Appendix 4

Aquatic Baseline Report

DERRYNADARRAGH WIND FARM
AQUATIC ECOLOGY

Version: 11th of September 2025

Tait Business Centre, Dominic Street,
Limerick City, Ireland.
t. +353 61 313519, f. +353 61 414315
e. info@ecofact.ie
w. www.ecofact.ie

TABLE OF CONTENTS

1. INTRODUCTION

This report addresses the potential impact of the proposed Derrynadarragh Wind Farm (also referred to in this report as the 'Site') project on the receiving aquatic environment. The Site is located south of Edenderry, Co. Kildare and Northeast of Portarlington. Co. Laois. This document provides an assessment of the impact of the proposed development on aquatic habitats, aquatic ecological communities, and individual aquatic species. The aims of the aquatic ecology assessment are:

- To carry out a desktop study in order to determine the surface water features affected by the proposed development and surrounding area and
- To carry out a baseline fisheries and aquatic ecological survey of the identified aquatic areas.

Field survey work to inform the current assessment included kick/sweep sampling and visual assessments as well as electrical fishing surveying during September 2021 and September 2024.

The CIEEM (2019) advice note on the lifespan of ecological reports and surveys states that for reports more than three years only that "*the report is unlikely to still be valid and most, if not all, of the surveys are likely to need to be updated*". This advice is also in line with the NRA (2009) guidance for ecology surveys, which gives a three-year expiry date. The aquatic ecology surveys for this project were therefore all updated during September 2024 to a level of detail that will ensure that the assessment remains valid during the planning application period. The 2021 data is used as a reference point and for comparison purposes, rather than a basis for decision-making.

Figure 1 gives the location of the proposed Derrynadarragh Wind Farm. Figure 2 shows an aerial view of the Site. Figure 3 shows the Site with respect to the River Barrow and River Nore SAC and watercourses in the Barrow catchment. This report was prepared by Ecofact Environmental Consultants Ltd.

1.1 Statement of Authority

The report was prepared by Senior Ecologist Dr. Will O'Connor. Dr. O'Connor has over 30 years professional experience and holds an MSc in Applied Hydrobiology from the University of Wales, Cardiff and a PhD in Zoology from the National University of Ireland, Galway. He is a Fellow of the Royal Society of Biology and a full member of the Chartered Institute of Ecology and Environmental Management. The surveys were also completed by Dr. Will O'Connor with the assistance of junior staff.

2. METHODOLOGY

2.1 Desk study

A desktop study was undertaken to collate the existing available information on the aquatic ecology of the study area. The Study Area included the Site and all waterbodies/watercourses adjacent to the Site. The desktop study involved accessing the National Biodiversity Data Centre (NBDC) (www.biodiversityireland.ie) and the databases available for any records of sensitive aquatic ecology receptors. The National Parks and Wildlife Service (www.npws.ie) website and online maps were accessed in relation to designated areas, qualifying interests and site synopses on relevant Special Areas of Conservation with regard to aquatic ecology. Similarly, any relevant information on the website of Inland Fisheries Ireland (www.fisheriesireland.ie) was reviewed.

The Environmental Protection Agency (www.gis.epa.ie/EPAMaps/) websites including Catchments.ie (www.catchments.ie) and publications relating to the Water Framework Directive (WFD) were accessed to identify watercourses in the Study Area, in relation to water quality status and also water quality pressures in the study area. The Environmental Sensitivity Mapping (ESM) tool was also used to gather data on aquatic biodiversity, flora and fauna in the study area.

Aerial imagery was accessed online in order to gain a better understanding of the study area and its surrounding habitats. All documents reviewed are included in the bibliography section of the current report.

2.2 Field survey

2.2.1 Introduction

All watercourses / water bodies which could be affected directly (i.e. within the site) or indirectly (i.e. drain areas close to the site) were considered as part of the current appraisal. Aquatic habitat surveys were completed on all watercourses draining the Proposed Wind Farm Site and a total of 6 sites were selected for detailed assessment. The purpose of these sites is to provide baseline information and can also be used for monitoring during the construction of the Proposed Wind Farm. The locations of the sites are given in Table 1 and shown in Figure 1.

Table 1 Location of the aquatic ecology sites assessed for the Proposed Derrynadarragh Wind Farm Site.

Site No.	Catchment	Sub-catchment	Watercourse Name	Watercourse Order	Segment Code	EPA Code
1	Barrow 14	Barrow_SC_040	River Barrow	5th	14_1611	14B01
2	Barrow 14	Barrow_SC_040	River Figile	4th	14_1766	14F01
3	Barrow 14	Barrow_SC_040	River Cushina	3rd	14_276	14C04
4	Barrow 14	Barrow_SC_040	River Cushina	3rd	14_276	14C04
5	Barrow 14	Barrow_SC_040	River Cushina	3rd	14_275	14C04
6	Barrow 14	Figile_SC_020	River Figile	4th	14_10514	14F01

. The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare/protected/notable aquatic species at each site. The surveys were conducted in accordance with relevant best practice guidelines, as outlined in the following sections. All watercourses on the site were again viewed during the walkover

surveys. Of the sites chosen, two were within the Site, two were upstream and 2 were downstream of the Site. One of the upstream sites (Site 5) is also along the proposed Turbine Delivery Route (TDR).

2.2.2 Habitat Surveys

Habitat surveys were completed with reference to the Environment Agency's "*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*" (EA, 2003) and "*A Guide to Habitats in Ireland*" (Fossitt, 2000). Lamprey habitats in the study area were assessed with reference to the manuals 'Ecology of the River, Brook and Sea Lamprey *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus'* by Maitland (2003) and 'Monitoring the River, Brook and Sea Lamprey' by Harvey and Cowx (2003). Salmonid habitat was evaluated with reference the Department of Agriculture for Northern Ireland's Fisheries Division document, the '*Evaluation of habitat for Salmon and Trout'* (DANI, 1995), and the English Nature manuals 'Ecology of the Atlantic Salmon' by Hendry K & Cragg-Hine D (2003).

2.2.3 General Fish Surveys

Electrical fishing surveys were undertaken at the six sites during September 2021 and September 2024. The surveys were completed under authorisation from the Department of Environment, Climate and Communications under Section 14 of the Fisheries (Consolidation) Act (1959).

Sites were surveyed following the methodology outlined in the CFB (2008) guidance, and with reference to Matson *et al* (2018). A portable electrical fishing unit (Smith Root-LR 24backpack) was used to carry out the survey. The sites were fished continuously for 5 minutes each. Captured fish were collected into a container of river water using dip nets. The fish were released alive and spread evenly over the sampling area. No mortalities were recorded. Strict biosecurity measures were followed during all fieldwork (IFI, 2010).

2.2.4 Juvenile Lamprey Surveys

Juvenile Lamprey surveys followed the methodology for ammocoete surveys given in the manual *'Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri* and *Petromyzon marinus'* by Harvey & Cowx (2003). Electrical fishing for juvenile lampreys was carried out at three 1m^2 habitat patches where available. A total of 3 x 1 m^2 enclosures were fished at each site where suitable habitat was present and where conditions allowed. Lamprey identification followed '*Identifying Lamprey. A Field Key for Sea, River and Brook Lamprey'* by Gardiner R (2003). Sites were surveyed during September 2021 and September 2024

2.2.5 Biological water quality

A biological water quality rating was assigned at each site with regard to the methodology given in Toner *et al*., (2005). This was a rapid assessment and estimated water quality ratings were assigned for each of the 6 aquatic survey sites.

