



Bord na Móna

Bord Na Mona Derrygreenagh Substitute Consent Aquatic Ecology

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1. AQUATIC ECOLOGY TECHNICAL APPENDIX

1.1 BACKGROUND

This report presents the findings of the aquatic field surveys undertaken by TOBIN ecologists within and downstream of the Application Site. The objective of the aquatic surveys was to establish baseline conditions within the freshwater environment of the study area and to characterise the ecological value and sensitivity of the watercourses in relation to fisheries, aquatic habitats, biological water quality and protected aquatic species. Particular emphasis was placed on species of conservation importance, such as Atlantic Salmon (*Salmon salar*), Lamprey species, White-clawed Crayfish (*Austropotamobius pallipes*) and Otter (*Lutra lutra*).

This baseline report presents the findings of the aquatic surveys and describes the existing fisheries resource, biological water quality, macroinvertebrate communities, riverine habitats, aquatic macrophytes, invasive species, and protected aquatic and semi-aquatic fauna

1.2 RELEVANT GUIDANCE AND LEGISLATION

The aquatic surveys were carried out with regard to the following legislation:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, hereafter referred to as the Habitats Directive
- European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272/2009) and (Amendment) Regulations 2012 and 2015
- European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) (as amended)
- European Union (EU) Water Framework Directive (2000/60/EC) (WFD), transposed into Irish law in 2009 (S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended; hereafter referred to as the WFD Regulations
- Wildlife Act 1976 (as amended)
- Inland Fisheries Acts 1959 to 2017 as amended, hereafter referred to as the Fisheries Acts
- Invasive Alien Plant (IAPS) listed on the First Schedule of the European Union (Invasive Alien Species) Regulations 2024 (S.I. 374 of 2024)

1.3 CONSULTATION AND LICENCING

TOBIN obtained a Section 14 Authorisation from the Department of the Environment, Climate and Communications (DECC) on the 9th of April 2026, under the Fisheries Consolidation Act 1959, as substituted by section 4 of the Fisheries (Amendment) Act 1962, to conduct an electro-fishing assessment of the selected watercourses.

TOBIN also obtained a full crayfish licence from National Parks and Wildlife Services on the 14th of June 2026 to carry out a crayfish survey (Licence No. C142/2026).



2. METHODOLOGY

2.1 DESKTOP REVIEW

An ecological desktop review was carried out to collate information on aquatic faunal species and protected species in the environs of the study area and to identify features of aquatic ecological importance within the study area (refer to Section 2.4.1. and 2.4.2). This information was obtained by accessing the website of the National Parks & Wildlife Service (NPWS)¹, IFI² and the database of the National Biodiversity Data Centre (NBDC)³. The document '*Quantification of the Freshwater Salmon Habitat Asset in Ireland*' by McGinnity *et al.* (2003) was also reviewed to classify salmonid habitats in the study area.

A search of the NBDC database was carried out within the 10km grid square, N43, N44, N53 and N54 for freshwater species protected under the EU Habitats Directive and for species listed S.I No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations (2011). Protected species included including White Clawed Crayfish, Atlantic salmon (*Salmo salar*) and lamprey sp. (*Lampetra sp.*). Characteristics of river sites were checked on Ordnance Survey (OS) maps before each survey, and previous information on the presence and distribution of protected freshwater species was consulted when selecting survey sites.

2.2 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).

2.3 AQUATIC FIELD SURVEYS

The aquatic surveys were undertaken to establish baseline conditions within the freshwater environment of the study area and to characterise the aquatic habitats, biological communities and species assemblages associated with watercourses in the vicinity of the proposed development. The surveys focused on riverine habitats, biological water quality, aquatic macrophytes, fisheries resources, and protected aquatic and semi-aquatic species, including species of conservation importance where present.

Survey effort was directed towards both instream and riparian habitats at each aquatic survey location to provide a comprehensive baseline description of the receiving aquatic environment.

The aquatic field surveys comprised:

- Riverine habitat assessment;
- Biological water quality assessment using aquatic macroinvertebrate sampling (Q-sampling);
- Aquatic macrophyte surveys;

¹ Available at: <https://www.npws.ie/maps-and-data>

² Available at: <https://www.fisheriesireland.ie/>

³ Available at: <http://www.biodiversityireland.ie/>



-
- Fisheries habitat assessment, including an appraisal of salmonid spawning and nursery habitat;
 - Surveys for invasive alien species (IAS);
 - White-clawed Crayfish surveys;
 - Environmental DNA (eDNA) sampling; and
 - Electrofishing surveys to determine the presence and distribution of fish species and lamprey.

The objective of the biological water quality surveys was to establish baseline water quality conditions within the watercourses draining the study area. Water quality was assessed through macroinvertebrate sampling and the assignment of EPA Q-values in accordance with established EPA methodologies.

The fisheries surveys were undertaken to characterise fish populations and fisheries habitat within the study area, including the suitability of watercourses for Atlantic Salmon, Brown Trout (*Salmo trutta*), Lamprey species and other fish species of ecological interest.

Aquatic surveys were undertaken by TOBIN ecologists in June 2023 and again in June and July 2026 under baseflow conditions. Detailed river habitat and macroinvertebrate surveys were completed between 15 and 19 June 2026. Electrofishing surveys were undertaken between 6 and 9 July 2026. White-clawed Crayfish surveys were completed between 15 and 19 June 2026, while eDNA sampling was undertaken on 6 July 2026.

The findings of these surveys provide a baseline description of aquatic ecological conditions within the study area and identify the principal aquatic ecological receptors associated with the receiving environment.

2.3.1 Watercourse Survey Site Selection

All freshwater watercourses which could be affected directly or indirectly by the Project were considered as part of the current aquatic baseline. Representative survey locations on watercourses within the study area were selected for surveying using expert judgement, taking account of hydrological connectivity, watercourse characteristics, accessibility, existing ecological information, and their relationship to the historical peat extraction and ancillary activities undertaken at the Application Site.

Survey locations were selected to provide a representative coverage of the receiving aquatic environment and included:

- Sites within and adjacent to the Application Site, to characterise aquatic ecological conditions in watercourses associated with the historical peat extraction area;
- Sites downstream of the Application Site, to characterise aquatic habitats and ecological conditions within receiving waters hydrologically connected to the Application Site; and
- Sites upstream of the Application Site, where available, to provide representative reference locations for comparison with downstream survey sites

Additional considerations in survey site selection included safe access, stream order, watercourse morphology, flow characteristics, previous EPA biological water quality data, and the need to obtain a representative overview of aquatic ecological conditions across the study area..



A total of 14 aquatic survey locations were selected for detailed survey. These locations were situated within the Castlejordan_020, Castlejordan_030, Yellow (Castlejordan)_010, Yellow (Castlejordan)_020, Yellow (Castlejordan)_030, Kinnegad_010, Milltownpass_010 and Castletown Tara Stream_010 river waterbodies. The survey locations were located within the Yellow [Castlejordan]_SC_010, Figile_SC_020 and Boyne_SC_030 sub-catchments and were selected from watercourses mapped by the Environmental Protection Agency (EPA) and Ordnance Survey Ireland (OSI).

A list of survey types, dates and location are provided in Table 2-1. A map of the entire study area and the survey locations within the study area is shown on **Error! Reference source not found.**

While survey sites down-gradient of the proposed development may be influenced by factors outside of the site boundary, downstream biota are nonetheless receptors for the proposed development, and acquisition of baseline information at these locations was deemed important to provide a complete understanding of aquatic sensitivities. It is acknowledged that the larger size of watercourses downstream of the proposed development provide more habitat and are considered to have the potential to contain more salmonids than reaches inside the proposed project boundary.

2.4 DESCRIPTION OF WATERCOURSES IN THE STUDY AREA

The study area was defined as surface waters potentially affected by the proposed project, including watercourses within the proposed project site and those downstream draining the proposed project site. There was no fixed distance applied for the study area downstream, as site specific conditions determine the potential for pollution generation, downstream transport, and any consequential effects.

The proposed project and study area is located in the WFD catchments/ Hydrometric Area 07 within the Boyne Catchment and Yellow [Castlejordan]_SC_010 subcatchment. The site is flat and low lying in nature. The site falls in an easterly direction.

The study area includes the eight river water bodies (RWB), Castlejordan_020, Castlejordan_030, Yellow (Castlejordan)_010, Yellow (Castlejordan)_020, Yellow (Castlejordan)_030, Kinnegad_010, Castletown Tara Stream_010 (RWB) and Milltownpass_010 located within both the proposed wind farm site and adjacent or downstream of the site. The water features in the study area are illustrated in **Error! Reference source not found.**

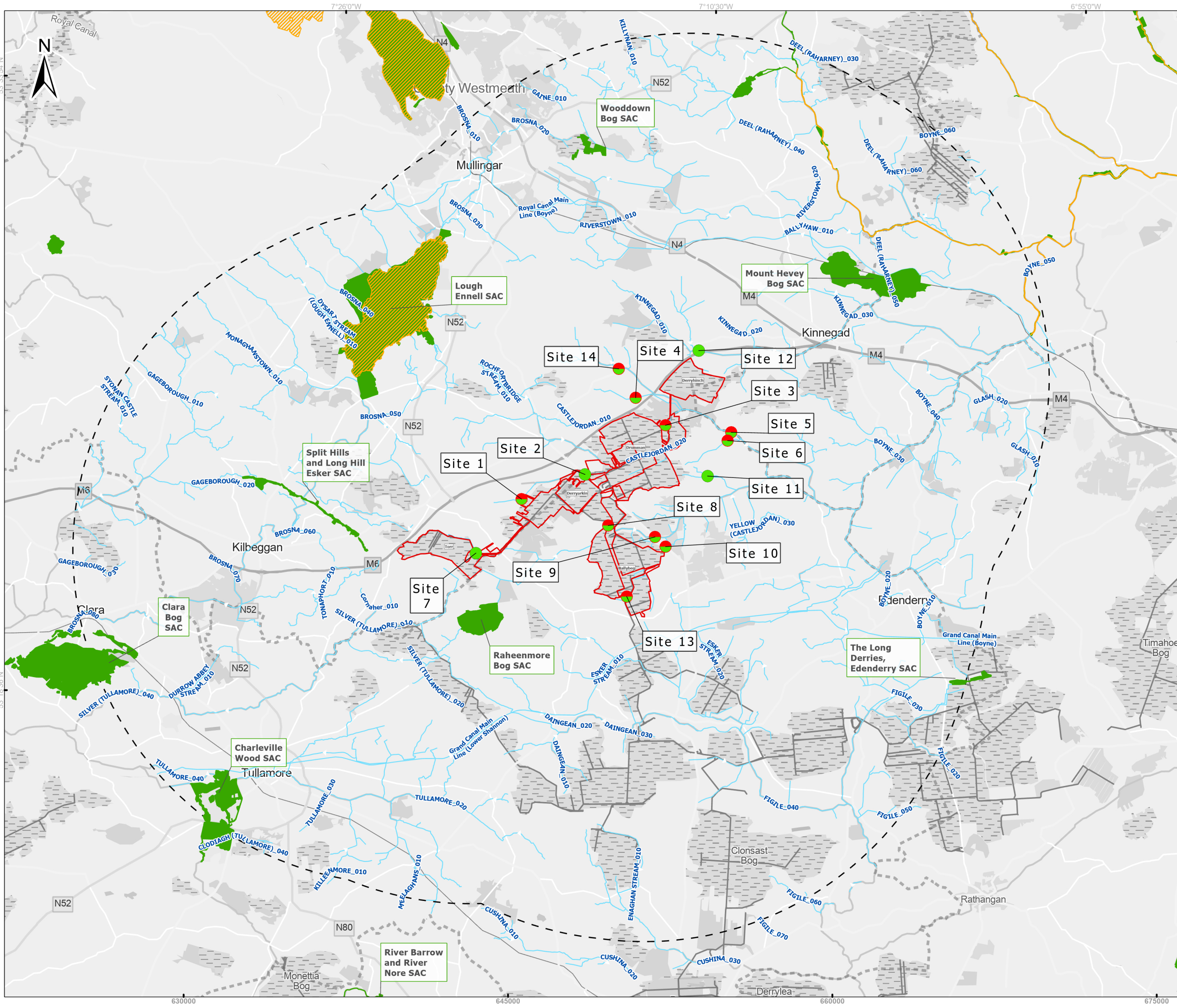
These all flow in an eastly direction before flowing into the Boyne_040 RWB approximately 12km downstream of the proposed project site. The proposed project and associated infrastructure is not located within a European site although there is downstream hydrological connectivity (via several watercourses) with the River Boyne and River Blackwater SPA (004232) and the River Boyne And River Blackwater SAC (002299). These sites are designations for freshwater species and habitats.

