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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED BALLINAGREE WIND FARM

VOLUME 2 – MAIN EIAR

CHAPTER 8 PART B - AQUATIC ECOLOGICAL ASSESSMENT

Prepared for: Ballinagree Wind DAC

Ballinagree Wind farm

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8B.1. INTRODUCTION

8B.1.1 Background

This report assesses the potential impact of the proposed project on aquatic ecology, through its various developmental phases of construction, operation and decommissioning. All elements of the design proposals have been assessed in the context of aquatic ecological sensitivities of the receiving environment.

The following report provides a baseline assessment of the aquatic ecology including fisheries and biological water quality as well as protected aquatic species and habitats in the vicinity of the project. This report also assesses the potential impacts of the proposed wind farm on the receiving aquatic environment based on its known sensitivities (i.e. quality of water, ecological status, presence of protected species etc.) along with proposed mitigation measures and any residual impacts of the proposed development (sections 5, 6 & 7). An assessment of the hydrological impacts of the proposed wind farm development on the receiving aquatic environment are discussed in Chapter 10 (Hydrology and Water Quality) of the main EIAR report.

Undertaken on a catchment-wide scale, the baseline surveys focused on aquatic habitats in relation to fisheries potential (including both salmonid and lamprey habitat), freshwater pearl mussel (*Margaritifera margaritifera*), white-clawed crayfish (*Austropotamobious pallipes*), otter (*Lutra lutra*), macro-invertebrates, macrophytes, aquatic invasive species, and fish of conservation value which may use the watercourses in the vicinity of the proposed development. Aquatic surveys were undertaken in June-July 2020 and June 2021.

The majority of survey sites within and draining to the south of the site were located on numerous watercourses within the Sullane_SC_010 sub-catchment, although several sites draining to the north of the site were located in the Blackwater [Munster]_SC_070. The development also overlapped with the Lee-Laney and Munster Blackwater *Margaritifera* sensitive areas (**Figure 8B.2.1**). While none of the aquatic survey sites were located within any European sites, several survey watercourses draining to the north of the site shared downstream hydrological connectivity with the Blackwater River SAC (site code: 002170) via the Nadanuller Beg Stream (EPA code: 18N05) and Glen River (18G04). The headwaters of the Glen River (including survey site A5) were located within the Boggeragh Mountains NHA (002447), a site designated for peatlands. **Figure 8B.1.1** gives the location of the proposed project with respect to relevant watercourses and their connectivity with European sites.

8B.1.2 Development Description

The key elements of the proposed project as described in Chapter 3 are referred to as follows throughout this chapter:

- The wind farm site (also referred to in this EIAR as ‘the Site’);
- The grid connection;
- The turbine delivery route (also referred to in this EIAR as ‘the TDR’);
- Biodiversity enhancement and management plan lands (also referred to in this EIAR as ‘the BEMP lands’).

The proposed wind farm site is located in an upland area near Ballinagree, approximately 10km north of Macroom, Co. Cork (**Figure 8B.1.1**). A full description of the proposed project is provided in Chapter 3.

As described in Chapter 1, the plans and particulars submitted with this application for consent are precise and provide specific dimensions for the turbine structures which incorporates a small range in dimensions. The turbine specifications will have a hub height range of between 102.5 and 110.5m and a rotor diameter range of between 149m and 155m with a tip height of between 179m and 185m. This chapter of this EIAR has fully assessed all combinations within this range in turbine specification and the ultimate final turbine selection will fall within the parameters of this range.

8B.1.3 Statement of Authority

Ross Macklin

Ross Macklin PhD (candidate) BSc (Hons) Applied Ecology HDip GIS Dip IPM MCIEEM IFM is an environmental scientist specialising in freshwater and fisheries ecology. He studied a Bachelors Degree in Applied Ecology at U.C.C. and later completed a higher diploma in Geographical Information Systems and Integrated Pest Management. He is currently completing his PhD in U.C.C. in the area of fisheries ecology. Ross has an in-depth knowledge of all freshwater ecosystems and riparian corridors. He has undertaken river habitat, lake habitat, wetland habitat and fisheries assessments in professional work for 16 years. His specialist freshwater experience lies in biological and physiochemical water quality analysis, fisheries ecology, riparian habitat assessments, habitat mapping, protected species, geographical information systems, ecological design and invasive species. Ross has expert experience in identifying and assessing macrophyte plant, aquatic bryophytes, fish and macroinvertebrates from a variety of aquatic habitats. He routinely undertakes Habitat Regulations Assessments, Fisheries Assessments, Protected Species Surveys, Invasive Species Surveys, Habitat & Surface Water Management Plans, CEMP, EcIA and EIAR reporting

Bill Brazier

Bill Brazier (Ph.D. (candidate), B.Sc. (Hons.) Applied Freshwater & Marine Biology, MIFM) is an environmental scientist specialising in freshwater and fisheries ecology. He studied Applied Freshwater & Marine Biology at Galway-Mayo IT and is currently completing a Ph.D. in fish ecology and genetics at University College Cork. He specialises in freshwater fisheries ecology, biology and water quality. He has considerable experience of over ten years in a wide range of ecological and environmental projects including EIAR, EcIA and AA/NIS reporting, as well as the areas of fisheries assessments, fish health screening, aquatic baselines, riparian habitat assessments, geographical information systems (GIS), habitat mapping, protected species surveys (e.g. otter, FWPM, white-clawed crayfish etc.), biodiversity enhancement, invasive species and fisheries management. Bill has extensive experience in identifying and assessing fish, macrophytes, aquatic bryophytes and macro-invertebrates from a variety of aquatic habitats. He routinely undertakes aquatic work for wind farm developments, flood relief schemes, road schemes, blueways/greenways and biodiversity projects.

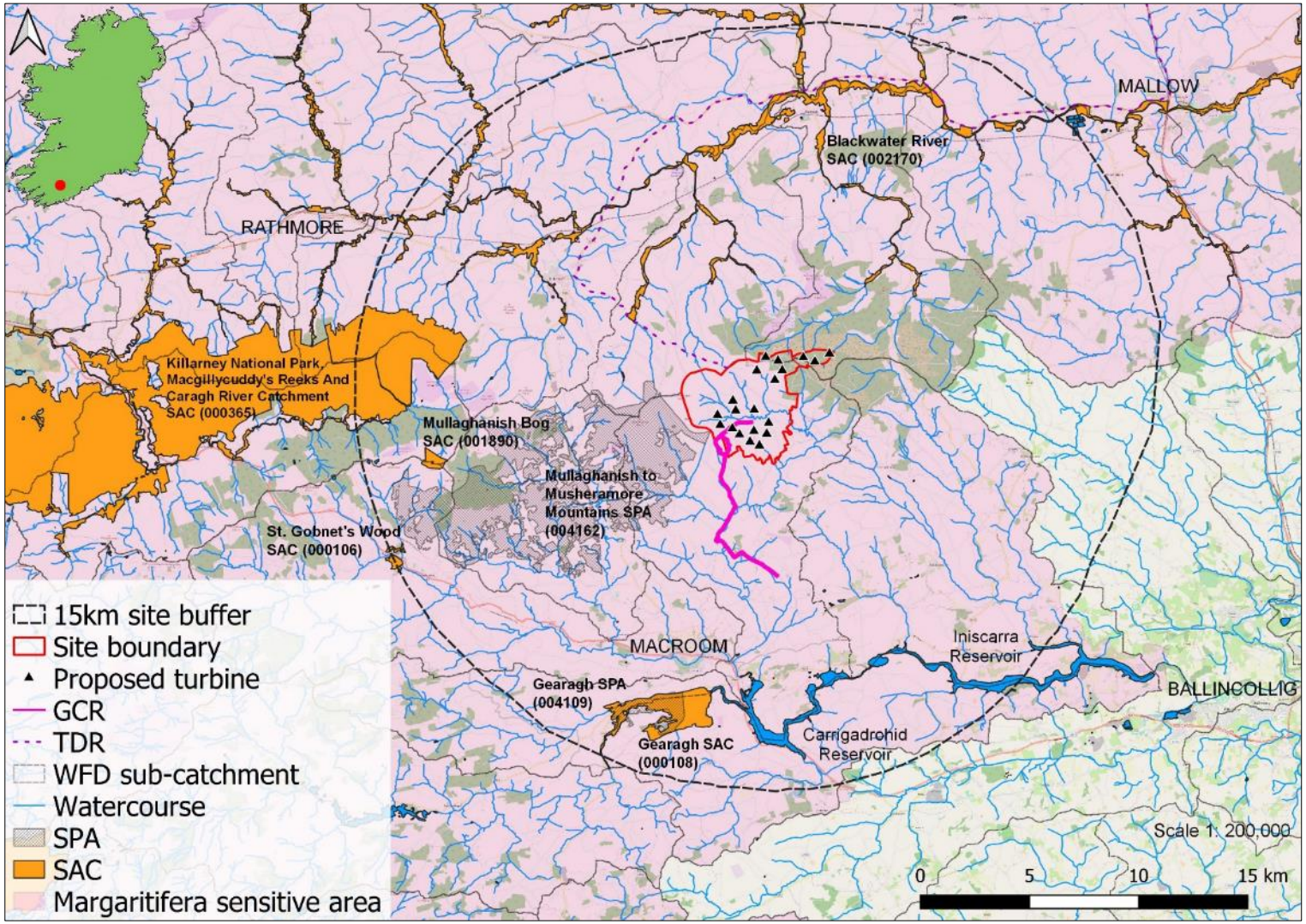

Figure 8B.1-1: Location of the proposed project, Co. Cork showing European sites within a 15km buffer

8B.2. METHODOLOGY

8B.2.1 Relevant 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, 2019). 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).

The assessment of potential impacts uses the impact significance scale defined in the 'Guidelines on the Information to Be Contained in Environmental Impact Assessment Reports' (EPA, 2017), as follows:

Imperceptible → Not significant → Slight → Moderate → Significant → Very significant → Profound

An impact assessed as 'imperceptible' using this scale is considered to be a negligible impact. An impact assessed as 'significant', 'very significant' or 'profound' corresponds to a significant impact in the context of the EIA Directive. Such an impact is considered to represent an impact "that supports [positive impact] or undermines [negative impact] biodiversity conservation objectives" for the relevant receptor (CIEEM, 2019). The duration of impacts will also be considered according to Environmental Protection Agency (EPA) guidance (EPA, 2017). 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, 2019).

Other guidance considered in the preparation of this report included the following;

- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. December 2019. Prepared by the Department of Housing, Planning and Local Government.
- EPA (2015). Advice Notes for Preparing Environmental Impact Statements.
- IFI (2016). Guidelines on protection of fisheries during construction works in and adjacent to waters. Inland Fisheries Ireland.
- Irish Wind Energy Association (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Irish Wind Energy Association.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.

8B.2.2 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed project were considered as part of the current assessment. This included watercourses draining the proposed wind farm site as well as those crossed by the proposed grid connection route and turbine delivery route (where any works had potential to cause impacts). A total of *n*=40 locations were selected for detailed aquatic assessment (see **Table 8B.2.1, Figure 8B.2.1** below). Sites were grouped according to survey clusters, i.e. A (north of proposed project), B (within project site) and C (downstream of project site). An additional *n*=5 surveys locations (i.e. sites N1, N2, N3, N4 & N5) were surveyed in June 2021 to reflect the updated site infrastructural layout. The nomenclature for the watercourses surveyed is as per the Environmental Protection Agency's (EPA) online map viewer.

A fisheries assessment (including electro-fishing and fisheries habitat appraisal) and white-clawed crayfish survey was undertaken at *n*=35 sites in June-July 2020 (**Table 8B.2.1, Figure 8B.2.1; Appendix 8B.A**). A fisheries appraisal (no electro-fishing) was undertaken at an additional *n*=5 locations in June 2021 to reflect the updated site infrastructural layout (i.e. sites N1, N2, N3 & N4 and N5).

Biological water quality sampling (Q-sampling) was undertaken at a representative sub-set of these sites (i.e. *n*=21 sites; A1, A2, A5, B6, B7, B8, B9, B10, B11, C3, C5, C7, C11, C12, C13, C17, N1, N2, N3, N4 & N5) (**Figure 8B.2.2; Appendix 8B.B**).

Physiochemical water quality samples were taken from a total of *n*=15 sites (i.e. A1, A2, A5, B6, B7, B8, B9, B10, C7, C13, C17, N1, N2, N3 & N4) (**section 8B.4.2**). A freshwater pearl mussel survey was conducted on sections of the River Laney and Awboy River (**Appendix 8B.C**).

This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed wind farm project.

More specific aquatic methodology is outlined below and in the appendices of this report.

Table 8B.2-1: *n*=40 aquatic survey locations for the proposed Ballinagree wind farm project, Co. Cork (watercourse names are according to the EPA)

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Nadanuller Beg Stream	18N05	Carrigagulla	536890	587246
A2	Nadanuller Beg Stream	18N05	Carrigagulla	537742	587571
A3	Unnamed stream	n/a	Crinnaloo South	538409	587668
A4	Unnamed stream	n/a	Crinnaloo South	538946	587720
A5	Glen River	18G04	Inchamay South	540517	587756
B1	Carrigagulla Stream	19C22	Carrigagulla	536626	585034
B2	Unnamed stream	n/a	Knocknagappal	534010	584604
B3	West Ballinagree Stream	19W12	Knocknagappal	534023	583798
B4	Knocknagappal 19 Stream	19K04	Knocknagappal	534644	583730
B5	River Laney	19L01	Ballynagree West	535126	584076
B6	River Laney	19L01	Ballynagree West	535248	583913
B7[1]	Unnamed stream	n/a	Ballynagree East	535968	584267
B8	River Laney	19L01	Ballynagree East	536600	583906
B9	Unnamed stream	n/a	Carrigagulla	538378	584701
B10	Ballynagree East Stream	19B21	Ballynagree East	536999	581849
B11	River Laney	19L01	Annagannihy	539060	582814
C1	Carrigthomas Stream	19C48	Knocknagappul	534443	582576
C2	Maulnahorna Stream	19M10	Rahalisk	533717	582074
C3	Carrigthomas Stream	19C48	Horsemount Bridge	534597	581268
C4	Rahalisk Stream	19R08	Knocknagappul	535030	580521
C5	Carrigthomas Stream	19C48	Coppeleenbawn Bridge	535286	579818

[1] Biological and physiochemical water quality sampling at this site was undertaken in May 2021

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
C6	Unnamed stream	n/a	Knocknagappul	536028	580673
C7	River Laney	19L01	Ballynagree West	536793	580028
C8	Lacknahaghny Stream	19L21	Lacknahaghny	536625	579348
C9	Unnamed stream	n/a	Carrigthomas	536313	579387
C10	Unnamed stream	n/a	Carrigthomas	535957	579674
C11	River Laney	19L01	Knocknagappul Bridge	535409	579769
C12	Awboy River	19A03	Awboy Bridge	534960	579216
C13	River Laney	19L01	Clonavrick Bridge	534605	578297
C14	Clonavrick Stream	19C74	Clonavrick	535048	577820
C15	Coolaniddane River	19C67	Caherbaroul	536466	577955
C16	Kilberrihert Stream	19K24	Derryroe	536269	577345
C17	Coolaniddane River	19C67	Caherbaroul	536005	577472
C18	Caherbaroul Stream	19C76	Caherbaroul	535712	577653
C19	Bealick Stream	19B45	Rockville	536620	577111
N1	West Ballynagree Stream	19W12	Knocknagappul	534473	583824
N2	River Laney	19L01	Knocknagappul	534962	584267
N3	Unnamed stream	n/a	Ballynagree East	535352	585631
N4	River Laney	19L01	d/s ford crossing at Carrigagulla	536666	583905
N5	Unnamed stream	n/a	Knocknagappul	534809	581860

8B.2.3 Desk Study

A sensitive species data request was submitted (9th November 2020) to the National Parks and Wildlife Service for the 10km grid squares containing and adjoining the proposed wind farm project (i.e. W28, W37, W38, W48 & W49) and was received on the 12th November 2020. Data held by the National Biodiversity Data Centre (NDBC) was also reviewed. Records for a number of rare or protected species were available although none overlapped directly with the wind farm boundary. However, several records overlapped with or shared hydrological connectivity with associated infrastructure (i.e. grid connection route, turbine delivery route).

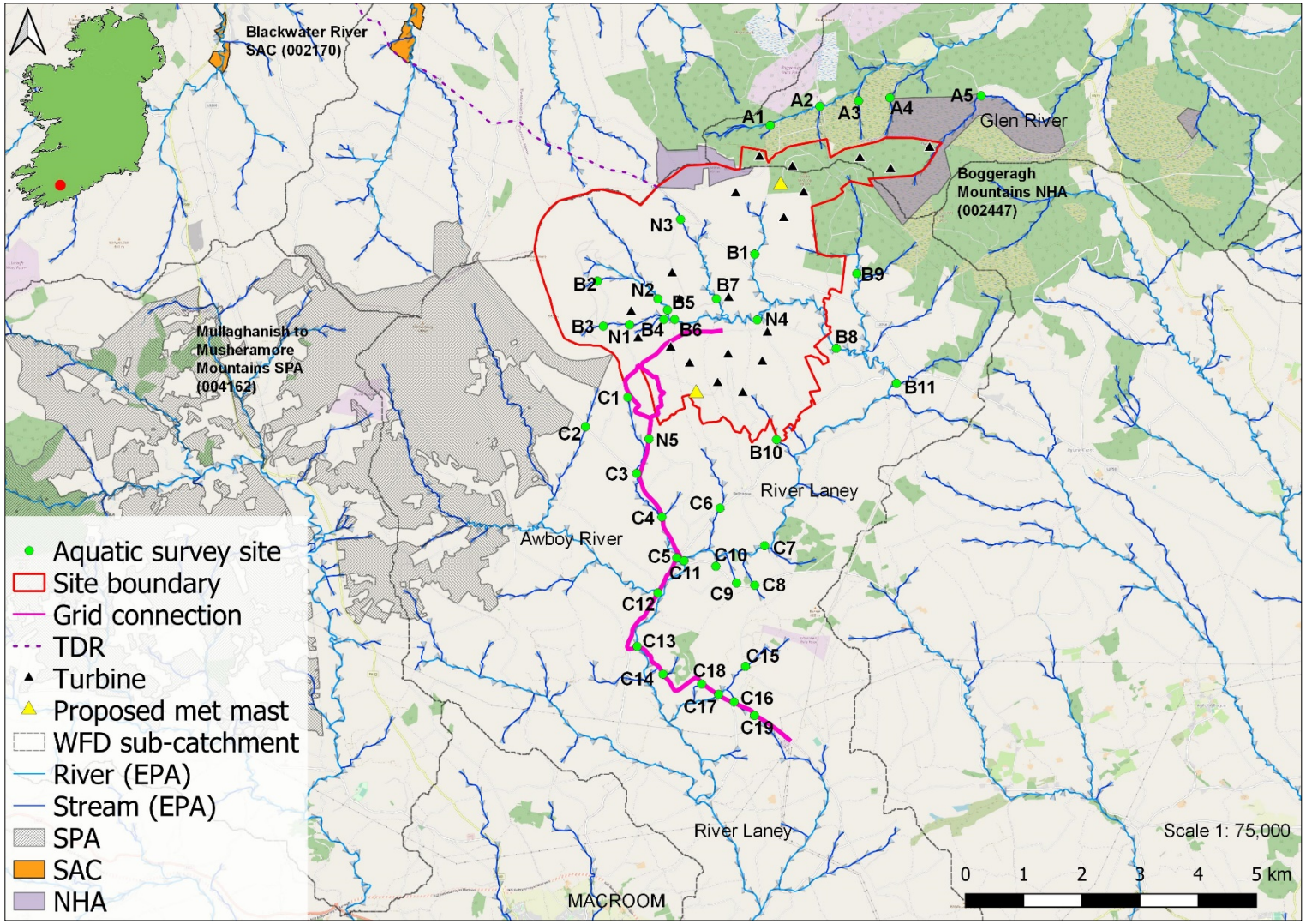

Figure 8B.2-1: Overview of the *n*=40 aquatic survey locations for the proposed Ballinagree wind farm project, Co. Cork.

8B.2.4 Field Assessment

Surveys of the aquatic sites within the vicinity of the proposed project were conducted in June-July 2020, June 2021 and December 2021 (total of *n*=40 survey locations). Survey effort focused on both instream and riparian habitats approx. 150m upstream and 150m downstream of each sampling point (see **Figure 8B.2.1** above). The watercourses at each survey location were described in terms of the important aquatic habitats and species. This helped to evaluate species and habitats of ecological value in the vicinity of each site. The aquatic baseline prepared informs mitigation for the proposed project. No significant constraints were noted with regards to aquatic ecology data collection during the field visits.

A broad aquatic habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.);
- 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;
- An appraisal of the macrophyte and aquatic bryophyte community at each site;
- Riparian vegetation composition.

8B.2.5 Otter signs

The presence of otter (*Lutra lutra*) at each of the *n*=40 aquatic survey locations was determined through the recording of otter signs within 150m of the survey area. The survey broadly followed the best practice survey methodology for otter as recommended by Lenton et al. (1980), Chanin (2003), Bailey & Rochford (2006) and CIEEM (2013). Otter signs included holts, couches, spraints, latrines, slides and prints, which are useful determinants of otter utilisation of watercourses. The location of signs was recorded via handheld GPS.

8B.2.6 Catchment-wide electro-fishing and fisheries appraisal

A catchment-wide electro-fishing (CWEF) survey of the watercourses within the vicinity of the proposed wind farm (*n*=35 of 39 sites, **Table 8B.2.1, Figure 8B.2.1**) was conducted in July 2020, following notification to Inland Fisheries Ireland (Macroom) and under the conditions of a Department of Communications, Climate Action & Environment (DCCAE) licence. The survey was undertaken in accordance with best practice and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of all *n*=40 aquatic survey sites was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment considered the quality of spawning, nursery and holding habitat within the vicinity of the survey sites using Life Cycle Unit (salmonids) and Lamprey Habitat Quality Index scores (lamprey). For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix 8B.A.**

8B.2.7 Freshwater pearl mussel survey

A freshwater pearl mussel survey was undertaken on sections of the River Laney and Awboy River in June 2020 (**Appendix 8B.C**) by Sweeny Consultancy under NPWS licence C15/2020. Methodology followed NPWS guidance (Anon, 2004).

Assessments were made of the habitat suitability for freshwater pearl mussels, based on the criteria of Hastie et al. (2000) and Skinner et al. (2003) (see **Appendix 8B.C** for further details).

Outside of these targeted survey areas on the River Laney, a broad appraisal of pearl mussel habitat was undertaken at each of the *n*=40 aquatic survey locations.

8B.2.8 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey locations under a National Parks and Wildlife (NPWS) open licence (no. C79/2020), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 5 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish licence sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction. Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). Trapping of crayfish was not feasible given the small nature of most aquatic survey locations sampled. An appraisal of white-clawed crayfish habitat at each location was also carried out based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider Ballinagree catchment was undertaken.

8B.2.9 Biological water quality (Q-sampling)

Biological water quality sampling (Q-sampling) was undertaken at a representative sub-set of aquatic survey locations in July 2020, June 2021 and December 2021 (i.e. *n*=21 sites; A1, A2, A5, B6, B7, B8, B9, B10, B11, C3, C5, C7, C11, C12, C13, C17, N1, N2, N3, N4 & N5) (**Figure 8B.2.2; Appendix 8B.B**). Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). All riverine samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a three-minute sample. Large cobble was also washed at each site where present and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2-2: Reference categories for EPA Q ratings (Q1 to Q5)

Q Value	WFD Status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

8B.2.10 Physiochemical water quality

Physiochemical water quality samples were collected from a total of *n*=15 aquatic survey locations (**Figure 8B2.3**) on 18th June 2020, 1st July 2020 or 1st June 2021 (i.e. A1, A2, A5, B6, B7, B8, B9, B10, C7, C13, C17, N1, N2, N3 & N4).

Samples were cooled and delivered to the laboratory on the same day for analysis. In order to collate a broad water quality baseline for the study area, a range of physio-chemical parameters for each site were laboratory-tested, namely;

- pH
- Alkalinity (mg $CaCO_3$/l)
- Total Ammonia (mg N/l)
- Molybdate Reactive Phosphorus (MRP) (mg P/l)
- Total Oxidised Nitrogen (TON) (mg N/l)
- Dissolved Organic Carbon (DOC) (mg C/l)
- Biochemical Oxygen Demand (BOD) (mg O_2/l)
- Chemical Oxygen Demand (COD) (mg O_2/l)
- Suspended solids (mg/L)

8B.2.11 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

8B.2.12 Biosecurity

A strict biosecurity protocol including the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced

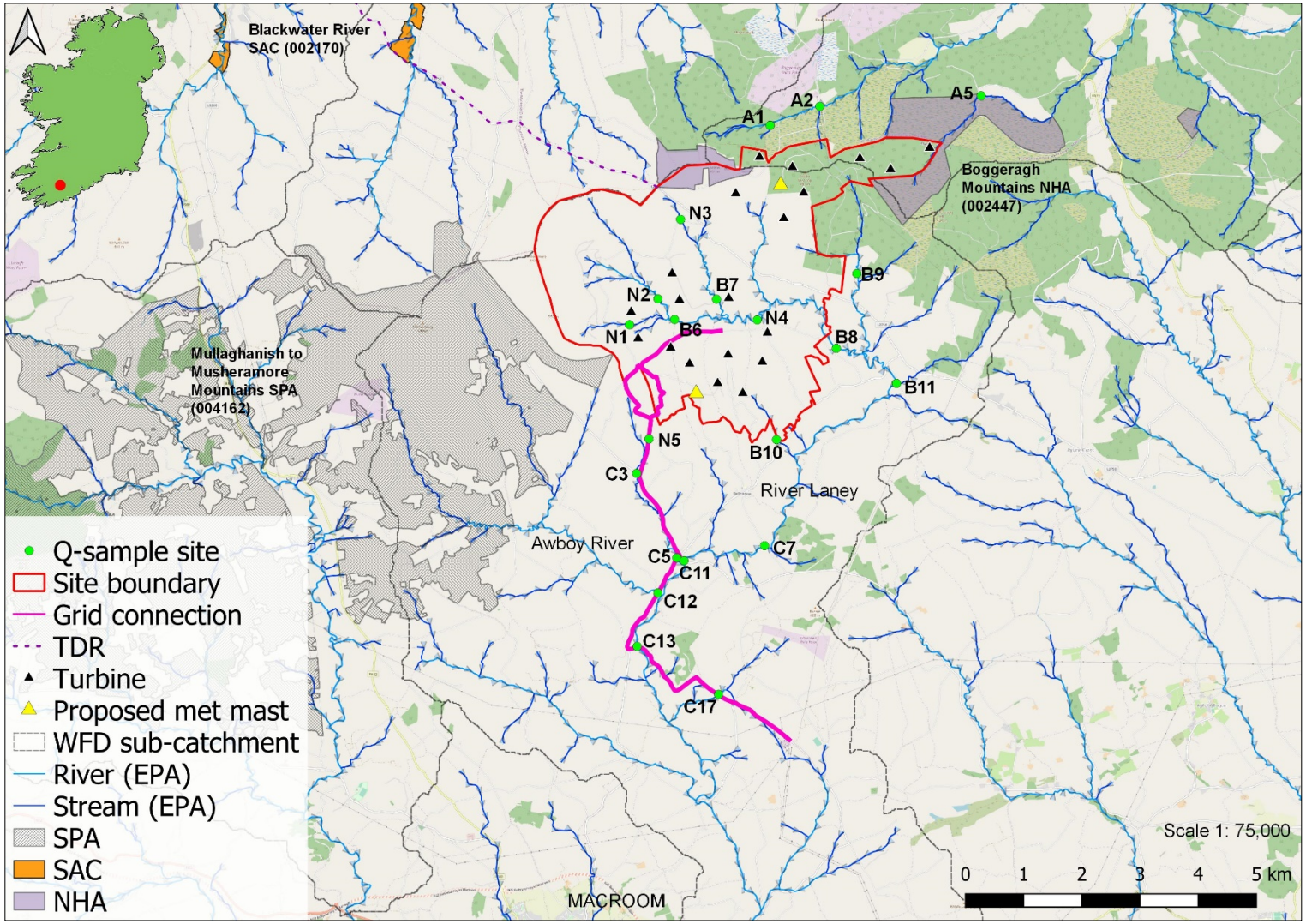

Figure 8B.2-2: Overview of the *n*=21 Q-sampling locations for the proposed Ballinagree wind farm project, Co. Cork

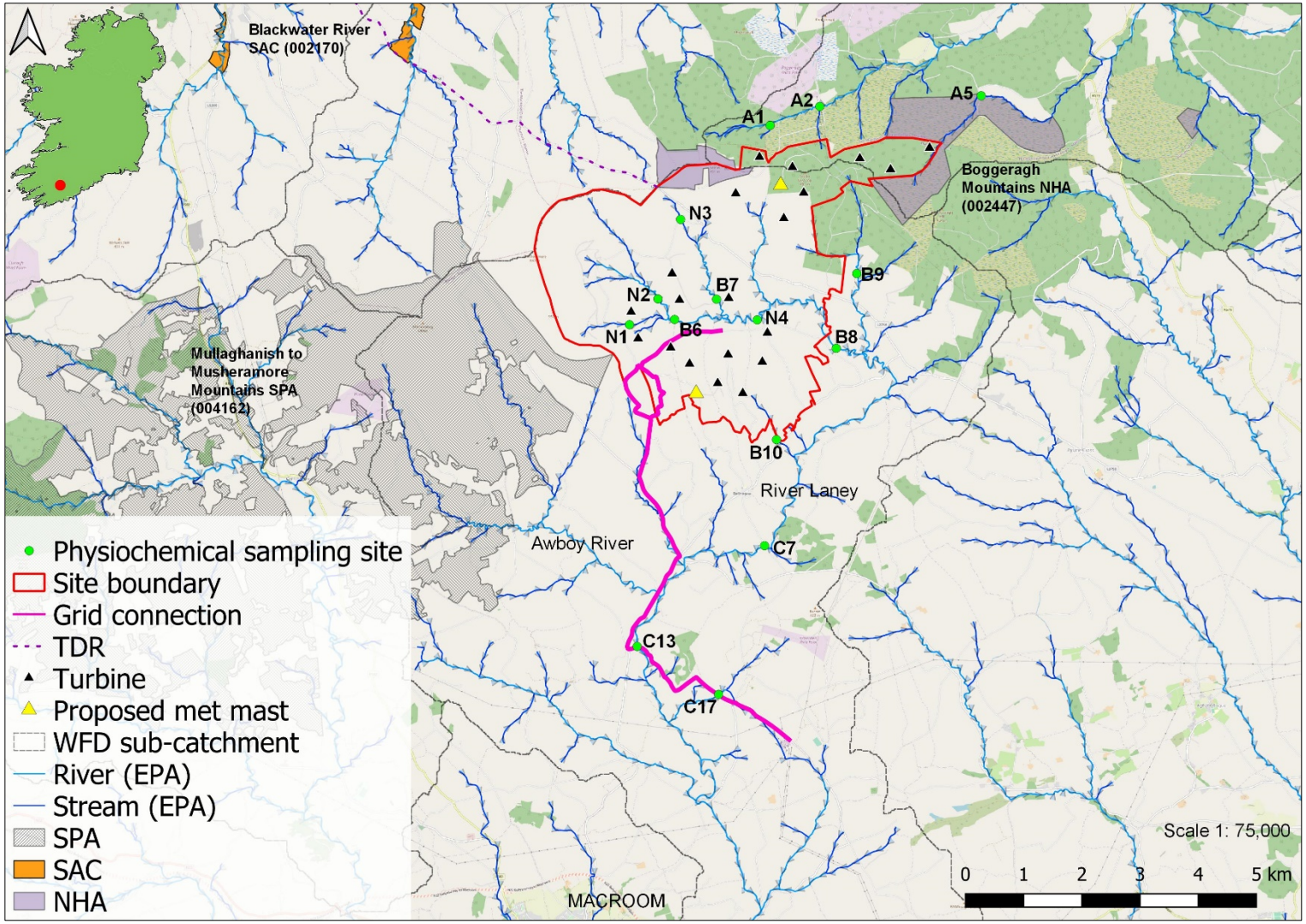

Figure 8B.2-3: Overview of the *n*=15 physiochemical water quality sampling locations for the proposed Ballinagree wind farm project, Co. Cork

8B.3. RECEIVING ENVIRONMENT

8B.3.1 Sites designated for aquatic interests

There were two European sites with downstream hydrological connectivity to the proposed Ballinagree wind farm project, namely Mullaghanish to Musheramore Mountains SPA (site code: 004162) and Blackwater River SAC (002170) (**Figure 8B.1.1**). No aquatic survey sites were located within a European site boundary. The Mullaghanish to Musheramore Mountains SPA is designated for the non-aquatic qualifying interest hen harrier (*Circus cyaneus*) [A082] (NPWS, 2020).

