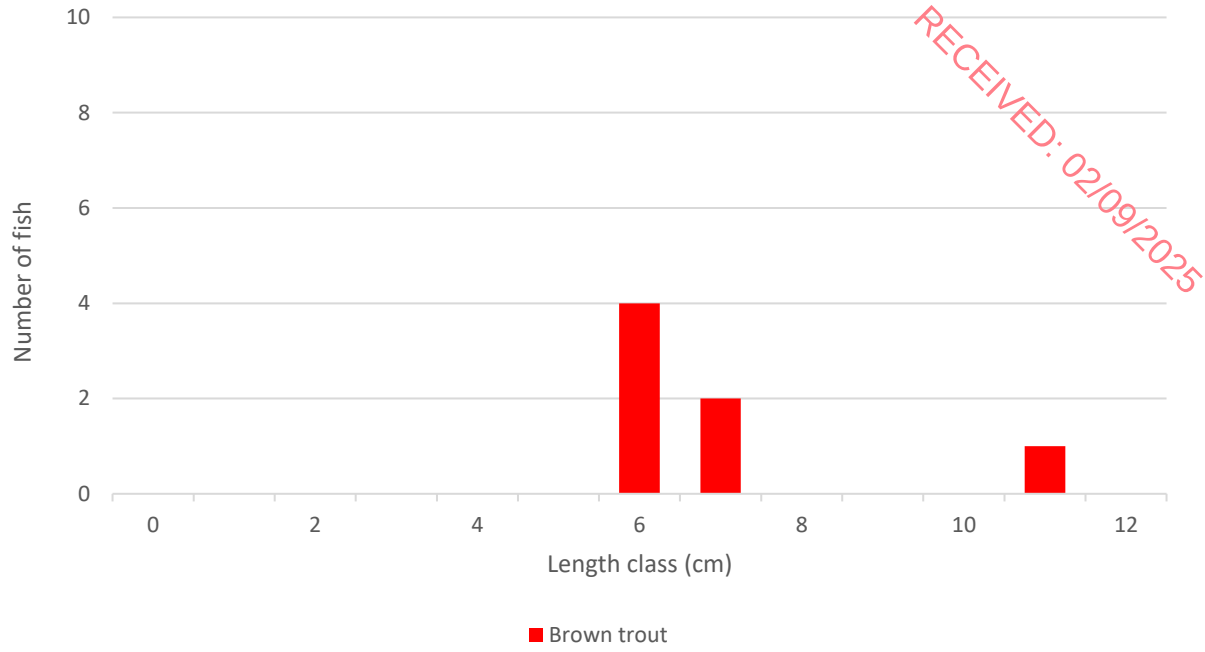

Figure 3.7 Length frequency distribution recorded via electro-fishing at site D2, July 2024

Plate 3.12 Mixed cohort brown trout recorded at site D2 on the Glenlara River at Gloun Dine Bridge, July 2024

3.1.13 Site D3 – Glenlara River, Glennamucklagh East

Moderate densities of brown trout (*n*=28) was the only fish species recorded via electro-fishing at site D3 located on the upper reaches of the Glenlara River (18G08) (**Figure 3.8**).

The small upland river was of good value to upland brown trout with mixed cohorts of fish recorded. Good habitat heterogeneity provided suitability for both juveniles (nursery) and adults (holding). Small

localised areas of mixed gravels (mostly upstream of road crossing) provided good quality salmonid spawning habitat although the value was compromised by siltation. Despite some suitability for European eel, none were recorded. The upland higher energy stream did not support lamprey populations, despite the presence of some local organic-rich sand accumulations that offered some nursery value.

