



GALETECH
ENERGY SERVICES

Islandmore Wind Farm

Environmental Impact Assessment
Report

Annex 5.12: Aquatic Ecology
Baseline

Islandmore Wind Farm Limited

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5.1 INTRODUCTION

Islandmore Wind Farm Limited ('the Developer') has commissioned Galetech Energy Services (GES) to manage the preparation of an Environmental Impact Assessment Report (EIAR) for the proposed Islandmore Wind Farm ('the project') in County Roscommon. APEM Group Woodrow has been commissioned by GES to prepare a technical appendix which presents the baseline data for aquatic ecology, to accompany Chapter 5 (Biodiversity) of the Environmental Impact Assessment Report (EIAR).

5.2 METHODOLOGY

5.2.1 DESKTOP SURVEYS

A desktop survey was undertaken to gather information on the likely occurrence of species and habitats in the general area prior to the site visits so that a targeted approach to surveying could be undertaken. Information was gathered online from a variety of sources including the National Biodiversity Data Centre (NBDC), National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), and Inland Fisheries Ireland (IFI) online databases. The following databases were used:-

- NBDC online map viewer and datasets¹;
- EPA online map viewer and datasets²;
- NPWS Map Viewer³;
- NPWS site synopses⁴;
- Invasive Species Ireland⁵;
- Geological Survey of Ireland (GSI) online mapping⁶; and,
- Inland Fisheries Ireland - Water Framework Directive (WFD) Rivers Fish Ecological Status 2008 to recent⁷.

Records for important and protected species within proximity of the study area were obtained from the NBDC online database. This incorporates a number of databases for Ireland. The NPWS Article 17 datasets for Annex I habitats were downloaded from the NPWS website and reviewed. These datasets document Annex I habitats within the project site, should they occur. Additionally, a data request was submitted to NPWS to gather records for protected species from sites which may be hydrologically connected to the site.

The study area falls within two 10-km grid squares (G60 and M69) and five 2km grid squares (G60F, M69E, M69J, M69D and M69I).

The aquatic desk study found no known records of freshwater pearl mussel (*Margaritifera margaritifera*) in the Owengarve River or Lung River. There are three

¹ <https://maps.biodiversityireland.ie>

² <https://gis.epa.ie/EPAMaps/>

³ <https://experience.arcgis.com/experience/edf34d92e28040fd87d3d14f55d8d95f>

⁴ <https://www.npws.ie/protected-sites>

⁵ <http://www.invasivespeciesireland.com/>

⁶ <https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228>

⁷ <https://data.gov.ie/dataset/water-framework-directive-rivers-fish-ecological-status-2008-to-recent>

freshwater pearl mussel sensitive areas within the Moy and Killala Bay catchment; these are the Moy – Deel, the Moy and the Moy – Tobergal. These three areas are classified as areas with 'other extant populations'⁸. The closest distance from the project to a mussel sensitive area is 20km, connected hydrologically upstream of a confluence. The project does not occur in an SAC which cites freshwater pearl mussel as a conservation objective.

According to Article 17 reporting (NPWS, 2019), the reported range for white-clawed crayfish (*Austropotamobius pallipes*) includes the Owengarve River, with a known historical distribution in its lower reaches, as well as the Moy Killala catchment. Additionally, NBDC data from 2022, showed that white-clawed crayfish were previously recorded in the Moy Killala catchment approximately 22km downstream of the project. The upstream reaches were considered largely unsuitable for the species due to their variable depths and flows. However, the presence of this species in the Moy Killala catchment suggests potential for its occurrence in the downstream reaches of the Owengarve River, where conditions provide greater suitability (e.g. fully submerged refuges such as boulders and undercut banks).

NBDC data from 2021 showed that white-clawed crayfish were recorded in the Upper Shannon catchment in close proximity to the project site, having been previously observed in the main channel of the Lung River, near Ballaghaderren. Additional data from 2006 also showed white-clawed crayfish occurring in a tributary of the Lung River.

A confirmed case of crayfish plague, caused by the water mould *Aphanomyces astaci*, occurred in the Moy Killala catchment in 2020 and 2021 (Brady et al, 2024), approximately 23km downstream of the study area. However, samples taken in 2017 from the Owengarve River have tested negative for plague. A confirmed case of crayfish plague also occurred in the Upper Shannon catchment in 2021 (Brady et al, 2024). The record was on the main Lung River, which has the potential to spread upstream to the tributaries.

5.2.2 FIELD SURVEYS

Aquatic surveys were conducted in September (25th and 26th) and October (10th and 11th) 2024 and May (6th and 7th) 2025. Surveys were conducted in the catchments of the Owengarve River [EPA code: 34O03] and the Lung River [EPA code: 26L03], which flow to the northwest and south, respectively, of the project.

The aquatic study area was defined as watercourses which drain into the main Owengarve River, as well as the Lung River. Both river sub basins form parts of separate catchments, with the Owengarve draining into the Moy Killala Bay catchment in the west, and the Lung draining into the Upper Shannon catchment in the east (**Figure 1**). Upon initial assessment, some areas in the upper reaches were deemed to have limited ecological viability. Subsequently, the study area was extended to reflect the existing ecological baseline of the Owengarve River and Lung River and to assess indirect downstream impacts arising from surface runoff carried by the watercourses draining the site (e.g. sedimentation, nutrient enrichment, acidification).

A total of eleven survey sites (n = 11) were selected, five of which were located in the Owengarve River catchment, and six were located in the Lung River catchment (see **Figure 1**). No upstream survey site representing a 'reference' survey site could be

⁸ <https://www.npws.ie/maps-and-data/habitat-and-species-data>

selected due to the project influencing all headwaters in the immediate vicinity. Q-value assessments (i.e. benthic macroinvertebrate surveys), which are detailed below, along with *in situ* measurements of basic water quality (WQ) parameters were conducted at seven of the survey locations. An outline of surveys undertaken at each site is listed in **Table 1**.

In view of historical records of white-clawed crayfish in both catchments, two downstream survey sites were assessed in each catchment for crayfish presence/absence. Licences were secured from NPWS prior to the commencement of these surveys in the Owengarve catchment (Licence No. C165/2024), and in the Lung catchment (Licence No. C80/2025), which permitted survey, trapping, capture and release.

Finally, to ascertain a representative depiction of the range of fish habitat in the Owengarve River and Lung River, six survey sites were also assessed for fish habitat suitability. Particular cognisance was given to the detection of habitats considered suitable for salmonids (i.e. Atlantic salmon and brown trout) and lamprey. An outline of the requirements for suitable fish habitat are detailed in **Tables 2 and 3**, while the location of the fish habitat surveys is shown in **Figure 1**.