The presence / absence of any rare or notable macroinvertebrate species was also assessed during the survey. This was based on the kick /sweep sampling results and visual observations at each site.

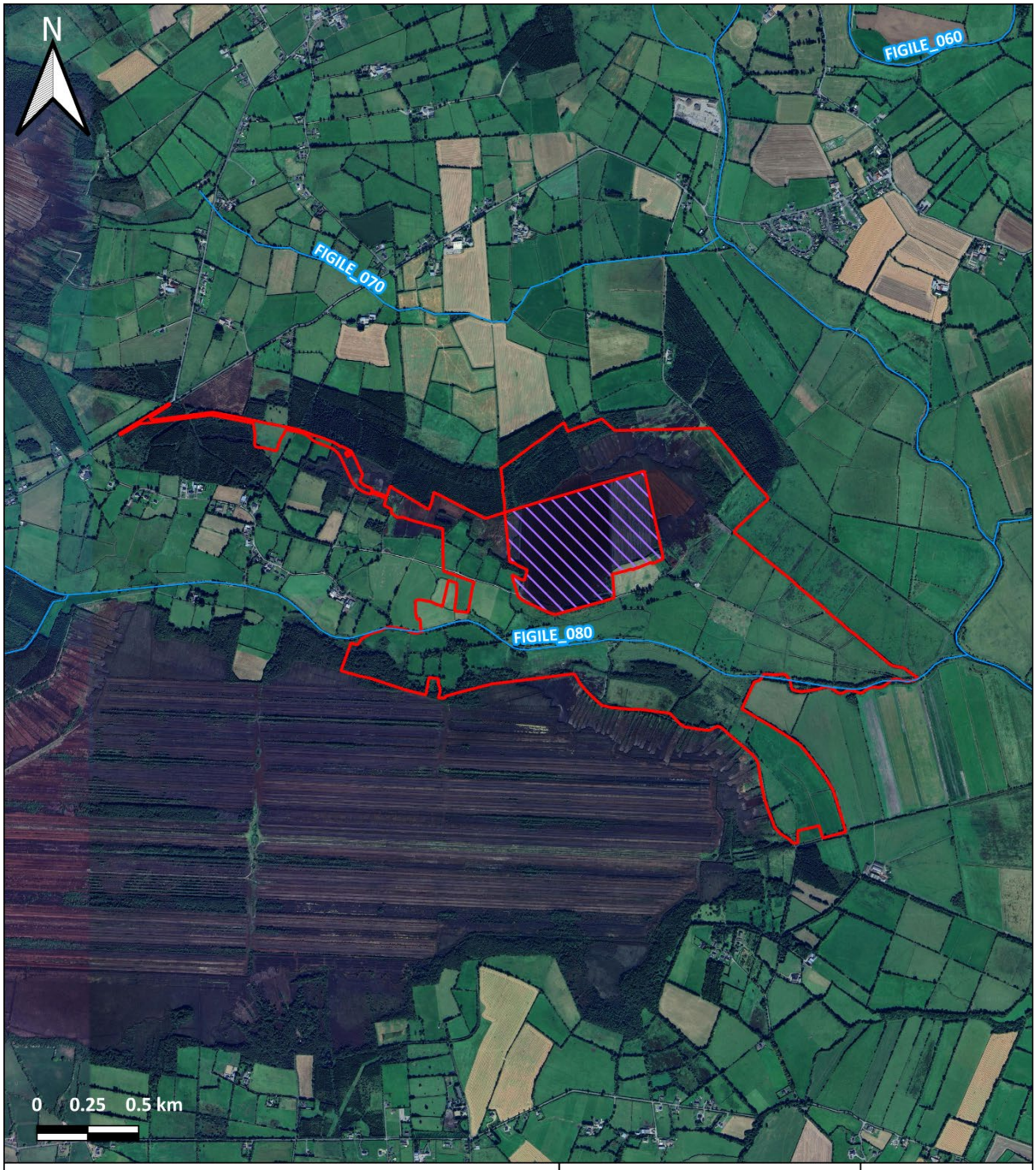

Figure 1 Location of the proposed Derrynadarragh Wind Farm site.

Figure 2 The location of the 6 aquatic ecology survey sites.

3. RECEIVING ENVIRONMENT

3.1 Desk study

3.1.1 Introduction

The proposed Derrynadarragh wind farm is located within the River Figile sub catchment, which is part of the Barrow catchment. The River Barrow is the 2nd longest river in Ireland, the Barrow catchment drains a total area of 3,025km^2.

The River Figile (EPA code: 14F01) is the largest sub-catchment of the River Barrow. It is a lowland drained catchment where land use is predominantly pastures and peat bogs, with some forest tracts scattered throughout too. The main tributaries of the Figile are the Cushina, Slate and Daingean Rivers. There are three survey sites (Sites 1, 2 and 6) located on the River Figile.

The Figile confluence with the Barrow is located at the Laois – Kildare County border, just north of Monasterevin. The 4th order Figile River flows in a southerly direction into the main channel of the River Barrow from the north side and to the west of the Grand Canal Barrow Line. Upstream of the Barrow the Figile is joined by a 1st order tributary, the Ummera_Beg, from the east before the 3rd order Cushina River flows in from the west to the north of Derrylea Bog. Just over 600rm upstream of the Cushina confluence, the 3rd order Slate River joins the watercourse from the east side. The Proposed Wind Farm is located directly west of this confluence.

Further upstream at Bracknagh, two small tributaries flow into the channel from the west, the Bracknagh River and the Clonshannon 14 River. Just downstream of Clonbulloge the 3rd order Ballygarrett 14 flows in from the east. The Daingean River confluence is located at the upstream side of the village of Clonbulloge. A number of 1st order streams drain into the Figile River as the channel turns to a west-east orientation upstream of Edenderry Power Station. The 3rd order Ballyleakin also flows in from the north. Several more 1st and 2nd order tributaries connect to the Figile in its upper reaches; including the Lullymore_East, Abbeylough and Parsontown Rivers just downstream of the source of the Figile at Dunfierth Bog North County Kildare.

The Proposed Wind Farm Site is located on the River Cushina c. 280rm upstream from the River Figile. Sites 3, 4 and 5 are also located on the River Cushina. This river rises c. 17.6rkm upstream from the Proposed Wind Farm Site. From where the river rises it flows east until it meets the River Figile. The only major tributary is the 3rd order Enaghan Stream (EPA code: 14E02).

3.1.2 Designated sites

Part of the River Barrow catchment is included in the River Barrow and River Nore Special Area of Conservation (SAC) (Site code: 002162). The boundary of the SAC is located approximately 6rkm downstream of the Proposed Derrynadarragh Wind Farm site. This is the only Natura 2000 river system potentially affected by the proposed development. The River Barrow and River Nore SAC comprise of the freshwater element of the River Barrow downstream of the Slieve Bloom Mountains to the tidal areas as far as Credaun Head in Waterford.