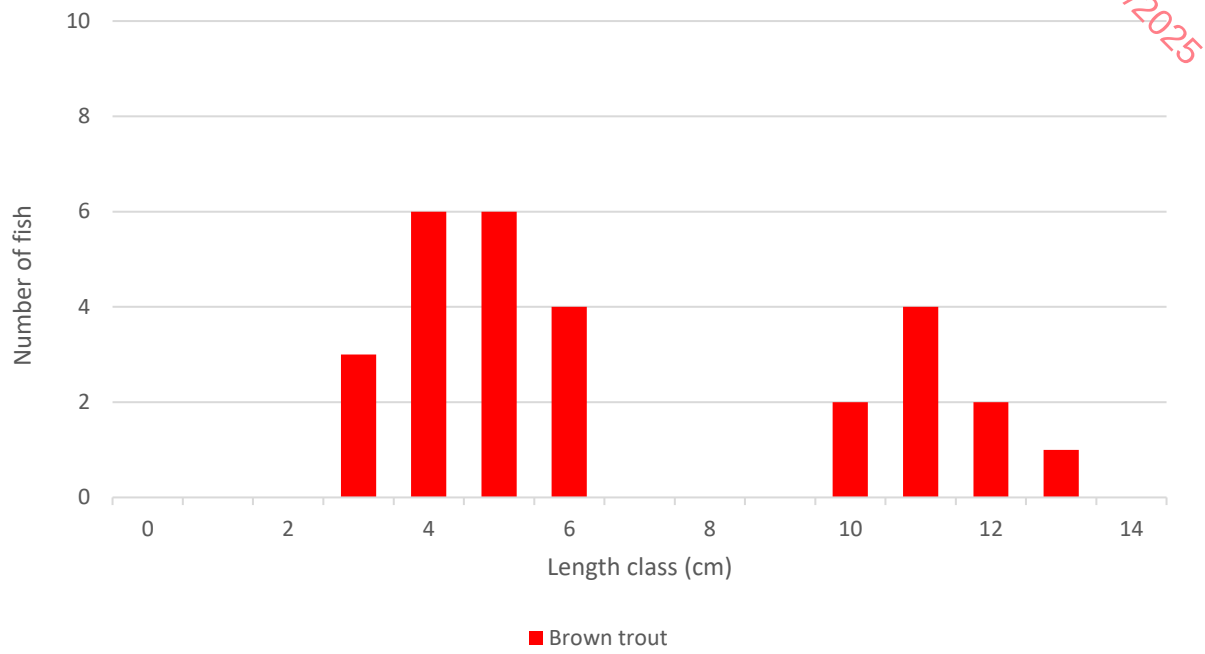

Figure 3.8 Length frequency distribution recorded via electro-fishing at site D3, July 2024

Plate 3.13 Mixed cohort brown trout recorded at site D3 on the Glenlara River, July 2024

3.1.14 Site D4 – Glenlara River, Ballyduane Bridge

High densities of Atlantic salmon (*n*=46) and moderate densities of brown trout (*n*=25) with low densities of European eel (*n*=3) and stone loach (*Barbatula barbatula*) (*n*=4) were recorded via electro-fishing at site D4 on the lower reaches of the Glenlara River (18G08) at Ballyduane Bridge (**Figure 3.9**).

The site was of high value for salmonids, supporting a high density of juvenile salmon in addition to a lower density of mixed cohort trout. This reflected the variety of instream habitats present (i.e. riffle, glide & pool). The site was of highest value as a salmonid nursery with abundant bryophyte-rich cobble and boulder providing instream flow refugia. Locally areas of mixed gravels and smaller, more mobile cobble offered good quality salmonid spawning habitat. Deeper glide and pool, particularly with scoured banks or overhanging vegetation, provided good quality holding habitat for adult salmonids. Good quality European eel habitat was present although only a low density were recorded. The upland characteristics were unsuitable for lamprey populations overall, despite the presence of some localised organic-rich sand accumulations.

