Planning and Environmental Consultants

Aquatic Baseline Report

Carrow Wind Farm

DOCUMENT DETAILS

Client:	**Carrow Renewable Energy Ltd.**
Project Title:	**Carrow Wind Farm**
Project Number:	**231102**
Document Title:	**Carrow Wind Farm Aquatic Baseline Report**
Document File Name:	**Carrow Wind Farm ABR – F– 2026.02.26–231102**
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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	05/01/2026	NR	AvdGM
02	Final	26/02/2026	NR	AvdGM

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1. INTRODUCTION

1.1 Background

MKO has been appointed to conduct an Aquatic Baseline Survey and subsequent Aquatic Baseline Report for the area within and in the vicinity of the proposed Carrow Wind Farm Development (henceforth referred to as 'Proposed Project').

Desk studies and Aquatic Baseline Surveys were undertaken in July and September 2024. This report provides a baseline assessment of the aquatic ecology within aquatic condition of the lands within and in the vicinity of the Proposed Project and acts as an aquatic baseline record to which future records and monitoring can be compared.

1.2 Statement of Authority

Aquatic Baseline Surveys were undertaken by Aran von der Geest Moroney (B.Sc.) and Niamh Rowan (B.Sc.) of MKO on the 10th - 12th and 17th July 2024, 7th – 10th October 2024 by Niamh Rowan and Kieran Sugrue (B.Sc.) and 23rd October 2025 by Niamh Rowan and Matthew Kieran (B.Sc).

This report has been prepared by Niamh Rowan and has been reviewed by Aran von der Geest Moroney. Aran von der Geest Moroney is a Senior Ecologist with over four years' experience in professional ecological consultancy. Aran and Niamh have undertaken ecological surveying and reporting for a wide range of projects.

1.3 Survey Locations

The aquatic baseline surveys for the Proposed Project took place in the vicinity of Carrowkeale, Carrow, Scarrough, Moheragh, and Glenpaudeen, Co. Tipperary. Proposed Wind Farm survey locations are shown in Figure 1-1; Proposed Grid Connection survey locations are shown in Figure 1-2.

Agricultural grassland and conifer plantation dominates the landscape surrounding the survey locations, as well as several existing active wind farm developments. Aquatic baseline surveys were undertaken both within the vicinity of the Proposed Wind Farm and along the Proposed Grid Connection, covering both low order, upper reach streams and downstream, wider, higher order rivers. Nomenclature for surveyed watercourses follows that of the Environmental Protection Agency (EPA) (Table 1.1, Figure 1-1, Figure 1-2).

The Proposed Wind Farm study area comprised 16 survey sites located across two hydrological sub catchments within the vicinity of the Proposed Wind Farm, as shown in Figure 1-1. Four survey sites were located within the Multeen [East]_SC_010 sub catchment (Sub catchment ID: 16_4), with the remaining 12 survey sites located within the Suir_SC_060 sub catchment (Sub catchment ID: 16_18). Within the Multeen [East]_SC_010 sub catchment, surveys were conducted on the Multeen_010 and Multeen_020. Within the Suir_SC_060 sub catchment, surveys were conducted on the Aughnaglanny_010.

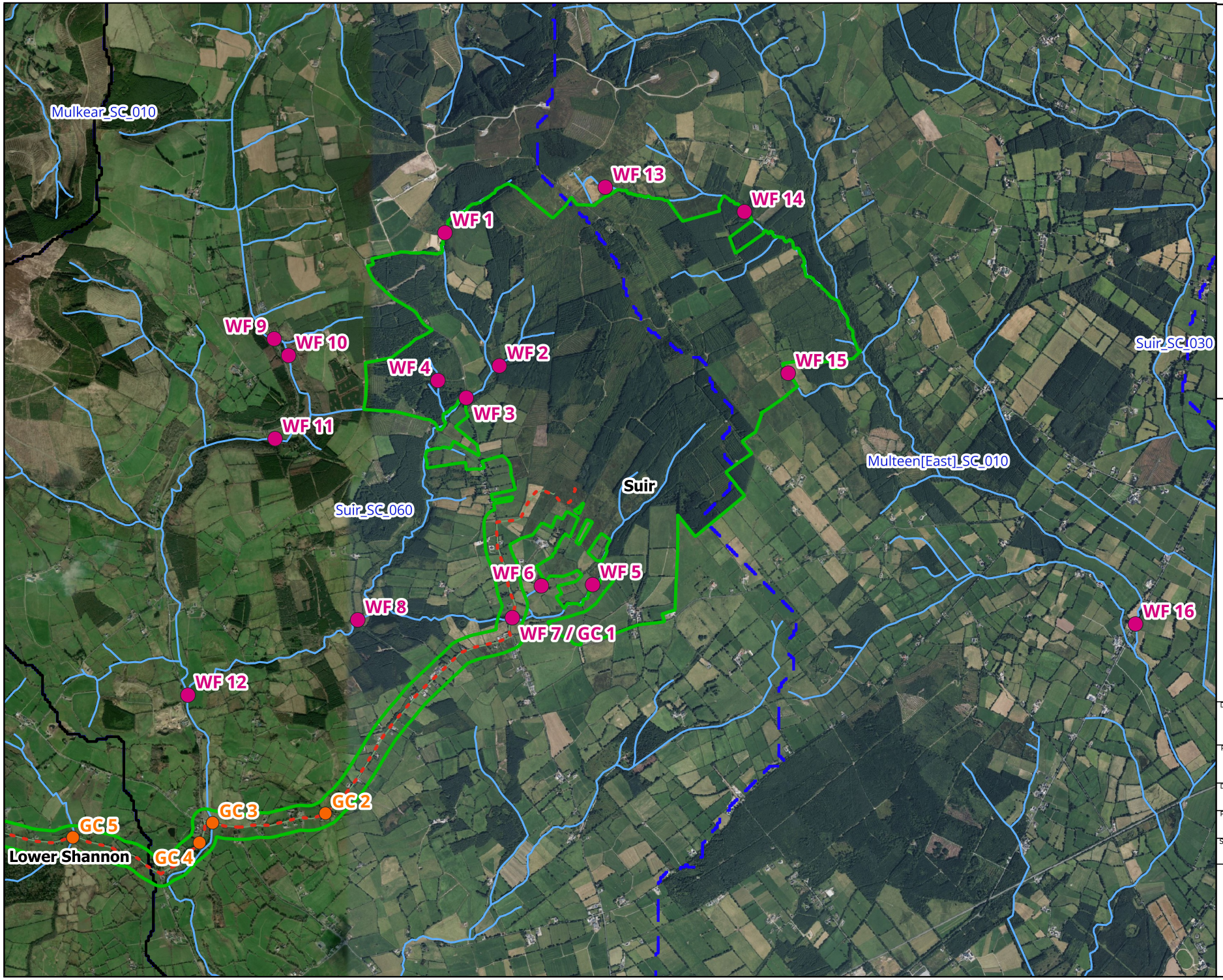
The Proposed Grid Connection Route consisted of 35 no. watercourse crossings and was surveyed as part of Aquatic Baseline surveys, as shown in Figure 1-2. The Proposed Grid Connection was located across two hydrological catchments (Suir and Lower Shannon) and six hydrological sub-catchments (Suir_SC_060, Dead_SC_010, Mulkear_SC_010, Mulkear_SC_020, Bilboa_SC_010 and the Shannon [Lower]_SC_090.

Aquatic surveys of the Turbine Delivery Route (TDR) were not conducted as no alterations to any existing watercourses or watercourse crossings along the TDR are proposed as part of works.

Table 1-1. Location of survey sites within the vicinity of the Proposed Wind Farm and Proposed Grid Connection.

Survey Site no.	Watercourse	EPA name	EPA code	X (ITM)	Y (ITM)
Survey sites within the vicinity of the Proposed Wind Far					
WF 1	Multeen_020	Lackenacoombe 16	16L73	593358	651634
WF 2	Multeen_020	Multeen	16M02	593782	650539
WF 3	Multeen_020	Multeen	16M02	593531	650304
WF 4	Multeen_020	Lackenacoombe 16	16L73	593301	650440
WF 5	Multeen_020	Scarrough 16	16S38	594558	648782
WF 6	Multeen_020	Scarrough 16	16S59	594137	648773
WF 7 / GC 1	Multeen_020	Scarrough 16	16S38	593903	648516
WF 8	Multeen_020	Lackenacoombe 16	16L73	592651	648494
WF 9	Multeen_010	Multeen	16M02	591970	650778
WF 10	Multeen_010	Multeen	16M02	592083	650639
WF 11	Multeen_010	Multeen	16M02	591981	649965
WF 12	Multeen_020	Multeen	16M02	591266	647867
WF 13	Aughnaglanny_010	Upper Genough	16U16	594661	652011
WF 14	Aughnaglanny_010	Upper Genough	16U16	595791	651807
WF 15	Aughnaglanny_010	Doorish 16	16D66	596146	650496
WF 16	Aughnaglanny_010	Aughnaglanny	16A05	598977	648454
Survey sites along the Proposed Grid Connection					
GC 2	Unmapped watercourse			592385	646925
GC 3	Multeen_020	Multeen	16M02	591472	646845
GC 4	Unmapped watercourse			591364	646684
GC 5	Cappawhite Stream_010	Cappawhite (Stream)	25C10	590340	646727
GC 6	Cappawhite Stream_010	Duminda	25Y16	590340	646727
GC 7	Unmapped watercourse			588498	647054
GC 8	Unmapped watercourse			588320	647123
GC 9	Unmapped watercourse			587738	647390
GC 10	Toem Stream_010	Toem Stream	25T05	586670	647544
GC 11	Toem Stream_010	Moher West 25	25M61	586248	647868
GC 12	Unmapped watercourse			585663	648558
GC 13	Cahernahallia_020	Cahermahallia	25C01	585230	649142
GC 14	Cahernahallia_020	Lisgaugh	25Q70	584448	649719

GC 15	Unmapped watercourse			584285	649935
GC 16	Doon Stream_010	Doon River	25D03	582958	650380
GC 17	Mulkear (Limerick)_010	Bottle_Hill	25B56	582676	650524
GC 18	Unmapped watercourse			582393	650602
GC 19	Bilboa_020	Ballycoshown	25B45	579744	651109
GC 20	Bilboa_020	Ballycoshown	25B45	579333	651207
GC 21	Unmapped watercourse			579153	651241
GC 22	Bilboa_020	Bilboa	25B03	578298	651373
GC 23	Bilboa_020	Bilboa 25	25B03	577484	651518
GC 24	Bilboa_020	Dooglasha (Slieve Felim)	25D14	577228	651628
GC 25	Bilboa_020	Dromsallagh	25D34	577175	651609
GC 26	Dooglasha (Cappamore)_010	Turagh	25T17	576053	651208
GC 27	Dooglasha (Cappamore)_010	Dooglasha river	25D02	574143	650692
GC 28	Mulkear (Limerick)_020	Mulkear	25M04	572185	650799
GC 29	Mulkear (Limerick)_040	Mulkear Trib 1	25M73	570011	651763
GC 30	Mulkear (Limerick)_040	Killinure 25	25K81	570005	651776
GC 31	Mulkear (Limerick)_050	Kishyquirk	25K88	567146	653250
GC 32	Unmapped watercourse			567029	653360
GC 33	Groody_010	Keyanna	25K90	565875	653321
GC 34	Groody_010	Whitehall 25	25W08	564639	653731
GC 35	Groody_010	Groody	25G05	563545	654350



Map Legend

- Proposed Wind Farm Survey Sites
- Proposed Grid Connection Survey Sites
- EIAR Site Boundary
- Proposed Grid Connection Route
- WFD River Waterbodies
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments

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Drawing Title: Proposed Wind Farm Survey Locations

Project Title: Carrow Wind Farm

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Project No.	Drawing No.
231102	Figure 1-1
Scale	Date
1:40,000	18.02.2026

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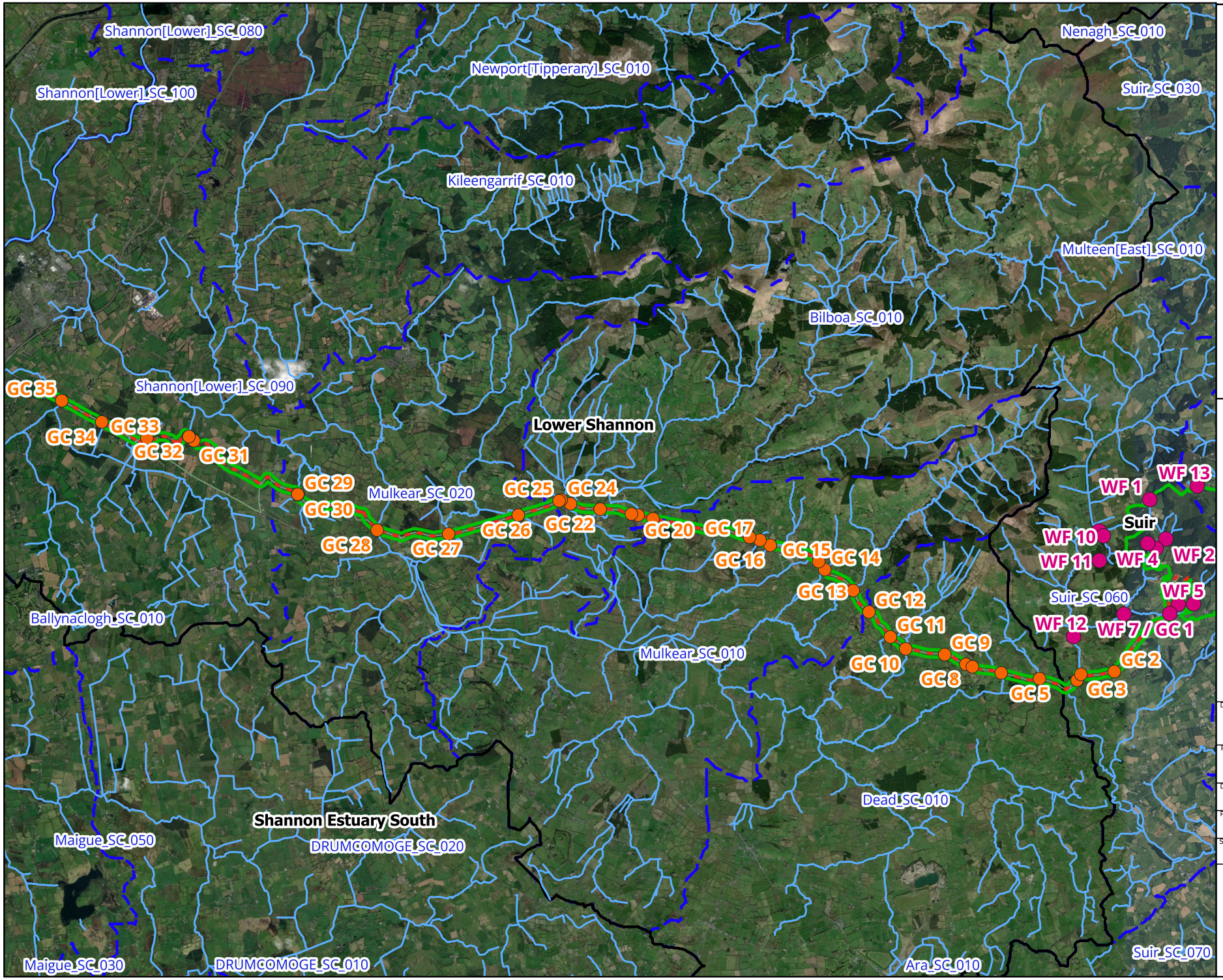

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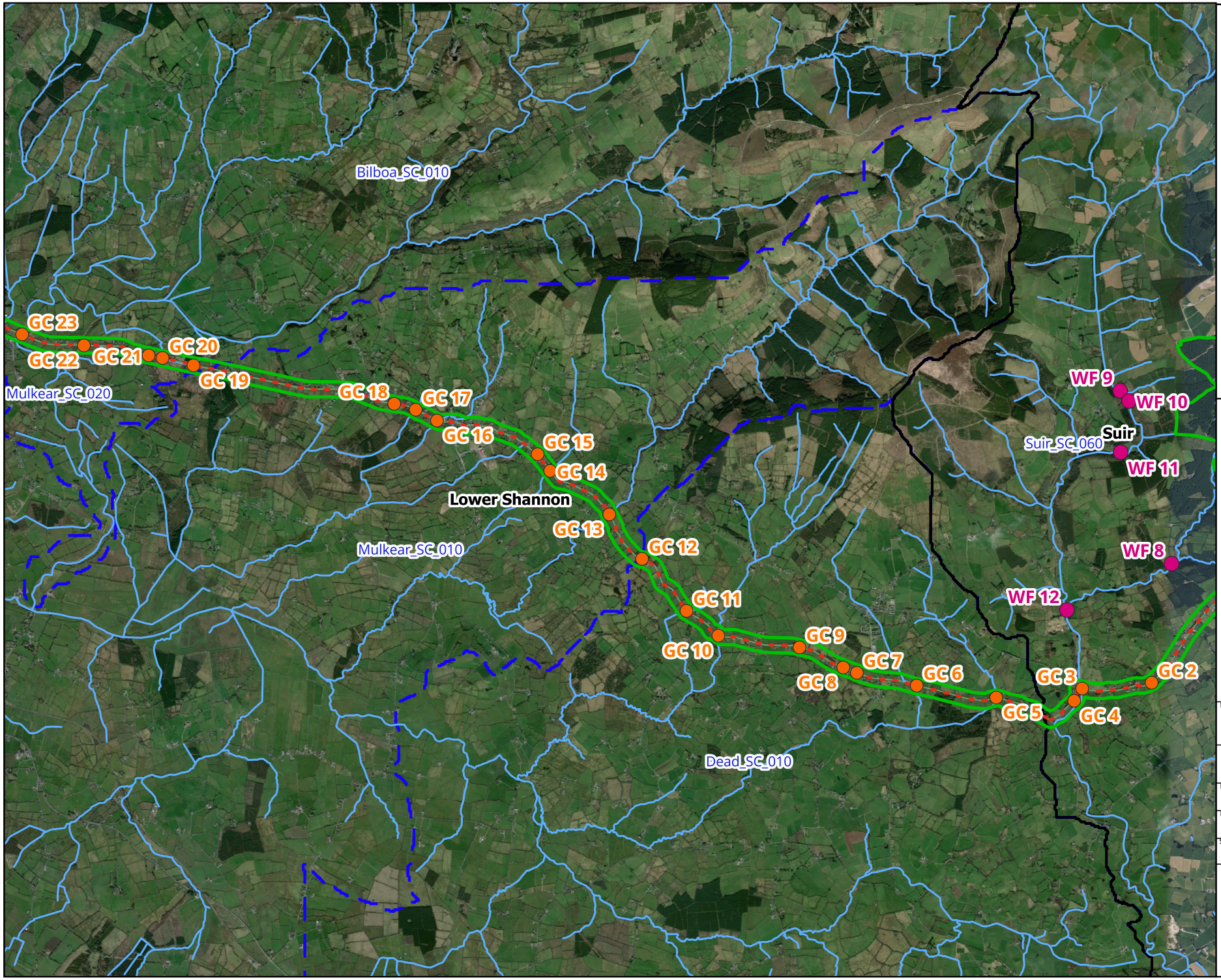

Map Legend

- Proposed Wind Farm Survey Sites
- Proposed Grid Connection Survey Sites
- EIAR Site Boundary
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Map Legend

- Proposed Grid Connection Survey Sites
- EIAR Site Boundary
- Proposed Grid Connection Route
- WFD River Waterbodies
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments

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Drawing Title
Proposed Grid Connection Survey Locations (2/2)

Project Title
Carrow Wind Farm

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2. METHODOLOGIES

2.1 Project Referencing

The 'Proposed Wind Farm study area' refers to the survey locations selected along watercourses upstream, downstream and within the Proposed Wind Farm Site, as shown in Figure 1-1. The 'Proposed Grid Connection study area' refers to the survey locations at which the Proposed Grid Connection crosses watercourses, as shown in Figure 1-2.

2.2 River Habitat Assessment

Aquatic habitat assessments/ appraisals were undertaken in order to determine the riverine habitat types present at each of the survey locations within the Proposed Wind Farm study area and along the Proposed Grid Connection. The survey design and methodologies were derived from current ecological best practice guidance documents. Habitats were classified in accordance with the national habitat classification system used in Ireland - A Guide to Habitats in Ireland (Fossitt (2000).

Riverine habitat assessments were conducted utilising elements of the following methodologies and literature to characterise the selected survey sites along watercourses:

- Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003)
- Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000).

All survey sites were assessed in terms of the following variables:

- Channel width and depth.
- Bank profiles, including Average bank height and composition.
- Substrate type, listing substrate fractions in order of dominance.
- Flow type.
- In-stream macrophyte and aquatic bryophytes occurring and the prominence of each (DAFOR scale).
- Water clarity and colouration.
- Riparian vegetation composition.

The survey was devised to gather ecological baseline information including any habitat features that could potentially support protected Qualifying Interest species associated with EU designated sites within the wider area. In addition, surveys considered the potential presence of problematic invasive alien species, with an emphasis on Invasive Alien Species (IAS) listed on the First Schedule of the European Union (Invasive Alien Species) Regulations 2024 (S.I. No. 374 of 2024) and Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). The assessments have regard to the TII guidance document - *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (GE-ENV-01105)* (Transport Infrastructure Ireland (TII, 2020)).

During the site visit, additional information on any other species of local biodiversity value occurring within the Site was recorded in order to provide a complete baseline understanding of the Proposed Development Site.

2.3 Fisheries Habitat Assessment

An assessment of the riverine habitats at each survey location was undertaken to determine the potential for watercourses within the Proposed Wind Farm study area to support fish species, including

Salmonids, Lamprey spp., and European eel, among other fish species likely to utilise watercourses within the study area.

Fisheries habitat assessments were conducted utilising elements of the following methodologies and literature to characterise the selected survey sites along watercourses:

- Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (Environment Agency, 2003)
- Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000).
- Channels & Challenges. Enhancing Salmonid Rivers. Irish Freshwater Fisheries Ecology & Management Series (O'Grady, 2006)
- Life Cycle Unit method (Kennedy, 1984; O'Connor & Kennedy, 2002)
- NPWS Irish Wildlife Manuals lamprey surveys (O'Connor, 2004; O'Connor, 2006; and O'Connor, 2007)
- Evaluation of Habitat for Salmon and Trout. Department of Agriculture Fisheries Division. EU Salmonid Enhancement Programme (DOA-NI, 2005)
- Restoration of Riverine salmon habitats (Hendry, K. & Cragg-Hine, D., 1997)
- Ecology of the Atlantic Salmon, Conserving Natura 2000 Rivers (Hendry, K & Cragg-Hine, D., 2003)
- Habitat requirements of Atlantic salmon and brown trout in rivers and streams (Armstrong. J.D. et al., 2003)
- Ecology of the River, Brook, and Sea Lamprey (Maitland, 2003)
- Monitoring the River, Brook and Sea Lamprey*, Lampetra fluviatilis, L. planeri* and *Petromyzon marinus* (Harvey J. & Cowx I. 2003).
- The Eel: Biology and Management of Anguillid Eels (Tesch, F.W., 2007)

2.4 Electrofishing Surveys

Electro-fishing operations for the purpose of forming baseline fisheries data for the Proposed Project Site were undertaken throughout the Proposed Wind Farm study area on the 10th – 12th and 17th July 2024.

A 5- or 10-minute timed electrofishing survey was undertaken at each of the survey locations, in order to determine the presence/ absence of fish species within the study area while adhering to best practice methodology (Electric Fishing in Wadeable Reaches, Central Fisheries Board (CFB, 2008)) and remaining in line with European standards for electrofishing (CEN, 2003). Two suitably qualified ecologists conducted electro-fishing operations at the electro-fishing locations as per Fig 1-1, using an E-fish EF-500B-SYS Electric Fishing Backpack System.

Fish captured during electro-fishing operations were kept in a holding container with oxygenated water. Stress to fish via temperature and low oxygen levels was monitored by consistently and continually checking water temperature both in the river/ watercourse being surveyed and the holding container in order to ensure temperatures of 20˚C were not surpassed. All fish temporarily captured during the survey were identified to species and measured. All fish temporarily captured were allowed to recover and were returned to the watercourse in the vicinity of where they were collected.

Biosecurity measures were followed as per Section 2.7 below.

2.5 Macroinvertebrate Surveys

The methodology followed was the same as that used by the EPA for their national water sampling regime (Toner et al. 2005). A two-minute kick sample was collected from a stream bed area of approximately one square metre with a standard hand net (250 mm x 250 mm, with a 300 mm bag depth and a 1 mm mesh size). One minute hand searches of submerged channel substrates, including

boulder and cobble, was undertaken as part of macroinvertebrate surveys. Kick sampling time was divided proportionally across habitats present within the watercourse survey stretch, such as riffle, glide, areas of instream vegetation and marginal areas. Samples were assessed *in situ,* with specimens identified using the FBA Guide to Freshwater Invertebrates (Dobson et al., 2012). Q-values are assigned using a combination of habitat characteristics and the structure of the macro-invertebrate community within the waterbody. Individual macro-invertebrate families are classified according to their sensitivity to organic pollution, and the Q-value is assessed based primarily on their relative abundance within a sample, as per Environmental Protection Agency (EPA) practice (Toner et al., 2005). The EPA Q-Value rating system is summarised in Table 2-1.

Table 2-1. EPA Quality (Q) Rating System.

Biotic Index	Quality Status	Quality Status	Quality Class	Condition
Q5, Q4–5	High	Unpolluted	Class A	Satisfactory
Q4	Good	Unpolluted	Class A	Satisfactory
Q3–4	Moderate	Slightly Polluted	Class B	Unsatisfactory
Q3, Q2-3	Poor	Moderately Polluted	Class C	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously Polluted	Class D	Unsatisfactory

2.6 Otter Surveys

Otter surveys were conducted as per TII (2008) guidelines *(Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (PE-ENV-01113).* This involved a search for all Otter signs, e.g., spraint, scat, prints, slides, trails, couches and holts both upstream and downstream of proposed survey locations. Within the Proposed Wind Farm study area, otter surveys were conducted 150m upstream and downstream of all survey points. Due to the small-scale nature of works proposed to be undertaken along the Proposed Grid Connection, as well as high levels of disturbance from the existing road, Otter surveys were conducted in the vicinity of grid route survey locations. In addition to the width of the rivers, a 10m riparian buffer (both banks) is considered to comprise part of the Otter habitat (NPWS 2009). Threat Response Plan: Otter (2009-20).

2.7 eDNA Surveys

The Proposed Wind Farm is located wholly within an area classified as having 'Catchments of other extant populations of *Margaritifera',* as well as being located upstream of NPWS mapped White-clawed Crayfish records. As such eDNA sampling for both Freshwater Pearl Mussel (FPM) and White-clawed Crayfish (WcC), as well as Crayfish Plague were undertaken in select watercourses within the study area.

To detect populations FPM and WcC, or the presence of Crayfish Plague within the Proposed Wind Farm study area, a composite water sample was collected from the watercourse at each of the selected eDNA survey sites in July 2024 and analysed for FPM, WcC and Crayfish Plague. eDNA survey sites were strategically chosen to maximise longitudinal (instream) coverage within the catchment, facilitating the likelihood of species detection.

Each composite (500ml) water sample was collected from each watercourse, with 20 x 25ml samples taken along the watercourse, for a representative geographic spread at the site. The composite sample was filtered and fixed while on site using a sterile proprietary eDNA sampling kit. The sample was stored at room temperature and sent to the laboratory for analysis following return from site.

Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence. Whilst an eDNA approach is not currently quantitative, the detection of the target species' DNA indicates the presence of the species at and or upstream of the sampling point.

2.8 Biosecurity Measures

Biosecurity measures which were implemented followed *IFI Biosecurity Protocol for Field Survey Work*, (IFI, 2010). Due to increasingly prevalent spread of crayfish plague in Ireland and to prevent the spread of aquatic invasive species, all equipment was scrubbed and cleaned prior to and post works with Virkon Aquatic. Additionally, equipment was cleaned with Virkon Aquatic between survey sites to when moving between sub-catchments, or when invasive species were encountered. Any instance of invasive species was recorded and conveyed to IFI via electrofishing data returns.

3. DESK STUDY

A Desk Study was conducted to gather baseline information from online sources and records on the aquatic habitats and aquatic dependent species within the vicinity of the survey area.

In preparation of the desk study, the following sources were used to gather information:

- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA, Water Framework Directive (WFD),
- Review of OS maps and aerial photographs of the survey area.

3.1 EPA Water Quality

The EPA Envision map viewer was consulted initially on 8th July 2024 and most recently on 13th December 2025 to regarding the water quality status and risk of the rivers which comprise the Proposed Wind Farm and Proposed Grid Connection survey locations. Table 3-1 presents a summary of the waterbody WFD status for 2013-2018, waterbody WFD status for 2016-2021, waterbody WFD status for 2019-2024 and WFD 3rd Cycle River Waterbodies Risk Projection, as well as details of the survey site locations.