The River Barrow and River Nore SAC is selected for the Annex I aquatic habitat Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]. The site is also listed for the following aquatic Annex II species; *Margaritifera margaritifera (*Freshwater Pearl Mussel) [1029], *Austropotamobius pallipes* (White-clawed Crayfish) [1092], Petromyzon marinus (Sea

Lamprey) [1095], *Lampetra planeri* (Brook Lamprey) [1096], Lampetra fluviatilis (River Lamprey) [1099], *Alosa fallax fallax* (Twaite Shad) [1103], and *Salmo salar* (Salmon) [1106].

3.1.3 Water Quality

The Environmental Protection Agency (EPA) carry out biological monitoring on a number of sites on the watercourses within the study area.

There is an EPA monitoring station on the River Figile at survey Site 6. This monitoring station (EPA station code: 14F01 0500) was rated Q4 in 2020 equivalent to WFD status "Good". A further 6rkm upstream there is another EPA monitoring station (EPA station code: 14F01 0400). This station was rated Q3 in 2023 equivalent to WFD status "Poor". There is another monitoring station located at Clonbulloge village c. 3rkm upstream. This site was rated Q3 in 2024.

The closest EPA monitoring station downstream is located on the River Barrow at Monasterevin. This site (EPA station code: 14B01 1000) was rated Q3-4 in 2023 equivalent to WFD status "Moderate".

There is an EPA monitoring station on the River Cushina (EPA station code: 14C04 0100). This site is located c. 1.8 rkm upstream of the Proposed Wind Farm Site. The site was rated Q3-4 in 2023. There is another EPA monitoring station (EPA station code: 14E02 0300) located c. 3.4rkm upstream. This site was rated Q4 in 2023 equivalent to WFD status "Good".

The Water Framework Directive sets out objectives to be met by river waterbodies in Ireland before 2027. Waterbodies are then assessed for their potential risk of not meeting these objectives set out by WFD and therefore are assigned a Risk rating. Waterbodies that are "At Risk" can then be prioritised for the implementation of measures. The River Figile directly downstream of the site is considered "Under Review". The River Cushina at the Wind Farm site is also "Under Review". These are located in the same sub-catchment. This sub-catchment (sub-catchment: Figile_080) is under pressure from channelisation and wastewater discharge. Directly upstream of Site 6 the River Figile is considered "Not at Risk". Upstream of the Figile_080 sub-catchment the Cushina_30 sub-catchment is "Not at Risk". Further upstream the River Cushina at "At Risk".

3.1.4 Previous Aquatic Ecology Records

The River Barrow supports a range of fish species including Atlantic salmon (*Salmo salar*), Brown Trout (*Salmo trutta*), Twaite Shad (*Alosa fallax*), Dace (*Leuciscus leuciscus*), Bream (*Abramis brama*), Perch (*Perca fluviatilis*), Rudd (*Scardinius erythrophthalmus*), Roach (*Rutilus rutilus*), Tench (*Tinca tinca*), and Pike (*Esox lucius*). The Barrow is known to support the only sizeable spawning population of Twaite Shad (*Alosa fallax*) in Ireland – however, this species does not occur in the study area as migration of Shad (*Alosa fallax*) in the river is blocked by the weir at St. Mullins (King, 2006). In general, the tributaries of the River Barrow tend to have limited habitat for juvenile Lamprey (*Lampetra sp.*) (King, 2006). Compared to other catchments in Ireland, such as the Slaney and Munster Blackwater and the Moy, the Barrow has limited ammocoete (*Lampetra* spp.) populations (King, 2006).

The River Barrow has a relatively good run of salmon which spawn downstream of the weirs on the main channel and also run into the tributaries. Most of the tributaries have been subjected to arterial drainage schemes and water quality is a significant pressure in the catchment. According to Inland Fisheries Ireland (IFI), the River Barrow catchment contains 5.75% of the accessible juvenile salmon habitat in Ireland, comprising 6.49 million m^2 of suitable juvenile salmon habitat. As gradient has a strong influence on habitat suitability for salmonids, especially at the early life stages, the main channel

of the River Barrow is regarded as a marginal habitat with respect to salmon production. To accommodate navigation, as well as providing hydropower to a number of industrial units, the River Barrow was regulated by a number of major weirs, creating a series of zero to very low gradient reaches between each weir.

IFI carried out an electrofishing survey of the entire River Barrow Catchment as part of the National Research Survey Programme in 2015 and again in 2020. Both surveys included sites located on the River Figile and the River Cushina catchments. There were four sites located on the River Figile. Of these, three were located just in a 2km stretch downstream of Daingean. These were located on the Philipstown River. This is over 30km upstream from where the River Figile flows into the river Cushina. Cumulatively at these sites in 2015, Stone loach, Pike, Nine-spiked stickle back and Three-spined stickleback were recorded. The River Figile site was located at Ticknevin and is over 20 rkm upstream from where the River Cushina flows in the River Figile. This site was only surveyed in 2020. There was a total of three species recorded. These were Brown trout (0.0101 fish/m^2), Stone loach (0.018 fish/m^2) and Three-spined stickleback (0.083 fish/m^2). There were two age classes of brown trout recorded. The minimum density recorded for 0+ fish was 0.046 fish/m^2 and for 1+ and older it was 0.055 fish/m^2 (Gordon 2021).

The survey site on the River Cushina was located upstream of the Proposed Wind Farm Site at Survey Site 5. At this site there were three species recorded. These were 1+ and older Brown trout (0.009 fish/m^2), Gudgeon (0.009 fish/m^2) and Stone loach (0.03 fish/m^2). Overall, the fish ecological status for the River Cushina and the Phillipstown river sites was Poor. The status for the River Figile site was Moderate (Gordon 2021).

The Barrow also supports populations of the protected, White-clawed Crayfish (*Austropotamobius pallipes*). The River Barrow and River Nore SAC was a stronghold for White-clawed crayfish (Demers *et al.,* 2005). This species is threatened on a global scale and Ireland holds one of the world's largest populations of the species. Crayfish plague, caused by the alien fungus *Aphanomyces astaci* is present in the River Barrow.

In 2017 large Crayfish mortality events occurred in the catchment between Graignamanagh in Kilkenny and upstream as far as Carlow. DNA tests from 4 different locations along this stretch confirmed the presence of Crayfish plague. According to catchments.ie, the highly infectious disease had spread through the main Barrow channel and was now widespread in the river. It had been recorded as far upstream in the main channel as Monasterevin in 2018. In May 2019 Crayfish Plague was found to be present within the Figile sub-catchment, its presence was confirmed on the River Slate at Rathangan (NPWS, 2019). Previous Ecofact surveys have shown that the Figile River has previously been considered important for this species (Ecofact 2014). Significant numbers were recorded at Cushaling Bridge in 2014. It is likely that the Figile River population has since been impacted by Crayfish Plague.

There are records of Freshwater Pearl Mussel (*Margaritifera margaritifera*) populations in the Barrow catchment. Pieces of empty *Margaritifera* shells have been recorded previously in the River Barrow (McMillan and Zeissler, 1990), however, no living specimens of the critically endangered species have been found outside of the River Nore since 1993. The Barrow Freshwater Pearl Mussel populations occur in the Aughavaud, Ballymurphy and Mountain sub-catchments. The Figile River was surveyed by Moorkens in 1991 (Moorkens *et al.* 1992) and the species was not present.

Figure 3 Natura 2000 Sites within 15km of proposed Derrynadarragh Wind Farm.