Site	Macroinvertebrate Sample (Survey Reference)	Water Quality Laboratory Sample (Survey Reference)	White-clawed Crayfish Survey (Survey Reference)	Fish Habitat Survey (Survey Reference)
1	✓ (MWQ1)	✓ (MWQ1)		✓ (FH1)
2	✓ (MWQ2)	✓ (MWQ2)		✓ (FH2)
3	✓ (MWQ3)	✓ (MWQ3)		✓ (FH3)
4	✓ (MWQ4)	✓ (MWQ4)		
5	✓ (MWQ5)	✓ (MWQ5)		
6	✓ (MWQ6)	✓ (MWQ6)		✓ (FH4)
7	✓ (MWQ7)	✓ (MWQ7)		
8			✓ (WCC1)	
9			✓ (WCC2)	✓ (FH5)
10			✓ (WCC3)	
11			✓ (WCC4)	✓ (FH6)

Table 1: List of Survey Types Undertaken

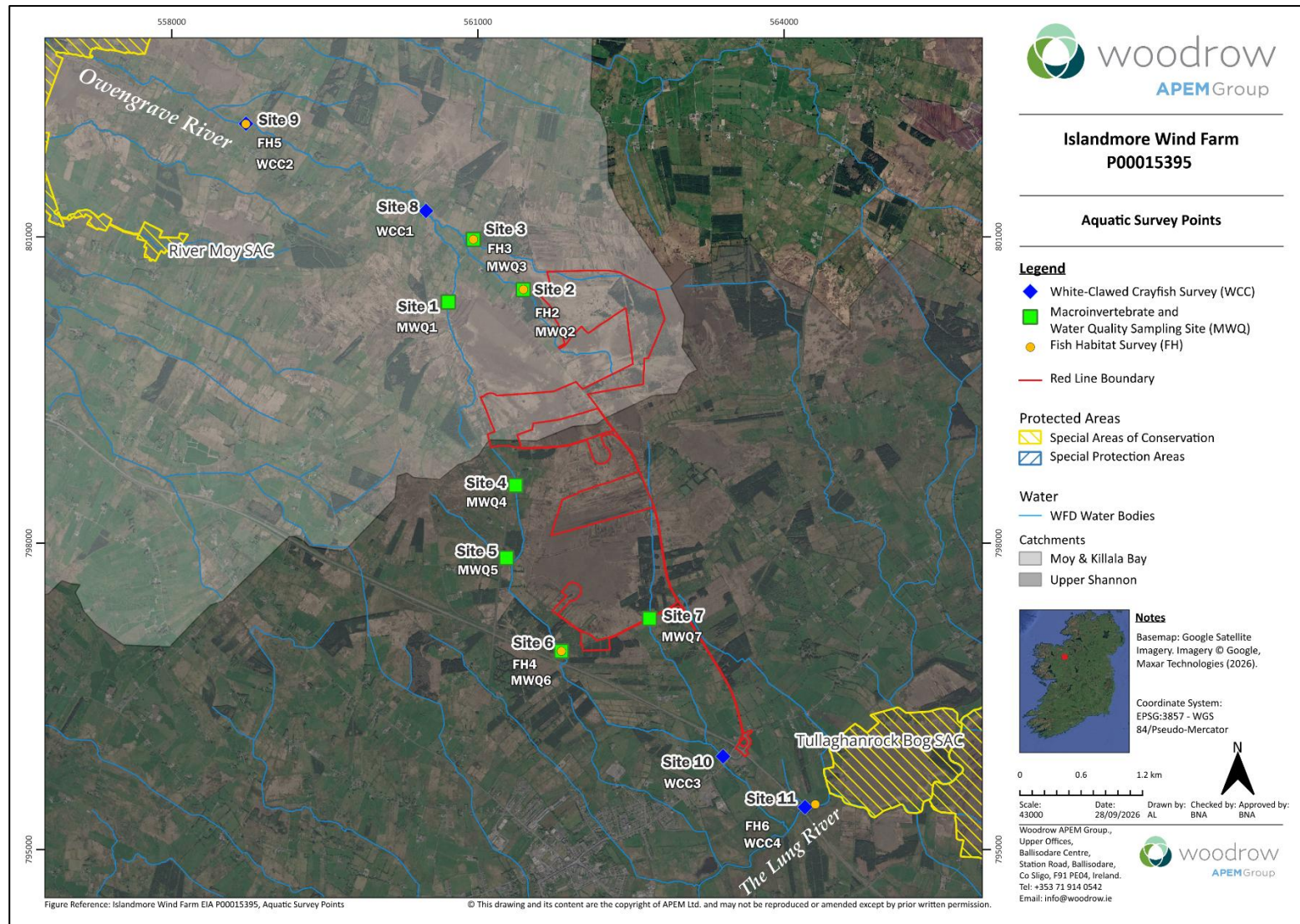


Figure 1: Aquatic Survey Site Locations, in relation to the Project Site and Designated Sites

5.2.3 BENTHIC MACROINVERTEBRATE SURVEYS

In Ireland, benthic macroinvertebrates are the main Biological Quality Element (BQE) determining the ecological status in rivers (required by the Water Framework Directive (WFD) 2000/60/EC) and are based on the Q-value. Q-value assessments were conducted at seven survey sites located in the upper parts of the Owengarve River (MWQ1 – 3) and Lung River catchments (MWQ4-7; see **Figure 1** and **Table 1**). Biological scoring was undertaken by adopting the sampling method currently employed by the EPA (Toner et al., 2005). To survey benthic macroinvertebrates, a handheld pond net (1mm mesh size) was used to collect a two-minute multi-habitat kick sample, followed by a one-minute stonewash where possible. Live macroinvertebrate samples were assessed in the field, where they were assigned to the lowest taxonomic resolution required for scoring, and their categorical relative abundance determined using approximate counts (Feeley et al., 2020). An EPA Q-value classification was assigned to each site. Q-values were assigned based on the presence and relative abundance of sensitive groups and the consideration of additional qualifying criteria, as described by Toner et al. (2005) and outlined in more detail in **Appendix I**.

5.2.4 WATER QUALITY SAMPLING

Basic water quality parameters were measured on a single occasion at each of the seven sites using an AP-2000 Water Monitoring Probe to provide a baseline profile of water chemistry in the sections of river assessed. Parameters measured included temperature (°C), pH, DO (% and mg/L), conductivity (µS/cm) and turbidity (NTU).

Water samples were collected in 1-litre pre-sterilised sampling bottles and rinsed with river water before the sample was taken. Water samples were taken from just below the surface, ensuring that the riverbed was not disturbed during sampling. Once sample bottles were filled, they were transported to an accredited laboratory for analysis within the recommended holding time for the selected water quality parameters. The results are provided in **Table 4**.

5.2.5 FRESHWATER PEARL MUSSEL SURVEYS

A broad appraisal/overview of the upstream and downstream habitat at each aquatic survey site was undertaken to evaluate the potential for Freshwater Pearl Mussel to be present within the survey area. A visual assessment of the general riverine habitat, topography, gradient, substrate and surrounding habitat was undertaken in relation to habitat requirements of this species.

5.2.6 WHITE-CLAWED CRAYFISH SURVEYS

In order to ascertain the possibility of white-clawed crayfish occurring within the study area, a qualitative assessment (i.e. presence/absence) was carried out at two sites on a downstream section of the Owengarve River (WCC1 and WCC2) and two survey sites on the Lung river and tributary (WCC3 and WCC4; see **Figure 1** and **Table 1**).

A trapping survey was undertaken using two strings of four trappy funnel crayfish traps that were baited with approx. 40g of Atlantic mackerel (*Scomber scombrus*). These were laid out and left to soak overnight in areas of suitable habitat. Traps were spaced approximately 4m apart and laid parallel to the riverbank. Each end of the string was secured to the riverbank in order to prevent the traps from being moved. Traps were checked for crayfish the following morning.

Sweep netting and hand-searching (following Reynolds et al., 2010) was utilised at survey sites to detect both adult and juvenile crayfish. Sweep netting involves the sampling of more stable refugia such as boulder and cobble accumulations, in addition to macrophyte beds and other potential habitat such as tree root systems. A second operator (with sweep net) was present to capture escape-swimming crayfish observed following the initial sweep or refuge search/ hand search.

5.2.7 FISH HABITAT SURVEYS

Walkover habitat surveys were conducted at six separate locations along the Owengarve River (see **Figure 1** and **Table 1**) on 25 and 26 September. The river flow at the time of survey was moderate and the instream habitat remained largely visible.