Table 3-1. WFD Status and Risk of surveyed watercourses within the vicinity of the Proposed Wind Farm and Grid Connection Route

Survey site	Watercourse	EPA code	Sub Catchment	Catchment	Waterbody WFD Status for 2013-2018	Waterbody WFD Status for 2016-2021	River Waterbody WFD Status 2019-2024	WFD 3rd Cycle River Waterbodies Risk Projection
Proposed Wind Farm Survey Sites								
WF1	Multeen_020	16L73	Suir_SC_060	Suir	Good	Good	Good	Not at Risk
WF 2	Multeen_020	16M02						
WF 3	Multeen_020	16M02						
WF 4	Multeen_020	16L73						
WF 5	Multeen_020	16S38						
WF 6	Multeen_020	16S59						
WF 7 / GC 1	Multeen_020	16S38						
WF 8	Multeen_020	16L73						
WF 9	Multeen_010	16M02			Good	Good	Good	Not at Risk
WF 10	Multeen_010	16M02						
WF 11	Multeen_010	16M02						
WF 12	Multeen_020	16M02						
WF 13	Aughnaglanny_010	16U16	Multeen[East]_SC_010		Moderate	Good	Moderate	At Risk
WF 14	Aughnaglanny_010	16U16						
WF 15	Aughnaglanny_010	16D66						
WF 16	Aughnaglanny_010	16A05						

Survey site	Watercourse	EPA code	Sub Catchment	Catchment	Waterbody WFD Status for 2013-2018	Waterbody WFD Status for 2016-2021	River Waterbody WFD Status 2019-2024	WFD 3rd Cycle River Waterbodies Risk Projection
Proposed Grid Connection Survey Sites								
GC 2	Unmapped watercourse	–	Suir_SC_060	Suir	–	–	–	–
GC 3	Multeen_020	16M02			Good	Good	Good	Not at risk
GC 4	Unmapped watercourse	–			–	–	–	–
GC 5	Cappawhite Stream_010	25C10	Dead_SC_010	Lower Shannon	Poor	Poor	Poor	At risk
GC 6	Cappawhite Stream_010	25Y16			Poor	Poor	Poor	At risk
GC 7	Unmapped watercourse	–			–	–	–	–
GC 8	Unmapped watercourse	–			–	–	–	–
GC 9	Unmapped watercourse	–			–	–	–	–
GC 10	Toem Stream_010	25T05			Poor	Poor	Poor	At risk
GC 11	Toem Stream_010	25M61			Poor	Poor	Poor	At risk
GC 12	Unmapped watercourse	–			–	–	–	–
GC 13	Cahernahallia_020	25C01	Mulkear_SC_010		Good	Good	Good	Not at risk
GC 14	Cahernahallia_020	25Q70			Good	Good	Good	Not at risk
GC 15	Unmapped watercourse	–			–	–	–	–
GC 16	Doon Stream_010	–			Good	Moderate	Moderate	At risk
GC 17	Mulkear (Limerick)_010	25B56			Good	Moderate	Moderate	At risk
GC 18	Unmapped watercourse	–			–	–	–	–

Survey site	Watercourse	EPA code	Sub Catchment	Catchment	Waterbody WFD Status for 2013-2018	Waterbody WFD Status for 2016-2021	River Waterbody WFD Status 2019-2024	WFD 3rd Cycle River Waterbodies Risk Projection
GC 19	Bilboa_020	25B45	Bilboa_SC_010		Good	Good	Good	Not at risk
GC 20	Bilboa_020	25B45			Good	Good	Good	Not at risk
GC 21	Unmapped watercourse	–			–	–	–	–
GC 22	Bilboa_020	25B03			Good	Good	Good	Not at risk
GC 23	Bilboa_020	25B03			Good	Good	Good	Not at risk
GC 24	Bilboa_020	25D14			Good	Good	Good	Not at risk
GC 25	Bilboa_020	25D34			Good	Good	Good	Not at risk
GC 26	Dooglasha (Cappamore)_010	25T17	Mulkear_SC_020		Moderate	Poor	Poor	Review
GC 27	Dooglasha (Cappamore)_010	25D02			Moderate	Poor	Poor	Review
GC 28	Mulkear (Limerick)_020	25M04			Good	Moderate	Moderate	At risk
GC 29	Mulkear (Limerick)_040	25M73			Good	Moderate	Moderate	At risk
GC 30	Mulkear (Limerick)_040	25K81			Good	Moderate	Moderate	At risk
GC 31	Mulkear (Limerick)_050	25K88	Shannon[Lower]_SC_090		Good	Good	Good	Not at risk
GC 32	Unmapped watercourse	–			–	–	–	–
GC 33	Groody_010	25K90			Moderate	Moderate	Moderate	At risk
GC 34	Groody_010	25W08			Moderate	Moderate	Moderate	At risk
GC 35	Groody_010	25G05			Moderate	Moderate	Moderate	At risk

The EPA Envision map viewer was consulted on 23rd of July 2024 and most recently on 27th Janaury 2026 regarding the water quality status of watercourses which comprise the Proposed Wind Farm and grid route survey locations. There were 15 EPA monitoring points within the vicinity of the Proposed Wind Farm and grid route study area (Table 3-2).

Table 3-2. EPA Water Quality Data

Watercourse	Sampling Station	Location	Sampling Year	Q-Value & Water Quality Status
Multeen_010, upstream of survey site WF 9	Bridge SW of Hollyford [Station Code: RS16M020540]	E 191910.32, N 153062.43	2011	Q4 - Good
Multeen_010, downstream of survey site WF 11	1 km SE of Inchinsquillib [Station Code: RS16M020600]	E 191298, N 149646	2023	Q4 - Good
Multeen_010, upstream of survey site WF 12	Bridge upstream of Glasheenyreagha River confluence [Station Code: RS16M020650]	E 191224.98, N 148472.83	1992	Q4–5 - High
Multeen (East)_030/ Aughnaglanny_010, at survey site WF 16	Victoria Bridge [Station Code: RS16A050100]	E 199018.31, N 148403.71	2023	Q3–4 - Moderate
Multeen_010, at survey site GC 3	Multeen – Ironmills Bridge [Station Code: RS16M020700]	E 191520.45, N 146799.41	1992	Q4–5 - High
Multeen_020/ Multeen_030, downstream of survey site GC 3	Bridge SW of Annacarty [Station Code: RS16M020780]	E 191813.95, N 145111.37	2023	Q4 - Good
Multeen_030, downstream of survey site GC 3	Multeen – Hawarden Bridge [Station Code: RS16M020800]	E 192097, N 144913	1992	Q5 - High
Cappawhite Stream_010, downstream, of surveys sites GC 5 and GC 6	Gortandrum Bridge [Station Code: RS25C100200]	E 187959.34, N 146163.48	2021	Q3 - Poor
Toem Stream_010, downstream of survey sites GC 10 and GC 11	Toem Stream - South Bridge at Toem [Station Code: RS25T050300]	E 186710, N 147474	2012	Q4 - Good
Dead_020, upstream of survey site GC 8	Cappawhite Stream - Ayle Bridge NE of Clonbrick [Station Code: RS25C100300]	E 185778, N 144701	2012	Q4 - Good
Cauteen_010/ Dead_010	Cauteen Bridge (d/s side) [Station Code: RS25C040500]	E 187556, N 143565	2021	Q3 - Poor
Dead_010, Dead_020	Pope's Bridge [Station Code: RS25D010100]	E 185598.07, N 143761.12	2021	Q3 - Poor
Dead_010	Just u/s of Dead River confluence [Station Code: RS25P030200]	E 186037.2, N 143524	2023	Q3 - Poor
Dead_020	Dead - Longford Bridge [Station Code: RS25D010150]	E 184202, N 145575	1987	Q3–4 - Moderate
Dead_020/ Toem Stream_010	Bridge u/s Dead River confluence [Station Code: RS25T050600]	E 184127, N 145649	2021	Q3 - Poor
Doon stream_010, downstream of survey site GC 16	Bridge at Gortavalla, SW of Doon [Station Code: RS25D030600]	E 181422.93, N 148938.68	2021	Q3-4 - Moderate
Bilboa_020, downstream of survey sites GC 22-GC 25	Bridge 1.5 km d/s Cappamore [Station Code: RS25B030300]	E 177973, N 150469	2021	Q4 - Good
Groody_010, upstream of survey site GC 35	Groody Bridge 2km North of Caherconlish (G4) [Station Code: RS25G050100]	E 167771, N 151681	2002	Q3-4 - Moderate

3.2 Salmonid River Status.

Aquatic sampling site WF 16 is located approx. 30km upstream of the confluence of the River Suir (Suir_130), with the Aherlow River, with the Aherlow designated as Salmonid River under S.I 293 (1988). Salmonid waters are those fresh waters classified under the first schedule, which are *'capable of supporting Salmon (Salmo salar), Trout (Salmo trutta), Char (Salvelinus) and Whitefish (Coregonus)'* species.

3.3 NPWS Data.

3.3.1 Freshwater Pearl Mussel

Wind Farm aquatic survey locations WF 1– WF 16 (including WF 7 / GC 1), as well as GC 2, GC 3 and GC 4 are located within the Suir – Multeen *Margaritifera* sensitive area, which is listed as a catchment of extant freshwater pearl mussel outside of the SAC populations listed in S.I. 296 of 2009. The remaining Proposed Grid Connection Survey sites are located outside of any *Margaritifera* sensitive area.

3.3.2 White-clawed Crayfish

The incidence of Annex II and V species White-clawed Crayfish (*Austropotamobius pallipes*) has been recorded by NPWS at survey sites WF 16, GC 3 and GC 28, as well as approx. 2.2km downstream of site GC 3, approx. 4.1 km and 4.5 km downstream of GC 10 and GC 11, respectively, approx. 1.9 km downstream of GC 29 and GC 30.

3.3.3 National Biodiversity Data Centre

The National Biodiversity Data centre database was accessed on 8th July 2024 to review records of protected faunal species which utilise aquatic habitats within the hectads pertaining to the Wind Farm study area and associated Proposed Grid Connection (R65, R75, R84, R85, R94, R95) (Table 3-3). The database was also searched for records of First Schedule and Third Schedule non-native invasive species within the hectads.

Table 3-3. NBDC records for protected aquatic fauna records (excl. birds) for hectads R65, R75, R84, R85, R94, R95

Common Name	Scientific Name	Protection Status	Hectads
Common Frog	*Rana temporaria*	Annex V, WA	R65, R75, R84, R85, R94
Common Newt	*Lissotriton vulgaris*	WA	R65, R75, R84, R94
Otter	*Lutra lutra*	Annex II, IV, WA	R65, R75, R84, R85, R94, R95
White-clawed Crayfish	*Austropotamobius pallipes*	Annex II, V, WA	R65, R75, R84, R94

Annex II, Annex IV, Annex V – Of EU Habitats Directive, WA – Irish Wildlife Acts (1976-2017)

Table 3-4. NBDC records for aquatic adjacent/dependent Invasive species for hectads R65, R75, R84, R85, R94, R95

Common Name	Scientific Name	Hectad
American Mink	*Mustela vison*	R65, R75, R85
Brown Rat	*Rattus norvegicus*	R65, R84
Canadian Waterweed	*Elodea canadensis*	R65
Dace	*Leuciscus leuciscus*	R65
Giant Hogweed	*Heracleum mantegazzianum*	R65, R75, R84, R94, R95
Himalyan Balsam	*Impatiens glandulifera*	R65, R75, R84, R85, R94, R95
Japanese Knotweed	*Fallopia japonica*	R65, R75, R85, R94, R95
Nuttall's waterweed	*Elodea nuttallii*	R65
Water fern	*Azolla filiculoides*	R65

3.3.4 Inland Fisheries Ireland

Atlantic Salmon (*Salmo salar*), Brown Trout (*Salmo trutta*), European Eel (*Anguilla anguilla*), Lamprey sp. (*Petromyzontidae*), Minnow (*Phoxinus phoxinus*), Pike (*Esox lucius*), and Stone Loach (*Barbatula barbatula*) were recorded in the South Eastern River Basin District in the vicinity of the Proposed Wind Farm and associated Grid Route by Inland Fisheries Ireland (IFI) during water sampling for the Water Framework Directive (WFD) from 2008-2022 (Matson et al., 2019, Inland Fisheries Ireland, 2008, 2014).

Atlantic Salmon (*Salmo salar*), Brown Trout (*Salmo trutta*), European Eel (*Anguilla anguilla*), Stone Loach (*Barbatula barbatula*) and Three-spined stickleback (*Gasterosteus aculeatus*) were recorded in the Shannon International River Basin District in the vicinity of the Proposed Wind Farm and associated Grid Route by Inland Fisheries Ireland (IFI) during water sampling for the Water Framework Directive (WFD) from 2008-2022 (Kelly et al., 2009, 2013., Inland Fisheries Ireland, 2020).

3.3.5 Annex I habitats

Distribution of the Annex I habitat *3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation* is mapped for the 10 km hectads in which the Proposed Wind Farm and Proposed Grid Connection are located (R65, R75, R84, R85, R94 and R95).

The Proposed Wind Farm study area and Proposed Grid Connection are located within the same 10km hectads as mapped areas of Annex I Residual Alluvial Forests, with mapped areas of this habitat located approx. 0.25 km and 0.4 km downstream of survey sites WF 14 and WF 15, and 0.65 km upstream of GC 13.

The 10 km hectad R65, in which the Proposed Grid Connection survey sites GC 31-GC 35 are located, is mapped for distribution of the Annex I 6430 Hydrophilous Tall Herb habitat. Point incidences of this habitat are mapped approx. 8.5km upstream of the western end of the Proposed Grid Connection.

3.3.6 Aquatic macrophytes

Opposite-leaved pondweed (*Groenlandia densa*), a plant species protected under the Flora (Protection) Order 2022 (S.I. No. 235/2022) was recorded within the 10km hectad R65, in the Lower Shannon Hydrological Catchment, most recently in 2006.

4. FIELD SURVEY RESULTS

4.1 Aquatic Survey Results.

Field surveys carried out in the vicinity of the proposed windfarm took place on the 10th 12th and 17th of July 2024; field surveys in the vicinity of the Proposed Grid Connection took place on 7th, 8th, 9th and 10th of October 2024 and 23rd October 2025.

Aquatic Baseline Surveys undertaken in the vicinity of the Proposed Wind Farm include:

- River habitat assessment,
- Fisheries habitat assessment,
- Electrofishing surveys,
- Macroinvertebrate surveys,
- Otter Surveys
- eDNA surveys

Aquatic Baseline Surveys undertaken along the Proposed Grid Connection include:

- River habitat assessment,
- Fisheries habitat assessment,
- Macroinvertebrate surveys,
- Otter Surveys

The below sections (4.1.1 & 4.1.2) summarise and describe the Proposed Wind Farm survey locations and the Proposed Grid Connection survey locations in line with the above survey types.

Appendix I presents a collated record of the species found at each survey location electrofishing was conducted on.

Appendix II presents a collated record of the Q-Values assigned across all survey locations.

4.1.1 Proposed Wind Farm Survey Locations

4.1.1.1 WF Survey Site 1 (WF 1)

Survey site WF 1 was located on the upland reaches of the Multeen Stream (Lackenacoombe 16, EPA code: 16L73). Properties of the watercourse at this survey location are provided in Table 4-1. Plate 4-1 shows a representative photo of the watercourse at survey site WF 1.

This low order section of *Eroding/Upland River (FW1)* averaged 0.5m wide, with low, vegetated banks approx. 0.1m in height. The watercourse meandered across a slight gradient within a plateau area of Willow *(Salix spp.)* dominant *Riparian woodland (WN5).* The stream basin was located within a larger V-shaped valley, with *Wet grassland (GS4)* and *Conifer plantation (WD4)* extending from the left- and right-hand sides, respectively. The immediate riparian zone featured standalone hawthorn *(Crataegus monogyna)* and sections of planted non-native Beech (*Fagus sylvatica*), with extensive ground cover flora including foxglove (*Digitalis purpurea*), creeping buttercup (*Ranunculus repens*), honeysuckle (*Lonicera periclymenum*), false oat-grass (*Arrhenatherum elatius*), cocksfoot (*Dactylis glomerata*), bramble (*Rubus fructicosus agg.*), nettle (*Urtica dioica*), marsh ragwort (*Jacobaea aquatica*), hard rush (*Juncus inflexus*), soft rush (*Juncus effusus*), false brome (*Brachypodium sylvaticum*) and wild angelica (*Angelica sylvestris).* Submerged macrophytes were absent, with water mint *(Mentha aquatica)* present at watercourse margins.

The river profile was comprised of a series of shallow cobble steps over riffle, with a maximum depth of approx. 0.1m. Loose, fine gravels were the dominant channel substrate, with areas of marginal silt adjacent to sections of actively eroding, undercut bank bends. Water was very clear, with moderate velocity and no colouration when undisturbed. Finer sediments remained in suspension when disturbed. Barbed wire fencing crossed the watercourse to limit livestock access at the downstream and upstream survey extents. No artificial bank or channel modifications were evident at the stretch of watercourse

Table 4-1. Properties of the watercourse at survey location WF 1.

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	0.5			
Wet Width (m)	0.6			
Flow	Low			
Colouration	None			
Clarity	Very Clear			
Average bank height (m)	LHB	0.1	RHB	0.1
Dominant Substrates	Cobble (>32–128mm): 10% Gravel (8-32mm): 20% Fine gravel (2-8mm): 60% Silt (<0.25mm): 10%			
Substratum Condition	Loose			

Given the headwater location of this survey site, shallow depth, lack of instream refugia or marginal sheltering features and lack of channel substrate variability, salmonid spawning and nursery potential were assessed as poor, and eel and salmonid holding potential were assessed as negligible. Despite the presence of some areas of marginal silt beds, gradient features within the wider watercourse landscape preclude upstream migration of lamprey *sp.* This survey site provided overall poor fisheries value.

No otter signs were observed at survey site WF 1. Foraging and commuting potential for otter along this stretch of watercourse was assessed as poor due to a lack of fisheries habitat and shallow, headwater river morphology. No fish were recorded via 5-minute semi-quantitative electrofishing survey at survey site WF 1.

Macroinvertebrate diversity and density were low and moderate, respectively. The Q rating assigned to survey site WF 1 was **Q3–4 –Moderate**, on the basis that at least one 'very pollution sensitive' Group A taxon was present in low numbers (2 *Rhithrogena* were identified); 'Pollution sensitive' taxa made up ~17% of the sample (5 individuals across three taxa in Groups A and B). 'Pollution tolerant' Group C species made up ~83% of the sample, with *Baetis rhodani* being the dominant species. Group D was represented by a single individual from one taxon. Group E taxa were absent from the sample. Results of Q-Value assessment are summarised in Table 4-2.

Table 4-2. Results of kick-sampling at survey location WF 1.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Rhithrogena sp.*	2
Group B – Moderately Pollution Sensitive	*Leuctra sp.*	2
	Sericostomatidae	1
Group C – Pollution Tolerant	*Baetis rhodani*	10
	Chironomidae	8
	Simuliidae	6
Group D – Very Pollution Tolerant	*Tipulidae*	1
Group E – Most Pollution Tolerant	-	-

Plate 4-1. A representative photo of Survey Site WF 1.

4.1.1.2 WF Survey Site 2 (WF 2)

Survey site WF 2 was located on the Multeen Stream (Multeen_020, EPA code: 16M02, Grid Reference: R 93831 50493). This headwater section of *Eroding/Upland River (FW1)* comprised high energy, fast flow over exposed bedrock step-pool formations. Channel substrata was dominated by bedrock, grading into localised deposits of cobble/gravel in stretches of slightly lower gradient riffle at the downstream survey extent. The watercourse averaged 2m wide and 0.15m deep, with deeper pools of up to 0.3m amongst step-pool sequences. Water had a slight yellow colouration and was very clear even when disturbed. Banks which were composed predominately of exposed rock with a vegetated

earth bank top ranged from 0.5-1.0m high. With the exception of naturally eroded and undercut bedrock, channel and bank modifications were not evident along the watercourse at this survey site. Properties of the stream at survey location WF 2 are shown in Table 4-3. Plate 4-2 shows a representative photo of the watercourse at survey site WF 2.

Bankside vegetation featured opposite-leaved golden-saxifrage *(Chrysosplenium oppositifolium),* meadowsweet (*Filipendula ulmaria*), wild angelica (*Angelica sylvestris*), great woodrush (*Luzula sylvatica*) and *Dryopteris sp.* fern, with marginal patches of water mint (*Mentha aquatica*) and abundant macrophyte coverage on boulder outcrops.

This survey site was of low fisheries value given its upland headwater location, exposed bedrock channel morphology and high downstream gradient, all of which precluded upward migration of fish. Salmonid or lamprey *sp.* spawning and lamprey *sp.* nursery habitat were assessed as poor, given the underlying bedrock substrate and headwater morphology, while localised areas of bedrock pool grading into cobble riffle-glide provided structural complexity and flow variation within the channel providing locally moderate salmonid nursery. Marginal pools suitable for adult salmonid fish may be inaccessible due to barriers to migration in the form of bedrock steps. A lack of in-channel vegetation and refugia, as well as fast, turbulent flow, saw poor European eel habitat. This stretch of watercourse was heavily tunnelled by strips of riparian woodland dominated by *Salix aurita,* which provided excessive shading to the watercourse. Habitats extending from the left- and right-hand banks featured *Riparian woodland (WN5)* and *Scrub (WS1)* and road classified as *Buildings and artificial surfaces (BL3)*, respectively. No otter signs were observed at survey site WF 2. Otter foraging and commuting potential for this stretch of watercourse were deemed as opportunistic *Low* potential due to a lack of fisheries habitat and the bedrock-dominant, steep gradient headwater river profile.

Table 4-3. Properties of the watercourse at survey location WF 2

Properties	Record			
Average Depth (m)	0.25			
Average Bank Width (m)	2			
Wet Width (m)	25			
Flow	Fast			
Colour	Slight yellow colouration			
Clarity	Very clear			
Average bank height (m)	LHB	0.5	RHB	1
Dominant Substrates	Bedrock: 70% Cobble (>32–128mm): 15% Gravel (8-32mm): 15%			
Substratum Condition	Highly compacted bedrock, compacted cobble and gravel			

Results of the 5-minute semi-quantitative electrofishing survey conducted at this survey site are presented in Table 4-4.

Table 4-4. Electrofishing results at survey location WF 2

Species	Length (cm)
Brown Trout (*Salmo trutta*)	4cm
Brown Trout (*Salmo trutta*)	7cm

Kick-sampling was carried out in areas of riffle and glide and pool. Macroinvertebrate diversity and density were poor and low, respectively. The Q rating assigned to survey site WF 2 was **Q3–Poor**. This score was assigned on the basis that Group A 'Very Pollution Sensitive' taxa were absent, while only one individual from one Group B 'Moderately Pollution Sensitive' taxon was present in the sample. Group C were the dominant indicator group in this sample (~93% of the sample, comprising of 14 individuals from four separate 'Pollution Tolerant' taxa). Individuals from Group D 'Very Pollution Tolerant' and Group E 'Most Pollution Tolerant' taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-5.

Table 4-5. Results of kick-sampling at survey location WF 2.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Glossomatidae*	1
Group C – Pollution Tolerant	*Baetis rhodani*	6
	Chironomidae	5
	Rhyacophila sp.	1
	Simuliidae	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-2. A representative photo of Survey Site WF 2.

4.1.1.3 WF Survey Site 3 (WF 3)

Survey site WF 3 was located on the Multeen_020 River (EPA code: 16M02, Grid Reference: R 93580 50272). This section of *Eroding/Upland River (FW1)* was characterised by moderate velocity shallow riffle flow over predominantly cobble channel substrate, with finer interstitial gravels. Wetted width varied from approx. 1–3.5m, as a result of marginal cobble banks and boulder outcrops which were exposed during low flow at the time of survey. This section of watercourse was largely natural in profile, with the exception of slow flow and deposition of fine sediment bars adjacent to scour pool directly upstream, downstream and throughout a single-span stone-arch bridge. Black pipes were observed entering the watercourse downstream of and under the bridge. Properties of the stream at survey location WF 3 are shown in Table 4-6. Plate 4-3 shows a representative photo of the watercourse at survey site WF 3.

Table 4-6. Properties of the watercourse at survey location WF 3

Properties	Record			
Average Depth (m)	0.1–0.7(within marginal scour pools)			
Average Bank Width (m)	3			
Wet Width (m)	1–3.5			
Flow	Moderate			
Colour	Slightly brown in colour			
Clarity	Clear, with heavy siltation when disturbed, particularly in the vicinity of the bridge structure when disturbed.			
Average bank height (m)	LHB	0.5	RHB	1
Dominant Substrates	Boulder (>128mm): 5% Cobble (>32–128mm): 40% Gravel (8-32mm): 20% Fine gravel (2-8mm): 20% Sand (0.25–2mm): 5% Silt (<0.25mm): 10%			
Substratum Condition	Semi-compacted amongst cobble riffle sections			

Finer sediments overlying coarse channel substrate created a high degree of siltation, particularly in the vicinity of silt and sand deposits along the right-hand bank, and throughout the heavily silted scour pools along the left-hand bank at either end of the bridge. Instream submerged macrophytes were absent from both the cobble and silt-dominant sections of watercourse. *Conocephalum conicum*, a thallose liverwort, was abundant on the bridge structure, along with Rustyback fern *(Asplenium ceterach).*

Emergent and bankside vegetation included hogweed *(Heracleum sphondylium)*, wild angelica *(Angelica sylvestris),* hart's-tongue fern *(Asplenium scolopendrium)*, great wood-rush *(Luzula sylvatica),* hedge woundwort *(Stachys sylvatica),* wood avens *(Geum urbanum)*, herb robert *(Geranium robertianum)* and bush vetch *(Vicia sepium).* Habitats extending from the left- and right-hand banks were characterised by Yorkshire fog *(Holcus lanatus),* false oat-grass *(Arrhenatherum elatius),* and cocksfoot *(Dactylis glomerata)* dominant *Dry calcareous and neutral grassland (GS2)* and bramble *(Rubus fruticosus agg.)* and nettle *(Urtica diocia)* scrub, respectively. Semi-continuous treelines along the left-hand bank consisted of rowan *(Sorbus aucuparia)*, ash *(Fraxinus excelsior)* and willow *(Salix sp.)* and provided moderate shading to the watercourse margins. Sections of the downstream survey extent were tunnelled with overhanging tree bows.

Salmonid spawning gravels assessed as locally moderate were silted and may be potentially inaccessible to upward migrating fish as a result of instream barrier to migration in the form of fallen tree branches and woody debris choking the channel at several sections of watercourse. Variations in substrate, flow patterns and depth across the channel provided moderate salmonid nursery. While scour pools within the vicinity of the bridge provided appropriate holding depth for adult salmonid fish, a lack of instream refugia in the way of macrophytes, root structures, undercut banks or submerged coarser substrates provided only moderate salmonid or European eel habitat. Similar to salmonid spawning, semi-compacted, silted gravels were both too large and immobile to provide suitable lamprey sp. spawning habitat. Marginal silt beds under overhanging vegetation provided moderate lamprey sp. ammocete nursery.

A 5-minute semi-quantitative electrofishing survey was conducted at this survey location. Brown trout *(Salmo trutta)* were the only fish species caught during the survey. Six additional salmonid fish were observed but not caught during electrofishing. Results of the 5-minute semi-quantitative electrofishing survey conducted at this survey site are presented in Table 4-7.

Table 4-7. Electrofishing results at survey location WF 3.

Species	Length (cm)
Brown Trout (*Salmo trutta*)	5.0
Brown Trout (*Salmo trutta*)	5.5

Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	4.5
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	4.5
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	5.0
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	5.7
Brown Trout (*Salmo trutta*)	5.6
Brown Trout (*Salmo trutta*)	4.6
Brown Trout (*Salmo trutta*)	3.5
Brown Trout (*Salmo trutta*)	4.5
Brown Trout (*Salmo trutta*)	4.9
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	5.0
Brown Trout (*Salmo trutta*)	5.4
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	5.4
Brown Trout (*Salmo trutta*)	4.4

No otter signs were observed along this stretch of stream, although the watercourse at WF 3 provided *Moderate* commuting and foraging habitat for otter, given its adequate water depth, bankside features and fisheries potential.

Kick-sampling was carried out in areas of riffle and glide. Macroinvertebrate diversity and density were low. The Q rating assigned to survey location WF 3 was a low **Q4–Good**, on the basis that pollution sensitive Group A and B taxa present in low numbers (two Group A 'Very Pollution Sensitive' taxa present in low numbers, a single Group B 'Moderately Pollution Sensitive' taxon was present in low numbers). Group C were the dominant indicator group in this sample (~76%, comprising of 22 individuals across four separate 'Pollution Tolerant' taxa). Group D and E 'Very' and 'Most Pollution Tolerant' taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-8.

Table 4-8. Results of kick-sampling at survey location WF 3.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Heptagenia sp.*	1
	Rhithrogena sp.	2
Group B – Moderately Pollution Sensitive	*Leuctra sp.*	4
Group C – Pollution Tolerant	*Baetis rhodani*	10
	Chironomidae	5
	Rhyacophila sp.	1
	Simuliidae	6
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-3. Plate 4 3. A representative photo of the upstream extent of Survey Site WF 3.

Plate 4-4. A representative photo of the downstream extent of Survey Site WF 3.

4.1.1.4 WF Survey Site 4 (WF 4)

Survey site WF 4 was located on the Multeen River (Lackenacoombe 16, EPA code: 16L73, Grid Reference: R 93350 50408). This section of *Eroding/Upland River (FW1)* was an upland, laterally confined first order stream with steep sided earthen banks and cobble dominant channel bed substrate. Flow was predominantly moderate velocity, shallow riffle along the narrowly wetted channel, with fragmented areas of shallow bedrock pool-steps. Properties of the stream at survey location WF 4 are shown in Table 4-9. Plate 4-5 shows a representative photo of the watercourse at survey site WF 4.

Table 4-9. Properties of the watercourse at survey location WF 4.

Properties	Record			
Average Depth (m)	0.05–0.2			
Average Bank Width (m)	0.5			
Wet Width (m)	0.3			
Flow	Moderate			
Colour	Highly brown colouration			
Clarity	Slightly turbid, particularly when disturbed			
Average bank height (m)	LHB	1.0–1.4	RHB	1.0–1.6
Dominant Substrates	Bedrock: 10% Cobble (>32–128mm): 60% Gravel (8-32mm): 20% Sand (0.25–2mm): 5% Silt (<0.25mm): 5%			
Substratum Condition	Highly compacted			

Water was highly brown in colour, with highly compacted cobble substrate overlain with a layer of finer sediments which, when disturbed, reduced visibility of the channel bed. Water depth was consistently shallow along the surveyed stretch (max. 0.2m), with frequent fallen dead wood and woody debris precluding flow along the watercourse. Habitats extending from both the left- and right-hand bank consisted of sitka spruce *(Picea sitchensis) Conifer Plantation (WD4)*, which provided excessive shading to the watercourse. Bankside vegetation was an assemblage of common riparian species, including common polypody *(Polypodium vulgare)*, broad buckler-fern *(Dryopteris dilatate)*, bramble, bracken *(Pteridium aquilinum),* ivy *(Hedera helix),* wood sorrel *(Oxalis acetosella),* bilberry *(Vaccinium myrtillus)* and opposite-leaved golden-saxifrage *(Chrysosplenium oppositifolium)*, which provided negligible buffering between conifer plantation and the watercourse.