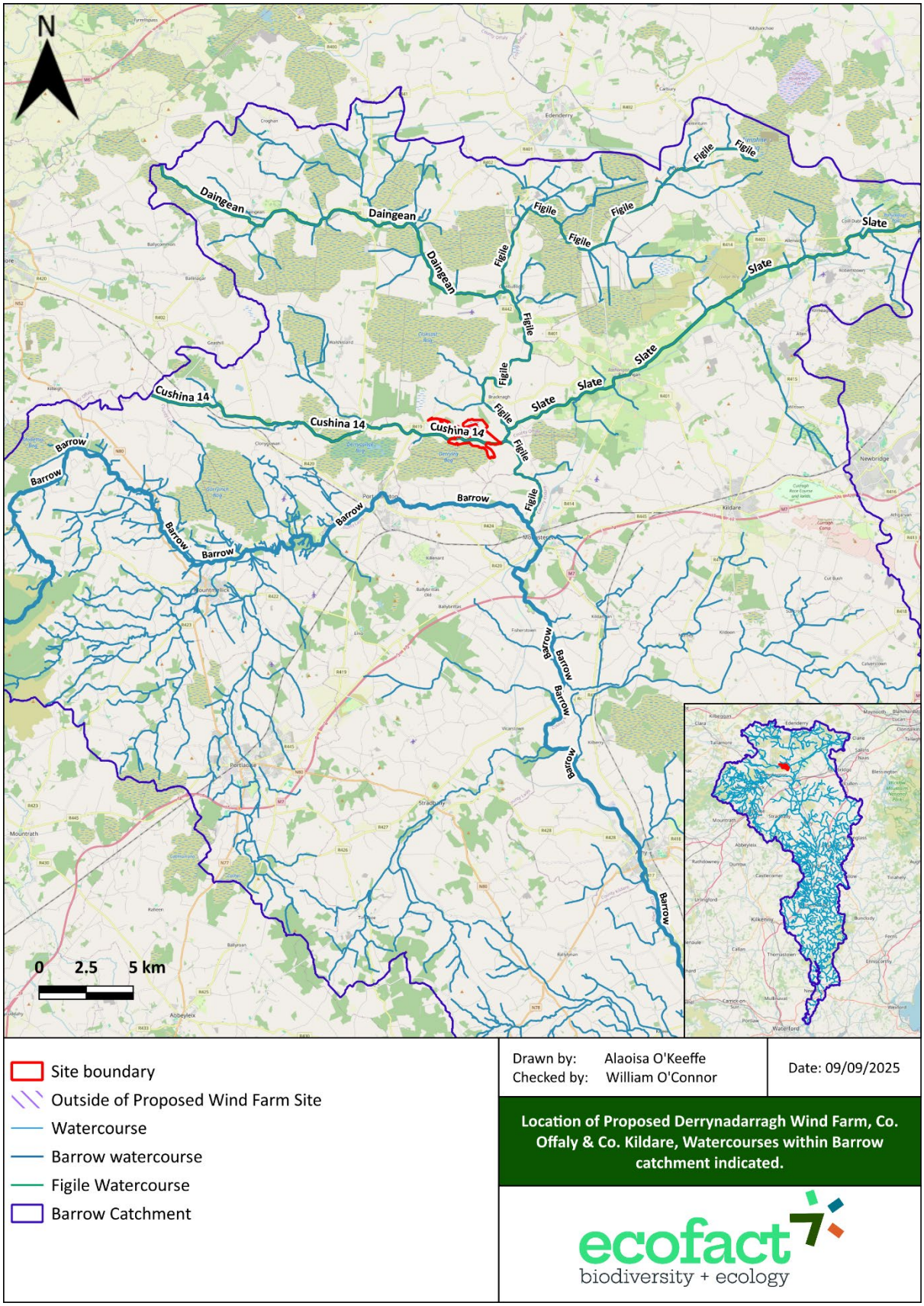

Figure 4 Location of the proposed Derrynadarragh Wind Farm in relation to the River Barrow catchment.

Table 3 Summary of the potential occurrence of aquatic qualifying interests of the River Barrow and River Nore SAC within the Figile sub-catchment.

	Natura Code	Qualifying Interests	Occurrence
Habitats	3260	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	The main area of this habitat for which the SAC is designated is located in the Kings tributary of the River Nore. It is noted that the full distribution of this habitat in the SAC is not currently known (NPWS, 2011). However, this habitat occurs in areas of good water quality, the water quality in the Figile sub-catchment is not sufficient to support this habitat type and so it does not occur in these rivers.
Species	1095	Sea lamprey (*Petromyzon marinus*)	Range in the Barrow catchment is limited to the lower reaches due to barriers to migration – therefore is not present in these rivers of the Figile sub-catchment in the Upper Barrow catchment.
	1096	Brook lamprey (*Lampetra planeri*)	Widely distributed in the River Barrow and recorded in the River Figile at Cushaling in 2014 (Ecofact, 2015).
	1099	River lamprey (*Lampetra fluviatilis)*	The range of this species is mainly limited to downstream areas due to barriers to upstream migration and so is unlikely to be present in these rivers of the Figile sub-catchment in the Upper Barrow catchment.
	1102	Allis shad (*Alosa fallax*)	Impassable barrier at St. Mullins weir prevents this species from accessing these rivers of the Figile sub-catchment in the Upper Barrow catchment (NPWS, 2013). This species therefore would not occur in the Figile sub-catchment located in the Upper Barrow catchment.
	1106	Atlantic salmon (*Salmo salar)*	This species has not been recorded on the main River Figile in previous Ecofact surveys (Ecofact, 2015; Ecofact, 2020) but is likely to occur here as it is known to be present in the Figile sub-catchment.
	1103	Twaite shad (*Alosa alosa*)	Impassable barrier at St. Mullins weir prevents this species from accessing these rivers of the Figile sub-catchment in the Upper Barrow catchment (NPWS, 2013). This species therefore would not occur in the Figile sub-catchment located in the Upper Barrow catchment.
	1092 *	White-clawed crayfish (*Austropotamobius pallipes*)	The Figile River has previously been considered important for this species (Ecofact 2014). Significant numbers were recorded at Cushaling Bridge in 2014. It is likely however that the Figile River population has since been impacted by Crayfish Plague as the invasive species was confirmed to be present in the River Slate in 2019.
	1029	Freshwater pearl mussel (*Margaritifera margaritifera*)	Freshwater pearl mussel populations recorded from the River Barrow sub-basin are restricted to three tributaries of the Barrow in Co. Carlow: the Aughavaud, Ballymurphy and Mountain Rivers. The Figile River was surveyed by Moorkens in 1991 (Moorkens *et al.* 1992) and the species was not present. This species is not present in this watercourse.