8B.3.1.1 Blackwater River SAC (002170)

The River Blackwater is one of the largest rivers in Ireland, draining a major part of Co. Cork and five ranges of mountains. The site consists of the freshwater stretches of the River Blackwater as far upstream as Ballydesmond, the tidal stretches as far as Youghal Harbour and many tributaries, the larger of which include the Licky, Bride, Flesk, Chimneyfield, Finisk, Araglin, Awbeg (Buttevant), Clyda, Glen, Allow, Dalua, Brogeen, Rathcool, Finnow, Owentaraglin and Awnaskirtaun. Overall, the River Blackwater is of considerable conservation significance for the occurrence of good examples of habitats and populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore, it is of high conservation value for the populations of bird species that use it. Two Special Protection Areas, designated under the E.U. Birds Directive, are also located within the site - Blackwater Callows and Blackwater Estuary. Additionally, the importance of the site is enhanced by the presence of a suite of uncommon plant species (NPWS, 2016).

Downstream hydrological connectivity exists between the proposed Ballinagree wind farm site and Blackwater River SAC (002170) via the Nadanuller Beg Stream and Nad River, as well as the Glen River (**Figure 8B.1.1**). The shortest hydrological pathway between the proposed project and this European site was 5.9km via the Glen River (from tree felling area at turbine T20). The TDR crosses the Blackwater River SAC at 4 no. locations. The grid connection does not cross the Blackwater River SAC.

The Blackwater River SAC is designated for the following qualifying interests (NPWS, 2012), namely;

- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Perennial vegetation of stony banks [1220]
- Salicornia and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]
- Mediterranean salt meadows (Juncetalia maritimi) [1410]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and aquatic mosses [3260]
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]
- *Margaritifera margaritifera* (freshwater pearl mussel) [1029]
- *Austropotamobius pallipes* (white-clawed crayfish) [1092]

- *Petromyzon marinus* (sea lamprey) [1095]
- *Lampetra planeri* (brook lamprey) [1096]
- *Lampetra fluviatilis* (river lamprey) [1099]
- *Alosa fallax* (twaite shad) [1103]
- *Salmo salar* (Atlantic salmon) [1106]
- *Lutra lutra* (otter) [1355]

A detailed description of the existing environment of the catchment is provided in chapter 10 of the EIAR.

8B.3.2 Sensitive species data request

A total of *n*=6 records for freshwater pearl mussel (*Margaritifera margaritifera*) were available for the River Laney (locally pronounced 'Lane'), with multiple records also available for the River Blackwater downstream of Banteer (**Figure 8B.3.1**). A single record overlapped with proposed wind farm infrastructure (grid connection route crossing) at survey site C13 at Clonavrick Bridge on the River Laney (record from 2007). Aside from this record, several other potential hydrological source-receptor pathways to known pearl mussel populations were identified (see **Figure 8B.3.1** below).

Common frog (*Rana temporaria*) were widespread throughout 10km grid squares W28, W37, W38, W48 & W49 although none overlapped with the proposed wind farm footprint.

Otter (*lutra lutra*) records were also widespread throughout the relevant grid squares. Otter records were available for the upper Awboy River, Carrigthomas Stream at Horsemount Bridge (survey site C3), Glen River at Glencaum Bridge and the Nad River in several locations. Otter were also previously recorded on the River Laney at Carrigagulla Bridge (near survey site B11), Clonavrick Bridge (survey site C11) and Morris's Bridge. The species is widespread on the River Blackwater. No otter records overlapped within the wind farm boundary.

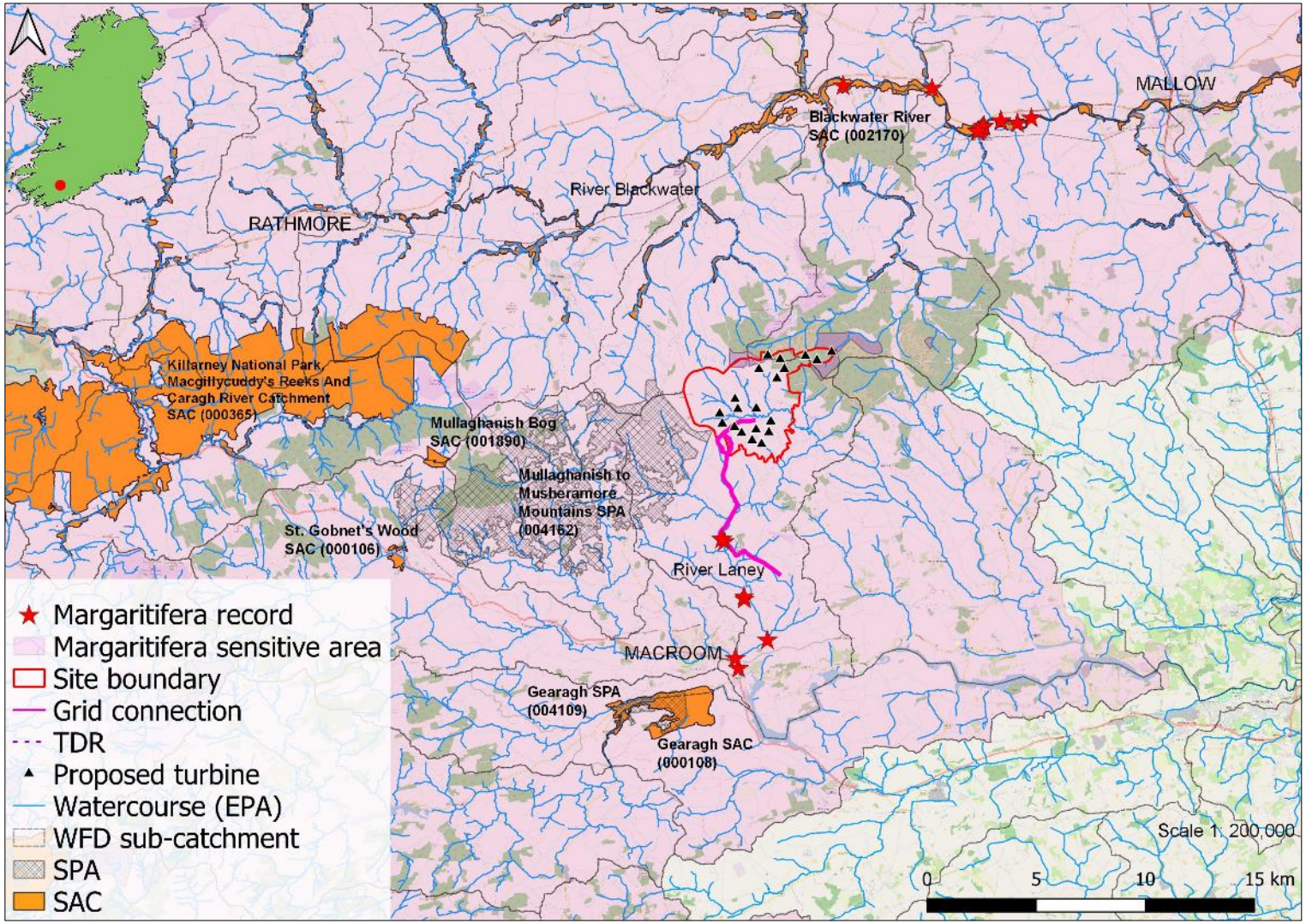

Figure 8B.3-1: Distribution of freshwater pearl mussel (*Margaritifera margaritifera*) in the vicinity of the proposed project

8B.3.3 EPA water quality data (existing data)

The following outlines the available water quality data for the watercourses in context of the proposed project. Only recent water quality (i.e. since 2018) is summarised below. EPA biological monitoring data was only available for the larger watercourses within the vicinity of the proposed wind farm project (i.e. River Laney, Awboy River and Glen River), with no data available for the smaller watercourses surveyed. Whilst there was no water quality data available for the Nadanuller Beg Stream draining to the north-east of the wind farm site, the downstream-connecting Nad River (18N01) achieved Q4-5 (high status) at station RS18N010400 in 2019.

Please note that biological water quality analysis was undertaken as part of this study, with the results presented in the **section 8B.4** and **Appendix 8B.B** of this report.

8B.3.3.1 River Laney

The River Laney (EPA code: 21F02, locally pronounced 'Lane') was the most significant watercourse draining the wind farm site, flowing in a loosely southerly direction before adjoining the River Sullane near Ford's Mill, Macroom. A number of survey watercourses adjoined the Laney (**Figure 8B.2.1**). There was a total of four EPA biological monitoring stations which have been recently monitored on the river (i.e. since 2017). The uppermost of these (station code: RS19L010100) was located at Carrigagulla Bridge, approx. 0.35km upstream of survey site B11, and achieved Q4-5 (high status) water quality in 2019. Station RS19L010200 at Knocknagappul Bridge (aquatic survey site C11) also achieved Q4-5 (high status) water quality in 2017. Downstream of the survey area, stations RS12C030100 and RS19L010500, also achieved Q4-5 (high status) water quality in 2019. The River Waterbodies Risk for the River Laney was 'not at risk' according to the EPA (although it was considered 'at risk' in the lower reaches, near Macroom).

8B.3.3.2 Awboy River

One of the larger Laney tributaries, the Awboy River (19A03) joined the Laney approx. 75m downstream of Awboy Bridge on the L3418 road. There was a single EPA biological monitoring station on the river, which achieved Q5 (high status) water quality at Awboy Bridge (station RS19A030200) in 2019. This equates to the highest possible water quality standard under the Water Framework Directive (i.e. pristine water quality). The River Waterbodies Risk for the Awboy River was 'at risk' according to the EPA.

8B.3.3.3 Glen River

The Glen River (18G04) drained to the north of the wind farm boundary and adjoined the River Blackwater near Banteer. There were four biological monitoring stations with recent data on the river and all achieved Q4-5 (high status) in 2018 (the nearest of which was at Glencaum Bridge approx. 2.5km downstream of survey site A5).

8B.4. RESULTS OF AQUATIC SURVEYS

The following section summarises each survey site in terms of aquatic habitats, physical characteristics and overall value for fish, freshwater pearl mussel, white-clawed crayfish and macrophyte communities. Biological water quality (Q-sample) and physiochemical water quality results are also summarised for each site, where applicable. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Most sites were surveyed in July 2020 with a low number (N1-N4) surveyed in June 2021. Please refer to **Appendix 8B.A** (fisheries assessment report), **Appendix 8B.B** (biological water quality) and **Appendix 8B.C** (freshwater pearl mussel report) for more detailed results. An evaluation of the aquatic ecological importance of each survey location based on these aquatic surveys is provided and summarised in **Table 8B.4.1**.

No significant constraints were noted in terms of data collection to inform the aquatic and fisheries surveys.

8B.4.1 Aquatic survey location results

8B.4.1.1 Site A1 – Nadanuller Beg Stream, Carrigagulla

Site A1 was located on the uppermost reaches of the Nadanuller Beg Stream (EPA code: 18N05, also known locally as the Owenaluggin River). The upland eroding watercourse (FW1) was characterised by glide and riffle sequences with localised pool habitat over boulder cascades. The channel was approximately 1m wide and 0.2m deep with peat-stained water at the time of survey. The deep U-shaped channel graded into a valley with shallow slopes adjoining upland conifer plantations (WD4, 10-15 years old). The substrata were dominated by bedrock (20%), boulder (30%), large cobble (20%) and peat, with only localised coarse and medium gravels. The substrata were moderately silted and featured a very high coverage of filamentous algae at the time of survey. The adjoining lands comprised of wet grassland (GS4), blanket bog and pockets of heath, with purple moor grass (*Molinia caerulea*), *Juncus* sp. rushes and marsh bedstraw (*Galium palustre*) dominating. Macrophytes were absent due to the high energy of the site. However, aquatic bryophyte coverage was high locally, with *Fontinalis squamosa* and common earwort (*Scapania undulata)* present on boulder tops.

No fish were recorded from site A1 via electro-fishing (**Appendix 8B.A**). The site was considered a poor salmonid habitat overall, with poor nursery, spawning and holding areas present. The small, high-energy stream was not considered of value to European eel and was unsuitable for lamprey. Fisheries potential improved further down the watercourse (i.e. site A2.). There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**). Molybdate reactive phosphorus (MRP) (0.043mg P/l) and total ammonia (0.094mg N/l) concentrations were high and, thus, the site failed meet the good status thresholds as set out under S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019.

Given the low fisheries value, the aquatic ecological evaluation of site A1 was of **local importance (lower value).**

Plate 8B.4-1: Representative image of site A1 on the Nadanuller Beg Stream, June 2020 (facing upstream)

8B.4.1.2 Site A2 – Nadanuller Beg Stream, Carrigagulla

Site A2 was located on the upper reaches of the Nadanuller Beg Stream, approx. 1km downstream from site A1. The upland eroding watercourse (FW1) averaged 1.5-2m wide and 0.2-0.3m deep. Characteristic of a high-energy, upland site, the profile was dominated by shallow riffle and glide sequences over boulder/bedrock cascades with localised pool. Bank heights were 1.5m, with a U-shaped channel. The bed was dominated by small boulder and cobble with bars of bedrock, with gravel pockets interstitially. The substrata were clean and unbedded with very limited algae growth. The site was located in upland blanket bog (PB2) and localised wet grassland (GS4), with scattered grey willow scrub (*Salix cinerea*). Macrophytes were absent but instream moss cover was high, being represented by localised *Fontinalis squamosa* and common earwort.

Brown trout (*Salmo trutta*) was the only fish species recorded from site A2 via electro-fishing (**Appendix 8B.A**). The site was considered an excellent trout nursery, with the population dominated by juveniles. Spawning habitat was good, locally, although deeper holding habitat for adults was sparse (as were adult fish themselves). The small, high-energy stream was considered of low value to European eel and was unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the excellent salmonid nursery habitat and the presence of a salmonid population and good status (Q4) water quality, the aquatic ecological evaluation of site A2 was of **local importance (higher value).**

Plate 8B.4-2: Representative image of site A2 on the Nadanuller Beg Stream, July 2020

8B.4.1.3 Site A3 – unnamed stream, Crinaloo South

Site A3 was located on an unnamed stream at Crinaloo South, approx. 180m upstream of the Nadanuller Beg Stream confluence. The upland eroding watercourse (FW1) averaged just 0.5-1m wide and <0.2m deep. Characteristic of a high-energy, upland site, the profile was dominated by shallow riffle and glide sequences over boulder cascades with localised deeper pools. Bank heights were 1m, with a V-shaped channel. The riparian zone was colonised by bracken (*Pteridium aquilinum*) scrub (WS1). The substrata were dominated by large boulder and cobble with small pockets of coarse gravel interstitially. Siltation was moderate. Macrophytes were absent but bryophytes were present in the form of *Fontinalis squamosa* and common earwort, with pinnate scalewort (*Porella pinnata*) and yellow fringe moss (*Racomitrium aciculare*) also present.

Brown trout was the only fish species recorded from site A3 via electro-fishing (**Appendix 8B.A**). Low numbers of adult trout were recorded, with an absence of juveniles. The site was considered of moderate value for salmonids, overall. The small, high-energy stream was considered of low value to European eel (none recorded) and was unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the presence of a salmonid population, the aquatic ecological evaluation of site A3 was of **local importance (higher value).**

Plate 8B.4-3: Representative image of site A3 on an unnamed stream at Crinaloo South, July 2020

8B.4.1.4 Site A4 – unnamed stream, Crinaloo South

Site A4 was located on a second unnamed stream at Crinaloo South, approx. 1.2km upstream of the Nadanuller Beg Stream confluence. The upland eroding watercourse (FW1) averaged 2-2.5m wide and 0.2m deep. Characteristic of a high-energy, upland site, the profile was dominated by shallow riffle and glide sequences over boulder cascades with localised deeper pools. Bank heights were 1.5m, with a U-shaped channel. The site was situated in an upland area bordering mature sitka spruce (*Picea sitchensis*) plantations (WD4) with riparian areas of blanket bog. The substrata were dominated by large boulder and cobble with small pockets of coarse gravel interstitially. Siltation was moderate. Macrophytes were absent but bryophytes were present in the form of *Fontinalis squamosa* and common earwort on instream boulders.

Brown trout and European eel (*Anguilla anguilla*) were the only two fish species recorded from site A4 via electro-fishing (**Appendix 8B.A**). Trout were present in moderate numbers, with both adults and a low number of juveniles present. A single adult eel was also recorded. The river was considered a moderate nursery with moderate quality spawning locally. Holding habitat was also considered moderate. Eel habitat was moderate overall but the high-energy site was considered unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the presence of a salmonid population and European eel, the aquatic ecological evaluation of site A4 was of **local importance (higher value).** Site A4 was bordering but not located within the Boggeragh Mountains NHA (0002447), a site designated for peatlands.

Plate 8B.4-4: Representative image of site A4 on an unnamed stream at Crinaloo South, July 2020

8B.4.1.5 Site A5 – Glen River, Inchamay South

Site A5 on the upper reaches of the Glen River (EPA code: 18G04) (bridge crossing CC-L95791-005.00) was an upland eroding watercourse (FW1) characterised by glide and riffle sequences with localised pool habitat over boulder cascades. The channel averaged 2m wide and 0.3m deep with peat-stained water at the time of survey. The shallow U-shaped channel was cut into a shallow sloping valley. The site drained an upland area which featured frequent coniferous afforestation (WD4). The adjoining lands comprised heath (south bank)) and wet grassland with pockets of heath to the north. The riparian zone featured open banks with low lying cover of soft rush (*Juncus effusus*), ferns, common sorrel (*Rumex acetosa*), bramble (*Rubus fruticosus* agg.), foxglove (*Digitalis purpurea*), heather (*Calluna vulgaris*), purple moor grass, rank grasses and occasional willow and rowan (*Sorbus aucuparia*). The substrata were dominated by boulder (30%), large cobble (40%) with coarse and medium gravels (20%). The remaining proportions comprised silt and small pockets of finer gravel in interstitial spaces, with a concrete apron near the bridge. The substrata were heavily covered with floc and filamentous algae. Macrophytes were not present upstream but downstream slower glide supported small beds of water crowfoot vegetation (*Ranunculus* sp.). The site had a high coverage of *Fontinalis squamosa* and *Chiloscyphus polyanthos,* with common earwort and yellow fringe moss also present. The presence of more than three indicator macrophyte/bryophyte species means the site's aquatic vegetative community was representative of the Annex I habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation and aquatic mosses [3260]'.

Brown trout was the only fish species recorded from site A5 via electro-fishing (**Appendix 8B.A**). Trout were present in high numbers, with a high proportion of juveniles and a low number of adults present. The site was considered a very good nursery with locally good quality salmonid spawning habitat Holding habitat was also considered good in frequent, small deeper pools. Eel habitat was moderate overall but the high-energy site was considered unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Site A5 was located within the Boggeragh Mountains NHA (0002447), a site designated for peatlands. This site was therefore considered of **national importance**. The site also supported good-quality salmonid habitat, the presence of Annex I 'floating river vegetation' habitat and good status (Q4) water quality.

Plate 8B.4-5: Representative image of site A5 on the Glen River (facing downstream from bridge)

8B.4.1.6 Site B1 – Carrigagulla Stream, Carrigagulla

Site B1 was located on the Carrigagulla Stream (EPA code: 19C22) approx. 270m upstream of the L2758 road crossing. The semi-natural, upland eroding watercourse (FW1) featured roughly equal proportions of riffle, glide and pool habitat with no evident channel modifications. The stream averaged 1.5m wide and 0.2-0.3m deep with a strong flow at the time of survey. The profile was characteristic of high energy site (i.e. boulder cascade). The bed was dominated by small boulder and cobble with well-rounded coarse gravel. The substrata had light siltation and were unbedded and well-rounded indicating prevalent higher energy conditions. The V-shaped channel was bordered by semi-improved grassland (GA1, wet in nature) with the immediate riparian areas characterised by patches of gorse (*Ulex europaeus*) and bramble scrub (WS1) with localised willow. Bank heights were shallow and graded into the river valley at a low angle. Macrophytes were absent but some *Fontinalis squamosa* and common earwort was present.

Brown trout was the only fish species recorded from site B1 via electro-fishing (**Appendix 8B.A**). Trout were present in low numbers, with only small adults recorded. Despite this, nursery habitat was moderate overall, with locally good spawning habitat present, However, the high-energy, steep-gradient of the site reduced the fisheries value considerably. The site was of limited value for eel and considered unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the presence of a salmonid population, the aquatic ecological evaluation of site B1 was of **local importance (higher value).**

Plate 8B.4-6: Representative image of site B1 on the Carrigagulla Stream, July 2020

8B.4.1.7 Site B2 – unnamed stream, Knocknagappal

Site B2 was located on an unnamed stream in an upland area to the western boundary of the wind farm site. The channel represented an upland eroding watercourse (FW1) although it was 100% dry at the time of survey. However, the channel likely conveyed significant water flows following rainfall (i.e. non-perennial stream). Situated in a steep V-shaped channel, the dry stream averaged 1.5-2m wide in a 2-4m wide channel. The stream fell over a moderate gradient downstream of the road crossing, with a bed dominated by cobble and coarse gravels (both 35%), with occasional boulder and high fractions of sand. The bankfull height ranged from 3-4m and graded into (low intensity) improved agricultural pasture (GA1) downstream of the road culvert. The riparian zone featured sparse growth of nettle (*Urtica dioica*), soft rush, foxglove, marsh bedstraw, common sorrel and marsh thistle (*Cirsium palustre*) with scattered scrub patches of bramble, grey willow, gorse and fuchsia (*Fuchsia magellanica*). Rank grasses grew along the channel bed. The stream drained coniferous afforestation (WD4) and clear-fell (WD5) upstream, with agricultural pasture and coniferous afforestation (WD4) dominating downstream. Due to the dry channel, no macrophyte or aquatic bryophyte growth was present.

The stream offered no fisheries value at the time of survey (100% dry) and was considered to offer little if any fisheries value when conveying water given its small, high-gradient, high-energy upland nature. The site had no potential for freshwater pearl mussel or white-clawed crayfish given the seasonal, upland nature of the stream. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the lack of fisheries value and non-perennial nature, the aquatic ecological evaluation of site B2 was of **local importance (lower value).**

Plate 8B.4-7: Representative image of site B2 on the upper reaches of an unnamed stream at Knocknagappul (site 100% dry during the survey period)

8B.4.1.8 Site B3 – West Ballinagree Stream, Knocknagappul

Site B3 was located in the uppermost reaches of the West Ballinagree Stream (EPA code: 19W12) at a local road crossing. The channel represented an upland eroding watercourses (FW1) although it was 100% dry at the time of survey. However, the channel likely conveyed significant water flows following rainfall (i.e. non-perennial stream). Situated in a deep U-shaped channel, the dry stream averaged <1m wide in a 1.5-2m wide channel with bankfull heights averaging 1m. The stream fell over a moderate gradient downstream of the road crossing, with a bed comprising 20% small boulder, 30% cobble, 20% medium gravel, 20% fine gravel and 10% sand. Silt or mud accumulations were absent. The site was situated in an upland area dominated by coniferous afforestation (sitka spruce, WD4). Upstream of the site, the channel was situated in a mature block of sitka spruce, with maturing coniferous plantation downstream. The riparian zone was heavily scrubbed (shading >95%) with a typical upland plant composition dominated by abundant grey willow and bramble (WS1). Nettle, foxglove, bilberry (*Vaccinium myrtillus*), common sorrel, marsh thistle, soft rush, bittercress (*Cardamine* sp.), rank grasses and terrestrial moss species such as big shaggy moss (*Rhytidiadelphus triquetrus*) were common. Due to the dry channel, no macrophyte or aquatic bryophyte growth was present.

The stream offered no fisheries value at the time of survey (100% dry) and was considered to offer little if any fisheries value when conveying water given its small, high-gradient, high-energy upland nature. The site had no potential for freshwater pearl mussel, white-clawed crayfish or otter given the seasonal, upland nature of the stream.

It was not possible to assess biological water quality at this site given a lack of water and flow.

Given the lack of fisheries value and non-perennial nature, the aquatic ecological evaluation of site B2 was of **local importance (lower value).**

Plate 8B.4-8: Representative image of site B3 on the West Ballynagree Stream (100% dry during the survey period)

8B.4.1.9 Site B4 – Knocknagappal Stream, Knocknagappal

Site B4 was located on the lower reaches of the Knocknagappul Stream (EPA code: 19K04, approx. 50m upstream of the confluence with the River Laney. The natural upland eroding watercourse (FW1) averaged 1-1.5m wide and 0.1-0.2m deep in a deeply cut (near vertical-sided) U-shaped channel. Shallow glide and riffle dominated the site (40% each) with only localised plunge pools, some to 1m in depth but mostly shallower. Bankfull heights were 1.5-2m and the channel evidently conveyed significantly more water during spate conditions. Natural bank scouring was frequent, particularly on the many meanders at the site. The substrata were dominated by small cobble (40%) with occasional small boulder (5%). Fine to medium gravels were frequent (30% overall), with sand also present (10%). Some exposed peat was present locally. Although some silt plumes were present underfoot, overall siltation levels were low in this high-energy channel. The stream meandered through a valley floor with mosaics of lowland blanket bog (PB4) and degraded raised bog (PB1). Common plant species included purple moor grass, soft rush, heath milkwort (*Polygala serpyllifolia*), marsh lousewort (*Pedicularis palustris*), tormentil (*Potentilla erecta)* bog myrtle (*Myrica gale*) and localised bog cotton (*Eriophorum angustifolium*). The area was exposed to low intensity sheep grazing and the bank of the stream were open, with low-height scrub and rank grasses. There was no instream macrophyte growth given the typically high energy of the site (spate channel). The bryophyte community was also poorly represented with only very limited drab brook moss (*Hygrohypnum luridum*) on instream boulders.

Brown trout was the only fish species recorded from site B4 via electro-fishing (**Appendix 8B.A**). Only a low number of juveniles were recorded. However, the site was of good value overall for salmonids given good nursery habitat, moderate spawning and moderate holding areas. Salmonid habitat improved in the downstream-connecting River Laney. The site was of moderate value for eel (albeit none recorded) but was considered unsuitable for lamprey (i.e. high-energy, upland eroding spate channel). There was no suitability for freshwater pearl mussel. No white-clawed crayfish were not recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the presence of a salmonid population, the aquatic ecological evaluation of site B4 was of **local importance (higher value).**

Plate 8B.4-9: Representative image of site B4 on the Knocknagappul Stream (facing upstream from near River Laney confluence).