Lack of suitable habitat provided by this narrow, shallow, highly shaded stretch of upland watercourse, with compacted and unsuitably sized silted gravels saw poor salmonid spawning, nursery and holding habitat at survey site WF 4. Lack of any suitable silt beds saw a lack of any lamprey spp. ammocoete habitat. Despite bank undercutting in sections, lack of deeper, sheltered pools saw a lack of any holding habitat for European eel. A narrow under-road pipe culvert at the upstream survey extent which was raised above the stream bed and occluded by dislodged stone created a complete barrier to upward migrating fish, making this section of low fisheries potential watercourse inaccessible.

No fish were recorded via 5-minute semi-quantitative electrofishing survey at site WF 4. No otter signs were observed along this stretch of headwater stream, which provided poor commuting and foraging habitat for otter.

Kick-sampling was carried out in areas of cobble-gravel riffle and shallow areas of pool-step. Macroinvertebrate diversity and density were poor and low, respectively. The Q rating assigned to survey location WF 4 was **Q3–Poor**, on the basis that Group C taxa were the dominant and only indicator group present in the sample comprising of 10 individuals from four separate 'Pollution Tolerant' taxa. Pollution sensitive Group A and B taxa, and Pollution tolerant Group D and E taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-10.

Table 4-10. Results of kick-sampling at survey location WF 4.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	2
	Gammarus sp.	6
	Simuliidae	1
	Polycentropodidae	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-5. A representative photo of Survey site WF 4.

4.1.1.5 WF Survey Site 5 (WF 5)

Survey site WF 5 was located on the Scarrough (16)S38 (EPA code: 16S38, Grid Reference: R 94607 48750). Properties of the watercourse at this survey location are provided in Table 4-11 below and a representative photograph of the survey location is shown in Plate 4-6.

Table 4-11. Properties of the watercourse at survey location WF 5

Properties	Record
Average Depth (m)	0.1–0.4
Average Bank Width (m)	2.5
Wet Width (m)	0.7–1.8
Flow	Low
Colour	Slight brown colouration
Clarity	Clear when undisturbed
Average bank height (m)	LHB 0.7 RHB 0.7
Dominant Substrates	Bedrock: 50% (underlying) Boulder (>128mm): 20% Cobble (>32–128mm): 20% Gravel (8-32mm): 10%
Substratum Condition	Underlying bedrock with areas of overlying compacted boulder and cobble

This section of watercourse was a narrow bedrock-boulder dominant stretch of headwater *Eroding/Upland River (FW1)*, laterally confined within a wider asymmetrical valley sloping to the left-hand bank. Earthen banks were disturbed by recent livestock poaching, with a high degree of sedimentation around areas of exposed earth. With the exception of extensive livestock poaching at the channel margins, bank and channel modifications were not known. Habitats surrounding the watercourse was largely mosaic *Improved agricultural grassland (GA1)* and *Wet grassland (GS4).*

The channel was widest at the upstream survey extent, with undercut sections of earthen bank and overhanging tree limbs creating areas of slow flow and marginal backwater pools. As stream gradient increased and channel substrate became coarser and more consolidated, flow velocity increased over areas of cobble riffle and shallow bedrock steps. Water was slightly brown in colour and clear when undisturbed, with plumes of silt evident when the channel margins were disturbed under foot.

Instream macrophytes were absent from the watercourse, with the exception of occasional bryophyte coverage over exposed boulder and cobble outcrops. Bankside vegetation included bramble, bracken *(Pteridium aquilinum)*, bush vetch *(Vicia sepium)*, creeping buttercup, dog rose *(Rosa canina)*, great wood rush *(Luzula sylvatica)*, herb robert *(Geranium robertianum)*, hogweed, meadowsweet, narrow buckler fern *(Dryopteris carthusiana),* ragwort *(Jacobaea vulgaris)*, soft rush and yorkshire fog. A continuous treeline consisting of Ash, rowan and willow *(Salix spp.)*. Treelines provided adequate shading to the entire channel width, with sections of channel tunnelled by overhanging and instream Willow trees at the upstream and downstream survey extents.

While some gravel deposits were present toward the middle section of the watercourse, the survey stretch was largely composed of an underlying layer of bedrock with overlying boulders and cobbles. In addition to offering negligible spawning potential for salmonid and lamprey *spp.*, the upgradient, headwater location limited overall accessibility of this watercourse to nursery age salmonid fish. The absence of silt beds saw a lack of any suitable lamprey ammocete habitat. Water was largely too shallow for salmonid or European eel holding habitat, with the exception of overhanging vegetation and undercut banks at the upstream survey extent. However, this area of watercourse was again likely inaccessible to fish, with barriers to migration in the form of bedrock pool-steps along the entire stretch.

No fish were recorded via 5-minute electrofishing survey at site WF 5. No otter signs were identified in the vicinity of survey site WF 5. Due to poor fisheries potential and upgradient, inaccessible nature of this watercourse, it is unlikely that Otter use this stretch of watercourse for commuting or foraging in any significant manner.

Kick-sampling was carried out in areas of compacted cobble riffle. Biological water quality based on Q-sampling was calculated as **Q3–4 –Moderate**, on the basis that a single 'Very Pollution Tolerant' Group A taxon was present, with 'Pollution Tolerant' Group C being the dominant taxa in the sample (~90% of

the sample). Group D 'Very Pollution Tolerant' and Group E 'Most Pollution Tolerant' taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-12.

Table 4-12. Results of kick-sampling at survey location WF 5

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus sp.*	1
Group B – Moderately Pollution Sensitive	*Leuctra sp.*	1
	Limnephilidae	2
Group C – Pollution Tolerant	*Baetis rhodani*	8
	Elmidae	1
	Gammarus sp.	18
	Polycentropodidae	2
	Simuliidae	6
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-6. A representative photo of survey site WF 5.

4.1.1.6 WF Survey Site 6 (WF 6)

Survey site WF 6 was located on the Scarrough (16) watercourse (EPA code: 16S59, Grid Reference: R 94186 48740). Properties of the watercourse at this survey location are provided in Table 4-13 below and representative photographs of the survey locations are shown in Plate 4-7 and Plate 4-8.

Table 4-13. Properties of the watercourse at survey location WF 6

Properties	Record
Average Depth (m)	<0.03m along ford crossing, 0.1m in shallow pool of standing water
Average Bank Width (m)	0.3m (no defined banks)
Wet Width (m)	0.1–0.2m
Flow	Low, slow

Colouration	Brown			
Clarity	Highly turbid, particularly in pool of standing water			
Average bank height (m)	LHB	0	RHB	0
Dominant Substrates	Gravel (8-32mm): Mud/Silt (<0.25mm): 80%			
Substratum Condition	Very loose			

The accessible section of the Scarrough stream was a heavily disturbed livestock ford crossing, with no defined banks or channel bed structure. The channel itself was highly eroded as a result of ongoing livestock access, with livestock excrement observed throughout. The watercourse was negligibly wetted along the road (<0.03m in depth), with one small area of shallow, heavily silted standing water at the upstream extent (max 0.1m in depth), directly downstream of a historically section of bedrock-dominant headwater *Eroding/Upland River (FW1)*. Water was brown in colour and highly turbid, with a heavy degree of sedimentation throughout.

No riparian buffer zone existed between this stretch of watercourse and the surrounding *Improved agricultural grassland (GA1)* landscape and *Spoil and bare ground (ED2),* with no vegetation in the immediate vicinity of the undefined, negligibly wetted channel. Downstream of the survey site, a stretch of bedrock-dominant headwater stream, characterised by fast flowing water and a cascade-step-pool profile with falls and plunge pools, was inaccessible for survey. The stream was heavily tunnelled with willow *(Salix spp.)* trees at this point. Vegetation in the vicinity of the inaccessible bedrock stream included bramble, creeping buttercup, *Dryopteris sp.* Fern, golden opposite-leaved saxifrage *(Chrysosplenium oppositifolium),* hard-fern *(Blechnum spicant)*, herb robert *(Geranium robertianum),* ivy, wood sorrel and yorkshire fog. The exposed section of watercourse utilised as a livestock crossing and agricultural road was entirely unshaded, while upstream and downstream sections of watercourse were heavily tunnelled. Instream macrophytes were absent from the watercourse.

Survey site WF 6 was not electrofished due to a negligibly wetted stretch of undefined channel, with one section of impounded, excessively silted standing water at the upstream survey extent. The watercourse upstream and downstream of the livestock ford crossing was not accessible due to sheer-faced vertical drops along the steep stretch of bedrock cascade-pool-step stream profile, as well as the channel being entirely tunnelled by dense bramble and hawthorn *Scrub (WS1)* and willow trees.

Given the inadequate water depth, undefined channel and bank structure, unconsolidated channel substrate, heavy degree of siltation and ongoing disturbance and modification to the watercourse, survey site provided negligible fisheries value. The bedrock-dominant, steep gradient profile of the watercourse throughout the wider landscape may preclude migration of fish species.

Given the highly modified nature of the watercourse in the immediate vicinity of the ford crossing, and the steep gradient, bedrock cascade-step-pool nature of the stream in the wider landscape, it is unlikely that Otter use this stretch of watercourse for commuting or foraging in any significant manner.

Kick-sampling was carried out in areas of extremely shallow–negligibly wetted riffle and one area of impounded, heavily silted standing water. Biological water quality based on Q-sampling was calculated as **Q3 –Poor**, on the basis of absent Group A, B, D and E taxa. 'Pollution Tolerant' Group C were represented by a single, poorly represented taxon *(Gammarus sp.).* Results of the kick-sample are summarised in Table 4-14.

Table 4-14. Results of kick-sampling at survey location WF 6.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Gammarus sp.*	10
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-7. A representative photo of the upstream Survey Extent of Survey site WF 6

Plate 4-8. A representative photo of the downstream Survey Extent of Survey site WF 6

4.1.1.7 WF Survey Site 7 (WF 7) / Grid Connection Route Survey Site 1 (GC1)

Survey site WF 7 was located on the Scarrough (16) watercourse (EPA code: 16S38, Grid Reference: R 93952 48485), at Sacrrough Bridge. This survey site in the vicinity of the Proposed Wind Farm overlaps with the first underground cabling location for the Proposed Grid Connection. Survey Locations Properties of the watercourse at this survey location are provided in below Table 4-15 and representative photographs of the survey locations are shown in Plate 4-9 and Plate 4-11.

Table 4-15. Properties of the watercourse at survey location WF 7.

Properties	Record
Average Depth (m)	0.05–0.7
Average Bank Width (m)	2.5
Wet Width (m)	2
Flow	Slow
Colouration	Highly brown colouration
Clarity	Highly turbid, sediment laden
Average bank height (m)	LHB 0.8 RHB 1
Dominant Substrates	Cobble (>32–128mm): 60% Gravel (8-32mm): 10% Sand (0.25–2mm): 5% Silt (<0.25mm): 25%
Substratum Condition	Highly compacted

This stretch of *Eroding/Upland River (FW1)* was heavily sediment laden, exhibiting a high degree of turbidity and an opaque brown colouration, likely as a result of instream disturbance further upstream.

Survey site WF 7 was visited on both the 11th and 12th July 2024 to assess whether high levels of turbidity and suspended fine sediments would dissipate. However, the watercourse exhibited the same opaque, brown colouration on both days. This survey site was not electrofished due to decreased effectiveness of electrofishing as a result of a high level of suspended particles, reduced visibility and increased risk of stress and injury to fish. An unmapped secondary watercourse fed into the Scarrough river from the left-hand bank, which provided a small area of improved water clarity in the immediate downstream vicinity of the confluence.

The watercourse profile was predominantly composed of compacted cobble channel substrate and riffle flow over a gentle gradient, transitioning to slow flowing, partially impounded flow beneath a single span stone arch bridge (classified as *Stone walls and other stonework, BL1).* There was significant sediment deposition under the bridge, with an extensive marginal sediment bar opposite pools of standing along the right side of the channel.

Downstream of the bridge, the watercourse was frequently traversed by livestock, with heavily poached banks and channel substrate disturbance resulting in a high degree of sedimentation. Livestock were present in the watercourse at the time of survey. Much of the earthen left-hand bank was heavily eroded, which transitioned into exposed cobble outcrops. Bank faces were frequently undercut. With the exception of livestock poaching, cattle access to the channel and the single-span stone arch bridge (which made up a section of the banks), no other channel or bank modifications were known.

Riparian vegetation consisted of a variety of herbaceous and shrub species, including bramble, bush vetch, cleaver *(Galium aparine),* cow parsley *(Anthriscus sylvestris),* creeping buttercup *(Ranunculus repens),* crested dog's-tail (Cynosurus cristatus), gorse *(Ulex europaeus),* hedge bindweed *(Calystegia sepium),* herb robert *(Geranium robertianum),* ivy, marsh stitchwort *(Stellaria palustris),* nettle *(Urtica dioica),* ragwort *(Jacobaea vulgaris),* soft rush *(Juncus effusus),* wild angelica *(Angelica sylvestris),* wood speedwell *(Veronica montana),* yellow pimpernel *(Lysimachia nemorum),* yorkshire fog *(Holcus lanatus),* sweet vernal grass *(Anthoxanthum odoratum)* and perennial rye grass *(Lolium perenne).*

Habitats extending from the right and left banks consisted of bramble and hawthorn *Scrub (WS1)* and *Improved agricultural grassland (GA1)*, respectively.

The First and Third Schedule invasive species giant hogweed *(Heracleum mantegazzianum)* was observed along the road adjacent to WF 7 / GC 1.

The upstream survey extent was heavily shaded by overhanging grey willow *(Salix cinerea)* and hazel *(Corylus avellana)*, with sparse tree coverage as the channel widened out to points of historic livestock access. Instream macrophyte growth was not visible, although patches of sewage fungus and filamentous green algae were evident, particularly under the bridge structure.

The highly turbid, sediment laden nature of the watercourse at the time of survey precluded assessment of the fisheries habitat present at survey site WF 7 / GC 1. While the heavy degree of sedimentation itself limits suitable fisheries habitat, the coarse and compacted nature of channel substrate and frequent instream livestock disturbance provides negligible spawning habitat for salmonid or lamprey *spp.* fish. Holding pools were largely absent from the watercourse, with the exception of the small area of standing water at Scarrough Bridge.

Habitat degradation and stress associated with a high level of suspended fine sediment particles likely limits fisheries potential for all fish species. Although undercut banks, overhanging vegetation and cobble/boulder outcrops provided marginal and instream refugia, nursery habitat for salmonid fish and refugia for European eel are limited by barriers to migration in the form of livestock crossing points. Stable sand/silt beds suitable for lamprey ammocete habitat were absent from the watercourse.

No otter signs were observed in the vicinity of survey site WF 7. With the exception of the high level of turbidity at the time of survey, this watercourse likely provides moderate commuting and feeding habitat for otter.

The Q rating assigned to survey location WF 7 was **Q3–4 –Moderate**, on the basis that a single Group A 'Very Pollution Tolerant' taxon was present in low numbers, with 'Pollution Tolerant' Group C being the dominant taxa in the sample (90% of the sample). Group D 'Very Pollution Tolerant' and Group E 'Most Pollution Tolerant' taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-16.

Table 4-16 Results of kick-sampling at survey location WF 7

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus sp.*	2
Group B – Moderately Pollution Sensitive	*Leuctra sp.*	2
Group C – Pollution Tolerant	*Baetis rhodani*	10
	Dicranota sp.	1
	Elmidae	10
	Gammarus sp.	10
	Seratella ignita	5
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-9. A representative photo of survey site WF 7 on 11.07.2024

Plate 4-10. Giant hogweed (Heracleum mantegazzianum) present along the road adjacent to survey site WF 7 / GC 1

Plate 4-11. A representative photo of survey site WF 7 on 12.07.2024

4.1.1.8 WF Survey Site 8 (WF 8)

Survey site WF 8 was located on the Lackenacoombe (16) watercourse (EPA code: 16L73, Grid Reference: R 92700 48462). Properties of the watercourse at this survey location are provided in below Table 4-17 and representative photographs of the survey location are shown in Plate 4-12, Plate 4-13 and Plate 4-14.

Table 4-17. Properties of the watercourse at survey location WF 8.

Properties	Record			
Average Depth (m)	0.01–0.8			
Average Bank Width (m)	4.5			
Wet Width (m)	4			
Flow	Moderate			
Colouration	Slightly brown colouration			
Clarity	Clear when undisturbed			
Average bank height (m)	LHB	0.4	RHB	0.3–0.6
Dominant Substrates	Boulder (>128mm): 30% Cobble (>32–128mm): 40% Gravel (8-32mm): 20% Silt (<0.25mm): 10%			
Substratum Condition	Semi-compacted			

The profile of this section of the Lackenacoombe was consistent with that of an *Eroding/Upland River (FW1)* with coarse, semi-compacted cobble/boulder dominant substrate and repeating pool-riffle-glide complexes over a slight gradient. Water velocity was moderate, with areas of slower, backwater flow

directly upstream and downstream of a 2-span concrete bridge and associated concrete bridge apron (classified as *Buildings and artificial surfaces, BL3)*, with resulting deposition of silt and sand in the vicinity of the bridge abutment and apron. The watercourse passed through the right-hand bridge span only, with consolidated deposits of gravel extending from the left- hand bank. Bank reinforcement in the form of a concrete retaining wall extended from the upstream and downstream sides of the bridge. With the exception of undercut banks and bare earth bank faces from natural erosional processes, additional channel and bank modifications were not visible.

Instream macrophytes were absent from this stretch of watercourse. Bank face and top vegetation was uniform and sparse downstream of the bridge, largely consistent with the surrounding *Improved agricultural grassland (GA1)* habitat and included Soft Rush, Ragwort, White Clover and Yorkshire Fog. No significant vegetative riparian buffer existed between pastural fields and the watercourse at this point Contrastingly, Elder *(Sambucus nigra)* and Willow (*Salix sp.) Treelines (WL2)* and Gorse and Bramble *Scrub (WS1)* lining the upstream survey extent provided a dense buffer between surrounding habitat, as well as shading to the channel margins.

At more naturally sinuous sections of the river profile, slower flow and deposition of instream and marginal cobble/gravel bars were observed. Water had a slightly brown colouration and was clear when undisturbed. Layers of silt overlying channel substrate cleared relatively quickly when disturbed under foot. Sewage fungus was occasionally present at the channel margins, downstream of the bridge.

Gravel and cobble substrate of suitable size were limited in terms of salmonid and lamprey spawning suitability due to their compacted nature and overlying siltation. Pool-riffle-glide sequences and diverse substrate structure created a variety of flow types and instream refugia, providing good salmonid nursery. Deeper pools, particularly along slower flowing meanders and undercut banks, provided good salmonid holding habitat, while overhanging vegetation and tree bows and interstitial spaces between larger boulder substrate provided good localised European eel habitat.

A 10-minute semi-quantitative electrofishing survey was conducted at this survey location. Atlantic salmon, Brown trout and Stone loach were caught during the survey. 11 additional salmonid fish were observed but not caught during electrofishing. Results of the 10-minute semi-quantitative electrofishing survey conducted at this survey site are presented in Table 4-18.

Table 4-18.Electrofishing results at survey location WF 8

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	6.2
Atlantic salmon *(Salmo salar)*	6.5
Atlantic salmon *(Salmo salar)*	6
Atlantic salmon *(Salmo salar)*	10.5
Atlantic salmon *(Salmo salar)*	11.5
Atlantic salmon *(Salmo salar)*	11.9
Atlantic salmon *(Salmo salar)*	11.5
Atlantic salmon *(Salmo salar)*	12.5
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	5
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	5
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	7
Brown Trout (*Salmo trutta*)	5
Brown Trout (*Salmo trutta*)	5.5

Brown Trout (*Salmo trutta*)	5.2
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	5.1
Brown Trout (*Salmo trutta*)	9.7
Brown Trout (*Salmo trutta*)	10.4
Brown Trout (*Salmo trutta*)	11
Stone Loach *(Barbatula barbatula)*	10

No otter signs were found in the vicinity of survey site WF 8. However, this stretch of watercourse provided excellent commuting and foraging habitat.

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q4 –Good**, on the basis of at least one Group A taxon being present in reasonable numbers proportionate to reasonable numbers of 'Moderately Pollution Tolerant' Group B taxa (~32% of the sample), and dominant Group C 'Pollution Tolerant' taxa (~59% of the sample). Results of the kick-sample are summarised in Table 4-19.

Table 4-19. Results of kick-sampling at survey location WF 8

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus*	3
	Rhithrogena sp.	2
Group B – Moderately Pollution Sensitive	*Glossomatidae*	15
	Leuctra sp.	3
Group C – Pollution Tolerant	*Baetis rhodani*	12
	Elmidae	1
	Gammarus sp.	9
	Polycentropodidae	1
	Rhyacophila sp.	1
	Serratella ignita	6
	Simuliidae	2
	Tipulidae	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-12. A representative photo of the downstream extent of survey site WF 8.

Plate 4-13. A representative photo of the upstream extent of survey site WF 8.

Plate 4-14. A representative photo of the bridge at survey site WF 8.

4.1.1.9 WF Survey Site 9 (WF 9)

Survey site WF 9 was located on a section of the Multeen River *(Eroding/Upland River (FW1))* (EPA code: 16M02, Grid Reference: R 92020 50744). Properties of the watercourse at this survey location are provided in below Table 4-20 and a representative photograph of the survey location is shown in Plate 4-15.

Table 4-20. Properties of the watercourse at survey location WF 9.

Properties	Record			
Average Depth (m)	0.2–0.9			
Average Bank Width (m)	3			
Wet Width (m)	2.7			
Flow	Fast			
Colouration	No distinct colouration			
Clarity	Very clear			
Average bank height (m)	LHB	0.3	RHB	1–1.2
Dominant Substrates	Bedrock: 5% Boulder (>128mm): 20% Cobble (>32–128mm): 45% Gravel (8-32mm): 20% Sand (0.25–2mm): 5% Silt (<0.25mm): 5%			
Substratum Condition	Semi-compacted			

Plate 4-15. A representative image of survey site WF 9

This fast-flowing section of watercourse exhibited high clarity water with no distinct colouration. Channel substrate was composed predominantly of clean cobble and gravel substrate, with some finer interstitial gravels. The channel itself was asymmetrical, with a gently sloping left bank and a steeper, concave right bank, particularly along the river meander upstream of the 2-span stone arched bridge (classified as *Stone walls and other stonework, BL1)*. The river profile was composed of repeating pool-riffle-glide sequences and was diverted entirely through the right-hand bridge span.

Bank modifications included historic poaching and rock armour installation along the left and right banks respectively, with areas of undercut bank face at both sides. The river appeared to follow it's natural course, with no known channel modifications.

Habitats extending from the left and right banks consisted of *Improved agricultural grassland (GA1)* and bramble and bracken *Scrub (WS1)* transitioning into *Conifer plantation (WD4).* Occasional standalone ash, hazel, hawthorn and rowan trees provided adequate shading along the left bank, with isolated willow *(Salix spp.)* trees along the right-hand river margin. No defined riparian buffer existed along the left-hand bank, with short herbaceous vegetation, including nettle, dock *(Rumex sp.)*, creeping buttercup, herb robert, meadowsweet and giant hogweed (which had been cut).

Abundant mats of water-crowfoot, combined with undercut banks, overhanging vegetation and a variety of substrate structure and associated flow patterns provided excellent instream refugia for juvenile salmonid fish. While substrata were clean and well aerated with swift flow, substrate particles were predominantly coarse and semi-compacted, providing only small, localised areas of sufficiently sized salmonid or lamprey spawning gravels. Structured marginal silt beds adjacent to undercut banks and overhanging vegetation created good, localised lamprey ammocete habitat. However, high velocity, turbulent flow in this stretch of watercourse may preclude lamprey spp. access to these nursery beds.

Deep, marginal scour pools and submerged boulders along the right-hand bank created excellent holding pools used by adult salmonid fish to feed, seek refuge and hold station adjacent to fast flow, while areas of deeper water adjacent to overhanging tree bows provided good habitat for European eel.

A 10-minute semi-quantitative electrofishing survey was conducted at this survey location. Atlantic salmon and Brown trout were caught during the survey. Results of the 10-minute semi-quantitative electrofishing survey conducted at this survey site are presented in Table 4-21.

Table 4-21.Electrofishing results at survey location WF 9

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	5.5
Atlantic salmon *(Salmo salar)*	6.5
Atlantic salmon *(Salmo salar)*	5.4
Atlantic salmon *(Salmo salar)*	4
Atlantic salmon *(Salmo salar)*	10.7
Atlantic salmon *(Salmo salar)*	12.5
Atlantic salmon *(Salmo salar)*	11
Atlantic salmon *(Salmo salar)*	12
Brown Trout (*Salmo trutta*)	6.3
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	7.5
Brown Trout (*Salmo trutta*)	7
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	6.2
Brown Trout (*Salmo trutta*)	4.5
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	7
Brown Trout (*Salmo trutta*)	6.5
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	5.9
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	5
Brown Trout (*Salmo trutta*)	4.5
Brown Trout (*Salmo trutta*)	5
Brown Trout (*Salmo trutta*)	12.5
Brown Trout (*Salmo trutta*)	10.5
Brown Trout (*Salmo trutta*)	12
Brown Trout (*Salmo trutta*)	11.9
Brown Trout (*Salmo trutta*)	13.5
Brown Trout (*Salmo trutta*)	14.3
Brown Trout (*Salmo trutta*)	12.5
Brown Trout (*Salmo trutta*)	8.4
Brown Trout (*Salmo trutta*)	14.5
Brown Trout (*Salmo trutta*)	15
Brown Trout (*Salmo trutta*)	18
Brown Trout (*Salmo trutta*)	10.5
Brown Trout (*Salmo trutta*)	12
Brown Trout (*Salmo trutta*)	17.2
Brown Trout (*Salmo trutta*)	16.3
Brown Trout (*Salmo trutta*)	11.5
Brown Trout (*Salmo trutta*)	12.5
Brown Trout (*Salmo trutta*)	11.3
Brown Trout (*Salmo trutta*)	11
Brown Trout (*Salmo trutta*)	11.5
Brown Trout (*Salmo trutta*)	11.5
Brown Trout (*Salmo trutta*)	9.5

No otter signs were found in the vicinity of survey site WF 9. However, this stretch of watercourse provided excellent commuting and foraging habitat, with a high degree of connectivity to the wider Multeen river.

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3–4 –Moderate**. Although Group A 'Very Pollution Sensitive' taxa were absent, Group B 'Moderately Pollution Sensitive' taxa were well represented in terms of species density and was the most abundant sensitivity group in the sample. Pollution Tolerant Groups D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-22.

Table 4-22. Results of kick-sampling at survey location WF 9

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Glossomatidae*	195
	Sericostomatidae	1
Group C – Pollution Tolerant	*Baetis rhodani*	12
	Chironomidae	2
	Gammarus sp.	4
	Piscicola sp.	1
	Rhyacophila sp.	1
	Serratella ignita	7
	Simuliidae	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.10 WF Survey Site 10 (WF 10)

Survey site WF 10 was located on a section of the Multeen River (EPA code: 16M02, Grid Reference: R 92132 50607), approx. 0.2km downstream from survey site WF 9. Properties of the watercourse at this survey location are provided in Table 4-23 below and representative photographs of the survey location are shown in Plate 4-16 and Plate 4-17.

Table 4-23. Properties of the watercourse at survey location WF 10.

Properties	Record			
Average Depth (m)	0.01–0.6			
Average Bank Width (m)	4–5			
Wet Width (m)	4–5			
Flow	Fast			
Colouration	No distinct colouration			
Clarity	Very clear			
Average bank height (m)	LHB	1.5–2	RHB	0.1–2
Dominant Substrates	Boulder (>128mm): 10% Cobble (>32–128mm): 45% Gravel (8-32mm): 15% Fine gravel (2-8mm): 15% Sand (0.25–2mm): 15%			
Substratum Condition	Loose			

This section of the Multeen river was characterised by moderate flowing glide and loose cobble/gravel dominant channel substrate upstream of a single-span concrete road bridge and associated bridge apron, transitioning into fast-flowing boulder/cobble riffle, with areas of accelerating flow over the artificial step created by the bridge apron. Channel substrate structure and distribution varied throughout the survey stretch, with instream gravel bars and abundant well-structured sand/silt beds at the channel margins in areas of slower flow upstream and downstream of the bridge. Water had no

distinct colouration and was very clear, with plumes of sand/silt clearing quickly when finer sediment beds were disturbed underfoot.

In addition to the bridge and associated apron, channel and bank modifications included areas of heavily poached bank at a point of historic livestock access, with areas of sloping, bare earth bank. The channelised profile of the watercourse downstream of the bridge exhibited evidence of historical straightening and/or embankment. No trees were present along the riverbanks downstream of the bridge, while semi-continuous treelines of Hazel and Willow *Salix spp.)* lined both banks upstream of the bridge. Emergent vegetation included Floating Sweet-grass *(Glyceria fluitans)*, and bank top vegetation included Bush Vetch *(Vicia sepium),* Common Hogweed *(Heracleum sphondylium),* Fox Glove *(Digitalis purpurea),* Gorse *(Ulex europaeus),* Great Willow Herb *(Epilobium hirsutum),* Wild Angelica *(Angelica sylvestris)* and First Schedule and Third Schedule invasive Himalayan Balsam *(Impatiens glandulifera).*

Vegetation throughout *Improved agricultural grassland (GA1)* habitat extending from the right bank included bittercress *(Cardamine sp.),* cocksfoot, dock *(Rumex spp.),* meadow buttercup *(Ranunculus acris),* ragwort, soft rush, white clover *(Trifolium repens)* and yorkshire fog *(Holcus lanatus).* Habitats extending beyond the left bank included gorse and bramble *Scrub (WS1)* and old ash plantation (classified as *WD1 (Mixed) broadleaved woodland).*

Gravel bars composed of clean, mobile substrate in a variety of sizes provided good salmonid and lamprey *spp.* spawning habitat. The range of substrate sizes, coupled with diverse flow patterns and abundant mats of Water-crowfoot provided high-quality almonid nursery habitat. Structured sand and silt beds adjacent to undercut banks and stands of emergent vegetation provided excellent lamprey *spp.* ammocoete habitat. Marginal scour pools with moderate current velocities and instream cover were well connected to the wider watercourse and provided excellent, as well as adequate depth throughout the centre of the channel. These same pools with submerged boulders provided good European eel habitat.