The methodology applied to the habitat survey follows that outlined by Hendry & Cragg-Hine (1997). The riverbank was walked, noting habitat features in the river channel and drawing these directly onto a map using a field tablet, with the boundaries of the different habitat classifications being drawn to represent their actual position within the river. Prominent features, such as log jams, macrophyte beds, weirs and bridges, were noted and their locations confirmed. This allowed for an exact representation of the areas of individual habitat types that were encountered. In this manner, a mosaic of the different habitat types was drawn along the whole section of the river. The drawings of the habitat types along the section of the river were subsequently digitised using QGIS.

5.2.7.1 Salmonid Habitat Assessment

The principal instream physical habitat variables that determine suitability for juvenile salmonids are water depth, water velocity, streambed substratum and cover (Heggenes, 1990). The habitat types and their descriptions are outlined in **Table 2** and were recorded, where present, during the survey.

Habitat Type	Description
Spawning Gravel	Ideally stable but not compacted, with a mean grain size of 25 mm or less for trout, but up to 80 mm for salmon. 'Fines' (< 2 mm grain size) to be less than 20% by weight.
Fry (0+) habitat	Shallow, < 20 cm deep, fast flowing (> 30 cm/s), with surface turbulence and a gravel and cobble substrate
Parr (>1+) habitat	20 - 30 cm deep, fast flowing (>30 cm/s), surface turbulent, with gravel/cobble / boulder substrate.
Riffles	Shallow (< 30 cm deep), fast-flowing (> 50 cm/s), surface turbulent, gravel/cobble / boulder substrate.
Glides	= or > 30 cm deep, moderate velocity in the range 10-30 cm/sec, surface smooth and unbroken, relatively even substrate of cobbles with finer material
Pools	= or > 40 cm deep, slow flowing (< 10 cm/s), surface unbroken, substrate with a high proportion of sand and silt.

Table 2: Habitat Classification System for Salmonids

In addition to the habitats listed in **Table 2**, other features within the study sites were noted including:-

- The existence of physical barriers to fish migration which are graded 1-3 (G1 being impassable at Q90 flow conditions and G3 passable under Q90 flow conditions);

- Areas of excessive erosion which could cause siltation of spawning habitat- e.g., areas where cattle enter the river;
- Anthropogenic alterations to the channel which could affect fish migration;
- Areas which could cause difficulties for migrating or spawning individuals during periods of low water levels (e.g., shallow areas near weirs, spawning gravels etc.); and,
- Locations where branches cross the entire channel giving rise to tunnel vegetation.

5.2.7.2 Lamprey Habitat Assessment

The guidance published in JNCC (2015) was applied to lamprey habitat assessments. The approach followed Natura 2000 guidance for the monitoring of river, brook and sea lamprey (*Lampetra fluviatilis*, *Lampetra planeri* and *Petromyzon marinus*; Harvey and Cowx 2003) and included assessment of habitats using visual mapping of substrates suitable for adult and Juvenile lamprey (Maitland 2003). The habitats suitable for lamprey spawning and larval lamprey (ammocoetes) are outlined in **Table 3** and were recorded, where present, during the survey.

Species / Life stage	Habitat Description
<i>Lampetra</i> spp. spawning	Areas of small stones and gravel in flowing water
<i>Petromyzon marinus</i> spawning	Flowing shallow water amid gravel
<i>Lampetra</i> spp. ammocoetes	Stable fine sediment or sand > 15 cm deep, low water velocity and the presence of organic detritus
<i>Petromyzon marinus</i> ammocoetes	Non-marginal (open channel) sites of >1.5 m depth featuring fine sand and silt accumulations; lower velocity areas of pools and glide habitat

Table 3: Definitions of Ecologically Functional Habitat Types for Lamprey (based on Maitland 2003; Harvey & Cowx 2003; Teague et al. 2012)

5.2.8 BIOSECURITY

All survey work was carried out in line with the IFI (2010) Biosecurity Protocol for Field Survey Work, which involved dipping and rinsing sampling equipment (e.g. pond nets) in a 1% solution of Virkon™ Aquatic, inspecting footwear and personal protective equipment (PPE) for debris or vegetation prior to leaving a site, and cleaning footwear and PPE with Virkon.

5.3 BASELINE ECOLOGICAL CONDITION

The following section describes the existing ecological baseline, i.e. the survey results, within the study area, following the desk study and field surveys undertaken according to the methodology outlined in the previous section (**Section 5.2**).

The baseline aquatic ecology for the study area is outlined below. A map of the existing aquatic environment relative to the project is provided in **Figure 1**, which can be cross-referenced with the list of survey types undertaken (**Table 1**), water quality assessment results (see **Table 4**) and fish habitat survey maps (**Appendix II**). Images of the survey sites are shown in **Appendix III**.

5.3.1 BENTHIC MACROINVERTEBRATE SURVEYS

Q-value results, outlined in **Table 4**, show that survey sites along the Owengarve River scored a Q3-4 ('Slightly Polluted'), indicating Moderate WFD status. The most recent WFD assessment, carried out in 2025 by the EPA, resulted in a Good WFD status for this section of river (Owengarve (Sligo)_010), previously recorded as High WFD status by the EPA in 2022.

The results of the Q value assessments in the Lung river survey sites ranged from Q3-4 ('Slightly polluted') to Q4 ('Unpolluted'). The most recent WFD assessments completed by the EPA in 2023, resulted in Good WFD status for this section of river (Lung_050). It should be noted that there is an urban wastewater treatment plant discharging primary effluent to the Lung river approximately 1km upstream of the confluence of the tributary that was surveyed.

A total of 16 macroinvertebrate taxa were recorded within the study area (see **Appendix I** for a full list of taxa), with 4-13 taxa per site. Macroinvertebrates were grouped according to their sensitivity to organic pollution: Group A=Sensitive; Group B=Less Sensitive; Group C=Tolerant; Group D=Very Tolerant; Group E=Most Tolerant (Toner et al., 2005). The majority of survey sites were dominated by Group C (tolerant) taxa, while Group A (pollution-sensitive) taxa were present in all but one kick samples assessed (Site 1).

The Q-value results provided, together with the basic water quality parameters obtained, suggest that these water bodies are affected by slight levels of pollution. Altered channel morphology at Site1, resulting in mesohabitat dominated by a depositing glide, may explain the lack of Group A taxa. The Q-value results suggest slight pollution, potentially reflecting pressures associated with surrounding land uses including agriculture, commercial forestry and turbary.

Channel substrate was made up of cobble and coarse gravel for the majority of sites, which is expected for eroding upland channels. Instream habitats consisted of run, riffle and glide habitat, while instream vegetation was sparse. Riparian vegetation consisted of heather and some sections of coniferous forestry. The adjacent land-use was forestry, turbary and agriculture with improved grassland habitat.