Due to the low elevation of the proposed project site and its location in the environs of the catchments' watershed, the watercourses within the site are no larger than 3rd order rivers. The watercourses are of gradual sloping gradient and generally slow to moderately flowing and categorised as depositing/lowland rivers with reference to Fossitt (2000).



These waterbodies represent historically modified channels that have been straightened and deepened for land drainage, with some channels been directed to others and cut off. The banks have been raised and sloped, and the original riverbed has been removed. The natural physical and ecological features of the rivers corridors have been removed causing an imbalance in natural hydromorphology of these rivers in sections, thus affecting the flow regime of the study watercourses within the study area.





Legend

- Site Boundary
- Designated Sites
 - Special Protected Areas (SPAs)
 - Special Areas of Conservations (SACs)
 - WFD - Rivers
- Electrofishing
 - eDNA, Crayfish, Electrofishing, Kick sampling, and RHAT
 - Crayfish, Electrofishing, Kick sampling and RHAT

0 1.5 3 Kilometers

Spatial Reference Datum: IRENET95 EPSG: 2157		Copyrights: Sources: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri, ©	
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Client:

Project: Derrygreenagh Substitute Consent

Title: Figure 2-1:
Overview of the Watercourses Within the Study Area and Aquatic Survey Site Locations

Scale @ A3: 1:160,000

Prepared by:	Checked by:	Date:
K.Kale	B.Kasonde	October 2026

Tel: +353-(0)1-8030406
Email: info@tobin.ie
www.tobin.ie

Map Ref: 12334-003-E.FISH-AE..AA-TOB-A

Draft: A

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Table 2-1: Aquatic Ecological Survey Site Locations on Watercourses Within the Study Area of the Project

Site	Survey Type: eDNA KS (Kick sampling) EFS (Electrofishing) CFS (Crayfish survey)	WFD River Sub-Catchment	WFD Watercourse	EPA Name	EPA Code	ITM (x)	ITM (y)
1	KS EFS CFS	Yellow [Castlejordan]_SC_010	Castlejordan_020	Kiltotan and Collinstown	07K04	645626	737730
2	KS EFS CFS	Yellow [Castlejordan]_SC_010	Castlejordan_020	Kiltotan and Collinstown	07Y04	648560	738871
3	KS EFS CFS	Yellow [Castlejordan]_SC_010	Castlejordan_020	Castlejordan 07	07C04	652284	741142
4	KS EF CFS	Yellow [Castlejordan]_SC_010	Castlejordan_020	Null	Null	650902	742412
5	eDNA KS EFS CFS	Yellow [Castlejordan]_SC_010	Castlejordan_020	Castlejordan 07	07C04	655323	740817
6	KS EFS CFS	Yellow [Castlejordan]_SC_010	Castlejordan_030	Baltinoran	07B59	655155	740432
7	KS EF CFS	Yellow [Castlejordan]_SC_010	Yellow (Castlejordan)_010	Rathgarrett	07_508	643514	735235
8	KS EFS CFS	Yellow [Castlejordan]_SC_010	Yellow (Castlejordan)_010	Yellow [Castlejordan]	07Y02	649633	736513
9	KS EFS CFS	Yellow [Castlejordan]_SC_010	Yellow (Castlejordan)_020	Yellow [Castlejordan]	07Y02	651796	735984
10	KS EF CFS	Yellow [Castlejordan]_SC_010	Yellow (Castlejordan)_020	Coolcor stream	07C08	652286	735537
11	eDNA KS EFS CFS	Yellow [Castlejordan]_SC_010	Yellow (Castlejordan)_030	Null	Null	654231	738794
12	eDNA KS EFS CFS	Boyne_SC_030	Kinnegad_010	Kinnegad 07	07K01	653822	744590



Site	Survey Type: eDNA KS (Kick sampling) EFS (Electrofishing) CFS (Crayfish survey)	WFD River Sub-Catchment	WFD Watercourse	EPA Name	EPA Code	ITM (x)	ITM (y)
13	KS EF CFS	Yellow [Castlejordan]_SC_010	CastletownTara Stream_010	Coolcor stream	07C08	650491	733231
14	KS EF CFS	Yellow [Castlejordan]_SC_010	Milltownpass_010	Milltownpass	07M04	650122	743749



2.4.1 Riverine Habitat Survey

The aquatic ecological assessment included a habitat assessment of the receiving watercourses within the study area. The habitat assessment of the watercourses followed methodologies outlined in the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual*' (EA, 2003) and the Irish Heritage Council's '*A Guide to Habitats in Ireland*' (Fossitt, 2000).

Riverine habitat surveys were undertaken at each selected survey location to characterise the physical, hydromorphological and ecological characteristics of the watercourses. Concurrent aquatic surveys, including macroinvertebrate sampling, were also undertaken to establish baseline biological water quality conditions.

All watercourse survey locations were assessed in terms of:

- Stream width and depth, bank height and width and other physical characteristics including associated evidence of historical drainage
- Substrate type, listing substrate fractions in order of dominance, i.e. bedrock, boulder, cobble, gravel, sand, silt etc
- Flow type, listing percentage of riffle, glide and pool in the sampling area
- In-stream macrophyte and bryophyte communities occurring and their percentage coverage of the stream bottom at each sampling site
- Percentage of overhead shade present
- Riparian vegetation composition on banksides

The diversity and condition of riverine habitats were assessed through the recording of natural and semi-natural features within the channel and river corridor. Features such as point bars, side bars, mid-channel bars, eroding riverbanks, large woody debris, waterfalls, backwaters and floodplain wetlands were recorded, where present. Channel substrate, flow characteristics, instream vegetation, riparian tree and hedgerow cover, and adjacent land use were also documented.

Evidence of hydromorphological modification, including channel straightening, deepening, bank reinforcement and other artificial alterations, was noted where present. The information collected was used to characterise the condition and ecological quality of the surveyed watercourses and to identify aquatic habitats with the potential to support species of conservation importance. Anthropogenic influences, including agricultural activities, drainage works and livestock access, were also recorded where observed along the surveyed reaches..

2.4.2 Fisheries Habitat

Each sampling site along the watercourse was described in terms of the aquatic habitats present and the aquatic species recorded, with particular attention given to species and habitats of conservation importance.

A fisheries assessment was carried out at each watercourse utilising methodology elements of (O'Grady, 2006), Armstrong *et al.* (2003), Harvey & Cowx (2003) and Hendry & Cragg-Hine, 2003) to characterise the channel morphology, substrate composition, flow characteristics and overall fisheries habitat quality.



A broad appraisal/overview of the upstream and downstream habitat at each site was undertaken to characterise the suitability of watercourses for fish species and to identify habitats of potential importance for salmonid and lamprey spawning, nursery and holding habitat.

The suitability of the habitat to support aquatic species of conservation concern (e.g. white-clawed crayfish, river lamprey (*Lampetra fluviatilis*), brook lamprey (*Lampetra planeri*), and Atlantic salmon was also recorded.

Potential lamprey habitats within the study area was assessed with reference to methodologies outlined in '*Ecology of the River, Brook, and Sea Lamprey*' (Maitland, 2003) and also NPWS Irish Wildlife Manuals lamprey surveys (O'Connor, 2007). A visual assessment was carried out on the habitat suitability for lamprey such as slower flowing water, nursery areas of sandy silt beds, an assessment on potential barriers on migration route, potential spawning areas, suitable hiding places and clean spawning gravels over stretches of running water. Juvenile lamprey habitat was identified from the descriptions given in Maitland (2003). Substrate depth and composition was examined for potential ammocoete habitat, especially focusing on the composition of mud, silt, or silt and sand and its suitability for ammocoetes. Areas where suitable spawning gravels may occur, were searched, especially at tails of pools where the gravels have been deposited from upstream and the scouring of pools were examined for potential spawning habitats for adults.

Any fish captured were identified with reference to the Freshwater Biological Association's publication '*Key to British Freshwater Fish with notes on their ecology and distribution*' (Maitland, 2003) and other referenced sources.

2.4.3 Macrophytes

Aquatic plants as well as rare and/or protected plant species and Invasive Alien Species (IAS) flora were identified and recorded at each site where present while wading at each site or from visual assessment from the riverbank. Plant species nomenclature followed '*New Flora of the British Isles*' (Stace 2019). An assessment of the aquatic vegetation community to identify any rare macrophyte species (Flora Protection Order or Wyse-Jackson *et al.*, 2016) and to determine whether the surveyed watercourses supported habitat characteristics consistent with Annex I aquatic habitats including '*Water courses of plain to montane levels, with submerged or floating vegetation of the Ranunculion fluitantis and Callitriche-Batrachion (low water level during summer) or aquatic mosses [3260]*', commonly referred to as '*floating river vegetation*'.

2.4.4 Biological Water Quality Sampling

Biological water quality surveys were undertaken to establish baseline ecological conditions within the receiving watercourses against which any future changes can be assessed. Aquatic macroinvertebrate communities were used as indicators of ecological condition and biological water quality.

Biological water quality was assessed through macroinvertebrate sampling undertaken at accessible survey locations. The survey results were used to assign EPA Biological Quality Ratings (Q-values) in accordance with established EPA methodologies. The resulting Q-values



provide an indication of the ecological condition and biological water quality of the surveyed watercourses at the time of survey.