8B.4.1.10 Site B5 – River Laney, Ballynagree West

Site B5 on the upper reaches of the River Laney (EPA code: 19L01) was located approx. 0.1km upstream of the Knocknagappul Stream confluence. The upland eroding watercourse (FW1) averaged 2-2.5m wide in a 3m wide channel with a shallow U-shaped profile. The depth averaged 0.2-0.4m in a shallow glide dominated habitat (60%). Riffles were frequent (30%) as the river flowed over a moderate gradient, with occasional small pools locally to 0.7m. The substrata typified a higher-energy site and was dominated by cobble (40%) and small boulder (20%), with good fractions of fine to medium gravels (30% overall). Sand was present, particularly in marginal areas. Some of these areas featured soft sediment but accumulations were sand-dominated, shallow (<2cm) and relatively compacted. Exposed clay/peat was present in some areas. The substrata were unbedded. Bankfull heights averaged 1-2m (lower on the eastern bank). Natural scouring was frequent at the site (i.e. undercut banks, frequent meanders). The site was bordered by a mature coniferous plantation (WD4) to the east, with a narrow border of alder (*Alnus glutinosa*) and grey willow alongside a riparian strip of wet grassland (GS4). The west bank featured lowland blanket bog/grassland habitat supporting purple moor grass, marsh thistle, gorse (low-lying), soft rush and common lowland blanket bog species such as common sorrel, marsh lousewort, heath milkwort and common catsear (*Hypochaeris radicata*). The banks were low and open with little to no shading of the river channel. There was no instream macrophyte growth in the high energy channel. However, a range of aquatic bryophytes were present locally including drab brook moss, *Hygroamblystegium tenax*, *Chiloscyphus polyanthos and Racomitrium aciculare*. *Lemanea* sp. algae was also present locally. Filamentous algae coverage was low (<1%) but indicated a source of enrichment.

Brown trout was the only fish species recorded from site B5 via electro-fishing (**Appendix 8B.A**), with a moderate number of juveniles and adults captured. Nursery habitat was considered good with locally good spawning habitat also present given the unbedded, clean nature of the smaller substrata. Holding habitat was limited but good nonetheless where present in localised deeper pools. European eel habitat was moderate but the value was reduced given the paucity of larger boulder refugia and deep pools.

The Laney at site B5 was not considered of any value to lamprey given the high-energy nature. There was low suitability for freshwater pearl mussel and none are known from the River Laney (**Appendix 8B.C**). No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its upland nature.

Biological water quality was not assessed at this site.

Given the presence of a salmonid population, the aquatic ecological evaluation of site B5 was of **local importance (higher value).**

Plate 8B.4-10: Representative image of site B5 on the River Laney (facing downstream)

8B.4.1.11 Site B6 – River Laney, Ballynagree West

Site B6 on the upper reaches of the River Laney (EPA code: 19L01) was located approx. 0.3km downstream from site B5. The upland eroding watercourse (FW1) averaged 2-2.5m wide in a 3m wide channel with a shallow U-shaped profile. The depth averaged 0.2-0.4m in a shallow glide dominated habitat (70%). Riffles were frequent as the river flowed over a moderate gradient, with occasional small pools to 0.6m. The substrata typified a higher-energy, spate site; cobble dominated (40%) with occasional boulder (10%), both of which retained some mobility. The site featured relatively high fractions of fine (20%) and medium gravels (20%) with sand in interstitial spaces and in slacker areas of flow. Bedrock was present but rare. There were no accumulations of fine sediment and overall levels of siltation were low with generally clean, unbedded substrata. Bankfull heights were invariably 1m. The site was situated between dense blocks mature coniferous afforestation (WD4, sitka spruce). The river was bound by very dense scrub (WS1) dominated by gorse, grey willow and bramble. Fuchsia was common throughout with frequent great woodrush (*Luzula sylvatica*), bugle (*Ajuga reptans*), marsh bedstraw and fern species spurge (get species). Riparian fringes were often wet along both banks and dominated by a mossy understory in addition to the aforementioned scrub species.

Shading was high (>90%) with tunnelling frequent. Given this, macrophyte growth was absent although there was localised *Racomitrium aciculare*, *Hygroamblystegium tenax* and claw brook moss (*Hygrohypnum ochraceum*) on the topside of boulder/cobble with occasional *Chiloscyphus polyanthos* on submerged substrata. The liverwort *Pellia epiphylla* was frequent on the river banks.

Brown trout was the only fish species recorded from site B6 via electro-fishing (**Appendix 8B.A**), with adults and a low number of juveniles present.

The site was considered a good salmonid habitat overall, with good quality spawning and moderate nursery habitat present, although deeper holding areas were scarce. European eel habitat was considered moderate (none recorded) but the value was reduced given the paucity of larger boulder refugia and deep pools. The high-energy upland site was unsuitable for lamprey. There was low suitability for freshwater pearl mussel and none are known from the River Laney (**Appendix 8B.C**). No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of a salmonid population and the good status water quality present, the aquatic ecological evaluation of site B6 was of **local importance (higher value).**

Plate 8B.4-11: Representative image of site B6 on the River Laney (facing downstream)

8B.4.1.12 Site B7 – unnamed stream, Ballynagree East (WF-HF9)

Site B7 (watercourse crossing WF-HF9) was located on a semi-natural unnamed stream at Ballynagree East at the site of a forestry access ford crossing, approx. 0.6km upstream from the River Laney confluence. The site was also the location of a proposed watercourse crossing (pre-cast box culvert). The upland eroding watercourse (FW1) averaged 2-2.5m wide (narrowed upstream) and 0.1-0.3m deep. The shallow U-shaped profile was dominated by shallow glide habitat (60%) with frequent riffles (30%) and only localised pool (10%). Bankfull height ranged from 0.5-1m. The stream flowed over a slight gradient and adjoined the River Laney approx. 0.4km downstream.

The stream was of moderate energy with a bed dominated by cobble (40%) and boulder (30%) substrata, which were moderately compacted. Fine to medium gravels and sands were present locally in interstitial spaces and on the channel margins (30% overall). Siltation was moderate with plumes visible underfoot.

The site was bordered to the west by mature coniferous plantations (WD4), with an area of replanted clear-fell located upstream and downstream on the east bank. Improved agricultural pasture (GA1) bordered the stream further downstream on the east bank. Riparian shading was high (>90%) with tunnelling frequent throughout the site, particularly upstream. Dense scrub of grey willow, gorse, fuchsia, bramble and scattered mature sitka spruce bordered the channel. Given the high shading, macrophyte growth was not present.

However, there was relatively high cover (50%) of aquatic bryophytes with species *Hygrohypnum ochraceum*, *Chiloscyphus polyanthos* and *Fontinalis squamosa* dominating. Water-forget-me-not (*Myosotis scorpioides*) was present locally in more open marginal areas of damp ground. Crescent cup liverwort (*Lunularia cruciata*) was present on muddy banks and on the topside of larger instream boulders. Filamentous algae coverage was low (<1%) but indicated a source of enrichment.

Brown trout was the only fish species recorded from site B7 via electro-fishing (**Appendix 8B.A**), with a low number of adults and juveniles present. The site was considered to have moderate nursery and spawning value for salmonids that would have been higher if not bordered by conifers (abundant pine needle deposition on bed and sedimentation visible). Holding habitat was moderate at best. European eel habitat was considered moderate but none were recorded. The high-energy upland site was unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its upland nature.

Biological water quality, based on Q-sampling (June 2021), was calculated as **Q4-5 (high status)** (**Appendix 8B.B**).

Given the presence of a salmonid population and high status (Q4-5) water quality, the aquatic ecological evaluation of site B7 was of **local importance (higher value).**

Plate 8B.4-12: Representative image of site B7 on an unnamed stream at Ballynagree East (at forestry track ford crossing and watercourse crossing WF-HF9)

8B.4.1.13 Site B8 – River Laney, Ballynagree East

Site B8 on the upper reaches of the River Laney (EPA code: 19L01) was located approx. 4.7km downstream from site B6, at a forestry track ford crossing and 0.3km downstream of the wind farm boundary. The upland eroding river (although more depositing than upstream) averaged 4-5m in width and 0.2-0.6m in depth. The shallow U-shaped channel (bankfull height 1-2m) was dominated by slow flowing, relatively deep glide >0.5m (50%) and pool habitat (30%), with occasional riffles. Some pools were >1m deep, locally. The substrata were comprised primarily of relatively clean, unbedded cobble and medium to coarse gravels (50%) overall, with occasional larger boulder (20%, particularly upstream).

Significant amounts of sands were also present (20%), particularly in association with macrophyte beds downstream of the ford. Overall, siltation was light but present. The site was adjoined by maturing coniferous afforestation (WD4) on all sides. The banks were heavily scrubbed although the channel suffered only light shading. Scrub composed of grey willow, gorse, bramble dominated the riparian zone, with other common species including foxglove, soft rush, meadowsweet (*Filipendula ulmaria*), agrimony (*Eupatorium cannabinum*), fuchsia and fern species. Instream macrophytes were frequent upstream and downstream of the ford, with water crowfoot (*Ranunculus* sp.) dominating (20% cover overall) – this provided some good salmonid nursery areas. Hemlock water dropwort was occasional on exposed gravel shoals and along the margins. The aquatic bryophyte community consisted of common *Fontinalis squamosa* with more occasional *Hygroamblystegium tenax* and *Chiloscyphus polyanthos*. The presence of more than three indicator macrophyte/bryophyte species means the site's aquatic vegetative community was representative of the Annex I habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation and aquatic mosses [3260]'.

Brown trout and European eel were the only fish species recorded from site B8 via electro-fishing (**Appendix 8B.A**). The trout population was dominated by adults although smaller numbers of juveniles were present also. A single adult eel was also captured. The site was considered a very good nursery and spawning area. It was also a very good holding habitat given the presence of deeper glide and pool. Despite a moderate value for lamprey (localised sediment accumulations) none were recorded. Despite good suitability for freshwater pearl mussel, none were recorded at this site (**Appendix 8BC**). No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its upland nature.

Biological water quality was not assessed at this site. Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of a salmonid population and European eel, Annex I 'floating river vegetation' habitat and good status water quality, the aquatic ecological evaluation of site B8 was of **local importance (higher value).**

Plate 8B.4-13: Representative image of site B8 on the River Laney (facing downstream from ford crossing)

8B.4.1.14 Site B9 – unnamed stream, Carrigagulla

Site B9 was located on the upper reaches of an unnamed stream at a farm access bridge crossing. The stream was a largely natural, upland eroding watercourse (FW1) which averaged 2.5m wide and 0.2-0.4m in depth. The channel featured a shallow U-shaped profile and was comprised primarily of shallow glide and riffle with occasional pools, especially on frequent meanders. Bankfull height was generally 1-1.5m. The substrata were dominated by cobble (40%) and boulder (20%) with occasional patches of fine to medium gravels. Siltation was moderate throughout slower-flowing areas of channel, with silt plumes present underfoot. The margins occasionally featured sand-silt accumulations. The site drained upland coniferous afforestation (WD4) and was bordered by mosaics of agricultural pasture (GA1) and species-poor wet grassland (GS4), dominated by soft rush with frequent willow and gorse scrub. The channel was heavily scrubbed in the vicinity of the survey site, with dense grey willow, bramble and gorse-dominated scrub lining both banks. Riparian shading was high (>75%), with few open areas of channel present (i.e. tunnelling). Localised marsh horsetail (*Equisetum palustre*) and coltsfoot (*Tussilago farfara*) were present upstream pf the bridge. Given the high shading, macrophyte growth was not present. However, *Fontinalis squamosa*, *Hygroamblystegium tenax* and *Chiloscyphus polyanthos* were common on instream substrata, with occasional *Scapania undulata* also recorded.

Brown trout and European eel were the only fish species recorded from site B9 via electro-fishing (**Appendix 8B.A**). The trout population was dominated by juveniles. A single juvenile eel was also captured. The site was considered a good salmonid nursery with moderate quality spawning (diminished because of heavily bedded substrata). Holding habitat also considered moderate locally (a small number of deeper pools present). Eel habitat was of moderate quality. The high-energy upland site was unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4-5 (high status)** (**Appendix 8B.B**).

Given the presence of a salmonid population, European eel and high status water quality, the aquatic ecological evaluation of site B9 was of **local importance (higher value).**

Plate 8B.4-14: Representative image of site B9 on an unnamed stream at Carrigagulla

8B.4.1.15 Site B10 - Ballynagree East Stream, Ballynagree East

Site B10 was located upstream of the L3418 road crossing on the upper reaches of the Ballynagree East Stream (EPA code: 19B21). The small, shallow, high-energy stream was an upland eroding watercourse (FW1) and averaged <1m in width and 0.05-0.15m deep. The channel was situated in a 6-7m wide steep incised V-shaped valley with bankfull heights of 3-4m. The stream flowed over a moderate to steep gradient and, resultingly, the profile was dominated by riffle (40%) with fast glide (40%). Pool habitat, although frequent, was limited in extent. The substrata were dominated by cobble (40%) and small boulder (30%) which were heavily silted in many areas (clay deposits, large silt plumes underfoot). Sand (20%) and clay-dominated silt accumulations were present, mostly in channel margins. Medium to coarse gravels were present locally. Both upstream and downstream of the survey site, the gradient decreased. The site was adjoined by improved agricultural grassland (GA1) both upstream and downstream of the bridge. The valley through which the stream flowed upstream of the bridge was steep and well-developed, with the rocky escarpment supporting mature sycamore (*Acer psuedoplatanus*), oak (*Quercus* sp.), blackthorn (*Prunus spinosa*) and sitka spruce. The understory comprised bilberry, opposite-leaved golden saxifrage (*Chrysosplenium oppositifolium*), creeping jenny (*Lysimachia nummularia*), ground elder (*Aegopodium podagraria*), wood sorrel (*Oxalis acetosella*) and fern species. Riparian shading was high and this precluded macrophyte growth, with none recorded present. The bryophyte community was poorly represented with local *Hygroamblystegium tenax*.

A single juvenile brown trout was the only fish recorded from site B10 via electro-fishing (**Appendix 8B.A**). The small, shallow high gradient stream (with heavy siltation) provided poor spawning, nursery or holding habitat and also offered little value for European eel. The upland eroding site was unsuitable for lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**). The site failed to meet the EPA nitrate threshold for good status water quality (i.e. very high TON of 2.299mg N/l) (**Table 8B.4.1**).

Given the presence of a salmonid population and good status water quality, the aquatic ecological evaluation of site B10 was of **local importance (higher value).**

Plate 8B.4-15: Representative image of site B10 on the Ballynagree East Stream

8B.4.1.16 Site B11 – River Laney, Annagannihy

Site B11 on the River Laney (EPA code: 19L01) was located downstream of the confluence with the Annaginnihy Stream, approx. 0.3km downstream of Carrigagulla Bridge. The medium-sized, high-energy river was an upland eroding watercourse (FW1) which averaged 5-6m wide and 0.2-0.5m deep. The river flowed through a shallow U-shaped channel in an agricultural landscape (GA1) although maintained good riparian buffers of scrub. Characteristically, the profile was comprised primarily of riffle and fast glide (40% each) with frequent small pools, some of which were 1m in depth. The river was evidently exposed to high flow rates seasonally (i.e. spate channel) and the banks were frequently scoured and undercut locally. The substrata were dominated by boulder (40%) and large cobble (30%) with frequent bedrock (10%). Slack areas comprised smaller hard substrata (fine to coarse gravels). Sand was present locally in deeper pools (especially near the confluence). Siltation was light. A large pool located near the confluence was dominated by small cobble, finer gravels and sands. The site was adjoined by improved agricultural grassland (GA1) on both banks both upstream and downstream. The riparian buffers were dominated by grey willow and bramble/gorse scrub. Hawthorn was occasional. Non-native montbretia (*Crocosmia* x *crocosmiiflora*) was common throughout. Riparian shading was low. In terms of macrophytes, water crowfoot predominated (20% cover overall) with occasional water dropwort on gravel shoals and in channel margins. *Fontinalis squamosa* was abundant instream (30% cover) with frequent *Hygrohypnum ochraceum*, *Chiloscyphus polyanthos* and *Racomitrium aciculare*. The presence of more than three indicator macrophyte/bryophyte species means the site's aquatic vegetative community was representative of the Annex I habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation and aquatic mosses [3260]'.

Brown trout was the only fish species recorded from site B11 via electro-fishing (**Appendix 8B.A**), with juveniles and adults present in moderate numbers. The site was a very good brown trout nursery, with moderate (locally good) spawning and some good (locally excellent) holding habitat. Instream macrophyte beds bolstered the nursery value of the site. European eel habitat was considered good throughout given undercut banks, ample boulder refugia and frequent pools although none were recorded. The high energy nature of the site precluded the presence of lamprey. There was low suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey but the site was considered of moderate suitability.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of a salmonid population, Annex I 'floating river vegetation' habitat and good status water quality, the aquatic ecological evaluation of site B11 was of **local importance (higher value).**

Plate 8B.4-16: Representative image of site B11 on the River Laney (facing downstream from Annaginnihy Stream confluence)

8B.4.1.17 Site C1 – Carrigthomas Stream, Knocknagappul

Site C1 was located in the upper reaches of the Carrigthomas Stream (EPA code: 19C48). The site was represented by a small upland eroding watercourse (FW1) averaging 1m wide and 0.05-0.1m deep. The stream was considered likely non-perennial at this location. The channel flowed over a moderate gradient and the profile was dominated by shallow riffle (50%) with occasional riffle and limited shallow pool (10%). The stream flowed through a deeply cut, semi-natural deep U-shaped channel with frequent scouring indicative of spate tendencies. The substrata comprised cobble (40%), small boulder (30%), coarse gravel (10%), medium gravels (10%) and coarse sands (10%). Soft sediment accumulations were not present given the high energy of the site. The channel bankfull height was 1.1.2m and graded into heavily scrubbed riparian areas of grey willow, gorse, bracken and bramble, with a treeline of mature sitka spruce along the east bank. Riparian shading was very high (>90%) although the stream was more open further downstream. The riparian composition immediately bordering the stream on both the east and west banks comprised mostly mature shrubby grey willow with bracken foxglove bilberry, bramble, soft shield fern (*Polystichum setiferum*) and a well-developed terrestrial moss layer in the treeline understory. The site drained coniferous plantations (WD4) upstream, with improved pasture (GA1) downstream. The stream contained no macrophytes given the heavily shaded nature, high energy nature and very shallow water. However, *Chiloscyphus polyanthos* was present locally on instream cobble and boulder.

No fish species were recorded from site C1 via electro-fishing (**Appendix 8B.A**). The small, shallow possible seasonal site offered poor fisheries habitat overall, for both salmonids and eel. However, fisheries value improved significantly downstream (i.e. site C3). There was no suitability for lamprey, freshwater pearl mussel or otter given the site characteristics. No white-clawed crayfish were recorded and there were no records for the species within the catchment.

Biological water quality was not assessed at this site.

Given the poor fisheries value, the aquatic ecological evaluation of site C1 was of **local importance (lower value).**

Plate 8B.4-17: Representative image of site C1 on the Carrigthomas Stream, Knocknagappul

8B.4.1.18 Site C2 – Maulnahorna Stream, Rahalisk

Site C2 on the Maulnahorna Stream (EPA code: 19M10) was a small, semi-natural upland eroding stream (FW1), averaging 0.75-1.5m wide and 0.1-0.15m deep. Located at a road crossing, the stream flowed over a moderate gradient upstream of the bridge before grading out and meandering downstream. The water level was low at the time of survey although the stream had capacity to convey significantly more water during higher flow periods (i.e. spate channel but likely non-perennial). The profile was dominated by shallow glide (50%) and frequent riffle (40%) with only localised pool to 0.2m max. Bankfull height varied from 0.5-1.5m in a shallow U-shaped channel (more V-shaped upstream). Given the high energy nature of the site, the substrata were moderately compacted. The substrata comprised 50% cobble, 20% boulder, 10% 20% medium gravel and 10% fine gravel/sand. Although some silt had accumulated underneath the bridge structure in association with an instream blockage (debris and livestock gate), siltation was light overall (i.e. clean substrata). Downstream of the bridge, the site was bordered by improved agricultural pasture (GA1) to the west with an immature sitka spruce plantation (WD4) and scrub border to the east. The riparian zone was exposed to low intensity sheep grazing and was typified by often dense patches of gorse, bramble and grey willow scrub. The channel was moderately shaded by riparian species. Macrophyte growth was largely absent although hemlock water dropwort was abundant along stream margins and on exposed gravel/cobble shoals instream. The bryophyte community was poorly represented, with only very localised *Hygroamblystegium tenax* present in the vicinity of the bridge.

No fish species were recorded from site C2 via electro-fishing (**Appendix 8B.A**). The narrow, shallow site was considered likely non-perennial which, despite some suitability as a salmonid nursery, precluded resident fish. There was no suitability for freshwater pearl mussel given the site characteristics. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the poor fisheries value, the aquatic ecological evaluation of site C2 was of **local importance (lower value).**

Plate 8B.4-18: Representative image of site C2 on the Maulnahorna Stream (downstream of bridge)

8B.4.1.19 Site C3 – Carrigthomas Stream, Horsemount Bridge

Site C3 on the Carrigthomas Stream (EPA code: 19C48, also known as the Glashreagh River) was located Horsemount Bridge, approx. 1.5km downstream from site C1. The stream was a semi-natural, upland eroding channel (FW1) draining both afforested (WD4) and agricultural pasture (GA1) areas upstream. The stream had been straightened locally near the bridge (30m section, downstream of concrete/cobble bridge apron) but retained a good natural, meandering profile further downstream. The channel averaged 2-2.5m wide but narrowed to <2m further downstream, with an average depth of just 0.1-0.15m in a shallow, U-shaped channel. Shallow glide (60%) and riffle (20%) dominated with occasional small pools, particularly downstream of the straightened section. The substrata were comprised predominantly of boulder (20%) and cobble (50%), although interstitial spaces featured medium and fine gravels (20% overall), with sand in channel margins (10%). The substrata were moderately compacted. Silt accumulations were not present although the site was suffering from moderate siltation overall (high clay-fraction silt plumes underfoot, evident agricultural impacts from livestock poaching upstream). The site was bordered by agricultural pasture on both banks (GA1), with WD4 sitka upstream in addition to more pasture. In the open section of channel in the vicinity of the bridge, the riparian zone was poorly developed (recovering from previous works) although further downstream the stream was bound by often dense scrub of grey willow, gorse and bramble. Tunneling was frequent. Macrophyte growth was sparse with only very limited water starwort (*Callitriche* sp.) and water mint (*Mentha aquatica*) present. A single small patch of round-leaved crowfoot (*Ranunculus omiophyllus*) was recorded immediately upstream of the bridge in the muddy paludal. The bryophyte community was poorly represented although some limited *Chiloscyphus polyanthos* was present locally on the topside of small boulders. *Lemanea* sp. algae was present occasionally on larger instream cobble and boulder.

Brown trout was the only fish species recorded from site C3 via electro-fishing (**Appendix 8B.A**), with juveniles predominating in relatively high numbers. A small number of small adults were also recorded, mostly confined to deeper pool areas near the bridge. The site was evidently a very good brown trout nursery, although this was compromised somewhat by virtue of evident siltation and substrata compaction. Nevertheless, some limited spawning habitat was present, along with localised holding areas (more so downstream). European eel habitat was moderate give the shallow nature of the site (none recorded).

The high energy nature of the site precluded the presence of lamprey. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of a salmonid population and good status water quality, the aquatic ecological evaluation of site C3 was of **local importance (higher value).**

Plate 8B.4-19: Representative image of site C3 on the Carrigthomas Stream (facing downstream from Horsemount Bridge)

8B.4.1.20 Site C4 – Rahalisk Stream, Knocknagappul (GCR-WCC15)

Site C4 on the Rahalisk Stream (EPA code: 19R08) was located immediately upstream of the confluence with the Carrigthomas Stream (pipe culvert, fish passable) at a proposed grid connection crossing (GCR-WCC15). The small, moderate-gradient upland eroding stream channel (FW1) averaged 0.5-0.75m wide and ≤0.05m deep. The water level was very low at the time of survey and the risk of the stream drying up was considered high during drier periods. The stream flowed in a steep, deep V-shaped channel with bankfull heights of 2-3m. Fast shallow glide and riffle dominated with no pool habitat apart from in association with the road culvert (0.2m max. depth). The substrata were composed predominantly of loose fine to medium gravel (40%) with frequent small cobble (35%) and small boulder (20%). Sand was occasional (10%), with localised shallow silt. The stream adjoined agricultural grassland (GA1) to the east and a small block of scrubby willow woodland (WD1) to the west. The riparian zone was very heavily scrubbed with dense (impenetrable) growth of bramble, nettle, gorse and bracken. Shading from terrestrial species was extremely high (>95%) and, as a result, there was no instream macrophyte growth. Some limited *Chiloscyphus polyanthos* was present on small cobble and boulder.

No fish were recorded via electro-fishing (**Appendix 8B.A**). Overall, the stream offered little fisheries value given the extremely shallow and overgrown nature of the channel. However, fisheries habitat improved in the downstream-connecting Carrigthomas Stream, underneath the local road crossing.

There was no suitability for freshwater pearl mussel or otter given the site characteristics. No white-clawed crayfish were recorded and there were no records for the species within the catchment.

Biological water quality was not assessed at this site.

Given the poor fisheries value, the aquatic ecological evaluation of site C4 was of **local importance (lower value).**

Plate 8B.4-20: Representative image of site C4 on the Rahalisk Stream, Knocknagappul (heavily bound in scrub)

8B.4.1.21 Site C5 – Carrigthomas Stream, Coppeleenbawn Bridge (GCR-WCC9)

Site C5 on the Carrigthomas Stream (EPA code: 19C48) was located downstream of the L3418 road and proposed grid connection crossing (GCR-WCC9), approx. 100m upstream from the River Laney confluence. Here, the stream was a semi-natural, upland eroding channel (FW1) which averaged 2-2.5m wide in a shallow U-shaped channel, with an average depth of 0.2-0.3m. Shallow glide dominated (60%) with frequent riffle areas (30%) and localised pool (10%) to a maximum of 0.3m. Bankfull height varied from 1.5-2m with frequent undercut banks throughout. Livestock poaching was prevalent along the southern bank (no riparian fencing) although siltation levels were light. The substrata were comprised predominantly of well-sorted gravels (50%) with frequent small cobble (30%) and localised boulder (20%). Sand and silt were present in marginal slacks (5% each). Silt was flocculent, where present. The substrata were loose and mobile throughout most of the survey section.

The site was bordered by agricultural pasture on both banks (GA1), with a scattered treeline and scrub mosaic on the north bank supporting grey willow and hawthorn with occasional osier (*Salix viminalis*), ash and alder. The scrub was dominated by bramble and gorse. Riparian shading was low overall, although high locally in more vegetated sections. Macrophyte growth was sparse with only localised hemlock water dropwort. The bryophyte community was poorly represented (low cover given mobile substrata) although some limited *Hygroamblystegium tenax* and *Hygrohypnum ochraceum* was present locally on the topside of small boulders. Filamentous algal cover was moderate locally (10% overall), although large sections of channel were free from algal impacts.

Brown trout was the dominant species recorded from site C5 via electro-fishing (**Appendix 8B.A**), with juveniles predominating in relatively high numbers. A small number of adults were also present in addition to a low number of *Lampetra* sp. ammocoetes.

The site was considered an excellent salmonid nursery (brown trout only), supporting mixed cohorts. Spawning habitat was good (locally very good, particularly near the Laney confluence in lower reaches) with holding habitat limited (moderate value). European eel habitat was moderate, at best, and none were recorded during electro-fishing. Two *Lampetra* sp. ammocoetes were recorded (likely brook lamprey given catchment migration barriers) – these were present in sub-optimal sand-flocculent silt heavily covered filamentous algae. Lamprey habitat was considered good given the presence of good spawning substrata although the lack of optimal soft sediment accumulations reduced the site's value overall. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey but the site was considered of moderate suitability.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix 8B.B**).

Given the presence of a salmonid population and *Lampetra* sp. ammocoetes, the aquatic ecological evaluation of site C5 was of **local importance (higher value).**

Plate 8B.4-21: Representative image of site C5 on the Carrigthomas Stream downstream of Coppeleenbawn Bridge

8B.4.1.22 Site C6 – Unnamed stream, Knocknagappul

Site C6 on an unnamed stream was located downstream of the L3418 road and proposed grid connection crossing (pipe culvert), approx. 0.75km upstream of the River Laney crossing. The small upland eroding watercourse (FW1) averaged 1-1.5m in width and just 0.05-0.1m in depth in a deep U-shaped channel. The moderate-energy stream had been straightened and deepened historically with old embankments present on the south bank. Roadside retaining walls were present upstream of the culvert. The profile was dominated by shallow glide with occasional riffle and very localised shallow pool to a maximum depth of 0.25m. The substrata were characterised by mixed gravels (more so medium and coarse) (40%) with frequent small cobble and boulder (40%). The substrata were both bedded and moderately silted throughout (heavy locally).

The site was intermittently exposed to livestock poaching on both banks. Having flowed alongside the L3418 road (channel straightened), the stream flowed through intensive agricultural grassland (GA1) downstream of the road crossing. Here the channel was heavily bound in scrub (invariably impenetrable) dominated by bramble, nettle, gorse and grey willow. Mature ash and hawthorn were present intermittently along the channel.