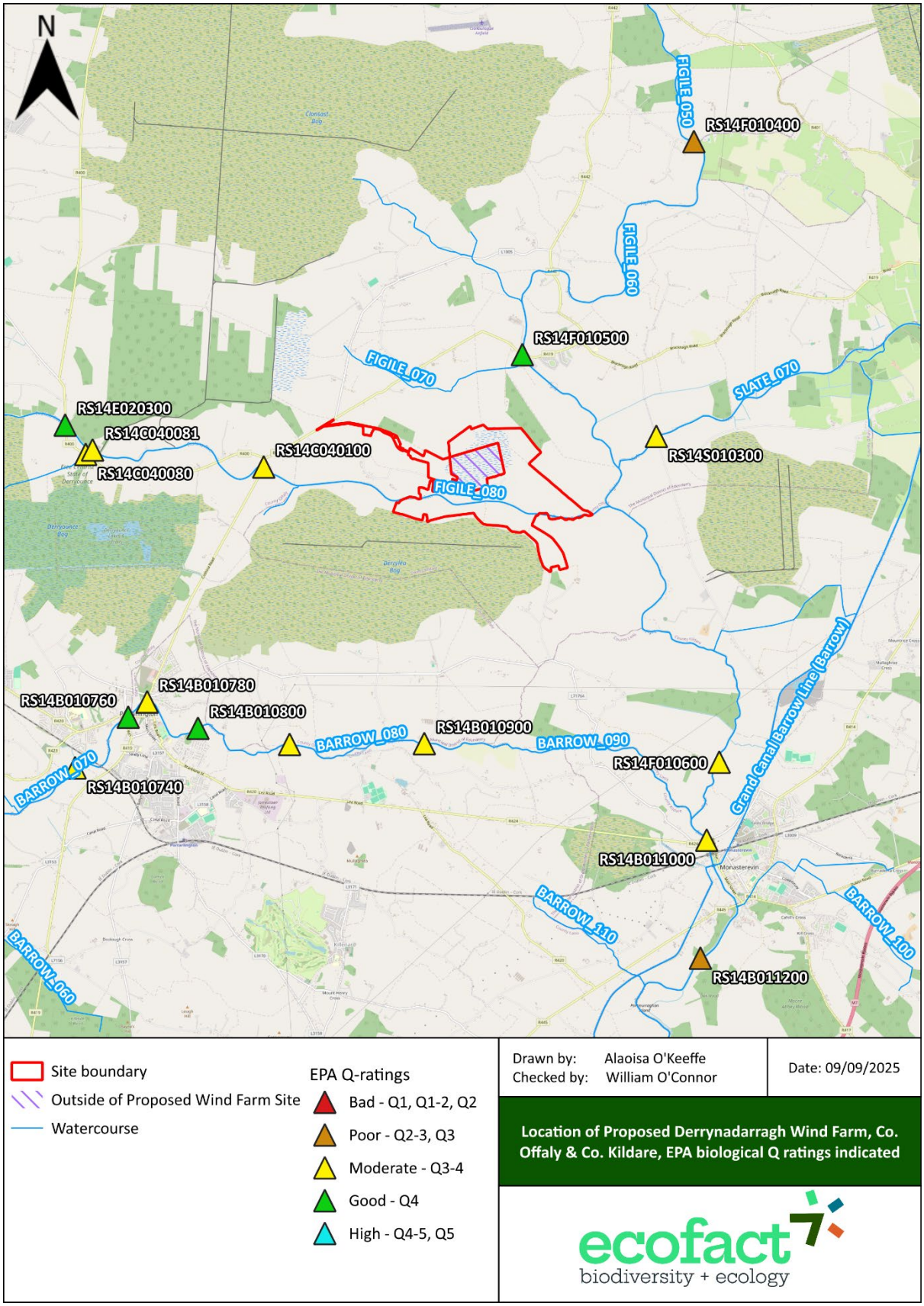

Figure 5 EPA Monitoring Stations in Relation to proposed Derrynadarragh Wind Farm.

3.5 Baseline Aquatic Ecology Surveys 2021-2024

3.5.1 Site 1

Site 1 is located on the 5th order River Barrow (EPA segment code: 14_1611). This site is located c. 390rm downstream of the River Figile confluence with the River Barrow and c. 5.5 km downstream from the Proposed Wind Farm Site boundary. This site is located within the River Barrow and River Nore SAC.

The river here was wide with a wetted width of c. 30m. The water depth at the site was also relatively high with a mean depth of 70cm and a maximum depth of over 1m. Habitat present was predominantly glide (80%), no riffle habitat and 10% pool habitat. The substrate at the site was dominated by fine material. Silt/mud increased towards the riverbanks. The gradient here was low and siltation was moderate. The channel has been drained and channelised. Filamentous algae were recorded here.

The fish community at this site was dominated by coarse fish. The most abundant species were Minnow, Dace, and Roach. Small numbers of Brown trout and lampreys were recorded at this site.

Salmon were not recorded in either the 2021 or 2024 survey. Salmon are present in this stretch but the nursery habitat here is suboptimal. Adult salmon pass through to spawn in areas upstream and only very low densities of parr would be expected, and these were not picked up in the surveys. White-clawed crayfish were present at the site until recently, but the population here has been impacted by crayfish plague. Crayfish were not recorded during the 2021 and 2024 surveys, but it is hoped the population will recover again in the future.

The site was assigned a Q-value of Q3-4 equivalent to WFD status “Moderate”. The EPA assigned the site a rating of Q3-4 also in 2023. The dominant fish are coarse fish species and moderate siltation along with filamentous algae were present.

3.5.2 Site 2

Site 2 is located on the 4th order River Figile (EPA segment code: 14_10483). This site is located c. 600rm downstream of the Proposed Wind Farm Site.

The river here had a wetted width of 12m. The water depth at the site was on average 50cm. The riverbank here was 3m high. The level of instream vegetation at the site was c. 30%. Habitat present was predominantly glide (80%) with no riffle and 10% pool habitat. The substrate was predominantly sand/fine (50%) with lower levels of cobble (30%) and rock (20%). The gradient here was low and siltation was moderate. The channel has been drained and channelised.

The fish community recorded was again dominated by coarse fish species. The most abundant species was Minnow. Three-spined stickleback were recorded in small numbers. Small numbers of Brook lamprey were also present. Salmonids were recorded during the 2021 survey but not in the 2024 survey. This does not mean they were absent, but they are present in very low numbers in suboptimal habitat here and were not detected during the September 2024 survey. The river levels were slightly lower during the 2021 survey, and this may have affected sampling efficiency.

White-clawed crayfish were not recorded in either survey. White-clawed crayfish were present at the site until recently, but the population here has been impacted by crayfish plague (see Section 3.1.4 above).

The site was assigned a Q-value of Q3 equivalent to WFD status “Poor”. This rating is driven by the suboptimal habitat at the site. The dominant fish are coarse fish species and moderate siltation along with filamentous algae were present.

3.5.3 Site 3

Site 3 is located on the 3rd order River Cushina (EPA segment code: 14_276) c. 50m downstream of the Proposed Wind Farm Site boundary. This site is located c. 250rm upstream of the river Cushina and River Figile confluence.

The river here is c. 8m wide. There is a mean depth of c. 30cm with a maximum of c. 50cm. The proportion of instream vegetation present was 35%. The dominant habitat here was glide. The substrate was predominantly cobble with lower levels of sand/fine and rock. The gradient here was low and siltation was moderate. Filamentous algae were present. The channel has been drained and channelised. The fish community here was again dominated by coarse fish. There were overall small numbers of salmonids and lampreys present. White-clawed crayfish were not recorded.

The site was assigned a Q-value of Q3 equivalent to WFD status “Poor”. This rating is driven by the suboptimal habitat at the site. The dominant fish are coarse fish species and moderate siltation along with filamentous algae were present.

3.5.4 Site 4

Site 4 is located within the Proposed Wind Farm Site. This site is on the 3rd order River Cushina (EPA segment code: 14_276). This was located c. 1.7rkm upstream from survey Site 3.