2.4.4.1 Kick Sampling

Semi-quantitative sampling of benthic (or bottom dwelling) aquatic macroinvertebrates was undertaken at each site using standard EPA kick-sampling methods (Toner *et al.*, 2005). A two-minute kick-sample was conducted at each site, principally from the faster flowing riffle habitats, but glides, margins and pools were included according to their proportional presence. A standard 500µm mesh D-shaped kick net was submerged on the riverbed with the mouth of the net directed upstream. The substrate just upstream of the net was disturbed (with the foot, in a kicking motion) in order to dislodge invertebrates into the net. The surveyor moved in a diagonal direction upstream to ensure that different micro-habitats in the waterbody, such as fast-moving riffles and glides were included in the sample.

A further one-minute hand search was carried out to locate macroinvertebrates that may have remained attached to the underside of the cobbles (Toner *et al.*, 2005). This approach is designed to achieve maximise taxonomic representation and improve the detection of less abundant or less mobile taxa. This sampling approach requires avoidance of obvious localized disturbance (e.g. cattle access points) which may adversely influence the sample taken.

Following collection, the macroinvertebrate samples were identified to family level using the standard range of identification keys published by the Freshwater Biological Association (FBA), AIDGAP and others, and their relative abundance was recorded on the riverbank. The relative abundance of each taxon was recorded to facilitate subsequent biological water quality assessment and Q-value determination. Once all taxa and their relative abundance were recorded, the sample was returned to the river.

2.4.4.2 Water Quality

2.4.4.2.1 Biotic Indices

The Biological River Classification System (Q-Scheme)

The Biological River Quality Classification System Quality Rating (Q) System (Toner *et al.*, 2005) was used to obtain a water quality rating for each site. The Biotic Index is a quality measurement for freshwater bodies. In order to determine the biological quality of the river, the Q-scheme index is used whereby the analyst assigns a Biotic Index value (Q-Value) based on macroinvertebrate results.

The macroinvertebrate data were used to derive a Biotic Index value Q-value to the sampled streams using the EPA methodology (McGarrigle *et al.*, 2002) and assigned to WFD status classes based on the presence and relative abundance of sensitive groups and the consideration of additional qualifying criteria, as described by Toner *et al.* (2005). The resulting species list was used to assign a Biotic Index value (Q-Value) to the sampled watercourses. This involved recording the taxa present at a suitable and attainable taxonomic resolution and their categorical relative abundance determined using approximate counts. This Q-value system is a five point scale (Q1-Q5: with intermediate scores obtainable, e.g. Q3-4) based on the proportions of five groups of macroinvertebrates, with different pollution tolerances with Q1 being of poorest quality and Q5 being pristine/unpolluted (see Table 2-2). The system facilitates rapid and



effective assessment of the water quality of rivers and streams. Each site was assigned a biological status on a scale of High-Good-Moderate-Poor-Bad.

The Quality Rating System has been shown to be a robust and sensitive measure of riverine water quality and has been linked with both chemical status and land use pressures in catchments (Donohue *et al.*, 2006).

Table 2-2: Reference Categories for EPA Q-Ratings

Biotic Index	WFD Quality Status	Pollution status	Quality Class	Condition
Q5 or 4-5	High status	(Unpolluted)	Class A	Satisfactory
Q4	Good status	(Unpolluted)	Class B	Satisfactory
Q3-4	Moderate status	(Slightly Polluted)	Class C	Unsatisfactory
Q3 or 2-3	Poor status	(Moderately Polluted)	Class D	Unsatisfactory
Q2, 1-2 or 1	Bad status	(Seriously Polluted)	Class E	Unsatisfactory

2.4.5 Fisheries Assessment (Electrofishing)

An electro-fishing survey across the study area to characterise fish communities and fisheries resources within watercourses associated with the Application Site. The survey was designed to establish the distribution and relative abundance of fish species present and to characterise the suitability of the surveyed watercourses as habitats for salmonids, lamprey (*Lampetra* spp.), European eel (*Anguilla anguilla*) and other fish species.

A total of 14 riverine survey sites were selected were selected for fisheries assessment. Electrofishing surveys were carried out at 11 sites. Three sites (Site 2, 4 and 9) could not be surveyed by electrofishing due to water depth, dense instream vegetation or where the channel had completely dried out. The survey limitations around these sites are further discussed in Section 2.2.10 of this report.

2.4.5.1 Methodology

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) and electrofishing dip nets were used to electrofish sites on watercourses in the vicinity of the proposed project. Ten-minute electrofishing surveys were carried out following the methodology set out by Beaumont (2016) and Matson *et al.*, (2018). The electrofishing methodology and technique also complied with the European Committee for Standardisation (CEN) guidelines for fish stock assessment in wadable rivers (CEN, 2003) and Section 14 licensing requirements. Water temperature and conductivity were measured at each sampling site and habitat characteristics were recorded, including sediment type, water depth, flow type, shading, channel modification etc.

For salmonids, electro-fishing was conducted in an upstream direction at each site for a standard ten-minute fishing (Matson *et al.*, 2018) Catch Per Unit Effort (CPUE). Approximately 50-75m of channel was surveyed at each site, where feasible. Lamprey species were specifically targeted in areas of low/reduced flow and with a higher proportion of soft sediment.



2.4.5.2 Electrofishing Settings

Two separate electrofishing methodologies were employed, incorporating different settings based on target species i.e. lamprey and salmonids, during the electro-fishing surveys.

The threshold values for different fish responses to electric current differ based on the level of water conductivity in the water and the resistance to the passage of an electric current through it (Zalewski and Cowx, 1990). Conductivity (μS) was therefore measured on-site with a conductivity meter prior to any electro-fishing activity. The appropriate voltage and frequency settings were applied based on conductivity readings.

In order to minimise potential damage and undue stress, electrofishing settings were modified to target specific species at the site. For salmonids, a voltage of approximately 200-220V, frequency of 40-45Hz and pulse duration of ten minutes was used to draw fish to the anode without causing physical damage.

Electrofishing for lamprey sp. ammocoetes was conducted within a defined area (1m^2) as per Harvey & Cowx (2003), where sand/silt were encountered. As lamprey take longer to emerge from silt, a low frequency (20-30Hz) setting was used within soft sediment areas. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013).

The anode was placed under the water 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.

2.4.5.3 Fish Handling and Processing

Once immobilised, salmonids, European eel, lamprey sp., and other captured fish species were transferred to a holding container with oxygenated water following capture. To reduce stress on the captured fish and aid processing and recovery times, anaesthesia (clove oil) was applied. All fish were speciated and measured to the nearest centimetre (standard length (SL) for eel and lamprey; fork length (FL) for all other species). Any fish captured during biological sampling were identified and recorded with reference to the Freshwater Biological Association's publication '*Key to British Freshwater Fish with notes on their ecology and distribution*' (Maitland, 2004) and other referenced sources.

Lampreys were identified using the document '*Identifying Lamprey - A field key for Sea, River and Brook Lamprey*' by Gardiner (2003). Lamprey ammocoetes were identified as Lamprey sp. as they could not be differentiated onsite by eye. Fish were then placed into a freshly oxygenated bucket of water to recover and allowed sufficient time to recover before being returned to the river. Any fish that struggled to recover, were given additional time to do so until they were able to swim. Lamprey were returned to the silt habitat they were removed from. Handling of live fish was kept to a minimum when processing any captured individuals.

Fish were only humanely euthanised if showing no sign of recovery. This is carried out with blunt force to the top of the head.



2.4.6 White-clawed Crayfish Survey

The White-clawed Crayfish survey was carried out under licence as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2023), to capture and release crayfish to their site of capture in late June 2026, when there is no “berried” females or females with young hatchling still attached. Under this licence, any mortalities during the collection of crayfish were to be recorded and reported to NPWS. The survey was carried out when crayfish are most active and present in shallow waters (Reynolds 2006).

Following the guidelines set out by NPWS within the licence, the crayfish survey method included two methods used to capture crayfish from this river channel. The survey methodology used was based on the standard approached by Reynolds *et al.* (2010), O'Connor *et al.*, 2009 and Peay (2003). These include, trapping and hand/visual searching for both adult and juvenile crayfish. By using these two methods, it was hoped all life stages and sexes would be collected from the river (Reynolds (2006), Gallagher *et al.*, (2006)) during the both the least active and most active times. A crayfish habitat assessment was also carried out at each site.

Suitable survey sites were selected within close proximity to the proposed project and also based on flow conditions, heterogeneous habitat and access. A total of 14 sites were selected, however the crayfish surveys were carried out at 12 sites. Two sites (Site 2 and 4) were inaccessible due to water depth, dense instream vegetation or heavy tunnelling of riparian vegetation across the river and hand searching at these sites was not feasible however traps were set at all 14 sites. The survey limitations around these sites are further discussed in Section 2.2.10 of this report.

All captured crayfish were held in buckets prior to processing. Measurements and notes were taken of crayfish as appropriate, including carapace length, sex, evidence of breeding status, evidence of recent moulting, and signs of damage or disease while on site.

2.4.6.1 Trapping

Trapping was used in both wadable and non-wadable areas and would chiefly capture larger crayfish. Trapping was undertaken within areas of suitable habitat including abundant refuges and vegetation in wadable and non-wadable water or where hand searching was not ideal or suitable.

Trapping was carried out using cylindrical plastic crayfish traps (Trappy™ crayfish trap, Virserum, Sweden), 50cm long and 20cm in diameter with 25 x 35mm mesh and a 51mm diameter aperture. These traps were set symmetrically down both sides of the riverbank and spaced approximately 5-10m apart based on suitable habitat and location and laid parallel to the riverbank along the river channel where access is available. Each trap was labelled and attached to a light rope and pegged to the riverbank to prevent the baited traps from being moved.

Each trap was pre-weighted on the outside of the trap to allow it to sink to the bottom of the river and remain in place. These traps aimed to target both juvenile and adult crayfish. Traps were baited with fresh fish (cod and salmon). These baited traps can attract crayfish from a radius of several meters. Each trap was baited and left for 24 hours before being lifted and removed. A total of 56 traps were set, four traps at each location within the study site.



2.4.6.2 Habitat Assessment

A habitat suitability assessment to support White-clawed Crayfish was undertaken along all wadable sites (12 sites). The habitat suitability survey assessed the quality of the watercourse and riparian habitat following (Peay, 2002). This included an assessment of:

- Water quality
- Physical properties of the watercourse including the type of watercourse, depth, flow and channel width
- Refuges in the channel and bank
- Substrate composition
- Pollution, erosion and siltation

Habitat assessments were conducted across a 50-100m length of each survey site. Habitat features for each survey site was recorded if present. This included searching soft riverbanks for burrows, suitable instream vegetation, boulders, rocks and wooden debris that provides shelter and cover for crayfish. It also included assessing the suitability of gravels for hatchlings and several water features including riffles pools and glides as areas of food sources (macroinvertebrates) for the crayfish. Shaded areas are also important to ensure crayfish are in waters of optimal temperatures. Pressures such as pollution was also assessed at each site. Habitat characteristics of the sites were recorded on field data sheets adapted from Reynolds *et al.* (2010) and Peay (2003).