Survey Site	1	2	3	4	5	6	7
Date surveyed	26/09/24	25/09/24	26/09/24	26/09/24	10/10/24	10/10/24	25/9/24
River	Owengarve	Owengarve	Owengarve	Lung	Lung	Lung	Lung
Stream order	1 st Order	1 st Order	1 st Order	1 st Order	1 st Order	2 nd Order	1 st Order
EPA code	34O03	34O03	34O03	26L03	26L03	26L03	26L03
Q-Value	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4	Q4	Q3-4
WFD Quality Class	B	B	B	B	B	A	C
WFD Quality Status	Moderate	Moderate	Moderate	Moderate	Moderate	Good	Moderate
Temp °C	10.7	10.7	10.5	10.3	9.9	9.4	12.25
pH	8.5	7.3	8.0	8.7	8.3	8.5	7.9
Dissolved O ₂ %	64.2	79.8	71.5	80.2	73.1	89.5	93.1
Dissolved O ₂ mg/L	6.89	8.55	7.70	8.68	8.17	10.13	9.6
Conductivity µS/cm	197	240	124	268	123	112	239
Turbidity NTU	0	0	0	0	0	0	0
Total Suspended Solids (TSS) (mg/l)	<2	<2	<2	37	<2	2	2
Ammonia (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (mg/l)	0.8	1.1	1	1.2	0.9	0.7	1.2
Nitrite (mg/l)	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.002
Orthophosphate (mg/l)	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total TPH >C6-C40 (µg/l)	28.00	131.00	31.00	27.00	<10	51.00	54.00

Table 4: Water Quality Results: Q-values, WFD Status and In-situ Water Quality Parameters

5.3.2 WATER QUALITY

Dissolved oxygen was above 6mg/L at all sites and almost all occasions, although the overall saturation was below the required 80% (Department of Environment, 1988) at four of the sites, particularly in the Owengarve river catchment. Nutrient concentrations were generally low, and within acceptable levels, with orthophosphate below the limit of detection at almost all sites.

Pollution indicators were generally within acceptable ranges, although several high total petroleum hydrocarbon (TPH) readings were recorded. TPH is an indicator of contaminants such as oil-based fuels; however, in this case all readings were defined as 'Unknown Pattern', indicating the presence of naturally forming hydrocarbons in the sample that cannot be attributed to a hydrocarbon with a known 'fingerprint' such as diesel or kerosene. Therefore, they are assumed to be natural derivatives of the peat in the catchment.

All sites had low suspended solids concentrations on all occasions, apart from Site 4 where a high 37mg/L was recorded in October 2024. The elevated TSS measurement may be attributable to high-flow conditions associated with recent rainfall at the time of sampling.

In summary, therefore, water quality is considered to be generally good in the catchments, although with evidence of some issues which, although individually short term, may have a cumulative impact on the catchment.

5.3.3 FRESHWATER PEARL MUSSEL

Based on the general riverine habitat, topography, gradient, substrate and surrounding habitat, the potential for this species to be present was poor at all survey sites. Therefore, no freshwater pearl mussel survey was carried out within the streams of the project site, and it can be assumed that there is no likely impact on this species as a consequence of the project.

Salmonid fish play a part in the life cycle of freshwater pearl mussels. The streams within the project site do not hold suitable habitat for salmonids due to the steep gradient, poor spawning habitat and lack of nursery habitats. There is an absence of the sandy, gravelly substrate, which is needed by both the juvenile pearl mussel to develop, but also the salmonids to spawn.

Generally freshwater pearl mussels are found in the upper, narrower parts of the river catchment, often with a stream order of 2–4 with little sediment deposition. In the smallest watercourses, there is a risk of drying out or bottom freezing, and consequently mussels are seldom found. The watercourses that flow through the project site are of stream order 1-2 and these streams may be prone to drying out in summer months.

Freshwater Pearl Mussels require a substrate that is stable. The site must also be a fast-flowing area without too much sedimentation, with sufficiently low water temperatures. Areas with major sedimentation of silt do not contain freshwater pearl mussels.

5.3.4 WHITE-CLAWED CRAYFISH SURVEYS

No crayfish were recovered during the baited trap surveys in the Owengarve River, nor were there any signs of crayfish predation along the riverbanks (e.g. in otter spraint). Habitat in the lower reaches of the Owengarve River is considered suitable

for white-clawed crayfish, containing firm substrate with sufficient refuges present in the form of boulders/cobbles and crevices in overhanging banks.

One adult crayfish was visually observed at Site 6 during hand searches, although it was not captured. There were no crayfish recovered during the baited trap surveys in the Lung River. Habitat in the Lung River tributary is also considered suitable for white-clawed crayfish.

5.3.5 FISH AND FISH HABITAT SURVEYS

Fish species with potential to occur in the study area were determined through pre-existing fisheries data, obtained from the WFD Rivers Fish Ecological Status 2008 to recent layer. This shows fish distribution and WFD fish ecological status for a section of the Moy River. This is the nearest location with fisheries data, situated approximately 30km downstream of the study area. These records provide an indication of species assemblages within the wider catchment but are not necessarily representative of the headwater streams within the study area. The most recent surveys concerning this section of the Moy were completed in 2010. The survey site was assigned Good Fish Ecological Status, and the species recorded at each site are presented in **Table 5**. Although not observed in these surveys, additional fish species such as lamprey, are assumed capable of using the full Moy system.

Records available for lamprey species in the Moy Killala catchment showed that larval *Lampetra* spp. were present at index sites approximately 20km downstream of the study area in 2021 (Gallagher et al., 2022).

Regarding the Upper Shannon catchment fish distribution and WFD fish ecological status, the closest site with data is Lough Gara, approximately 5 km downstream of study area, with a second site approximately 30 km downstream, close to where the Upper Shannon meets Lough Eidín. The most recent surveys concerning these sections of the Upper Shannon were completed in 2015 and 2022 respectively. Both survey sites were assigned Moderate status, and the species recorded at each site are presented in **Table 5**. Although not observed in these surveys, additional fish species, such as lamprey, are assumed capable of using the full Upper Shannon system. Atlantic salmon are considered highly unlikely to be found in this part of the catchment due to connectivity issues downstream (i.e. Ardnacrusha).

The fish habitat surveys placed particular emphasis on the river's suitability to support salmonids and lamprey. The sections surveyed in the Owengarve River (**Appendix II**) were approximately 250m long and ranged from approximately 1- 3.5m wide. The channels were sparsely vegetated instream with occasional occurrence of bryophytes and *Callitriche* sp. Shading was occasional and provided by hawthorn (*Crataegus monogyna*) and willow (*Salix* sp.), with the riparian vegetation consisting of nettle (*Urtica dioica*), bramble (*Rubus fruticosus*) and tall herbs.

Survey site 1 (FH1) had little value as salmonid habitat due to its upland, low-energy nature. Lamprey spawning and nursery habitat was absent. The substrata were largely bedded in peat and, as such, there was little spawning value for salmonids. Fish access was good given the low-elevation and absence of migratory barriers. Overall, the site was considered to have limited suitability for resident fish and may support migratory European eel at low densities.

Survey site 2 (FH2) had low fisheries value due to the upland and small nature of the channel which flowed over a relatively moderate gradient. Spawning and nursery habitat was impacted by siltation and bedded gravels due to adjacent peat and

forestry influences. There was limited holding habitat given the low-energy flows. No suitable lamprey spawning or ammocoete habitat was identified within the surveyed reaches. There were no accessibility issues for salmonids from downstream given moderate gradients. Overall, the site was not considered suitable for resident fish.

Survey site 3 (FH3) had low fisheries value due to upland and small nature of the channel. As with sites 1 and 2 (connecting watercourse), spawning and nursery habitat was impacted by siltation and bedded gravels due to adjacent peat and forestry influences. There was limited holding habitat given the low-energy flows. No suitable lamprey spawning or ammocoete habitat was identified within the surveyed reach.

Survey site 6 (FH4) is located on tributary of the Lung River. The stream was 2-3m wide with an average depth of 0.25m. The stream flowed over a moderate gradient with shallow valley sides. The site had low fisheries value due to the upland and small nature of the channel. Spawning habitat was absent and there was limited holding habitat given the low-energy flows. No suitable lamprey spawning or ammocoete habitat was identified within the surveyed reach.