Riparian shading was extremely high in most areas, with frequent tunnelling. Instream macrophytes were limited to very localised common water starwort (*Callitriche stagnalis*) and brooklime (*Veronica beccabunga*) in open areas of channel. *Scapania undulata* was occasional instream, in more open areas.

Brown trout was the only fish species recorded from site C6 via electro-fishing (**Appendix 8B.A**), with two small individuals captured. The site offered only moderate quality salmonid habitat, with a lack of deeper holding areas and only moderate quality nursery and spawning (siltation). European eel habitat was poor with none recorded via electro-fishing. Potential for lamprey existed but was low, with poor quality spawning substrata present (silted, bedded) and a lack of suitable sediment accumulations for larval burial. There was no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and shallow, high-energy nature.

Biological water quality was not assessed at this site.

Given the presence of a salmonid population, the aquatic ecological evaluation of site C5 was of **local importance (higher value).**

Plate 8B.4-22: Representative image of site C6 on an unnamed stream at Knocknagappul

8B.4.1.23 Site C7 – River Laney, unnamed bridge, Ballynagree West

Site C7 on the River Laney (EPA code: 19L01) was located at a local road crossing (twin arch masonry bridge), approx. 1km south of Ballinagree village. The semi-natural upland eroding watercourse (FW1) featured some more lowland depositing characteristics. The channel averaged 6-8m wide and 0.3-0.5m deep, with frequent pools to >1.2m. Bank height ranged from <1 to 2m, with historical retaining walls on the north bank.

The moderate energy site was characterised by deeper glide (50%) with frequent fast riffles (30%) and frequent pool areas (20%). In general, the river slowed and deepened downstream of the bridge (more deeper glide and pool), with faster glide and riffles dominating upstream. The substrata were dominated by clean, unbedded, well-mixed gravels and small cobble (60% overall), with occasional boulder (especially in vicinity of the bridge and downstream of the bridge) and sand (20%) in marginal areas and interstitial spaces. The site featured only light siltation and soft sediment accumulations were dominated by sand, where present. The site was adjoined by low intensity improved agricultural grassland (GA1) and mosaics of wet grassland (often dominated by soft rush but supporting a range of rank grass and herbaceous species also). The riparian zones were well developed and comprised mature treelines of grey willow, alder, hazel (*Corylus avellana*), hawthorn, osier, sycamore and occasional ash with scattered cypress (*Cupressus* sp.) and sitka spruce. The scrubby understorey supported species including bramble, bracken, meadowsweet, foxglove, montbretia, broom (*Cytisus scoparius*), yellow iris (*Iris psuedacorus*) common valerian (*Valeriana officinalis*), gorse and rank grasses. Riparian shading was relatively low. Instream macrophyte growth was dominated by water crowfoot (20% cover) (especially downstream of bridge) with frequent *Fontinalis squamosa*. Hemlock water dropwort was common on exposed gravel shoals and in channel margins. *Chiloscyphus polyanthos* was frequent on instream cobble and boulder. Occasional *Hygroamblystegium tenax* was present on boulders. The presence of more than three indicator macrophyte/bryophyte species means the site's aquatic vegetative community was representative of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and aquatic mosses [3260]'. A dipper (*Cinclus hibernica*) nest was also recorded under the bridge.

Brown trout was the only fish species recorded from site C7 via electro-fishing (**Appendix 8B.A**). Mixed cohorts of brown trout were present, ranging from juveniles to larger adults. Site C7 offered excellent salmonid habitat overall, with combinations of excellent spawning (clean, unbedded gravels and cobble), excellent nursery habitat (particularly in the vicinity of *Ranunculus* beds and upstream of the bridge) and excellent holding habitat for adults (downstream of the bridge). European eel habitat was considered good given the presence of instream refugia although none were recorded during electro-fishing. Whilst optimal larval lamprey habitat was not present, areas of sub-optimal sand-dominated substrata were present in marginal areas and in association with *Ranunculus* beds. However, no ammocoetes were recorded during electro-fishing. Lamprey spawning habitat was of moderate quality locally, particularly in marginal slacks downstream of the bridge where lower flows were more amenable to the species. There was some suitability for freshwater pearl mussel, although none were recorded in surveys throughout the River Laney (**Appendix 8B.C**). No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey but the site was considered of good suitability due to healthy salmonid population and good foraging habitat.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of a salmonid population, Annex I 'floating river vegetation' habitat and good status water quality, the aquatic ecological evaluation of site C7 was of **local importance (higher value).**

Plate 8B.4-23: Representative image of site C7 on the River Laney at an unnamed bridge, Ballynagree West

8B.4.1.24 Site C8 – Lacknahaghny Stream, Lacknahaghny

Site C8 on the Lacknahaghny Stream (EPA code: 19L21) was a small, narrow upland eroding watercourse (FW1) located in the vicinity of a local road crossing (pipe culvert) and proposed grid connection crossing. The stream flowed between blocks of coniferous woodland (WD4) and averaged <0.75m wide and ≤0.05m deep, in a steep V-shaped channel with bankfull heights of 2-3m. Although conveying low volumes of water at the time of survey, the channel was considered non-perennial. The substrata comprised coarse gravels and small cobble with occasional boulder although these were heavily silted and compacted. Water quality issues were evident, with near stagnant conditions and heavy peat staining. The stream meandered through dense scrub dominated by grey willow and bramble, with hogweed, gorse, common polypody, bilberry and fern species. The sitka spruce plantations flanked the channel on both banks, with a narrow alder border. Upstream of the road crossing, the channel drained a wet upland area dominated *Juncus* sp. rushes. The narrow channel featured heavy encroachment of terrestrial species and shading was invariably excessive. Macrophyte species were not present and the only bryophyte recorded was very localised *Scapania undulata* on instream boulders.

No fish were recorded from site C8 via electro-fishing (**Appendix 8B.A**). Site C8 offered no fisheries value at the time of survey and the channel was considered likely seasonal in its upper reaches, thus precluding resident fish. The site had no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the lack of fisheries value and likely non-perennial nature, the aquatic ecological evaluation of site C8 was of **local importance (lower value).**

Plate 8B.4-24: Representative image of site C8 on the Lacknahaghny Stream

8B.4.1.25 Site C9 – unnamed stream, Carrigthomas

Site C9 was located on an unnamed stream in the vicinity of a local road and proposed grid connection crossing, approx. 0.5km upstream of the River Laney confluence. The stream was a very small, narrow upland eroding watercourse (FW1). The stream had been historically modified downstream of a local road crossing alongside a mature sitka spruce plantation (WD4), with extensive straightening and deepening evident. The stream flowed in a deep V-shaped channel with bankfull heights of 2.5-3m. The stream averaged <1m wide and <0.05m deep at the time of survey, with a slight flow only. The substrata were dominated by small boulder and cobble (50%) with frequent sand accumulations. Iron oxide (bacterial) deposits were frequent on instream substrata (these are often associated with leachate from afforestation and low dissolved oxygen levels). Siltation was moderate locally. The profile was shallow fast glide dominated with frequent small plunge pools over a moderate gradient. The stream was heavily scrubbed over in the vicinity of the road crossing (impenetrable bramble and gorse scrub), with riparian shading also high as it flowed along the eastern boundary of the coniferous block. The small valley escarpment supported scrubby grey willow and bramble with foxglove, wood sorrel, common polypody, broad buckler fern (*Dryopteris dilatata*) and terrestrial mosses. There were no macrophytes instream given the high shading. *Scapania undulata* was occasional on instream cobbles.

No fish were recorded from site C9 via electro-fishing (**Appendix 8B.A**). Site C9 offered no fisheries value at the time of survey and the channel was considered likely non-perennial in its upper reaches, thus precluding resident fish. The site had no suitability for freshwater pearl mussel or otter. No white-clawed crayfish were recorded and there were no records for the species within the catchment.

Biological water quality was not assessed at this site.

Given the lack of fisheries value and likely non-perennial nature, the aquatic ecological evaluation of site C9 was of **local importance (lower value).**

Plate 8B.4-25: Representative image of site C9 on an unnamed stream at Carrigthomas

8B.4.1.26 Site C10 – unnamed stream, Carrigthomas

Site C10 was located on an unnamed stream in the vicinity of a local road and proposed grid connection crossing, approx. 185m upstream of the River Laney confluence. The small, shallow upland eroding watercourse (FW1) emanated from a pipe culvert pipe associated with the local road and joined a small unnamed stream which flow parallel to said road. The water level was low at the time of survey, with only low flows present and depths of 0.05-0.1m. The stream featured 1.5 to 2m bank heights in an often-steep, deeply-cut, V-shaped channel. Natural scouring was evident throughout the site (i.e. spate channel). The profile was featured slow-flowing glide over a moderate gradient with occasional riffle (10%) and frequent pool (70%). The substrata were dominated by a mix of bedrock (10%), small boulder (20%), cobble (40%), mixed gravels (20%) and sand (5%). The substrata were moderately silted (high clay fractions, 5%) given the low flows at the time of survey (i.e. deposition of sediment). The site was adjoined by improved agricultural grassland (GA1) to the west and an alder plantation to the east (GA1 upstream). The riparian zone was heavily scrubbed by grey willow, bramble, foxglove, wild angelica (*Angelica sylvestris*), wood sorrel, hogweed, hedge bindweed (*Calystegia sepium*), ivy and fern species. Shading of the channel was high (>75%). Instream macrophyte growth was, thus, absent. However, some limited *Hygroamblystegium tenax* was present on the topside of instream boulders with occasional *Chiloscyphus polyanthos* on larger boulders.

No fish were recorded from site C10 via electro-fishing (**Appendix 8B.A**). Site C10 offered very low fisheries value at the time of survey and the channel was considered likely non-perennial, thus precluding resident fish. However, some limited, sub-optimal habitat was present for salmonids and European eel further downstream nearer to the Laney confluence (more deeper pools). The upland eroding site was unsuitable for lamprey. The site had no suitability for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality was not assessed at this site.

Given the low fisheries value and likely non-perennial nature, the aquatic ecological evaluation of site C10 was of **local importance (lower value).**

Plate 8B.4-26: Representative image of site C10 on an unnamed stream at Carrigthomas, immediately downstream of the road culvert

8B.4.1.27 Site C11 – River Laney, Knocknagappul Bridge

Site C11 on the River Laney (EPA code: 19L01) was located at Knocknagappul Bridge, a proposed grid connection crossing point. Downstream of Knocknagappul Bridge (a 3-arch structure), the swift-flowing river (FW1) averaged 6-8m in width and 0.2-0.4m deep, with locally deeper pools to 1.5m. The channel was considered semi-natural with a well-defined thalweg and bankfull heights of 1-1.5m. The profile was dominated by riffle and shallow, fast glide near the bridge with more predominant deeper glide habitat approx. 40m downstream. The riverbed comprised mostly mobile, unbedded cobble (40%) with frequent small boulder (30%) and medium to coarse gravels in the interstitial spaces and in marginal areas (20%). Sand was occasional (10%) and small accumulations were present in association with the bridge structure, instream macrophyte beds and further downstream in slacker areas of channel (i.e. pool). Siltation was light overall given the swift flows. The site was adjoined by mosaics of agricultural grassland (GA1) and species-poor wet grassland (GS4), with soft rush frequent. Wetter areas along the riparian zone supported yellow iris and meadowsweet. The channel was flanked by treelines of mature grey willow with occasional ash, hawthorn and alder. Non-native montbretia was scattered throughout. Hemlock water dropwort was abundant along riparian areas and also common instream, with water crowfoot frequent (20% cover), particularly upstream of the bridge and downstream in deeper, slower glide habitat. Coverage of bryophytes was relatively high with frequent *Fontinalis squamosa*, *Chiloscyphus polyanthos* and *Hygroamblystegium tenax* on cobble and boulders. *Fontinalis antipyretica* was occasional. The presence of more than three indicator macrophyte/bryophyte species means the site's aquatic vegetation community was considered representative of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and aquatic mosses [3260]'. *Lemanea* sp. algae was also occasional throughout faster-flowing areas. Great scented liverwort (*Conocephalum conicum*) was present on muddy banks and the bridge structure.

Brown trout was the dominant fish species recorded from site C11 via electro-fishing (**Appendix 8B.A**). Relatively high numbers of mixed cohort brown trout were present, ranging from juveniles to larger adults. A single **Atlantic salmon (*Salmon salar*)** parr was also recorded (17.0cm FL). This was the only salmon recorded in the Ballinagree study area. The site was an excellent salmonid habitat, with good spawning substrata present throughout in addition to excellent quality nursery and holding habitat.

The site was considered of good value to European eel given the presence of deeper pool areas, scoured banks and large woody debris/boulder refugia in stream (however, none were recorded). Lamprey spawning habitat was present but localised (site more suited to salmonids) with sand-dominated sediment accumulations present locally in vicinity of the bridge and some instream *Ranunculus* beds (none recorded). There was some suitability for freshwater pearl mussel, although none were recorded in surveys throughout the River Laney (**Appendix 8B.C**). No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded in the vicinity of the bridge although the site had high suitability for the species given the presence of a healthy salmonid population and good foraging habitat.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of both **Atlantic salmon** and brown trout, Annex I 'floating river vegetation' habitat and good status water quality, the aquatic ecological evaluation of site C11 was of **local importance (higher value).**

Plate 8B.4-27: Representative image of site C11 the River Laney at Knocknagappul Bridge (facing downstream from bridge

8B.4.1.28 Site C12 – Awboy River, Awboy Bridge (GCR-WCC8)

Site C12 on the Awboy River (EPA code: 19A03) was a medium-sized, moderate energy upland eroding watercourse (FW1). Located downstream of Awboy Bridge (proposed grid connection crossing GCR-WCC8) and 70m upstream of the River Laney confluence, the river averaged 4-5m wide and 0.2-0.4m deep. The largely-natural channel (modified upstream of the bridge, straightened through a residential garden) featured a bankfull height of 1-1.5m in a shallow U-shaped channel. Downstream of the bridge, the profile featured a repeating series of riffle-glide-pool sequences. Fast, shallow glide dominated (50%) with frequent riffles (30%) and localised pool, to a maximum depth of 0.8m. The substrata were dominated by cobble (50%) with frequent small boulder (30%) and localised bedrock (5%). Fine to medium gravels were present in interstitial spaces (10%), with occasional coarse gravels. Silt was largely absent given the high-energy nature of the site. The substrata were mostly unbedded and largely free from filamentous algae.

The site was bordered on both banks by agricultural grassland (GA1) with a mature riparian zone on both banks (willow/sycamore treelines with scrub). The mobile nature of the substrata combined with fast flows and shade discouraged macrophyte growth although some water crowfoot was present locally with hemlock water dropwort common in margins and on instream gravel shoals. *Chiloscyphus polyanthos* and *Fontinalis squamosa* dominated the bryophyte community. The presence of three indicator macrophyte/bryophyte species means the site's aquatic vegetation community was considered representative of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and aquatic mosses [3260]'. A single kingfisher was observed in flight near the bridge. No otter signs were recorded during the survey but given the presence of a healthy salmonid population and good foraging habitat

Brown trout was the only fish species recorded from site C12 via electro-fishing (**Appendix 8B.A**). Moderate numbers of mixed cohort brown trout were present, ranging from juveniles to larger adults. The site was evidently a good salmonid habitat, with good quality spawning, nursery and holding habitat present. Despite some good European eel suitability, particularly in vicinity of the bridge and in deeper pools, none were recorded. The high energy of the site and lack of sediment deposition precluded larval lamprey, despite some localised spawning habitat in slacker areas. No freshwater pearl mussels were recorded at this site (**Appendix 8B.C**). No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey but the site had high suitability for the species given the presence of a healthy salmonid population and good foraging habitat.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of a salmonid population, Annex I 'floating river vegetation' habitat and good status water quality, the aquatic ecological evaluation of site C12 was of **local importance (higher value).**

Plate 8B.4-28: Representative image of site C12 the Awboy River at Awboy Bridge (facing downstream from bridge)

8B.4.1.29 Site C13 – River Laney, Clonavrick Bridge (GCR-WCC7)

Site C13 on the River Laney (EPA code: 19L01) was located at Clonavrick Bridge, a proposed grid connection crossing point (GCR-WCC7). The river at this site was a high-energy large upland eroding watercourse (FW1), which averaged 10-12m wide and 0.6-1m in depth. The site was typified by deep, fast glide (60%) (up to 1.5m in depth upstream of the bridge) with occasional riffles areas and localised small pools.

Downstream of the bridge featured shallower, faster glide and riffles. The substrata were characteristic of a high-energy site with bedrock (10%), boulder (30%) and cobble (40%) dominating although there were good fractions of well-mixed (fine, medium, coarse) gravels in interstitial spaces and slacker areas of flow. Coarse sand was present locally (5%). Silt was absent given the high flow rates. Filamentous algae was very localised (almost absent). The site was flanked on both banks by mature treelines of ash, grey willow and sycamore with bramble-dominated scrub. In terms of macrophytes, water crowfoot was present locally (occasional) with hemlock water dropwort commonly present in margins and on exposed cobble/gravel shoals. *Fontinalis squamosa* was abundant on larger boulder and cobble, with *Chiloscyphus polyanthos* frequent. The presence of three or more indicator macrophyte/bryophyte species means the site's aquatic vegetation community was considered representative of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and aquatic mosses [3260]'. *Conocephalum conicum* was present on the bridge structure. A single otter spraint (old) was recorded underneath the bridge structure (ITM, 534606, 578288).

Brown trout was the only fish species recorded from site C13 via electro-fishing (**Appendix 8B.A**). Moderate numbers of mixed cohort brown trout were present, with juvenile size classes dominating over a smaller number of larger adults. Overall, site C13 was of excellent value to salmonids, with good spawning and nursery habitat in addition to excellent holding habitat (particularly downstream of the bridge) for larger adult trout. Despite good physical habitat for European eel (ample boulder refugia), none were recorded. The high-energy nature of the site precluded the presence of lamprey. No freshwater pearl mussels were recorded at this site, despite some suitability and historical records near the bridge (**Appendix 8B.C**). No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey but the site had high suitability for the species given the presence of a healthy salmonid population and good foraging habitat.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the presence of a salmonid population, Annex I 'floating river vegetation' habitat and good status water quality, the aquatic ecological evaluation of site C13 was of **local importance (higher value).**

Plate 8B.4-29: Representative image of site C13 the River Laney at Clonavrick Bridge (facing back upstream towards bridge)

8B.4.1.30 Site C14 – Clonavrick Stream, Clonavrick (GCR-WCC6)

The Clonavrick Stream (EPA code: 19C74) at site C14 was located at local road and proposed grid connection crossing (GCR-WCC6), approx. 0.4km upstream of the River Laney confluence. The <1m wide stream was semi-dry at the time of survey (0.05m deep max) with localised ponding and an imperceptible flow. The river had been extensively modified in the vicinity of the road crossing with a number of agricultural (pipe) culverts present downstream and recent drainage excavations adjoining the stream. Further downstream, the channel had been historically straightened but not deepened and sat in a shallow U-shaped channel. The substrata were heavily silted (plumes underfoot) and comprised coarse gravels and small cobble, with frequent silt accumulations – these were invariably flocculent. The stream was evidently suffering from enrichment and water quality issues, with a foul odour and discolouration present in addition to excessive siltation (mostly from livestock poaching). The stream flowed through agricultural grassland (GA1) with narrow riparian buffers open to regular livestock poaching. Upstream of the road crossing, the stream emanated in a small area of mixed woodland (WD1) supporting sitka spruce, sycamore and beech (*Fagus sylvatica*). Downstream, the stream was intermittently shaded by willow-dominated treeline with associated bramble and holly (*Ilex aquifolium*) scrub. Terrestrial encroachment of grasses (e.g. soft rush) was common instream. Filamentous algae (*Cladophora* sp.) was present (20% cover in those areas containing water).

No fish were recorded at site C14 via electro-fishing (**Appendix 8B.A**) and the site was not of fisheries value at the time of survey given the lack of water and evidently poor water quality (i.e. siltation, enrichment etc.). However, fisheries habitat improved further downstream nearer the Laney confluence. There was no suitability for freshwater pearl mussel or white-clawed crayfish. No otter signs were recorded during the survey and the site was considered of low suitability given its small size.

Biological water quality was not assessed at this site.

Given the lack of fisheries value, semi-dry nature and evident water quality issues, the aquatic ecological evaluation of site C14 was of **local importance (lower value).**

Plate 8B.4-30: Representative image of site C14 the Clonavrick Stream (downstream of road culvert)

8B.4.1.31 Site C15 – Coolaniddane River, Caherbaroul

Site C15 on the upper reaches of the Coolaniddane River (EPA code: 19C67) was located downstream of a local road crossing. The small upland eroding watercourse (FW1) was semi-natural in the vicinity of the road culvert (double 900m pipe culverts), with bankfull heights of 2-2.5m in a historically straightened and deepened V-shaped channel. The river averaged 1.5-2m wide and 0.1-0.2m deep. The profile was dominated by shallow glide (70%) with occasional riffle (20%) and localised shallow pool to a maximum depth of 0.3m. The substrata were comprised of small cobble (50%) with occasional boulder (20%) with localised fine to medium gravels. Smaller substrata predominated upstream of the road crossing. As per upstream, siltation and compaction of the substrata was moderate. The site was bordered by agricultural grassland (GA1) to the north with an area of dense scrubby grey willow-dominated woodland to the south. The channel became heavily overgrown downstream of the road crossing (impenetrable scrub), dominated by bramble and gorse. Sitka spruce bordered the channel upstream of the road crossing. There were no macrophytes given the high riparian shading, with localised *Hygroamblystegium tenax* present. Filamentous algal cover was 20%, thus indicating enrichment.

No fish were recorded at site C15 via electro-fishing (**Appendix 8B.A**), despite some physical habitat suitability. Whilst the foul odour present upstream (agricultural run-off) was not present downstream, enrichment was evident and it appeared upstream agricultural pressures had impacted the fisheries habitat of the river. Thus, the site had very poor fisheries value. Irrespectively, European eel habitat was poor given the small, shallow nature of the site. The higher energy and lack of suitable sediment accumulations precluded the presence of lamprey. There was no suitability for freshwater pearl mussel or white-clawed crayfish given the site characteristics. No otter signs were recorded during the survey and the site was considered of low suitability given its small size.

Biological water quality was not assessed at this site.

Given the poor fisheries value and evident water quality issues, the aquatic ecological evaluation of site C15 was of **local importance (lower value).**

Plate 8B.4-31: Representative image of site C15 on the Coolaniddane River (downstream of road culvert)

8B.4.1.32 Site C16 – Kilberrihert Stream, Derryroe (GCR-WCC3)

Site C16 was located on the uppermost reaches of the Kilberrihert Stream (EPA code: 19K24), downstream of a local road and proposed grid connection crossing (GCR-WCC3), approx. 260m upstream of the Coolaniddane River confluence. The channel, flowing in an east to west direction, represented a dry drainage ditch (FW4) at the time of survey. The non-perennial stream had been historically straightened and deepened in the vicinity of the road crossing and a small coniferous plantation (mature sitka spruce, WD4). The channel featured a shallow, U-shaped channel (bankfull height <0.5m) and evidently only conveyed water during periods of high flow and rainfall. The substrata were 100% silt (wet mud base, with abundant leaf litter). Given the high shading from afforestation, the understorey was poorly developed with bramble scrub dominating. Macrophytes were lacking given the extreme shading and lack of water.

No fish were recorded at site C16 (**Appendix 8B.A**) and the site had no fisheries value at the time of survey given the lack of water or flow. Being located in the uppermost reaches, with no connectivity to other watercourses nearby, the site was considered unlikely to serve as a migratory pathway for European eel. There was no suitability for freshwater pearl mussel, otter or white-clawed crayfish given the site characteristics.

It was not possible to assess biological water quality at this site given a lack of water and flow.

Given the lack of fisheries value and evident non-perennial nature (dry channel), the aquatic ecological evaluation of site C16 was of **local importance (lower value).**

Plate 8B.4-32: Representative image of site C16 on the Kilberrihert Stream (downstream of road culvert)

8B.4.1.33 Site C17 – Coolaniddane River, Caherbaroul (GCR-WCC4)

Site C16 on the Coolaniddane River (EPA code: 19C67) was located downstream of a local road and proposed grid connection crossing (GCR-WCC4), approx. 0.8km downstream from site C15. The small upland eroding watercourse (FW1) averaged 1.5-2m wide and 0.1-0.2m deep, with swift flow. Shallow glide and riffle dominated (both 40%) with only localised shallow pool present. The substrata were comprised of small cobble (40%) with occasional boulder (20%) and 40% fine to medium gravels.

As per site C15 upstream, siltation and compaction of the substrata was moderate. The site was bordered by intensive agricultural grassland (GA1) and coniferous afforestation (WD4), with the stream heavily overgrown by willow and bramble-dominated scrub. There were no macrophytes given the high riparian shading, with localised *Hygroamblystegium tenax* present. Filamentous algal cover was 20%, thus indicating enrichment.

Despite some physical suitability, no fish were recorded at site C17 via electro-fishing (**Appendix 8B.A**). Enrichment was evident and it appeared upstream agricultural pressures had impacted the fisheries habitat of the river. Thus, the site had very poor fisheries value. There was no suitability for freshwater pearl mussel or white-clawed crayfish given the site characteristics. No otter signs were recorded during the survey and the site was considered of low suitability given its small size.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix 8B.B**). The site failed to meet the EPA nitrate threshold for good status water quality (i.e. very high TON of 2.489mg N/l) (**Table 8B.4.1**).

Given the poor fisheries value and poor status water quality, the aquatic ecological evaluation of site C17 was of **local importance (lower value).**

Plate 8B.4-33: Representative image of site C17 the Coolaniddane River (upstream of road culvert)

8B.4.1.34 Site C18 – Caherbaroul Stream, Caherbaroul (GCR-WCC5)

Site C18 was located on the uppermost reaches of the Caherbaroul Stream (EPA code: 19C76) at a local road and proposed grid connection crossing (GCR-WCC5). The stream was semi-dry at the time of survey, with localised ponding present to a maximum depth of 0.05m. The watercourse was evidently non-perennial at this location. The stream had been extensively straightened but not deepened and sat in a U-shaped channel. Bankfull height was 1-1.5m. A pipe culvert was present 5m downstream of the road culvert. The substrata were dominated by medium to coarse gravels but were compacted with moderate to heavy siltation. The site was bordered by intensive agricultural grassland (GA1), with a small area of grey willow scrub near the road crossing. The channel was heavily scrubbed over by low-lying scrub, dominated by bramble, gorse, nettle, broad-leaved dock (*Rubex obtusifolius*) and rank grasses.

No fish were recorded at site C18 via electro-fishing (**Appendix 8B.A**) and site had no fisheries value at the time of survey given the lack of water or flow. Being located in the uppermost reaches, with no connectivity to other watercourses nearby, the site was considered unlikely to serve as a migratory pathway for European eel. There was no suitability for freshwater pearl mussel, otter or white-clawed crayfish given the site characteristics.

Biological water quality was not assessed at this site.

Given the lack of fisheries value, non-perennial nature and evident water quality issues, the aquatic ecological evaluation of site C18 was of **local importance (lower value).**

Plate 8B.4-34: Representative image of site C18 the Caherbaroul Stream (downstream of road culvert, heavily bound in scrub)

8B.4.1.35 Site C19 – Bealick Stream, Rockville

Site C19 was located on the uppermost reaches of the Bealick Stream (EPA code: 19B45) adjacent to a local road and the proposed grid connection. The channel represented a semi-dry drainage ditch (FW4), with very little water (depth <0.01m) at the time of survey. The stream had been historically straightened and deepened. The channel featured a near-vertical, deep U-shaped profile, with a bankfull height of 1m. Only local ponding of water was present and the channel was considered non-perennial at this location. The substrata were dominated by compacted fine to medium gravels with light to moderate siltation. The site was adjoined by species-poor wet grassland (GS4) to the south (*Juncus* sp. dominated) to the south with frequent areas of scrub (WS1) and wet grassland (GS4) adjoining the stream. Upstream, the channel flowed through a small area of willow-dominated mixed broad-leaved woodland. The stream was heavily scrubbed over (near 100% shading), dominated by bramble, grey willow and rank grasses. Macrophytes were lacking given the extreme shading and lack of water.

No fish were recorded at site C19 via electro-fishing (**Appendix 8B.A**) and site had no fisheries value at the time of survey given the lack of water. However, the stream likely supports fish populations a considerable distance downstream, nearer the Laney confluence (i.e. >4km downstream).

Being located in the uppermost reaches, with no connectivity to other watercourses nearby, the site was considered unlikely to serve as a migratory pathway for European eel. There was no suitability for freshwater pearl mussel, otter or white-clawed crayfish given the site characteristics.
Biological water quality was not assessed at this site.

Given the lack of fisheries value and non-perennial nature, the aquatic ecological evaluation of site C19 was of **local importance (lower value).**

Plate 8B.4-35: Representative image of site C19 the Bealick Stream (semi-dry channel, localised ponding only)

8B.4.1.36 Site N1 – West Ballynagree Stream, Knocknagappul (WF-HF5)

Site N1 was located on the West Ballynagree Stream at a proposed pre-cast box culvert crossing (WF-HF5), approx. 0.45km downstream from site B3. The stream was a small upland eroding watercourse (FW1), which averaged <1m wide and <0.1m deep when surveyed (June 2021). The shallow stream cascaded over boulder and localised bedrock and was dominated by a series of riffles and fast glides with localised shallow pools to 0.25m max. The stream flowed over a moderate gradient and was evidently spate in nature, with scouring and undercut banks frequent. The stream was known to be non-perennial (i.e. channel was dry at site B3 in 2020 survey period). The substrata were dominated by very coarse gravels, small cobble and angular boulder, with only very localised finer gravels. Siltation was low overall. The site was bordered by young sitka spruce plantations (WD4) with abundant willow, gorse and bramble scrub (WS1) with wet soft rush-dominated grassland (GS4) adjoining the channel. The narrow channel was often heavily tunnelled by scrub.