2.4.7 Environmental DNA

To further validate site surveys and detect potentially cryptically low populations of high conservation value aquatic species within the survey area, aquatic Environmental DNA (eDNA) sampling survey was carried out at four of the 14 aquatic survey sites (Site 5, 7, 11 and 12) within and upstream of the proposed project to detect the presence of the Salmon, Freshwater Pearl mussel, River and Brook lamprey.

Water samples were collected using single-use nitrile gloves, plastic sample bag and a 30 ml ladle supplied in the eDNA kit. Samples were taken against the flow of the river in a diagonal pattern ensuring no disturbed sediment and organic matter was collected in the sample. Each sample was taken from the middle of the water column (where possible) and at least 10cm below surface water level. After collecting the complete water sample (min. 600 ml) in the sample bag, the sample bag was agitated to mix the sample. After mixing, 500 ml was filtered using a 50 ml syringe and filter element. All samples were labelled and stored at room temperature and sent to the laboratory for analysis with 24 hours of collection. where twelve replicates of each sample were tested for Salmon, Freshwater Pearl mussel, River and Brook lamprey eDNA. 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 E for full eDNA laboratory analysis methodology



2.4.8 Otter Signs

The presence of Otter 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.). Particular attention was given under bridges on ledges and large boulders for spraint and fresh mud for paw prints.

2.4.9 Biosecurity

A strict biosecurity protocol, recommended by IFI, was adhered to during surveys. As per Inland Fisheries Ireland aquatic biosecurity recommendations, all surveys started at the uppermost site(s) of each catchment or sub-catchment in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction. All equipment and Personal Protection Equipment (PPE) was disinfected with Virkon® prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of invasive species and water-borne pathogens between sites, according to standard IFI biosecurity protocols (IFI 2010).

2.4.10 Survey Limitations

For aquatic surveys, some sites contained deep sections of the watercourses that were unwadable and too deep to fully access. Other watercourses limitations included low flows, excessive depths, unsuitable substrate conditions, completely dried out channels, which prevented electrofishing and crayfish surveys at certain locations or reduced sampling efficiency. Every effort was made to carry out the surveys, including adaptation of the methodology to suit site conditions.

Access was limited to 12 of the 14 survey sites to conduct the biological water quality assessment, and 11 sites of the 14 survey sites for electrofishing and crayfish hand searching. This was due to steep banks, heavy vegetation and deep waters.



3. RESULTS

This section provides the results of the desk study undertaken and findings of aquatic habitats, fish, crayfish, macroinvertebrates and water quality surveys undertaken within the study area.

3.1 DESKTOP STUDY

A comprehensive desktop review of available data (NPWS, NBDC, BSBI & other data) for 10km grid squares N43, N44, N53 and N54 containing and adjoining the proposed project site was carried out to identified records of rare and or protected aquatic species and aquatic Invasive Alien Plant (IAPS) listed on the First Schedule of the European Union (Invasive Alien Species) Regulations 2024 (S.I. 374 of 2024) within the vicinity of the proposed project.

3.1.1 Invasive Aquatic Species

Results from NBDC show records of no First Schedule aquatic plant species within the grid squares. The aquatic mollusc Jenkins' Spire Snail (*Potamopyrgus antipodarum*) shows 23 records from the national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018 (EPA) database. These species are listed as Medium Impact Invasive species. Zebra Mussel (*Dreissena (Dreissena) polymorpha*), a high impact invasive species show four records from National Invasive Species Database and All Ireland Non-Marine Molluscan Database since 2003. The American Mink (*Neovison vison*), show 14 records in the General Biodiversity Records from Ireland database from 2014 and 2015.

Below in Table 3-1 shows a recorded aquatic fauna within the grid squares.

Table 3-1: Aquatic Invasive Species Recorded with 10km Grid Squares with the Study Area of the Proposed Project

Species name	Grid Square	Count	Latest Record	Title of dataset	Designation
Jenkins' Spire Snail (<i>Potamopyrgus antipodarum</i>)	N43	1	12/09/2012	A national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018 (EPA)	Medium Impact
	N44	5	26/06/2018		
	N53	11	28/06/2018		
	N54	6	18/07/2018		
Zebra Mussel (<i>Dreissena (Dreissena) polymorpha</i>)	N44	2	30/06/2010	National Invasive Species Database	High Impact >> Regulation S.I. 477 (Ireland) Invasive Species: Regulation S.I. 374/2024 (Ireland)
	N53	2	07/04/2003	All Ireland Non-Marine Molluscan Database	
American Mink (<i>Neovison vison</i>)	N43	4	30/01/2015	General Biodiversity Records from Ireland	EU Invasive Alien Species Regulation No. 1143/2014 Regulation S.I. 477/2011 (Ireland)
	N44	1	21/10/2014		
	N53	6	21/10/2014		



Species name	Grid Square	Count	Latest Record	Title of dataset	Designation
	N54	3	23/10/2014		Invasive Species: High Risk Invasive Species (2013 Report) Regulation S.I. 374/2024 (Ireland) The Wildlife (Northern Ireland) Order 1985

3.1.2 Protected Aquatic Species

A comprehensive desktop review of available data (NPWS, NBDC, BSBI, IFI, National Crayfish Plague Surveillance Programme (NCPSP), EPA and other data) within the 10km grid squares containing and adjoining the proposed project was carried out and identified records for rare and or protected aquatic species within the vicinity of the proposed project. Note all data pre 2006 (20 years ago or more) is outdated and therefore considered historic. The results of the available data are summarised hereunder.

3.1.1 Fish

The Kinnegad_030, Yellow (Castlejordan)_030 are known to support *Lampetra sp.* (O'Connor, 2006) as well as good stocks of small-sized Brown trout. The Castlejordan RWB supports Brown trout, Lamprey (*Lampetra sp.*), Stone loach (*Barbatula barbatula*), Perch (*Perca fluviatilis*), Pike (*Esox lucius*) and Three-spined stickleback (*Gasterosteus aculeatus*).

The Kinnegad_030 and Castlejordan_030 RWB support a genetically distinct sub-population of Brown trout within the Boyne catchment (Massa-Gallucci & Mariani, 2011).

Previous ecological reports (Triturus 2023) have recorded Brown trout, lamprey (*Lampetra sp.*) and pike were recorded in the Milltownpass River.

IFI assessed the status of fish stocks in the Yellow (Castlejordan)_020 and Yellow (Castlejordan)_030 RWB as part of the WFD fish stock assessment in 2022.

A total of one Habitats Directive Annex II fish species, Atlantic Salmon was recorded in the Yellow (Castlejordan)_030 RWB. No other Annex II fish species were recorded within the catchment. Brown trout, Minnow and Stone loach were recorded present within the Yellow (Castlejordan)_020 RWB. Brown trout, Minnow, and Salmon were recorded within Yellow (Castlejordan)_030 RWB.

These waterbodies received a WFD Moderate fish ecological status. Fisheries data for the other watercourses within the survey area was not available at the time of survey. There are no other records of fish within the study area available.

3.1.1.1 White Clawed Crayfish

Existing data on the presence and distribution of White-clawed Crayfish within the Study Area was consulted on the NBDC mapping portal.



Current records show the presence of White-clawed Crayfish within Yellow (Castlejordan)_010 RWB, Yellow (Castlejordan)_030 and Castlejordan_030 RWB within the study area. NBDC shows records of White-clawed Crayfish within grid squares N43, N53, and N53 at seven locations, with several records from different locations within the same river. Additionally, records from Article 17 spatial data (NPWS, 2019b) were also reviewed and the results are listed in Table 3-2.

Table 3-2: Records of White-Clawed Crayfish Within the Study Area

Grid square/ I.D Location	EPA Station and RWB	Latest Record	Data Source
N43 N497364	RS07Y020070 Yellow (Castlejordan)_010	28/06/2018	A national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018 (EPA)
N525423	Boyne / Milltown	22/08/2006	Crayfish of Ireland, Central Fisheries Board
N53 N554407	RS07C040100 Castlejordan_030	10/08/2009	A national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018 (EPA)
N53/N54 N591387	RS07C040190 Castlejordan_030	11/08/2009	
N595375	RS07Y020300 Yellow (Castlejordan)_030		

3.1.1.2 Freshwater Pearl Mussel

There is no record of 'FPM sensitive areas' in the Yellow [Castlejordan]_SC_010 subcatchment.

3.1.1.3 Otter

There is a moderate record of European Otter (in the relevant grid square, ($n=9$ records in grid N43, $n=17$ in grid N53 and $n=7$ in grid N 54). These are from 2015 in the Atlas of Mammals in Ireland 2010-2015 and General Biodiversity Records from Ireland database.

3.1.2 Fisheries Habitats

The results of the general physical habitat assessment are presented in Appendix A. This gives the physical characteristics of the aquatic study sites and the substrate composition at each site.



A review of the current barrier atlas map of Europe⁴ was undertaken across the study site. There is no evidence of barriers located within the study site, as shown in Figure 3.1. However, it cannot be stated that there are no potential barriers within the study site, as there may be structures present along the rivers within or downstream of the study site that are yet to be recorded onto this atlas map. It is known that structures such as culverts, weirs, ramps etc, form migration barriers to diadromous fish species such as Sea lamprey, River lamprey and Atlantic Salmon.

⁴ <https://amber.international/european-barrier-atlas/>

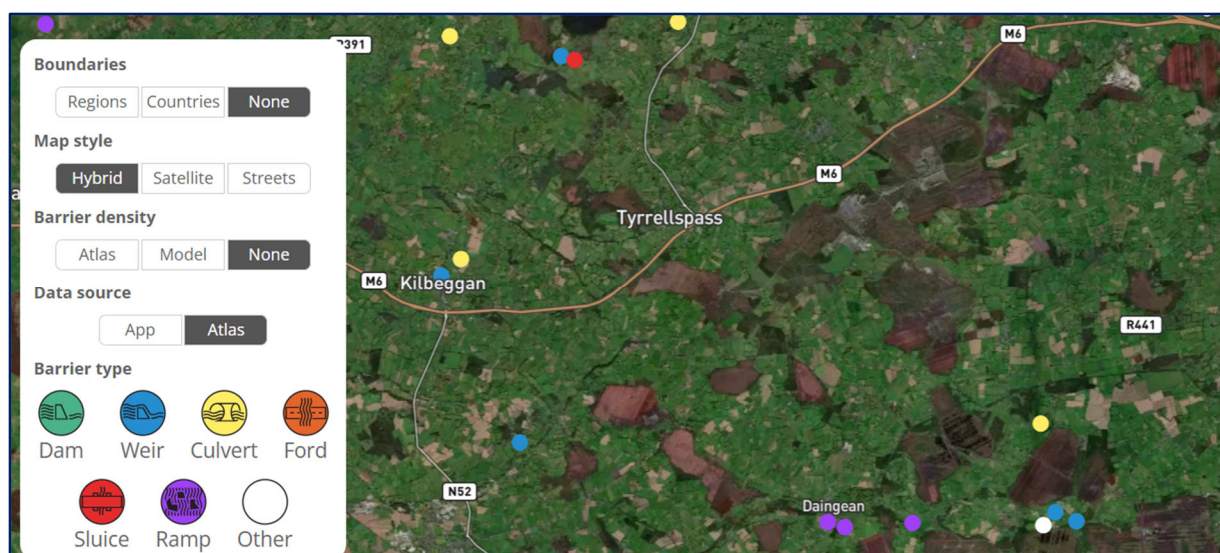


Figure 3-1: A Map of The Physical Barriers on Rivers Located Within the Study Area

3.1.3 Existing Water Quality Records

3.1.3.1 EPA Water Quality Data

A search of the EPA Unified GIS Application⁵ and the EPA Catchments database (EPA 2026)⁶ was conducted for the water quality status of watercourses located within the Zol. Table 3-3 lists the most recent Q-value assessment available of relevant EPA monitoring stations located upstream, and downstream of the proposed project providing data on overall water quality in the area. Based on the data presented in Table 3-3, the overall water quality in the area surrounding the proposed Project Site and the proposed GCR has been of Poor to Good status since regular monitoring commenced, with Q-values being consistently between Q3 and Q4.

