6 AQUATIC ECOLOGY

6.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Figure 1.2**) on Aquatic Biodiversity. The Project refers to all elements of the Inchamore Wind Farm (**Chapter 2: Project Description**) including the Grid Connection Route and the Turbine Delivery Route. This chapter will identify, describe and assess the direct and indirect effects of the Project on aquatic biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC". Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in Volume III.

A detailed Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. This document includes all of the mitigation prescribed within the EIAR. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

6.1.1 Statement of Authority

This chapter has been written by Paul Murphy of EirEco Environmental Consultants who also undertook the aquatic field surveys and Freshwater Pearl Mussel surveys. He holds an MSc in Environmental Science and a Diploma in Aquatic Biology, is a Chartered Environmentalist (Society for the Environment), a full member of the Chartered Institute of Ecology and Environmental Management and a member of the Institute of Fisheries Management. Paul has been operating in the environmental field for over three decades covering a broad range of projects in a variety of countries. He has expert knowledge of the various EU Environmental Directives and extensive experience in Environmental Impact Assessment and ecological mitigation design for numerous major infrastructural schemes (roads, bridges, power plants, wind farms, etc.).

Karen Banks assisted during the Freshwater Pearl Mussel survey as bankside recorder. Karen is a professional ecologist with 15 years' experience in the field of ecological assessment and holds a BSc in Environment and Development from Durham University, and is a full member of the Chartered Institute of Ecology and Environmental Management.

Electro-fishing surveys were undertaken by Ross Macklin (Triturus Environmental Ltd.) and John Brown (Stillwater's Consultancy). Ross is an environmental scientist who specialises in freshwater and fisheries ecology, in addition to informing engineering solutions for construction works on rivers, including site improvement and rehabilitation. He has fifteen years professional experience and holds a PhD and BSc. John is a retired Inspector of Fisheries in the Fisheries Research Centre of the Department of Fisheries and Forestry, and Head of the Stock Assessment Section in the Marine Institute. He established Stillwaters Consultancy in 1999 to provide fisheries management and water quality advice to the public and private sector.

The assessments in this chapter, together with the desktop study outlined in Section 6.2.1.2 and the field investigations outlined in Section 6.2.1.4 are considered adequate to allow the Council to carry out an assessment of the Development.

6.1.2 Assessment Structure

In line with the revised EIA Directive and EPA 2022 Guidelines on the information to be contained in Environmental Impact Assessment Reports, the structure of this Aquatic Biodiversity chapter is as follows:

- Assessment Methodology and Significance Criteria.
- Description of baseline conditions at the Site.
- Identification and assessment of impacts to Biodiversity associated with the Development, during the construction, operational and decommissioning phases of the Development.
- Identification of cumulative impacts if and where applicable
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual impact of the Development considering mitigation measures.

6.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

6.2.1 Assessment Methodology Aquatic Biodiversity

6.2.1.1 Guidance

The general approach used for the evaluation of ecological receptors and assessment of potential impacts for this current assessment is based on the '*Guidelines for Ecological Impact Assessment in the UK and Ireland*' (CIEEM, 2018). The evaluation of ecological receptors contained within this report uses the geographic scale and criteria defined in the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009).

Effects were considered to be either significant or not significant at a geographic scale equivalent to or less than the conservation importance of the ecological feature being assessed (Chartered Institute of Ecology and Environmental Management, 2018). Duration of impacts is considered according to Environmental Protection Agency (EPA) guidance (EPA, 2022). The magnitude of an impact will depend on the nature and sensitivity of the ecological features and will be influenced by intensity, duration (temporary/permanent), timing, frequency and reversibility of the potential impact (CIEEM, 2016).

6.2.1.2 Desktop Study

A review was completed of existing data and records for fish, protected aquatic species and habitats (including Annex II species and aquatic Annex I habitats), and invasive species (listed under the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011)) on watercourses hydrologically connected (i.e., downstream) of the Development. The main sources of information are the National Biodiversity Data Centre and National Parks and Wildlife Service websites.

6.2.1.3 Consultations

A sensitive species data request was made to the NPWS for aquatic flora and fauna within 10 km grid squares IW17 and IW27 on 13th March 2023. Consultations were also undertaken with Inland Fisheries Ireland in relation to existing data on fish stocks and in relation to concerns or requirements vis-a-vis the Development. Licence applications were submitted to NPWS in relation to Stage 1 survey for Freshwater Pearl Mussel and to IFI in relation to Electro-fishing surveys.

6.2.1.4 Field Survey

Zone of Influence

The Zone of Influence (ZOI) differs for different habitats and species. Within terrestrial habitats, the ZOI may be confined to the study area, whereas for aquatic habitats, the ZOI will be much more extensive and the surveys undertaken were scoped accordingly. In view of hydrological connectivity, this entailed establishing the baseline conditions in aquatic habitats at a range of points downstream in the various watercourses draining the site and is reflected in the range and extent of surveys undertaken. An Appropriate Assessment Screening Report and Natura Impact Statement have been prepared as part of this application which assesses potential impacts on European designated sites (the Natura 2000 network), a number of which are hydrologically connected via surface water flow.

Aquatic Habitats

A survey of watercourses at the Site and within a potential zone of influence of the Development and for c. 500 m downstream was undertaken on 3rd June 2020 and on the 14th and 15th July 2020. The surveys identified and mapped aquatic habitats, determined fisheries value and potential, and determined presence or suitability for Annex listed species or invasive alien species. The aquatic habitat assessment conducted at all sites was based on the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland*' (Fossitt, 2000). All sites were assessed in terms of:

- Stream width, depth and other physical characteristics.
- Substrate type, listing substrate fractions in order of dominance, i.e., bedrock, boulder, cobble, gravel, sand, silt etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area.
- In-stream macrophyte, bryophytes occurring and their percentage coverage of the stream bottom at the sampling sites.
- Riparian habitats and species composition.

A Biosecurity protocol was rigidly followed to avoid the potential for transfer of invasive alien species to or from the site in accordance with guidance produced by Invasive Species Ireland and Inland Fisheries Ireland (Decontamination and Disinfection procedures for equipment and personnel). A specific Biosecurity Method Statement was produced for the survey operation.

Electro-fishing Survey and Fisheries Habitat Assessment

Electro-fishing was undertaken at six (6 No.) locations on watercourses downstream of the wind farm site under Section 14 authorisation (dated 9th July 2020) from the Department of Communications, Climate Action and Environment. The electro-fishing survey was undertaken by Ross Macklin (Triturus Environmental Ltd.) and John Brown (Stillwater's Consultancy). A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish a total of six sites on the Inchamore Stream within the Sullane catchment.

The electro-fishing survey is considered adequate for the following reasons: As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique, the broad characterisation of the fish community at each sampling reach was determined. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., Central Fisheries Board, 2008). Stations were

selected on the basis of representative and accessible locations along each of the watercourses within or draining the Development. Each station was fished over a length of 30 m of channel with a series of three electro-fishing passes (these are shown as the upstream and downstream extents in **Figure 6.1**). All captured fish were removed from the water using dip nets with insulated handles and transferred into water filled plastic bins. All specimens fished were anesthetized to facilitate identification, age class and length measurement before being subsequently returned to the water. Photographs of each survey location were recorded.