Survey site 9 (FH5) is located approximately 4 km downstream of site 3. The stream was 2.5-3.5m wide with an average depth of 0.3m. The stream flowed over a moderate gradient with shallow valley sides. The site had low fisheries value due to the upland and small nature of the channel. Spawning habitat was absent and there was limited holding habitat given the low-energy flows. No suitable lamprey spawning or ammocoete habitat was identified within the surveyed reach.

Survey site 11 (FH6) is located on the main channel of the Lung River. The river was 12m wide with an average depth of 1.5m. The river flowed over a low gradient and the channel was broadly U-shaped. The river retained a semi-natural profile flowing through agricultural grassland and the survey section featured deep glide habitat. Areas of emergent vegetation were present in marginal slacks. Holding habitat was good throughout the river with deep glide. The low energy of the channel resulted in accumulation of fines which were composed of silt and fine gravel. These areas were not considered deep or extensive enough to support lamprey ammocoetes. The site provided some good potential for European eel.

Overall, salmonid habitat was considered poor, due to the low gradient and slow flows. Much of the fish habitat was characterised by glide and riffle sections with very few mixed juvenile (fry/parr) habitats.

Lamprey habitat was poor across all survey sites in the study area. Suitable spawning habitat by way of finer, unbedded gravels for the creation of redds, and finer sediment (silt) accumulations suitable for larval (ammocoete) settlement were absent from all sites surveyed.

Overall, eel habitat quality was considered typically moderate given the general lack of deeper pools and accessible instream refugia. However, given the life history of European eels, even sub-optimal (e.g. drainage channel or high-energy) sites may be utilised by the species as seasonal migration routes (i.e. adult migration seawards, usually from September/October onwards).

While there is limited suitability in the areas assessed, these water bodies are likely to hold smaller fish and species such as minnow and three-spined stickleback and other coarse fish which are important components of the aquatic food web and for top level predators such as kingfisher (*Alcedo atthis*) and otter (*Lutra lutra*).

Fish species	Moy 2010 Survey – n = 1 sites	Upper Shannon Lough Gara 2015 Survey – n = 1 sites	Upper Shannon Lough Eidín 2022 Survey – n = 1 sites
Bream (<i>Abramis brama</i>)		✓	
Roach (<i>Rutilus rutilus</i>)	✓	✓	✓
Roach x bream hybrid		✓	
Gudgeon (<i>Gobio gobio</i>)			
Perch (<i>Perca fluviatilis</i>)	✓	✓	✓
Rudd (<i>Scardinius erythrophthalmus</i>)		✓	
Tench (<i>Tinca tinca</i>)		✓	
Pike (<i>Esox lucius</i>)			✓
Salmon (<i>Salmo salar</i>)	✓		
Sea trout (<i>Salmo trutta</i>)	✓		
Brown Trout (<i>Salmo trutta</i>)	✓	✓	
European eel (<i>Anguilla anguilla</i>)	✓	✓	
Minnow (<i>Phoxinus phoxinus</i>)	✓		
Three-spined stickleback (<i>Gasterosteus aculeatus</i>)	✓		

Table 5: Fish Species Recorded by IFI as part of WFD monitoring in Moy (2010) and Upper Shannon (2015 and 2022 respectively) catchments

5.4 DISCUSSION

Water quality within the two catchments surveyed was generally good, with oxygen concentrations above 6mg/L, albeit with relatively low levels of saturation. This may be at least partially due to the small size and deeply incised nature of these small headwater streams. Nutrient concentrations and pollution indicators generally suggested good quality.

Water quality assessments were, however, based on single readings at each location, whereas full assessments require a range of readings at different times of year. The macroinvertebrate surveys partially overcome this limitation as the extended lifespan of the organisms surveyed integrate water quality over several months. Macroinvertebrate surveys indicated Moderate ecological status (Q3-4) at the majority of sites surveyed. This suggests that there had been water quality issues previously or that they are intermittent. The macroinvertebrate dataset is from a single year and while it will integrate environmental conditions over the several months covered by the life cycles of the taxa recorded, it cannot give an indication of interannual variation. Where possible, therefore, it is always advisable to take repeat samples in multiple years.

Key ecological constraints that have been identified as a result of the surveys and that may be impacted by the proposed development are as follows:-

- Q-value assessments classified the section of the Owengarve River north of the project, as Moderate (Q3-4). Q value assessments in the Lung river tributaries ranged from Q3-4 (Moderate) to Q4 (Good);
- Evidence of White clawed crayfish presence was recorded during hand searches in tributary of the Lung river. While the lower reaches of the Owengarve River and Lung River tributaries provide some suitability for

crayfish, the upper reaches are considered largely unsuitable as a result of high water velocities, shallower depth and highly variable flows. Outbreaks of crayfish plague within the River Moy and Upper River Shannon catchments, may have spread upstream as far as the Owengarve and Lung Rivers, representing a potential pressure on local populations; and,

- There was limited habitat suitability for salmonid and lamprey species within the section of river assessed. According to IFI WFD data, no fish surveys have been conducted within 20 km of either the Owengarve or Lung River, and thus, there are no records of salmonid or lamprey species occurring within either river. However there are records of salmonids and lamprey larvae (ammocoetes) occurring downstream of the study area in the Moy catchment, at respective distances of 30km and 20km away. Conversely, there are no records of salmonids occurring at the IFI site 30 km downstream of Lung River. There is a NBDC record of brook lamprey occurring 25 km downstream of the Lung River.

REFERENCES

- Brady, D.J.; Meade, R.; Reynolds, J.D.; Vilcinskas, A.; Theissinger, K. (2024) The Crayfish Plague Pathogen *Aphanomyces astaci* in Ireland. *Microorganisms* 2024, 12, 102. <https://doi.org/10.3390/microorganisms12010102>
- Department of Environment (1988) *European Communities (Quality of Salmonid Waters) Regulations 1988*. Statutory Instrument No. 293 of 1988. Dublin: Department of Environment.
- Feeley, H.B., Bradley, C., Free, G., Kennedy, B., Little, R., McDonnell, N., Plant, C., Trodd, W., Wynne, C. & Boyle, S.O. (2020). A national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018. *Scientific Data*, 7(1), pp.1-9.
- Gallagher, T., O'Gorman, N.M., Rooney, S.M., Brett, A., and O'Leary, C. (2022). National Programme: Habitats Directive and Red Data Book Species Summary Report 2021. Inland Fisheries Ireland, 3044 Lake Drive, Citywest, Dublin 24, Ireland.
- Harvey, J.P. & Cowx I.G. (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
- Heggenes, J. (1990). Habitat utilization and preferences in juvenile Atlantic salmon (*Salmo salar*) in streams. *Regulated Rivers: Research & Management* 5, 341-354.
- Hendry K and Cragg-Hine D (1997). Restoration of riverine salmon habitats. Environment Agency Fisheries Technical Manual, 4.
- IFI (2010). IFI Biosecurity Protocol for Field Survey Work. Inland Fisheries Ireland, Dublin, Ireland.
- JNCC (2015). Common Standards Monitoring Guidance for Freshwater Fauna (2015). Joint Nature Conservation Committee, Peterborough.
- Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.
- NPWS (2019) The Status of EU Protected Habitat and Species in Ireland. Species Assessments, Volume 3: Species Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill. Department of Culture, Heritage, and the Gaeltacht. Accessed: 10 February 2025. Available: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol3_Species_Article17.pdf
- Teague, N., Webb, H., Allen, V., Cesar, C.P., Thomas, R. & Hatton-Ellis, T.W. (2012). Lamprey monitoring on the River Dee special area of conservation SAC 2011. CCW Science Report No. 975. Bangor: Countryside Council for Wales (CCW).
- Toner, P., Bowman, K., Clabby, K., Lucey, J., McGarrigle, M, Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MaCarthaigh, M., Craig, M., & Quinn, R. (2005). Water Quality in Ireland 2001-2003. Environmental Protection Agency, Wexford.