The most recent EPA biological water quality results at WFD monitoring stations in the study area are located on the Kinnegad_010, Kinnegad_020, Milltownpass_010, Castlejordan_020, Castlejordan_030, Castletown Tara Stream_010, Yellow (Castlejordan)_010, Yellow (Castlejordan)_020, and Yellow (Castlejordan)_030 RWB and are presented in Table 3-3 below. These are within close proximity to the proposed project and indicate the overall water quality in this area. The most recent EPA biological water quality results at stations that achieved Moderate ecological quality overall indicate that they are not meeting the requirements of the Water Framework Directive (2000/60/EEC). Stations achieving a Q4 'Good' status in 2024, indicates it is meeting the requirements of the WFD (2000/60/EEC).

⁵ Available at <https://gis.epa.ie/EPAMaps/>. Accessed in January 2026

⁶ Available at <https://www.catchments.ie/>. Accessed in January 2026

Table 3-3: Most Recent EPA Biological Quality Ratings (Q-values) at Stations Within the Study Area

River	Station Code	Station Name	Year	Q - Valus and Status	WFD River Waterbody Approved Risks
Kinnegad_010	RS07K010060	Br SE of Cloonfad Ho	2024	Q 3-4 Moderate	At Risk
Kinnegad_020	RS07K010070	Br on L8021 (u/s Kinnegad)	2024	Q 3 Poor	Under Review
Milltownpass_010	RS07M040400	Br in Milltownpass	2024	Q 3 Poor	At Risk
Castlejordan_020	RS07C040100	Baltinoran Br	2024	Q 3-4 Moderate	Under Review
Castlejordan_030	RS07C040190	Castlejordan Br	2024	Q 4 Good	Not at Risk
	RS07C040200	Castlejordan - 0.5km d/s Castlejordan Br	1985	Q 3-4 Moderate	Not at Risk
Castletown Tara Stream_010	RS07C080020	Rhode WWTW upstream	2024	Q 3 Poor	At Risk
	RS07C080190	Rhode WWTW downstream	2024	Q 3 Poor	At Risk
Yellow (Castlejordan)_010	RS07Y020060	Yellow (Castlejordan) - Nr Derryarkin	2003	Q 3 Poor	At Risk
	RS07Y020070	Br d/s Big R confl	2024	Q 3 Poor	At Risk
Yellow (Castlejordan)_020	RS07Y020100	Garr Br	2024	Q 3-4 Moderate	Not at Risk
Yellow (Castlejordan)_030	RS07Y020200	Yellow (Castlejordan) - Sheep Br	1990	Q 3-4 Moderate	Not at Risk
	RS07Y020300	Clongall Br	2024	Q 4 Good	Not at Risk

3.2 AQUATIC FIELD SURVEY RESULTS

This section provides a description of each of the survey sites (1-14), in terms of physical characteristics and hydromorphological condition. In addition, the fisheries habitats, as well as the results of the biological water quality (Q-sample), eDNA sampling, White-clawed Crayfish,



IAS and macrophyte communities in the study area, based on the 14 survey sites examined (Section 3.2.1 to Section 3.2.8). The results of the survey at each site are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery and spawning habitat for salmonids, European Eel and lamprey species. The sites are discussed

Please refer to Appendix A on the Physical Characteristics, and Appendix B on the Electrofishing site characteristics of the study sites.

The Biological water quality (Q-sample) results for each survey site are provided in Appendix C. Detailed fisheries species results and length is provided in Appendix D.

3.2.1 Fisheries Assessment

3.2.2 Riverine Habitat and Riparian Zone Characteristics

The watercourses in the study area are generally moderate flowing. The stream and river substrates comprised mainly of cobble and gravel. The limited presence of riffle and complete absence of pool habitat, modified banks provide limited salmonid nursery habitat in the watercourses surveyed. All surveyed sites lacked adequate deeper areas and holding pools for adult salmonids.

The results of the general physical habitat assessment are presented in Appendix A. This gives the physical characteristics of the aquatic study sites and the substrate composition at each site.

Based on the habitats present at the sites surveys, as well as the poor to moderate water quality, the watercourses draining the site are considered poor for the early life stages of salmonids. There is an absence of heterogenous fluvial habitat that would provide ideal rearing conditions for salmonids. These sites were of poor quality salmonid nursery being degraded due to historical drainage, poor flow rates, heavy siltation and evident enrichment. The quality of spawning habitat was also poor (for both salmonids and lamprey) being reduced by the deterioration of the bed from algae and sedimentation.

While gravel and cobble substrates with the potential to support salmonid spawning were recorded at several survey locations, the suitability of spawning habitat varied across the study area due to differing levels of substrate siltation (see Appendix A). Sites 7, 8, 9, 12 and 14 contained relatively low proportions of fine sediment and supported the most suitable spawning substrates, with clean gravel and cobble being well represented within the channel bed. In contrast, Sites 1, 5, 10, 11 and 13 exhibited elevated levels of fine sediment deposition, with silt comprising between 30% and 90% of the channel substrate. These sites are therefore considered sub-optimal to poor for salmonid spawning. Excessive siltation can clog the interstitial spaces within spawning gravels, reducing water circulation and oxygen availability to developing eggs, impeding alevin emergence and reducing the survival and fitness of juvenile salmonids. Consequently, although appropriate spawning substrates were present at a number of locations, the overall quality of spawning habitat within the study area is constrained by sedimentation pressures associated with historical channel modification, low flow velocities and peat-derived fine sediment deposition.

Despite the agility and persistence of Salmon in leaping obstacles, falls and rapids on certain reaches of watercourses are considered barriers for upstream migrating Salmon, and perhaps



European eel also. Other barriers to migration include bridge aprons and perched culverts. For instance, there is one bridge plinth on the Yellow [Castlejordan]_SC_010 at Site 2 and on the Castlejordan_020 at Site 7. These represents an upstream migration barrier for some species including lamprey and perhaps European eel. However, this location is upstream of the proposed wind farm site.

The riparian zones of the surveyed watercourses were generally characterised by narrow corridors of semi-natural vegetation comprising grasses, rushes, fool's watercress, marginal scrub and scattered riparian trees. In many locations, riparian habitats were modified by historical drainage and channel maintenance works, resulting in reduced structural diversity and limited development of natural riparian features. Agricultural land use, drainage infrastructure and channel modification were common influences throughout the study area.

Instream vegetation was generally dominated by common lowland and slow-flowing watercourse species including Fool's Watercress (*Apium nodiflorum*), Sparganium spp., Pondweed (*Potamogeton* spp.), Water Mint (*Mentha aquatica*), Water Plantain (*Alisma plantago-aquatica*), Reedmace (*Typha latifolia*) and occasional Duckweed (*Lemna* spp.). Macrophyte cover varied considerably between sites, reflecting differences in flow, substrate composition, channel morphology and levels of siltation

3.2.3 Salmonids

During the kick sampling surveys, juvenile Brown Trout (0+ age class) were recorded at a number of survey locations, confirming successful recruitment within parts of the study area. Brown Trout were also observed within watercourses containing suitable riffle and gravel habitats, indicating that sections of the surveyed watercourses provide suitable spawning and nursery habitat for salmonids. In addition, Brown Trout were observed actively utilising several watercourses during the surveys. No Atlantic Salmon were recorded during the kick sampling surveys.



Plate 3-1: Brown Trout Present in the Kick Sample

3.2.4 Lamprey

Scoop tests were carried out at survey sites that contained suitable silt deposits. Lamprey were detected at three of the five sites sampled, including sites within the Yellow [Castlejordan]_SC_010 River and Site 16 on the Boyne_SC_030 River. A total of five lamprey were on the Yellow River and one lamprey ammocete in the Boyne River. The length frequency

ranged from 2-5cm indication indicates ongoing recruitment in this reach of each river. Overall, the survey sites were of moderate value for lamprey ammocoetes with minimal localised shallow silt deposits supporting a low density population.



Plate 3-2: Lamprey Ammocoetes Recorded in fine sediment in the Yellow River and the Boyne River

3.2.5 European Eel

All watercourses in the study area have the potential to support European eel. Suitable habitat for this species occurs in the smallest of watercourses affected by the proposed development, namely rocky substrates.

3.2.6 Other fish

Four individuals of Three spine stickleback were recorded in kick samples at Site 12 .

3.2.7 Electrofishing Survey

Electrofishing site characteristics at aquatic survey sites examined for the proposed project are provided in Appendix D.

A total of 104 fish of nine species were recorded during the electrofishing surveys. Salmon (n=1), Brown trout (n=61), European eel (n=3), Three-spine stickleback (*Gasterosteus aculeatus*) (n=9), Minnow (*Phoxinus phoxinus*) (n=2), Pike (*Esox lucius*) (n=1), Perch (*Perca fluviatilis*) (n=1), Lamprey (*Lampetra* sp), (n=24) and Stone loach (*Barbatula barbatula*) (n=2).

The lengths of the fish caught during the electrofishing can be seen in Appendix D. The overall results of fish caught at each site is presented in Table 3 4 below.

Table 3-4: Summary of Fish Species and Quantity Recorded at Each Site During Electrofishing Surveys in the vicinity of the Proposed Project

Site No.	1	2	4	7	8	9	10	11	12	13	14	Total
Brown Trout	2		6	1		13	4		9		26	61
Salmon											1	1
Minnow							2					2
Eel			1					1	1			3



3 Spined Stickleback	1		1	1			2	3	1			9
Lamprey sp.						2	2	13	1		6	24
Pike					1							1
Perch										1		1
Stoneloach						1	1					2
Total	3	0	8	2	1	16	11	17	12	1	33	104

3.2.8 Environmental DNA

Samples were collected at four sites across the on the EPA waterbodies Castlejordan_020, Yellow (Castlejordan)_030, Kinnegad_010 and Yellow (Castlejordan)_010. An overview of the eDNA laboratory analysis results is provided in Table 3 2 (the full report can be found in Appendix E). Results showed that freshwater pearl mussel is not present within the watercourses of the study area. A positive result for Salmon shows its presence within the Castlejordan_020 and Yellow (Castlejordan)_030 and a positive result for Brook/River lamprey showing that this species is present within the Castlejordan_020, Yellow (Castlejordan)_030 and Kinnegad_010 watercourses and absent within the Yellow (Castlejordan)_010 which is upstream of the Yellow (Castlejordan)_030.