Given the occurrence and ecological implications of a number of aquatic invasive alien species and diseases throughout the country, appropriate measures were undertaken to ensure there was no risk of transfer of any alien invasive species or diseases to or from the survey locations. Guidance produced by Invasive Species Ireland and Inland Fisheries Ireland (*Decontamination and Disinfection procedures for equipment and personnel*) in relation to reducing the risks of spread was adhered to rigorously and a specific Biosecurity Method Statement was produced for the fish survey operation.

The river channel morphology, substrate and flow regime were assessed to determine the suitability of the habitat for spawning or as nursery habitat by salmonids and other species including lamprey and ammocoete larvae in marginal silt beds. The presence and abundance of aquatic vegetation in the river was recorded and a species list compiled. A photographic record was made with locations noted on the field maps.

Freshwater Pearl Mussel Stage 1 Survey

On the basis of the known distribution of Freshwater Pearl Mussel (FPM) within the catchment of the Development derived from consultation with NPWS, a review of OSI mapping and aerial imagery was undertaken to identify potentially suitable locations for survey. A licence application to carry out a Stage 1 Survey was submitted to NPWS and this was subsequently received (Licence No. C171/2020). Field maps and data sheets were prepared and the NPWS Divisional Manager was notified in advance of the proposed survey. The surveys were undertaken on 14th, 15th and 16th July 2020 using the NPWS Stage 1 methodology (presence/absence survey) detailed in the Irish Wildlife Manual No. 12 (2004) aimed specifically to establish presence or absence at eight locations. At each survey location a total length of c. 200 m was intensively searched using a bathyscope wading in an upstream direction covering areas of fast flowing water, glides and pools. Specific attention was given to areas under overhanging vegetation where mussels frequently are found in rivers subject to periodic algal growth. Bankside shingle banks were also surveyed for dead shells where they occurred. The operation was undertaken by two people with one operator instream (Paul

Murphy) and one bank-side recorder (Karen Banks). The surveys were carried out in conditions of moderate flow though with high water clarity. The weather during the survey period was generally bright and sunny with occasional cloudier periods.

Biotic Index (Q Value) Macro-invertebrate Assessment

Water quality was assessed using the Q Value biotic index system at the six locations sampled for electro-fishing on each of the watercourses draining the wind farm. This standardised approach for the biological assessment of water quality as used by the Environmental Protection Agency is based on the composition of the macroinvertebrate community which inhabit the substratum of rivers and streams. These comprise in the main, immature aquatic stages of insects, together with crustacean (shrimps), molluscs (snails and bivalves), oligochaetes (worms) and hirudinea (leeches). Shallow, fast-flowing stretches of riffle habitat are sampled in preference to non-riffle areas as they show most clearly the water quality status and effects of pollution. For assessment purposes the invertebrate communities are divided into four groups – sensitive, less sensitive, tolerant and very tolerant forms. The relative proportions of the various organisms in samples are determined and the water quality status is inferred by comparison with the expected ratios in unpolluted habitats of the type under investigation. The assessment procedure also takes into account other relevant factors such as the intensity of algal and or / aquatic plant growth, water turbidity, bottom siltation, nature of the sub-stratum, speed of current, and water depth. The biological information is then condensed to readily understandable form by means of a 5-point biotic index (Q values) in which invertebrate diversity and water quality are related as outlined in **Table 6.1**. Intermediate values (e.g., Q3-4) are used to describe conditions where appropriate.

Table 6.1: EPA Water Quality and Status Summary (EPA, 2010)

Biotic Index	Quality Status	Water Quality	WFD Ecological Status
Q5	Unpolluted	Good	High
Q4-5	Unpolluted	Fair-to-Good	High
Q4	Unpolluted	Fair	Good
Q3-4	Slightly Polluted	Doubtful-to- Fair	Moderate
Q3	Moderately Polluted	Doubtful	Poor
Q2-3	Moderately Polluted	Poor-to-Doubtful	Poor
Q2	Seriously Polluted	Poor	Bad
Q1-2	Seriously Polluted	Bad-to-Poor	Bad

6.2.1.5 Ecological Evaluation and Impact Assessment Methodology

The evaluation of the key ecological receptors and the criteria used to assess the significance of impacts are derived from the Guidelines for Assessment of Ecological Impacts on National Road Schemes (TII, June 2009) (the "TII Guidelines"), Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, May 2022) (the "EPA Guidelines") and the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2016) (the "CIEEM Guidelines").

The criteria used for assessment of the value of the ecological resources sets out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular site is of importance on the following scale:

- International Importance;
- National Importance;
- County Importance;
- Local Importance (Higher Value), and
- Local Importance (Lower Value).

Receptors of Local Importance (Lower Value) contain habitats and species that are widespread and of low ecological significance and of importance only in the local area. Internationally Important sites are either designated for conservation as part of the Natura 2000 network, i.e., Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) or provide the best examples of habitats or internationally important populations of protected flora and fauna.

The CIEEM Guidelines define a significant effect as, "an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'...or for biodiversity in general". The criteria used for assessment of impacts are as follows while the Criteria for Assessing Impact Significance are presented in **Table 6.2**:

Positive or Negative: Positive and negative impacts/effects should be determined according to whether the change is in accordance with nature conservation objectives and policy;

Extent: Extent should be predicted in a quantified manner and relates to the area over which the impact occurs;

Magnitude: Magnitude refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population;

Duration: Duration is intended to refer to the time during which the impact is predicted to continue, until recovery or re-instatement (which may be longer than the impact-causing activity). Duration should be defined in relation to ecological characteristics (such as a species' lifecycle);

Frequency and Timing: The timing of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and concomitant impacts) would take place can be an important determinant of the impact on receptors and should also be assessed and described;

Reversibility: An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

Likelihood:

- Certain/Near Certain: >95% chance of occurring as predicted;
- Probable: 50-95% chance as occurring as predicted;
- Unlikely: 5-50% chance as occurring as predicted and
- Extremely Unlikely: <5% chance as occurring as predicted.

Table 6.2: Criteria for Assessing Impact Significance (EPA, 2022)

Impact Magnitude	Definition
No change	No discernible change in the ecology of the affected feature
Imperceptible Impact	An impact capable of measurement but without noticeable consequences
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends
Significant Impact	An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment
Profound Impact	An impact which obliterates sensitive characteristics

6.3 BASELINE DESCRIPTION

6.3.1 Aquatic Environment

6.3.1.1 Aquatic Habitats

The Proposed Wind Farm Site

The Site lies entirely within the Inchamore Stream sub-catchment where five tributaries flow into the Bardinch River which then joins the Sullane River, a tributary of the Lee. The Sullane River supports good populations of brown trout (*Salmo trutta*) with resident populations as well as larger fish running up from the reservoir downstream (O'Reilly, 2004). The catchment of the Development is listed as supporting extant populations of Freshwater Pearl Mussel (*Margaritifera margaritifera*). The watercourses within the proposed wind farm site itself are small 1st order tributaries which have high gradients and do not provide suitable habitat for fish or larger aquatic organisms. There are three minor watercourses within the site that will be crossed by the proposed road network within the site, all of which will entail clear-span structures and thus will not interact with the waterbodies and will avoid instream works.

Grid Connection Route

The Grid Connection Route is 19.9 km in length and traverses in an east to south easterly direction from the existing Ballyvouskill 220 kV substation to the Inchamore Wind Farm substation location utilising public local road networks, and existing forestry access tracks. There are three minor streams along the length of the Grid Connection Route (refer to planning drawings 05934-DR-201-210) which will be crossed by horizontal directional drilling (HDD) thereby avoiding any instream works. These are small watercourses with no fisheries value or the potential to support any protected aquatic species. Other minor watercourses (streams and drainage ditches) along the length of the route will be crossed on existing culverts as they have adequate depth of fill to accommodate the cable.