This coupled with fast flows, mobile substrata and likely low summer flows resulted in an absence of macrophytes. However, *Scapania undulata* was occasional on instream boulder with *Racomitrium aciculare* also occasional.

An electro-fishing survey was not undertaken at this site (i.e. fisheries appraisal only). Apart from some low seasonal potential for migratory European eel, the small upland stream had no fisheries value given its location in the headwaters of the stream and non-perennial nature.

However, fisheries value improved further downstream near the River Laney confluence. The non-perennial, high-energy site was unsuitable for freshwater pearl mussel. No white-clawed crayfish were recorded and there were no records for the species within the catchment. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Whilst a Q-sample was taken in June 2021, the paucity of macro-invertebrates recorded (very low numbers of Tubificidae larvae and *Lumbriculus* sp.) was not sufficient to reliably calculate water quality status (**Appendix 8B.B**). This was presumably an artefact of the non-perennial nature of the stream.

Given the poor fisheries value and non-perennial nature, the aquatic ecological evaluation of site N1 was of **local importance (lower value).**

Plate 8B.4-36: Representative image of site N1 on the West Ballynagree Stream at proposed watercourse crossing WF-HF5

8B.4.1.37 Site N2 – River Laney, Knocknagappul (WF-HF6)

Site N2 (watercourse crossing WF-HF6) was located on the upper reaches of the River Laney, approx. 0.35km upstream of survey site B5. The upland eroding watercourse (FW1) averaged 3-4m wide and 0.1-0.2m deep, with localised pools to >0.5m locally and (often in association with meanders). The spate channel featured bankfull heights of 1m within a wider channel/shallow valley between coniferous blocks (WD4). Natural scouring and undercutting of banks was frequent. The meandering channel featured occasional plunge pools to 0.7m. The substrata typified an upland river with frequent boulder, cobble and well-sorted gravels interstitially. Coarse sand was also frequent.

Given the site characteristics (moderate gradient, moderate flows), there was little or no siltation of instream substrata and no sediment accumulations. The site was bordered by scrub vegetation supporting abundant gorse, fuchsia, willow and occasional bramble. Tunnelling of the channel was often present. The site was adjoined by mature coniferous afforestation (WD4). Riparian shading and high flows coupled with mobile substrata resulted in a lack of macrophyte growth. However, *Racomitrium aciculare* was common on larger instream boulder.

An electro-fishing survey was not undertaken at this site (i.e. fisheries appraisal only). The River Laney at site N2 (proposed pre-cast box culvert) was a moderate-quality salmonid habitat with some locally good spawning habitat. Holding pools for larger adults was sparse. The site was most of value as a brown trout nursery. European eel habitat was moderate given the site characteristics and their presence would have been inhibited by the presence of downstream hydro-electric dams. There was no potential for white-clawed crayfish. Freshwater pearl mussel were not recorded and the species is not known from the River Laney, despite some physical habitat suitability (**Appendix 8B.C**). No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the moderate-quality salmonid and European eel habitat, in addition to good status (Q4) water quality, the aquatic ecological evaluation of site N2 was of **local importance (higher value).**

Plate 8B.4-37: Representative image of site N2 on the upper River Laney at proposed watercourse crossing WF-HF6

8B.4.1.38 Site N3 – Unnamed stream, Ballynagree East (WF-HF8)

Site N3 (watercourse crossing WF-HF8) was located on the uppermost reaches of a small, unnamed tributary of the River Laney at a local road crossing. The upland eroding watercourse (FW1) meandered over a moderate gradient in a natural incised valley. The stream averaged 1-2m wide and 0.1-0.2m deep. The swift-flowing channel was dominated by a series of riffles and fast shallow glide, often cascading over boulder. Occasional deeper pools (0.3m max) were present, particularly in association with meanders.

A single deep plunge pool (1m) was present in association with the existing road box culvert. This also featured a 2m fall and was a barrier to fish migration. Upstream of the bridge, the stream flowed over a steeper gradient, was shallower and narrower. Typical of a small spate channel, the substrata were dominated by angular cobble and boulder with interstitial coarse and medium gravels with some localised coarse sand. Soft sediment accumulations were absent. Overall, siltation was low given high flow rates. The substrata were compacted. The banks were frequently scoured and undercut, especially on meanders. Whilst the channel was open in the vicinity of the crossing (sheep grazing, open banks), macrophyte growth was absent.

Localised *Racomitrium aciculare* was present with occasional *Cinclidotus fontinaloides*. Filamentous algae was present but coverage was low. The site was bordered by improved agricultural pasture (wet GA1) adjoined by small coniferous afforestation blocks (WD4) downstream.

An electro-fishing survey was not undertaken at this site (i.e. fisheries appraisal only). Site N3 was located in the headwaters of the small unnamed stream and thus was of low fisheries value. The high-gradient spate channel was considered likely exposed to low flows during summer months and this, coupled with natural and artificial barriers on the watercourse, likely precluded fish presence (however, some low eel potential, in season). The box culvert under road acted as an impassable barrier to fish, with a 2m fall. There was no suitability for white-clawed crayfish or freshwater pearl mussel. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and upland nature.

Biological water quality, based on Q-sampling, was calculated as **Q4-5 (high status)** (**Appendix 8B.B**).

Despite low fisheries value, given the high status (Q4-5) water quality, the aquatic ecological evaluation of site N3 was of **local importance (higher value).**

Plate 8B.4-38: Representative image of site N3 on the upper reaches of a small unnamed River Laney tributary at proposed watercourse crossing WF-HF8 (facing downstream from road crossing)

8B.4.1.39 Site N4 – River Laney, Carrigagulla (WF-HF4)

Site N4 (watercourse crossing WF-HF4) was located on the upper reaches of the River Laney, approx. 30m downstream of an existing ford crossing and 2km downstream of survey site B6. The upland eroding river (FW1) averaged 5-8m wide and 0.2-0.4m deep in a naturally cut channel with bankfull heights of 1.5-2m. The moderate-flowing river was dominated by deep, slow-flowing glide with frequent pool and occasional riffle areas (diverse range of habitats). The substrata comprised a mix of clean, unbedded (mobile) small cobble and well-sorted gravels, with only very occasional small boulder. Sand was frequent also, with some accumulations in marginal slacks. Siltation was low overall (clean substrata), despite evident spate erosion of muddy banks (often scoured and undercut).

The site was bordered by coniferous afforestation (WD4) on both banks with buffers of often mature willow, fuchsia and bramble scrub (WS1/WL2). Riparian shading was moderate but not excessive although some partial tunnelling was present downstream of the proposed singles-span bridge crossing. Instream macrophytes were limited to occasional water crowfoot in more open, swift glide areas (5% cover). The mobile substrata prevented growth of aquatic bryophytes.

An electro-fishing survey was not undertaken at this site (i.e. fisheries appraisal only). Site N4 was evidently of high value to salmonids with excellent quality spawning and nursery habitat present, in addition to some localised deeper holding pools and undercuts for larger adults. European eel habitat, whilst present, was sub-optimal given the general paucity of suitable refugia (e.g. larger boulders). Although some sand accumulations were present marginally, these were unsuitable for larval lamprey and the general upland eroding (higher-energy) nature of the site likely precluded the presence of *Lampetra* sp. The substrata were generally considered to be too mobile for freshwater pearl mussel and, irrespective of some habitat suitability, the species is not known from the River Laney (**Appendix 8B.C**). No otter signs were recorded during the survey but the site was considered of moderate suitability given the presence of a healthy salmonid population.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the high salmonid value of the site, in addition to good status (Q4) water quality, the aquatic ecological evaluation of site N4 was of **local importance (higher value).**

Plate 8B.4-39: Representative image of site N4 on the upper reaches of the River Laney at proposed watercourse crossing WF-HF4 (facing upstream to existing ford crossing)

8B.4.1.40 Site N5 – unnamed stream, Knocknagappul (GCR_WCC19)

Site N5 was located on an unnamed, unmapped Carrigthomas Stream tributary (no EPA code) at a local road and proposed grid connection crossing (GCR-WCC19). The small, swift-flowing upland eroding stream (FW1) averaged 2-2.5m wide and 0.1-0.2m deep with localised pool associated with cascades and meanders to 0.4m. The largely natural stream channel flowed over a moderate gradient and had not been historically modified (with the exception of the road box culvert). The shallow stream likely suffered from low flows/water levels during drier periods.

The substrata were dominated by moderately-compacted cobble and small boulder, with locally frequent small patches of fine and medium gravels and sand in slacks and in interstitial spaces. Siltation was moderate overall (due to surrounding land uses) but the high-energy of the site precluded sediment deposits. The stream was often heavily shaded by riparian scrub and macrophytes were limited to occasional watercress and water starwort (*Callitriche* sp.) along the margins. The bryophytes *Chiloscyphus polyanthos* and *Fontinalis antipyretica* were occasional on larger instream substrata. Filamentous algae was present (<1% cover), indicating enrichment. Livestock poaching was present in several locations. The site was bordered by sloping, low-intensity wet (*Juncus*-dominated) improved grassland (GA1) with frequent gorse-dominated scrub (WS1). Coniferous plantations (WD4) bordered the site upstream. Gorse, bramble and grey willow scrub tunnelled the stream downstream of the road crossing.

An electro-fishing survey was not undertaken at this site (i.e. fisheries appraisal only). The site was of moderate value as a salmonid nursery and spawning habitat (brown trout only). Holding habitat for adults was (typically for a small stream) present but limited in distribution and extent. Salmonid habitat improved in the downstream-connecting Carrigthomas Stream. Whilst some finer gravels suitable for *Lampetra* sp. spawning were present, there was no suitable ammocoete habitat given the high energy nature of the site. European eel habitat was moderate overall given the high energy of the site and paucity of optimal refugia. The site had low suitability for white-clawed crayfish and none were recorded. There was no suitability for freshwater pearl mussel given the small, shallow size of the stream. No otter signs were recorded during the survey and the site was considered of low suitability given its small size and high-energy nature.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 8B.B**).

Given the moderate salmonid value of the site, in addition to good status (Q4) water quality, the aquatic ecological evaluation of site N5 was of **local importance (higher value).**

Plate 8B.4-42: Representative image of site N5 on an unnamed, unmapped stream at proposed watercourse crossing GCR-WCC19

8B.4.2 Biological water quality (macro-invertebrates)

With the exception of two sites (C5 and C17), all sampling locations met the good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC). Sites B9 (unnamed stream), N2 (River Laney), and N4 (River Laney) achieved Q4-5 (high status).

Sites C5 (Carrigthomas Stream, Q3-4 moderate status) and C17 (Coolaniddane River, Q3 poor status) failed to meet the good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC).

No rare or protected macro-invertebrate species of conservation status greater than least concern (according to national red lists) were recorded in the biological water quality samples taken from *n*=21 sites (**Figure 8B.4.1, Appendix 8B.B**). Whilst no red list for caddis species is currently available, there is a paucity of records for the three of the recorded cased caddis species *Drusus annulatus* (sites B6, B7, C17, N2, N4), *Potamophylax cingulatus* (sites A2, A5, B8)*, Chaetopteryx villosa* (site A5) in the southwest (O'Connor, 2020).

The majority of samples achieved Q4 or Q4-5 (good status) given the presence of numbers of EPA group A (sensitive) species, such as the mayflies *Ecdyonurus venosus* and *Rhithrogena semicolorata,* and the stonefly *Perla bipunctata*. The samples also contained a good representation of group B (less sensitive) species, such as *Leuctra hippopus* and *Silo pallipes*, and low abundances of group C (tolerant) species aside from the widespread mayfly species *Baetis rhodani*.

Site C5 (Carrigthomas Stream) achieved Q3-4 (moderate status) given the presence of a single group A species, a paucity of group B and dominance of group C species. Site C17 (Coolaniddane River) achieved Q3 (poor status) given the absence of group A species, paucity of group B and the dominance of group D species.

At site N1 on the West Ballynagree Stream (watercourse crossing WF-HF5) a low number of macro-invertebrate individuals and species was recorded (i.e. very low numbers of Tubificidae larvae and *Lumbriculus* sp. were recorded present). This community composition was not sufficient to reliably calculate water quality status and was considered an artefact of the non-perennial nature of the stream.

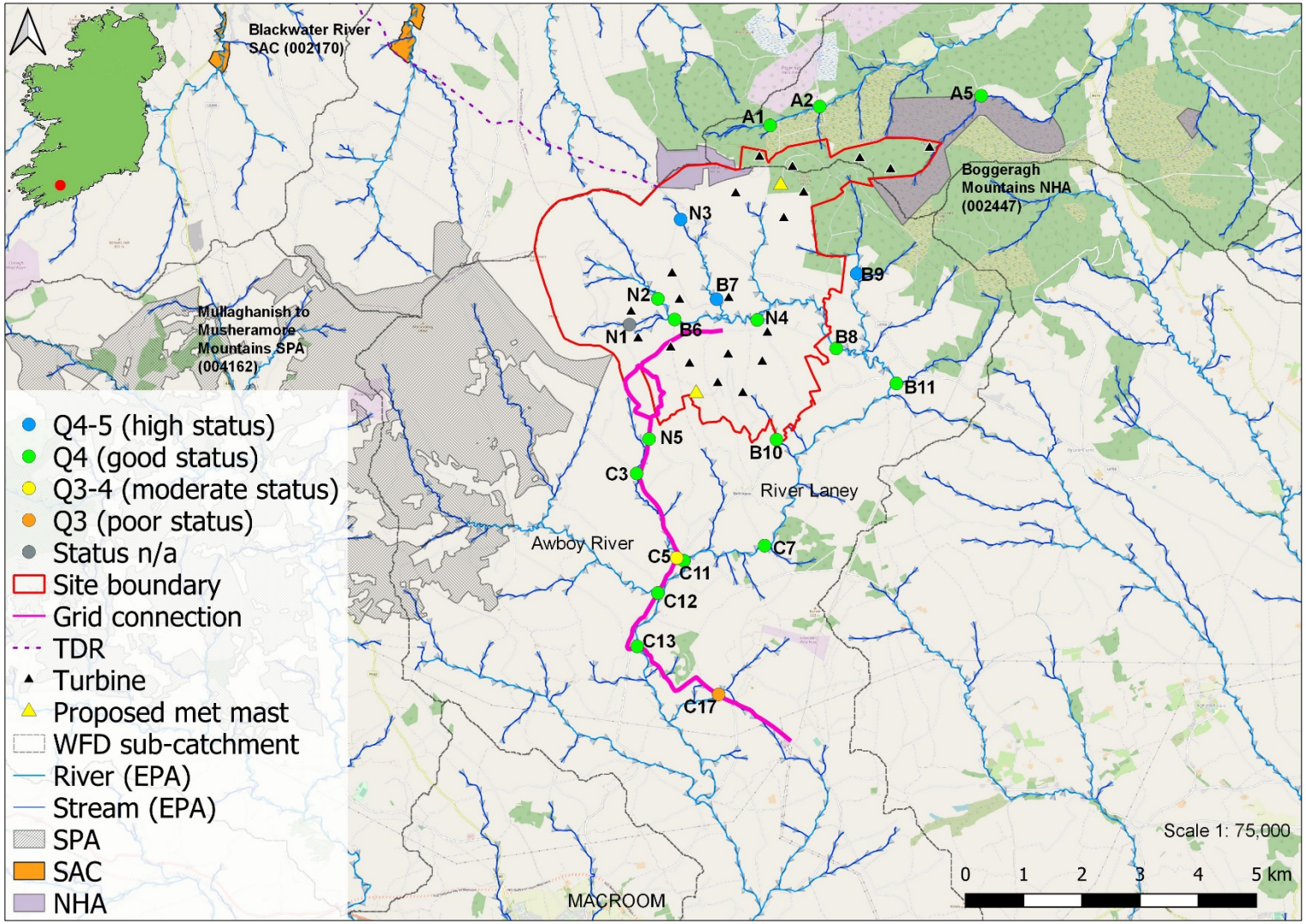

Figure 8B.4-1: Biological water quality results (Q-ratings) for the *n*=21 sampling locations

8B.4.3 Physiochemical water quality

The pH levels across the riverine sites was typically circumneutral with levels recorded between 6.58 and 7.54 (however, site N1 was 6.22). The majority of the sample sites were of low alkalinity (i.e. ≤20mg/l $CaCO_3$ at sites A1, A2, B6, B7, B8, B9, C7, C13, N1, N2, N3 and N4). Sites A5 (Glen River), B10 (Ballynagree East Stream) and C17 (Coolaniddane River) were of moderate alkalinity (i.e. 20-100mg/l $CaCO_3$ due to greater calcareous influences).

With the exception of site A1 (0.094mg N/l) the sampling sites had low levels of total ammonia which were equivalent to high status water quality (i.e. Total Ammonia levels ≤0.040 mg N/l) according to S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019. Site A1 failed to meet the good status standard (i.e. ≤0.065 mg N/l) whilst site D1 achieved good but not high status.

With regards to nutrients, molybdate reactive phosphate (MRP) levels were typically very low across the sampling and thus met high status as required in the Surface Water Regulations (i.e. levels ≤ 0.025 mg P/l). However, MRP concentrations were elevated at sites A1 (0.043mg P/l) and D1 (0.116mg P/l), with both sites failing to meet the good status threshold (≤0.035mg P/l) as set out under S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019.

Levels of total oxidised nitrogen (TON) ranged from 0.011 to 2.489mg N/l across the sampling sites. Particularly high levels were recorded at sites B10 (2.299mg N/l) and C17 (2.489mg N/l). Total oxidised nitrogen is taken to be equivalent to nitrate given the concentration of nitrite is usually negligible (O'Boyle et al., 2019). Whilst there are no environmental quality standards for nitrate, average nitrate concentration values ≤4 mg/l NO_3 (≤0.9mg N/l) and ≤8mg/l NO_3 (≤1.8mg N/l) are considered by the EPA to be indicative of high and good quality water, respectively. Thus, only sites B10 (Ballynagree East Stream) and C17 (Coolaniddane River) fell outside acceptable parameters for nitrate.

The observed dissolved organic carbon (DOC) levels were low across most survey sites, being <5mg C/l. These levels indicated low levels of leaching of DOC and escapement of solids into surface waters from the afforested and improved agriculture-dominated landscape in the catchment of the wind farm. However, several sites to the north of the site boundary (sites A1, A2 and A5) featured considerably higher DOC levels (i.e. 18.7, 10.4 and 5.61mg C/l, respectively). All three of these sites drained upstream coniferous plantations.

BOD levels were low across all sites with all sampling locations achieving equivalent high-status water quality under S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (i.e. ≤1.3 mg O_2/l).

Whilst there are no clearly defined standards for COD concentrations in surface waters, levels were elevated at sites A1 and A2 on the Nadanuller Beg Stream (i.e. an order of magnitude higher than other sampling sites at 66.9mg and 35mg O_2/l, respectively). Water with high COD typically contains high levels of oxidizable organic matter (e.g. decaying plant matter) and COD elevations often accompany clear-felling activities (Drinan et al., 2013). Higher COD results in lower dissolved oxygen levels which may negatively impact aquatic biota.

Table 8B.4-1: Summary of physiochemical water quality results, June 2021 and June 2021 (B7 & N1-N4 only). Values in bold indicate failure to achieve 'good status' targets set out under the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77 of 2019)

	Site														
Parameter	**A1**	**A2**	**A5**	**B6**	**B7**	**B8**	**B9**	**B10**	**C7**	**C13**	**C17**	**N1**	**N2**	**N3**	**N4**
pH	6.69	7.16	7.21	7.04	7.20	7.33	7.32	7.54	7.40	7.40	7.46	6.22	6.96	7.00	6.96
Alkalinity (mg $CaCO_3$/l)	9.6	18.3	21.1	12.8	16.3	16.5	18.4	26.3	16.9	18.3	38.0	11.5	11.4	12.4	11.4
Total Ammonia (mg N/l)	**0.094**	0.023	0.006	0.003	0.021	0.005	0.008	0.008	0.019	0.017	0.025	0.006	0.009	0.008	0.009
MRP (mg P/l)	**0.043**	0.016	0.004	0.001	0.024	0.002	0.005	0.009	0.010	0.006	**0.116**	0.001	0.003	0.003	0.005
TON (mg N/l)	0.155	0.126	0.011	0.267	0.951	0.443	0.265	**2.299**	0.730	0.701	**2.489**	0.179	0.359	0.376	0.445
DOC (mg C/l)	18.7	10.4	5.61	1.95	2.61	2.41	2.95	1.38	3.27	3.75	3.40	2.95	1.70	1.02	2.39
BOD (mg O_2/l)	1.3	0.9	0.5	0.3	0.6	0.5	0.4	0.6	0.6	1.1	1.0	0.5	0.5	0.4	0.8
COD (mg O_2/l)	66.9	35.2	16.4	8.2	13.1	9.1	13.2	8.6	12.7	13.7	9.5	9.5	7.7	5.0	13.6
Suspended Solids (mg/l)	3.8	2.4	0.4	0.2	0.8	1	1.6	14.6	1.0	2.0	2.2	0.4	0.2	0.8	0.6

8B.4.4 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of aquatic surveys, electro-fishing, white-clawed crayfish, freshwater pearl mussel, physiochemical water quality and biological water quality surveys (**Table 8B.4.2**).

A total of *n*=14 survey locations (A2, B2, B3, C4, C8, C9, C10, C14, C15, C16, C17, C19, N1 & N3) (36% of total locations) did not support fish at the time of survey (i.e. non-perennial/seasonal channels). Where fish were present, brown trout (*Salmo trutta*) dominated across the survey area, with low abundances of European eel (*Anguilla anguilla*) also recorded. *Lampetra* sp. larvae (ammocoetes) were recorded at a single site only (C5, Carrigthomas Stream). A single Atlantic salmon (*Salmo salar*) was recorded via electro-fishing at site C11 on the River Laney at Knocknagappul Bridge.

No freshwater pearl mussel or white-clawed crayfish were recorded during the aquatic surveys. Aquatic vegetation communities representative of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and aquatic mosses [3260]' ('floating river vegetation') were recorded at sites A5 (Glen River), C12 (Awboy River) and sites B8, B11, C7, C11, C13 (all on River Laney).

The majority of survey locations featured low alkalinity, circum-neutral pH, low MRP and low to moderate total oxidised nitrogen (TON) levels (**Table 8B.4.1**). However, TON was particularly high at sites C17 and B10 (failed to meet EPA's threshold for good status). Levels of molybdate reactive phosphorus (MRP) were particularly high at site A1, with the site failing to meet the good status threshold set out under S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019.

A total of *n*=18 sites achieved ≥Q4 'good status'. Three unnamed River Laney tributaries (sites C7, B9 and N3) achieved high status (Q4-5) water quality. Two sites (C5 and C17) were of Q3 (poor status) **Appendix 8B.B**). Siltation and afforestation pressures (siltation, eutrophication etc.) were evident on numerous watercourses within the survey area which were not achieving good status.

Site A5 on the Glen River was located within the Boggeragh Mountains NHA (0002447), a site designated for peatlands. This site was therefore considered of **national importance**. None of the other aquatic survey locations were evaluated as being of greater than **local importance (higher value).** Over half of the sites surveyed in the vicinity of the proposed Ballinagree wind farm (22 of 40, 55% of sites) were evaluated as being of **local importance (higher value)** in terms of their aquatic ecology (i.e. A2, A3, A4, B1, B4, B5, B6, B7, B8, B9, B10, B11, C3, C5, C6, C7, C11, C12, C13, N2, N3, N4 & N5). Primarily this was due to the presence of overall moderate to good salmonid habitat and the presence of brown trout at the survey sites, in addition to good status (Q4) water quality. Site B9 (unnamed stream at Carrigagulla) achieved high status (Q4-5) water quality (i.e. pristine water quality). A single Atlantic salmon parr was recorded at site C11 (River Laney), with *Lampetra* sp. ammocoetes recorded from site C5 (Carrigthomas Stream). A kingfisher was recorded at site C12 (Awboy River).

A total of *n*=16 sites (41% of sites) were evaluated as being of **local importance (lower value)** in terms of their aquatic ecology (i.e. sites A1, B2, B3, C1, C2, C4, C8, C9, C10, C14, C15, C16, C17, C18, C19 & N1). Generally, this was due to low or a lack of fisheries value, in addition to poor or moderate water quality (i.e. ≤Q3-4) and an absence of other species/habitats of high conservation value.

Table 8B.4-2: Aquatic ecological evaluation summary of the *n*=40 survey locations according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
A1	Nadanuller Beg Stream	18N05	Local importance (lower value)	Low fisheries value (no fish recorded); Q4 (good status) water quality; site failed to meet S.I. No. 77/2019 MRP & total ammonia good status thresholds; no other aquatic species or habitats of high conservation value
A2	Nadanuller Beg Stream	18N05	**Local importance (higher value)**	Excellent salmonid (brown trout) nursery; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
A3	Unnamed stream	n/a	**Local importance (higher value)**	Moderate salmonid habitat, brown trout present; no other aquatic species or habitats of high conservation value
A4	Unnamed stream	n/a	**Local importance (higher value)**	Moderate salmonid habitat, brown trout & European eel present; no other aquatic species or habitats of high conservation value
A5	Glen Stream	18G04	**National importance**	Located within Boggeragh Mountains NHA (002447); good salmonid habitat, very good nursery, brown trout present; aquatic vegetation with good links to Annex I 'floating river vegetation' habitat[1]; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
B1	Carrigagulla Stream	19C22	**Local importance (higher value)**	Moderate salmonid habitat, brown trout present; no other aquatic species or habitats of high conservation value
B2	Unnamed stream	n/a	Local importance (lower value)	No fisheries or aquatic ecology value (non-perennial, 100% dry channel)
B3	West Ballinagree Stream	19W12	Local importance (lower value)	No fisheries or aquatic ecology value (non-perennial, 100% dry channel)
B4	Knocknagappul 19 Stream	19K04	**Local importance (higher value)**	Moderate salmonid habitat, brown trout present; no other aquatic species or habitats of high conservation value
B5	River Laney	19L01	**Local importance (higher value)**	Good salmonid habitat, brown trout present; no other aquatic species or habitats of high conservation value
B6	River Laney	19L01	**Local importance (higher value)**	Good salmonid habitat, very good nursery, brown trout present; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
B7	Unnamed stream	n/a	**Local importance (higher value)**	Moderate salmonid habitat, brown trout present; no other aquatic species or habitats of high conservation value

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
B8	River Laney	19L01	**Local importance (higher value)**	Good salmonid habitat, very good nursery, brown trout & European eel present; aquatic vegetation with good links to Annex I 'floating river vegetation' habitat[1]; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
B9	Unnamed stream	n/a	**Local importance (higher value)**	Good salmonid habitat, good nursery, brown trout & European eel present; **Q4-5** (**high status**) water quality; no other aquatic species or habitats of high conservation value
B10	Ballynagree East Stream	19B21	**Local importance (higher value)**	Poor salmonid habitat but brown trout present in low density; Q4 (good status) water quality; failed to meet EPA's TON target for good status water quality; no other aquatic species or habitats of high conservation value
B11	River Laney	19L01	**Local importance (higher value)**	Good salmonid habitat, very good nursery, brown trout present; aquatic vegetation with good links to Annex I 'floating river vegetation' habitat[1]; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
C1	Carrigthomas Stream	19C48	Local importance (lower value)	Low fisheries value (no fish recorded); no other aquatic species or habitats of high conservation value
C2	Maulnahorna Stream	19M10	Local importance (lower value)	Low fisheries value (no fish recorded); no other aquatic species or habitats of high conservation value
C3	Carrigthomas Stream	19C48	**Local importance (higher value)**	Good salmonid habitat, very good nursery, brown trout present; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
C4	Rahalisk Stream	19R08	Local importance (lower value)	Low fisheries value (no fish recorded); no other aquatic species or habitats of high conservation value
C5	Carrigthomas Stream	19C48	**Local importance (higher value)**	Good salmonid habitat, excellent nursery, good spawning, brown trout & ***Lampetra* sp. ammocoetes** present; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
C6	Unnamed stream	n/a	**Local importance (higher value)**	Poor salmonid habitat but brown trout present in low density; no other aquatic species or habitats of high conservation value
C7	River Laney	19L01	**Local importance (higher value)**	Excellent salmonid spawning, nursery & holding habitat, brown trout present; aquatic vegetation aquatic vegetation representative of Annex I 'floating river vegetation' habitat[1]; Q4

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
				(good status) water quality; dipper nest under bridge; no other aquatic species or habitats of high conservation value
C8	Lacknahaghny Stream	19L21	Local importance (lower value)	Low fisheries value (no fish recorded); no other aquatic species or habitats of high conservation value
C9	Unnamed stream	n/a	Local importance (lower value)	Low fisheries value (no fish recorded), non-perennial channel; no other aquatic species or habitats of high conservation value
C10	Unnamed stream	n/a	Local importance (lower value)	Low fisheries value (no fish recorded), non-perennial channel; no other aquatic species or habitats of high conservation value
C11	River Laney	19L01	**Local importance (higher value)**	Excellent salmonid nursery & holding habitat, good spawning, **Atlantic salmon** & brown trout present; aquatic vegetation representative of Annex I 'floating river vegetation' habitat[1]; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
C12	Awboy River	19A03	**Local importance (higher value)**	Good salmonid spawning, nursery & holding habitat, brown trout present; aquatic vegetation aquatic vegetation representative of Annex I 'floating river vegetation' habitat[1]; Q4 (good status) water quality; **kingfisher** recorded in flight; no other aquatic species or habitats of high conservation value
C13	River Laney	19L01	**Local importance (higher value)**	Good salmonid spawning & nursery, excellent holding habitat, brown trout present; aquatic vegetation with good links to Annex I 'floating river vegetation' habitat[1]; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
C14	Clonavrick Stream	19C74	Local importance (lower value)	Low fisheries value (no fish recorded), non-perennial channel with gross siltation pressures; no other aquatic species or habitats of high conservation value
C15	Coolaniddane River	19C67	Local importance (lower value)	Low fisheries value (no fish recorded), non-perennial channel with evident water quality pressures; no other aquatic species or habitats of high conservation value
C16	Kilberrihert Stream	19K24	Local importance (lower value)	No fisheries or aquatic ecology value (non-perennial, 100% dry channel)
C17	Coolaniddane River	19C67	Local importance (lower value)	Low fisheries value (no fish recorded); Q3 (poor status) water quality; failed to meet EPA's TON target for good status water quality; no other aquatic species or habitats of high conservation value

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
C18	Caherbaroul Stream	19C76	Local importance (lower value)	Low fisheries value (no fish recorded), non-perennial channel, evident water quality pressures; no other aquatic species or habitats of high conservation value
C19	Bealick Stream	19B45	Local importance (lower value)	Low fisheries value (no fish recorded), non-perennial channel; no other aquatic species or habitats of high conservation value
N1	West Ballynagree Stream	19W12	Local importance (lower value)	Very low fisheries value (non-perennial stream); biological water quality sample taken but not sufficient to calculate status; no other aquatic species or habitats of high conservation value
N2	River Laney	19L01	**Local importance (higher value)**	Moderate quality salmonid and eel habitat; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
N3	Unnamed stream	n/a	**Local importance (higher value)**	Low fisheries value; Q4-5 (high status) water quality; no other aquatic species or habitats of high conservation value
N4	River Laney	19L01	**Local importance (higher value)**	Excellent quality salmonid nursery and spawning habitat, moderate European eel habitat; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value
N5	Unnamed stream	n/a	**Local importance (higher value)**	Moderate quality salmonid and eel habitat; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value

[1] The Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]' was recorded at sites A5, B8, B11, C7, C11, C12 & C13

*** Conservation value:** Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (L*ampetra planeri*), river lamprey (*Lampetra fluviatilis*), white-clawed crayfish (*Austropotamobius pallipes*) and otter (*Lutra lutra*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon, river lamprey, white-clawed crayfish and otter are also listed under Annex V of the Habitats Directive [92/42/EEC]. Otters, along with their breeding and resting places, are also protected under provisions of the Irish Wildlife Acts 1976 to 2021. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Fisheries Acts 1959 to 2019, brown trout have no legal protection in Ireland.