A 10-minute semi-quantitative electrofishing survey was conducted at this survey location. Atlantic salmon and Brown trout were caught during the survey. Results of the 10-minute semi-quantitative electrofishing survey conducted at this survey site are presented in Table 4-24

Table 4-24. Electrofishing results at survey location WF 10

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	10.9
Brown Trout (*Salmo trutta*)	5.7
Brown Trout (*Salmo trutta*)	6
Brown Trout (*Salmo trutta*)	6.5
Brown Trout (*Salmo trutta*)	6.2
Brown Trout (*Salmo trutta*)	6.2
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	6.5
Brown Trout (*Salmo trutta*)	6.1
Brown Trout (*Salmo trutta*)	6.8
Brown Trout (*Salmo trutta*)	5.4
Brown Trout (*Salmo trutta*)	5.3
Brown Trout (*Salmo trutta*)	6.5
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	6.5
Brown Trout (*Salmo trutta*)	30
Brown Trout (*Salmo trutta*)	18
Brown Trout (*Salmo trutta*)	16
Brown Trout (*Salmo trutta*)	20.5
Brown Trout (*Salmo trutta*)	19

Brown Trout (*Salmo trutta*)	19
Brown Trout (*Salmo trutta*)	16
Brown Trout (*Salmo trutta*)	13.5
Brown Trout (*Salmo trutta*)	11
Brown Trout (*Salmo trutta*)	10.7
Brown Trout (*Salmo trutta*)	26
Brown Trout (*Salmo trutta*)	21.2
Brown Trout (*Salmo trutta*)	23.5
Brown Trout (*Salmo trutta*)	18.5
Brown Trout (*Salmo trutta*)	14
Brown Trout (*Salmo trutta*)	11.4
Brown Trout (*Salmo trutta*)	12.6
Brown Trout (*Salmo trutta*)	13
Brown Trout (*Salmo trutta*)	16.1
Brown Trout (*Salmo trutta*)	11.4
Brown Trout (*Salmo trutta*)	11
Brown Trout (*Salmo trutta*)	11.6
Brook Lamprey (*Lampetra planeri*)	10
Brook Lamprey *(Lampetra planeri)*	9
Brook Lamprey *(Lampetra planeri)*	8
Brook Lamprey *(Lampetra planeri)*	6
Brook Lamprey *(Lampetra planeri)*	3
Brook Lamprey *(Lampetra planeri)*	12
Brook Lamprey *(Lampetra planeri)*	13
Brook Lamprey *(Lampetra planeri)*	14
Brook Lamprey *(Lampetra planeri)*	4
Brook Lamprey *(Lampetra planeri)*	5
Brook Lamprey *(Lampetra planeri)*	6
Brook Lamprey *(Lampetra planeri)*	6
Brook Lamprey *(Lampetra planeri)*	6.5

No otter signs were found in the vicinity of survey site WF 10. However, this stretch of watercourse provided excellent commuting and foraging habitat, with a high degree of connectivity to the wider Multeen river.

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3–4 –Moderate**. Group A 'Very Pollution Sensitive' taxa were represented by a single taxon. Group B 'Moderately Pollution Sensitive' taxa were well represented in terms of species density, with Group C 'Pollution Tolerant' *Simuliidae sp.* being the dominant taxa in the sample. Pollution Tolerant Groups D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-25.

Table 4-25. Results of kick-sampling at survey location WF 10

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Rhithrogena sp.*	1
Group B – Moderately Pollution Sensitive	*Glossomatidae sp.*	200
	Sericostomatidae sp.	3
Group C – Pollution Tolerant	*Ancylidae sp.*	6
	Baetis rhodani	50
	Gammarus sp.	20
	Polycentropodidae sp.	1
	Rhyacophila sp.	3
	Serratella ignita	30
	Simuliidae sp.	300

Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-16. A representative photo of the downstream extent of Survey Site WF 10

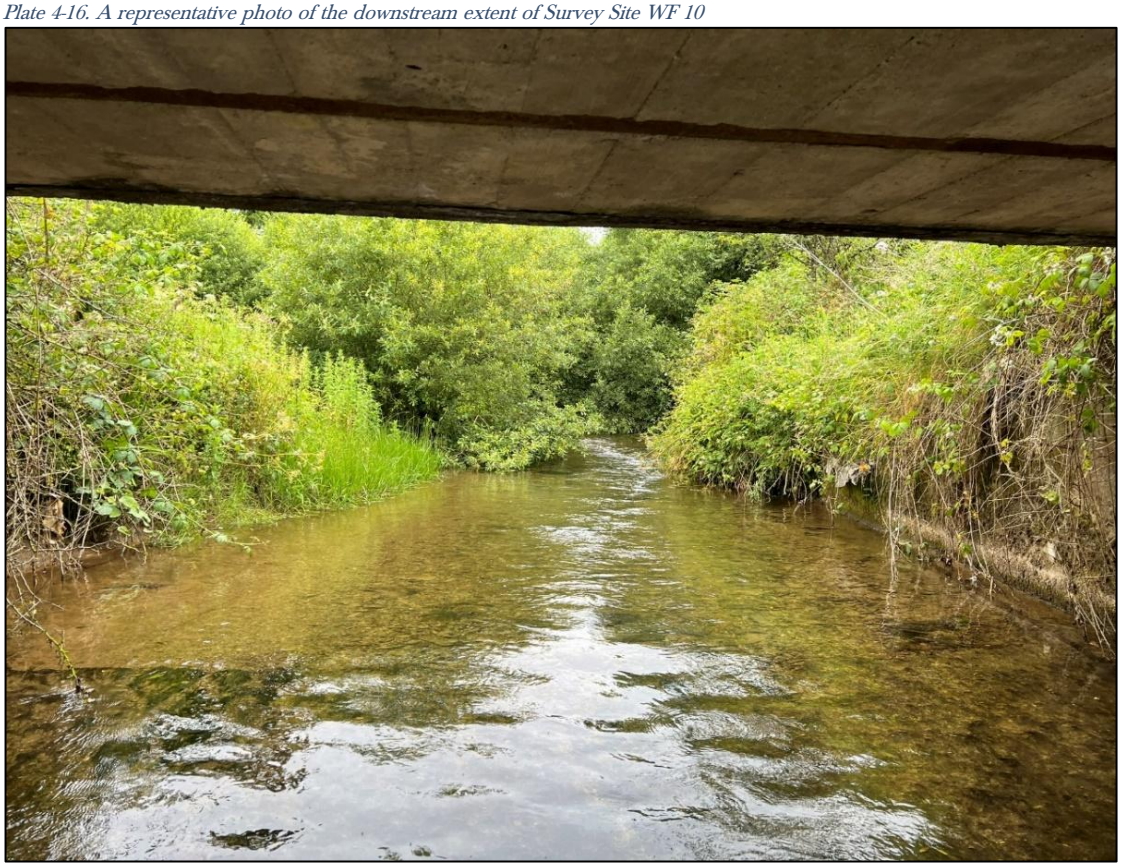

Plate 4-17. A representative photo of the upstream extent of Survey Site WF 10

4.1.1.11 WF Survey Site 11 (WF 11)

Survey site WF 11 was located on a section of the Multeen, an *Eroding/Upland River (FW1)* (EPA code: 16M02, Grid Reference: R 91997 49947). Properties of the watercourse at this survey location are provided in Table 4-26 below and representative photographs of the survey location are shown in Plate 4-18 and Plate 4-19.

Table 4-26. Properties of the watercourse at survey location WF 11.

Properties	Record			
Average Depth (m)	0.3–0.6			
Average Bank Width (m)	4–6			
Wet Width (m)	4			
Flow	Fast			
Colouration	No colouration			
Clarity	Very clear			
Average bank height (m)	LHB	0.2–2	RHB	0.8–2
Dominant Substrates	Boulder (>128mm): 5% Cobble (>32–128mm): 40% Gravel (8-32mm): 20% Fine gravel (2-8mm): 20% Sand (0.25–2mm): 5% Silt (<0.25mm): 10%			
Substratum Condition	Loose			

This stretch of the Multeen was characterised by fast flowing riffle and cobble-dominant channel substrate with interstitial fine gravels. Deposition was evident in areas of slower backwater and wake flow directly upstream and downstream of a 2-span bridge and associated stone bridge apron (classified as *BL3 Buildings and artificial surface*s). The watercourse passed under the left bridge span only, with the right side filled in will vegetated earth.

Earthen banks were steep sided and heavily vegetated, with the exception of areas of extensively eroded and historically poached bank upstream and downstream of the bridge, respectively. There was a moderate degree of sedimentation in the watercourse, likely due to cattle access upstream of the bridge at the time of survey. However, water was clear, with no distinct colouration, and plumes of disturbed finer sediments cleared quickly with swift flows. Exposed cobble/gravel bars were present along much of the left-bank, while the right-bank was frequently undercut.

Bank top vegetation included First Schedule and Third Schedule Invasive giant hogweed (*Heracleum mantegazzianum*), as well as bush vetch, cow parsley (*Anthriscus sylvestris*), dock (*Rumex spp.*), Greater Bird's-foot-trefoil (*Lotus pedunculatus*), hogweed (*Heracleum sphondylium*), Meadow Pea (*Lathyrus pratensis*), Nettle (*Urtica dioica*), montbretia (*Crocosmia × crocosmiiflora*), Spear thistle *(Cirsium vulgare),* Wild Angelica (*Angelica sylvestris*), and Yorkshire Fog (*Holcus lanatus*). Emergent bankside vegetation included dense stands of Great Willow Herb (*Epilobium hirsutum*), Hemlock Water Dropwort (*Oenanthe crocata*), Hedge Bindweed (*Convolvulus sepium*) and Meadowsweet (*Filipendula ulmaria*).

Habitats extending from the left and right banks consisted of Bramble dominant *Scrub (WS1)* and *(Mixed) broadleaved woodland (WD1).* A narrow riparian buffer of bramble and Gorse Scrub lined the right-bank, which extended back in *Improved agricultural grassland (GA1).* With the exception of isolated Willow *(Salix spp.)* trees at the downstream survey extent, much of the remaining channel unshaded.

Accumulations of relatively clean, mobile gravels and swift riffle flow provided good potential salmonid spawning habitat at this survey site, with areas of finer interstitial gravels providing localised moderate lamprey *spp.* Diverse channel substrate and dynamic flow patterns created microhabitats across the

channel, with fast-flowing riffle-glide and cobble substrate in the centre of the channel and slower flowing current at the finer sediment-dominant channel margins suitable for salmonid nursery age fish and lamprey ammocetes, respectively. The stone bridge apron and upstream livestock ford crossing may preclude migration of poorer swimming Lamprey *spp.* Abundant mats of water crow-foot *(Ranunculus sp.)* provided further instream refugia along the survey stretch. Water depth ranged from 0.3–0.6m, with well shaded pools along the right bank provided good, localised salmonid holding. Areas of backwater amongst undercut banks, overhanging vegetation and Willow *(Salix spp.)* tree bows also provided good marginal European eel habitat.

A 10-minute semi-quantitative electrofishing survey was conducted at this survey location. Atlantic salmon, Brown trout, Brook Lamprey and Three-spined stickleback *(Gasterosteus aculeatus)* were caught during the survey. Results of the 10-minute semi-quantitative electrofishing survey conducted at this survey site are presented in Table 4-27.

Table 4-27. Electrofishing results at survey location WF 11.

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	5.5
Atlantic salmon *(Salmo salar)*	6.5
Atlantic salmon *(Salmo salar)*	6
Atlantic salmon *(Salmo salar)*	6.1
Atlantic salmon *(Salmo salar)*	6
Atlantic salmon *(Salmo salar)*	5.4
Atlantic salmon *(Salmo salar)*	13.5
Atlantic salmon *(Salmo salar)*	14
Atlantic salmon *(Salmo salar)*	16.5
Atlantic salmon *(Salmo salar)*	13.5
Atlantic salmon *(Salmo salar)*	14
Atlantic salmon *(Salmo salar)*	14.5
Atlantic salmon *(Salmo salar)*	10.2
Brown Trout (*Salmo trutta*)	3.5
Brown Trout (*Salmo trutta*)	6.7
Brown Trout (*Salmo trutta*)	6.3
Brown Trout (*Salmo trutta*)	6.2
Brown Trout (*Salmo trutta*)	6.7
Brown Trout (*Salmo trutta*)	6.2
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	5.4
Brown Trout (*Salmo trutta*)	5.7
Brown Trout (*Salmo trutta*)	5.4
Brown Trout (*Salmo trutta*)	5.9
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	5.0
Brown Trout (*Salmo trutta*)	5.0
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	4.9
Brown Trout (*Salmo trutta*)	5.0
Brown Trout (*Salmo trutta*)	5.0
Brown Trout (*Salmo trutta*)	4.9
Brown Trout (*Salmo trutta*)	5.3
Brown Trout (*Salmo trutta*)	14.2
Brown Trout (*Salmo trutta*)	19.4
Brown Trout (*Salmo trutta*)	17.0
Brown Trout (*Salmo trutta*)	14.7

Brown Trout (*Salmo trutta*)	25.6
Brown Trout (*Salmo trutta*)	13.0
Brown Trout (*Salmo trutta*)	11.5
Brown Trout (*Salmo trutta*)	16.0
Brown Trout (*Salmo trutta*)	12.0
Brown Trout (*Salmo trutta*)	14.5
Brown Trout (*Salmo trutta*)	15.0
Brown Trout (*Salmo trutta*)	13.5
Brown Trout (*Salmo trutta*)	10.7
Brown Trout (*Salmo trutta*)	11.5
Brown Trout (*Salmo trutta*)	12.5
Three-spined stickleback *(Gasterosteus aculeatus)*	6.3
Brook Lamprey *(Lampetra planeri)*	12
Brook Lamprey *(Lampetra planeri)*	9.3
Brook Lamprey *(Lampetra planeri)*	13
Brook Lamprey *(Lampetra planeri)*	14

No otter signs were found in the vicinity of survey site WF 11. However, this stretch of watercourse provided excellent commuting and foraging habitat, with a high degree of connectivity to the wider Multeen river.

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3–4 –Moderate**. Group A 'Very Pollution Tolerant' was represented by a single individual from one taxon. Several exuviae from late instar stoneflies were also present in the sample. Group B 'Moderately Pollution Sensitive' taxa were most abundant (~66% of the sample) with, high *Glossomatidae sp.* species density. Group C 'Pollution Tolerant' taxa were also well represented in the sample. Pollution Tolerant Groups D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-28.

Table 4-28. Results of kick-sampling at survey location WF 11

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Perla sp.*	1
Group B – Moderately Pollution Sensitive	*Glossomatidae*	270
	Goeridae	7
Group C – Pollution Tolerant	*Baetis rhodani*	30
	Elmidae	6
	Ephemerellidae	18
	Gammarus sp.	26
	Rhyacophila sp.	1
	Simuliidae	60
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-18. A representative photo of Survey Site WF 11.

Plate 4-19.A representative photo of Survey Site WF 11.

4.1.1.12 WF Survey Site 12 (WF 12)

Survey site WF 12 was located on a section of the Multeen, an *Eroding/Upland River (FW1)* (EPA code: 16M02, Grid Reference: R 91321 47852). Properties of the watercourse at this survey location are provided in Table 4-29 below and representative photographs of the survey location are shown in Plate 4-20.

Table 4-29. Properties of the watercourse at survey location WF 12.

Properties	Record			
Average Depth (m)	0.1–0.5			
Average Bank Width (m)	8–10			
Wet Width (m)	8			
Flow	Fast			
Colouration	No colouration			
Clarity	Very clear			
Average bank height (m)	LHB	0.5–1.6	RHB	0.8–1.6
Dominant Substrates	Boulder (>128mm): 15% Cobble (>32–128mm): 55% Gravel (8-32mm): 15% Sand (0.25–2mm): 10% Silt (<0.25mm): 5%			
Substratum Condition	Compacted			

Similar to survey sites WF 9–WF 11, survey site WF 12 was characterised by cobble-dominant channel substrate and swift flow across repeating riffle-glide. Flow was particularly turbulent around boulder outcrops throughout the channel, which featured abundant coverage of the moss *Rhynchostegium riparioides.* Water was very clear, with no distinct colouration and a low degree of sedimentation. While the Multeen River largely follows its natural course at this survey site, the right bank showed evidence of historic resectioning and/or embankment. Additionally, a ford crossing composed of earthen embankment, placed boulder/cobble substrate stretches across the point of confluence of the Lackenacoombe and Multeen Rivers.

Banks heights ranged from low slopes at the upstream survey extent, to steep sided, actively eroded bank faces at the downstream survey extent. Sparse bank face vegetation included Hard fern *(Blechnum spicant),* Goarse, Creeping buttercup, Clover *(Trifolium sp.),* Water figwort *(Scrophularia auriculata)* and Redshank *(Persicaria maculosa).*

Surrounding habitats consisted almost entirely of *Improved agricultural grassland (GA1)*, with little-to-no riparian buffer between the watercourse and pastural fields, with the exception of stands of Great Willow Herb and Meadowsweet and occasional Bramble, Gorse and Nettle *Scrub (WS1).* Bank top vegetation included Meadow buttercup, Yorkshire fog, Dock *(Rumex sp.),* Perennial rye grass and Creeping thistle *(Cirsium arvense),* although overall, riparian buffers between pastural fields and the watercourse were sparse-absent.

Clean, albeit compacted cobble-dominant beds, in combination with a lack of marginal shading, provided, poor-moderate spawning habitat for salmonids. Although water velocity, depth and areas of fast flowing riffle and glide provided suitable river profile conducive with spawning, channel substrate was considered too large and immobile for significant redd formation. Areas of interstitial gravels located between boulders may provide suitably sized gravel beds with swift flow over top. Similar to salmonids, Lamprey *spp.* spawning habitat was assessed as poor-moderate.

In-stream macrophytes were absent from the watercourse. Diverse channel substrate and dynamic flow patterns created areas of stone-based in-stream refuge and provided moderate salmonid nursery habitat across the channel, with lack of riparian shading. Well-structured sand and silt beds along areas of slower, marginal flow at the downstream survey extent provided isolated areas of moderate lamprey

ammocete habitat. However, areas of high velocity broken standing waves/white-water were considered too turbulent for optimal lamprey ammocoete habitat. Water depth ranged from 0.1–0.5m, with interspersed areas of deeper glide toward the centre of the channel, providing moderate-good salmonid holding habitat, particularly around eddy flow created around boulders. The channel was largely unshaded, with exposed earthen banks and a lack of any riparian treelines (with the exception of standalone Ash and Willow species trees) or overhanging vegetation providing negligible marginal refuge. Despite isolated pools of deeper water interspersed through the centre of the channel, high velocity flow and lack of submerged and marginal sheltering features were considered suboptimal for European eel habitat.

No otter signs were found in the vicinity of survey site WF 12. As riparian vegetation and adequate bank margins for feeding were largely absent along the survey stretch, this stretch of the Multeen may be used opportunistically for feeding and commuting, with more suitable habitat upstream and downstream of the survey site.

A 10-minute semi-quantitative electrofishing survey was conducted at this survey location. Atlantic salmon, Brown trout and Brook Lamprey were caught during the survey. Results of the 10-minute semi-quantitative electrofishing survey conducted at this site are presented in Table 4-30.

Table 4-30. Electrofishing results at survey location WF 12.

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	6.0
Atlantic salmon *(Salmo salar)*	6.3
Atlantic salmon *(Salmo salar)*	6.9
Atlantic salmon *(Salmo salar)*	7.0
Atlantic salmon *(Salmo salar)*	6.0
Atlantic salmon *(Salmo salar)*	5.8
Atlantic salmon *(Salmo salar)*	5.7
Atlantic salmon *(Salmo salar)*	12.9
Atlantic salmon *(Salmo salar)*	15.0
Atlantic salmon *(Salmo salar)*	12.0
Atlantic salmon *(Salmo salar)*	13.0
Atlantic salmon *(Salmo salar)*	10.5
Atlantic salmon *(Salmo salar)*	13.5
Atlantic salmon *(Salmo salar)*	11.5
Atlantic salmon *(Salmo salar)*	10.5
Brown Trout (*Salmo trutta*)	7.5
Brown Trout (*Salmo trutta*)	6.5
Brown Trout (*Salmo trutta*)	7.5
Brown Trout (*Salmo trutta*)	5.4
Brown Trout (*Salmo trutta*)	6.5
Brown Trout (*Salmo trutta*)	6.9
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	7.0
Brown Trout (*Salmo trutta*)	7.0
Brown Trout (*Salmo trutta*)	6.7
Brown Trout (*Salmo trutta*)	7.0
Brown Trout (*Salmo trutta*)	6.8
Brown Trout (*Salmo trutta*)	5.6
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	5.7
Brown Trout (*Salmo trutta*)	6.8
Brown Trout (*Salmo trutta*)	7.4
Brown Trout (*Salmo trutta*)	6.0

Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	7.3
Brown Trout (*Salmo trutta*)	5.5
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	6.7
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	5.8
Brown Trout (*Salmo trutta*)	7.0
Brown Trout (*Salmo trutta*)	6.0
Brown Trout (*Salmo trutta*)	15.0
Brown Trout (*Salmo trutta*)	18.0
Brown Trout (*Salmo trutta*)	20.5
Brown Trout (*Salmo trutta*)	14.0
Brown Trout (*Salmo trutta*)	12.5
Brown Trout (*Salmo trutta*)	19.5
Brown Trout (*Salmo trutta*)	22.2
Brown Trout (*Salmo trutta*)	11.9
Brown Trout (*Salmo trutta*)	10.5
Brown Trout (*Salmo trutta*)	10.0
Brook Lamprey (*Lampetra planeri*)	7
Brook Lamprey *(Lampetra planeri)*	7

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q4 –Good**. Group A 'Very Pollution Tolerant' was proportionately well represented, with Group C 'Pollution Tolerant' Taxa being dominant (~85% of the sample). Pollution Tolerant Groups D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-31.

Table 4-31. Results of kick-sampling at survey location WF 12

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Chloroperlidae sp.*	2
	Ecdyonurus sp.	5
Group B – Moderately Pollution Sensitive	*Glossomatidae*	7
Group C – Pollution Tolerant	*Baetis rhodani*	25
	Dicranota sp.	3
	Elmidae	2
	Ephemerellidae	15
	Rhyacophila sp.	1
	Simuliidae	34
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-20. A representative photo of Survey Site WF 12.

4.1.1.13 WF Survey Site 13 (WF 13)

Survey site WF 13 was located on a section of narrow *Eroding/Upland River (FW1)* along the Upper Genough watercourse (EPA code: 16U16, Grid Reference: R 94701 51992). Properties of the watercourse at this survey location are provided in below Table 4-32 and representative photographs of the survey location are shown in Plate 4-21 and Plate 4-22

Table 4-32. Properties of the watercourse at survey location WF 13.

Properties	Record
Average Depth (m)	0.03–0.05
Average Bank Width (m)	0.6
Wet Width (m)	0.4–0.5
Flow	Fast
Colouration	Slightly brown colouration
Clarity	Clear
Average bank height (m)	LHB 0.1 RHB 0.1
Dominant Substrates	Bedrock: 20% Cobble (>32–128mm): 10% Gravel (8-32mm): 25% Fine gravel (2-8mm): 25% Sand (0.25-2mm): 10% Silt (<0.25mm): 10%
Substratum Condition	Highly compacted bedrock

This stretch of headwater stream was characterised by gravel substrates atop bedrock, with shallow riffle flow types. The watercourse was in low flow at the time of survey, with slightly brown colouration and clear when undisturbed. The stream profile at the upstream extent consisted of a shallow bedrock pool and step, transitioning into shallow riffle. The left-bank top was heavily poached with livestock fencing spanning the watercourse, with a moderate degree of siltation likely arising from this actively eroded bank.

Instream macrophytes were absent from this stretch of watercourse, with emergent brooklime (*Veronica beccabunga*) at the channel margins. Vegetation atop low, sloping clay and cobble-gravel banks

included Bramble *(Rubus fructicosus agg.),* bush vetch (*Vicia sepium*), Creeping Buttercup (*Ranunculus repens*), foxglove (*Digitalis purpurea*), Meadow Buttercup (*Ranunculus acris*), Ragged Robin (*Silene flos-cuculi*), Ragwort (*Jacobaea vulgaris*), Red Clover (*Trifolium pratense*), Self-heal (*Prunella vulgaris*), Spear Thistle (*Cirsium vulgare*) and Wild angelica *(Angelica sylvestris).*

Species-poor mosaic *Improved Agricultural Grassland (GA1)* and *Dry Calcareous and Neutral Grassland (GS1)* extended beyond the left-hand bank, and included Crested Dog's-tail (*Cynosurus cristatus*), Jointed Rush (*Juncus articulatus*), Soft Rush (*Juncus effusus*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Willowherb (*Epilobium sp.*), and Yorkshire Fog (*Holcus lanatus*).

Shallow water with a lack of any instream cover provided negligible fisheries value. The steep gradient and bedrock profile of the watercourse throughout the wider area further limits fisheries value, and in combination with the under-road, steep incline culvert, is likely inaccessible to upward migrating fish.

No otter signs were found in the vicinity of survey site WF 13. The upland, steep gradient topography of the watercourse in this area likely limits otter commuting and foraging habitat. No fish were recorded via 5-minute semi-quantitative electrofishing survey at site WF 13.

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q2–3–Poor**, given the absence of both 'Very' and 'Moderately Pollution Sensitive' Groups A and B. Group C 'Pollution Tolerant' taxa represented the only group in the sample. Results of the kick-sample are summarised in Table 4-33.

Table 4-33. Results of kick-sampling at survey location WF 13.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	5
	Gammarus sp.	4
	Simuliidae	3
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-21. A representative photo of Survey Site WF 13.

Plate 4-22. A representative photo of livestock poaching at Survey Site WF 13.

4.1.1.14 WF Survey Site 14 (WF 14)

Survey site WF 14 was located on the Upper Genough watercourse, a section of *Eroding/Upland River (FW1)* (EPA code: 16U16, Grid Reference: R 95840 51775). Properties of the watercourse at this survey location are provided in below Table 4-34, and a representative picture of the survey site is shown in Plate 4-23.

Table 4-34. Properties of the watercourse at survey location WF 14

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	1.8			
Average Wetted Width (m)	1.3			
Flow	Moderate			
Colouration	Slightly yellow colouration			
Clarity	Very clear			
Average bank height (m)	LHB	0.4–0.8	RHB	0.4–0.8
Dominant Substrates	Boulder (>128mm): 5% Cobble (>32–128mm): 30% Gravel (8-32mm): 30% Fine gravel (2-8mm): 25% Sand (0.25–2mm): 10%			
Substratum Condition	Semi-compacted cobbles, loose gravels			

Survey site WF 14 represented by a section of 3rd order *Eroding/Upland River (FW1)* located within an area of *Riparian woodland (WN5)* dominated by willow *(Salix spp.)* and hawthorn. Ground flora throughout the surrounding habitat included bramble, bracken, creeping buttercup, false oat grass, garden heliotrope, great woodrush, herb robert (*Geranium robertianum*), hogweed, ivy, montbretia, opposite-leaved saxifrage, wild angelica and wood speedwell. Canopy cover provided by the *Riparian woodland (WN5)* habitat provided a combination of continuous shading and dappled light to the watercourse.

Water was very clear when undisturbed, with slightly yellow water colouration. Channel bed substrate consisted of loose gravel and fine gravel dominant channel substrates overlain with cobble. The channel profiled sloped to the left, with silt, sand and earth beds along much of the right-hand bank, and exposed root and overhanging tree limb features over occasional pools (approx. 0.4m in depth) along the left-hand bank. Flow patterns along the survey stretch comprised repeating sequences of shallow riffle and glide, with slower marginal flow along prominent undercut features along the left-hand bank.

Loose, relatively clean gravel and cobble substrate was largely unsilted at this survey site and provided *Moderate* spawning habitat for both salmonid and lamprey species, while varied channel substrate, in combination with bankside vegetative cover and under banks, provided *Moderate* salmonid nursery throughout sheltered riffle and glide flow for juvenile salmonids. Semi-continuous fine sediment beds featuring some organic matter provided *Moderate* lamprey ammocoete habitat in areas of slower marginal flow. Water depth was generally prohibitively shallow to provide significant holding habitat for adult salmonids, with the exception of infrequent, localised areas of deeper water along the left-hand bank. Overall European eel habitat was assessed as *Moderate*, with frequent refuge along the banks provided by the exposed root structures, woody debris accumulations and overhanging banks. However, like adult salmonid holding habitat, overall depth was too shallow, with no continuous deeper water required for optimal adult European eel habitat.

No fish were recorded during 5-minute semi-quantitative electrofishing survey conducted at survey site WF 14.

While no otter signs were found in the vicinity of survey site WF 14, multiple mammal tread paths were identified along both riverbanks.

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q4—Good**, given the presence of one Group A 'Very Pollution Sensitive' taxa in reasonable numbers relative to the sample. Group C was the dominant group in the sample, dominated by *Baetis rhodani* and *Gammarus sp.* Results of the kick-sample are summarised in Table 4-35.

Table 4-35. Results of kick-sampling at survey location WF 14.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Rhithrogena sp.*	7
Group B – Moderately Pollution Sensitive	*Leuctra sp.*	2
Group C – Pollution Tolerant	*Baetis rhodani*	9
	Gammarus sp.	9
	Polycentropus sp.	2
	Simuliidae sp.	4
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-23. A representative photo of Survey Site WF 14.