Turbine Delivery Route

The Turbine Delivery Route (TDR) extends from Ringaskiddy Port to the Site via the N28, N40 and N22, and from there onto an upgraded forestry road as shown on **Figure 2.5**. The TDR is on a public road and crosses innumerable existing watercourses – all on existing bridges / culverts and with no requirement for modification to the watercourses to enable turbine delivery.

6.3.1.2 Electro-fishing Survey and Fisheries Habitat

The six locations of watercourses surveyed by electro-fishing is shown in **Figure 6.1**. A description of the aquatic and riparian habitats at each site and summary of the results of the electro-fishing survey with an appraisal of their ecological value is presented below.

Site1. Inchamore Stream (Sullane Catchment) (photos of locations provided below in Table 6.3)

Site 1 was situated in an upland eroding stream (FW1) with 1.5 m water width and was predominantly shallow (0.1 m to 0.4 m depth). The bank heights were variable between 1.0 m and 3.0 m. The channel comprised of boulder cascade reaches with equal proportions of pool, riffle and glide. The bed was boulder and cobble dominated with very localised pockets of coarse gravels and medium energy (reflective of the higher gradient and higher energy environment). The bed comprised loose (unconsolidated) bed material with low siltation levels. The riparian areas comprised of semi-improved grassland (wet in nature) and were predominantly sheep grazing lands. The channel was open with no overhanging trees, and bordered by open pasture (i.e., semi-improved grassland as previously described).

From a fisheries perspective the small upland spate stream could be considered a moderate to good quality brown trout nursery. The stream had a good semi-natural profile with holding and nursery habitat being good overall for an upland trout stream. Spawning areas were as expected for a stream of this nature, being localised and restricted to small pockets in pools between boulder areas. Overall spawning potential can be considered moderate within the survey reach.

Site 2. Inchamore Stream (Sullane Catchment)

Site 2 was an upland eroding stream (FW1) that had 1.5 m to 2.0 m water width. The stream was predominantly shallow (0.1 m to 0.3 m depth). The bank heights were typically 1.5 m high. The channel was of high energy with dry boulder and cobble bars indicating much higher winter flows. The bed was boulder and cobble dominated with frequent pockets of coarse, medium and fine gravels. The stream gradient was lower than site 1 and had higher proportions of gravel. The bed comprised loose (unconsolidated) bed material but siltation levels were moderate with evident silt deposition in pools. The riparian areas comprised of semi-improved grassland.

From a fisheries perspective the upland spate stream could be considered a moderate to good quality brown trout nursery but this was not reflected in the fish population recorded. It is considered that land use practices may have impacted the stream fish population (e.g.,

heavily afforested upstream catchment). The stream had a good semi-natural profile with holding and nursery habitat being good overall for an upland trout stream. Spawning areas were locally good with mixed unconsolidated gravels at pool tailings. Overall spawning potential can be considered good within the survey reach for brown trout. Surprisingly recruitment was much poorer than would be expected for a stream of this nature as reflected in the fisheries demographic.

Site 3. Inchamore Stream (Sullane Catchment)

Site 1 was an upland eroding stream (FW1) that had a 1.0 m water width. The stream was predominantly shallow (0.1 m to 0.2 m depth) with bank heights typically between 2.0 m to 2.5 m high. The channel was of very high energy with boulder cascade reaches. The profile comprised of 50% pool, 10% riffle and 40% glide. The bed was boulder and cobble dominated with locally frequent pockets of coarse, medium and fine gravels. These were most common in the glide tailings of pool. The stream gradient was steep and higher than at sites 1 and 2. The bed comprised loose (unconsolidated) bed material and siltation levels were low. The riparian areas were either open (east bank) or comprised dense grey willow stands with scattered Sitka spruce, gorse and bramble. The upstream catchment comprised of gorse scrub and conifer plantation.

From a fisheries perspective the upland spate stream could be considered a lower quality brown trout nursery given very high energy and smaller size. The stream had a good semi-natural profile with holding being good overall for an upland trout stream. Spawning areas were locally good with mixed unconsolidated gravels at pool tailings. However, despite relatively good habitat characteristics for an upland brown trout stream, the recorded population was very small (single adult recorded). The high energy and small upland nature of the stream likely accounted for the lower fisheries value overall.

Site 4. Inchamore Stream (Sullane Catchment)

Site 4 was an upland eroding stream (FW1) site that had a 1.0 m water width widening locally to 1.5 m and had an average depth of 0.2 m. The river was bank heights were typically 1.0 m to 1.5 m high. The river had a sinuous profile with no evident historical modifications at the survey area. The channel was of high energy with boulder cascade areas with equal proportions of pool, riffle and glide. The bed was dominated by boulder and cobble. Pockets of coarse and medium gravels were present in pool and glide areas behind boulders. The stream gradient was high and similar to site 1. The riparian areas comprised of willow, bracken and bramble scrub with frequent fuchsia. The site was bordered by improved pasture (GA1; sheep grazing).

From a fisheries perspective the stream could be considered a moderate quality brown trout nursery given the smaller size and shallower depth. The stream however had a well-defined profile, with good sinuosity and riffle, glide and pool sequences. The substrata while dominated by boulder and cobble had good areas of mixed coarse and medium gravels for spawning. Consequentially, the river spawning was considered good. Holding habitat value was also locally good.

Site 5. Inchamore Stream (Sullane Catchment)

Site 5 was an upland eroding river (FW1) site that had a 4.0 m water width and an average depth of 0.3 m. The river had bank heights that were1.0 m to 1.5 m high. The river was historically straightened along the road with boulder armour present. However, the river exhibited excellent recovery with a good semi-natural profile with clean unbedded substrata. The channel was of moderate energy with exposed bedrock, large boulders and cobbles present but was not cascading as with upstream areas. Pockets of coarse and medium gravels were present in pool and glide areas behind boulders. The profile comprised of 30% shallow pool, 50% glide and 20% riffle. No macrophytes were present in the channel but *Fontinalis squamosa* moss was frequent on instream boulders. The stream gradient was significantly lower than upstream sites (i.e., Sites 1, 2 and 3) resulting in improved spawning potential. The riparian areas comprised of mature willow with bracken and bramble scrub.

From a fisheries perspective the river could be considered a good quality brown trout nursery given the larger size and good river profile with mixed pool, glide and riffle sequences. The river had good riparian cover that improved the holding value in deeper glide and shallow pool areas between boulder and bedrock. The river spawning was considered good with mixed unconsolidated gravels in pool areas behind bedrock and boulder.

Site 6. Inchamore Stream (Sullane Catchment)

Site 6 was an upland eroding river (FW1) site that had a 6.0 m water width and an average depth of 0.3 m but deepened to 0.8 m locally. The river had bank heights that were 1.0 m to 1.5 m high. The channel was of moderate energy with exposed bedrock, large boulders and cobbles present but was not cascading as with upstream areas. Pockets of coarse, medium and fine gravels were present in pool and glide areas behind boulders. The profile comprised of 30% pool, 50% glide and 20% riffle. No macrophytes were present apart from localised *Myriophyllum* species. The moss species *Fontinalis squamosa* was localised. The river gradient was significantly lower than upstream sites and was similar to site 5, meaning spawning potential improved. The riparian areas comprised of mature willow and gorse

with scattered mature Sitka spruce. The banks were however more open immediately downstream of the bridge and the river was adjoined by improved pasture (GA1).