Table 3-5: eDNA Results (Positive qPCR Replicates out of 12 in Parentheses)

Site	EPA Watercourse	Freshwater Pearl Mussel (<i>Margaritifera margaritifera</i>)	Atlantic Salmon (<i>Salmo salar</i>)	Brook/River Lamprey (<i>Lampetra planeri/Lampetra fluviatilis</i>)
5	Castlejordan_020	0	3	12
7	Yellow (Castlejordan)_010	0	0	0
11	Yellow (Castlejordan)_030	0	2	12
12	Kinnegad_010	0	0	12

3.3 INVERTEBRATES

3.3.1 Macroinvertebrates

Macroinvertebrate sampling was undertaken at 12 out of the 14 aquatic survey sites. Biological water quality data, as prescribed by the EPA (Toner *et al.* 2005), group invertebrates into classes whereby species highly intolerant to pollution and low dissolved oxygen levels are denoted Class A, and species with greater tolerance to pollution and dissolved oxygen levels fall into the successive classes B through E respectively. As such the presence or absence of these groups and their relative abundances facilitates an assessment of biological river health.



The results from these sites are discussed in this context in order to interpret potential changes in the riverine community composition. A detailed list of the macroinvertebrate taxa recorded during the surveys with the classification of macroinvertebrate species recorded in terms of their pollution sensitivity is provided in Appendix C. The species listed are separated by the EPA taxonomic classes as prescribed above and colour coded for clarity.

The macroinvertebrate communities recorded at survey sites comprised of a range of macroinvertebrate taxa and generally confirmed the local pressures to the aquatic environment, as well as the failure of the majority of the WFD river water bodies to achieve the WFD objectives. The macroinvertebrate assemblages were dominated by Group C taxa, with frequent assemblages of D were present, whereas only a limited number of sites supported Group A and B taxa in low abundance and an absence of E taxa. The Q-values were assigned on the basis of the sensitivity groups present in abundance, % representation and taxon richness. The Q-value and the ecological status of each sampled site is provided in Table 3-6. Of the 12 sites sampled, the target of Q4 unpolluted water was not achieved at any of the sampling sites. Site 12 received a Q3-4 rating, corresponding to Moderate ecological status under the Water Framework Directive (WFD). This rating reflects the limited abundance and diversity of pollution-sensitive macroinvertebrate taxa recorded at the site. Site 6 received a Q2 rating, corresponding to Bad ecological status, and was characterised by a macroinvertebrate assemblage dominated by Group D taxa. All remaining sites achieved a Q3 poor status of moderately polluted water due to the paucity of pollution sensitive taxa, as well as the degree of siltation (considerable) and algal growth (luxuriant). The current survey results indicate that the overall biological water quality in the watercourses draining the application site is poor and moderately polluted. The sampled watercourses do not provide water of a quality adequate to support a range of pollution sensitive mayfly and stonefly larvae, as well as salmonids. Full details of the biological water quality results can be found in Appendix C.

The major groups including Ephemeroptera, Plecoptera and Trichoptera were poorly represented at most locations (larval stage). No stonefly larvae (Plecoptera) were recorded at any kick sampling site.

The mayfly assemblage was dominated by *Baetis rhodani* which is classified as a pollution tolerant (Group C) indicator by the EPA. The other two mayfly species present were *Serratella ignita* and *Ecdyonurus* spp. These species ranged from 'present' to 'fair numbers' at site where they occurred. These taxa are all classified as pollution sensitive (Group C) by the EPA, with the exception of *Ecdyonurus* spp. (Group A).

The Trichopterans were well represented group, with two cased (Group B) taxa and five caseless (Group C) taxa recorded. Cased caddisfly larvae had patchy distribution and generally 'scarce' to 'fair numbers' in relative abundance with the exception of *Beraea maura*, present at 5 of the 12 sites, with an estimate 40 individuals present at Site 12 alone.

Dipteran larvae accounted for a moderate proportion of the macroinvertebrate community at the study sites. The most common true fly larvae were pollution tolerant Simuliidae ('present' to 'common'). Beetles in two different families were recorded: Dytiscidae and Elmidae. The most common beetles were *Hygrotus versicolor* (generally 'fair numbers'), a small predatory diving beetle. The crustacean *Gammarus deubeni* and *Asellus aquaticus* of the Order Crustacea were recorded at all sites. Both species were widespread in most sites and its relative abundance was 'dominant'. Gastropoda was represented by Lymnaeidae and Pulmonata. These were present at



one site, Site 13 in generally 'low numbers'. One leech, *Hemiclepsis marginata* was present in Site 11. The only molluscs recorded were *Pisidium* (Site 13) with 'scarce' abundance. The total taxa recorded at each sampling site is shown in **Error! Not a valid bookmark self-reference.** below.

Table 3-6: Biological Water Quality and Interpretations at Study Sites on Watercourses Draining the Proposed Project

Site	Q-value	WFD Ecological Status
1	Q3	Poor status (Moderately Polluted)
4	Q3	Poor status (Moderately Polluted)
6	Q2	Bad status (Seriously Polluted)
11	Q3	Poor status (Moderately Polluted)
9	Q3	Poor status (Moderately Polluted)
8	Q3	Poor status (Moderately Polluted)
2	Q3	Poor status (Moderately Polluted)
12	Q3-4	Moderate status (Slightly Polluted)
13	Q3	Poor status (Moderately Polluted)
10	Q3	Poor status (Moderately Polluted)
7	Q3	Poor status (Moderately Polluted)
14	Q3	Poor status (Moderately Polluted)

3.3.2 White Clawed Crayfish

No white-clawed crayfish were recorded during field surveys at any of the 14 aquatic survey sites. No crayfish were captured in the traps during the survey. No white-clawed crayfish were recorded present at any of the sites, nor were any captured during kick sampling or electrofishing surveys. No evidence of white-clawed crayfish carapace or claw remains were recorded on the riverbanks or bridge ledges in the form of Otter scat or remains from predation.

Although habitat suitability for White-clawed Crayfish was assessed as moderate at several sites, particularly where suitable refugia and calcareous influences were present. The absence of direct observations was attributed to factors including significant siltation, hydromorphological modification and sub-optimal ecological conditions across the surveyed watercourses. White-clawed Crayfish require moderate to good water quality, with conditions such as oxygen saturation above 50% and BOD below 3 ppm (Reynolds, 1998; Demers *et al.*, 2003). This protected species also needs relatively hard water, with a pH of 7 or above, and calcium concentrations of at least 5mg/l, as sufficient calcium is necessary to harden their exoskeletons after moulting (Gallagher *et al.*, 2006). Additionally, firm substrates and moderate productivity levels are important for crayfish habitats (Reynolds, 1998). White-clawed Crayfish hatchlings require a presence of gravels (Reynolds, 1998; Reynolds *et al.*, 2010), and typically shelter in vegetation, gravel, and fine tree roots, and smaller crayfish are often found among weeds and debris in shallow water. Larger juveniles are more commonly found among cobbles and detritus, such as leaf litter (Reynolds and O'Keeffe, 2005). Larger crayfish need stones to



hide under or earthen banks for burrowing (Demers et al., 2003). Table 3-7 summarises the results of the habitat assessments and capture surveys.

Table 3-7: Summary Data of White Clawed Crayfish Habitat Assessment and Captures

Site No	Water Clarity	Suitable Refugia	Crayfish Presence	Hand Picking	Trapping	Total	CPUE	Population Abundance Grade
1	Poor	No	No	0	0	0	0	N/A
2	Moderate	No	No	0	0	0	0	N/A
3	Moderate	No	No	0	0	0	0	N/A
4	Good	Yes	No	0	0	0	0	N/A
5	Good	No	No	0	0	0	0	N/A
6	Poor	Yes	No	0	0	0	0	N/A
7	Poor	No	No	0	0	0	0	N/A
8	Good	Yes	No	0	0	0	0	N/A
9	Moderate	Yes	No	0	0	0	0	N/A
10	Good	Yes	No	0	0	0	0	N/A
11	Moderate	Yes	No	0	0	0	0	N/A
12	Good	Yes	No	0	0	0	0	N/A
13	Moderate	No	No	0	0	0	0	N/A
14	Good	Yes	No	0	0	0	0	N/A
Total Crayfish				0	0	0	0	

3.3.1 Aquatic Invasive Species

There was no invasive aquatic macrophytes recorded at any of the sampling sites. One invasive fauna species, the American mink, was visually recorded as present.



4. DISCUSSION

4.1 FISHERIES

The watercourses in the vicinity of the Application Site were typically small, modified, lowland depositing channels draining areas of cutover bog. Historical drainage pressures (straightening & deepening) and siltation have significantly reduced the quality and heterogeneity of aquatic habitats in the vicinity of the proposed development.

Salmonids

The majority of the watercourses within the study area of the proposed development offer limited habitats for spawning and nursery for the early life stages of Salmonids due to this modification which has resulted in an absence or limited amount of riffle features and poor water quality.

The watercourse reaches examined and considered in this report are largely sub-optimal for holding large salmonids due to their size. In general, adult salmon are deemed to enter these areas only during the salmonid spawning season, as pools are insufficiently deep.

The presence of migration obstacles such as artificial structures like bridge plinths may affect the migration of fish species upwards on some rivers within the study area. The modification and diversion of channels for land drainage and convenience purposes change the morphological conditions and decrease the habitat value for fish. The majority of the channels surveyed within and downstream of the study site have had some form of modification.

The electrofishing survey conducted at various locations on the Yellow River, Milltownpass River, Castlejordan River, Kinnegad and Esker River, were found to support salmonid populations and/or lamprey (*Lampetra* sp.) and provided some quality fisheries habitats however salmon was only recorded present in the Yellow River in moderate densities while brown trout was recorded present in the remaining watercourses invariably in low densities.

All watercourses surveyed in the vicinity of the proposed project have been historically modified and the majority were exposed to considerable siltation pressures. Historical straightening and deepening of watercourses damages habitat and hydromorphological heterogeneity, encourages sediment deposition and invariably results in an irreparable reduction in fisheries potential, particularly for salmonids (O'Grady, 2006).

The majority of the watercourses within the Application Site development flow over peat bog and agricultural lands. Diffuse siltation is one of the major threats to salmonid populations, particularly in peat and agricultural catchments. Sediment particles can settle under the low flow conditions causing a phenomenon known as external colmation, this can lead to the clogging of the top layer of channel sediments. This smoother substrata with fine particles that ingress into the coarse sediment and limits oxygen supply to salmonid eggs (required for healthy embryonic development & successful hatching) thus reducing available spawning habitat and impact macro-invertebrate communities on which salmonids feed (Kelly-Quinn *et al.*, 2020; Davis *et al.*, 2018; Conroy *et al.*, 2016). Gravel compaction from sedimentation reduces the spawning capacity of a channel and it has been shown that eggs laid in clean gravels which have subsequently been silted over by peat have failed to hatch (Crisp, 2000).