8B.5. POTENTIAL IMPACTS

As with any construction project, wind farm developments and associated infrastructure have the potential to cause negative impacts on water dependent species and habitats that fall within the vicinity of the project or share downstream hydrological connectivity.

The majority of survey sites within and draining to the south of the site were located on numerous watercourses within the Sullane_SC_010 sub-catchment, although several sites draining to the north of the site were located in the Blackwater (Munster)_SC_050 and Blackwater [Munster]_SC_070 sub-catchments.

The proposed Ballinagree wind farm drains into the Sullane_SC_010 and Blackwater [Munster]_SC_050 and Blackwater [Munster]_SC_070 sub-catchments. Several watercourses draining to the north of the site shared downstream hydrological connectivity with the Blackwater River SAC (site code: 002170) via the Nadanuller Beg Stream (EPA code: 18N05) and Glen River (18G04). The project also overlapped with the Lee-Laney and Munster Blackwater *Margaritifera* sensitive areas. To elucidate potential impacts resulting from the proposed project, detailed surveys of physical and riparian habitats, and assessments of fish stocks (electro-fishing), fisheries habitat, white-clawed crayfish, freshwater pearl mussel, otter, biological water quality (Q-sampling) and physiochemical water quality were undertaken in June-July 2020 and June 2021.

The principle impacts from the proposed project on the aquatic environment are expected to occur during the construction phase where access tree felling, track construction, concrete pouring for turbine bases and watercourse crossings are required. Ongoing operational activities including the maintenance of the turbines and infrastructure are considered unlikely to result in significant impacts on the receiving aquatic environment due to more localised footprints and the absence of direct disturbance to habitats.

The conventional source-pathway-target model was applied to assess potential impacts to downstream aquatic receptors as a result of the proposed project. This was evaluated by establishing the closest downstream watercourses and likely pathways for direct or indirect effects. The nearest hydrological distances from the aforementioned infrastructure to receiving watercourses are summarised in **Table 8B.5.1.**

The proposed turbine delivery route (TDR) and grid connection route travel predominantly along the existing road network and utilise existing bridge and culvert structures over various watercourses. These proposed watercourse crossings are summarised in Chapter 2 and Chapter 10 of the EIAR (section 10.6.4). Within the proposed site boundary, new access tracks will be required and these will also convey a short section of the grid connection.

The potential impacts of the proposed project are outlined below for the 'do-nothing' scenario along with the construction, operation and decommissioning phases (as applicable). These are the impacts that could potentially occur in the absence of mitigation measures. The summary of potential impacts, magnitude, duration, likelihood and whether it is of a direct or indirect nature are provided in **Table 8B.5.1**.

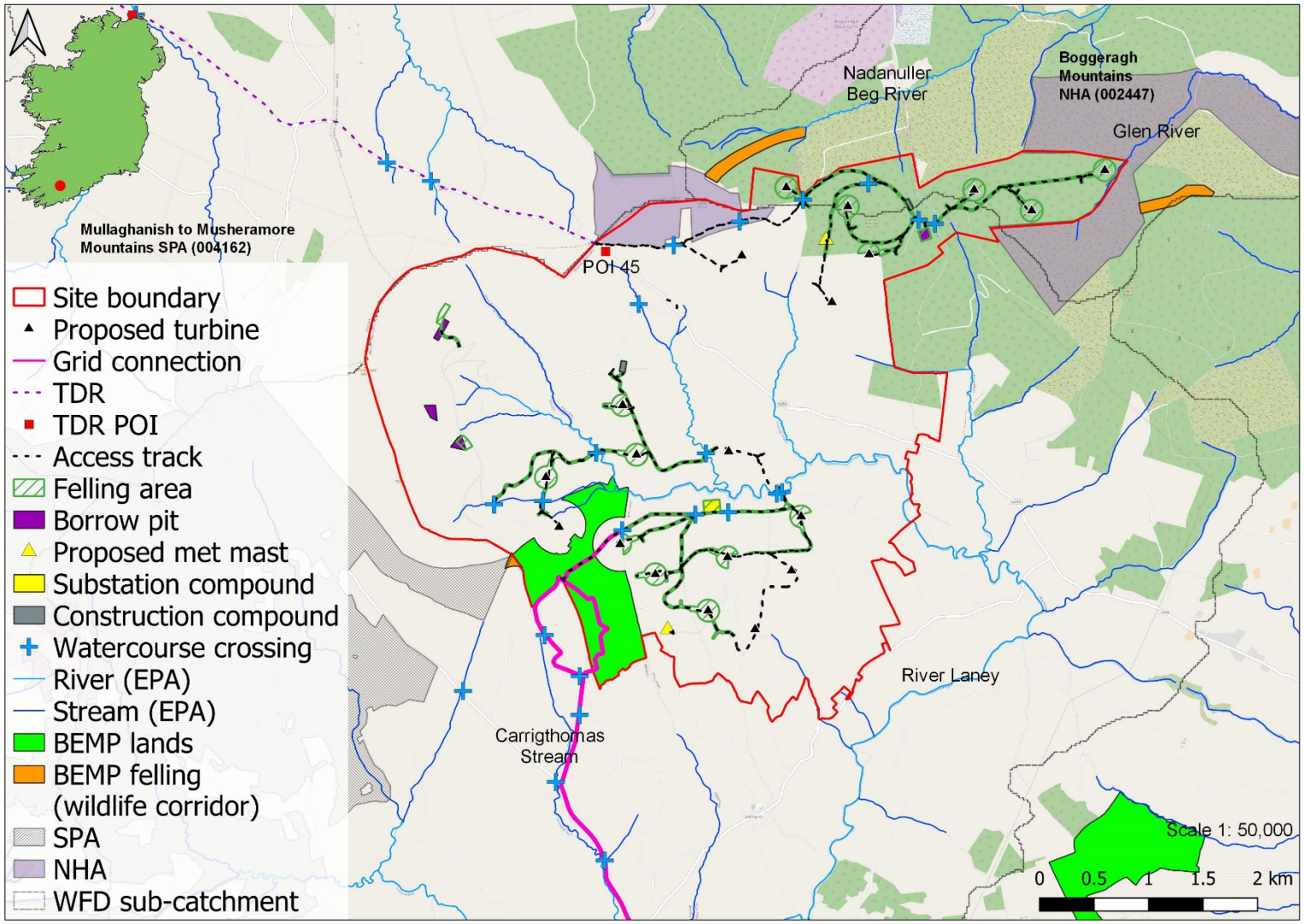

Figure 8B.5-1: Location of the proposed infrastructure and biodiversity enhancement felling areas

8B.5.1 'Do nothing' scenario

If the proposed project does not go ahead then the land in the vicinity of the site will continue to be used for commercial forestry production and lower-intensity pasture. The 'do-nothing' approach would result in water quality, hydrological regimes and the aquatic ecology of the receiving watercourses remaining consistent with the emergent baseline (i.e. pre-development). The majority of the biological water quality samples (*n*=17 sites) achieved good or high status (i.e. ≥Q4) water quality (**Appendix 8B.B**). Agricultural and afforestation pressures would continue to pose a threat to water quality within the wider catchment in the absence of the proposed project.

8B.5.2 Potential construction phase impacts

The principle impacts from the proposed project on the aquatic environment are expected to occur during the construction phase. Primarily, these risks relate to water pollution and or contamination via siltation, hydrocarbons, concrete and or tree felling. The project design has been developed to reduce the requirement for in-stream works and to minimise the risk of potential contamination and water pollution. The Construction Environmental Management Plan (CEMP), which details the construction methodologies, has been developed to apply best-practice construction methodologies. Potential impacts relating specifically to hydrology are dealt with in Chapter 10 of the EIAR (Hydrology and Water Quality). The potential impacts relating to specific construction-phase activities on the aquatic environment are discussed in detail below.

8B.5.2.1 Potential impacts within the wind farm site

8B.5.2.1.1 Potential impacts during tree felling

Tree felling will be required at 14 of the 20 no. proposed turbine locations to facilitate hardstand construction and access (i.e. T1, T3, T4, T6, T7, T9, T11, T12, T14, T15, T16, T18, T19 & T20). Furthermore, felling will be required to facilitate access track construction and or improve existing access (i.e. track widening) to turbines T1, T2, T3, T4, T5, T6, T7, T9, T10, T11, T12, T14, T15, T16, T17, T18, T19 &T20 (see **Figure 8B.5.1).** It is estimated that 70ha in total of existing forestry will be felled to allowed for development of the proposed wind farm infrastructure (e.g. turbine base, met mast and sub-station construction, borrow pit excavation and associated access tracks). A further 18ha of coniferous felling will be undertaken as part of the BEMP (please refer to section 5.2.4 for details). Given the location of these felling areas in upland areas of peat bog and coniferous afforestation, there are risks associated with sediment and nutrient run-off to surface waters resulting from felling activities, including machinery tracking and extraction methods.

In the vicinity of the proposed felling areas, potential hydrological source-receptor pathways for water quality impacts to sensitive aquatic receptors were identified on the West Ballynagree Stream, Knocknagappul Stream and River Laney and three unnamed tributaries (all draining southwards), as well as the Nadanuller Beg Stream and three unnamed tributaries and Glen River (all draining northwards) (**Figure 8B.5.1**). Based on the shortest distance, the greatest threat to aquatic ecology was identified on the Glen River, where the felling area for turbine T20 was located approx. 30m up-gradient from the watercourse.

Furthermore, with regard to the 18h felling for BEMP (i.e. wildlife corridors) (**Figure 8B.5.2**), the uppermost reaches of the Nadanuller Beg River and the Horsemount Mountain Stream are located along the northern boundary of the c.10ha wildlife corridor to the north of the proposed wind farm. Furthermore, the headwaters of the Donoure Middle Stream (Rathcool River tributary) are located ≤50m north-west from this proposed felling area. The upper reaches of the Glen River are located immediately north-west (i.e. <50m) of the c.6.6ha wildlife corridor to the north-east of the proposed wind farm.

There are no watercourses located in the vicinity of the c.0.1ha wildlife corridor located to the west of Kelleher's lands, with the nearest watercourse (Maulnahorna Stream) located c.0.5km south according to EPA mapping.

In light of the site topography (gradient) and vicinity of proposed felling areas, the greatest risk of impacts was identified on the River Laney, Nadanuller Beg Stream and Glen River. The Nadanuller Beg Stream and Glen River both share downstream hydrological connectivity to the Blackwater River SAC (002170) (shortest potential hydrological distance approx. 6.9km and 5.9km downstream from the nearest felling areas, respectively). Whilst neither of these watercourses are known to support freshwater pearl mussels, the nearest downstream record (River Blackwater) is approx. 14.7km, along the Glen River pathway. On the River Laney, the nearest freshwater pearl mussel record to a proposed felling area (watercourse crossing WF-HF4 access track) was located approx. 12.5km downstream (Clonavrick Bridge). However, this was a historical record (2007) and current surveys did not identify any extant pearl mussels in the River Laney, despite some suitability (see **Appendix 8B.C**).

The River Laney did however, support Atlantic salmon (single fish recorded at Knocknagappul Bridge; **Appendix 8B.A**) and localised examples of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and aquatic mosses [3260]'. This habitat was also recorded on the Glen River (survey site A5), downstream of proposed felling areas. Biological water quality was of Q4 (good status) or Q4-5 (high status) in the majority of watercourses with potential hydrological connectivity to proposed felling areas.

Therefore, in light of the above, the tree felling process to facilitate turbine base, met mast, construction compound and sub-station construction, borrow pit excavation and associated access tracks, in addition to the BEMP, could result in impacts to the aforementioned watercourses through water quality deterioration via sediment release and nutrient (especially phosphorus) run-off. The release of suspended solids and or nutrients to watercourses can also come from brash if material is left within close proximity to receiving watercourses (riparian zone) or if it is incorrectly managed (e.g. not replaced as required when used for off-road plant). This may cause impacts to salmonid spawning habitat (siltation of gravels) as well as an overall deterioration of the ecological health of the watercourses (including otter and freshwater pearl mussel).

The felling of conifers on site may result in periodic and localised changes to the pH of down-gradient receiving watercourses ('acid pulses'), largely driven by increases in dissolved organic carbon (DOC) concentrations (Kelly-Quinn et al., 2016). This may impact aquatic invertebrate communities and the sensitive developmental stages of salmonids (Finn, 2007; Giller & O'Halloran, 2004). Felling may also result in increases in heavy metal concentrations, which may impact development and growth of aquatic species (Lehane et al., 2004; Graham et al., 2014; Harrison et al, 2014).

Exposure of soil and subsoil (particularly peaty soils) following felling vehicle tracking, skidding and extraction methods also has the potential to release nutrients to surface waters, posing a risk to aquatic ecosystems and species, including aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170). Annex II freshwater pearl mussel, such as those in the downstream-connecting Blackwater River SAC (002170), are highly sensitive to sedimentation and eutrophication and require a maintenance of high water quality (Moorkens, 2000). Felling for access tracks passing close to or crossing watercourses (e.g. River Laney at WF-HF4, WF-HF5 & WF-HF6), could allow the migration of silt-laden run-off into watercourses via surface water pathways (see section 5.2.1.3 below). The trafficking of heavy machinery required for tree felling could lead to pollution of adjoining surface waters due to spillage of fuels and hydrocarbons. There is also a risk that machinery associated with tree felling could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses (albeit no invasive species were recorded in the vicinity of watercourse crossings during surveys). Potential hydrological impacts as a result of tree felling or felling activities are considered in section 10.4 of Chapter 10 of the EIAR.

Given the close proximity of and potential hydrological connectivity of the River Laney, Nadanuller Beg Stream and Glen River and their respective associated tributaries, in addition to the Donoure Middle Stream, to proposed tree felling areas, potential impacts to aquatic ecology, in the absence of mitigation, are assessed as being significant negative, short-term and **at the local scale**[2].
With regard to the downstream-connecting Blackwater River SAC (002170) (via Nadanuller Beg Stream and Glen River pathways), potential impacts to aquatic qualifying interests are considered as likely significant negative, short-term and at the scale of the European site. In the case of freshwater pearl mussels in the downstream connecting Blackwater River SAC (002170), potential impacts are considered as significant negative, **permanent and the context of the European site**.

8B.5.2.1.2 Potential impacts during on-site excavations

Dewatering of on-site excavations can lead to the escapement of sediment-laden surface water run-off to adjacent watercourses, increasing sedimentation and turbidity, thus impacting aquatic biota. Standing water in excavations could contain an increased concentration of suspended solids as a result of the disturbance of the underlying soils. Run-off from the borrow pit areas could be silt-laden, with the risk of draining into receiving watercourses, given the exposed nature of the borrow pit areas due to the excavation and haulage of stone from the area. There are 3 no. borrow pits proposed within the wind farm site (**Figure 8B.5.1**). Whilst all are located ≥50m from receiving watercourses, the up-gradient location of three of the fourborrow pits presents a risk of water quality impacts to sensitive aquatic receptors, particularly via the release of sediment-laden surface water run-off and nutrients. The 3 no. borrow pits are located in close proximity to the headwaters of the River Laney (200m shortest over-land distance), an unnamed Laney tributary at Knocknagappul (50m) and an unnamed Laney tributary at Carrigagulla (240m). The unnamed tributary at Knocknagappul (western extent of the site) is a non-perennial channel (dry for much of the year) and, as such, the risk of impacts is considerably reduced.

Siltation of watercourses could result in the smothering of fish eggs and invertebrates resulting in mortalities and changes to fish and invertebrate community composition at the local scale. Siltation of watercourses could also lead to increased natural deposition, thus encouraging a proliferation of filamentous algae and or macrophytes, changing local hydrology, water quality (dissolved oxygen) and overall aquatic habitat quality. An increase in suspended solids/sedimentation can have significant negative impacts on aquatic biota and instream flora through a reduction in light penetration and habitat heterogeneity and altering overall aquatic ecology (Bilotta & Brazier, 2008). This would include Annex I 'floating river vegetation [3260]' habitat present in the River Laney.

Smaller-scale temporary dewatering may occur at other excavations (e.g. those for turbine bases, met mast, access roads, cable trenches, site compound) and, as such, there is potential for water quality impacts to receiving watercourses. The risk of such is greatest where excavations are proposed in close proximity to watercourses, such as at turbine T20 (c.110m from Glen River headwaters), the temporary site compound at Seefin (c.100m from unnamed Laney tributary) or the site sub-station (c.70m from River Laney). This is of particular concern given the ≥Q4 (good status) water quality of these watercourses. Escapement of sediment-laden run-off could be particularly harmful in context of the Glen River pathway given the presence of downstream freshwater pearl mussel population in the Blackwater River SAC (002170).

Despite the likely small-scale of such events due to geographic separation/limited surface water pathways to receiving watercourses, potential impacts to aquatic ecology resulting from excavations (earthworks) are considered **significant negative, short-term and in the local context**, in the absence of mitigation.

[2] i.e. Impacts at the river sub-catchment scale given the nature of pollutants at source, dilution in the receiving environment and sensitivity of receptors in the sub-catchment. Impacts to the downstream European sites are considered separately.

The nearest downstream record for freshwater pearl mussel in the River Blackwater is approx. 14.7km from a proposed turbine base excavation, along the Glen River pathway. For pearl mussel, potential impacts resulting from site excavations are considered **significant negative, permanent and in context of the European site**, in the absence of mitigation. The Blackwater River SAC (002170) is located approx. 5.9km downstream of this location. Potential impacts to other aquatic qualifying interest species are considered **significant negative, short-term and in context of the European site .**

8B.5.2.1.3 Potential impacts during access track construction

It is proposed to construct approximately 13.7 km of completely new access track to facilitate site access and construction activities. New access tracks and upgrade of existing tracks have the potential to contribute to the increase in surface water run-off and cause more localised water quality impacts through sediment- and nutrient-laden run-off, including from tree felling areas associated with new tracks (discussed in Section 5.2.1.1 above). Works leading to erosion of the river banks/bed could result in the release of suspended solids. This may impact sensitive aquatic ecological receptors in receiving watercourses through mobilisation of sediment and or contaminants, as well as additional erosion, resulting in impacts to both water quality and aquatic habitat. Details on the projected increase in surface water run-off are provided in section 10.4.2.1 of chapter 10 of the EIAR.

Access track construction will also require localised tree felling. Potential impacts on aquatic ecological receptors from tree felling required for access track construction are the same as those outlined above in section 5.2.1.1.

As outlined in section 10.6 of chapter 10 of the EIAR, most of the existing tracks on site are 5m wide. However, these tracks do not have hard surface cover. It is proposed to widen approximately 11.8 km of existing tracks, with some additional widening at bends. This will involve slight relocation of existing roadside drains to allow widening, which may interfere with existing site drainage (see section 5.2.5 below). It is proposed to utilise the existing tracks in so far as possible to access the new turbines. The existing tracks will require strengthening and widening to achieve a track width of 5 m. All track widening will be undertaken using clean uncrushable stone with a minimum of fines. Nonetheless, these activities have the potential to convey suspended solids and contaminants (e.g. nutrients, hydrocarbons) to receiving watercourses, particularly in the vicinity of watercourse crossings.

There will be a total of 15 no. watercourse crossings to facilitate new access track construction within the wind farm site. New crossings are located on the River Laney (single span bridge at WF-HF4 and pre-cast box culvert at WF-HF6), an unnamed Laney tributary (pre-cast box culvert, WF-HF9) and West Ballynagree Stream (pre-cast box culvert, WF-HF5). The River Laney at WF-HF4 (aquatic survey site N4) was of high value to salmonids (including spawning habitat) and had Q4 (good status) water quality. At WF-HF6 (aquatic survey site N2), the River Laney provided moderate-quality salmonid and eel habitat in addition to Q4 (good status) water quality. The unnamed Laney tributary at WF-HF9 (aquatic survey site B7) supported salmonids and Q4-5 (high status) water quality. The West Ballynagree Stream at WF-HF5 (aquatic survey site N1) was a non-perennial stream of low aquatic value.

Furthermore, there will be a total of 9 no. upgrades to existing culverts on the forestry drain network. These access track crossings are detailed in section 10.4.6 and Table 10-12 of chapter 10 of the EIAR, and shown in **Figure 8B.5.1** above. Forestry drains will be crossed using 450mm diameter pipes. Where cross drains are to be provided to convey the drainage across the track, the minimum sizes of these cross drains are 300 mm diameter pipes.

Given the close proximity of and potential hydrological connectivity of access track construction to the River Laney (and tributaries) and, to a lesser extent, Nadanuller Beg Stream and Glen River (located 540m and 170m down-gradient from access track construction, respectively), potential impacts to aquatic ecology, in the absence of mitigation, are assessed as being **significant negative, short-term and at the local scale.**

With regards the downstream-connecting Blackwater River SAC (002170), given geographical separation and poor potential hydrological pathways for impacts to the Nadanuller Beg Stream (and tributaries) and Glen River, potential impacts to qualifying interests are considered as **moderate negative, short-term and at the scale of the European site**.

For pearl mussel in the Blackwater River SAC (002170), potential impacts resulting from access track construction are considered **likely significant negative, permanent and in context of the European site**, in the absence of mitigation.

8B.5.2.1.4 Potential impacts during turbine, met mast and other on-site construction

The construction of 20 no. wind turbines (with a transformer at each turbine and associated hardstand areas) and 1 no. met mast will include construction activity, large-scale earthworks, drainage and pouring of concrete. Turbines T1, T2, T3, T6, T7, T8, T9, T10, T11, T12, T13, T16 and T17 are within the Laney_010 sub-basin. Turbines T4 and T5 are within Laney_020. Turbines T14, T15 and T18 are within Nad_010 and turbine T19 and T20 are within Glen (Banteer)_010 sub-basin. The 20 no. turbines have been positioned at a minimum distance of c.70m (measured along potential flow paths, invariably >120m) from the lotic watercourses draining the site, i.e. West Ballynagree Stream, Knocknagappul Stream and River Laney and three unnamed tributaries (all draining southwards), as well as the Nadanuller Beg Stream and three unnamed tributaries and Glen River (all draining northwards) (**Figure 8B.5.1**).

Proposed met mast PMM1 is located >900m from the nearest down-gradient watercourse (Ballynagree East Stream) and, thus, impacts to aquatic ecology, are not anticipated. Proposed met mast PMM2 is located approx. 330m north-east of an unnamed tributary of the Carrigagulla Stream. Given the proximity and up-gradient location of the met mast to this watercourse, there is a risk of potential impacts to water quality.

The 0.35ha temporary construction compound, located in coniferous plantation (proposed felling area) in the north-eastern portion of the site (Seefin), poses a risk to water quality of an unnamed Nadanuller Beg Stream tributary and an unnamed River Laney tributary, both located down-gradient of the proposed compound (c.260m and 350m shortest distances, respectively). Similarly, the construction of the 1.57ha on-site sub-station, located approx. 65m south of the River Laney, poses a risk to water quality.

The earthworks required to facilitate turbine base, met mast, temporary constriction compound and sub-station construction may liberate nutrients and increase the sediment load of surface water run-off, potentially impacting water quality and aquatic sensitivities (e.g. fish, macro-invertebrates, otter, floating river vegetation) in adjacent and downstream watercourses, including the Blackwater River SAC (002170).

Whilst all 20 no. turbines are located up-gradient of receiving watercourses, the greatest threat to aquatic ecology from turbine base (hard stand) construction (based on site topography and the layout of surface water features) was identified at those turbines in closer proximity to watercourses, i.e. T1, T2, T5, T9, T11 & T20) (see **Table 8B.5.1** for distances). The risk was particularly high at the turbine T20 hard stand area which is located in a coniferous plantation c.70m from the headwaters of the Glen River, a watercourse that supports salmonids, European eel, Annex I 'floating river vegetation' and shares downstream connectivity with the Blackwater River SAC (002170).

Wet concrete poured for turbine bases, met mast, sub-station and rinsing of truck chutes on-site could lead to contamination of receiving waters via surface water run-off. Cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality and aquatic biota, including Atlantic salmon, lamprey, otter and freshwater pearl mussel.

Heavy machinery required for construction activities may also lead to pollution of nearby receiving watercourses due to spillage of fuels and hydrocarbons. Haul tracks crossing the River Laney and or its tributaries or passing close to the site drainage channel network could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways (e.g. wheel rutting).

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons can cause significant pollution risk to surface waters and aquatic ecology. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in surface waters, resulting in death of aquatic organisms.

There is also a risk that machinery required for construction could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses. However, no invasive species were identified in the vicinity of the proposed turbines or site access tracks and the geographical separation of same from adjacent watercourses would reduce this risk considerably.

The potential impacts to aquatic ecology resulting from turbine base, met mast, temporary construction compound and sub-station construction are considered **significant negative, short-term and in the local context,** in the absence of mitigation.

The nearest downstream record for freshwater pearl mussel in the River Blackwater is approx. 14.7km from the turbine T20 hard stand, along the Glen River pathway. For pearl mussel, potential impacts resulting from site excavations are considered **significant negative, permanent and in context of the European site**, in the absence of mitigation. The Blackwater River SAC (002170) is located approx. 5.9km downstream of this location. Potential impacts to other aquatic qualifying interests are considered **significant negative, short-term and in context of the European site.**

8B.5.2.1.5 Potential impacts during installation of site drainage

The construction phase may result in significant changes or alterations to the existing drainage network within the wind farm boundary, which may increase sediment and nutrient loads to receiving watercourses within, adjoining or draining the site. No alterations to existing drainage are proposed or expected outside of the wind farm boundary (e.g. along the TDR or grid connection). As outlined in in section 5.2.1.3 above and section 10.4.6 of chapter 10, there are several drain crossings to be installed to facilitate wind farm access track construction. Track widening will involve slight relocation of existing roadside drains. Forestry drains will be crossed using 450mm diameter pipes. Where new cross drains are to be provided to convey the drainage across the track, the minimum sizes of these cross drains are 300mm diameter pipes. These pipes will be at 250m intervals to ensure the existing site drainage pattern is not altered. Culverting may impact surface water run-off to the riverine watercourses draining the wind farm site (e.g. River Laney), mobilising and increasing siltation rates and exacerbating the risk of other water quality impacts (e.g. eutrophication).

Site drainage, including silt traps and settlement ponds, will be put in place in parallel with construction, such that excavation for new infrastructure will have functional drainage system in place. Inappropriate management of the carrying out of these modifications could result in blockages of existing trackside drainage and drainage swales, which may both increase the risk of water contamination to receiving watercourses via siltation, fuel spillages etc., as well as cause alterations in the existing hydrology of the wider site. Inappropriate management of the excavated material associated with construction (e.g. inadequate silt fences on drainage channels alongside access/haul tracks) could also lead to loss of suspended solids to surface waters.

The 0.35ha temporary construction compound, located in coniferous plantation (proposed felling area) in the north-eastern portion of the site (Seefin), poses a risk to water quality of an unnamed Nadanuller Beg Stream tributary and an unnamed River Laney tributary, both located down-gradient of the proposed compound (c.260m and 350m shortest distances, respectively). Whilst set-back from the watercourses and site drainage network, inappropriate management of surface water run-off to the associated interceptor drain and settlement ponds could lead to aquatic ecological impacts (water quality). Potential impacts to hydrology resulting from site drainage of the temporary construction compound are outlined in section 10.6.6 of chapter 10 of the EIAR.