From a fisheries perspective the river could be considered a very good quality brown trout nursery given the larger size and good river profile with mixed pool, glide and riffle sequences. The spawning habitat was considered good given large pockets of coarse, medium and fine gravels in glide areas and also in pools. The nursery habitat was also very good given the presence of abundant shallow glide and riffle sequences. Holding habitat as with nursery habitat and spawning habitat was also very good. The combination of very good, nursery, spawning and holding habitat was reflected in the mixed cohort fish population recorded.

6.3.1.1 Freshwater Pearl Mussel Stage 1 Survey

The known distribution of Freshwater Pearl Mussel (*Margaritifera margaritifera*) (FPM) in the catchment is shown in **Figure 6.2** based on records provided by the NPWS (2020). The nearest records of FPM to the wind farm site are on the River Sullane at Coolea approximately 6 km downstream of the Site.

A total of eight locations (see **Figure 6.3**) were surveyed for FPM using a bathyscope wading in an upstream direction over a length of c. 200 m of river bed at each site. Each location was subject to an intensive search which included examination of shingle banks where they occurred for evidence of dead shells. The results of the survey are detailed in **Table 6.3** which presents an overview of each survey location including a description of the aquatic and riparian habitats, and a photograph showing a typical view of the survey area.

No evidence of freshwater pearl mussels was recorded from any of the transect locations surveyed for the Project with the exception of a single dead shell on the Sullane River at a point upstream of the Bardinch Confluence at Site 6, where anecdotal records of mussels having existed in the past were reported by a landowner. A section of the Sullane River c. 500 m downstream of Mahony's Bridge (not within the drainage catchment of the wind farm) was surveyed on the basis of this information though no live mussels were recorded despite the apparent suitability of the habitat.

Table 6.3: Summary results of Stage 1 Freshwater Pearl Mussel survey on watercourses draining the proposed Inchamore Wind Farm

Site number	Grid ref.	Description and Results	Overview Photograph
1	512016 577418	Inchamore Stream W=5-7 m. Cobble and gravel with occasional boulder. Series of mini-cascades and riffles with small pools. Banks open with wet heath and gorse scrub. Subject to spate flows. Accessed by cattle. No FPM recorded and conditions considered unsuitable.	
2	512775 577171	Inchamore Stream W=7-8 m. Boulder, cobble and gravel substrate. Small cascades and pools. Fontinalis abundant. Subject to spate flows. Banks open with rushy grassland and gorse scrub. Accessed by cattle. No FPM recorded and conditions considered unsuitable.	
3	513612 577141	Inchamore tributary W=1.5-2 m. Small boulders, cobble and gravel. Numerous small cascades. Banks steep and heavily tunnelled with overhanging vegetation including willow, gorse, bracken and ruderals. No FPM recorded and conditions considered unsuitable.	

Site number	Grid ref.	Description and Results	Overview Photograph
4	513741 576826	Inchamore Stream W=7-8 m. Small boulders, cobble and gravel, with occasional exposed bedrock. Pools, glides and occasional small cascade. Banks with boulder reinforcement along road, heavily vegetated with willow dominated scrub. No FPM recorded but conditions considered potentially suitable in pockets.	
5	513972 576138	Bardinch River W=10 m. Cobble and boulders with pockets of gravels. Layer of fine silt on substrate. Riffles with small cascades and occasional pools. Myriophyllum beds occasional. No FPM recorded but conditions considered potentially suitable.	
6	514901 575718	Sullane River W=12 m. Sands, gravels and occasional cobbles with silt layer. Pool and gentle glide. Ranunculus, Myriophyllum and Callitriche occasional. Banks tree-lined with adjacent grassland pasture. One dead mussel shell recovered. Potentially suitable habitat and anecdotal records from landowner of mussels present in the past.	

Site number	Grid ref.	Description and Results	Overview Photograph
7	514976 575894	Bardinch River W=20 m. Cobbles with pockets of gravel. Riffle and glide habitat, with evidence of channel being artificially straightened. Algae on substrate. Banks with low scrub fringe and adjacent improved pasture. No FPM recorded but potentially suitable habitat.	
8	516148 575963	Sullane River W=15-25 m. Boulder, cobbles and pockets of gravel / sands. Fontinalis and Ranunculus frequent. Series of cascades with large boulders transforming to deep pool conditions with soft substrates downstream. Banks with woodland cover, subject to active clearance on the east of the river downstream of Milleeny Bridge. No FPM recorded but potentially suitable habitat.	

6.3.1.2 Biotic Index (Q Value) Macro-invertebrate Assessment

Water quality was assessed using the Q Value biotic index system at the eight locations sampled for electro-fishing (see **Figure 6.1**) on each of the watercourses draining the Site The results are presented in **Table 6.4** which gives their Q Value and corresponding Water Framework Directive status (see **Table 6.1** above).

The most recent EPA data available for the Sullane River at Milleeny Bridge near Coolea (Site 8 of the FPM survey) is from 2017 when the river was given a Q4-5 equating to high quality. The river maintained its high quality status downstream as far as Macroom where a Q4 (good status) was recorded.

All watercourse sampled were in High status with good macroinvertebrate diversity and no evidence of algal cover or excessive macrophyte growth. The watercourses are all high energy reflecting the topography and high levels of rainfall within the catchments.

Table 6.4: Water Quality Assessment of Watercourses (Q Value and WFD Ecological Status)

Site No.	Q Value	WFD Ecological Status	Comments
1	4-5	High	1.5 m width, 0.1 m to 0.4 m depth, banks 1.0 m and 3.0 m. Riffle, glide and pool with boulder cascade reaches. Substrate boulder and cobble dominated with pockets of gravels. No macrophytes. Macroinvertebrate diversity good with abundant flattened mayfly, stonefly and cased cadis.
2	4-5	High	1.5 m to 2.0 m width, depth 0.1 m to 0.3 m, bank heights 1.5 m. High energy channel with dry boulder and cobble bars indicating higher winter flows, forming series of pools with riffle sections. Substrate boulder and cobble dominated with frequent pockets of gravels, and moderate silt deposition in pools. No macrophytes. Macroinvertebrate diversity good with abundant flattened mayfly, frequent stonefly, cased cadis and blackfly.
3	4-5	High	1.0 m width, depth 0.1 m to 0.2 m, bank height 2.0 m to 2.5 m. High energy channel with boulder cascade reaches and riffle, glide and pool sequence. Substrate boulder and cobble dominated with pockets of gravels. No macrophytes. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly, cased cadis, beetle and blackfly.
4	4-5	High	1.0 – 1.5 m width, depth 0.2 m, bank heights 1.0 m to 1.5 m. High energy channel with boulder cascade and riffle, glide, pool sequence. Substrate dominated by boulder and cobble with pockets of gravels. No macrophytes. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly and cased cadis.
5	4-5	High	4.0 m width, depth 0.3 m, bank heights 1.0 m to 1.5 m. Historically straightened channel adjacent road but with good semi-natural profile and riffle, glide, pool sequence. Substrate exposed bedrock, large boulders and cobbles with pockets of gravels. No macrophytes but frequent willow moss. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly, cased cadis, blackfly and beetle larvae.
6	4-5	High	6.0 m width, depth 0.3 m to 0.8 m, bank heights 1.0 m to 1.5 m. Moderate energy channel with exposed bedrock, large boulders and cobbles, and pockets of gravels. Riffle, glide and pool sequence. Occasional water milfoil and willow moss. Macroinvertebrate diversity good with abundant flattened mayfly, frequent stonefly, cased cadis, water louse, beetle larvae and molluscs.