Lamprey

Lamprey were recorded at three locations within the study area on the Yellow river and the Boyne River. Lamprey ammocoetes (*Lampetra* sp., likely *L. planeri* given the location in the upper reaches of the respective catchments) were also recorded during the electrofishing surveys from four sites on the Rochfortbridge Stream, Castlejordan River, Milltownpass River and the Yellow River. Lamprey were present at low densities in the survey areas containing the species with the exception of the Milltownpass River which supported a medium density of ammocoetes. O'Connor (2006) reported who found a widespread distribution of lamprey in the Castlejordan/Yellow sub-catchment, similar to teg findings from the electrofishing survey.

Overall, lamprey habitat was generally poor across the survey area. There was a general lack of sand/silt deposits, a requirement for lamprey larvae. The only suitable sediment recorded at five of the survey sites and their presence recorded in three of those., Lamprey ammocoetes require the deposition of fine, organic-rich sediment $\geq 5\text{cm}$ in depth in which to burrow and mature (Goodwin *et al.*, 2008; Aronsuu & Virkkala, 2014). Peat-dominated substrata (i.e., humic deposits), such as those typically found in the vicinity of the proposed development, do not provide suitable burial/burrowing habitat complexity or structure for ammocoetes.

Lamprey have similar habitat requirements for spawning trout. They require clean, fine gravels in which to dig their redds (Lasne *et al.*, 2010; Rooney *et al.*, 2013; Dawson *et al.*, 2015) although areas may also include fractions of sand, larger gravels, and cobble (Nika & Virbickas, 2010).

There is limited lamprey spawning habitat in the watercourses draining the proposed development, which was of poor quality due to (peat) siltation pressures (as outlined above).

European eel

European eel were only recorded (single individual) from a one site on the Yellow River during the electrofishing survey. The European eel is a Red-listed species in Ireland (King *et al.*, 2011) and are classed as 'critically endangered' on a global scale (Pike *et al.*, 2020). However numerous sites provided some good physical suitability for the species, which the presence of boulders and vegetation for refuge.

Other Fish Species

No other fish species of particular conservation significance were recorded during the fisheries surveys undertaken within the study area. Fish communities were generally species-poor and dominated by salmonids where suitable habitat occurred. This is consistent with the nature of the receiving environment, which comprises predominantly small, historically modified watercourses draining peatland and agricultural catchments.

The physical condition of many of the surveyed channels, including historical straightening, deepening, and ongoing siltation pressures, has reduced habitat diversity and limited the availability of suitable instream habitats required by a wider range of fish species. Habitat features such as well-developed riffle-pool sequences, submerged macrophyte beds, undercut banks and clean gravels were generally limited or absent across much of the survey area.

While some reaches, particularly within the Yellow River, Castlejordan River, Milltownpass River and Kinnegad River systems, provided moderate habitat quality and supported fish populations, the overall fisheries value of the watercourses within and adjoining the Application



Site is constrained by historical hydromorphological modification and sedimentation pressures. Consequently, the fish assemblages recorded are considered typical of small, modified lowland watercourses within peatland catchments. The presence of salmonids, lamprey and European eel nevertheless confirms the ecological importance of these watercourses and highlights the need to maintain water quality and protect aquatic habitats within the receiving environment.

4.2 INVERTEBRATES

4.2.1 Macroinvertebrates

Based on the relative low abundance or absence of macroinvertebrates that specialize in shredding (Ephemeroptera) (Plecoptera) and collecting (Trichoptera) as a feeding strategy, it is concluded that the aquatic ecosystems at the study sites are driven primarily by energy sources derived within the aquatic zone. The macroinvertebrate compositions are indicative of watercourses that have supply of organic matter for biological sustenance. As mentioned above, the negative impacts of high and persistent sediment loads affect invertebrate assemblages and abundances, with Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa exhibiting the greatest negative response to increased sediment⁷.

The naturally low nutrient concentrations of surface waters in the study area, coupled in some instances with their peaty nature mean that benthic life and therefore higher organisms are highly dependent on terrestrial energy sources for survival, rather than primary production instream. Low Crustacean diversity and abundance reflects the siliceous nature of the study area.

High ranking threats to rivers include 'modification of hydrographic functioning', 'diffuse pollution to surface waters due to agricultural and forestry activities and 'restructuring agricultural landholding. During the current field surveys, these threats were noted. For example, drainage of reaches of all the rivers within the proposed development has taken place in the past, with evidence of land drainage, including instream modifications. This represents an interference with hydrographic functioning. Current biological water quality degradation is likely attributable at least in part, to agricultural, forestry and peat activities.

The latest EPA biological monitoring of watercourses in the study area, show water quality to be generally good as indicated by the latest EPA Q4 rating, however it is noted that there is a decline in water quality outside of the study area. The EPA also recorded the Little Brosna_040 River to be 'At Risk' of failing to meet 'Good' ecological status as required under the WFD.

The biotic indices derived at the survey sites also indicate that the water quality of the watercourses within and downstream of the Proposed Project is achieving Q values that range from Q2, Q3 and Q3-4. These ratings indicate a range from unpolluted to moderately polluted water quality and range from 'Poor to Moderate' ecological status.

As such the majority of the sites have moderate status, with none achieving the target Q4 'Good' status water quality required under the WFD. These sampling sites are all located adjacent to

⁷ <https://www.salmon-trout.org/wp-content/uploads/2017/09/STC-The-impact-of-excess-fine-sediment-on-invertebrates-and-fish-in-riverine-systems.pdf>



agricultural fields and bogs, and within proximity to Sitka spruce plantations. All of these habitats have been heavily drained and flow into the Little Brosna_040 River.

It is likely that diffuse agricultural and forestry enrichment are contributing to the localised declines in water quality. Macroinvertebrate diversity corresponded with habitat suitability, with greater diversity recorded in areas of better habitat. In the Irish context, biological water quality in the study area is considered moderate, considering the range of pressures on surface waters at a national level, such as nutrient, organic, chemical, and sediment pollution.

4.2.2 White-clawed Crayfish

The aquatic habitats within the surveyed sites of the Boyne catchment was considered to be suitable to support any White-clawed Crayfish given the suitable substrate and instream vegetation and refuge. The remaining sites, Site 13, 15 and 18, did not have potential of White-clawed Crayfish due to the low energy of the channel and unsuitable habitat, especially lacking gravels for White-clawed Crayfish hatchlings. There was also a lack of suitable burrowing habitat required for White-clawed crayfish at these sites four sites. As such there is no suitable availability of refuges for this species.

This species requires moderate to good water quality (Demers *et al.*, 2003). Given the biological water quality results obtained from these surveys,

White-clawed Crayfish typically require hard, mineral rich waters flowing over (high calcium) calcareous substrates, preferably with alkalinity levels of >100mg CaCO₃ (Lucey & MacGarrigle, 1987; Holdich, 2003; Gallagher *et al.*, 2006). Consequentially, crayfish distribution follows many of Ireland's carboniferous limestone belts and occurs mostly throughout the limestone-rich midlands.

Whilst the Energy Park Wind farm drains peatlands, these areas are underlain by carboniferous limestone and mudstones (Waulsortian limestones, GSI, 2024). Therefore, the watercourses are physiochemically capable of supporting white-clawed crayfish.

Siltation is known to negatively impact respiratory function of crayfish (Rosewarne *et al.*, 2014) and the high levels of peat-derived, flocculent sediments in the majority of survey sites 13, 15 and 18, have resulted in sub-optimal crayfish habitat, despite some suitable physiochemical and physical habitat parameters.



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Appendix A PHYSICAL CHARACTERISTICS OF THE STUDY SITES

Site	Bank Height (m)	Bank Width (m)	Wetted Width (m)	Mean Dept (cm)	Riffle (%)	Glide (%)	Pool (%)	Shade (%)	Boulder (%)	Cobble (%)	Gravel (%)	Sand (%)	Silt (%)	Velocity	Macrophyte	Algae (%)
1	5	4	2	9.4	0	100	0	25	0	0	0	10	90	Very Slow	Fools watercress 95%, water mint 2%	0
2	11	19	12	57.8	0	100	0	25	3	12	25	25	35	Slow	Sparganium 90%, water plantain 1%, Potamogeton 8%	0
3	5	12	7	150	0	100	0	25	N/A	N/A	N/A	N/A	N/A	Slow	Potamogeton 25%, sparganium 15%, bur reed 5%	55
4	3	7	2	4.2	70	0	30	50	25	35	25	10	5	Slow	Fools watercress 50%, water mint 5%	0
5	4	10	7	150	0	100	0	25	10	25	25	10	30	Slow	Potamogeton 55%, Sparganium 20%, water mint 3%	0
6	2.5	6	1	2.8	0	100	0	75	20	25	25	10	20	Very slow	0	0
7	2.5	8	4	11.2	0	90	10	25	5	45	35	15	0	Very slow	Sparganium 10%, water mint 1%,	0
8	3	9	7	53	0	80	20	50	5	20	60	10	10	Slow	Sparganium 30%, Potamogeton 3%, fools watercress 10%, water mint 5%	0



Site	Bank Height (m)	Bank Width (m)	Wetted Width (m)	Mean Dept (cm)	Riffle (%)	Glide (%)	Pool (%)	Shade (%)	Boulder (%)	Cobble (%)	Gravel (%)	Sand (%)	Silt (%)	Velocity	Macrophyte	Algae (%)
9	4	8	4	26	0	100	0	50	20	25	35	5	5	Slow	Sparganium 20%, fools watercress, 5%	15%,
10	1.5	5	3	15.8	10	90	0	25	2	5	20	33	40	Slow	Lemna 5%, sparganium 25%, fools water cress 1%, water mint 1%	5
11	5	3.5	1	10	0	100	0	50	2	15	20	3	65	Very slow	Fools watercress 80% flag iris 5%, Watermint 5%,	0
12	1	9	7	12.4	75	20	5	50	8	35	45	2	10	Very Slow	fools watercress 5%	35
13	5	4	3.5	30.8	0	100	0	25	0	0	10	40	50	Vey Slow	Water plantain 3%, Potamogeten 10%, sparganium 20%, lemna 5%, water mint 5%	45
14	2	8	2.5	24	45	45	10	25	15	25	45	15	10	Moderate	Fools watercress 10%	40