4.1.1.15 WF Survey Site 15 (WF 15)

Survey site WF 15 was located on the Doorish (16) watercourse (EPA code: 16D66, Grid Reference: R 96197 50465). Properties of the watercourse at this survey location are provided below and representative photographs of the survey location are shown in Plate 4-24.

Survey site WF 15 was not electrofished or kick-sampled due to the channel being dry and heavily vegetated with bramble-dominant *Scrub (WS1).* The dry channel was also inaccessible due to high, sheer-sided banks (approx. 3m in height) either side of a ravine, which were also heavily vegetated with bramble, foxglove, Yorkshire fog, false oat-grass, bilberry, bush vetch and honeysuckle, with a

hedgerow of willow *(Salix sp.),* hawthorn and gorse, with intermittent ash and immature rowan trees along the left-hand ban.

Where visible through dense vegetation growth, boulder outcrops were visible through the stretch of dry channel. Surrounding habitat consisted of pastural land classed as *Improved agricultural grassland (GA1)* and *Conifer plantation (WD4).*

At the time of survey, the completely dry stretch of channel at survey site WF 15 offered no suitable fisheries habitat for salmonid spawning, nursery or holding, lamprey spawning or nursery, European eel or any other freshwater fish. This survey site also provided no significant supporting habitat for otter at the time of survey.

Plate 4-24. A representative of the dry, heavily vegetated channel at survey site WF 15

4.1.1.16 WF Survey Site 16 (WF 16)

Survey site WF 16 was located on the Aughnaglanny (16) watercourse (EPA code: 16A05, Grid Reference: R 99026 48422). Properties of the watercourse at this survey location are provided in below Table 4-36 and a representative photograph of the survey location is shown in Plate 4-25.

Table 4-36. Properties of the watercourse at survey location WF 16

Properties	Record			
Average Depth (m)	0.2			
Average Bank Width (m)	3			
Wet Width (m)	2.5			
Flow	Fast			
Colouration	Slightly brown colouration			
Clarity	Clear			
Average bank height (m)	LHB	0.2–1.0	RHB	0.6–1.4
Dominant Substrates	Boulder (>128mm): 5% Cobble (>32–128mm): 40% Gravel (8-32mm): 15% Fine gravel (2-8mm): 15% Sand (0.25–2mm): 20% Silt (<0.25mm): 5%			
Substratum Condition	Loose			

Plate 4-25. A representative photo of survey site WF 16

Survey site WF 16 represented by a section of *Eroding/Upland River (FW1)* characterised by repeating sequences of fast-flowing riffle and glide dominated by loose cobbles and interstitial gravels. Water was clear with a slight brown colouration, with water depth ranging from 0.1m over shallow cobble banks, to deeper pool (up to 0.8m) along the concave bend of meander features along the left-hand bank.

At the upstream survey extent, a single-span arched masonry bridge exhibited deposition of fine gravels, silt and sand, creating an exposed sediment bank along the left-hand bank under and upstream of the bridge. Bank reinforcement and scour protection measures in the form of a concrete wall (classed as *Buildings and artificial surfaces (BL3)*), extended upstream of the bridge along the right-hand bank.

Non-continuous treelines of willow *(salix spp.)* and hawthorn provided occasional, shading to the channel margins, sometimes encroaching into the watercourse at the downstream extent. Mosaic *Scrub (WS1)* and *Dry meadows and grassy verges (GS2)* bankside habitats included the following vegetation, cocksfoot, cinquefoil *(Potentilla spp.),* coltsfoot*(Tussilago farfara)*, common couch (*Elytrigia repens*), creeping buttercup, dock *(Rumex sp.)*, false oat-grass, great willow herb, hedge bindweed, lesser stitchwort (*Stellaria graminea*), meadow buttercup *(Ranunculus acris)*, rosebay willowherb *(Chamerion angustifolium),* white clover *(Trifolium repens),* and Yorkshire fog. The First Schedule and Third Schedule Invasive giant hogweed was also present along the river margins. Habitats extending from both banks consisted of pastural land (classed as *Improved agricultural grassland (GA1),* with historic poaching along the right-hand bank downstream of the bridge.

Cobble and gravel substrate provided *Moderate* spawning habitat for salmonids and lamprey, limited by the semi-compacted state of substrates and the dominance of coarse substrates throughout the channel bed. The variety of channel bed substrate and associated variability of flow patterns provided instream complexity and combined with marginal vegetative refuge, provided *Good* salmonid nursery. The lack of any fine marginal fine sediment beds saw overall *Poor* lamprey ammocoete habitat. Overall adult salmonid holding habitat was classed as *Moderate,* given the intermittent presence of sufficiently deep pools with instream cover between otherwise shallow riffle flows. European eel habitat was similarly *Moderate* in these areas of deeper pool, with encroaching treelines and submerged boulder features providing suitable holding habitat for adult eel.

No otter signs were identified at WF 16 at the time of survey. However, the watercourse at this survey site offered good potential commuting and foraging habitat for otter.

Kick-sampling was carried out in areas cobble/gravel riffle and glide. Biological water quality based on Q-sampling was calculated as **Q4-5–High**, given the presence of two Group A 'Very Pollution Sensitive' taxa in 'common' numbers relative to the rest of the sample. Group C was the dominant group in the sample, dominated by *Simulidae.* 'Very' and 'Most' Pollution Tolerant taxa were absent from the sample. Results of the kick-sample are summarised in Table 4-37.

Table 4-37. Results of kick-sampling at survey location WF 16

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Perla sp.*	6
	Heptagenia sp.	7
	Rhithrogena sp.	1
Group B – Moderately Pollution Sensitive	*Leuctra sp.*	4
Group C – Pollution Tolerant	*Baetis rhodani*	40
	Chironomidae	4
	Diacranota sp.	2
	Elmidae	1
	Gammarus sp.	8
	Rhyacophila sp.	1
	Simuliidae	50
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

A 10-minute semi-quantitative electrofishing survey was conducted at this survey location. Atlantic salmon and Brown trout were caught during the survey. Results of the 10-minute semi-quantitative electrofishing survey conducted at this survey site are presented in Table 4-38.

Table 4-38. Electrofishing results at survey location WF 16

Species	Length (cm)
Atlantic salmon *(Salmo salar)*	7.1
Atlantic salmon *(Salmo salar)*	6.5
Atlantic salmon *(Salmo salar)*	6.3
Atlantic salmon *(Salmo salar)*	6.1

Atlantic salmon *(Salmo salar)*	7.4
Atlantic salmon *(Salmo salar)*	6.2
Atlantic salmon *(Salmo salar)*	12
Atlantic salmon *(Salmo salar)*	10.2
Atlantic salmon *(Salmo salar)*	10.2
Brown Trout *(Salmo trutta)*	7.3
Brown Trout *(Salmo trutta)*	5.5
Brown Trout *(Salmo trutta)*	7.2
Brown Trout *(Salmo trutta)*	7.3
Brown Trout *(Salmo trutta)*	6.7
Brown Trout *(Salmo trutta)*	6.5
Brown Trout *(Salmo trutta)*	7.2
Brown Trout *(Salmo trutta)*	6.5
Brown Trout *(Salmo trutta)*	6
Brown Trout *(Salmo trutta)*	6.9
Brown Trout *(Salmo trutta)*	6.8
Brown Trout *(Salmo trutta)*	5.6
Brown Trout *(Salmo trutta)*	6.8
Brown Trout *(Salmo trutta)*	6
Brown Trout *(Salmo trutta)*	6.8
Brown Trout *(Salmo trutta)*	12
Brown Trout *(Salmo trutta)*	20.6
Brown Trout *(Salmo trutta)*	17.1
Brown Trout *(Salmo trutta)*	28.4
Brown Trout *(Salmo trutta)*	21
Brown Trout *(Salmo trutta)*	18.1
Brown Trout *(Salmo trutta)*	10.6
Brown Trout *(Salmo trutta)*	12.9
Brown Trout *(Salmo trutta)*	11.6
Brown Trout *(Salmo trutta)*	10.1
Brown Trout *(Salmo trutta)*	12.3

4.1.2 Proposed Grid Connection Survey Locations

4.1.2.1 Grid Connection Route Survey Site 2 (GC 2)

Survey site GC 2 was located on an unmapped watercourse (Grid Reference: R 92433 46892) with upstream hydrological connection to the Multeen stream. Properties of the watercourse at this survey location are provided in Table 4-39. Plate 4-26 shows a representative photo of the watercourse at survey site GC 2.

The watercourse at GC 2 represented a narrow, laterally confined stretch of *Eroding/Upland River (FW1)*, with compact, cobble-dominant substrate and no overlying siltation. Flow patterns were predominantly shallow riffle, with a negligibly wetted pipe culvert (Plate 4-27) and under road box culvert (Plate 4-28) at either end of the survey stretch, posing a significant barrier to migration of aquatic species.

The watercourse was located adjacent to a road *(Buildings and artificial surfaces, BL3)* and residential gardens *(Amenity grassland (improved), GA2)*, with a semi-continuous treeline of sycamore *(Acer pseudoplatanus),* lawson cypress *(Chamaecyparis lawsoniana)* and beech *(Fagus sylvatica).*

Bankside vegetation included bramble, common vetch *(Vicia sativa),* cow parsley, creeping buttercup, hard shield fern *(Polystichum aculeatum),* hart's-tongue fern, herb Robert, wild angelc, marsh woundwort *(Stachys palustris),* nettle, soft shield fern *(Polystichum setiferum),* wild angelica, and wood speedwell. Emergent vegetation included brooklime and fool's-water-cress. The non-scheduled invasive species montbretia *(Crocosmia × crocosmiiflora)* and snowberry *(Symphoricarpos albus)* were identified along the watercourse at this survey site.

Table 4-39. Properties of the watercourse at survey location GC 2

Properties	Record			
Average Depth (m)	<0.05			
Average Bank Width (m)	0.5			
Wet Width (m)	0.4			
Flow	Moderate			
Colouration	No apparent colouration			
Clarity	Clear			
Average bank height (m)	LHB	0.3	RHB	0.4
Dominant Substrates	Cobble (>32–128mm): 80% Gravel (8-32mm): 10% Sand (0.25–2mm): 10%			
Substratum Condition	Compacted			

Plate 4-26. A representative photo of survey site GC 2

This shallow, highly modified stretch of watercourse offered overall poor fisheries habitat. The watercourse was largely exposed, with a minimal riparian buffer between the right-hand bank and the adjacent road. Spawning habitat for both salmonid and lamprey species was assessed as poor-negligible, given the compacted, cobble dominant nature of channel substrate, in combination with modification and barrier to migration throughout the wider watercourse.

While shallow riffle dominated this stretch of watercourse, Salmonid nursery habitat was also assessed as poor, given the lack of instream complexity and refuge, with the exception of opportunistic marginal shelter along areas of overhanging bankside vegetation. Lamprey nursery habitat was assessed as poor due to the lack of any fine sediment beds suitable for ammocoete habitat.

Salmonid holding habitat was largely absent from the watercourse, with lack of adequate depth for adult salmonids along the surveyed stretch. European eel habitat was similarly limited by the lack of any continuous deeper glide or pool, along with lack of any significant instream refugia by way of exposed root structures, undercut banks, marginal backwaters or submerged boulder complexes.

No otter signs were identified in the vicinity of GC 2 at the time of survey. Due to the narrow, laterally confined nature of this watercourse adjacent to the active road, the watercourse at GC 2 did not offer any significant suitable commuting or foraging habitat.

Plate 4-27. A representative image of the pipe culvert at survey location GC 2

Plate 4-28. A representative image of the box culvert at survey location GC 2

Kick-sampling was carried out in areas cobble riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3–Poor**, given the absence of Group A and B Pollution Sensitive taxa, as well as the absence of Group D and E 'Very' and 'Most' pollution tolerant taxa. Group C was the sole, dominant group in the sample, dominated by Gammarus sp. Results of the kick-sample are summarised in Table 4-40.

Table 4-40. Results of kick-sampling at survey location GC 2

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Dysticidae*	2
	Gammarus sp.	20
	Lumbriculidae	2
	Lymnaeidae.	1
	Polycentropus sp.	4
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.2 Grid Connection Route Survey Site 3 (GC 3)

Survey site GC 3 was located on the Multeen Stream (EPA code: 16M02, Grid Reference: R 91520 46812). Properties of the watercourse at this survey location are provided in Table 4-41. Plate 4-29 shows a representative photo of the watercourse at survey site GC 3. Due to inaccessibility in the vicinity of the single-span masonry arch bridge along which the grid connection will pass, surveys were conducted approximately 100 m upstream of the bridge.

The watercourse at survey location GC 3 represented a stretch of fast flowing *Eroding/Upland River (FW1)*, featuring semi-compacted cobble dominant substrate across repeating sequences of riffle and glide.

Habitats extending beyond the left- and right-hand banks consisted of *Improved agricultural grassland (GA1)* and a road and wastewater treatment plant classed as *Buildings and artificial surfaces (BL3)*. A sparse riparian buffer consisting of bramble, gorse, bracken and nettle existed atop the left-hand bank, which exhibited undercut features along its length. Marginal and emergent vegetation included watercress *(Nasturtium officinale)* and bur-reed (*Sparganium sp.;* underwater leaves and not in flower). The steeper right-hand bank had a semi-continuous treeline of ash, grey willow and sycamore, which provided marginal shading to the channel margin.

Channel substrate displayed good variability, with boulder features throughout cobbles and interstitial gravels. Fine sediment beds were present along the channel margins, particularly along the sloping right-hand bank. The channel appeared largely unmodified, with the exception of areas of boulder reinforcement along the left-hand bank in areas of active erosion.

Table 4-41. Properties of the watercourse at survey location GC 3

Properties	Record			
Average Depth (m)	0.3			
Average Bank Width (m)	5.0			
Wet Width (m)	5.0			
Flow	Fast			
Colouration	No apparent colouration			
Clarity	Very clear			
Average bank height (m)	LHB	3.0	RHB	4.0
Dominant Substrates	Boulder (>128mm): 20% Cobble (>32–128mm): 40% Gravel (8-32mm): 10% Fine gravel (2-8mm): 10%			

	Sand (0.25–2mm): 10% Silt (<0.25mm): 10%
Substratum Condition	Semi-compacted

Plate 4-29. A representative photo of survey site GC 3

Areas of interstitial gravels throughout well aerated riffle flow provided localised areas of moderate spawning habitat for salmonid and lamprey.

A high variety of channel substrate and associated flow pattern variability, combined with instream and marginal refuge in the way of patches of water crowfoot and marginal vegetative refugia provided good salmonid nursery habitat. Localised marginal silt beds, particularly along the right-hand bank, provided moderate Lamprey nursery habitat. While shallower riffle dominated much of the survey stretch, localised deeper glide and pool in the vicinity of the downstream bridge provided localised salmonid holding habitat assessed as moderate. Exposed root structures and undercut features along the left-hand bank provided moderate European eel habitat, with areas of scour and backwater in the vicinity of the bridge providing further suitable habitat. No otter signs were identified at survey location GC 3.

Kick-sampling was carried out in areas cobble riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3-4 –Moderate**, given the presence of Group A 'Very Pollution Sensitive' taxa in low numbers, the absence of Group B 'Moderately Pollution Sensitive' taxa, with Group C being the dominant group. Group D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-42.

Table 4-42. Results of kick-sampling at survey location GC 3

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus sp.*	1
	Heptagenia sp.	3
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	8
	Gammarus sp.	5
	Hydropsyche sp.	1
	Rhyacophila sp.	3
Group D – Very Pollution Tolerant	-	-

Group E – Most Pollution Tolerant	-	-

4.1.2.3 Grid Connection Route Survey Site 4 (GC 4)

Survey site GC 4 was located along a section of unmapped watercourse upstream of the Multeen stream (Grid Reference: R 91412 46651). Plate 4-30 shows a representative photo of the watercourse at survey site GC 4. The watercourse at GC 4 represented a dry channel (approx. 2 m in width) at the time of survey, with waterlogged earth channel substrate covered with leaf litter and several fallen tree limbs along the channel. An under-road stone culvert was present at the downstream survey extent.

Habitats extending from the channel consisted of *Improved agricultural grassland (GA1),* with a semi-continuous *Treeline (WL2)* of ash and hawthorn. The steep sided left-hand bank and low, sloping right-hand bank were vegetated with an assemblage of common species, including bramble, hart's-tongue fern, ivy and hard shield fern, as well as the non-scheduled invasive species snowberry. Fool's-water-cress was present in sections of waterlogged earth.

Overall fisheries habitat was assessed as negligible for all fish, given the lack of wetted channel or any distinctive watercourse features at the time of survey. If wetted in higher flows, the small under-road culvert may act as a barrier to migration of fish species, as well as limiting the movement of other aquatic species such as otter. Survey location GC 4 offered no significant suitable habitat for otter, and no otter signs were identified at the time of survey. Due to the unwetted nature of the channel, macroinvertebrate kick-sampling could not be conducted.

Plate 4-30. A representative photo of survey site GC 4

4.1.2.4 Grid Connection Route Survey Site 5 (GC 5)

Survey site GC 5 was located on the Cappawhite Stream (EPA code: 25C10, Grid Reference: R 90388 46694). Properties of the watercourse at this survey location are provided in Table 4-43. Plate 4-31 shows a representative photo of the watercourse at survey site GC 5.

The watercourse at survey location GC 5 represented a section of *Eroding/Upland River (FW1)*, dominated by compacted cobble substrates and a thin layer of siltation overtop all channel substrate. Flow patterns consisted primarily of shallow riffle, with exposed cobble banks along the channel at the time of survey. Shallow step features were noted in conjunction with boulder substrate at several points along the watercourse.

The watercourse was largely unmodified, with the exception of reinforcement of the right-hand bank directly upstream of the under-road bridge culvert, as well as undercut features and exposed root structures along sections of earthen bank. A black inflow pipe was noted entering the watercourse from the left-hand bank. Fly tipping was evident along the watercourse from the adjacent road.

The watercourse was heavily shaded by a *Treeline (WL2)* of beech, with encroaching bankside vegetation along the survey stretch, including bramble, ivy, hart's-tongue fern, hard shield fern and hawthorn. Habitats extending beyond the immediate riparian buffer of *Scrub (WS1)* consisted of *Improved agricultural grassland (GA1)* and *Amenity grassland (improved)(GA2).*

Due to the coarse, compacted nature of channel substrate and lack of any significant areas of suitably sized, loose clean gravels, spawning habitat for salmonids and lamprey was assessed as negligible. Localised areas of salmonid nursery habitat were assessed as moderate, with some available refuge amongst sheltered sections of cobble riffle, as well as marginally adjacent to fallen dead wood and throughout natural woody dams created by these trees. Silt beds suitable for lamprey nursery habitat were largely absent from the survey stretch, with superficial overlying fine sediments not of sufficient depth for burrowing ammocoetes. A slight gradient observed along the survey stretch, in combination with the under-road culvert, may also act as a barrier to any lamprey species.

Despite the presence of marginal habitat in the way of overhanging vegetation and exposed root structure, shallow depths along this stretch of watercourse offered no significant suitable habitat for adult European eel. Similarly, lack of any deep continuous glide or holding pools saw an absence of salmonid holding habitat at this survey site.

No otter signs were observed at survey location GC 5, with no significant suitable foraging or commuting habitat offered by the watercourse.

Table 4-43. Properties of the watercourse at survey location GC 5

Properties	Record			
Average Depth (m)	0.05			
Average Bank Width (m)	2.0			
Wet Width (m)	1.4			
Flow	Moderate			
Colouration	No apparent colouration			
Clarity	Very clear			
Average bank height (m)	LHB	0.4	RHB	0.5
Dominant Substrates	Boulder (>128mm): 15% Cobble (>32–128mm): 65% Gravel (8-32mm): 5% Sand (0.25–2mm): 5% Silt (<0.25mm): 10% (overlying substrate)			
Substratum Condition	Compacted			

Plate 4-31. A representative photo of survey site GC 5

Kick-sampling was carried out in areas cobble riffle. Biological water quality based on Q-sampling was calculated as **Q3–Poor**, given the absence of Group A and B Pollution Sensitive taxa, as well as the absence of Group D and E 'Very' and 'Most' pollution tolerant taxa. Group C was the sole, dominant group in the sample, dominated by *Gammarus sp.* Results of the kick-sample are summarised in Table 4-44.

Table 4-44. Results of kick-sampling at survey location GC 5

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	2
	Elmidae	1
	Gammarus sp.	12
	Rhyacophila	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.5 Grid Connection Route Survey Site 6 (GC 6)

Survey site GC 6 was located on the Duminda Stream (EPA code: 25Y16, Grid Reference: R 90388 46694). Properties of the watercourse at this survey location are provided in Table 4-45. Plate 4-32 shows a representative photo of the watercourse at survey site GC 6.

The watercourse at survey location GC 6 represented a straightened, laterally confined stretch of *Eroding/Upland River (FW1)* which was heavily shaded both by a *Treeline (WL2)* of beech and encroaching bankside vegetation, including bracken, sycamore saplings, hawthorn, yellow flag iris (Iris pseudacorus), hart's-tongue fern, soft shield fern, hawthorn, hard shield fern, remote sedge(Carex remota), ivy and abundant trailing bramble Scrub (WS1). Further habitat extending beyond the

immediate treeline and scrub-dominant riparian buffer consisted of a road classed as *Buildings and artificial surfaces (BL3)* and *Amenity grassland (Improved) (GA2).*

Channel substrate consisted primarily of compacted cobbles with interstitials gravels and fine gravels. Silt formed both a fine layer overlying coarser channel substrate and silt beds along the channel margins. Flow patterns consisted of shallow riffle and short sections of glide interspersed between.

In addition to historic straightening of the channel, further modifications included boulder reinforcement along the right-hand bank, as well as an under-road bottomless culvert (Plate 4-33) and pipe culvert (Plate 4-34) at either end of the survey stretch.

Given the compacted nature of channel substrate and the laterally confined, modified nature of the watercourse, spawning habitat for salmonids and lamprey were assessed as negligible. Localised salmonid nursery assessed as poor throughout areas of highly shaded watercourse, with shallowly wetted cobble riffle often limited by the presence of overlying siltation, as well as barriers to migration at either end of the survey stretch. Limited areas of marginal silt beds provided some lamprey nursery habitat, although overall habitat suitability for lamprey ammocoetes was assessed as poor due to the potentially impassable culverts, and periodically unwetted nature of fine sediment beds along the survey stretch.

Despite the present of some marginal habitat complexity in the way of boulder reinforcement at the bank toe and overhanging bankside vegetation, the channel was prohibitively shallow and a lack of any deep glide or pool provided negligible salmonid holding habitat or adult European eel habitat.

No otter signs were observed at GC 6 at the time of survey, and the survey site was assessed as providing poor opportunistic commuting and foraging habitat only.

Table 4-45. Properties of the watercourse at survey location GC 6

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	1.4			
Wet Width (m)	1.0			
Flow	Moderate			
Colouration	No apparent colouration			
Clarity	Clear			
Average bank height (m)	LHB	0.8	RHB	1.2
Dominant Substrates	Boulder (>128mm): 10% Cobble (>32–128mm): 40% Gravel (8-32mm): 15% Fine gravel (2-8mm): 15% Sand (0.25–2mm): 10% Silt (<0.25mm): 15%			
Substratum Condition	Compacted			

Plate 4-32. A representative photo of survey site GC 6

Plate 4-33. A representative image of the under-road culvert at survey location GC 6

Plate 4-34. A representative image of the pipe culvert at survey location GC 6

Kick-sampling was carried out in areas cobble riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3-4 –Moderate**, given the presence of Group A 'Very Pollution Sensitive' taxa in low numbers, the absence of Group B 'Moderately Pollution Sensitive' taxa, with Group C being the dominant group (dominated by *Gammarus sp.)*. Group D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-46.

Table 4-46. Results of kick-sampling at survey location GC 6

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Heptagenia sp.*	1
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	6
	Gammarus sp.	30
	Polycentropus	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.6 Grid Connection Route Survey Site 7 (GC 7)

Survey site GC 7 was located along a section of unmapped watercourse (Grid Reference: R 88546 47021). Plate 4-35 shows a representative photo of the watercourse at survey site GC 7, which was a largely unwetted channel at the time of survey. The banks and channel (approx. 0.7 m wide)exhibited evidence of disturbance in the form of poached bare earth along the left-hand bank, with a culvert located at the upstream survey extent.

No riparian buffer existed between the dry channel and surrounding agricultural landscape *(Improved agricultural grassland, GA1),* with occasional bankside vegetation including gorse, hard shield fern,

bramble, hart's-tongue fern and eared willow *(Salix aurita).* A continuous *Treeline (WL2)* of ash and elm ran along the right-hand bank for much of the survey stretch. Channel bed substrate consisted of loose earth, with waterlogged sections of earth featuring mats of brooklime and water mint.

The watercourse at survey location GC 7 offered negligible fisheries potential for all fish species, given the largely unwetted nature of the channel at the time of survey, with no perceptible flow. Survey location GC 7 offered no significant suitable habitat for otter, and no otter signs were identified at the time of survey. Due to the unwetted nature of the channel, macroinvertebrate kick-sampling could not be conducted.

Plate 4-35. A representative photo of survey site GC 7

4.1.2.7 Grid Connection Route Survey Site 8 (GC 8)

Survey site GC 8 was located a section of unmapped watercourse (Grid Reference: R 88368 47090). Properties of the watercourse at this survey location are provided in Table 4-47.Plate 4-36 shows a representative photo of the watercourse at survey site GC 8, which was largely unwetted at the time of survey, with the exception of a single pool adjacent to an impassable under-road culvert.

The dry channel was tunnelled by a *Treeline (WL2)* of holly (*Ilex aquifolium*), beech, sycamore, grey willow, with vegetation along undefined, sloping banks consisting of bramble, hart's-tongue fern, herb robert, wild angelica, soft shield fern, hedge bindweed, meadowsweet and great willow herb. Habitats extending from the channel consisted of agricultural land and standalone residential housing.

In addition to the channel being unwetted, with a non-functional under-road culvert, the historic left-hand bank also showed evidence of reinforcement in the form of a stone wall *(Stone walls and other stonework, BL1)* and an outflow pipe was identified along the right-hand bank. The channel showed evidence of abundant fly tipping, with corrugated iron strewn across the channel.

The watercourse at survey location GC 8 offered negligible fisheries potential for all fish species, given the largely unwetted nature of the channel with no perceptible flow and impassable collapsed under-road culvert. Survey location GC 8 offered no significant suitable habitat for otter, and no otter signs were identified at the time of survey. Due to the unwetted nature of the channel, macroinvertebrate kick-sampling could not be conducted.

Plate 4-36. A representative photo of survey site GC 8

Table 4-47. Properties of the watercourse at survey location GC 8

Properties	Record				
Average Depth (m)	0.1 (where wetted)				
Average Bank Width (m)	2.0				
Wet Width (m)	1.0 (wetted section)	Flow	No perceptible flow		
Colouration	Slightly brown	Clarity	Turbid		
Average bank height (m)	LHB	0.3	RHB	0.1	
Dominant Substrates	Clay: 100%				
Substratum Condition	Loose				

4.1.2.8 Grid Connection Route Survey Site 9 (GC 9)

Similar to survey locations GC 7 and GC 8, GC 9 was located along a section of unmapped watercourse (Grid Reference: R 87786 47357). Properties of the watercourse at this survey location are provided in Table 4-48. Plate 4-37 shows a representative photo of the watercourse at survey site GC 9.

The watercourse at this survey site represented a section of *Eroding/Upland River (FW1)* with barriers to migration of aquatic species in the form of a raised, shallowly wetted pipe culvert (Plate 4-38) and more passable under-road bottomless stone culvert. In addition to culverting, the channel exhibited modification in the form of livestock poaching and bare earth along the right-hand bank.

The channel represented a narrow stretch of watercourse, which was heavily encroached by bankside vegetation including great willow herb, bramble, nettle, herb robert, soft rush hard shield fern, Yorkshire fog, meadow buttercup and dog rose. A continuous treeline of ash, hazel and hawthorn along the left-hand bank provided good shading to the watercourse upstream of the stone under-road culvert. Habitats extending beyond the *Scrub (WS1)* dominant riparian buffer consisted of pastural agricultural fields.

Contrastingly, downstream of the stone culvert, habitats extending beyond both banks consisted of highly managed residential gardens *(Amenity grassland (Improved), GA2)*, with no riparian buffer between the watercourse and surrounding habitats (Plate 4-39)

Instream and emergent macrophytes in the stretch of watercourse between the pipe culvert and stone under-road culvert included fool's-water-cress, watercress and brooklime, with greater water-moss *(Fontinalis antipyretica)* present on marginal cobbles and boulders.

Channel substrate consisted primarily of compacted cobbles with limited areas of interstitial gravels. Flow patterns were predominantly slow-flowing riffle, with a slow flow area of pool directly downstream of the raised pipe culvert. While siltation was not abundant overtop of coarse channel substrate, silt and sand were the dominant channel substrate type within this area of slow flowing pool.

Table 4-48. Properties of the watercourse at survey location GC 9

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	1.5			
Wet Width (m)	1.2		Flow	Slow
Colouration	None		Clarity	Very clear (when undisturbed)
Average bank height (m)	LHB	0.8	RHB	0-0.5m
Dominant Substrates	Boulder (>128mm): 5% Cobble (>32–128mm): 40% Gravel (8-32mm): 15% Fine gravel (2-8mm): 15% Sand (0.25–2mm): 10% Silt (<0.25mm): 15%			
Substratum Condition	Compacted cobbles and gravels, loose fine sediments downstream of pipe culvert			

Spawning habitat for salmonids and lamprey was assessed as poor, given the shallow and narrow, laterally confined nature of the watercourse, in combination with compacted, coarse channel substrates and significant barriers to fish migration. Areas of shallow riffle with bankside vegetative refuge provided localised, salmonid nursery habitat, albeit similarly limited by barriers to migration and an exposed stretch of watercourse downstream of the under-road culvert.

Fine sediment beds were limited to the immediate downstream vicinity of the raised pipe culvert, providing isolated, poor quality lamprey nursery habitat. Lack of any suitably deep glide or pool saw a lack of salmonid holding habitat. Undercut banks in combination with overhanging vegetation provided some marginal refuge, although utilisation of this habitat by European eel may be limited by overall shallow depth and barriers to migration.