6.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

A more in-depth discussion of water quality is provided in **Chapter 9: Hydrology and Hydrogeology**. The focus in this section is on the effects on aquatic species and ecology. Groundwater pathways are not considered an issue for the Development on account of the underlying geology (Devonian sandstones) and the area is mapped as low vulnerability by the EPA (EPA Maps).

6.4.1 The 'Do-Nothing' Impact

If the Development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'do-nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices.

6.4.2 Construction Phase Potential Effects

A full description of the Project is given in **Chapter 2: Project Description**. A summary of potential sources of direct impacts on aquatic ecology during the construction and decommissioning stage include:

- Clearance of vegetation, soil and rock for widening and construction of access roads, hardstand and turbine bases with associated impacts on the drainage network and site run-off on water quality within the watercourses onsite and downstream;
- Clear-fell of approximately 26.43 ha coniferous forestry mostly consisting of Sitka Spruce or Lodgepole Pine with potential effects of felling on water quality as a result of sediment and nutrient release;
- Crossing of watercourses within the proposed site and along the grid connection route;
- Placement and storage of material arising from infrastructure works;
- Access by construction equipment, including access away from the proposed infrastructure location (compaction and other damage);
- Potential for accidental spillage of hydrocarbons and other pollutants including concrete laitance;
- Potential of peat slippage or failure, and,
- Removal of infrastructure at decommissioning stage.

All construction activities have the potential to cause negative effects to receiving watercourses and aquatic species and habitats as a result of the release of suspended solids, concrete and hydrocarbons in run-off. The potential for increased silt loads could negatively impact on water quality, salmonid spawning habitat and Freshwater Pearl Mussel

(FPM) populations in the downstream reaches, with the scale of impact being proportionate to the scale and duration of siltation.

Wind Farm Site

The principal potential construction phase effects of the development relate to the release of sediments into the drainage network arising from all construction related site works including the access road network, turbine bases and associated hardstands, drainage network, sub-station building, borrow pits and repository areas, and the grid connection route. The Turbine Delivery Route will utilise the existing road network with no modifications of watercourses or potential impacts on any watercourses along its entire length. There is a minor risk of nutrient release as a result of the clear-fell of conifers (26.43 ha) required for the proposed development though this is of a minor scale in comparison to the normal forestry activities taking place at the Site due to the limited scale proposed. The most pertinent potential sources of impact on the aquatic environment are considered to be:

- The construction of three watercourse crossings within the site.
- Water quality degradation in surface and groundwater from siltation or other forms of pollutants associated with the construction phase including tree felling.

The three watercourse crossings on the proposed road network within the site are all on minor headwater streams which do not support fish stocks due to their elevation and gradients on downstream sections preventing access. All three watercourses will none-the-less be crossed with clear-span structures avoiding any requirements for channel modification or instream works. While the construction of these presents risks of sediment or other pollutants entering the watercourses and affecting water quality downstream, the structures themselves will not result in any significant loss of instream habitat or impede the movement of fish or other aquatic biota, including otter.

All turbine locations are located a minimum of 65 m from the nearest watercourse, while the borrow pit location is over 500 m from the nearest watercourse. No works will take place within a 65 m buffer zone of watercourses except for the three clear span watercourse crossings on the proposed access track network.

Grid Connection Route

The connection of the wind farm to the national electricity grid, will be via 38 kV underground cable connection to the existing Ballyvouskill 220 kV Substation. Approximately 15.7 km of the route will be located along the route of an existing forestry road which runs parallel to the Clydagh River and entails the crossing of numerous small tributaries of the river. The

Clydagh River is within the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.

For most of the watercourse crossings along the Grid Connection Route, as shown on planning drawings 05934-DR-201-210, there is sufficient depth over existing culverts to accommodate trenching of the cable within the road structure. This operation will result in no instream works and presents a low risk of generating suspended solids or other pollutants, which are readily controlled by mitigation. There are three water crossings along the Grid Connection Route which do not have sufficient depth of material on the existing culverts. To avoid instream works, these will be crossed by means of directional drilling technology. Details of the directional drilling procedure are outlined in **Chapter 2: Project Description** (**Section 2.9.5.2**). This methodology addresses the potential risks of siltation or other pollutants entering the watercourses during the construction phase.

There are in addition, a number of minor ditches running under the existing road, which are either dry or have minimal flows, that will be crossed by damming the ditch upstream and over-pumping (if necessary) during the trenching operation. Without mitigation, these crossings present a temporary minor risk of sediment release and of other pollutants entering the Clydagh River downstream. To mitigate this risk, the trenching and laying of the grid connection pipe at these open crossings will be undertaken as a single operation which will be completed in a number of days. These works will be confined to dry periods during the summer months.

Freshwater Pearl Mussel

The nearest records of Freshwater Pearl Mussel (FPM) to the wind farm site are on the River Sullane at Coolea approximately 6 km downstream of the site. While the population of FPM are not within a Special Area of Conservation, in view of their Annex II Listed status, their unfavourable conservation assessment (NPWS, 2013) and being listed as critically endangered in the Republic of Ireland (Moorkens 2006), they are considered of international importance.

FPM also occur on the River Flesk (the lower reaches of the Clydagh River) and are a qualifying interest for the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC which extends to include the Clydagh River. The construction of the Grid Connection Route parallels the Clydagh River where it runs along an existing forestry track.

Fine sediment can affect adult FPM, as it interferes with filter feeding. It can also dramatically change the nature of a river bed where juveniles require water movement through gravel beds to obtain oxygen. Even short-term sedimentation is likely to kill all juveniles present (DAFM, 2018). In addition, nutrient-rich sediment may enter watercourses following felling, while the decomposition of harvest residue onsite can lead to the release of phosphorous for several years after harvesting.

Any impact on FPM as a result of construction phase activities is considered a medium term significant negative effect at the international scale. In view of the existing threats to water quality in the lower reaches of the Sullane River, effects on the FPM populations from siltation or other pollutants, may last longer than the impact-causing activity.

Salmonids

Salmonid species require very high levels of water quality in order to complete their life cycles. High levels of suspended solid concentrations in waterbodies can affect the feeding and health of individual species through increased turbidity (inhibiting respiration through gills) and increased siltation affecting composition of riverbed substrate (reducing fry survival) as well as affecting spawning beds. Suspended solids often hold nutrients such as phosphorus that can result in eutrophication and reduced oxygen levels, which can affect all life stages of Atlantic salmon. Aquatic invertebrate communities and aquatic macrophytes can also be affected by sediment loading which reduces both the biotic diversity and the food resource for fish populations through direct toxicity to fish and invertebrates, and also indirectly effecting top predators such as otter and kingfisher in downstream reaches through a reduction in prey availability.

Watercourse Crossings within the Wind Farm Site

Direct effects on watercourses within the wind farm site are limited to the crossing points of the road access network which will entail three separate watercourse crossings as shown in **Figure 6.4**. All watercourse crossings are on minor headwater streams at locations that are of limited fishery value on account of their small size and variable flow rates. Some also have potential barriers to fish movement in their lower reaches. The new proposed watercourse crossings have been designed on a bespoke basis in consultation with Inland Fisheries Ireland (IFI) (design calculations are presented in **Appendix 2.1** of the EIAR). The following approach and guidance were used in the sizing of the proposed watercourse crossings:

- Detailed mapping of drainage paths across the wind farm site has been undertaken; utilising topographical surveys, contour mapping and aerial photography.