Similarly, the 1.57ha on-site sub-station may result in water quality impacts to the River Laney, located approx. 65m south of the river. However, the low gradient of this area and the presence of an existing coniferous plantation between the sub-station and River Laney are considered to reduce the risk of pre-mitigation impacts to aquatic ecology.

Whilst the on-site drainage network was not of value to sensitive aquatic receptors (e.g. salmonids, lamprey, European eel), inappropriate sizing of pipework or blockages could impede flows, particularly during heavy rainfall events. Local flooding or surface water ponding could result, potentially resulting in the release of suspended solids to receiving watercourses or altering local hydrology. The significance of the effect of the increase in site run-off as a result of the proposed project has been assessed as "not significant" on receiving waters because estimated increases in the peak run-off is low compared to the flows of receiving waters (section 10.4.2.1 of chapter 10). Further consideration to site drainage and the potential for hydrological impacts are considered in section 10.6 of chapter 10 of the EIAR.

Potential impacts resulting from drainage of the borrow pits has been addressed in section 8B.5.2.1.2 above.

Given the likely small-scale of site drainage-related events due to geographic separation and limited surface water pathways to receiving watercourses, potential impacts to aquatic ecology resulting from alterations to/inadequate site drainage management are considered **moderate negative, short-term and in the local context**, in the absence of mitigation.

Potential impacts to Blackwater River SAC (002170) qualifying interest species and habitats are considered **likely significant negative, short-term and in context of the European site**, in the absence of mitigation. For pearl mussel, potential impacts resulting from site drainage are considered **likely significant negative, permanent and in context of the European site.**

8B.5.2.2 Potential impacts during grid connection installation (trenching & HDD)

The proposed underground grid connection will follow access tracks and local public roads to connect to the existing Clashavoon 220kV substation 4.5km north-east of Macroom. The grid connection will cross a total of 14 no. watercourses, including 9 no. riverine watercourses, namely (from north to south) the Rahalisk Stream (GCR-WCC15), Carrigthomas Stream (GCR-WCC9), Awboy River (GCR-WCC8), unnamed stream (GCR-WCC19), River Laney (GCR-WCC7), Clonavrick Stream (GCR-WCC6), Caherbaroul Stream (GCR-WCC5), Coolaniddane River (GCR-WCC4) and Kilberrihert Stream (GCR-WCC3). The remaining crossings are over drainage channels. The Kilberrihert Stream and Caherbaroul Stream are evidently non-perennial (dry at the time of survey, June-July 2020).

With the exception of crossing points GCR-WCC7, GCR-WCC8, GCR-WCC9 and GCR-WCC19 (see below), watercourses will be crossed via standard cable trenching methods. The cable ducts will be placed in the verge or carriageway of the public road network, whilst along internal site tracks, the cable ducts will be installed adjoining proposed pre-cast concrete box culverts (see section 10.3.7 of chapter 10 of the EIAR). The proposed grid connection trench will be up to 930mm wide and up to 1200mm deep. Where the proposed grid connection cable route encounters minor culverts, the ducts will be installed above, below or beside the culvert depending on its depth in accordance with construction methodologies outlined in the CEMP. Excavation of the grid connection trenching presents a potential risk to water quality of adjacent watercourses from silt and hydrocarbons during construction. There is a potential impact, in the absence of mitigation measures, of sediment-laden run-off in surface water from the ground surface surrounding the cable trench. Wheel rutting from machinery could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways. Concrete has a high pH and presents a potential significant risk to the aquatic environment. Underground cabling can potentially provide a preferential flow path for surface water.

Along the grid connection, the River Laney (GCR-WCC7), Awboy River (GCR-WCC8), Carrigthomas Stream (GCR-WCC9) and an unnamed Carrigthomas Stream tributary (GCR-WCC19) will be crossed via horizontal directional drilling (HDD). These watercourses do not share hydrological connectivity with a European site. However, the Laney was found to support salmonids (including Atlantic salmon), European eel, otter, Annex I 'floating river vegetation' habitat and good status (Q4) water quality. Whilst historical records for pearl mussel exist for the grid connection crossing at Clonavrick Bridge (from 1987 and 2007), no extant populations were identified during freshwater pearl mussel surveys undertaken in 2020 (**Appendix 8B.C**). The Awboy River, downstream of the proposed grid connection crossing at Awboy Bridge supports salmonids, Annex I 'floating river vegetation' habitat and good status (Q4) water quality. The grid connection crossing of the Carrigthomas Stream at Coppeleenbawn Bridge (survey location C5) supports salmonids, *Lampetra* sp. ammocoetes and Q3-4 (moderate status) water quality. The crossing of the unnamed Carrigthomas Stream tributary (survey location N5) provides moderate-quality salmonid habitat and Q4 (good status) water quality.

In light of the above, there is a risk of surface water quality impacts on the River Laney, Awboy River and Carrigthomas Stream during HDD and groundworks associated with potential directional drilling. Watercourses crossed by directional drilling are at risk of suspended solid releases, hydrocarbon pollution (fuel spillage) and frack-out (escapement) of drilling lubricants. The release of suspended solids, would negatively affect fish populations, invertebrates and other water-dependent species, such as otter (recorded along the Laney). Suspended solids can damage fish spawning substrata through the blocking of interstitial spaces, preventing oxygen diffusion and effecting egg/larval development, or directly smothering attaching and burrowing invertebrates, causing mortalities and changes to fish and invertebrate community composition at the local scale. An increase in suspended solids can also have negative effects on instream flora through a reduction in light penetration and habitat heterogeneity, thus altering overall aquatic ecology and potentially impacting Annex I 'floating river vegetation' habitat. In the River Laney and Awboy River, any impact to water quality may compromise the existing Q4 to Q4-5 (good to high status) of the sites.

The crossing of cable ducts over watercourses within the site boundary (i.e. along access tracks) are addressed in section 8B.5.2.1.3 above.

The potential impacts of grid connection installation (both trenching and HDD) to aquatic ecology of the receiving riverine watercourses, in the absence of mitigation, are assessed as being **significant negative, short-term and at the local scale**.

Given the absence of crossings over watercourses with downstream hydrological connectivity to the Blackwater River SAC (002170), there are no predicted potential impacts (significant or otherwise) to aquatic qualifying interests, including freshwater pearl mussel.

8B.5.2.3 Potential impacts during turbine delivery

In addition to turbine construction, the delivery of turbines and associated materials has the potential to impact water quality of watercourses crossed during transport. The turbine delivery route (TDR) will follow the existing road network and will run for 141km from the port of Foynes, Co. Limerick via the N69, M20, N20, N72, R583 and L2758 to the northern extent of the site (site entrance) at Ballynagree East. Turbine components will be delivered along the route as described in Chapter 3 of the EIAR.

In total, the TDR will cross 80 no. watercourses and these are listed in Table 10-9 of chapter 10 of the EIAR. Modifications along the TDR involves the temporary removal of street furniture, trimming and removal of vegetation and the temporary local widening of public roads and junctions which will involve the stripping of topsoil and laying and compacting of graded aggregates. These minor works are confined to relatively small localised areas and it is not anticipated that this will have any significant impact to aquatic receptors.

Significant works to watercourse crossings are only proposed at a single location, namely crossing WF-HF8 located on an unnamed River Laney tributary in the northern portion of the wind farm site (aquatic survey site N3). The works will comprise the replacement of the existing bridge with a 6m-single span bridge. Cable ducts associated with the wind farm internal collector circuit will be built into the bridge deck, which will be pre-fabricated off site.

Whilst there is some low risk for potential water quality impacts resulting from instream works to this watercourse and the downstream-connecting River Laney (2.4km downstream), including the release of suspended solids, nutrients or hydrocarbons, the installation of a new single span bridge will accommodate improved fish passage (bridge culvert is currently impassable to salmonids and poorly passable to European eel).

The most significant temporary works from an aquatic ecological perspective will be required at POI-36 and POI-44. At POI-36, a temporary hardstanding area is envisaged. At this location, turbine blades travelling from the port of entry shall be transferred using cranes from flat, extendible carrier trailers, onto blade lifting trailers for the remainder of the route. The purpose of this is to minimise the amount of temporary accommodation works required between Millstreet and the site. These proposed works are located approx. 400m (over-land) from the nearest receiving watercourse, i.e. Coomlogane River, a tributary of the River Finnow, and approx. 2.7km over-land plus instream distance from the Blackwater River SAC (002170). The Finnow supports sensitive aquatic receptors including Atlantic salmon and otter and forms part of the Blackwater River SAC (002170).

At POI-44, ground reprofiling and placement of load bearing surface will be required. Inappropriate management of the carrying out could result in releasing of the suspended solids into the Owenbaun (Rathcool) River, located approx. 30m east of the proposed works. The Owenbaun River has downstream connectivity to the Blackwater River SAC (002170) approx. 30m over-land and 75m downstream of the proposed works area (i.e. 105m shortest total distance).

Although no instream works are proposed at these areas, the close proximity of works to the respective watercourses presents a low but potential risk of water quality impacts from sediment-laden run-off and or nutrient escapement resulting from vegetation removal. There is also a low risk of water quality impacts resulting from fuel spillage (hydrocarbons) from associated plant machinery in vicinity of the works areas.

Potential impacts to aquatic ecology resulting from turbine delivery are considered **slight negative, short-term and in the local context**, in the absence of mitigation.

Impacts to the downstream-connecting Blackwater River SAC (002170) as a result of works at POI-36 and or POI-44 are considered as **not significant, short-term and at the scale of the European site**.

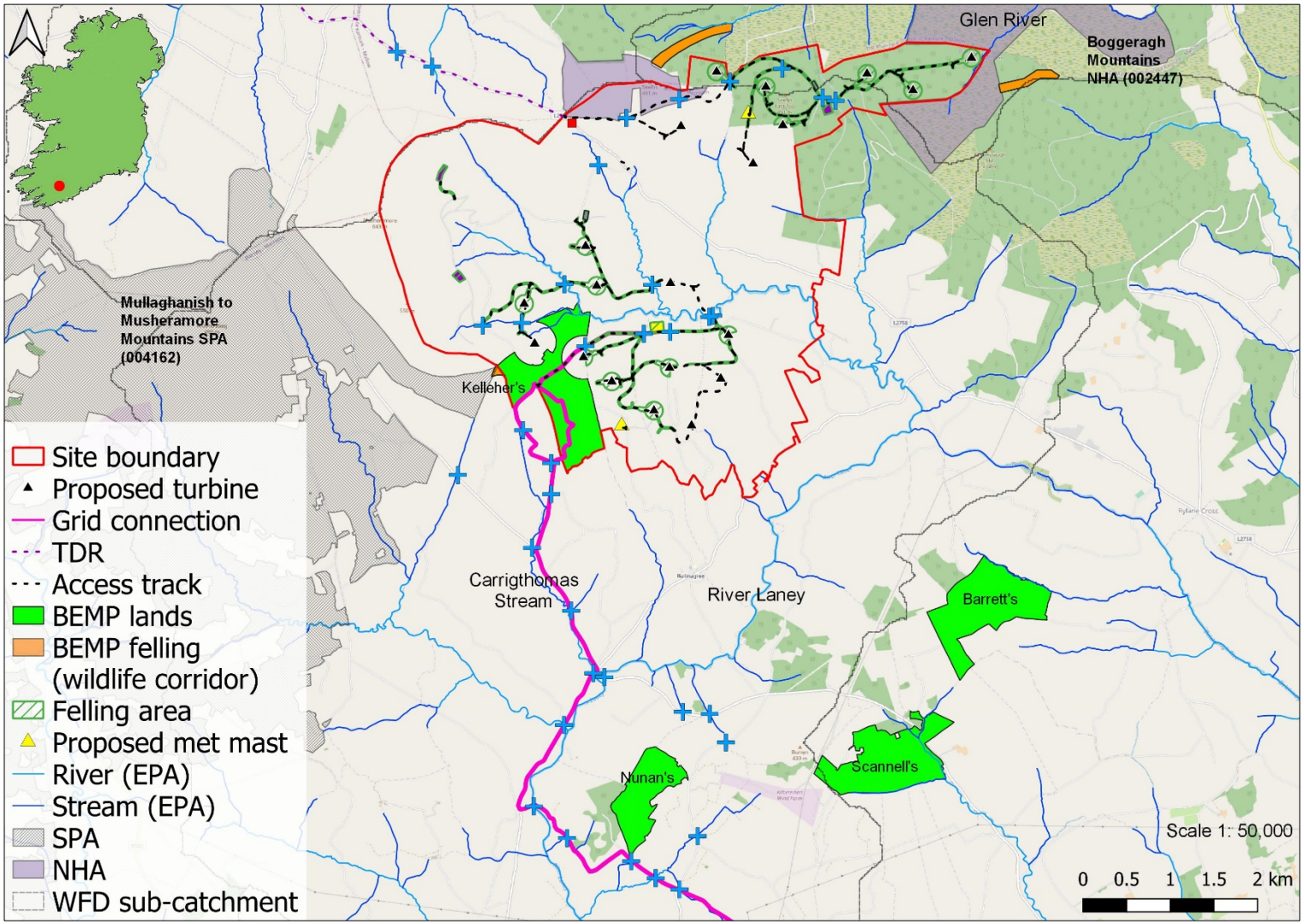

Figure 8B.5-2: Location of the proposed BEMP lands relative to the proposed project

Table 8B.5-1: Summary of construction phase impacts to aquatic ecological receptors *(pre-mitigation)*

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
Tree felling (wind farm site)	**River Laney** Felling required for access track crossings at WF-HF6 and WF-HF4; turbine T11 felling area c.140m up-gradient of river **Nadanuller Beg Stream** (c.180m from T18 access track over land and & via unnamed tributary, 6.9km hydrological distance from Blackwater River SAC) **Glen River** (c.30m from turbine T20 over land, 5.9km hydrological distance from Blackwater River SAC)	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species*:* **significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) excluding FWPM: **significant negative, short-term and in context of the European site** Freshwater pearl mussel: **significant negative, permanent and in context of the European site**
Tree felling (BEMP)	**Wildlife corridor (northern)** Borders Nadanuller Beg Stream & Horsemount Mountain Stream **Wildlife corridor (north-eastern)** Glen River located 50m north-west	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species*:* **significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) excluding FWPM:

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
				significant negative, short-term and in context of the European site Freshwater pearl mussel: **significant negative, permanent and in context of the European site**
On-site excavations	**Glen River** (c.70m over land from T20 hard stand) **River Laney** (c.70m over land from sub-station) **Unnamed Laney tributary** (c.100m over land from site compound)	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **moderate negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) excluding FWPM: **significant negative, short-term and in context of the European site** Freshwater pearl mussel: **significant negative, permanent and in context of the European site**
Access track construction	**River Laney** (access track crossings at WF-HF4 (single span bridge) and WF-HF6 (pre-cast box culvert) **Unnamed Laney tributary** (access track crossings at WF-HF9 (pre-cast box culvert))	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **moderate negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) excluding FWPM:

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
	West Ballynagree Stream (access track crossings at WF-HF5 (pre-cast box culvert)) **Glen River** (c.170m from nearest access track construction at T20) **9 no. drainage channels** (crossed by access tracks – see section 10.4.6 of chapter 10)			**moderate negative, short-term and in context of the European site** Freshwater pearl mussel: **significant negative, permanent and in context of the European site**
Turbine base and met mast construction	<u>Turbine bases:</u> **Glen River** (c.70m over land from T20 hard stand, 5.9km from Blackwater River SAC) **West Ballynagree Stream** (c.130m over land south of T1 hard stand) **Knocknagappul Stream** (c.160m over land north-east of T2 hard stand) **Ballynagree East Stream** (c.140m over land south-east of T5 hard stand)	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) excluding FWPM: **significant negative, short-term and in context of the European site** Freshwater pearl mussel: **significant negative, permanent and in context of the European site**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
	River Laney (c.200m over land north of T9 hard stand, c.150m west of T11 hard stand) <u>Met masts:</u> **Ballynagree East Stream** (c.900m from met mast PMM1, downstream connectivity to River Laney) **Unnamed Carrigagulla stream tributary** (c.330m north-east of PMM2, downstream connectivity to River Laney)			
Site drainage (incl. crossing/culverting of drainage channels)	**River Laney** (c.65m over land north of on-site sub-station; various source-receptor pathways via drainage channels) **Unnamed Laney tributary** (c.350m east of construction compound) **Unnamed Laney tributary** (c.260m north of construction compound)	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **moderate negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) excluding FWPM: **significant negative, short-term and in context of the European site** Freshwater pearl mussel:

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
				significant negative, permanent and in context of the European site
Grid connection	**Crossed by trenching:** Rahalisk Stream (GCR-WCC15), Clonavrick Stream (GCR-WCCC6), Caherbaroul Stream (GCR-WCCC5), Coolaniddane River (GCR-WCCC4) and Kilberrihert Stream (GCR-WCCC3) **Crossed by HDD:** Carrigthomas Stream (GCR-WCCC9), Awboy River (GCR-WCCC8), River Laney (GCR-WCCC7) **5 no. drainage channels** (crossed by grid connection via trenching – see section 10.6.4 and Table 10-12 of chapter 10)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp. (Carrigthomas Stream), kingfisher (Awboy River), otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170): **no impacts predicted (no connectivity to site)**
Turbine delivery route (TDR)	**Owenbaun River** (c.30m over land from POI-44 works area, 0.1km over-land plus instream distance from Blackwater River SAC) **Coomlogane River** (c.400m over land from POI-36 works area, 2.7km over-land plus instream	Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of contaminants (water quality impacts); spread of invasive species along watercourses	All downstream aquatic habitats & species: **slight negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) excluding FWPM:

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
	distance from Blackwater River SAC)			**not significant, short-term and in context of the European site** Freshwater pearl mussel: **significant negative, permanent and in context of the European site**
BEMP (excl. felling)	**Kelleher's lands** Overlaps River Laney, Knocknagappul Stream & West Ballynagree Stream **Scannal's lands** Adjoins Glashagarriff River **Barrett's lands** Adjoins unnamed Delehinagh River tributary **Kelleher's lands** Overlaps River Laney, Knocknagappul Stream & West Ballynagree Stream	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., otter, Annex I 'floating river vegetation' habitat [3260]	No negative impacts, rather positive impacts predicted based on livestock-proof fencing, improved grassland management etc.	All downstream aquatic habitats & species*:* **Medium to long-term positive and in the local context**

8B.5.3 Potential operational phase impacts

8B.5.3.1 Potential impacts within the site

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is via water quality impacts, when oils and lubricants are used on the site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent impacts to aquatic ecology. However, the likelihood of this occurring is very low, and the potential significance of this impact can be mitigated through effective mitigation and appropriate management.

Increases in the surface water run-off volume as a result of less-permeable surfaces of the wind farm (e.g. hardstands, access tracks etc.) are predicted to be <1% of the average daily/monthly volume in comparison to the baseline pre-development conditions (section 10.6 of chapter 10 of the EIAR). Thus, no significant operational phase impacts are predicted as a result of increases in surface water run-off.

The unmitigated increase in peak runoff due to construction of the wind farm site is 0.483 m^3/s for 1% AEP event. However, the increase in the peak runoff will be mitigated by the proposed drainage system (Chapter 10 of the EIAR). Therefore, there are no anticipated impacts to vulnerable aquatic species in downstream receiving watercourses, such as slow-swimming European eel or *Lampetra* sp.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage.

Spills of any oil or fuels (hydrocarbons) from site vehicles onto access tracks may leach to adjacent watercourses. However, this is unlikely to be a significant impact considering the low volumes of vehicular traffic involved in typical wind farm operations. During the operation stage, small quantities of oil will be used in cooling the transformers associated with the facility. A back-up generator at the sub-station may be used (and refuelled). There is, therefore, a potential for small oil spills which may enter surface waters and cause impacts to aquatic ecology. Upgrading of the site track/road network within the wind farm boundary could present the risk of silt-laden run-off resulting from excavations required for underground cable maintenance.

The replacement of an existing bridge with a 6m single span structure on the headwaters of an unnamed River Laney tributary at watercourse crossing WF-HF8 will incorporate fish-passable culvert. The existing bridge culvert is currently poorly passable to fish species. The installation of fish passable culvert will, therefore, result in a positive long-term operational phase impact to migratory fish species which may utilise the stream (albeit no fish were recorded at this location via electro-fishing during the survey).

Potential operational phase impacts on aquatic ecology are considered **likely slight negative, short-term and in the local context**, in the absence of mitigation. However, the installation of a fish passable culvert at watercourse crossing WF-HF8 will result in a **likely slight positive, long-term impact in the local context**.
Given the downstream-connectivity from the wind farm site and associated infrastructure (grid connection, sub-stations, access tracks etc.), potential impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) are considered **likely not significant negative, short-term and in context of the European site**, in the absence of mitigation.

8B.5.3.2 Potential impacts of BEMP

The primary potential impacts on adjoining or nearby watercourses from the BEMP are associated with tree felling for the provision of wildlife corridors (18ha total area). These impacts have been outlined in section 8B.5.2.1.1 above (under construction-related impacts).

The BEMP proposes to block any extant land drains in accordance with the advice of the project ecologist. This will have a negligible impact on hydrology and water quality because the catchment area of these drains is small compared to the catchment area of the sub-catchments. The surface runoff from the BEMP lands will drain via low-order tributaries within the Sullane_SC_020 and Lee[Cork]_SC_040 sub-catchments.

Livestock will be prevented from accessing natural watercourses by stock-proof fencing. Livestock entering the watercourses can cause siltation, bank erosion and water pollution at watercourse drinking points. Preventing livestock entering the watercourses will have a positive long-term impact on local watercourses. Furthermore, the commitment to biodiversity-friendly farming practices through control of stocking densities, minimising the use of herbicides and pesticides will further protect water quality. These measures will result in a **medium to long-term positive impact in the local context.**

8B.5.4 Potential decommissioning phase impacts

Decommissioning activities of the Ballinagree wind farm project will take place in a similar fashion to the construction phase. Potential impacts will be similar to the construction phase but on a reduced scale. The decommissioning phase poses similar risks of potential effects vis-á-vis the construction phase.

However, with suitable planning and provision of adequate mitigation, potential negative impacts on the receiving aquatic environment during decommissioning can be minimised. The decommissioning phase is described in Chapter 3 and these works will be subject to a decommissioning plan, to be agreed with Cork County Council.

There would be increased trafficking and an increased risk of disturbance to underlying soils at the wind farm, during the decommissioning phase, in this instance, leading to the potential for silt laden run-off entering receiving watercourses from the wheels of vehicles (i.e. wheel-rutting).

Any such potential impacts would be likely to be less than during the construction stage as the drainage swales would be fully mature and would provide additional filtration of run-off. Any diesel or fuel oils stored on main wind farm site will be bunded.

For access tracks and turbine foundations it is proposed that they are left in place and covered with local topsoil and re-vegetated. Removal of this infrastructure would result in considerable disruption to the local environment in terms of an increased possibility of sedimentation. It is considered that leaving the turbine foundations hardstanding areas in-situ will cause less environmental damage than removing them.

Grid connection cables will be left in the ground, therefore no potential impacts to aquatic ecology during the decommissioning stage are likely to occur.

The temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site and removed using standard HGVs.

No decommissioning activities are envisaged for the Biodiversity Enhancement and Management Plan lands.

Potential decommissioning phase impacts on aquatic ecology are considered **slight negative, short-term and in the local context**, in the absence of mitigation.

Potential impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) are considered **not significant negative, short-term and in context of the European site**, in the absence of mitigation.

8B.5.5 Potential cumulative impacts

There is the potential for cumulative impacts to occur to aquatic ecological receptors during the construction and operational phases of the proposed project. The potential cumulative and in-combination impacts on designated European sites arising from the proposed development is discussed in detail in the NIS which accompanies this planning application.

As part of the assessment of cumulative impacts, planning searches were undertaken using Cork County Council (CCC) online planning enquiry portals to search for existing and permitted large scale developments within 20km of the proposed Ballinagree wind farm project area. The CCC planning portal was also searched for existing and permitted small scale developments. The full list of existing and permitted projects and the methodology for determining this list are identified in Chapter 1 of the EIAR. The majority of the projects were of a scale and/or distance that they would not cause a cumulative effect in relation to Hydrology and Water quality and have been ruled out for further consideration on that basis.

Cumulative impacts from an aquatic ecology perspective can only occur if assessed developments are hydrologically linked. All developments with the potential for cumulative impact have been considered (see list in Appendix 1.2). Developments with the potential for cumulative impacts and which require a review in terms of aquatic ecology are listed below.

- Tree felling of the surrounding commercial forest
- Boggeragh Wind Farm (1)
- Boggeragh Wind Farm (2)
- Esk Wind Farm
- Carriganimmy Wind Farm
- Bawnmore Wind Farm
- Solar Farm at Knockglass & Kilberrihert, Coachford, Co. Cork
- Solar Farm at Carragraigue, Co. Cork
- Solar Farm at Berrings, Co. Cork
- Solar Farm at Cloghmacow and Currabeha, Crookstown, Co. Cork
- Battery storage compound at Caherdowney, Millstreet, Co. Cork
- Met mast – existing
- Met mast - proposed
- Extension to 110kV Substation to include Battery Storage, Crinnaloo South, Millstreet, Co. Cork
- Extension to Substation to include Battery Storage at Kilberrihert, Coachford, Co. Cork

8B.5.5.1 Tree felling of the surrounding commercial forest (ongoing)

For each stage of the project, impacts from ongoing tree felling in the vicinity of the proposed Ballinagree Wind Farm have been assessed as not significant to aquatic receptors. Tree felling will be permitted under limited felling licence(s) from the Forest Service and will be subject to the conditions of such a licence. Tree felling of the surrounding commercial forest will implement similar measures as proposed for the proposed project (see section 5.2.1.1 above). Therefore, no cumulative impact is envisaged.

8B.5.5.2 Existing and proposed renewable energy facilities and associated infrastructure

8B.5.5.2.1 Boggeragh Wind Farm (1)

The Boggeragh Wind Farm (1) is located approximately 2km north of the proposed wind farm site and is hydrologically linked to it (within the Blackwater[Munster]_SC_070 sub-catchment). The Boggeragh Wind Farm (1) is operational. Therefore, no construction-related impacts such as the release of suspended solids to surface waters are anticipated. As stated in chapter 10 of the EIAR, the increase in run-off due to the construction and operational stage of the project is 'not significant'. This will be further reduced with the drainage system within the wind farm site. The release of suspended solids and pollutants during the construction of the proposed wind farm will be mitigated by proposed mitigation measures described in Section 8B5.2 above. The cumulative impact with the existing Boggeragh Wind Farm (1) on aquatic receptors is not significant.

8B.5.5.2.2 Boggeragh Wind Farm (2)

The Boggeragh Wind Farm (2) is operational and is located approximately 1km east of the proposed wind farm site, within the Sullane_SC_020 sub-catchment and Dripsey_010 sub-basin. It is not hydrologically linked to the proposed project. Therefore, there is no potential for cumulative impacts on aquatic receptors.

8B.5.5.2.3 Esk Wind Farm

The existing Esk Wind Farm is located approximately 6km north-east of the proposed wind farm site and is hydrologically linked to it (within the Blackwater[Munster]_SC_070 sub-catchment). The Esk Wind Farm is operational. Therefore, no construction-related impacts such as the release of suspended solids to surface waters are anticipated. The release of suspended solids and pollutants during the construction of the proposed Ballinagree wind farm will be mitigated by proposed mitigation measures described in Section 5.2 above. Thus, cumulative impacts on aquatic receptors with the existing Esk wind farm is not significant.

8B.5.5.2.4 Carriganimmy Wind Farm

The Carriganimmy Wind Farm is located approximately 5km west of the proposed wind farm site and approximately 5km northwest of watercourse crossing GCR-WCC8 on the Awboy River. The Carriganimmy Wind Farm is located in the Sullane_SC_020 sub-catchment and is hydrologically linked with the proposed wind farm site via the Cusloura River and Awboy River (which connects to the River Laney). In Section 8B5.7 it is concluded that the impact of grid connection on aquatic receptors is not significant. The Carriganimmy Wind Farm is operational. Therefore, no construction-related impacts such as the release of suspended solids to surface waters are anticipated and there is no potential for cumulative impacts on aquatic receptors.

8B.5.5.2.5 Bawnmore Wind Farm

The Bawnmore Wind Farm is located approximately 5km south of the proposed wind farm site in the Sullane_SC_020 sub-catchment and is hydrologically linked to it (both wind farms share connectivity with the River Laney). The Carriganimmy Wind Farm is operational. Therefore, no construction-related impacts such as the release of suspended solids to surface waters are anticipated and there is no potential for cumulative impacts on aquatic receptors.

8B.5.5.2.6 Solar Farm at Knockglass & Kilberrihert, Coachford, Co. Cork

The proposed solar farm is located approximately 1.9 km north of the Clashavoon Sub-station. The solar farm is located in the Sullane_SC_020 sub-catchment. However, there are no mapped waterbodies draining from the solar farm and, therefore, no hydrological connectivity exists between the solar farm and the proposed Ballinagree Wind Farm and associated infrastructure (i.e. grid connection). Given this, there is no potential for cumulative impacts on aquatic receptors.