APPENDIX I - DESCRIPTION OF Q-VALUE ASSESSMENT AND TAXA LIST



Q-VALUE ASSESSMENT

The EPA Q-value classification is assigned based on the assessment of the macroinvertebrate sample, which involves recording the taxa present at a suitable and attainable taxonomic resolution (under field conditions) and their categorical relative abundance determined using approximate counts (as described in Feeley et al., 2020). From this, the number of taxa present and categorical relative abundance of sensitive (Group A), less sensitive (Group B), tolerant (Group C), very tolerant (Group D) and most tolerant (Group E) taxa to organic pollution are examined. Additional Qualifying Criteria are also considered, consisting of recording the abundance of *Cladophora* sp., Macrophytes, and slime growths/sewage fungus, as well as the Dissolved Oxygen Saturation % and the level of substratum siltation. Then, based on the combination of number and relative abundance of the sensitive or tolerant groups present, a Q-value is assigned. Details on the assignment of the scores can be found in Toner et al., (2005).

In Ireland, macroinvertebrates are the main Biological Quality Element (BQE) determining the ecological status in rivers (required by the Water Framework Directive; WFD) and are based on the Q-value. The WFD requires BQE scores to be expressed as an Ecological Quality Ratio (EQR) to standardize and provide a common scale of ecological quality across participatory Member States using differing national methods. Intercalibration of the Q-value with the EQR and the corresponding ecological status are described in the table below.

Q value Score	EQR	Pollution Gradient	WFD Ecological Status
Q5	1.0	Unpolluted	High
Q4-5	0.9	Unpolluted	High
Q4	0.8	Unpolluted	Good
Q3-4	0.7	Slightly Polluted	Moderate
Q3	0.6	Moderately Polluted	Poor
Q2-3	0.5	Moderately Polluted	Poor
Q2	0.4	Seriously Polluted	Bad
Q1-2	0.3	Seriously Polluted	Bad
Q1	0.2	Seriously Polluted	Bad

Group	Taxon	Indicator Group*	1	2	3	4	5	6	7
Ephemeroptera	Heptageniidae (<i>Heptagenia</i>)	A	-	-	3	2	5	-	6
Ephemeroptera	Heptageniidae (<i>Ecdyonurus</i>)	A	-	-	-	-	-	25	-
Ephemeroptera	Heptageniidae (<i>Rhithrogena</i>)	A	-	7	-	-	15	35	-
Plecoptera	Leuctra	B	-	-	1	-	4	2	-
Trichoptera	Limnephilidae	B	-	-	2	1	2	-	-
Odonata		B	2	-	-	-	-	-	-
Arachnida	Hydrachnida	C	-	-	-	-	-	6	-
Amphipoda	Gammaridae	C	5	11	5	4	5	10	16
Ephemeroptera	<i>Baetis rhodani/atlanticus</i>	C	4	-	-	1	10	10	-
Trichoptera	Philopotamidae	C	-	-	3	2	1	20	1
Trichoptera	Polycentropodidae	C	-	2	-	-	1	-	-
Trichoptera	Rhyacophilidae	C	-	-	-	-	1	2	-
Coleoptera	Elmidae	C	-	-	1	2	5	2	-
Diptera	Chironomidae (non- <i>Chironomus</i> spp.)	C	1	-	1	1	-	1	2
Diptera	Limoniidae	C	-	-	-	-	4	-	-
Diptera	Pediciidae	C	1	3	-	1	6	2	-
Diptera	Simuliidae	C	-	-	-	-	10	5	-
Oligochaeta		D	2	-	2	1	1	1	3
Taxon Richness			6	4	8	9	13	12	5
Total Abundance			15	23	18	15	70	117	28

APPENDIX II – FISH HABITAT SURVEY MAPS



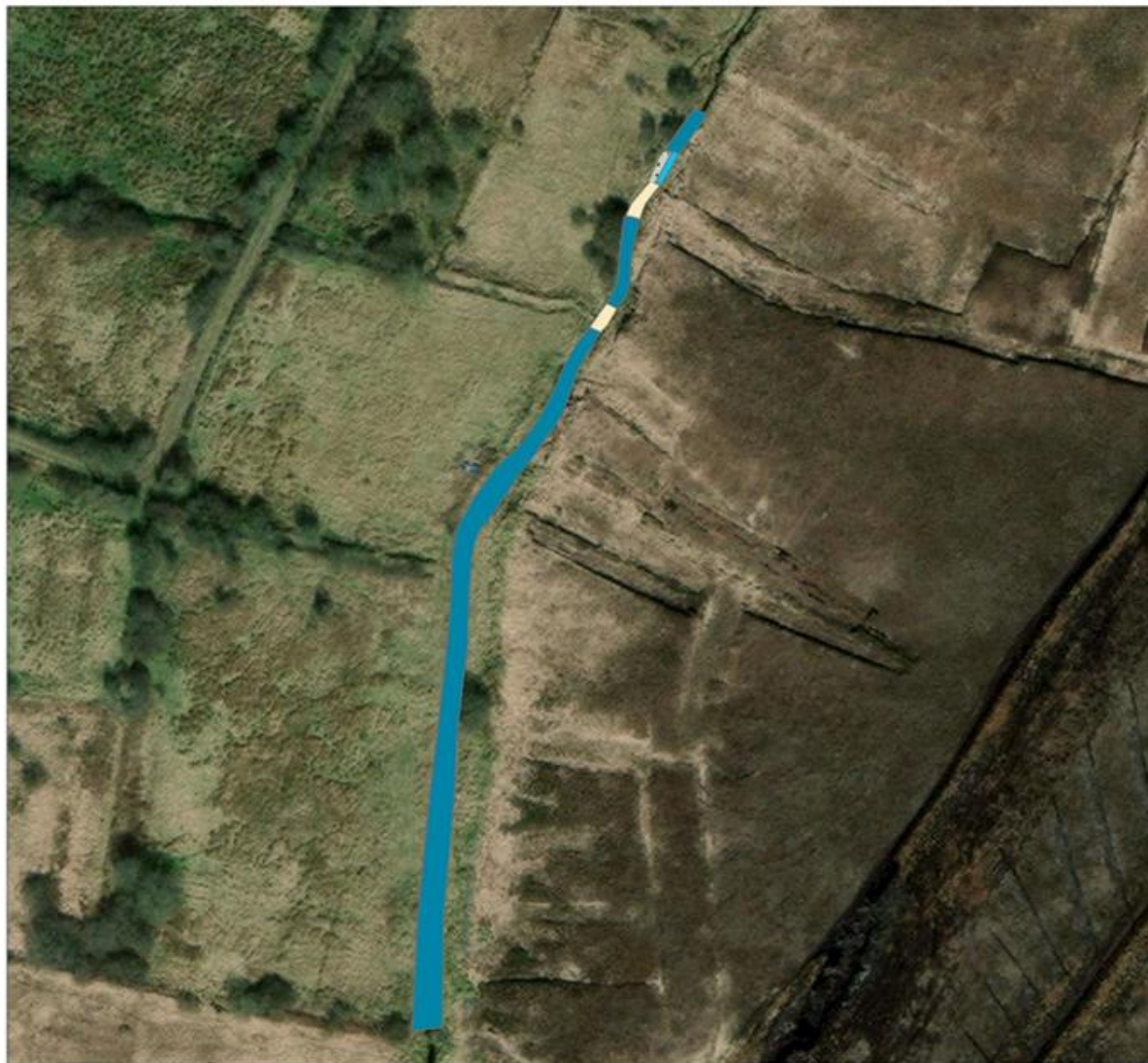


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Site Name
Islandmore Wind Farm