- Hydrological assessments made using a number of methods including *Flood Estimation Handbook* (Statistical Analysis) and *Flood Studies Report* (FSR) where appropriate to determine the design flow.
- CIRIA *Culvert Design and Operation Guide* (C689).
- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*.
- In addition, where planning consent is received a Section 50 Application will be submitted to Office of Public Works (OPW) for approval prior to works commencing on site (required to ensure unimpeded conveyance and storage capacities of channels and floodplains). It should be noted that the Section 50 application will be based on the details proposed in this application, subject to compliance with any conditions relating to the permitted development.

Without appropriate design and construction methodologies, the crossings would result in a loss of aquatic habitat or interfere with the connectivity of the watercourses. In addition, the construction works for the crossings would have the potential to give rise to water quality effects which would extend downstream to stretches with higher fisheries value and supporting freshwater pearl mussel populations. Pollutants entering the watercourses could result in direct mortality of aquatic biota with the scale and extent dependant on the volumes and toxicity of the pollutant. The potential for release of sediment, fine concrete particles and the spillage of hydrocarbons is primarily associated with the construction of watercourse crossings due to the set-backs of other infrastructure from the watercourses. The potential impact of sediment release in the absence of mitigation is therefore considered **short term but significant negative at the local scale**.

The three water crossings within the wind farm site will be clear span structures (as shown on **Planning Drawing No. 6226-PL-WC1 to 6226-PL-WC3** with the following design criteria:

- The clear span design is a segmented precast arch or similar and will avoid disruption to the stream bed and banks, protecting fishery habitats.
- The crossing direction will be perpendicular to the stream direction, therefore minimising the length of stream affected.
- The crossing detailed design allows for the passage of out-of-bank flood flows within the clear span.
- The crossing locations have been informed by the hydrological analysis and identification of constraints to:
    - Ensure location in an area where bank slopes are shallow, thus reducing the potential for runoff to carry sediment into the watercourse.

- Avoid locations with any incoming tributary streams.

- The structure shall include ledges or areas of undisturbed riverbank to allow for the free passage of otters.

The clear span design of the crossings will not affect instream aquatic habitat or interfere with the passage of fish or other aquatic fauna.

A number of existing minor drains along the existing Site Access Road network within the site will require upgrading to accommodate the increased width of the road. These are minor surface drains which are mainly dry and receive flows only following heavy rainfall events. However, due to their connectivity to the more important lower reaches in the catchment, appropriate mitigation measures as detailed in Section 6.5 below will be required during the track upgrade stage to avoid siltation or other pollutants entering the drainage network. The existing drainage network is shown on **Figure 9.2 (a) Surface Water Network Wind Farm.**

Invasive Alien Species

Machinery required for construction activities also poses a risk as a vector for the introduction and spread of invasive non-native species (e.g., Himalayan balsam, Japanese knotweed) to watercourses, which would have negative effects on aquatic ecology and riparian habitats. There are no records or evidence of any invasive plant species recorded from the Site or its surrounds.

Peat Slippage

The risk of peat failure or slippage occurring on the Site during the construction phase has been analysed by RSK Group as part of the hydrogeological assessment (**Chapter 9**). The depth of peat has informed the layout of the Site and all areas of deep peat have been avoided. The risk of peat failure is therefore considered to be very low to low due to the overall shallow nature of the peat deposits in the works zone.

Summary Assessment

In the absence of mitigation, potential impacts on the aquatic environment are classified as being **medium term significant negative** at the international scale on account of the sensitive freshwater pearl mussel populations in the downstream catchments and the value of the lower reaches of the watercourses for salmonids.

6.4.3 Operational Phase Potential Effects

There is potential for effects on watercourses within the wind farm site during the operational phase due to ongoing activities and maintenance of permanent site drainage. The risk to watercourses during the operational phase of the wind farm is considered slight and would primarily arise from the use of oils and lubricants for infrastructure maintenance either through accidental spillage or inappropriate disposal. These effects are already described for the construction phase of the development in **Section 6.4.2** above. Impacts on water quality and aquatic habitats occurring during the operational phase are not considered likely in view of the distance between the turbines and substation and watercourses (>65 m) and the measures detailed in Section 6.5.3 below. Site maintenance activities such as road repair and drainage network maintenance may give rise to a localised risk of sediment release, but again, this risk is considered to be very unlikely in view of the infrequency and limited scale of such operations.

Taking this into account, the potential for secondary effects on watercourses resulting from the unmitigated operational phase of the wind farm site is considered to be imperceptible. There will be no operational effects from the Grid Connection Route once the cable laying process is complete, though any repairs or maintenance would be required to adopt the same approach and mitigation as for the construction phase.

6.4.4 Decommissioning Phase Potential Effects

The decommissioning phase of the Site (as described in in **Chapter 2: Project Description**, Section 2.9 and the Decommissioning Plan, which is included as part of the CEMP in **Appendix 2.1**) poses a similar suite of potential risks with less likelihood of potential effects on the aquatic environment as the construction phase, though in view of the presence of the road network and associated infrastructure, the resultant scale of impact is considered to be much lower. In the absence of mitigation, the potential impact on the aquatic environment is considered to be a moderate short-term negative impact at the local scale.

6.5 MITIGATION MEASURES

6.5.1 Embedded Mitigation

The entire development proposal incorporates embedded mitigation aimed at minimising the potential impacts during the design phase. This includes the design principle of maintaining set-backs of 65 m for turbines and associated infrastructure from watercourses and utilising existing forestry access tracks, rather than constructing new tracks, where feasible.

6.5.2 Construction Phase Mitigation

6.5.2.1 Mitigation by Avoidance

The greatest risk of negative impacts on the aquatic environment will occur during the construction phase of the development. Key to minimising this risk has been the siting of all works, including turbine locations and other key infrastructure at a minimum set-back from watercourses (65 m). In designing the layout of the access roads, careful consideration has been given to minimise the numbers of watercourse crossings and in choosing locations where crossing design can readily achieve the objective of maintaining the potential for unimpeded fish pass and ecological connectivity. The layout (as assessed in **Chapter 9: Hydrology and Hydrogeology**) has also avoided any interference with existing hydrology on the Site and along the proposed Grid Connection Route and Turbine Delivery Route, and maintains surface water flow networks through the use of cross drains on access roads.

6.5.2.2 Mitigation by Design

A comprehensive suite of drainage measures has been developed to protect all receiving waters from potential impacts during the construction of the development in the catchment of the Site and along the proposed Grid Connection Route and Turbine Delivery Route, and are outlined in full in **Chapter 9: Hydrology and Hydrogeology**. These measures are aimed at preventing sediments or other pollutants from entering watercourses through the containment and treatment of all surface water run-off from areas of works and the diversion of upstream flows away from works areas. An Ecological Clerk of Works (ECoW) will be appointed to ensure compliance during the construction stage with all mitigation measures and legislative requirements related to aquatic ecology.