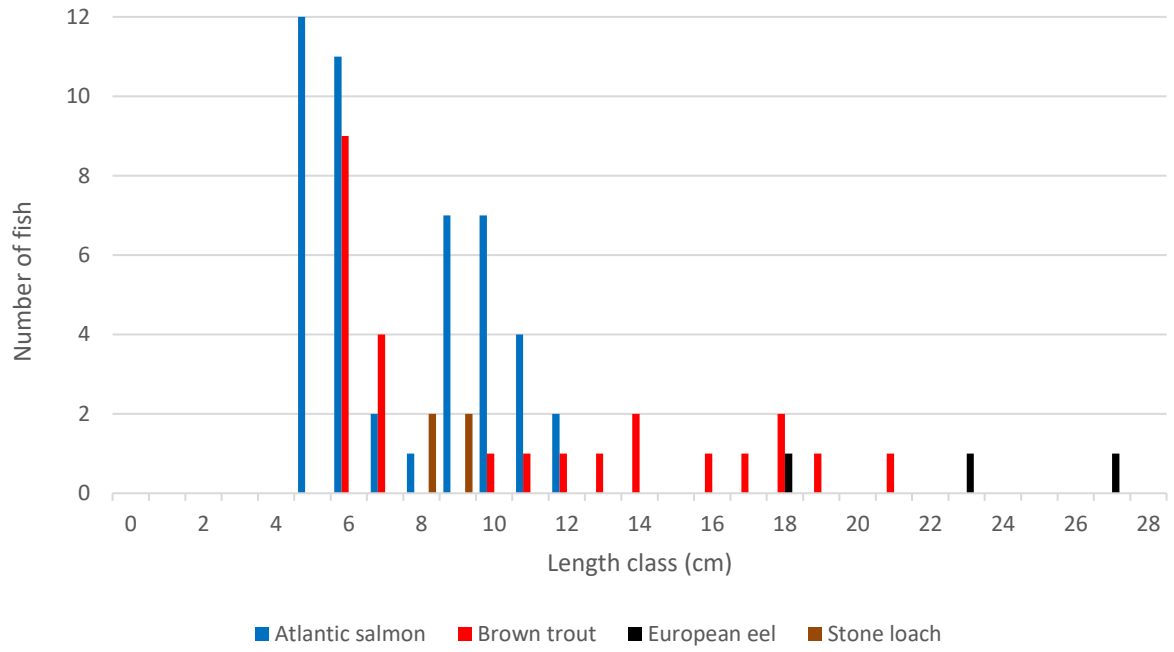

Figure 3.9 Length frequency distribution recorded via electro-fishing at site D4, July 2024

Plate 3.14 Atlantic salmon, brown trout and stone loach recorded at site D4 on the Glenlara River at Ballyduane Bridge, July 2024

Table 3.1 Fish species densities per m^2 recorded at sites in the vicinity of the Site via electro-fishing in July 2024 (**bold** indicates highest density recorded per species)

Site	Watercourse	CPUE (elapsed time)	Approximate area fished (m^2)	Atlantic salmon	Brown trout	European eel	Stone loach
A1	Knockahorrea East River	5	105	0.000	0.010	0.000	0.000
A2	Glennaknockane Stream	5	45	0.000	0.000	0.000	0.000
A3	Knockahorrea East River	10	120	**0.442**	0.117	0.000	0.000
A4	Knockahorrea East River	10	220	0.395	0.055	0.000	0.000
B1	Glasheenanargid Stream	5	70	0.000	0.000	0.000	0.000
B2	Unnamed stream	5	30	0.000	0.000	0.000	0.000
B3	Glenacarney River	10	175	0.240	**0.269**	0.000	0.000
B4	Glenacarney River	10	250	0.160	0.064	0.000	0.000
C1	Taurmore Stream	5	25	0.000	0.000	0.000	0.000
C2	Owenkeal River	10	280	0.093	0.104	0.004	0.000
D1	Inchatotane Stream	n/a	Dry channel	n/a	n/a	n/a	n/a
D2	Glenlara River	5	90	0.000	0.078	0.000	0.000
D3	Glenlara River	10	150	0.000	0.187	0.000	0.000
D4	Glenlara River	10	250	0.184	0.100	**0.012**	**0.016**

Table 3.2 Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the vicinity of the Site, July 2024

Site	Watercourse	Atlantic salmon	Brown trout	European eel	Other species
A1	Knockahorrea East River		Low		
A2	Glennaknockane Stream				No fish recorded
A3	Knockahorrea East River	High	Medium		
A4	Knockahorrea East River	Very high	Medium		
B1	Glasheenanargid Stream				No fish recorded
B2	Unnamed stream				No fish recorded
B3	Glenacarney River	High	High		
B4	Glenacarney River	High	Medium		
C1	Taurmore Stream				No fish recorded
C2	Owenkeal River	Medium	Medium	Low	
D1	Inchatotane Stream				No fish recorded – dry channel
D2	Glenlara River		Low		
D3	Glenlara River		Medium		
D4	Glenlara River	High	Medium	Low	Stone loach