The river at the site here is c.5m wide. The mean depth was c. 40 cm with a maximum depth of c. 70cm. The habitat here was 100% glide. The substrate was 100% sand/fine. The gradient here was low and siltation was moderate. Filamentous algae were present. The channel has been drained and channelised.

Minnow, Roach, Three-spined Stickleback, and Stone Loach were recorded at this site. This is very suboptimal habitat for salmonids and none were recorded in either survey. However, both salmon and trout are present in more suitable habitats on this waterbody. There were ongoing river works at this site when it was visited in September 2021. It is regularly dredged, and this further degrades the habitats present. Low densities of lampreys may be present, but they were not recorded. Juvenile lampreys are very vulnerable to river maintenance works.

The site was assigned a Q-value of Q3 equivalent to WFD status “Poor”. This rating is driven by the suboptimal habitat at the site. The dominant fish are coarse fish species and moderate siltation along with filamentous algae were present.

3.5.5 Site 5

Site 5 is located on the 3rd order River Cushina (EPA segment code: 14_275). This site is located c. 1.8rkm upstream of the Proposed Wind Farm Site boundary. The site is located where the River Cushina crosses the R419 road.

The wetted width of the channel was c. 5m. The mean depth was c. 35cm with a maximum of c. 70cm. The coverage of instream vegetation present was c. 50%. The dominant habitat here was glide (70%)

followed by pool (20%) and riffle (10%). The substrate was predominantly sand/fine (40%), with equal proportions of rock (30%) and cobble (30%). The gradient here was low and siltation was moderate. Filamentous algae were present. The channel has been drained and channelised. There were ongoing river works at this site when it was visited in September 2021.

The fish community at this site is again dominated by coarse fish species. Gudgeon were recorded here in the 2024 survey but were not detected in the previous survey. Minnow and Dace were the most common species. Salmon, Brown Trout, Brook lamprey were recorded. However, the habitats here are very suboptimal for salmonids and lampreys.

The site was assigned a Q-value of Q3-4 equivalent to WFD status “Moderate”. The dominant fish are coarse fish species and moderate siltation along with filamentous algae were present.

3.5.6 Site 6

Site 6 is located on the River Figile (EPA segment code: 14_10514). This site is located where the river crossed the regional R419 road. This site is located c. 3.5rkm upstream from Site 2.

The wetted width of this site was c.10m with a maximum depth of 80cm. The coverage of instream vegetation was 40%. The dominant habitat here was glide (90%) followed by riffle (10%). The substrate was predominantly sand/fine (40%), with equal proportions of rock (30%) and cobble (30%). The gradient here was low and siltation was moderate. Filamentous algae were present. The channel has been drained and channelised. River works were ongoing downstream of the site when it was surveyed in 2021.

The most abundant species were Minnow and Three-spined stickleback. Eel, Salmon, Brown Trout, Dace, Stone Loach and Pike were also recorded. Small numbers of salmonids and lampreys were present. The habitats here are very suboptimal for these species.

The site was assigned a Q-value of Q3-4 equivalent to WFD status “Moderate”. The dominant fish are coarse fish species and moderate siltation along with filamentous algae were present.

Table 4 Summary of the results of the aquatic ecology surveys completed for the proposed Derrynadarragh Wind Farm development.

Site No.	Watercourse name	Biological Water quality	Aquatic habitat	Fish population	Rare / notable species	Overall evaluation
1	River Barrow	Q3-4	Drained and channelised. Gravel substrate with muddy sides.	Fish community dominated by coarse fish. Small numbers of salmonids and lampreys also present.	Brook Lamprey Brown Trout White-clawed crayfish were present until recently. Salmon likely to be present.	Moderate status channel dominated by coarse fish species.
2	River Figile	Q3	Drained and channelised. Substrate dominated by silt/mud.	Fish community dominated by coarse fish. Small numbers of salmonids and lampreys also present.	Brook Lamprey, Brown Trout, Salmon. White-clawed crayfish were present until recently	Moderate status channel dominated by coarse fish species, but salmonids and lampreys present in low numbers.
3	River Cushina	Q3	Drained and channelised. Substrate dominated by silt/mud.	Fish community dominated by coarse fish. Small numbers of salmonids and lampreys also present.	Brook Lamprey, Brown Trout, Salmon.	Moderate status channel dominated by coarse fish species, but salmonids and lampreys present in low numbers.
4	River Cushina	Q3	Drained and channelised. Substrate dominated by silt/mud. Ongoing river works.	Minnows and Three spined sticklebacks recorded in the survey. However, some salmonids and lampreys likely to be present and occur upstream.	None	Moderate status channel. Modified and ongoing river works.
5	River Cushina	Q3-4	Drained and channelised. Ongoing river works.	Fish community dominated by coarse fish. Small numbers of salmonids and lampreys also present.	Brook Lamprey, Brown Trout, Salmon.	Moderate status channel dominated by coarse fish species, but salmonids and lampreys present in low numbers.
6	River Figile	Q3-4	Drained and channelised. Ongoing river works.	Fish community dominated by coarse fish. Small numbers of salmonids and lampreys also present.	Brook Lamprey, Brown Trout, Salmon.	Moderate status channel dominated by coarse fish species, but salmonids and lampreys present in low numbers.

5. CONCLUSION

The overall assessment of the aquatic habitats within and adjacent to the site have been assessed to be of moderate quality, with Q-Values of 3 and 3-4 recorded. The fish community is generally dominated by coarse fish with small numbers of salmonids and lampreys also present in some of the survey sites. The river channels, at least at the points surveyed, have been, and continue to be, modified through dredging and channelisation.

REFERENCES

Atkinson, S., Bruen, M., O'Sullivan, J. J., Turner, J. N., Ball, B., Carlsson, J., ... & Kelly-Quinn, M. (2020). An inspection-based assessment of obstacles to salmon, trout, eel and lamprey migration and river channel connectivity in Ireland. *Science of The Total Environment*, *719*, 137215.

CFB (2008) Methods for the Water Framework Directive - Electric fishing in wadable reaches. Central Fisheries Board.

CIEEM, (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland (Terrestrial, Freshwater, Coastal and Marine). Chartered Institute of Ecology and Environmental Management.

Construction Industry Research and Information Association (CIRIA) (2006) Control of water pollution from linear construction projects. CIRIA Report No. C648. London: Construction Industry Research and Information Association.

DANI (1995) *Evaluation of habitat for Salmon and Trout.* Fisheries Division of the Department of Agriculture for Northern Ireland.

Environment Agency, (2003). River Habitat Survey in Britain and Ireland Field Survey Guidance Manual: 2003 Version' published by the Environment Agency, United Kingdom.