The mitigation measures have been incorporated into a Construction and Environmental Management Plant (CEMP) (**Appendix 2.1**) for the Development which includes Construction Method Statements for key works. The CEMP includes a Surface Water Management Plan (SWMP), a Water Quality Management Plan (WQMP), a Waste Management Plan (WMP), a Peat and Spoil Management Plan (PSMP) and an Emergency Response Plan (ERP). The CEMP and associated plans will require mandatory adherence by all parties involved in the construction of the Development (including any sub-contractors) in order to protect aquatic conservation interests within the study area. The development of the mitigation measures and all method statements for watercourse crossings follows all relevant guidance and current best practice as detailed in:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.

- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney & Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Southern Regional Fisheries Board.
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

The use of Sustainable Drainage Systems (SuDS) on site will eliminate risk to watercourses from sedimentation during the construction, operational and decommissioning phases of the proposed development. SuDS adopts the following design principles to drainage:

Minimise → Intercept → Treat → Disperse → Dilute

All surface water management measures will be put in place concurrently during the development of the road network. The measures entail the following key elements which are described in detail within the Surface Water Management Plan:

- Open Constructed drains for development run-off collection and treatment;
- Collection Drains for upslope "clean" water collection and dispersion;
- Filtration Check Dams to reduce velocities along sections of road which run perpendicular to contours;
- Settlement Ponds, Settlement Lagoons and Buffered Outfalls to control and store development runoff to encourage settlement prior to discharge at Greenfield runoff rates as illustrated on planning drawings 6226-PL-100-108.

There will be no direct site run-off to watercourses during the construction phase with all outflows from drainage via settlement ponds from which treated surface water is released by

diffuse overland flow at appropriate locations. To reduce the amount of silt laden water to be treated, clean water drains will be created upstream of the works area to divert water away from construction areas, thereby lessening the volume of water to be treated onsite.

De-watering of excavations where required, will be through filtered 'silt socks' / dewatering bags or a 'Siltbuster' or similar system, prior to discharge. Excavations will be kept to the absolute minimum for the specific task and undertaken on a 'just in time' basis to minimise the extent of silty water generated and requiring treatment prior to discharge.

The three watercourse crossings along the access road network are all designed as clear span structures with abutments set back from the river banks to avoid any modification to the stream channel in accordance with the requirements of IFI. The method statements prepared for the construction of the bridges and associated works in Section 4 of the WQMP (Appendix 2.1) detail the sequencing of works required to avoid the risk of silt or other pollutants entering the watercourses. The construction of the watercourse crossings will be undertaken during the period 1st July to 30th September as required by IFI Guidance (2016) to avoid accidental damage or siltation of spawning beds, unless otherwise specified by IFI during consultations in advance of works. There will be no instream works undertaken and no tracking of machinery across any watercourse. Temporary crossings will be undertaken by Bailey bridge (a type of portable, pre-fabricated, truss bridge) or similar if required. All machinery will stay within designated routes (working corridor) within the development Site Boundary for the windfarm and Grid Connection Route. This will include preparatory work in the vicinity of all watercourses and all river bank works. All bank-sides in the vicinity of the new crossings will be fully reinstated with vegetation cover as quickly as possible using only native species appropriate to the existing environment.

The directional drilling of the three watercourses on the grid connection route will be undertaken by either Horizontal Directional Drilling (HDD) or Auger Bore method in accordance with the method statements provided in **Appendix 2.3: Grid Connection Route Details**. These methods detail the potential risks of pollutants or contaminants arising during the works and provide specific measures to neutralise the risks.

A Slope Stability Risk Assessment was carried out and indicates that the risk of significant mass movement of soils or landslides occurring is Very Low to Low within the footprint of the Development. However, an assessment of the peat quality indicates that there remains the potential for peat stability issues to arise at a localised scale, for example, point locations associated with deeper peat and/or steeper inclines and/or close proximity to sensitive

receptors. In accordance with the requirements of IFI, the CEMP contains a contingency plan to deal with the scenario of a peat movement occurring on the Site which includes measures to control silt in such a scenario, and measures to be put in place at the initial stages of construction to off-set this risk. Specific measures are detailed in **Chapter 9: Hydrogeology and Hydrology** (**Section 9.5.2.10 Emergency Response**) to be implemented in the unlikely eventuality a peat failure or some other form of failure or over-loading of the drainage and attenuation design.

6.5.2.3 Mitigation by Reduction

The specified measures detailed below are aimed at protection of instream aquatic biota within the vicinity of any proposed works at watercourses effected by the Development of the windfarm site and Grid Connection Route but equally with regards to the protection of the downstream population of Freshwater pearl mussel and salmonids. No mitigation is required for the Turbine Delivery Route. These measures are a summary of the principal requirements with full detail being presented in **Chapter 9: Hydrogeology and Hydrology**, which are transposed into the Construction Environmental Management Plan (see **Appendix 2.1: CEMP**).

- During the construction phase the appointed Contractor(s) will ensure that the following mitigation is adhered to in line with IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters:
- No works will take place within the 65 m buffer zone of watercourses except for the clear span bridges, road development and drainage measures as detailed.
- Site compounds and Soil storage areas will be located at a minimum distance of 65 m from any watercourse. All drainage from these facilities will be directed through a settlement pond with appropriate capacity and measures to provide spill containment.
- All site drainage, as described in the surface water management plan and shown on associated drawings, will be directed through either sediment traps, settlement ponds and / or buffered drainage outfalls to ensure that total suspended solid levels in all waters discharging to any watercourse will not exceed 25 mg/L (IFI, 2016). All construction site run-off will be channelled through a stilling process to allow suspended solids to settle out and through a spill-containment facility prior to discharge. Discharge outside of surface water buffer zones will be by buffered outfall to vegetated areas. Within the surface water buffer zones, discharges will be directed through the use of stilling ponds, in line check dams and provided with erosion control to the receiving drain or surface water feature. No discharges will occur in areas identified as high-risk landslide areas.
- Daily monitoring of all sediment traps and settlement ponds will be undertaken by the Environmental Manager or Ecological Clerk of Works to ensure satisfactory operation

and/or maintenance requirements. A full specification for the water quality monitoring is presented in the WQMP (provided as part of **Appendix 2.1**).

- The storage of oils, hydraulic fluids, etc., will be undertaken in accordance with current best practice for oil storage (Enterprise Ireland, BPGCS005).
- All machinery operating on the windfarm site and on the Grid Connection Route will be fully maintained and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken at a discrete "fuel station" within the temporary site compound and will be designated for the purpose of safe fuel storage and fuel transfer to vehicles.
- Any extensions to existing drainage culverts on the site roads will be undertaken in dry conditions and in low flow conditions on drains that do not run dry.
- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc., will be completed in the dry to avoid pollution of the freshwater environment (see **Chapter 9** for further details). There will be no batching or storage of cement allowed in the vicinity of any watercourse crossing construction area.
- Procedures (as detailed in **Chapter 9**) will be put in place to ensure the full control of raw or uncured waste concrete to ensure that watercourses will not be impacted.
- Should there be any incidents of pollution to watercourses, immediate steps as specified in the Emergency Response Plan (CEMP-Management Plan 1) will be undertaken to resolve the cause of the pollution and where feasible, mitigate against the impact of pollution.
- Re-seeding / re-vegetation of all areas of bare ground or the placement of Geo-jute (or similar) matting will take place prior to the start of the operational phase to prevent silt-laden run-off. The seed mix will contain only suitable native species of plant.
- Silt traps erected during the construction phase within roadside and artificial drainage will be replaced with stone check dams for the lifetime of the project. These stone check dams will only be placed within artificial drainage systems such as roadside drains and not in natural streams or drainage lines.