4. Discussion

The watercourses in the vicinity of the Site were typically small, upland eroding spate channels of moderate to good fisheries value. Characteristic of such habitats (Wood & Budy, 2009; Richardson, 1993), the upper reaches of several survey watercourses were of poor fisheries value and a total of 5 no. sites (A2, B1, B2, C1 & D1) did not support resident fish at the time of survey due to high natural gradients, poor summer flows and the small size of the channels. Whilst eutrophication and siltation pressures were evident in both the Feale_SC_010 and Dalua_SC_010 river sub-catchments, salmonid populations were widespread in the survey area. A typically low diversity of fish species for Cork sandstone catchments was recorded during the electro-fishing survey, with Atlantic salmon, brown trout, European eel and stone loach captured (**Table 3.1, 3.2**).

Brown trout were recorded from all 9 no. sites supporting fish, with Atlantic salmon present at 6 no. sites on the Knockahorrea East River (site A3, A4), Glenacarney River (B3, B4), Owenkeal River (C2) and Glenlara River (D4). These four larger watercourses provided the best quality fisheries habitats and often supported high densities of juvenile salmonids, with areas of bryophyte-rich cobble and boulder providing good quality nursery habitats. The highest salmonid densities were recorded on the Knockahorrea East River (**Table 3.1**), a tributary of the River Feale[1].

Lamprey (*Lampetra* sp.) ammocoetes were not recorded in the current survey, despite some low suitability at sites D3 and D4 on the Glenlara River. This restricted distribution reflected the upland, higher-energy, spate nature of the survey watercourses which reduces the extent of fine gravels required for spawning (Dawson et al., 2015; Rooney et al., 2013; Lasne et al., 2010) and discourages the deposition of fine, organic-rich sediment ≥5cm in depth generally required by larval *Lampetra* spp. (Aronsuu & Virkkala, 2014; Goodwin et al., 2008; Gardiner, 2003). Juvenile lampreys are known to have a restricted distribution in the Feale catchment and are present at lower densities than in many other Irish catchments (O'Connor, 2006). The Owenkeal River is known to support both lamprey (*Lampetra* sp.) as well as sea lamprey (*Petromyzon marinus*) (King & Linnane, 2004), albeit in the lower reaches.

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). Despite habitat suitability elsewhere, only a single European eel was recorded during the survey, from site C2 on the Owenkeal River, a tributary of the River Dalua. The high energy survey sites were generally more suited to salmonids with low habitat suitability for eel (as per Degerman et al., 2019; Laffaille et al., 2003). Furthermore, eel occurrence decreases significantly with increasing distance from the sea and is negatively related to instream gradient (Harwood et al., 2022; Matondo et al., 2021; Degerman et al., 2019; Chadwick et al., 2007).

[1] which is a designated salmonid watercourse under the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293/1988)

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8. Appendix B – eDNA lab report

Folio No:	3334-2024
Purchase Order:	eDNA_Jul24
Contact:	Triturus Environmental Ltd
Issue Date:	29.08.2024
Received Date:	19.08.2024

SureScreen Scientifics

eDNA Analysis

Summary

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

Results

Lab ID	Site Name	OS Reference	Target Species	Sample Integrity Check	Result	Positive Replicates
FK1871	Taurbeg WF - Site B4_Glenacarney River		White-clawed crayfish	Pass	Negative	0
			Crayfish plague	Pass	Negative	0
			Freshwater pearl mussel	Pass	Negative	0
FK1863	Taurbeg WF - Site A4_Knockahorrea East River		White-clawed crayfish	Pass	Negative	0
			Crayfish plague	Pass	Negative	0
			Freshwater pearl mussel	Pass	Negative	0
FK1867	Taurbeg WF - Site C2_Owenkeal River		White-clawed crayfish	Pass	Negative	0
			Crayfish plague	Pass	Negative	0
			Freshwater	Pass	Negative	0

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SureScreen Scientifics

		pearl mussel			
FK1866	Taurbeg WF - Site D4_Glenlara River	White-clawed crayfish	Pass	Negative	0
		Crayfish plague	Pass	Negative	0
		Freshwater pearl mussel	Pass	Negative	0