8B.5.5.2.7 Solar Farm at Carragraigue, Inchamay North and Crinnaloo South, Co. Cork

The proposed solar farm is located approximately 5km north of the proposed wind farm site within the Blackwater[Munster]_SC_050 sub-catchment. The solar farm and proposed project share hydrological connectivity with the downstream-connecting River Blackwater. As solar farms have no moving parts and installation of panels creates minimal disturbance to the ground, risk to aquatic receptors are considered not significant impacts of wind farm construction (section 8B5.2) on aquatic receptors has been assessed as not significant. Thus, the cumulative impact with the proposed solar farm on aquatic receptors is not significant.

8B.5.5.2.8 Solar Farm at Carragraigue, Inchamay North and Crinnaloo South, Co. Cork

The proposed solar farm is located approximately 5km north of the proposed wind farm site within the Blackwater[Munster]_SC_050 sub-catchment. The solar farm and proposed project share hydrological connectivity with the downstream-connecting River Blackwater. As solar farms have no moving parts and installation of panels creates minimal disturbance to the ground, risk to aquatic receptors are considered not significant. impacts of wind farm construction (section 8B5.2) on aquatic receptors has been assessed as not significant. Thus, the cumulative impact on aquatic receptors with the proposed solar farm is not significant.

8B.5.5.2.9 Solar Farms at Cloghmacow and Currabeha, Crookstown, Co. Cork (granted)

The proposed solar farms at Cloghmacow and Currabeha are located within the Lee[Cork]_SC_050 sub-catchment. approx. 11.5km and 13km south of the nearest infrastructure associated with the proposed Ballinagree Wind Farm (i.e. Clashavoon sub-station). There is no hydrological connectivity between these solar farms and the proposed project (i.e. located in separate sub-catchments). Therefore, there is not potential for cumulative impacts to aquatic receptors.

8B.5.5.2.10 Solar Farm at Berrings, Co. Cork (granted)

The proposed solar farm at Berrings is located within the Lee[Cork]_SC_040 sub-catchment. approx. 14km east of the nearest infrastructure associated with the proposed Ballinagree Wind Farm (i.e. Clashavoon sub-station). There is no hydrological connectivity between these solar farms and the proposed project (i.e. located in separate sub-catchments). Therefore, there is not potential for cumulative impacts to aquatic receptors.

8B.5.5.2.11 Battery storage compound at Caherdowney, Millstreet, Co. Cork

Construction of a battery storage compound (including 2 no. battery storage buildings with associated plant and equipment, an ancillary 110kV electricity substation with 2 no. control buildings, associated electrical plant & equipment and fencing, underground electricity cabling, surface water drainage, site entrance and access track, security fencing and all ancillary site works) is proposed at Caherdowney, approx. 9km west of the wind farm site, within the Foherish_SC_010 sub-catchment. There is no hydrological connectivity between these solar farms and the proposed project (i.e. located in separate sub-catchments). Therefore, there is not potential for cumulative impacts to aquatic receptors.

8B.5.5.3 Met masts

8B.5.5.3.1 Met Mast – Existing

There is an existing Met Mast approximately 50m east of the proposed turbine T6, located within an area with proposed coniferous felling and access track construction. The impact of an existing met mast on aquatic receptors (e.g. water quality) is not significant. As stated in Section 10.4.2 of chapter 10 of the EIAR, the increase in run-off due to the construction and operational stage of the proposed project is not significant. The release of suspended solids and pollutants during the construction of the proposed Ballinagree wind farm will be mitigated by proposed mitigation measures described in Section 8B5.2 above. Thus, the cumulative impact on aquatic receptors with the existing met mast is not significant.

8B.5.5.3.2 Met Mast – proposed (granted)

There is a meteorological met mast proposed at Carrigagulla within the proposed project boundary, approximately 200m east of the proposed turbine T17. The site overlaps with proposed access track construction and associated felling for the proposed project, in addition to ongoing commercial forestry activities. The met mast is located c.0.5km north (up-slope) from the nearest watercourse (an unnamed River Laney tributary). Whilst the construction of the met mast will require concrete pouring for foundations (which will be constructed in line with the plans and mitigation/particulars submitted with that planning application), hydrological and geographical separation would further reduce the risk of direct over-land flow to this watercourse. Impacts to aquatic receptors during the construction of the proposed Ballinagree wind farm will be mitigated by proposed mitigation measures described in Section 8B5.2.1.4 above. Thus, the cumulative impact on aquatic receptors with the proposed met mast construction is not significant.

8B.5.5.4 Sub-station extensions

8B.5.5.4.1 Extension to 110kV Substation to include Battery Storage, Crinnaloo South, Millstreet, Co. Cork

The proposed sub-station extension at Crinnaloo South is located approximately 1km north of the proposed wind farm site. The extension to 110kV sub-station to include battery storage has been completed.

Therefore, no impacts to aquatic receptors (e.g. release of suspended solids or pollutants to surface waters) is anticipated. The impacts of wind farm construction (section 8B5.2) on aquatic receptors has been assessed as not significant. Thus, the cumulative impact on aquatic receptors with the proposed sub-station extension is not significant.

8B.5.5.4.2 Extension to Substation to include Battery Storage at Kilberrihert, Coachford, Co. Cork

There is an extension to existing sub-station (including battery storage) proposed at Kilberrihert as part of Bawnmore Wind Farm (c.3.5km north of wind farm site and 1.7km north of Clashavoon sub-station). This development and the proposed Ballinagree wind farm project are both situated within the Sullane_SC_020 sub-catchment. Whilst there is shared hydrological linkage (both developments located upstream of the River Laney), the sub-station at Kilberrihert has its own drainage network to manage the surface run-off (as does Ballinagree Wind Farm). Furthermore, the impacts of sub-station construction and wind farm construction (section 8B5.2) on aquatic receptors has been assessed as not significant. Thus, the cumulative impact on aquatic receptors with the proposed sub-station extension is not significant.

8B.6. MITIGATION MEASURES

8B.6.1 Construction phase mitigation (aquatic ecology)

Construction phase mitigation for hydrology and water quality should follow that outlined in section 10.7 of Chapter 10 of the EIAR, and the mitigation measures outlined should be adhered to in conjunction with those outlined in this section. Construction phase mitigation measures for aquatic ecology predominantly involve the preservation of water quality.

All measures for the protection of water quality within the proposed development site, as detailed in the CEMP, will also protect the aquatic ecology and fisheries value of downstream watercourses. The measures adopted within the CEMP (including recommendations from Inland Fisheries Ireland) will ensure effective protection of aquatic ecological interests downstream of the proposed project, particularly the habitats supporting sensitive aquatic species and with hydrological connectivity to the Blackwater River SAC (002170).

8B.6.1.1 Potential impacts within the wind farm site

8B.6.1.1.1 Mitigation measures for tree felling

Tree felling will be required at 14 of the 20 no. proposed turbine locations to facilitate hardstand construction and access (i.e. T1, T3, T4, T6, T7, T9, T11, T12, T14, T15, T16, T18, T19 & T20). Furthermore, felling will be required to facilitate access track construction and or improve existing access (i.e. track widening) to turbines T1, T2, T3, T4, T5, T6, T7, T9, T10, T11, T12, T14, T15, T16, T17, T18, T19 &T20 (see **Figure 8B.5.1).** Tree felling will also be undertaken along or adjacent to the Nadanuller Beg River and unnamed tributaries, Horsemount Mountain Stream, Glen River, Donoure Middle Stream and an unnamed tributary of the River Laney as part of the BEMP (**Figure 8B.5.1**).

It is estimated that 68.7ha in total of existing forestry will be felled to allowed for development of the proposed wind farm infrastructure (e.g. turbine base, met mast and sub-station construction, borrow pit excavation and associated access tracks). Tree felling will be undertaken prior to the construction of site access tracks and hard stand areas. An additional 27ha of coniferous felling will be undertaken for the BEMP.

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zone (DAFM, 2015). In light of the site topography (gradient) and vicinity of proposed felling areas, this would be particularly important adjacent to the Glen River (felling area for turbine T20 approx. 30m west from watercourse), as well as adjacent to the River Laney and Nadanuller Beg Stream. Given the close proximity of felling areas to receiving watercourses and potential source-receptor pathways (i.e. drainage channels), a machinery exclusion zone of 10m will apply. Check dams/silt fences will be required within the on-site drainage channels which provide potential surface water pathways to receiving watercourses. Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.

To ensure tree clearance methodology that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- DAFM (2015). Forestry Standards manual

Additional mitigation measures for the protection of aquatic ecology and receptors during felling activities will follow those outlined in section 10.7 of chapter 10 of the EIAR (e.g. minimum buffer zone widths along watercourses, keyhole felling of trees for access track construction).

Given the sensitivity of aquatic ecological receptors in the River Laney, Nadanuller Beg Stream and Glen River and downstream-connecting Blackwater River SAC (002170) (e.g. salmonids, otter, freshwater pearl mussel, Annex I floating river vegetation), machine operations must not take place in the 48hour period before predicated heavy rainfall, during heavy rainfall or in the 48hour period following heavy rainfall (DAFM, 2018). Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of drainage channels will reduce nutrient seepage immediately post-felling and in the proceeding years after felling has occurred (DAFM, 2019).

Additional mitigation is proposed for felling within BEMP lands. This includes the following;

1. Fell and extract existing conifer crop with tracked machinery in Year 1.
2. Mulch any remaining brash using a low ground-pressure excavator in Year 1.
3. Block furrow drains in Year 1, inserting peat dams at intervals of 10 metres. Dams may be spaced further apart in flatter areas.
4. During year 3 check to see if any natural regeneration of conifers is occurring in the area and manually clear any regeneration of exotics if present.
5. During Year 6 check to see if any natural regeneration of conifers is occurring in the area and manually clear any regeneration of exotics if present.

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from tree felling are considered **likely not significant negative, short-term and in the local context**.

Potential impacts to aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170) (including freshwater pearl mussel) are considered **likely not significant negative and short-term in context of the European site,** in the presence of mitigation.

8B.6.1.1.2 Mitigation measures for on-site excavations

Whilst smaller-scale temporary dewatering may occur at some excavations (i.e. turbine bases, borrow pits) the risk of sediment escapement to surface waters (e.g. Glen River, Nadanuller Beg Stream, River Laney and associated tributaries) is reduced given the small-scale and localised nature of these dewatering events, in addition to considerable geographic separation (≥50m) and limited potential surface water pathways on site. Mitigation measures to address these potential impacts (e.g. avoidance of working during rainfall, ≥50m set-back/buffer zones, interceptor drains, silt fences etc.) are outlined in detail in sections 10.6 and 10.7.1 of chapter 10 of the EIAR and the CEMP. Soil management is also addressed in chapter 9 of the EIAR and soil management in the CEMP. Excavated spoil will be used to reinstate borrow pits and no stockpiling areas are required on site. Topsoil will be stored local to excavations and used for reinstatement and landscaping.

The mitigation measures for cable trench excavation and associated spoil are considered in section 6.1.6 below. In the presence of mitigation measures to protect water quality, potential impacts to aquatic ecology resulting from excavations are considered **likely not significant negative, short-term and in the local context**.

Potential impacts to aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170) (including freshwater pearl mussel) as a result of on-site excavations are considered **likely not significant negative and short-term in context of the European site,** in the presence of mitigation.

8B.6.1.1.3 Mitigation measures for access track construction

It is proposed to construct approximately 13.7 km of completely new access track to facilitate site access and construction activities and to widen approximately 11.8 km of existing tracks by approximately 1m, with some additional widening at bends. All track widening will be undertaken using clean uncrushable stone with a minimum of fines, to reduce the risk of suspended solid releases to receiving watercourses.

The proposed new crossing over the River Laney (WF-HF4) to facilitate access track construction will be via a single span bridge. The single span bridge and 2.5m set back from the banks will avoid the requirement for instream works. N

Mitigation measures to protect site hydrology and water quality during access track works will be undertaken as detailed in chapter 10 of the EIAR. These include measures to reduce or prevent surface water run-off, suspended solids, hydrocarbons, site wastewater, cement and nutrients escaping to receiving surface waters (i.e. settlement ponds, silt traps, interceptor drains etc.). The mitigation measures proposed will reduce potential direct and indirect impacts from the construction of access tracks. The risk of water quality impacts to receiving watercourses, including at 6 no. riverine watercourse crossings, via siltation or nutrient release will be further reduced through siltation management as detailed in the Chapter 10 of the EIAR.

The 9 no. surface water drains within the site boundary to be crossed during the construction phase will be via precast box culverts (refer to section 10.6.4 of chapter 10 of the EIAR). Forestry drains will be crossed using 450mm diameter pipes. Where cross drains are to be provided to convey the drainage across the track, the minimum sizes of these cross drains are 300mm diameter pipes. Silt Protection Controls (SPCs) are proposed at the location of the drain crossings. It is recommended that the SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse.

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from access track construction are considered **likely not significant negative, short-term and in the local context**.

Potential impacts to aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170) (including freshwater pearl mussel) are considered **likely not significant negative and short-term in the context of the European site,** in the presence of mitigation.

8B.6.1.1.4 Mitigation measures during turbine and met mast construction

Whilst all 20 no. turbines are located up-gradient of receiving watercourses, the greatest threat to aquatic ecology from turbine base (hard stand) construction (based on site topography and the layout of surface water features) was identified at those turbines in closer proximity to watercourses, i.e. T1, T2, T5, T9, T11 & T20) (see **Table 8B.5.1** for distances). The risk was particularly high at the turbine T20 hard stand area which is located in a coniferous plantation c.110m from the headwaters of the Glen River, a watercourse that supports salmonids, European eel, Annex I 'floating river vegetation' and shares downstream connectivity with the Blackwater River SAC (002170).

Given that the proposed met mast PMM1 and PPM2 is located >900m from the Ballynagree East Stream and >300m from an unnamed tributary of the Carrigagulla Stream, respectively, no impacts to aquatic ecology are anticipated, in the presence of mitigation.

Please refer to sections 10.6 and 10.7.1 of Chapter 10 of the EIAR for detailed mitigation measures for site drainage and silt attenuation to prevent impacts to the water quality of downstream watercourses during the construction phase. These include measures to prevent run-off erosion from vulnerable areas and consequent sediment release into nearby watercourses to which the proposed development site discharges. The mitigation measures proposed will reduce potential direct and indirect impacts from the construction of the turbine foundations/hardstands. The risk of water quality impacts to receiving watercourses via siltation or nutrient release will be further reduced through siltation management as detailed in the CEMP.

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from turbine base and met mast construction are considered **likely not significant negative, short-term and in the local context**.

Potential impacts to aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170) (including freshwater pearl mussel) are considered **likely not significant negative and short-term in the context of the European site,** in the presence of mitigation.

8B.6.1.1.5 Mitigation measures for site drainage

As outlined in section 8B.5.2.5, it is noted that there is typically poor hydrological connectivity and considerable geographic separation between the proposed construction areas and the riverine watercourses draining the site (e.g. frequent coniferous plantation buffers present etc.), so the risk of silt-laden surface water run-off to receiving watercourses is much reduced, even in the absence of mitigation.

Please refer to section 10.6 of Chapter 10 of the EIAR and the CEMP for detailed mitigation measures for site drainage and silt attenuation to prevent impacts to the water quality of downstream watercourses during the construction phase.

In the presence of mitigation to protect water quality, potential impacts to aquatic ecology resulting from alterations to and or inadequate site drainage management are considered **likely not significant negative, short-term and in the local context**.

Potential impacts to aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170) (including freshwater pearl mussel) are considered **likely not significant negative and short-term in in context of the European site,** in the presence of mitigation.

8B.6.1.2 Mitigation measures for grid connection installation (trenching & HDD)

The Rahalisk Stream (GCR-WCC15), Clonavrick Stream (GCR-WCC6), Caherbaroul Stream (GCR-WCC5), Coolaniddane River (GCR-WCC4) and Kilberrihert Stream (GCR-WCC3) will be crossed via trenching (5 no. locations). A further 5 no. grid connection crossings are over on-site drainage channels. The cable ducts will be placed in the verge or carriageway of the public road network, whilst along internal site tracks, the cable ducts will be installed above proposed pre-cast concrete box culverts. Excavation of the grid route trench will require excavation of soils/subsoils which has the potential to impact the water quality and aquatic habitat of receiving watercourses. Excavated spoil emanating from the cut trenches, where appropriate (i.e. when trenching within private tracks or the public road verge) will be used to back-fill the trenches. Any excess will be disposed of off-site, at an appropriate licenced facility.

All excavated material emanating from trenches within the public road network will be disposed at an appropriate licenced facility. Mitigation measures to prevent the escapement of suspended solids to receiving watercourses (e.g. silt fences, interceptor drains, settlement ponds, drain blocking etc.) are outlined in section 10.7 of chapter 10 and the CEMP.

The River Laney (GCR-WCC7), Awboy River (GCR-WCC8), Carrigthomas Stream (GCR-WCC9) and an unnamed Carrigthomas Stream tributary (GCR-WCCC19) will be crossed via horizontal directional drilling (HDD). These watercourses do not share hydrological connectivity with a European site. Mitigation measures relating to water quality preservation are outlined in detail in section 10.7 of chapter 10 of the EIAR. These measures will also serve to protect sensitive aquatic ecological receptors. Although no-instream works are proposed, the drilling works will only be completed during a dry period between July and September (as required by Inland Fisheries Ireland for in-stream works) to avoid the salmonid spawning season and sensitive life stage period. A pre-construction otter survey should be undertaken in the vicinity of the 4 no. drilling locations to ensure than no breeding or resting areas are located within 150m of the drilling locations. Should an otter breeding (holt) or resting area (couch) be detected, a derogation licence will be obtained from the NPWS to facilitate drilling works. At GCR-WCC7, GCR-WCC8, GCR-WCC9 and GCR-WCCC19, silt curtains and floating booms will also be used where deemed to be appropriate, in consultation with IFI.

An Ecological Clerk of Works (ECoW) will monitor both turbidity and observe the riverbed during the drilling process to detect any leakage (frac-out) of drilling fluid. Should this leakage be observed, works will cease immediately.

Further mitigation measures in relation to the grid connection (including the spread of invasive species) are outlined in the CEMP.

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from grid connection installation are considered **likely not significant negative, short-term and in the local context**.

Given the absence of crossings over watercourses with downstream hydrological connectivity to the Blackwater River SAC (002170), there are no predicted potential impacts (significant or otherwise) to the site's aquatic qualifying interests.

8B.6.1.3 Mitigation measures for turbine delivery route

With regards the TDR, works with potential to cause significant impacts to watercourse crossings are only proposed at a single location, namely crossing WF-HF8 located on an unnamed River Laney tributary in the northern portion of the wind farm site (aquatic survey site N3). To reduce the requirement for instream works, the existing bridge will be replaced with a 6m-single span bridge. Cable ducts associated with the wind farm internal collector circuit will be built into the bridge deck, which will be pre-fabricated off site. The installation of a new single span bridge will incorporate a fish-passable culvert, which will greatly improve fish passage opportunities on the watercourse. Mitigation to protect aquatic sensitivities, including migratory fish and water quality, are as outlined above in section 8B.6.1.1 and 8B.6.1.2 (e.g. undertake instream works between July and September as per IFI guidance, de-water site and translocate fish via electro-fishing prior to works etc.).

As outlined in section 8B.5.2.3, the most significant temporary TDR works from an aquatic ecological perspective will be required at POI-36 (temporary hardstanding area) and POI-44 (ground reprofiling and placement of load bearing surface). In addition to general mitigation measures to protect water quality, additional mitigation measures for these two locations are outlined in section 10.7.3 of Chapter 10 of the EIAR. Combined, these measures will protect sensitive aquatic ecological receptors and qualifying interests of the adjacent/downstream-connecting Blackwater River SAC (002137).

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from turbine delivery are considered **likely not significant negative, short-term and in the local context**.

Potential impacts to aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170) (including freshwater pearl mussel) are considered **likely not significant negative and short-term in in context of the European site,** in the presence of mitigation.

8B.6.1.4 Mitigation measures for BEMP

The mitigation applied to the BEMP lands will be specific to felling during provision of the wildlife corridors. The mitigation would be as prescribed under felling in section 8B.6.1.1.1 above.

8B.6.2 Operational phase mitigation

8B.6.2.1 Mitigation measures within the site

The overall estimated increase in the peak run-off the due to construction of all new hardstanding areas, on-site substation, new roads and the widening of the existing tracks is 0.483m^3/s (or 0.16%) for a 1-in-100 years storm event (Chapter 10 of the EIAR, section 10.4.2). In light of this slight increase, potential impacts to receiving watercourses are considered unlikely, even pre-mitigation. Nonetheless, mitigation measures (including interceptor drains and check dams installed with the swales) will be implemented to reduce this risk even further. Mitigation for the maintenance regime respective of hydrology and water quality is outlined in section 10.7.4 of chapter 10 of the EIAR. These measures will also serve to protect sensitive aquatic receptors.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there will be a further reduction in the risk of sediment release to the watercourses during the operational stage.

In the presence of mitigation, potential operational phase impacts on aquatic ecology are considered **likely not significant negative, short-term and in the local context**.

Given the downstream-connectivity from the wind farm site and associated infrastructure (grid connection, sub-stations, access tracks etc.), potential impacts to aquatic qualifying interests of the Blackwater River SAC (002170) are considered **likely not significant negative, short-term and in context of the European site**, in the presence of mitigation.

8B.6.2.2 Mitigation measures for BEMP

During the operational phase of the BEMP lands, no specific mitigation will be required. The proposed measures will be in alignment with the existing land use practices, .e. grazing regimes, livestock fencing maintenance etc. However, the intensity and nature of the land management will be improved to benefit biodiversity. The measures will also include areas dedicated solely to biodiversity, such as the creation of wildlife corridors and the planting of broadleaf woodland. Specifically, the reduction in areas of coniferous afforestation, the fencing of watercourses (from livestock) and the improvement of herbicide and nutrient application regimes will further benefit water quality of adjoining watercourses. As such, potential operational phase impacts on aquatic ecology are considered **likely medium to long-term positive, in the local context**.

8B.6.3 Decommissioning phase mitigation

In relation to aquatic ecology, similar mitigation measures will apply for the decommissioning phase as for the construction phase. In the event of decommissioning of the Ballinagree wind farm, the access tracks will be used in the decommissioning process. Mitigation measures applied during decommissioning activities will be similar to those applied during construction but will be of reduced magnitude.

It is proposed that turbine foundations and hardstand areas should be left in place and covered with local soil/topsoil to revegetate at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. The grid connection ducting and substation will be left in situ as part of the national grid, therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required.

The temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site and removed using standard HGVs.
No decommissioning activities are envisaged for the Biodiversity Enhancement and Management Plan lands .

In the presence of mitigation, potential decommissioning phase impacts on aquatic ecology are considered **likely not significant negative, short-term and in the local context**, in the presence of mitigation.

Potential impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) are considered **likely not significant negative, short-term and in context of the European site**, in the presence of mitigation.

8B.7. RESIDUAL IMPACTS

The layout and design of the proposed project has taken the aquatic ecology of the existing environment into consideration. The limitation of indirect impacts arising from water quality pollution events such as siltation and run-off of suspended solids will significantly reduce the potential for impacts affecting aquatic ecological interests within the vicinity of the proposed project. Provided all mitigation measures are implemented in full, no significant residual impacts on the local aquatic ecology or integrity of the Blackwater River SAC (002170) are expected from the project.

Overall, the proposed project will have a **significant negative, short-term impact** on sensitive aquatic receptors in the local scale context during the construction phase, in the absence of mitigation (**Table 8B.5.1**). Potential impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) are (depending on the activity assessed) considered **moderate negative to significant negative, short-term and in context of the European site**, in the absence of mitigation. The grid connection is not predicted to have any impacts, even pre-mitigation, on the qualifying interests of the Blackwater River SAC (002170) given the lack of hydrological connectivity. For freshwater pearl mussel in the Blackwater River SAC (002170), other potential impacts would be elevated to **significant negative, permanent and at the scale of the European site**, in the absence of mitigation. Pre-mitigation impacts are summarised in **Table 8B.5.1**.

However, through the implementation of the mitigation measures outlined in section 6 above and accompanying section 10.7 of chapter 10 of the EIAR, residual impacts to water-dependent species and habitats are considered to be **non-significant, short-term and in the local context** (i.e. sub-catchment scale). Residual impacts to the aquatic qualifying interests (including freshwater pearl mussel) of the Blackwater River SAC (002170) are considered to be **not significant negative, short-term and in context of the European site.**

The residual impacts on aquatic ecology resulting from Ballinagree wind farm project are summarised in **Table 8B.7.1** below, using the impact assessment criteria outlined in Section 8B.2.1.

Table 8B.7-1: Summary of residual impacts to aquatic ecological receptors *(post-mitigation)*

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential residual impact significance
Tree felling (wind farm site)	**River Laney** Felling required for access track crossings at WF-HF6 and WF-HF4; turbine T11 felling area c.140m up-gradient of river **Nadanuller Beg Stream** (c.180m from T18 access track over land and & via unnamed tributary, 6.9km hydrological distance from Blackwater River SAC) **Glen River** (c.30m from turbine T20 over land, 5.9km hydrological distance from Blackwater River SAC)	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species*:* **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) including FWPM: **likely not significant negative, short-term and in context of the European site**
Tree felling (BEMP)	**Wildlife corridor (northern)** Borders Nadanuller Beg Stream & Horsemount Mountain Stream **Wildlife corridor (north-eastern)** Glen River located 50m north-west	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species*:* **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) including FWPM:

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential residual impact significance
				likely not significant negative, short-term and in context of the European site
On-site excavations	**Glen River** (c.110m over land from T20 hard stand) **River Laney** (c.70m over land from sub-station) **Unnamed Laney tributary** (c.100m over land from site compound)	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) including FWPM: **likely not significant negative, short-term and in context of the European site**
Access track construction	**River Laney** (access track crossings at WF-HF4 (single span bridge) and WF-HF6 (pre-cast box culvert) **Unnamed Laney tributary** (access track crossings at WF-HF9 (pre-cast box culvert)) **West Ballynagree Stream** (access track crossings at WF-HF5 (pre-cast box culvert)) **Glen River**	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) including FWPM: **likely not significant negative, short-term and in context of the European site**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential residual impact significance
	(c.170m from nearest access track construction at T20) **9 no. drainage channels** (crossed by access tracks – see section 10.4.6 of chapter 10)			
Turbine base and met mast construction	<u>Turbine bases:</u> **Glen River** (c.110m over land from T20 hard stand, 5.9km from Blackwater River SAC) **West Ballynagree Stream** (c.130m over land south of T1 hard stand) **Knocknagappul Stream** (c.160m over land north-east of T2 hard stand) **Ballynagree East Stream** (c.140m over land south-east of T5 hard stand) **River Laney** (c.200m over land north of T9 hard stand, c.150m west of T11 hard stand) <u>Met masts:</u>	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) including FWPM: **likely not significant negative, short-term and in context of the European site**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential residual impact significance
	Ballynagree East Stream (c.900m from met mast, downstream connectivity to River Laney) **Unnamed Carrigagulla stream tributary** (c.330m north-east of PMM2, downstream connectivity to River Laney			
Site drainage (incl. crossing/culverting of drainage channels)	**River Laney** (c.65m over land north of on-site sub-station; various source-receptor pathways via drainage channels) **Unnamed Laney tributary** (c.350m east of construction compound) **Unnamed Laney tributary** (c.260m north of construction compound)	Salmonids (Atlantic salmon & brown trout), European eel, otter, Annex I 'floating river vegetation' habitat [3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) including FWPM: **likely not significant negative, short-term and in context of the European site**
Grid connection	**Crossed by trenching:** Rahalisk Stream (GCR-WCC15), Clonavrick Stream (GCR-WCCC6), Caherbaroul Stream (GCR-WCCC5), Coolaniddane River (GCR-WCCC4) and Kilberrihert Stream (GCR-WCCC3)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp. (Carrigthomas Stream), kingfisher (Awboy River), otter, Annex I 'floating river vegetation' habitat	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, invertebrates & water quality; spread of invasive species along watercourses	All downstream aquatic habitats & species: **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential residual impact significance
	Crossed by HDD: Carrigthomas Stream (GCR-WCCC9), Awboy River (GCR-WCCC8), River Laney (GCR-WCCC7), unnamed Carrigthomas Stream tributary (CGR-WCC19) **5 no. drainage channels** (crossed by grid connection via trenching – see section 10.6.4 and Table 10-12 of chapter 10)	[3260]; Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)		Blackwater River SAC (002170) including FWPM: **likely not significant negative, short-term and in context of the European site**
Turbine delivery route (TDR)	**Owenbaun River** (c.30m over land from POI-44 works area, 0.1km over-land plus instream distance from Blackwater River SAC) **Coomlogane River** (c.400m over land from POI-36 works area, 2.7km over-land plus instream distance from Blackwater River SAC)	Blackwater River SAC aquatic qualifying interests (including freshwater pearl mussel)	Release of contaminants (water quality impacts); spread of invasive species along watercourses	All downstream aquatic habitats & species: **likely not significant negative, short-term and in the local context** All downstream aquatic qualifying interests of Blackwater River SAC (002170) including FWPM: **likely not significant negative, short-term and in context of the European site**
BEMP (excl. felling)	**Kelleher's lands** Overlaps River Laney, Knocknagappul Stream & West Ballynagree Stream	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., otter, Annex I 'floating	No negative impacts, rather positive impacts predicted based on livestock-proof fencing, improved grassland management etc.	All downstream aquatic habitats & species: **Likely medium to long-term positive and in the local context**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential residual impact significance
	Scannal's lands Adjoins Glashagarriff River **Barrett's lands** Adjoins unnamed Delehinagh River tributary **Kelleher's lands** Overlaps River Laney, Knocknagappul Stream & West Ballynagree Stream	river vegetation' habitat [3260]		

8B.8. REFERENCES

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