Figure Title
Fish habitat survey (FH1)

Legend

Aquatics

Name

Exposed Stone

Glide

Riffle

Run

Notes

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Datum: WGS84
Projection: UTM30N

0 0.01 0.03 Km

Scale Date Drawn by Checked by Approved by
1:1,200 28/02/2025 DC MC MT

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Site Name
Islandmore Wind Farm

Figure Title
Fish habitat survey (FH2)

Legend

Aquatics

Name

- Exposed Stone
- Glide
- Minor Obstruction
- Mixed juvenile
- Pool
- Riffle
- Run



Notes

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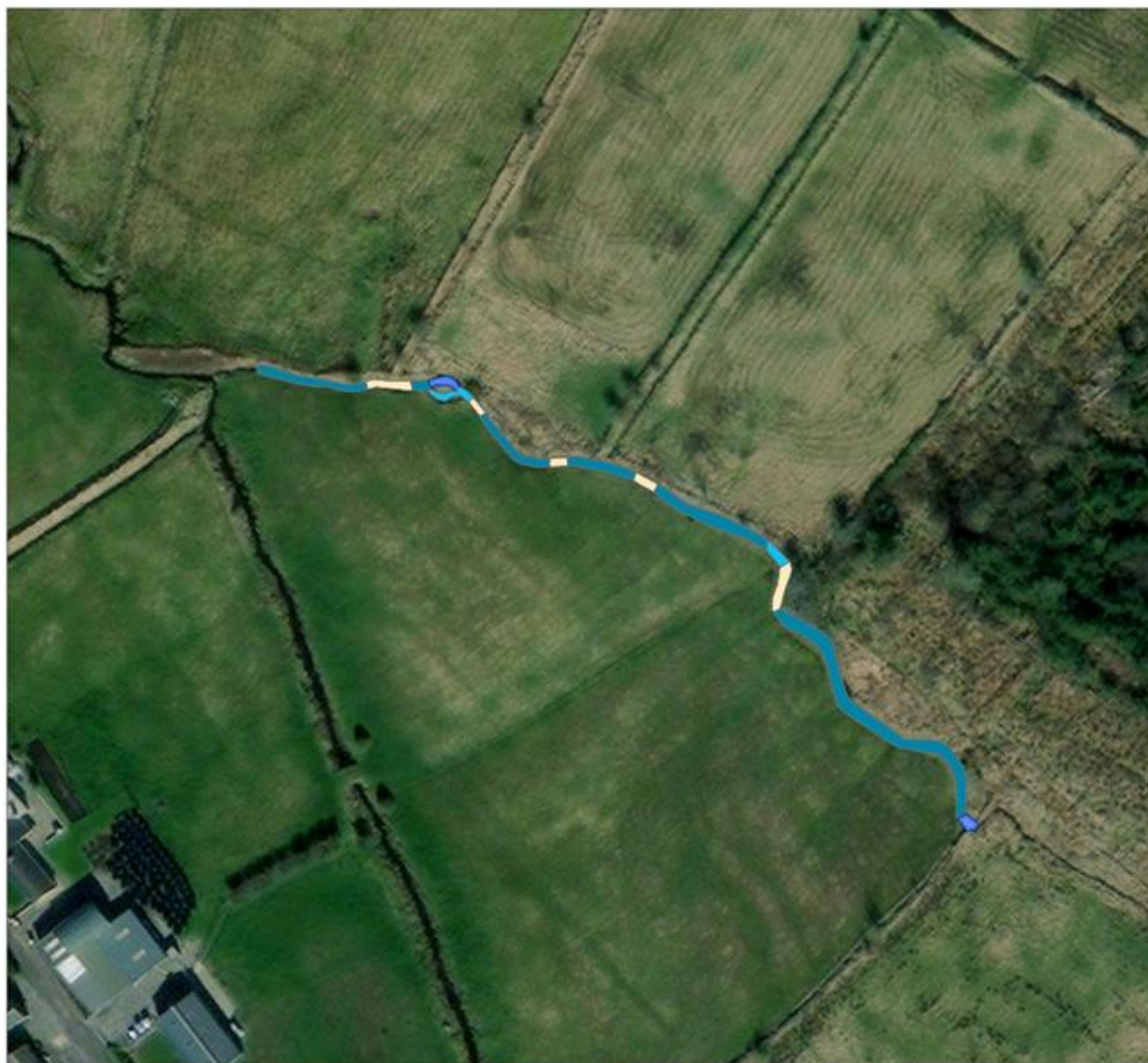


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Site Name
Islandmore Wind Farm

Figure Title
Fish habitat survey (FH3)

Legend

Aquatics

Name

- Glide
- Pool
- Riffle
- Run



Notes

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Site Name
Islandmore Wind Farm

Figure Title
Fish habitat survey (FH4)

Legend

Aquatics

Name

- Glide
- Mixed juvenile
- Riffle
- Run



Notes

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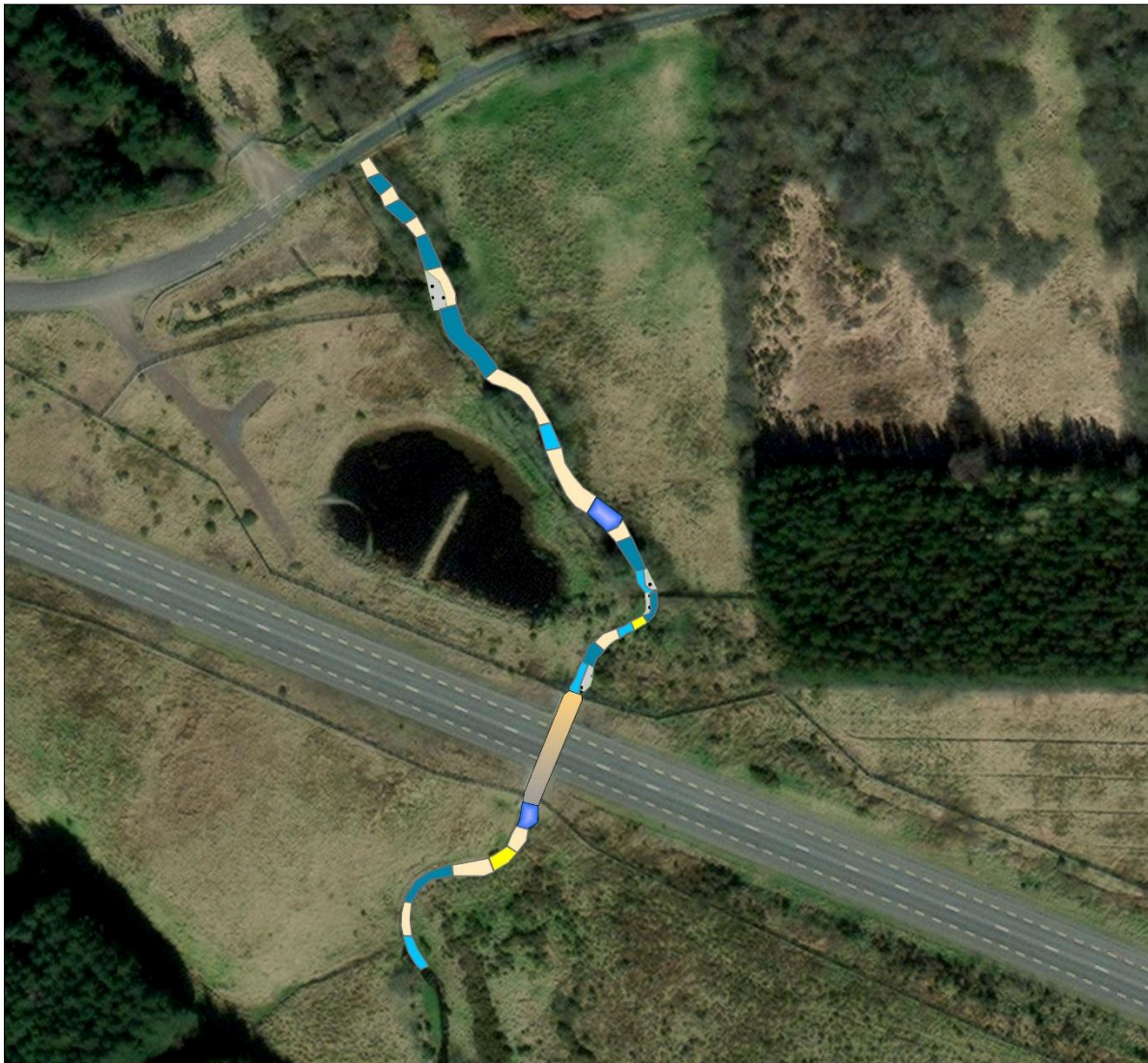