Survey location GC 9 offered only opportunistic commuting habitat for otter, limited by the presence of barriers to migration. No otter signs were identified at the time of survey at GC 9

Plate 4-37. A representative photo of survey site GC 9

Plate 4-38. A representative image of the pipe culvert at the upstream survey extent at GC 9

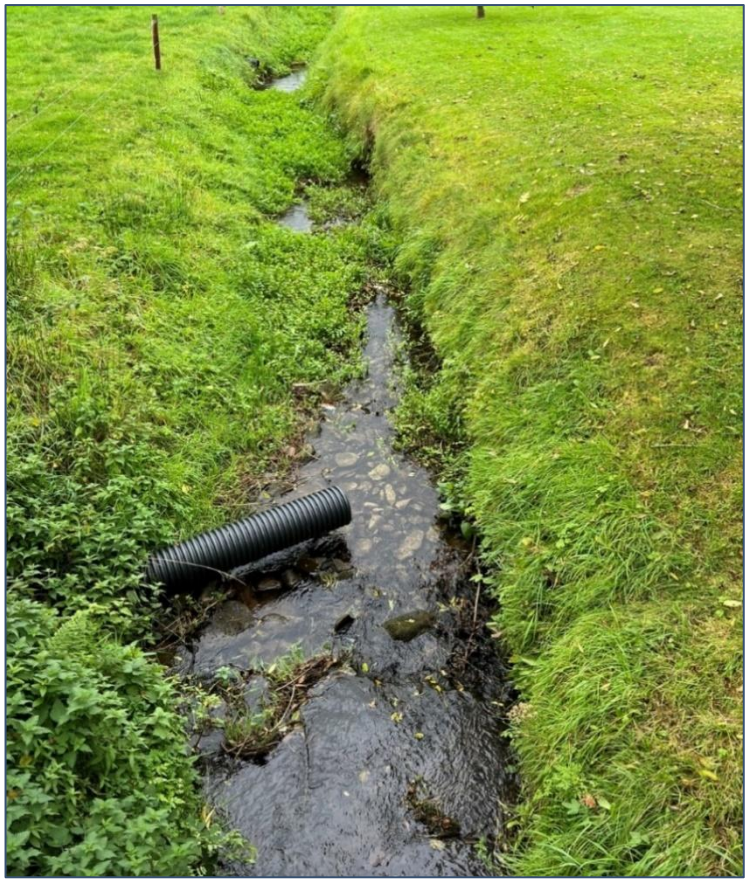

Plate 4-39. A representative image of the downstream survey extent at GC 9

Kick-sampling was carried out in areas cobble riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa. 'Moderately Pollution Sensitive' Group B was represented by a single taxon. Group C was the dominant group. Group D was present in few numbers, while 'Most Pollution tolerant' Group E was represented by a single taxon in low numbers. Results of the kick-sample are summarised in Table 4-49.

Table 4-49. Results of kick-sampling at survey location GC 9

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Glossomatidae*	11
Group C – Pollution Tolerant	*Ancylus fluviatilis*	5
	Chironomidae	3
	Ephermerllidae	1
	Gammarus sp.	20
	Hydracarina	1
	Lymna	1
	Philopotamous sp.	3
	Polycentropus	1
Group D – Very Pollution Tolerant	*Asellus aquaticus*	8
Group E – Most Pollution Tolerant	*Tubificidae*	4

4.1.2.9 Grid Connection Route Survey Site 10 (GC 10)

Survey site GC 10 was located on the Toem Stream (EPA code: 25T05, Grid Reference: R 86718 47511). Properties of the watercourse at this survey location are provided in Table 4-50. Plate 4-40 and Plate 4-41 show a representative photo of the watercourse at survey site GC 10.

The watercourse at GC 10 represented a highly modified section of historically *Eroding/Upland River (FW1).* Upstream of a single-span masonry bridge, the watercourse exhibited signs of significant modification in the way of bank resectioning and dredging. No riparian buffer existed between the watercourse and surrounding agricultural and residential landscapes upstream of the bridge, with dominance of silt and sand substrate along much of this stretch. The watercourse was also heavily vegetated with watercress and brooklime upstream of the bridge, with evidence of livestock poaching along the left-hand bank.

Limited bankside vegetation upstream of the bridge consisted of nettle, creeping buttercup, ivy and hogweed. Bryophyte species present along the stone bridge included crescent-cup liverwort *(Lunularia cruciate)* and redshank *(Ceratodon purpureus).*

Contrastingly, under and downstream of the bridge, channel substrate was composed of a higher proportion of naturally coarse substrates, with unconsolidated built stone throughout. From the upstream to downstream survey extent, flow patterns transitioned from slow, modified flow to more naturalised riffle downstream of the bridge. Woody flood debris and fly tipping were present along the survey stretch.

The watercourse downstream of the bridge exhibited modification in the form of reinforced stone wall, extending along the right-hand bank downstream of the bridge. While the channel was unshaded upstream of the bridge, encroaching willow trees, bramble and cotoneaster *(Cotoneaster sp.)* tunnelled the stretch of watercourse downstream of the bridge.

Table 4-50. Properties of the watercourse at survey location GC 10

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	5.0			
Wet Width (m)	4.0			
Flow	Moderate			
Colouration	No apparent colouration			
Clarity	Clear when undisturbed			
Average bank height (m)	LHB	0-1.0	RHB	1.2
Dominant Substrates	Boulder (>128mm): 5% Cobble (>32–128mm): 15% Gravel (8-32mm): 15% Sand (0.25–2mm): 20% Silt (<0.25mm): 45%			
Substratum Condition	Loose			

As a result of the channel bed modification and fine sediment dominance upstream of the bridge, and compacted nature of coarser substrate under and downstream of the bridge, overall salmonid spawning habitat was assessed as poor. Salmonid nursery habitat was assessed overall as poor, given the modified nature of channel substrate and lack of any suitable instream refuge upstream of the bridge (with the exception of sections of watercourse choked by instream vegetation), and the highly shaded section of watercourse downstream of the bridge. Despite the presence of abundant fine sediment beds upstream of the bridge, fine sediments in this section of watercourse were compacted and disturbed via livestock poaching, with available lamprey nursery habitat assessed as poor.

Lack of suitably deep water saw negligible salmonid holding habitat. Similarly, lack of suitable depth, in combination with instream refuge or channel substrate complexity, saw lack of suitable European eel habitat.

No otter signs were identified at GC 10 at the time of survey. Due to the modified nature of the watercourse, GC 10 offered poor potential commuting and foraging habitat for otter.

Plate 4-40. A representative image of survey location GC 10

Plate 4-41. A representative image of the bridge at survey location GC 10

Kick-sampling was carried out in areas cobble riffle, with sweep netting conducted through instream vegetation upstream of the bridge. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C was the dominant group. 'Very Pollution Tolerant' Group D taxa were absent, while Group E 'Most

Pollution Tolerant' taxa was represented by a single taxon. Results of the kick-sample are summarised in Table 4-51.

Table 4-51. Results of kick-sampling at survey location GC 10

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	1
	Chironomidae	3
	Gammarus sp.	4
	Lymna sp.	3
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	*Chironomus sp.*	1

4.1.2.10 Grid Connection Route Survey Site 11 (GC 11)

Survey site GC 11 was located on the Moher West Stream (EPA code: 225M61, Grid Reference: R 86296 47835). Properties of the watercourse at this survey location are provided in Table 4-52. Plate 4-42 shows a representative photo of the watercourse at survey site GC 11.

The section of watercourse at survey location GC 11 represented a highly modified section of historically *Eroding/upland River (FW1),* with evidence of significant bank resectioning and a collapsed non-functional under-road pipe culvert (Plate 4-43). Banks were also reinforced with concreted directly downstream of the culvert.

Channel substrate was comprised primarily of loose silts with a high proportion of detritus, with occasional patches of fine gravels toward the downstream survey extent. Livestock poaching was evident along the right-hand bank and throughout the watercourse, with slurry present within the watercourse. Plumes of silt were readily disturbed and remained in suspension due to largely imperceptible flow patterns, particularly throughout the pooling of water directly downstream of the raised pipe culvert.

At several locations, the watercourse was heavily vegetated with fool's-water-cress, watercress and brooklime. Where banks did not consist of bare, actively eroding earth, sparse bankside vegetation included Yorkshire fog, false oat-grass, hogweed and curled dock *(Rumex crispus),* with a minimal riparian buffer between surrounding pastural fields extending beyond the right-hand bank. Vegetation along the left-hand bank consisted of bramble, ivy, great willow herb and gorse, with a semi-continuous *Treeline (WL2)* of ash, sycamore, spruce, ivy, elder and hawthorn providing marginal shading to the watercourse.

Table 4-52. Properties of the watercourse at survey location GC 11

Properties	Record			
Average Depth (m)	0.2			
Average Bank Width (m)	2.0			
Wet Width (m)	1.0			
Flow	Very slow			
Colouration	Slightly brown			
Clarity	Highly turbid			
Average bank height (m)	LHB	2.5	RHB	1.5
Dominant Substrates	Fine gravel (2-8mm): 30% Silt (<0.25mm): 70%			
Substratum Condition	Loose			

Plate 4-42. A representative image of survey location GC 11

The watercourse at survey location GC 11 provided negligible habitat for salmonid or lamprey spawning, salmonid nursery or salmonid or European eel holding, due to the highly modified nature of the banks, the lack of natural, clean coarse cobble and gravel substrates, excessive siltation, ongoing livestock poaching within the watercourse channel, and lack of any significant suitable instream or marginal refugia or shading, compounded by the presence of an impassable barrier to migration at the collapsed under-road pipe culvert. While fine sediment was abundant throughout this section of watercourse, silt beds were heavily laden with slurry and other detritus and assessed as unsuitable for lamprey ammocoetes.

No otter signs were identified at GC 11 at the time of survey. Due to the highly modified nature of the watercourse, including the impassable culvert, GC 11 offered poor potential commuting and foraging habitat for otter.

Plate 4-43. A representative image of the non-functional under-road culvert at survey location GC 11

Kick-sampling was carried out in limited areas of fine gravel riffle, with sweep netting conducted through instream vegetation. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C. dominated by *Gammarus sp.,* represented the majority of the sample. 'Very Pollution Tolerant' Group D taxa were absent, while Group E 'Most Pollution Tolerant' taxa was represented by a single taxon. Results of the kick-sample are summarised in Table 4-53.

Table 4-53. Results of kick-sampling at survey location GC 11

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	1
	Chironomidae	3
	Gammarus sp.	18
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	*Chironomus sp.*	3

4.1.2.11 Grid Connection Route Survey Site 12 (GC 12)

Survey site GC 12 was located along a section of unmapped watercourse (Grid Reference: R 85711 48525). Properties of the watercourse at this survey location are provided in Table 4-54. Plate 4-44 shows a representative photo of the watercourse at survey site GC 12.

Table 4-54. Properties of the watercourse at survey location GC 12

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	2.0			
Wet Width (m)	1.4			
Flow	No perceptible flow			
Colouration	Slightly brown			
Clarity	Clear (when undisturbed)			
Average bank height (m)	LHB	0.1-1.0	RHB	0.1-1.0
Dominant Substrates	Silt (<0.25mm): 50% Clay & Earth: 50%			
Substratum Condition	Loose			

The watercourse at GC 12 represented a stretch of modified watercourse, conforming most with closely with *Depositing/Lowland River (FW2).* Channel substrate at this survey site consisted entirely of clay and earth with overlying layer of silt, which were readily disturbed and remained in suspension. No perceptible flow was noted at the watercourse, with sections of negligibly wetted channel. The channel was also choked with dense mats of fool's-water-cress, with abundant common duckweed *(Lemna minor).* Surrounding habitats consisted of *Improved agricultural grassland (GA1)*, with a sparse riparian buffer between the watercourse and wider pastural landscape, with the exception of isolated stretches of gorse and bramble *Scrub (WS1).* The watercourse was largely unshaded, with individual ash trees sporadically along the survey stretch.

Due to imperceptible flow, negligibly wetted sections of watercourse, dense instream vegetation, lack of any natural coarse substrates and ongoing disturbance to the watercourse in the form of livestock poaching, fisheries habitat at this survey site was assessed as negligible for all fish species and life cycle stages, with the exception of opportunistic habitat for Cyprinidae and Gasterosteidae fish such as minnow and three-spined stickleback. This survey site offered no significant suitable otter habitat, with no otter signs observed at GC 12 at the time of survey.

Plate 4-44. A representative image of survey location GC 12

Kick-sampling was carried throughout silt beds, with sweep netting conducted through instream vegetation. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa, as well as the absence of Group D 'Very' and Group E 'Most Pollution Tolerant' species. Group C represented the only group in the sample, with both low species diversity and low abundance of taxa present. Results of the kick-sample are summarised in Table 4-55

Table 4-55. Results of kick-sampling at survey location GC 12

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Gammarus sp.*	6
	Gyrinus sp.	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.12 Grid Connection Route Survey Site 13 (GC 13)

Survey site GC 13 was located on the Cahermahallia River (EPA code: 225M61, Grid Reference: R 85278 49109). Properties of the watercourse at this survey location are provided in Table 4-56. Plate 4-45 and shows a representative photo of the watercourse at survey site GC 13.

Due to the presence of stands of the First and Third Schedule invasive species giant hogweed along the banks at the proposed grid connection crossing, the watercourse was accessed upstream of the 2-span stone arch bridge located along the grid connection route.

The watercourse at survey location GC 13 represented a section of *Eroding/Upland River (FW1)* characterised by fast, broken and white-water water flow across bedrock and boulder steps. The watercourse was heavily shaded by continuous treelines of lawson cypress and sycamore along the survey stretch, with the non-scheduled invasive species cherry laurel *(Prunus laurocerasus)* present abundant along both banks. Bank top vegetation along the surveyed stretch included bracken fern, bramble, hard shield fern, hart's-tongue fern and ivy. Habitats extending beyond the immediate riparian treelines included *Spoil and bare ground (ED2), Recolonising bare ground (ED3),* standalone residential housing classed as *Buildings and artificial surfaces (BL3)* and agricultural fields classed as *Improved agricultural grassland (GA1).*

The river appeared naturally sinuous in profile, with no modifications to the channel with the exception of a partially collapsed wall or weir which extended from the left-hand bank into the river (Plate 4-45) Flow was slightly impounded behind the partial structure classed as *Stone walls and other stonework (BL1),* with accumulation of woody debris around the structure narrowing the flow path of the channel at this section of the watercourse.

Table 4-56. Properties of the watercourse at survey location GC 13

Properties	Record			
Average Depth (m)	0.35			
Average Bank Width (m)	8.0			
Wet Width (m)	6.0			
Flow	Fast-Torrential			
Colouration	Slightly yellow			
Clarity	Very clear			
Average bank height (m)	LHB	2.0	RHB	1.8
Dominant Substrates	Bedrock: 20% Boulder (>128mm): 30% Cobble (>32–128mm): 40% Gravel (8-32mm): 10%			
Substratum Condition	Compacted			

Plate 4-45. A representative image of the upstream extent of survey location GC 13

With the exception of isolated patches of interstitial gravels in areas of slower flow, suitably sized gravel spawning substrate was absent from the surveyed stretch, with spawning habitat for salmonids and lamrpey species assessed as poor across sequential bedrock and boulder step features. The watercourse exhibited high flow diversity across the channel, with areas of faster flowing glide toward the centre of the channel, with areas of more sheltered, moderate velocity flow at the river margins and in eddy flow of cobble and boulder substrate. Areas of instream refuge provided by this flow diversity across varied channel substrate, in combination with marginal sheltering features in the way of undercut banks or woody debris accumulations, provided salmonid nursery habitat assessed as moderate. Due to the absence of any fine sediment beds, marginal or otherwise, in combination with swift and at times cascading flows, provided negligible lamprey nursery habitat. Variable water depth with continuous glide and areas of deeper marginal pool and backwater provided good salmonid holding habitat. Suitable depth, in combination with the instream complexity and refuge provided by exposed root

structures, undercut banks and woody dams, created areas of slower flowing marginal backwater assessed as providing locally good European eel habitat.

No otter signs were identified at the time of survey. However, the watercourse at GC 13 provided good potential commuting and foraging habitat for otter.

Plate 4-46. A representative image of survey location GC 13

Plate 4-47. A representative image of First & Third Schedule invasive species giant hogweed (Heracleum mantegazzianum) found at survey location GC 13

Kick-sampling was carried out in areas cobble, with stone washing of coarser cobble and boulder substrate. Biological water quality based on Q-sampling was calculated as **Q3-4–Moderate**, given the presence of Group A 'Very Pollution Sensitive' taxa in low numbers, the absence of Group B 'Moderately Pollution Sensitive' taxa, with Group C being the dominant group (dominated by Baetis

rhodani). Group D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-57.

Table 4-57. Results of kick-sampling at survey location GC 13

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Dinocras cephalotes*	2
	Heptagenia sp.	3
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	10
	Chironomidae	1
	Dicranota sp.	1
	Gammarus sp.	6
	Hydropsyche sp.	2
	Rhyacophila sp.	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.13 Grid Connection Route Survey Site 14 (GC 14)

Survey site GC 14 was located on the Lisgaugh River (EPA code: 25Q70, Grid Reference: R 84496 49686). At the time of survey, the watercourse at survey location GC 14 represented a completely dry or culverted channel, with no distinct bank or channel features evident. Plate 4-23 shows a representative photo of the survey location at GC 14, located within an agricultural field classed as *Improved agricultural grassland (GA1).* This dry channel offered no significant suitable habitat for otter at the time of survey.

Plate 4-48. A representative image of survey location GC 14

4.1.2.14 Grid Connection Route Survey Site 15 (GC 15)

Survey site GC 15 was located along a section of unmapped watercourse (Grid Reference: R 84333 49902). Properties of the watercourse at this survey location are provided in Table 4-58. Plate 4-50 shows a representative photo of the watercourse at survey site GC 15.

The watercourse at GC 15 represented a narrow, laterally confined section of *Eroding/Upland River (FW1),* running directly adjacent to a stone wall and road, passing under a small stone under-road culvert classed as *Stone walls and other stonework (BL1).* The left-hand bank consisted largely of a hawthorn *Hedgerow (WL1),* with bankside vegetation encroaching into the watercourse at several points including hart's-tongue fern, bramble, ivy, hard shield fern, nettle, polypody *(Polypody sp,)* and herb robert, with the non-scheduled invasive species snowberry. Individual ash trees, in combination with trailing and tunnelled sections of vegetation provided intermittent high shading to the watercourse. No riparian buffer existed between the right-hand bank and road.

Despite the presence of adequately sized gravels and fine gravels, and no apparent degree of siltation overtop channel substrate, the highly modified and at times tunnelled nature of this narrow channel meant that spawning habitat for salmonid and lamprey species was assessed as poor.

Shallow, aerated riffle sequences and small pool-step features provided localised areas of salmonid nursery, with some vegetative instream refuge provided by emergent fool's-water-cress. However, in the context of wider watercourse modification and potential barriers to migration (culvert), potential salmonid nursery habitat was assessed as poor. Isolated areas of shallow, superficial sand beds overtop of cobble and gravel substrate did not provide significant suitable lamprey nursery habitat for ammocoetes. A lack of any suitable deep glide or pool saw a lack of any suitable salmonid holding habitat or habitat for adult European eel.

Given the shallow, modified nature of the watercourse at GC 15, with low fisheries value and a high degree of existing disturbance adjacent to a main road, survey location GC 15 provided poor commuting and foraging habitat for otter.

Table 4-58. Properties of the watercourse at survey location GC 15

Properties	Record			
Average Depth (m)	0.05			
Average Bank Width (m)	0.6			
Wet Width (m)	0.4			
Flow	Moderate			
Colouration	No apparent colouration			
Clarity	Very clear			
Average bank height (m)	LHB	1.0	RHB	0.4
Dominant Substrates	Cobble (>32–128mm): 45% Gravel (8-32mm): 25% Fine gravel (2-8mm): 20% Sand (0.25–2mm): 10%			
Substratum Condition	Loose			

Plate 4-49. A representative image of survey location GC 15

Kick-sampling was carried out in areas of shallow cobble and gravel riffle. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa, and the presence of a single individual from one Group B 'Moderately Pollution Sensitive' taxon. Group C taxa formed the majority of the sample, with *Baetis rhodani* being the dominant species both in Group C and the entire sample. 'Very' and 'Most Pollution Tolerant' Group D and E taxa were absent. Results of the kick-sample are summarised in Table 4-59.

Table 4-59. Results of kick-sampling at survey location GC 15

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Sericostomatidae*	1
Group C – Pollution Tolerant	*Baetis rhodani*	30
	Dicranota sp.	2
	Gammarus sp.	15
	Hydropsyche sp.	3
	Simuliidae	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.15 Grid Connection Route Survey Site 16 (GC 16)

Survey site GC 16 was located on the Doon River (EPA code: 25D03, Grid Reference: R 83006 50348). Properties of the watercourse at this survey location are provided in Table 4-60. Plate 4-50 shows a representative photo of the watercourse at survey site GC 16.

Due to the presence of livestock within and adjacent to the watercourse both upstream and downstream of the bridge crossing, the watercourse was not directly accessible for kick-sampling.

The watercourse at survey location GC 16 represented a narrow stretch of *Eroding/Upland River (FW1)* running adjacent to a field boundary *Treeline (WL2)* composed of hawthorn and sycamore along the left-hand bank, which, in combination with trailing bankside vegetation, provided moderate shading to the watercourse. The right-hand bank was extensively poached at the upstream extent, with no riparian buffer or fencing between the watercourse and pastural field extending beyond the right-hand bank.

Vegetation along the bank tops which may be frequently inundated with water included flag iris, nettle, broad leaved dock and meadow buttercup. Marginal and emergent macrophytes including water figwort *(Scrophularia auriculata),* water mint and mats of fool's-water-cress, which was particularly dense throughout the section of watercourse which ran adjacent to the bridge wall (which formed a short section of the left-hand bank), before passing under it.

Table 4-60. Properties of the watercourse at survey location GC 16

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	2.0			
Wet Width (m)	1.5			
Flow	Moderate			
Colouration	No apparent colouration			
Clarity	Very clear			
Average bank height (m)	LHB	0.6	RHB	0-0.2
Dominant Substrates	Cobble (>32–128mm): 30% Gravel (8-32mm): 40% Fine gravel (2-8mm): 40%			
Substratum Condition	-			

Although gravels and fine gravels were present throughout this watercourse (level of compaction unknown due to watercourse inaccessibility), the narrow, laterally confined nature of this watercourse, with persistent modification in the form of ongoing livestock poaching and bank alteration (stone wall partially forming the left-hand bank) provided poor salmonid spawning habitat. Shallow cobble and gravel riffle, in combination with marginal shelter providing by overhanging vegetation, provided localised moderate salmonid nursery habitat, although systemic barriers to migration throughout the watercourse (under-road culverts, livestock fords and poaching), may limit utilisation of this section of the watercourse by juvenile salmonids.

Lack of any suitable holding pools saw a lack of any significant salmonid holding habitat, with lack of suitable depth similarly restricting potential habitat for European eel (although elvers may opportunistically utilise sheltered cobble and gravel riffle).

In the context of widespread modification and low fisheries value, the watercourse at GC 16 was assessed as providing poor, opportunistic commuting and foraging habitat for otter.

Plate 4-50. A representative image of survey location GC 16

4.1.2.16 Grid Connection Route Survey Site 17 (GC 17)

Survey site GC 17 was located on the Bottle Hill (EPA code: 25B56, Grid Reference: R 82724 50492). Properties of the watercourse at this survey location are provided in Table 4-61. Plate 4-51 shows a representative photo of the watercourse at survey site GC 17.

The watercourse at GC 17 represented a highly modified stretch of historically *Eroding/Upland River (FW1),* with a significant barrier to the migration of aquatic species in the form of a broken box culvert with a raised apron (Plate 4-52). At the time of survey, the culvert was completely unwetted, with a small amount of water passing below the culvert, with insufficient space for fish migration.

Upstream of the culvert, the watercourse represented a stretch of narrow, laterally confined stream, choked with instream vegetation (including water mint and fool's-water-cress) and heavily tunnelled by bankside vegetation, including bramble, ivy, nettle, willowherb *(Epilobium sp.),* hedge bindweed and bracken fern. The First and Third Schedule Invasive species Rhododendron *(Rhododendron ponticum)* was present along the survey stretch.

Moving downstream of the culvert, the watercourse represented a wider, although similarly heavily modified stretch of watercourse. Natural boulder, cobble and gravel substrate was both littered with broken artificial stone and concrete and overlain with silt which, even when undisturbed, remained in suspension as a result of imperceptible flows through the shallowly wetted section of watercourse. In addition to the culvert, channel modifications included channel straightening and bank reinforcement, with a stone wall built along the right-hand bank downstream of the culvert. Areas of earthen bank which exhibited evidence of previous straightening sloped to the river margins, with exposed root structures above well above the water line.

This section of the watercourse was similarly tunnelled by trailing bramble and continuous *Treelines (WL2)* of holly and hawthorn, featuring sycamore and ash trees with ash dieback. Habitats extending beyond the right- and left-hand banks consisted of residential housing *(Buildings and artificial surfaces, BL3)* and gardens *(Ornamental/non-native shrub, WS3)* and *Scrub (WS1)* and *Improved agricultural grassland (GA1),* respectively.

Table 4-61. Properties of the watercourse at survey location GC 17

Properties	Record
Average Depth (m)	0.05
Average Bank Width (m)	1.0 upstream of culvert, 2.5 downstream of culvert
Wet Width (m)	0.6 upstream of culvert, 1.5 downstream of culvert
Flow	Imperceptible
Colouration	Slightly brown
Clarity	Turbid
Average bank height (m)	LHB 0–1.5 RHB 0–1.5
Dominant Substrates	Boulder (>128mm): 15% Cobble (>32–128mm): 40% Gravel (8-32mm): 15% Silt (<0.25mm): 30%
Substratum Condition	Compacted

Due to widespread modification both upstream and downstream of a likely impassable raised culvert, tunnelling of the watercourse, compacted channel substrate with a high degree of fly tipping and artificial placed stone throughout, and a high degree of siltation, salmonid spawning habitat was assessed as poor. Despite the presence of some channel substrate variability, the modified nature of the channel, in combination with lack of any perceptible flows and shallow-negligibly wetted sections of watercourse, salmonid nursery habitat was assessed as poor. Lack of any sufficiently deep glide or pool, with overall lack of continuous wetting of the channel in parts, saw negligible salmonid holding habitat available at this survey site. Similarly for European eel, lack of sufficient depth or instream refuge saw poor potential habitat only.

Given the low fisheries value of this survey site, combined with a high degree of channel and bank modification, habitat for commuting and foraging otter was assessed as poor. No otter signs were identified in the vicinity of survey location GC 17.

Plate 4-51. A representative image of survey location GC 17.

Kick-sampling was carried out in areas of shallow cobble and gravel riffle. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa, Group C taxa were the only group represented in the sample, with poor species diversity and low abundance of species present. Group D and E taxa were absent. Results of the kick-sample are summarised in Table 4-62.

Table 4-62. Results of kick-sampling at survey location GC 17

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Chironomidae*	3
	Elmidae	1
	Gammarus sp.	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

Plate 4-52. A representative image of the raised culvert at survey location GC 17

4.1.2.17 Grid Connection Route Survey Site 18 (GC 18)

GC 18 was located along an unmapped watercourse (Grid Reference: R 82441 50570) which was characterised by a completely dry channel at the time of survey. The survey location at GC 18, shown in Plate 4-53, was located within a pastural field classed as *Improved agricultural grassland (GA1)*, with evidence of livestock poaching and crossing along the historic channel throughout the survey stretch,

Although entirely unwetted at the time of survey, areas of waterlogged or damp soil featured patches of fool's-water-cress growing along poorly defined, low sloping earth banks. Other vegetation adjacent to the historic channel included bramble, gorse and the non-scheduled invasive species snowberry. A standalone ash tree was located at the survey extent nearest to the under-road culvert. This dry channel offered no significant suitable habitat for otter at the time of survey.

Plate 4-53. A representative image of survey location GC 18

4.1.2.18 Grid Connection Route Survey Site 19 (GC 19)

Survey site GC 19 was located on the Ballycoshown (EPA code: 25B45, Grid Reference: R 78345 51341). Properties of the watercourse at this survey location are provided in Table 4-63. Plate 4-54 shows a representative photo of the watercourse at survey site GC 19.

The watercourse at survey location GC 19 represented a highly modified stretch of *Depositing/Lowland River (FW2),* with deep, impounded stretches of stagnant water and channel bed substrate composed entirely of silt, clay, leaf litter and other detritus. Water was brown-grey in colour and highly turbid even when undisturbed, with no visibility of the channel bed. The channel was heavily vegetated with broad-leaved pondweed *(Potamogeton natans),* with fallen woody debris at several points along the channel compounding the stagnant nature of the watercourse.

Channel modifications included historic straightening of the river, potential embankment and a small under-road culvert (Plate 4-55). Earthen embankments were heavily vegetated with bramble dominant *Scrub (WS1)* and also featured hart's-tongue fern, hawthorn, pendulous sedge *(Carex pendula)*, as well as the non-scheduled invasive species snowberry. Habitats extending beyond the banks included *Riparian woodland (WN5)* featuring willow *(Salix spp.)* and oak *(Quercus sp.).*

Table 4-63. Properties of the watercourse at survey location GC 19

Properties	Record			
Average Depth (m)	0.7			
Average Bank Width (m)	2.5			
Wet Width (m)	2.0			
Flow	No perceptible flow			
Colouration	Highly brown/grey			
Clarity	Highly turbid			
Average bank height (m)	LHB	1.0-2.5	RHB	1.0-2.5

Dominant Substrates	Silt (<0.25mm): 50% Clay: 50%
Substratum Condition	Loose

Due to the highly modified nature of the channel, lack of any clean gravel (or any coarse substrates), and lack of any perceptible flow, with the channel being choked with instream macrophyte growth, encroaching bankside vegetation and fallen deadwood, the watercourse offered no significant suitable salmonid or lamprey spawninrg habitat. Silt beds where present, where heavily littered with detritus and anoxic conditions observed at the survey location were not conducive with any suitable lamprey nursery habitat. The absence of any well aerated riffle habitat saw a lack of any suitable salmonid nursery habitat. While water was continuously deep (in excess of 0.6m), the choked, stagnant nature of the watercourse provided poor salmonid holding habitat. Although incidences of woody debris and overhanging vegetation provided some marginal refuge, potential habitat for European eel was also assessed as poor in the context of the highly modified and stagnant conditions at this survey site.