Matters affecting result: none

Reported by:Chelsea Warner

Approved by: Chelsea Warner

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Methodology

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

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

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

Interpretation of Results

Sample Integrity Check:

Laboratory Arrival:

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

Degradation and Inhibition check:

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

Result:

Presence of eDNA (Positive/Negative/Inconclusive)

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

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

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

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

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

Table 9.1 Macro-invertebrate Q-sampling results, July 2024

Group	Family	Species	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	D2	D3	D4	EPA group
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*							1	3						**A**
Ephemeroptera	Heptageniidae	*Electrogena lateralis*					1	1								**A**
Ephemeroptera	Heptageniidae	*Heptagenia sulphurea*													4	**A**
Plecoptera	Nemouridae	*Nemurella picteti*		4												**A**
Plecoptera	Nemouridae	*Protonemura meyeri*				1										**A**
Plecoptera	Perlodidae	*Isoperla grammatica*			4									2		**A**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*							1					6		**B**
Trichoptera	Odontoceridae	*Odontocerum albicorne*													1	**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*				1						1				**B**
Trichoptera	Goeridae	*Silo pallipes*			1	3		6							8	**B**
Trichoptera	Cased caddis pupa	sp. indet.			1	7	3	4	2	3			1			**B**
Plecoptera	Leuctridae	*Leuctra fusca*		4	12					2		24		3	5	**B**
Plecoptera	Leuctridae	*Leuctra hippopus*				3			5	2						**B**
Ephemeroptera	Ephemerellidae	*Serratella ignita*			16	14			11	42	1	5	1		61	**C**
Ephemeroptera	Baetidae	*Baetis rhodani*		7	21	62	45	22	56	106	4	21	6	14	27	**C**
Ephemeroptera	Caenidae	*Caenis rivulorum*										1				**C**
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*			3	14			4	37	2	20		6	28	**C**
Trichoptera	Philopotamidae	*Wormaldia occipitalis*				1										**C**
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*					1	2						1		**C**
Trichoptera	Polycentropodidae	*Polycentropus kingi*				4			2	1		1			1	**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*			6	3	3		5	5		2		1	10	**C**
Crustacea	Gammaridae	*Gammarus duebeni*										8	10	17	16	**C**
Gastrpoda	Planorbidae	*Ancylus fluviatilis*										1	15	3	4	**C**
Coleoptera	Dytiscidae	Dytiscidae larva												1		**C**
Coleoptera	Dytiscidae	*Oreodytes sanmarkii*			6		3		3							**C**

Group	Family	Species	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	D2	D3	D4	EPA group
Coleoptera	Elmidae	*Elmis aenea*									1	8	1		12	**C**
Coleoptera	Elmidae	*Esolus parallelepipedus*						2				4	1		4	**C**
Coleoptera	Elmidae	*Limnius volckmari*				10					1	3		5	5	**C**
Coleoptera	Hydraenidae	*Hydraena gracilis*			1	5						1				**C**
Coleoptera	Hydrophilidae	*Anacaena globulus*									1					**C**
Diptera	Chironomidae	Non-*Chironomus* spp.			1	2	2		1	7		3	1	1	2	**C**
Diptera	Pediciidae	Dicranota sp.			3	1	1					5	2			**C**
Diptera	Simuliidae	sp. indet.		9	8	1	24	16	62	53	1	36	24	44	15	**C**
Hemiptera	Veliidae	Veliidae nymph	5				1						2	1		**C**
Arachnida	Hydrachnidiae	sp. indet.				8							1		2	**C**
Hirudinidae	Glossiphoniidae	sp. indet.							1							**D**
Diptera	Chironomidae	*Chironomus* spp.					2			5						**E**
Oligochaeta		sp. indet.			5				10		8	11			6	**n/a**
Abundance			**5**	**24**	**88**	**140**	**86**	**53**	**164**	**266**	**19**	**155**	**67**	**105**	**211**	
Q-rating			Q3/0	Q4	Q4	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4	Q3	Q3	Q3	Q3-4	Q3-4	
WFD status			Poor*	Good	Good	Mod.	Mod.	Mod.	Mod.	Mod.	Poor	Poor	Poor	Mod.	Mod.	

* toxic effect suspected

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