DEHLG (2010a). Freshwater Pearl Mussel Aughavaud Sub-Basin Management Plan – Second Draft. http://www.wfdireland.ie/docs/5_FreshwaterPearlMusselPlans/Freshwater%20Pearl%20Mussel%20Plans%20March%202010/Second%20Draft%20of%20Aughavaud%20Sub-Plan%20March.2010.pdf

DEHLG (2010b). Freshwater Pearl Mussel Ballymurphy Sub-Basin Management Plan – Second Draft. http://www.wfdireland.ie/docs/5_FreshwaterPearlMusselPlans/Freshwater%20Pearl%20Mussel%20Plans%20March%202010/Second%20Draft%20of%20Ballymurphy%20Sub-Plan%20March.2010.pdf

DEHLG (2010c). Freshwater Pearl Mussel Mountain Sub-Basin Management Plan – Second Draft. http://www.wfdireland.ie/docs/5_FreshwaterPearlMusselPlans/Freshwater%20Pearl%20Mussel%20Plans%20March%202010/Second%20Draft%20of%20Mountain%20Sub-Plan%20March.2010.pdf

DEHLG (2010d). Freshwater Pearl Mussel Nore Sub-Basin Management Plan – Second Draft. http://www.wfdireland.ie/docs/5_FreshwaterPearlMusselPlans/Freshwater%20Pearl%20Mussel%20Plans%20March%202010/Second%20Draft%20of%20Nore%20Sub-Plan%20March.2010.pdf

Demers, A., Lucey, J., McGarrigle, M.L. & Reynolds, J.D. 2005. The distribution of the white-clawed crayfish, *Austropotamobius pallipes*, in Ireland. Biology & Environment: Proc. RIA 105B: 65-69.

EPA, (2015). Advice Notes for Preparing Environmental Impact Statements: Draft. Environmental Protection Agency, Ireland.

EPA, (2017). Guidelines on the information to be contained in Environmental Impact Assessment Reports: Draft. Environmental Protection Agency, Ireland.

Environment Agency, (2003). River Habitat Survey in Britain and Ireland Field Survey Guidance Manual: 2003 Version' published by the Environment Agency, United Kingdom.

Fossitt, J., (2000). *A Guide to Habitats in Ireland*. The Heritage Council, Kilkenny.

Gordon, P., Donovan, R., Matson, R., Corcoran, W., and Kelly, F.L. (2021) Sampling Fish in Rivers 2020 – River Barrow Catchment, Factsheet No. 2020/01. National Research Survey Programme. Inland Fisheries Ireland.

Harvey J & Cowx I (2003). Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

IFI (2010) Biosecurity protocols for fieldwork. Inland Fisheries Ireland. https://www.fisheriesireland.ie/documents/73-biosecurity-protocol-for-field-survey-work-1/file.html

IFI, (2016). Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters. Inland Fisheries Ireland.

King, J.J (2006) The status and distribution of lamprey in the River Barrow SAC. Irish Wildlife Manuals No. 21. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Lucey, J. (1993). The Distribution of *Margaratifera margaratifera* (L.) in Southern Irish Rivers and Streams. J. Conch., Lond. **34,** 301-310.

Maitland PS (2003). Ecology of the River, Brook, and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Matson, R., Delanty, K., Shephard, S., Coghlan, B. and Kelly, F. (2018) Moving from multiple pass depletion to single pass timed electrofishing for fish community assessment in wadeable streams. *Fisheries Research,* 198, 99-108.

Murphy, D.F., (2004). Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin, Ireland.

NatureScot (2019) Good practice during wind farm construction. 4th Edition. https://www.nature.scot/doc/guidance-good-practice-during-wind-farm-construction

NPWS, (2013). The Status of EU Protected Habitats and Species in Ireland Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC. Department of the Environment, Heritage and Local Government.

NRA, (2010). The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads. National Roads Authority, Dublin.

NRA, (2008a). Environmental Impact Assessment of National Road Schemes – A practical guide, Rev. 1. National Roads Authority, Dublin, Ireland.

NRA, (2008b). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority, Dublin.

NRA, (2009a). Guidelines for Assessment of Ecological Impacts of National Road Schemes: Rev. 2. National Roads Authority, Dublin

NRA, (2009b). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes: Version 2. National Roads Authority, Dublin.

O'Connor, W. (2017) Aquatic Organisms. In: *Wildlife and Wind Farms: Conflicts and Solutions*. Volume 1. Ed. M. Perrow. Pelagic Books. ISBN9781784271190.

Toner, P., Bowman J., Clabby, K., Lucey J., McGarrigle, M., Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MacCárthaigh, M., Craig, M. and Quinn R., (2005). *Water Quality in Ireland 2001 – 2003*. Environmental Protection Agency, Ireland.

PLATES

Plate 1 The River Barrow downstream of the River Figile confluence (Site 1) during September 2024.

Plate 2 The River Cushina at Site 3, September 2024.

Plate 3 The River Cushina at Site 4, September 2024.

Plate 4 The River Cushina at Site 5, September 2024.

Plate 5 Eutrophication at Site 6 on the River Figile, September 2024.

Plate 6 Drainage maintenance works on the River Cushina between Sites 4 and 5 (September 2021).

Plate 7 Electrical fishing survey at Site 6 on the River Figile, September 2024.

Plate 8 Brown trout (top), Dace (centre) and Roach from Site 1 The fish community at this site was dominated by coarse fish species. However, juvenile trout and salmon were also present.

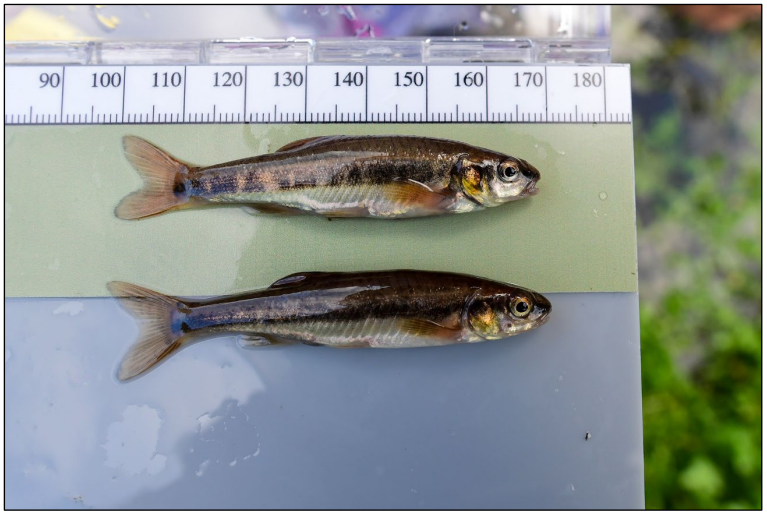

Plate 9 Minnows from the River Cushina at Site 3.

Plate 10 Juvenile Pike from the Site 6 on the River Figile, September 2024.

Plate 11 Stone Loach from the River Cushina at Site 5, September 2024.

Plate 12 Juvenile salmon (two age classes) from the River Cushina, at Site 5.

Plate 13 Pike (top), Dace (centre), and Gudgeon from Site 6 on the River Figile.

Plate 14 Juvenile Brook lampreys from at Site 6 on the River Figile.

Plate 15 Juvenile Brook lampreys from at Site 6 on the River Figile, September 2024.

APPENDIX 1 RESULTSI (2021-2024 SURVEYS)

Table A.1.1 General characteristics of the 6 survey sites.

Site	Watercourse Name	Wetted width (m)	Mean Depth (cm)	Max Depth (cm)	Instream vegetation (%)	Bank Height (m)
1	River Barrow	30	80	100+	20	3
2	River Figile	12	50	100+	30	3
3	River Cushina	8	40	80	35	1
4	River Cushina	5	40	70	90	2
5	River Cushina	4	35	60	50	2
6	River Figile	8	35	80	40	2

Table A.1.2 Flow and substrate characteristics of the 6 survey sites.