A full review of construction stage temporary drainage will be undertaken by the Developer (in conjunction with the Project Hydrologist/ Site Engineer and the Project Ecologist) following the completion of construction.

6.5.3 Operational Phase Mitigation

The following measures will be implemented during the operational phase to ensure the ongoing protection of watercourses and water quality at the Site and in downstream reaches:

- The temporary Site compound / office will house all potential pollutants within a secure bunded COSSH store for the operational phase of the project.

6.5.4 Decommissioning Phase Mitigation

Decommissioning will be scheduled to take place after the proposed 35-year lifespan of the Project. Decommissioning phase impacts for the Project are likely to be broadly similar to construction phase impacts, in terms of potential surface water quality impacts from ground disturbance, refuelling and the storage of potentially hazardous materials onsite. The implementation of all mitigation measures detailed for the construction phase will be adopted in full during the decommissioning phase to ensure all such impacts are avoided. A Decommissioning Plan has been included in **Appendix 2.1**.

When the final Decommissioning Plan is prepared prior to decommissioning, all drainage management measures, which will include maintenance of the operational drainage measures, will be included in that document. However, it should be noted that by the time decommissioning is undertaken after the planned 35-year lifespan of the Development, the areas within the Site will have revegetated resulting in a resumption of the natural drainage management that will have existed prior to any construction. It is not anticipated that the decommissioning phase will interrupt this restored drainage regime in any way with the works proposed. As a minimum measure, areas where freshly placed soil is placed as part of turbine foundation reinstatement work will be surrounded by silt fencing if deemed necessary until the area has naturally revegetated.

Restoration of the Site following decommissioning of infrastructure will require the prior establishment of the new baseline conditions at the site which will have developed over the intervening 35 years life of the Project. These studies will inform any modification or additional sensitivities that may need to be factored in restoration and site-specific measures.

6.6 RESIDUAL EFFECTS OF THE DEVELOPMENT

The three watercourse crossings along the site access road network are clear-span structures which will require no channel modification and result in no loss of instream habitat. The design of the crossings will ensure no impediment to movement of fish or other aquatic biota.

The approach to the development design, the use of SuDS drainage and the suite of comprehensive measures to avoid, reduce or remedy all potential impacts on water quality will ensure that the receiving water bodies in the catchment of the development do not suffer any deterioration in water quality, either during construction, operation, or decommissioning. The

populations of Freshwater Pearl Mussel in the lower catchments of the Development and along the Grid Connection Route will not be negatively affected by the Project.

There is expected to be no negative residual impact on any aquatic species, habitat or on water quality at a local or catchment level as a result of the Development.

6.7 MONITORING

In order to verify the efficacy of pollution prevention and mitigation works during construction, Water Quality Monitoring will be undertaken prior to, during and post completion of construction works in accordance with the parameters and schedules as set out in the in the **Chapter 9: Hydrogeology and Hydrology** and in the **Water Quality Management Plan (Appendix 2.1 CEMP, Management Plan 2)**. Monitoring will be undertaken in all watercourses within the catchment of the construction area. During both the construction and operational phases of the project watercourse crossings will be monitored frequently (daily during construction and intermittently during operational phase i.e., weekly / monthly inspections initially and reduced gradually in line with observed stability and confidence in longer term data obtained. The water course crossings will be monitored in terms of structural integrity and in terms of their impact on respective watercourses.

Site water runoff quality at all surface water monitoring locations will be monitored on a continuous basis during the construction phase of the Project. Monitoring will continue into the operational phase until such time that the Site and water quality have stabilised (stable conditions in line with baseline conditions for e.g., eight (8 No.) consecutive quarterly monitoring events). This monitoring will be carried out at the downstream surface water baseline sampling location (**Appendix 9.6**)

Continuous monitoring systems will be in place, particularly in principal surface water features draining the site using telemetric turbidity monitoring sensors.

Monitoring will be overseen by an independent Environmental Consultant and undertaken by the Environmental Manager or by the Ecological Clerk of Works qualified and experienced on the required monitoring methods and the use, calibration and maintenance of all monitoring equipment used).

Baseline monitoring undertaken at the Site as part of this study will be repeated periodically i.e., before, during and after construction phase, to measure any deviations from baseline hydrochemistry that occur at the Site, including discharge rates. The construction monitoring programme for the Inchamore site will include the following:

- During the construction phase daily inspection of silt traps, settlement ponds, buffered outfalls and drainage channels will be undertaken. Routine measurement of total suspended solids, electrical conductivity, pH and water temperature at selected water monitoring locations at the Site will be carried out. Monitoring of locations where excavations are being dewatered (likely high in solids) will be done in real time.
- During the construction phase of the Project, the Development areas will be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system so that it does not become blocked, eroded or damaged during the construction process.

6.7.1 Post-construction phase monitoring

On completion of the construction phase, post construction monitoring will be agreed with Cork County Council and undertaken using the suite of parameters as detailed in the WQMP which is included as part of **Appendix 2.1**. During the operational phase and post decommissioning of the project, the stilling ponds and buffered outfalls will be periodically inspected during maintenance visits to the Site.

6.8 SUMMARY OF SIGNIFICANT EFFECTS

The Development will entail the crossing of three small watercourses along the access track network. The watercourses are all minor headwater tributaries with limited fisheries value, though the downstream catchments are of significant value for salmonids as well as supporting populations of the Annex II listed Freshwater Pearl Mussel. All watercourses will be crossed by clear-span structures with the abutments set back from the river banks, ensuring no impediment to movement of fish or other aquatic biota. These and other construction works however, present a risk of impacting on water quality within the streams with potential for impacts extending downstream to affect salmonid and Freshwater Pearl Mussel populations. An extensive suite of mitigation measures is prescribed through all phases of the Project to prevent deterioration of surface waters within and downstream of the Site. The mitigation will ensure there are no significant effects on water quality within any receiving waters and on their associated biota.

The construction of the Grid Connection Route parallels the Clydagh River where it runs along an existing forestry track. The Clydagh also supports a population of Freshwater pearl mussel as well as being an important salmonid river. There are numerous feeder tributaries crossed by existing culverts along the track, the majority of which have sufficient depth of over-lying material to accommodate the burying of the Grid Connection Route across the culvert.

There are three watercourses which do not have culverts and these will be directionally drilled thereby minimising risks of silt or other pollutants entering the watercourse, with all frack arising from the drilling contained and disposed of appropriately. A small number of un-culverted drains will be crossed by open-cut but these do not support perennial flows and the works will be undertaken in the dry to avoid siltation. Subject to the adoption of the prescribed measures in **Section 6.5** above, the laying of the grid connection does not pose a risk of giving rise to any effects on water quality within the Clydagh River.

The mitigation measures as described in this chapter and within the CEMP and WQMP are aimed at avoiding any deterioration in water quality during the construction phase. Subject to their successful implementation, there is considered to be no significant risk of a deterioration in water quality in any receiving waters associated with the Development.

The operational phase of the Development is considered not to present any significant risk of affecting water quality within the catchment. Decommissioning will be scheduled to take place after the proposed 35 year lifespan of the Project. Decommissioning phase impacts are likely to be broadly similar to construction phase impacts and the implementation of all mitigation measures detailed for the construction phase will be adopted in full during the decommissioning phase to ensure all such impacts are avoided.

6.9 STATEMENT OF SIGNIFICANCE

It is considered that with the proposed mitigation successfully implemented, the Development will result in an overall negligible to low significance residual impact upon the aquatic ecological features that lie within the Zone of Influence.