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Site Name
Islandmore Wind Farm

Figure Title
Fish habitat survey (FH5)

Legend

Aquatics

Name

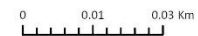
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- Minor Obstruction
- Mixed juvenile
- Pool
- Riffle
- Run



Notes

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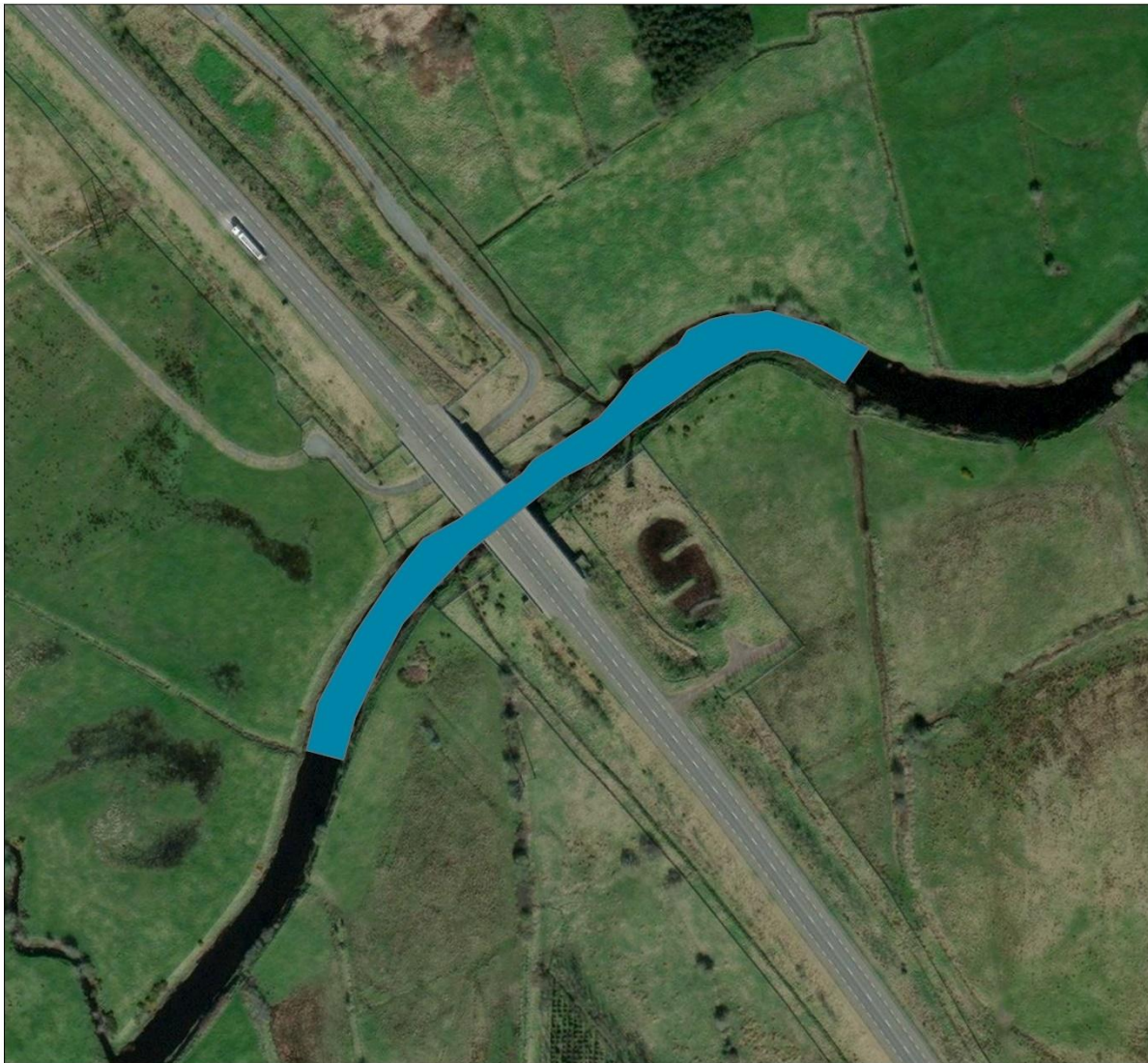


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Site Name
Islandmore Wind Farm

Figure Title
Fish habitat survey (FH6)

Legend

Aquatics

Name

 Glide



Notes

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Projection: UTM30N

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APPENDIX III - AQUATIC ECOLOGY SURVEY SITE IMAGES



Plate 1: Site 1- Macroinvertebrate survey site looking downstream



Plate 2: Site 2- Macroinvertebrate survey site looking upstream



Plate 3: Site1 (FH1)- Fish habitat survey facing upstream showing riffle/glide



Plate 4: Site 3 - Macroinvertebrate survey site looking upstream



Plate 5: Site 2 (FH2) – Fish habitat survey facing upstream riffle/run



Plate 6: Site 4- Macroinvertebrate survey site facing downstream



Plate 7: Site 3 (FH3) – Fish habitat survey facing upstream riffle/run



Plate 8: Site 5 - Macroinvertebrate survey site facing downstream



Plate 9: Site 6 – Macroinvertebrate survey site facing downstream



Plate 10: Site 6 (FH5)– Fish habitat survey facing upstream showing glide



Plate 11: Site 7 – Macroinvertebrate survey site facing downstream



Plate 12: Site 8 – White-clawed crayfish survey site facing downstream



Plate 13: Site 9 – White-clawed crayfish site facing downstream



Plate 14: Site 9 - Fish habitat survey facing upstream riffle/run



Plate 15: Site 10 – White-clawed crayfish site facing downstream



Plate 16 - Site 11 (FH6) - Fish habitat survey facing upstream deep glide



Plate 17: Site 11 - White-clawed crayfish site facing downstream showing marginal emergent vegetation



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