Site	Watercourse Name	Habitat	Riffle (%)	Glide (%)	Pool (%)	Rock (%)	Cobble (%)	Sand/Fine (%)
1	River Barrow	FW2	0	80	20	10	20	70
2	River Figile	FW2	0	80	20	20	30	50
3	River Cushina	FW2	10	70	20	20	60	20
4	River Cushina	FW2	0	100	0	0	0	100
5	River Cushina	FW2	10	80	10	30	30	40
6	River Figile	FW2	10	90	0	40	40	20

Table A.1.3 Results of the River Corridor Survey (RHS) Assessments at the 6 survey sites.

Site	EPA Code	Drained (Y/N)	Habitat	Gradient (Low/Med/High)	Siltation (Heavy/Moderate/Normal/Free)	Filamentous algae (Y/N)	Eroding Banks (Y/N)
1	14B01	Y	FW2	L	M	Y	N
2	14F01	Y	FW2	L	M	Y	N
3	14C04	Y	FW2	L	M	Y	N
4	14C04	Y	FW2	L	M	Y	N
5	14C04	Y	FW2	L	M	Y	N
6	14F01	Y	FW2	L	M	Y	N

Table A.1.4 Results of the aquatic ecology habitat assessments at the 6 survey sites.

Site	Watercourse Name	Salmonid Nursery(Y/N)	Salmonid Fishery (Y/N)	Coarse Nursery (Y/N)	Coarse Fishery (Y/N)	Salmon (P/A)	Trout (P/A)	Coarse Fish (P/A)	Eel (P/A)	Lamprey Habitat (P/A)	Lamprey (Y/N)	Crayfish (P/A)	FWPM (P/A)
1	River Barrow	N	N	Y	Y	A	P	P	A	P	Y	A*	A
2	River Figile	N	N	Y	N	P	P	P	A	P	Y	A*	A
3	River Cushina	N	N	Y	N	A	P	P	A	P	Y	A	A
4	River Cushina	N	N	Y	N	A	A	P	A	P	A	A	A
5	River Cushina	Y	N	Y	N	P	P	P	A	P	Y	A	A
6	River Figile	Y	N	Y	N	P	P	P	P	P	Y	A*	A

Y = Yes, N= No, P = Present, A = Absent, L = not recorded but likely to occur in the waterbody

A.1.5 Biological water quality and WFD status at the 6 aquatic survey sites (2024 results).

Site	Watercourse Name	EPA Code	EPA Q Value	Ecofact Q Value	WFD Status	WFD Waterbody Status
1	River Barrow	14B01	Q4	Q3-4	Moderate	Good
2	River Figile	14F01	-	Q3	Poor	-
3	River Cushina	14C04	-	Q3	Poor	-
4	River Cushina	14C04	-	Q3	Poor	-
5	River Cushina	14C04	Q4	Q3-4	Moderate	Good
6	River Figile	14F01	Q3-4	Q3-4	Moderate	Moderate

Table A.1.6 Native species abundance recorded at the 6 survey sites (summary of 2021-2024 results).

Site	Watercourse Name	Salmon	Brown Trout	Eel	Brook Lamprey	Three-spined stickleback
1	River Barrow		*		*	
2	River Figile	*	*		**	
3	River Cushina		*		**	
4	River Cushina					
5	River Cushina	*	*		*	
6	River Figile	**	*	**	*	

*Present, **Small Numbers, ***Common, ****Numerous

Table A.1.7 Non-native species abundance recorded at the 6 survey sites (summary of 2021-2024 results).

Site	Watercourse Name	Minnow	Stone Loach	Dace	Roach	Pike	Perch	Gudgeon
1	River Barrow	***	*	***	***	*	*	
2	River Figile	****	*	*	*	*		
3	River Cushina	**						
4	River Cushina	*						
5	River Cushina	**	***	**		*		
6	River Figile	***	*	**		*		**

*Present, **Small Numbers, ***Common, ****Numerous

Table A.1.8 Results of the 10-minute electrical fishing surveys at the 6 survey sites (CPUE fish/min). Results for native species the September 2024 survey.

Site	Watercourse Name	Salmon	Brown Trout	Eel	Three-spined stickleback
1	River Barrow	0.00	0.00	0.10	0.20
2	River Figile	0.00	0.00	0.00	0.00
3	River Cushina	0.00	0.00	0.00	0.60
4	River Cushina	0.00	0.00	0.00	0.50
5	River Cushina	0.60	0.40	0.00	0.50
6	River Figile	0.20	0.40	0.20	0.20

Table A.1.9 Results of the 10-minute electrical fishing surveys at the 6 survey sites (CPUE fish/min). Results for non-native species the September 2024 survey.

Site	Watercourse Name	Stone Loach	Dace	Roach	Pike	Perch	Gudgeon
1	River Barrow	0.00	0.60	0.20	0.00	0.00	0.00
2	River Figile	0.00	1.00	0.20	0.10	0.00	0.00
3	River Cushina	0.00	0.00	1.30	0.00	0.00	0.00
4	River Cushina	0.00	0.00	1.20	0.00	0.00	0.00
5	River Cushina	0.20	0.60	0.00	0.10	0.00	0.00
6	River Figile	0.10	0.80	1.00	0.20	0.10	0.40

Table A.1.10 Results of the 3-minute lamprey surveys at the 6 survey sites (CPUE fish/min). Results for the September 2024 survey.

Site	Watercourse Name	Potential lamprey nursery habitat present (Y/N)	Potential lamprey Spawning habitat present (Y/N)	CPUE
1	River Barrow	Y	N	1.67
2	River Figile	Y	N	0.00
3	River Cushina	Y	N	1.33
4	River Cushina	Y	N	0.00
5	River Cushina	Y	Y	3.00
6	River Figile	Y	Y	2.67

Table A.1.11 Results of the 5-minute electrical fishing surveys at the 6 survey sites (CPUE fish/min). Results for the September 2021 survey.

Site	Watercourse Name	Salmon	Brown Trout	Eel	Minnow	Three-spined stickleback	Stone Loach	Dace	Roach	Pike	Perch
1	River Barrow	0.00	0.20	0.00	0.00	3.00	1.00	0.20	1.20	2.00	0.20
2	River Figile	0.40	0.40	0.00	0.00	4.00	2.00	0.20	0.20	0.20	0.40
3	River Cushina	0.00	0.20	0.00	0.00	3.00	1.00	0.00	0.00	0.00	0.00
4	River Cushina	0.00	0.00	0.00	0.00	1.00	0.20	0.00	0.00	0.00	0.00
5	River Cushina	0.60	1.00	0.00	0.00	4.00	0.80	0.40	0.80	0.00	0.20
6	River Figile	0.80	0.60	0.80	0.80	3.00	2.80	0.20	0.60	0.00	0.20

*Present, **Small Numbers, ***Common, ****Numerous

Table A.1.12 Results of the 3-minute lamprey surveys at the 6 survey sites (CPUE fish/min). Results for the September 2021 survey.

Site	Watercourse Name	Potential lamprey habitat present (Y/N)	Brook Lamprey	CPUE
1	River Barrow	Y	3	1.00
2	River Figile	Y	5	1.67
3	River Cushina	Y	8	2.67
4	River Cushina	Y	0	0.00
5	River Cushina	Y	6	2.00
6	River Figile	Y	3	1.00