Given the low fisheries value and stagnant water conditions, survey location GC 19 offered little to no suitable otter habitat. No otter signs were identified at survey location GC 19.

Plate 4-54. A representative image of survey location GC 19

Due to the absence of any coarser substrates or suitable riffle flow, sweep netting was conducted throughout vegetation and silts at the watercourse at GC 19. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. 'Pollution tolerant' Group C were represented by a single taxon *(Gammarus sp.),* as was 'Very Pollution Tolerant' Group D, with *Asellus aquaticus* dominating the sample. Group E taxa was absent. Results of the kick-sample are summarised in Table 4-64.

Plate 4-55. A representative image of the bottomless concrete culvert at survey location GC 19

Table 4-64. Results of kick-sampling and sweep netting at survey location GC 19

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Gammarus sp.*	15
Group D – Very Pollution Tolerant	*Asellus aquaticus*	30
Group E – Most Pollution Tolerant	-	-

4.1.2.19 Grid Connection Route Survey Site 20 (GC 20)

Survey site GC 20 was located on the Ballycoshown (EPA code: 25B45, Grid Reference: R 79380 51175). Properties of the survey location are provided in Table 4-65. Plate 4-56Plate 4-54 shows a representative photo of the watercourse at survey site GC 20.

At the time of survey, survey location GC 20 represented a largely dry channel, with sections of waterlogged soil vegetated with greater pond sedge *(Carex riparia)* and bulrush *(Typha latifolia)* and water horsetail *(Equisetum fluviatile)* Other drier sections of the channel between the two distinct banks were vegetated with wild angelica, creeping buttercup, great willowherb, curled dock. Bramble-dominant *Scrub (WS1),* willow *(Salix spp.)* riparian woodland and *Improved agricultural grassland (GA1)* were the dominant habitats extending from both banks. A semi-continuous *Treeline (WL2)* of grey willow, hawthorn, blackthorn and ash with ivy provided moderate shading to the dry channel. While the channel was unwetted, with no perceptible flow patterns, the remnant channel banks exhibited signs of historic channel straightening.

Survey location GC 20 provided no potential fisheries habitat at the time of survey, given the entirely unwetted stretch of watercourse, with no evidence of natural, coarse channel substrates or any recent inundation or flow through the channel. Similarly, the unwetted nature of the channel at survey location GC 20 provided no suitable commuting or foraging habitat for otter. No otter signs were found in the vicinity of this survey site. Due to the unwetted nature of the channel, kick-sampling was not conducted at survey location GC 20.

Table 4-65. Properties of the watercourse at survey location GC 20

Properties	Record				
Average Depth (m)	–				
Average Bank Width (m)	1.5				
Wet Width (m)	–	Flow	–		
Colouration	–	Clarity	–		
Average bank height (m)	LHB	0.5	RHB	1.0	
Dominant Substrates	Clay/earth: 100%				
Substratum Condition	Compacted clay/earth				

Plate 4-56. A representative image of survey location GC 20

4.1.2.20 Grid Connection Route Survey Site 21 (GC 21)

GC 21 was located along an unmapped watercourse (Grid Reference: R 79200 51209) which, similar to the channel at survey location GC 20, represented a dry channel with no perceptible flow patterns. Properties of the survey location are provided in Table 4-66. Plate 4-57 shows a representative photo of the watercourse at survey site GC 21.

At the time of survey, survey location GC 21 represented an unwetted channel, with sections of waterlogged soil vegetated with water horsetail, meadowsweet, soft rush, branched bur-reed, hedge bindweed and bulrush *(Typha latifolia)*, best conforming with the habitats *Tall herb swamp (FS2)* and *Wet grassland (GS4)*. Habitats extending from the left- and right-hand bank consisted of *Scrub (WS1)*

and immature willow woodland *(WS2),* and a main road classed as *Buildings and artificial surfaces (BL3),* respectively.

While the channel was unwetted, with no perceptible flow patterns, the remnant channel banks exhibited signs of historic channel straightening adjacent to the road.

Survey location GC 21 provided no potential fisheries habitat at the time of survey, given the unwetted stretch of watercourse, with no evidence of natural, coarse channel substrates or any recent flow through the channel. Similarly, the unwetted nature of the channel at survey location GC 21 provided no suitable commuting or foraging habitat for otter. No otter signs were found in the vicinity of this survey site. Due to the unwetted nature of the channel, kick-sampling was not conducted at survey location GC 21.

Table 4-66. Properties of the watercourse at survey location GC 21

Properties	Record				
Average Depth (m)	–				
Average Bank Width (m)	2.5				
Wet Width (m)	–	Flow	–		
Colouration	–	Clarity	–		
Average bank height (m)	LHB	0	RHB	1.0	
Dominant Substrates	Clay/earth: 100%				
Substratum Condition	Compacted clay/earth				

Plate 4-57. A representative image of survey location GC 21

4.1.2.21 Grid Connection Route Survey Site 22 (GC 22)

Survey site GC 22 was located on the Bilboa (EPA code: 25B03, Grid Reference: R 78345 51341). Properties of the watercourse at this survey location are provided in Table 4-67. Plate 4-58 and Plate 4-59 show representative photos of the watercourse at survey site GC 22.

The watercourse at GC 22 represented a modified stretch of *Depositing/Lowland River (FW2),* with concrete bank reinforcement along both banks below and downstream of a single-span concrete road bridge. Channel substrate and flow patterns upstream and downstream varied, with a higher degree of siltation overtop cobble and gravel substrate and slower, more impounded flow upstream of the bridge. Contrastingly, flow was faster, with a lower degree of siltation over channel substrate downstream of the bridge.

While the channel was largely unshaded upstream of the bridge, encroaching treelines of ash, alder, basket willow *(Salix viminalis)* and grey willow provided shading and marginal shelter along both the right- and left-hand banks downstream of the bridge. Bankside vegetation included meadowsweet, great willow herb, curled dock and pendulous sedge, with marginal and emergent reed canary-grass *(Phalaris arundinacea)* and fool's-water-cress. Instream macrophytes included isolated patches of marginal horned pondweed *(Zannichellia palustris)* and greater water-moss *(Fontinalis antipyretica).* Habitats extending from both banks consisted of *Improved agricultural grassland (GA1).*

The non-scheduled invasive species montbretia was on the left-hand bank upstream of the bridge, while the First and Third Scheduled Invasive Species Himalayan balsam was present on both banks.

Loose cobble and gravel substrate downstream of the bridge were relatively clean and mobile, provided localise moderate spawning habitat for salmonid and lamprey species. Areas of sheltered riffle throughout repeating sequences of riffle-glide-pool provided moderate salmonid nursery habitat, particularly along marginal areas of overhanging tree bows and undercut banks. Areas of fine sediment deposition were particularly evident upstream, downstream and below the bridge and adjacent to marginal reed beds, providing moderate lamprey nursery habitat in these areas of slower flow. Sufficiently deep continuous glide and areas of deeper pool (in excess of 0.5 m) provide salmonid holding habitat assessed as good, while areas of marginal habitat complexity (exposed roots, overhanging trees), combined with areas of backwater provide good European eel habitat.

No otter signs were identified at survey location GC 22. However, continuous deep water and overall moderate-good fisheries habitat provided ample commuting and foraging habitat for otter.

Table 4-67. Properties of the watercourse at survey location GC 22

Properties	Record			
Average Depth (m)	0.5			
Average Bank Width (m)	10.0			
Wet Width (m)	8.0			
Flow	Moderate			
Colouration	Slightly brown-yellow			
Clarity	Clear			
Average bank height (m)	LHB	0.4-1.4	RHB	0.4-1.2
Dominant Substrates	Cobble (>32–128mm): 40% Gravel (8-32mm): 20% Fine gravel (2-8mm): 20% Silt (<0.25mm): 20%			
Substratum Condition	Loose			

Plate 4-58. A representative image of survey location GC 22

Plate 4-59. A representative image of survey location GC 22

Kick-sampling was carried out in areas of cobble and gravel riffle from downstream to upstream of the bridge. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa, and the presence of a two Group B 'Moderately Pollution Sensitive' taxa in low numbers. Group C taxa formed the majority of the sample, with Baetis rhodani being the dominant species both in Group C and the entire sample. 'Very' and 'Most Pollution Tolerant' Group D and E were represented in the sample with low species diversity and low abundance. Results of the kick-sample are summarised in Table 4-68.

A three-spined stickleback was observed in the sample during kick-sampling.

Table 4-68. Results of kick-sampling at survey location GC 22

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Glossomatidae*	3
	Sericostomatidae	3
Group C – Pollution Tolerant	*Baetis rhodani*	20
	Ceratopogonidae	1
	Chironomidae	5
	Elmidae	6
	Gammarus sp.	3
	Lumbriculidae	3
	Lymnaeidae	15
	Tipulidae	4
Group D – Very Pollution Tolerant	*Asellus aquaticus*	2
	Glossiphoniidae	1
Group E – Most Pollution Tolerant	*Tubificidae*	3

4.1.2.22 Grid Connection Route Survey Site 23 (GC 23)

Survey site GC 23 was located on the Bilboa (EPA code: 25B03, Grid Reference: R 77531 51486) and represented a largely natural stretch of Depositing/Lowland River (FW2), with the exception of stone bank reinforcement extending downstream of the 2-span arched masonry bridge (Plate 4-60 and Plate 4-61) Properties of the watercourse at this survey location are provided in Table 4-69.

Channel substrate was dominated by loose cobbles and gravels, with a slight degree of siltation overtop. Flow patterns consisted of swift repeating sequences of riffle and glide, with increased water velocity downstream of the bridge. Small vegetated, instream gravel bars were present downstream of the bridge, the largest of which featured young willow saplings *(Salix sp.)*, great willow herb and reed canary-grass. Bankside vegetation, both growing atop sections of natural earth bank and throughout reinforced stone walls included butterbur *(Petasites hybridus),* bramble, sycamore and elder saplings, ivy and hart's tongue fern. *Treelines (WL2)* of ash, beech, grey willow and sycamore encroached into the watercourse margins both upstream and downstream of the bridge, providing marginal shading to the watercourse. Instream macrophytes included emergent fool's-water-cress, and occasional incidences of water-starwort *(Callitriche).*

The First and Third Schedule invasive species Himalayan balsam was present adjacent to the watercourse at survey location GC 23. Habitats extending beyond the immediate riparian treeline buffer consisted of *Improved agricultural grassland* and residential housing classed as *Buildings and artificial surfaces (BL3).*

Areas of loose, relatively clean gravels and fine gravels provided moderate-good spawning habitat for both salmonid and lamprey species. Areas of shallow, well-aerated cobble and gravel riffle, particularly downstream of the bridge along the sheltered left-hand bank, provided moderate-good salmonid nursery habitat, with further marginal refuge throughout submerged sections of crevices within the

stone reinforced banks. Fine sediment beds were present in the immediate vicinity of the bridge but were somewhat compacted and lacked suitable fine sediment structure, providing lamprey nursery habitat assessed as poor-moderate.

Channel depth varied both laterally and longitudinally along the surveyed stretch, providing a range of suitable instream habitats, with channels of deeper continuous glide (in excess of 0.6 m), particularly upstream of the bridge, provided localised moderate salmonid holding habitat, while these areas of deeper water with overhanging tree limbs and encroaching vegetation created marginal backwater which provided moderate marginal European eel habitat.

No otter signs in the way of spraint or prints was found at survey location GC 23 at the time of survey, although areas of earth bank provided ample potential couch habitat upstream of the bridge. No holts were identified at this survey site at the time of survey, although the Bilboa river at this survey site provided excellent potential commuting and foraging habitat, particularly upstream of the bridge.

Table 4-69. Properties of the watercourse at survey location GC 23

Properties	Record
Average Depth (m)	0.4
Average Bank Width (m)	10.0
Wet Width (m)	8.0
Flow	Fast
Colouration	Slightly brown
Clarity	Slightly turbid (highly turbid when disturbed)
Average bank height (m)	LHB 2.0 RHB 2.5
Daominant Substrates	Boulder (>128mm): 5% Cobble (>32–128mm): 10% Gravel (8-32mm): 30% Fine gravel (2-8mm): 30% Silt (<0.25mm): 25%
Substratum Condition	Loose

Kick-sampling was carried out in areas of shallow cobble and gravel riffle downstream of the bridge, with stone washing of coarser cobble and boulder substrate. Biological water quality based on Q-sampling was calculated as **Q3-4 –Moderate**, given the presence of Group A 'Very Pollution Sensitive' taxa in low numbers, the presence of a single Group B 'Moderately Pollution Sensitive' taxon in low numbers, with Group C being the dominant group (dominated by *Baetis rhodani*). Group D was represented by a single taxon with low abundance, while Group E was absent from the sample. Results of the kick-sample are summarised in Table 4-70.

Plate 4-60. A representative image of survey location GC 23

Plate 4-61. A representative image of survey location GC 23

Table 4-70. Results of kick-sampling at survey location GC 23

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Ecdyonurus sp.*	1
	Heptagenia sp.	2
Group B – Moderately Pollution Sensitive	*Glossomatidae*	3
Group C – Pollution Tolerant	*Baetis rhodani*	40
	Dicranota sp.	1
	Gammarus sp.	15
	Lymnaeidae	12

	Rhyacophila sp.	1
	Tipulidae	3
Group D – Very Pollution Tolerant	*Naididae*	5
Group E – Most Pollution Tolerant	-	-

4.1.2.23 Grid Connection Route Survey Site 24 (GC 24)

Survey site GC 24 was located along the Dooglasha (Slieve Felim) (EPA code: 25D14, Grid Reference: R 77275 51596) which at the time of survey, represented an unwetted stretch of channel. Due to widespread modification of this watercourse (including culverting) as a result of the Mulkear Cappamore Arterial Drainage Scheme (ADS, https://www.floodinfo.ie/map/drainage_map/), the channel was surveyed at the closest accessible stretch, approx. 400m upstream of the grid connection route through the town of Cappamore. Plate 4-62 shows a representative image of the channel at GC 24 at the time of the survey. Properties of the dry channel at this survey location are provided in Table 4-71.

Table 4-71. Properties of the watercourse at survey location GC 24

Properties	Record			
Average Depth (m)	–			
Average Bank Width (m)	1.0			
Wet Width (m)	–	Flow	–	
Colouration	–	Clarity	–	
Average bank height (m)	LHB	2.0	RHB	2.5
Dominant Substrates	Clay/earth: 100%			
Substratum Condition	Compacted clay/earth			

Plate 4-62. A representative image of survey location GC 24

The watercourse at GC 24 exhibited no perceptible flow at the time of survey, with no evidence of recent flow or inundation. Coarse, natural stone channel substrates were absent from this section of the Dooglasha, with the channel bed consisting of largely unvegetated, compacted clay and earth littered with detritus. A continuous *Treeline (WL2)* of ash, beech, hawthorn and wych elm *(Ulmus glabra)* provided a high degree of shading along the right-hand bank, with dense bramble *Scrub (WS1)* and ivy, nettle, hard shield fern and sorrel *(Rumex acetosa)* vegetating the steep sided earth banks.

Survey location GC 24 provided no potential fisheries habitat at the time of survey, given the unwetted nature of the channel, with no evidence of recent flow in the area. No otter signs were found in the vicinity of this survey site, and the surveyed stretch of dry channel provided no significant commuting or foraging habitat for otter amongst the wider agricultural landscape, with evidence of historic livestock poaching from the left-hand bank. Due to the unwetted nature of the channel, kick-sampling was not conducted at survey location GC 24.

4.1.2.24 Grid Connection Route Survey Site 25 (GC 25)

Survey site GC 25 represented a stretch of highly modified *Depositing/Lowland River (FW2),* which similar to the watercourse at GC 24, is subject to Mulkear Cappamore ADS conducted by the OPW. Survey site GC 25 was located along the Dromsallagh (EPA code: 25D34, Grid Reference: R 77222 51577).

The watercourse at GC 25 was inaccessible for instream survey at the point of grid connection crossing due to the stream being laterally confined between houses, both upstream and downstream of the culvert crossing. Plate 4-63 shows a representative image of the watercourse at GC 25 at the time of the survey. Properties of the watercourse at the grid connection crossing point at GC 25 are provided in Table 4-72.

Both the right- and left-hand banks consisted of artificial reinforced stone walls backing directly onto houses. The channel was largely exposed with no continuous treelines, but dense growth of ivy, bramble, wild angelica, hart's-tongue fern, hard fern and nettle, which encroached entirely into the channel further downstream. Instream vegetation included dense mats of fool's-water-cress with occasional water mint and pendulous sedge. Fly tipping was evident throughout this stretch of the watercourse, with no perceptible flow patterns.

Due to dense instream vegetation and (where water was visible) a slight level of turbidity even when undisturbed, channel substrate could not be observed. Due to the highly modified nature of this watercourse, subject to urban pressures (adjacent to housing and a main road) and arterial drainage works, with shallow, imperceptibly flowing water, the watercourse in the immediate vicinity of GC 25 offered no significant spawning, nursery or holding habitat for salmonid or lamprey species, or European eel, with some suitable habitat for minnow and three-spined stickleback. Similarly, the modified nature of this watercourse, with a high level of existing disturbance, meant this stretch of watercourse did not offer any significant suitable commuting or foraging habitat for otter.

Table 4-72. Properties of the watercourse at survey location GC 25

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	1.4			
Wet Width (m)	1.4			
Flow	No perceptible flow			
Colouration	Slightly brown-grey			
Clarity	Slightly turbid (even when undisturbed)			
Average bank height (m)	LHB	1.0-3.0	RHB	1.0-3.0
Dominant Substrates	Not visible due to turbidity and dense instream vegetation			
Substratum Condition	–			

Plate 4-63. A representative image of survey location GC 25 along the grid connection route

The watercourse at GC 25 was accessed approx. 90 m upstream of the grid connection route. The watercourse here represented a narrow stretch of laterally confined *Depositing/Lowland River (FW2)* between steep sided, heavily vegetated banks. Channel substrate consisted primarily of soft, unconsolidated fine channel bed substrates, with a slight degree of turbidity even when undisturbed and no perceptible flow through the watercourse. This channel profile of the watercourse at this point was one of a historically straightened and/or embanked watercourse. Plate 4-64 shows a representative image of the channel at GC 25 approx. 90 m upstream of the grid connection crossing at the time of the survey.

A semi-continuous *Treeline (WL2)* of hawthorn with ivy ran along the right-hand bank, separating the watercourse from nearby *Buildings and artificial surfaces (BL3)* habitat in the form of roads and housing developments. Habitats extending from the right-hand bank included a margin of bramble *(WS1)* extending into *Improved agricultural grassland (GA1).* Other bankside vegetation included nettle, meadowsweet, creeping buttercup and field horsetail *(Equisetum arvense).*

Table 4-73. Properties of the watercourse at survey location GC 25 approx. 90 m upstream of the grid connection route

Properties	Record			
Average Depth (m)	0.3			
Average Bank Width (m)	1.6			
Wet Width (m)	1.0			
Flow	No perceptible flow			
Colouration	Slightly brown			
Clarity	Slightly turbid, highly turbid when disturbed underfoot			
Average bank height (m)	LHB	2.5	RHB	3.0
Dominant Substrates	Cobble (>32–128mm): 5% Gravel (8-32mm): 10% Fine gravel (2-8mm): 10% Silt (<0.25mm): 75%			

Substratum Condition	Loose

The watercourse was vegetated at points with fool's-water-cress and common duckweed, with abundant marginal reed canary-grass. Fisheries habitat at this watercourse was assessed as poor for all fish species, with the exception of habitat for Cyprinidae and Gasterosteidae fish such as minnow and three-spined stickleback. A lack of any significant areas of clean, mobile gravels saw negligible spawning habitat for salmonid or lamprey species. Absence of perceptible flow or well aerated cobble and gravel riffle sequences saw a lack of any suitable salmonid nursery habitat. While silt was the dominant channel substrate, areas of silt beds were poorly structured (excessively clogged with detritus) and likely anoxic in stagnant flow conditions, providing poor lamprey nursery habitat for ammocoetes. Although water depth was consistent along the surveyed stretch, lack of any accelerating flow through the channel provided negligible salmonid holding habitat and poor European eel habitat.

Kick-sampling was carried out in limited areas of gravel and fine gravel, with sweep netting conducted through instream vegetation. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C was represented by two taxa with low abundance, while the sample was dominate by Group D (represented by *Asellus aquaticus* in low abundance). Group E taxa were absent; Results of the kick-sample are summarised in Table 4-74.

Plate 4-64. A representative image of the watercourse at survey location GC 25 approx. 90 m upstream of the grid connection route

Table 4-74. Results of kick-sampling at the watercourse at survey location GC 25 approx. 90 m upstream of the grid connection route

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	1
	Gammarus sp.	1
Group D – Very Pollution Tolerant	*Asellus aquaticus*	4

Group E – Most Pollution Tolerant	-	-

4.1.2.25 Grid Connection Route Survey Site 26 (GC 26)

Survey site GC 26 was located on the Turagh (EPA code: 25T17, Grid Reference: R 76100 51176) and represented a narrow stretch of *Eroding/Upland River (FW1).* Plate 4-65 and Plate 4-66 show representative images of the upstream and downstream survey extent of GC 26 at the time of the survey. Properties of the watercourse at this survey location are provided in Table 4-75.

Flow was slow across cobble and gravel substrates, which exhibited an overlying layer of siltation which was readily disturbed underfoot and remained in suspension. At the upstream survey extent, the watercourse was tunnelled by a continuous treeline of beech, blackthorn and hawthorn, with steep sided earthen banks vegetated with ivy, hedge bindweed, hart's-tongue fern, herb robert, bramble and the non-scheduled invasive species montbretia.

Downstream of a single-span masonry arch bridge, flows patterns exhibited increased velocity through a narrower stretch of channel which was heavily encroached with bankside vegetation. Habitats extending beyond the banks consisted of *Improved agricultural grassland (GA1), Amenity grassland (Improved) (GA2)* and residential dwellings classed as *Buildings artificial surfaces (BL3).* In addition to reinforced stone wall along the left-hand bank, channel modifications included straightening of the channel downstream of the bridge.

Given the compacted nature of cobble-dominant channel substrate (with only small areas of interstitial gravels), as well as the narrow, tunnelled profile of the watercourse, spawning habitat for salmonids and lamprey were assessed as poor. Shallow riffle adjacent to undercut banks and overhanging banks provided moderate, opportunistic salmonid nursery habitat. Lack of suitably deep glide or pool saw a lack of any significant salmonid holding habitat or adult European eel habitat. Silt where present formed only a superficial layer over compacted coarse substrates, providing no significant suitable lamprey nursery habitat for ammocoetes.

The watercourse provided opportunistic commuting and foraging habitat for otter, with no otter signs identified at the watercourse at the time of survey.

Table 4-75. Properties of the watercourse at survey location GC 26

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	1.0			
Wet Width (m)	0.7			
Flow	Slow			
Colouration	No apparent colouration			
Clarity	Clear when undisturbed			
Average bank height (m)	LHB	0.3-2.0	RHB	0.3-2.0
Dominant Substrates	Cobble (>32–128mm): 40% Gravel (8-32mm): 15% Fine gravel (2-8mm): 15% Silt (<0.25mm): 30%			
Substratum Condition	Compacted			

Plate 4-65. A representative image of survey location GC 26

Plate 4-66. A representative image of survey location GC 26

Kick-sampling was carried out in limited areas of cobble and gravel. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C and D were each represented by a single taxon with low abundance, with the sample dominated by Gammarus sp. Group E taxa were absent. Results of the kick-sample are summarised in Table 4-76.

Table 4-76. Results of kick-sampling at survey location GC 26

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Gammarus sp.*	15
Group D – Very Pollution Tolerant	*Asellus aquaticus*	2
Group E – Most Pollution Tolerant	-	-

4.1.2.26 Grid Connection Route Survey Site 27 (GC 27)

Survey site GC 27 was located on the Dooglasha river (EPA code: 25D02, Grid Reference: R 74179 50666) and represented a stretch of *Depositing/Lowland River (FW2),* with two channel branches braided either side of an instream island vegetated with *Scrub (WS1)* and *Immature woodland (WS2)* species. Plate 4-67 and Plate 4-68 show representative pictures of the left- and right-hand channel branches along the surveyed stretch at GC 27, respectively. Properties of the watercourse at this survey location are provided in Table 4-77.

Channel substrates throughout both the left- and right-hand channel branches consisted predominantly of unconsolidated, loose sand and silt beds with a high proportion of detritus and woody debris throughout. Flow patterns were very slow and at time imperceptible along the meandering profile of both channels. Both channels displayed signs of modification in the form of historic livestock poaching, with an under-road culvert at the downstream survey extent.

Vegetation along the instream island and banks included hart's-tongue fern, holly, ivy, hard shield fern, nettle, guelder rose *(Viburnum opulus)* and blackthorn, with treelines of hazel and hawthorn at both sides. Habitats extending beyond the immediate scrub and immature woodland buffers consisted of *Improved agricultural grassland (GA1).*

Table 4-77. Properties of the watercourse at survey location GC 27

Properties	Record			
Average Depth (m)	0.15			
Average Bank Width (m)	Left-hand channel branch	1.0	Right-hand channel branch	1.2
Wet Width (m)	Left-hand channel branch	0.8	Right-hand channel branch	1.0
Flow	Very slow			
Colouration	Highly brown			
Clarity	Slightly			
Average bank height (m) (left-hand channel branch)	LHB	0.1-0.5	RHB	1.0-1.4
Average bank height (m) (right-hand channel branch)	LHB	1.0-1.4	RHB	1.0
Dominant Substrates	Fine gravel (2-8mm): 10% Sand (0.25–2mm): 45% Silt (<0.25mm): 45%			
Substratum Condition	Loose			

Due to the absence of any clean, mobile gravels (or any coarse stone based substrate) in either channel branches, spawning habitat for salmonids and lamprey were assessed as negligible. Shallow and at times negligbly wetted water depth, no suitable instream shelter (in the way of riffle or vegetative refugia) and lack of any accelerating flow saw poor salmonind nursery habitat. While channel substrate was composed primarily of sand and silt beds, fine sediments were poorly structured and excessively clogged with detritus and leaf litter, providing poor lamprey nursery habitat. Water was not sufficiently

deep for salmonid holding habitat. Although undercut bank features or trailing bankside vegetation providing some marginal refuge in the concave bends of meanders, lack of suffient water depth again limited European eel habitat.

These slow-imperceptibly flowing, shallow stretches of heavily silted watercourse provided overall low fisheries value and poor commuting and foraging habitat for otter. No otter signs were found at the time of survey.

Plate 4-67.A representative image of the left-hand branch of the watercourse at survey location GC 27

Plate 4-68. A representative image of the right-hand branch of the watercourse at survey location GC 27

Kick-sampling along the left-hand channel branch was carried out in areas of limited fine gravels, silt and detritus. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C was represented by two taxa with low abundance, while Group D was represented by a single taxon with low abundance. Group E taxa were absent from the sample. Results of the kick-sample are summarised in Table 4-78.

Table 4-78. Results of kick-sampling from the left-hand branch of the watercourse at survey location GC 27

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Dysticidae*	1
	Gammarus sp.	5
Group D – Very Pollution Tolerant	*Asellus aquaticus*	3
Group E – Most Pollution Tolerant	-	-

Similar to the left-hand channel branch of the Dooglasha, kick-sampling along the right-hand channel branch was carried out in areas of limited fine gravels, silt and detritus. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa. Group B was represented by two taxa, each with low abundance, while Group C, represented by a single taxon *(Gammarus sp.)* made up 75% of the sample. Group D and E were absent. Results of the kick-sample are summarised in Table 4-79.

Table 4-79. Results of kick-sampling from the right-hand branch of the watercourse at survey location GC 27

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Glossomatidae*	2
	Limnephilidae	2
Group C – Pollution Tolerant	*Gammarus sp.*	12
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.27 Grid Connection Route Survey Site 28 (GC 28)

Survey site GC 28 was located on the Mulkear river (EPA code: 25M04, Grid Reference: R 72257 50763) and represented a stretch of deep, moderate velocity Depositing/Lowland River (FW2). Plate 4-69 shows a representative image of surveyed stretch of watercourse at GC 28. Properties of the watercourse at this survey location are provided in Table 4-80.

A high degree of channel substrate diversity, associated flow pattern variability and variable depth laterally and longitudinally along the survey stretch provided a range of instream habitats at this watercourse. Steep sided earthen banks were vegetated with reed canary-grass, hogweed, nettle, hedge bindweed, dock *(Runex sp.)*, great willowherb and the First and Third Scheduled Invasive species Himalayan basalm. Semi-continuous treelines of basket willow, crack willow *(Salix fragilis)* and hawthorn provided marginal shading to the channel, with overhanging tree limbs and exposed root structures creating submerged marginal complexity, as well as suitable perches and foraging habitat for kingfisher.

Isolated areas of gravels and fine gravels between coarser large cobbles and boulder did not provide sufficient sized areas of loose, mobile gravels suitable for spawning, with spawning habitat for salmonid and lamprey species assessed as poor. The predominance of deep glide and pool saw a lack of the optimal well aerated, shallower cobble and gravel required for optimal salmonid nursery habitat, which was consequently assessed as poor, with moderate, opportunistic nursery habitat amongst shallower, more sheltered flow along encroaching treelines.

Pockets of marginal backwater created by overhanging trees, in combination with abundant submerged boulder features and under cutting and exposed roots along the left-hand bank provided good European eel habitat. Fine sediment beds required for lamprey nursery habitat were restricted to the slower flowing, shallower margins (particularly along the right-hand bank and assessed as moderate. Continuous deep glide and pool along the surveyed stretch of the Mulkear provided excellent salmonid holding habitat with water in excess of 1.0 m in the centre of the channel at the time of survey.