Appendix B ELECTROFISHING SITE CHARACTERISTICS AT SURVEY SITES EXAMINED FOR THE PROPOSED PROJECT

Site	Length Fished (m)	Width Fished (m)	Area Fished (M ²)	Time Fished (mins)	Mean Depth (cm)	Max Depth (cm)	Voltage	Current (Amp)	Pulse (Hz)	Temp (C°)	Conductivity (μ/s)	pH
1	25	2	50	10	9.4	20	185	.3	50	13.3	738	8.2
2	8	12	96	10	57.8	95	185	.2	50	14.5	748	7.6
3	n/a - too											
4	30	2	60	10	4.2	6	185	.4	50	15.8	793	8
5	N/A - Too deep											
6	N/A- Dried Out											
8	15	7	95	10	53	70	264	.2	50	19.3	720	8.3
9	20	4	80	10	26	45	150	.8	50	18	719	8.1
10	30	3	90	10	15.8	23	185	.9	50	18.3	737	8.3
11	8	1	8	10	5	7	188	.4	50	16.9	747	8
12	30	6	180	10	12.4	16	185	.8	50	18.5	747	8.2
13	15	3.5	52.5	10	30.8	55	185	1	50	18.2	714	7.8
14	40	4.5	180	10	24	30	165	.7	50	14.9	732	8
17	40	4	160	10	11.2	25	149	.7	50	16.1	686	8



Appendix C MACROINVERTEBRATES RECORDED DURING BIOLOGICAL SAMPLING ON WATERCOURSES WITHIN THE STUDY AREA OF THE PROPOSED PROJECT

Group/Organism	1	4	6	11	9	8	2	12	13	10	7	14	EPA Class Pollution sensitivity group
Mayfly (Ephemeroptera)													
Baetidae													
<i>Baetis rhodani</i>				5	70	10		20				200	C
Ephemerelliidae													
<i>Serratella ignita</i>		4		2	40	7		10	10			75	C
Heptageniidae													
<i>Ecdyonurus spp.</i>								1					A
Cased Caddisflies (Tricoptera)													
Limnephilidae													
<i>Glyptotaelius pellucidus</i>			1										B
Beraeidae													
<i>Beraea maura</i>					6	8		40	12	1			B
Rhyacophila sp.													
<i>Rhyacophila dorsalis</i>				1	12								C



Polycentropodidae													
Polycentropus flavomaculata		3											C
Hydropsychidae													
Hydropsyche peducidula											2		C
Phliopotamidae													
Philopotamus montanus	3												
leptoceridae													
Mystacides azurea										3			
Beetle (Coleoptera)													
Elmidae													
Potamonectes depressus													C
Elmis		20		2	1			1	1				
Dytiscidae													
Dytiscus marginalis		1	1	2					3				C
Hygrotus versicolor									100				
Two Winged Flies (Diptera)													
Chironomidae													



<i>Chironomus sp.</i>				15		3	10		1	15	8		C
Simuliidae													
<i>Simulium spp.</i>					15			10					C
Damselfly and Dragonfly nymphs (Odonata)													
Corduliidae													
<i>Cordulia aenea</i>				5									
Crustaceans													
Gammaridae													
<i>Gammarus deubeni</i>	80	150		250	65	50	50	100	20	50		30	C
Asellidae													
<i>Asellus aquaticus</i>	50	100	250	75			10	5	20	20	1		D
Leeches (Hirudinea)													
Glossiphoniidae													
<i>Hemiclepsis marginata</i>				1									D
Snails and Limpets (Gastropoda)													
Lymnaeidae													
<i>Lymnaea stagnalis</i>									3				C
Pulmonata													



<i>Physella fontinalis</i>									1				C
Bivalves													
<i>Pisidium</i>									50				
<i>Sphaerium spp.</i>													



Appendix D FISH SPECIES AND LENGTHS RECORDED DURING ELECTROFISHING SURVEYS ON WATERCOURSES WITHIN THE STUDY AREA OF THE PROPOSED PROJECT

Site No	River Name	Species	Length (Cm)
1	Castlejordan_020	Brown Trout	4.5
1	Castlejordan_020	Brown Trout	4.3
1	Castlejordan_020	Three Spine Stickleback	4.0
4	Castlejordan_020	Brown Trout	5.5
4	Castlejordan_020	Brown Trout	5.4
4	Castlejordan_020	Brown Trout	6.7
4	Castlejordan_020	Brown Trout	5.9
4	Castlejordan_020	Brown Trout	6.4
11	Yellow (Castlejordan)_030	European Eel	26.0
11	Yellow (Castlejordan)_030	Three Spine Stickleback	4.3
11	Yellow (Castlejordan)_030	Three Spine Stickleback	4.6
11	Yellow (Castlejordan)_030	Three Spine Stickleback	3.8
11	Yellow (Castlejordan)_030	Lamprey sp.	15.0
11	Yellow (Castlejordan)_030	Lamprey sp.	13.7
11	Yellow (Castlejordan)_030	Lamprey sp.	9.4
11	Yellow (Castlejordan)_030	Lamprey sp.	12.6
11	Yellow (Castlejordan)_030	Lamprey sp.	8.2
11	Yellow (Castlejordan)_030	Lamprey sp.	11.3
11	Yellow (Castlejordan)_030	Lamprey sp.	13.3
11	Yellow (Castlejordan)_030	Lamprey sp.	12.8
11	Yellow (Castlejordan)_030	Lamprey sp.	10.0
11	Yellow (Castlejordan)_030	Lamprey sp.	10.5
11	Yellow (Castlejordan)_030	Lamprey sp.	7.9



Site No	River Name	Species	Length (Cm)
11	Yellow (Castlejordan)_030	Lamprey sp.	5.0
11	Yellow (Castlejordan)_030	Lamprey sp.	4.5
9	Yellow (Castlejordan)_020	Lamprey sp.	5.0
9	Yellow (Castlejordan)_020	Lamprey sp.	7.5
9	Yellow (Castlejordan)_020	Stone Loach	9.7
9	Yellow (Castlejordan)_020	Brown Trout	17.3
9	Yellow (Castlejordan)_020	Brown Trout	18.5
9	Yellow (Castlejordan)_020	Brown Trout	10.0
9	Yellow (Castlejordan)_020	Brown Trout	14.7
9	Yellow (Castlejordan)_020	Brown Trout	15.0
9	Yellow (Castlejordan)_020	Brown Trout	11.0
9	Yellow (Castlejordan)_020	Brown Trout	13.1
9	Yellow (Castlejordan)_020	Brown Trout	5.5
9	Yellow (Castlejordan)_020	Brown Trout	5.8
9	Yellow (Castlejordan)_020	Brown Trout	5.0
9	Yellow (Castlejordan)_020	Brown Trout	5.7
9	Yellow (Castlejordan)_020	Brown Trout	5.5
9	Yellow (Castlejordan)_020	Brown Trout	6.2
8	Yellow (Castlejordan)_010	Pike	44.3
12	Kinnegad_010	Brown Trout	19.3
12	Kinnegad_010	Brown Trout	15.9
12	Kinnegad_010	Brown Trout	14.4
12	Kinnegad_010	Brown Trout	13.0
12	Kinnegad_010	Brown Trout	14.6
12	Kinnegad_010	Brown Trout	14.8
12	Kinnegad_010	Brown Trout	14.5



Site No	River Name	Species	Length (Cm)
12	Kinnegad_010	Brown Trout	14.0
12	Kinnegad_010	Brown Trout	14.6
12	Kinnegad_010	European Eel	14.5
12	Kinnegad_010	Lamprey sp.	11.0
12	Kinnegad_010	Three Spine Stickleback	4.3
13	Castletown Tara Stream_010	Perch	17.0
10	Yellow (Castlejordan)_020	Brown Trout	13.6
10	Yellow (Castlejordan)_020	Brown Trout	16
10	Yellow (Castlejordan)_020	Brown Trout	6.1
10	Yellow (Castlejordan)_020	Brown Trout	5.9
10	Yellow (Castlejordan)_020	Lamprey sp.	10.0
10	Yellow (Castlejordan)_020	Lamprey sp.	11.0
10	Yellow (Castlejordan)_020	Stone Loach	7.5
10	Yellow (Castlejordan)_020	Three Spine Stickleback	5.2
10	Yellow (Castlejordan)_020	Three Spine Stickleback	2.2
10	Yellow (Castlejordan)_020	Minnow	5.5
10	Yellow (Castlejordan)_020	Minnow	4.3
7	Yellow (Castlejordan)_010	Brown Trout	26.4
7	Yellow (Castlejordan)_010	Three Spine Stickleback	4.0
14	Milltownpass_010	Brown Trout	5.8
14	Milltownpass_010	Brown Trout	15.4
14	Milltownpass_010	Brown Trout	16.3
14	Milltownpass_010	Brown Trout	20.4
14	Milltownpass_010	Brown Trout	20.4
14	Milltownpass_010	Brown Trout	14.0
14	Milltownpass_010	Brown Trout	22.0



Site No	River Name	Species	Length (Cm)
14	Milltownpass_010	Brown Trout	20.7
14	Milltownpass_010	Brown Trout	18.5
14	Milltownpass_010	Brown Trout	17.5
14	Milltownpass_010	Brown Trout	14.9
14	Milltownpass_010	Brown Trout	15.5
14	Milltownpass_010	Brown Trout	16.4
14	Milltownpass_010	Brown Trout	15.1
14	Milltownpass_010	Brown Trout	15.1
14	Milltownpass_010	Brown Trout	16.5
14	Milltownpass_010	Brown Trout	17.1
14	Milltownpass_010	Brown Trout	16.6
14	Milltownpass_010	Brown Trout	13.4
14	Milltownpass_010	Brown Trout	14.7
14	Milltownpass_010	Brown Trout	15.1
14	Milltownpass_010	Brown Trout	13.6
14	Milltownpass_010	Brown Trout	6.8
14	Milltownpass_010	Brown Trout	6.2
14	Milltownpass_010	Brown Trout	5.1
14	Milltownpass_010	Brown Trout	5.4
14	Milltownpass_010	Salmon	13.5
14	Milltownpass_010	Lamprey sp.	8.0
14	Milltownpass_010	Lamprey sp.	6.5
14	Milltownpass_010	Lamprey sp.	11.0
14	Milltownpass_010	Lamprey sp.	2.5
14	Milltownpass_010	Lamprey sp.	2.5
14	Milltownpass_010	Lamprey sp.	9.0





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Purchase Order: POP002259
Contact: Tobin Consulting Engineers
Issue Date: 09.07.2026
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eDNA Report

Technical Report



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
FK3452	Site 7		Atlantic salmon (Salmo salar)	Pass	Negative	0
			Brook/River lamprey (Lampetra planeri/ Lampetra fluviatilis)	Pass	Negative	0
			Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
FK3453	Site 5		Atlantic salmon (Salmo salar)	Pass	Positive	3
			Brook/River lamprey (Lampetra planeri/ Lampetra fluviatilis)	Pass	Positive	12
			Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0

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FK3454	Site 11	Atlantic salmon (Salmo salar)	Pass	Positive	2
		Brook/River lamprey (Lampetra planeri/ Lampetra fluviatilis)	Pass	Positive	12
		Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0
FK3456	Site 12	Atlantic salmon (Salmo salar)	Pass	Negative	0
		Brook/River lamprey (Lampetra planeri/ Lampetra fluviatilis)	Pass	Positive	12
		Freshwater pearl mussel (Margaritifera margaritifera)	Pass	Negative	0

Matters affecting result: none

Reported by: Chelsea Warner

Approved by: Consuela Sopronyi

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.