The Mulkear at survey location GC 28 provided excellent otter commuting and foraging habitat, with otter prints identified along the right-hand bank under and downstream of the single-span stone arch bridge, as shown in Plate 4-70. No otter holts were identified 150 m upstream or downstream of the grid connection crossing at the time of survey in October 2024.

Table 4-80. Properties of the watercourse at survey location GC 28

Properties	Record
Average Depth (m)	0.2 (at channel margins), 1.0 through the centre of the channel
Average Bank Width (m)	12.0
Wet Width (m)	10.0
Flow	Moderate
Colouration	Highly brown
Clarity	Slightly turbid
Average bank height (m)	LHB 3.0 RHB 4.0
Dominant Substrates	Boulder (>128mm): 30% Cobble (>32–128mm): 30% Gravel (8-32mm): 10% Fine gravel (2-8mm): 10% Sand (0.25–2mm): 10% Silt (<0.25mm): 10%
Substratum Condition	Compacted

Plate 4-69. A representative image of survey location GC 28

Plate 4-70. A representative image of otter prints identified at survey location GC 28

Kick-sampling was carried out in areas of cobble riffle and glide, with associated stone washing of larger substrate, downstream of the bridge, Biological water quality based on Q-sampling was calculated as **Q3-4 –Moderate**, given the presence of a single Group A 'Very Pollution Sensitive' taxon in low numbers, the absence of Group B 'Moderately Pollution Sensitive', with Group C being the predominant group in the sample (dominated by *Hydropsyche sp.)* Group D and E were absent from the sample. Results of the kick-sample are summarised in Table 4-81.

Table 4-81. Results of kick-sampling at survey location GC 28

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	*Heptagenia sp.*	2
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	5
	Elmidae	2
	Gammarus sp.	8
	Hydropsyche sp.	10
	Limnius sp.	1
	Planorbis sp.	1
Group D – Very Pollution Tolerant	*Asellus aquaticus*	1
Group E – Most Pollution Tolerant	-	-

4.1.2.28 Grid Connection Route Survey Site 29 (GC 29)

Survey site GC 29 was located on the Mulkear tributary 1 (EPA code: 25M73, Grid Reference: R 70058 51731) and represented a stretch of narrow *Eroding/Upland River (FW1).* Plate 4-71 shows a representative image of surveyed stretch of watercourse at GC 29. Properties of the watercourse at this survey location are provided in Table 4-82.

GC 29 represented a narrow stream, directly adjacent to a concrete wall and road along the right-hand bank, and a residential garden along the left-hand bank. The concrete wall made up the right-hand riverbank for a short section of the watercourse in the vicinity of the grid connection crossing. A 2-pipe culvert was present at the downstream survey extent of GC 29, which was shallowly wetted and posed a barrier to migration to all aquatic species (Plate 4-72).

Channel substrates were predominantly composed of compacted cobbles encrusted with calcium carbonate precipitate, with interstitial gravels and artificial broken concrete throughout. Flow patterns consisted of swift riffle interspersed with short sections of glide. Bankside vegetation was absent from the right-hand concrete bank and consisted of *Recolonising bare ground (ED3)* species along the right-hand bank, with no riparian buffer between the watercourse and garden at this stretch of the watercourse. Instream vegetation included fool's-water-cress and brooklime.

Further upstream of the grid connection crossing, the watercourse exhibited a more natural profile, with earthen banks vegetated with hart's-tongue fern and ivy and a continuous *Treeline (WL2)* along the right-hand bank of ash, goat willow and sycamore.

Given the laterally confined, modified nature of the watercourse in the vicinity of the grid connection crossing point, in combination with compacted cobbles and gravels encrusted with calcium carbonate, spawning habitat for salmonid and lamprey species was assessed as poor. Swift flowing riffle across cobble substrate, in combination with instream vegetative refuge, provided moderate salmonid nursery habitat, with a more naturalised and well shaded channel profile further upstream providing slightly better juvenile salmonid habitat. Fine sediment beds suitable for lamprey nursery were absent from the watercourse at GC 29, and lack of sufficient depth (max 0.2 m) saw negligible salmonid holding habitat in the vicinity of GC 29. Absence of deeper water also saw overall poor habitat for European eel, with some localised habitat for elvers throughout sheltered and vegetated riffle.

No otter signs were identified at GC 29 at the time of survey and the watercourse at this survey site offered overall poor commuting and foraging habitat for otter due to the modified nature of the channel and culvert.

Table 4-82. Properties of the watercourse at survey location GC 29

Properties	Record				
Average Depth (m)	0.1				
Average Bank Width (m)	1.0				
Wet Width (m)	1.0		Flow	Moderate	
Colouration	No apparent colouration		Clarity	Very clear when undisturbed	
Average bank height (m)	LHB	0.4		RHB	0.4-2.0
Dominant Substrates	Cobble (>32–128mm): 40% Gravel (8-32mm): 20% Fine gravel (2-8mm): 10% Silt (<0.25mm): 10% Concrete: 20%				
Substratum Condition	Compacted				

Plate 4-71. A representative image of survey location GC 29

Plate 4-72. A representative image of the 2-pipe culvert at GC 29

Plate 4-73. A representative image of the more naturalised upstream survey extent of GC 29

Kick-sampling was carried out in areas of cobble riffle and glide, with associated stone washing of larger substrate, downstream of the bridge, Biological water quality based on Q-sampling was calculated as **Q3 –Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa. Group B 'Moderately Pollution Sensitive' taxa were present with moderate diversity but high abundance and were the dominant group in the sample. Group C 'Pollution tolerant' taxa were represented with high diversity and moderate abundance. Group D was represented by two taxa with moderate abundance. Group E were absent from the sample. Results of the kick-sample are summarised in Table 4-83.

Table 4-83. Results of kick-sampling at survey location GC 29

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Glossomatidae*	39
	Goeridae	1
	Sericostomatidae	6
Group C – Pollution Tolerant	*Baetis rhodani*	17
	Elmidae	2
	Gammarus sp.	18
	Polycentropus sp.	1
	Serratella ignita	3
	Simuliidae	1
Group D – Very Pollution Tolerant	*Asellus aquaticus*	24
	Erpobdellidae	3
Group E – Most Pollution Tolerant	-	-

4.1.2.29 Grid Connection Route Survey Site 30 (GC 30)

Survey site GC 30 was located on the Killinure 25 (EPA code: 25K81, Grid Reference: R 70052 51745) and represented a stretch of narrow, very slow flowing *Depositing/Lowland River (FW2)* at the upstream survey extent, transitioning to a stretch of *Eroding/Upland River (FW1).* Plate 4-74 and Plate 4-75 show representative images of the upstream and downstream extents of the surveyed stretch of watercourse at GC 30. Properties of the watercourse at this survey location are provided in Table 4-84.

Similar to GC 29, the watercourse at GC 30 represented a stretch of laterally confined, narrow watercourse. At the most upstream extent, the watercourse at GC 30 exhibited fine sediment dominance with deep (average depth of 0.6 m), slow flowing water, which transitioning into a fast flowing section of watercourse, featuring coarser channel substrates at the confluence with the Mulkear tributary 1 (watercourse at GC 29).

Marginal vegetation included yellow flag iris, with bankside vegetating including trailing bramble, cow parsley, herb robert and rose bay willow herb, with continuous *Treelines (WL2)* of grey willow, goat willow, hawthorn and beech.

Downstream of the grid connection crossing location, consisting of a stone bridge, the watercourse consisted of a narrow, stretch of *Depositing/Lowland River (FW2)* featuring instream and marginal growth of fool's-water-cress. While the watercourse upstream of the bridge was well shaded by marginal treelines, the watercourse downstream of the grid connection crossing route was largely unshaded amid the wide *Improved agricultural grassland (GA1)* habitats.

Given the laterally confined, slow flowing nature of the watercourse at GC 30, combined with unsuitable channel bed substrate in the form of silt dominance at the upstream survey extent, and compacted boulder and cobble at the downstream survey extent, spawning habitat for salmonid and lamprey species was assessed as poor. The areas of faster flowing cobble and boulder riffle at the downstream survey extent, in combination with marginal and overhanging bankside vegetative refuge, provided localised, moderate salmonid nursery habitat, although salmonid nursery habitat downstream of the grid connection crossing point was degraded, with a lack of suitable channel bed substrate or riparian cover or bankside shading. Fine sediment beds were present occasionally at the upstream survey extent and provided poor lamprey nursery habitat. Overall water depth provided some sufficient depth for salmonid holding habitat, although habitat suitability for salmonid holding habitat was limited to poor, given the narrow and at times very slow flowing nature of the watercourse. Areas of slower flowing water, particularly along marginal encroaching vegetation and bank undercuts saw some localised moderate habitat for European eel.

No otter signs were identified at GC 30 at the time of survey and the watercourse at this survey site offered overall poor commuting and foraging habitat for otter due to the laterally confined nature of the channel.

Table 4-84. Properties of the watercourse at survey location GC 30

Properties	Record				
Average Depth (m)	0.4				
Average Bank Width (m)	1.0				
Wet Width (m)	0.8		Flow	Slow	
Colouration	Slightly brown		Clarity	Clear (when undisturbed)	
Average bank height (m)	LHB	1.8		RHB	0.6
Dominant Substrates	Boulder (>128mm): 25% Cobble (>32–128mm): 25% Gravel (8-32mm): 10% Fine gravel (2-8mm): 10% Sand (0.25–2mm): 15% Silt (<0.25mm): 15%				

Substratum Condition	Compacted boulder and cobble, loose finer sediments at upstream extent

Plate 4-74. A representative image of survey location GC 30

Plate 4-75. A representative image of survey location GC 30

Plate 4-76. A representative image of the downstream survey extent of survey location GC 30.

Kick-sampling was carried out in areas of cobble riffle and glide. Biological water quality based on Q-sampling was calculated as **Q3 –Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa. Group B 'Moderately Pollution Sensitive' taxa and Group C 'Pollution tolerant' taxa were present with low diversity and abundance, relative to Group D (represented by *Asellus aquaticus)* which dominated the sample. Group E were absent from the sample. Results of the kick-sample are summarised in Table 4-85.

Table 4-85. Results of kick-sampling at survey location GC 30.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Baetidae*	1
	Limnephilidae	2
	Sericstomatidae	5
Group C – Pollution Tolerant	*Baetis rhodani*	3
	Bithnya sp.	1
	Dysticidae	1
	Elmidae	4
	Gammarus sp.	13
	Planorbis sp.	2
	Polycentropus sp.	2
	Simuliidae	1
Group D – Very Pollution Tolerant	*Asellus aquaticus*	60
Group E – Most Pollution Tolerant	-	-

4.1.2.30 Grid Connection Route Survey Site 31 (GC 31)

GC 31 was located along the Kishyquirk (Grid Reference: R 67193 53218, EPA Code: 25K88) which represented a narrow, stretch of modified Eroding/Upland River (FW1) with slow-moderate velocity, shallow riffle flow patterns at the time of survey. Properties of the survey location are provided in Table 4-86. Plate 4-77 shows a representative photo of the channel at survey site GC 31.

Table 4-86. Properties of the watercourse at survey location GC 31

Properties	Record			
Average Depth (m)	0.1			
Average Bank Width (m)	0.8			
Wet Width (m)	0.5	Flow	Slow-moderate	
Colouration	No apparent colouration	Clarity	Slightly turbid even when undisturbed	
Average bank height (m)	LHB 2.5		RHB 0.8	
Dominant Substrates	Cobble (>32–128mm): 10% Gravel (8-32mm): 10% Fine gravel (2-8mm): 20% Sand (0.25–2mm): 20% Silt (<0.25mm): 40%			
Substratum Condition	Loose			

Plate 4-77. A representative image of survey location GC 31

Modifications in the watercourse at survey site GC 31 included historical straightening and resectioning, particularly of the straight sided left-hand bank, with evidence of historic poaching along the right-hand bank. Channel substrate consisted predominantly of fines (silt and sand), which were soft and unconsolidated, with earth from disturbed sections of bank throughout the channel bed. Isolated area of fine gravels, where present, were also overlain with siltation. Flow patterns consisted predominantly of repeating sequences of shallow riffle and glide.

There was a high degree of leaf litter throughout the channel bed, particularly in sections of watercourse which were highly tunnelled by encroaching hawthorn, sycamore and blackthorn *Treelines (WL2)* with bramble *Scrub (WS1)* throughout. Bankside vegetation included ivy, herb-robert wild angelica and hart's tongue fern. Surrounding habitats beyond riparian treelines and scrub consisted of mosaic *Improved agricultural grassland (GA1)* and *Wet grassland (GS4).*

Shallow water depth along the stretch of watercourse at survey site GC 31 saw insufficient depth for suitable adult salmonid holding habitat. Similarly, lack of any submerged features such as root structures, boulders and deadwood which could provide suitable refuge for european eel, were largely absent. Short sections of more riffle featuring coarser cobble substrate provided some localised, albeit poor, nursery habitat for juvenile salmonid fish. While fine sediments were the dominant substrate type, high levels of exisiting bankside and instream disturbance and the presence of abundant detritus and earthen bank materials covering the channel bed limited optimal lamprey ammocoete nursery habitat throughout siltbeds, assessed as poor. The absence of clean, mobile gravel beds throughout the survey stretch saw negligible spawning habitat for salmonid or lamprey species.

No otter signs were identified at GC 31 at the time of survey and the watercourse at this survey site offered overall poor commuting and foraging habitat for otter due to the laterally confined, highly modified nature of the channel.

Kick-sampling and sweep netting were carried throughout heavily vegetated sections of the channel Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa and the low abundance and diversity of Group B 'Moderately Pollution Sensitive' taxa, represented by a single taxon. Group C was represented by three taxa, while Group D, represented by two taxa, made up ~47% of the sample. Group E taxa were absent from the sample. Results of the kick-sample are summarised in Table 4-87.

Table 4-87. Results of kick-sampling at survey location GC 31

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Sericostomatidae*	4
Group C – Pollution Tolerant	*Chironomidae*	1
	Gammarus sp.	18
	Planorbidae	1
Group D – Very Pollution Tolerant	*Asellus aquaticus*	20
	Erpobdellidae	1
Group E – Most Pollution Tolerant	-	-

4.1.2.31 Grid Connection Route Survey Site 32 (GC 32)

GC 32 was located along an unmapped watercourse (Grid Reference: R 67075 53329) which represented a highly modified stretch of *Depositing/Lowland River (FW2),* characterised by a highly channelised profile, earth and silt-dominant channel substrate, with shallow-negligible wetting of the channel. Properties of the survey location are provided in Table 4-88. Plate 4-78 shows a representative photo of the channel at survey site GC 32.

Table 4-88. Properties of the watercourse at survey location GC 32

Properties	Record
Average Depth (m)	0.05

Average Bank Width (m)	0.6			
Wet Width (m)	0.4			
Flow	No perceptible flow			
Colouration	Slightly brown			
Clarity	Turbid			
Average bank height (m)	LHB	0.2-0.4	RHB	0.2-0.4
Dominant Substrates	Boulder (>128mm): 15% Silt (<0.25mm) / Earth: 85%			
Substratum Condition	Loose			

The watercourse exhibited no perceptible flow patterns, with pooling of water only visible around patches of macrophytes, including brooklime, water mint and water starwort *(Callitriche sp.)*, with occasional stands of yellow flag iris along the channel. No riparian buffer in the way of riparian treeline, hedgerow or bankside vegetation existed between the watercourse and surrounding *Improved agricultural grassland (GA1)* or *Wet grassland (GS4).*

Plate 4-78. A representative image of survey location GC 32

The watercourse at survey site GC 32 provided negligible fisheries habitat, given the unstructured, soft silt and earth channel bed substrates and imperceptible, at times stagnant flow, as well as dense instream macrophyte growth. Clean, mobile gravel beds required for salmonid and lamprey spawning habitat were absent from the watercourse, with an almost complete absence of any coarser, stone-based channel substrate. The watercourse lacked sufficient water depth for the majority of fish species and age classes, including adult salmonid fish or European eel, with a lack of continuous wetting of the channel and overall poor connectivity. Fine sediment beds required for lamprey ammocoete habitat were also absent from the surveyed stretch of channel.

As a result of overall poor fisheries habitat and a high degree of channel modification, the watercourse offered poor foraging and commuting habitat for otter, with no otter signs found at the time of the

survey. The watercourse is also located adjacent to an active trainline, with high levels of existing disturbance.

Due to the largely unwetted nature of the watercourse at survey site GC 32, sweep netting and kick-sampling was performed in areas of semi-submerged or waterlogged vegetation. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A 'Very Pollution Sensitive' taxa and the low abundance and diversity of Group B 'Moderately Pollution Sensitive' taxa, represented by a single taxon. Group C was represented by five taxa, while Group D, represented by a single taxon, made up 50% of the sample. Group E taxa were absent from the sample. Results of the kick-sample are summarised in Table 4-89.

Table 4-89. Results of kick-sampling at survey location GC 32

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	*Sericostomatidae*	1
Group C – Pollution Tolerant	*Chironomidae*	1
	Dicranota sp.	4
	Elmidae	2
	Gammarus sp.	25
	Polycentropus sp.	2
Group D – Very Pollution Tolerant	*Asellus aquaticus*	35
Group E – Most Pollution Tolerant	-	-

4.1.2.32 Grid Connection Route Survey Site 33 (GC 33)

The watercourse at GC 33 was located along a section of the Keyanna, (EPA Code: 25K90, Grid Reference R 65922 53289). Properties of the survey location are provided in Table 4-90. Plate 4-79 shows a representative photo of the channel at survey site GC 33.

Table 4-90. Properties of the watercourse at survey location GC 33

Properties	Record			
Average Depth (m)	0.2			
Average Bank Width (m)	1.6			
Wet Width (m)	1.0			
Flow	Slow			
Colouration	Slightly brown			
Clarity	Slightly turbid			
Average bank height (m)	LHB	2.5-3	RHB	2.5-3
Dominant Substrates	Bedrock: 10% Boulder (>128mm): 5% Silt (<0.25mm): 85%			
Substratum Condition	Loose (silt)			

The watercourse at survey site GC 33 represented a narrow, historically straightened section of *Eroding/Upland River (FW1),* which was laterally confined between high-sided banks. Steep bank faces were densely vegetated with ivy, hart's tongue fern, soft shield fern, cow parsley and herb-robert, with sycamore and elm *(Ulmus sp.)* trees providing a moderate degree of shading to the watercourse amid the wider *(Mixed) broadleaved woodland (WD1)* habitat. Beyond this, habitats consisted of *Amenity grassland (improved) (GA2)* and residential developments classed as *Buildings and artificial surfaces (BL3).*

Flow was dominated by slow flowing glide, interspersed with occasional riffle, while channel substrate consisted primarily of silt and abundant leaf litter and detritus, with occasional boulder and some underlying bedrock. In addition to channel straightening, modifications to the watercourse also included an under-road pipe culvert, with reinforced stone banks extending from the culvert.

Spawning habitat suitable for salmonid and lamprey species was absent from the stretch of watercourse, given the absence of any suitable gravel beds along this silt-dominant stretch of watercourse. Nursery habitat for juvenile salmonids was also largely absent due to a lack of instream refugia, with the exception of that provided around isolated boulders and areas of overhanging bankside vegetation. The watercourse at survey site GC 33 also did not exhibit sufficiently deep water to provide supporting habitat for adult salmonid fish, with the culvert posing a potential barrier to fish passage.

Plate 4-79. A representative image of survey location GC 33

Plate 4-80. A representative image of the culvert at survey location GC 33

Due to the largely unwetted nature of the watercourse at survey site GC 33, sweep netting and kick-sampling was performed in areas of semi-submerged or waterlogged vegetation. Biological water quality based on Q-sampling was calculated as **Q2-3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C was represented by five taxa with low abundance, while Group D, represented by two taxa, was the dominant group, making up ~89% of the sample. Group E taxa were absent from the sample. Results of the kick-sample are summarised in Table 4-91

Table 4-91. Results of kick-sampling at survey location GC 33

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Chironomidae*	2
	Dysticidae	2
	Erpobdellidae	3
	Gammarus sp.	1
	Planorbidae	6
Group D – Very Pollution Tolerant	*Asellus aquaticus*	100
	Sphaeriidae	9
Group E – Most Pollution Tolerant	-	-

4.1.2.33 Grid Connection Route Survey Site 34 (GC 34)

Survey site GC 34 was located on the Whitehall 25 (EPA code: 25W08, Grid Reference: R 64686 53709). Properties of the survey location are provided in Table 4-92. Plate 4-81 shows a representative photo of the watercourse at survey site GC 34.

The watercourse at this survey location represented a modified stretch of *Depositing/Lowland River (FW2)*, characterised by entirely loose fine sediment beds and no perceptible flow. Water was highly

turbid, even when undisturbed, with highly brown colouration. The watercourse exhibited evidence of historical straightening and embankment. The watercourse at GC 34 was culverted beneath the N24, with the culvert likely acting as a barrier to migration to all aquatic species.

The channel was tunnelled by continuous *Treelines (WL2)* of hawthorn, elder and willow *(Salix sp.)* and trailing bramble *Scrub (WS1).* Bankside vegetation included hart's-tongue-fern and meadowsweet, with common duckweed present semi-continuously along the water's surface. Habitats extending beyond the immediate scrub-dominant riparian buffer consisted of *(Mixed) broadleaved woodland (WD1), Conifer plantation (WD4)* and *Improved agricultural grassland (GA1).*

Due to the stagnant nature of the watercourse, absence of any clean, mobile gravels or any other coarse stone substrates, high degree of siltation and tunnelling of the watercourse, survey site GC 34 offered little suitable fisheries habitat for all fish species, with the exception of habitat for three-spined stickleback. The high degree of channel modification, along with the under-road culvert, and the existing high level of disturbance from the adjacent road, all limited suitable otter commuting habitat, with no otter signs identified at GC 34 at the time of survey.

Table 4-92. Properties of the watercourse at survey location GC 34

Properties	Record			
Average Depth (m)	0.3			
Average Bank Width (m)	1.8			
Wet Width (m)	1.5			
Flow	No perceptible flow			
Colouration	Highly brown			
Clarity	Highly turbid			
Average bank height (m)	LHB	2.0	RHB	2.0
Dominant Substrates	Silt (<0.25mm): 50% Earth: 50%			
Substratum Condition	Loose			

Plate 4-81. A representative image of survey location GC 34

Soft, unconsolidated channel bed substrates and stagnant flow posed sub-optimal conditions for Q-value assessment, and sweep netting was carried out throughout vegetation and substrates at GC 34. Biological water quality based on Q-sampling was calculated as **Q3/0– Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C was represented by two taxa with low abundance. Group D was represented by a single taxon. Group E taxa were absent from the sample. Results of the kick-sample are summarised in Table 4-93.

Table 4-93. Results of kick-sampling at survey location GC 34

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Gammarus sp.*	5
	Planorbidae	3
Group D – Very Pollution Tolerant	*Asellus aquaticus*	1
Group E – Most Pollution Tolerant	-	-

4.1.2.34 Grid Connection Route Survey Site 35 (GC 35)

Survey site GC 35 was located on the Groody River (EPA code: 25G05, Grid Reference: R 63591 54318). Properties of the watercourse at this survey location are provided in Table 4-94. Plate 4-82, Plate 4-83 and Plate 4-84 show representative photos of the watercourse and bridge crossing at survey site GC 35.

The watercourse at survey location GC 35 exhibited differing channel substrate composition and flow patterns upstream and downstream of the single-span concrete road bridge (Plate 4-83), with a high degree of marginal and overlying siltation and slow flowing, impounded water upstream of the bridge, and clean boulder and cobble with interstitial gravels along sections of sinuous, riffle-glide and pool.

Vegetation along the steep-sided earthen banks included great willowherb, reed-canary grass and meadowsweet, with encroaching willow and hawthorn *(Salix sp.)* treelines and bramble *Scrub (WS1)* downstream of the bridge, which provided marginal shading and refuge to the channel. Instream vegetation included marginal fool's-water-cress, watercress, abundant mats of water crowfoot and marginal branched bur-reed. Habitats extending from the immediate treeline riparian habitats consisted of *Improved agricultural grassland (GA1)* and individual residential dwellings classed as *Buildings and artificial surfaces (BL3).*

Potential fisheries habitat upstream of the bridge was limited by low velocity flows and a high degree of siltation, with sufficiently deep, slow flowing glide for opportunistic commuting and holding habitat for a range of fish species. Areas of undercut bank in conjunction with submerged root structures along the upstream survey extent provided moderate European eel habitat, with more abundant, higher quality European eel habitat downstream of the bridge in areas of marginal scour and backwater. Areas of deep pool and scour at the downstream survey extent (in excess of 0.7 m) also provided good salmonid holding habitat, with abundant instream refuge in the way of boulder features and overhanging tree limbs and woody debris, particularly along the right-hand bank.

Areas of suitable spawning habitat were limited to areas of relatively clean interstitial gravels downstream of the bridge, providing moderate, localised spawning habitat for salmonid and lamprey species. Refugia for juvenile salmonids was available in the way of a high degree of channel substrate variability, flow pattern diversity and instream macrophytes, all of which provided suitable sheltering features, with salmonid nursery habitat assessed as moderate. Lamprey nursery habitat was assessed as moderate, with fine sediment beds limited to the river margins upstream of the bridge, with swift flows and coarse channel substrate dominance downstream of the bridge.

Potential commuting and foraging habitat for otter were assessed as moderate-good, with no otter signs identified at GC 35 at the time of survey.

Table 4-94. Properties of the watercourse at survey location GC 35

Properties	Record			
Average Depth (m)	0.3			
Average Bank Width (m)	4.0			
Wet Width (m)	3.0			
Flow	Moderate			
Colouration	No apparent colouration			
Clarity	Clear			
Average bank height (m)	LHB	2.0	RHB	1.4
Dominant Substrates	Boulder (>128mm): 30% Cobble (>32–128mm): 50% Gravel (8-32mm): 15% Fine gravel (2-8mm): 15%			
Substratum Condition	Compacted			

Plate 4-82. A representative image of the downstream survey extent of GC 35

Kick-sampling was carried out in areas of cobble and gravel from downstream to upstream of the bridge. Biological water quality based on Q-sampling was calculated as **Q3 – Poor**, given the absence of Group A and B 'Very' and 'Moderately Pollution Sensitive' taxa. Group C was represented with high diversity and abundance, dominated by Baetis rhodani. Group D was represented by a single taxon; Group E taxa were absent. Results of the kick-sample are summarised in Table 4-95.

Table 4-95. Results of kick-sampling at survey location GC 35

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	*Baetis rhodani*	30
	Elmidae	10

	Ephemerellidae	5
	Gammarus sp.	20
	Hydropsyche sp.	15
	Lumbriculidae	1
	Simuliidae	40
	Theodoxus fluviatilis	2
Group D – Very Pollution Tolerant	*Glossiphonidae*	1
Group E – Most Pollution Tolerant	-	-

Plate 4-83. A representative image of the road bridge at survey location GC 35

Plate 4-84. A representative image of the upstream survey extent of survey location GC 35

4.2 eDNA Results

Environmental DNA (eDNA) surveys were undertaken on watercourses at 5 no. locations within the vicinity of the Proposed Wind Farm. Freshwater Pearl Mussel (*Margaritifera margaritifera*) (FPM), White-clawed crayfish (*Austropotamobius pallipes*) (WCC) and Crayfish plague (*Aphanomyces astaci*) (CP) were tested for at each location.

There were no positive results for FPM at any survey location indicating an absence of these species at or upstream of the surveyed sites.

eDNA surveys at sites WF 8 (6/12 replicates) and WF 16 (3/12 replicates) indicated positive results for White-clawed crayfish. There were no positive replicates for crayfish plague.

All eDNA results can be found in Appendix 3 of this report.

4.3 Otter

Watercourses throughout the vicinity of the Proposed Wind Farm and along the Proposed Grid Connection were surveyed for signs of otter, including spraint, prints, trails, holts and couches. No otter signs were identified at any of the sites, with the exception of otter prints identified at survey location GC 28 (Plate 4-85). No holts were identified 150m upstream or downstream of the bridge crossing GC 28 at the time of survey, although the Mulkear River provided high quality commuting and foraging habitat for otter at GC 28.

Plate 4-85. A representative image of otter prints identified along the right-hand bank at survey location GC 28 along the Grid Connection.

4.4 Invasive species

Table 4-96 provides a summary of the First and Third Invasives species, as well as the non-scheduled invasive species identified in the vicinity of the Proposed Wind Farm survey sites and along the Proposed Grid Connection survey sites.

Table 4-96. A summary of non-scheduled and First & Third Schedule Invasive species identified in the vicinity of the Proposed Wind Farm and Proposed Grid Connection.

Common name	Scientific name	Status	Sites
Giant hogweed	*Heracleum mantegazzianum*	First Schedule of the European Union (Invasive Alien Species) Regulations 2024 (S.I. No. 374 of 2024) Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477 of 2011).	WF 7/GC 1 WF 11 WF 16 GC 13
Himalayan Balsam	*Impatiens glandulifera*		WF 10 GC 22 GC 23 GC 28
Rhododendron	*Rhododendron ponticum*		GC 17
Montbretia	*Crocosmia × crocosmiiflora*	Non-scheduled	GC 2 GC 22 GC 26
Snowberry	*Symphoricarpos albus*		GC 2 GC 4 GC 15 GC 19
Cherry laurel	*Prunus laurocerasus*		GC 13

5. CONCLUSIONS

5.1 Proposed Wind Farm Aquatic Baseline Assessment

Watercourses surveyed within the vicinity of the Proposed Wind Farm consisted of *Eroding/Upland Rivers (FW1)*, with upland, headwater rivers profiles at survey locations WF 1, WF 2, WF 4, WF 5, WF 6, WF 13 and WF 14. Survey locations WF 8 – WF 12 and WF 16 represented wider, lowland stretches of watercourse, with varying degree of modification but overall high fisheries potential.

Habitats surrounding the Proposed Wind Farm aquatic survey sites consisted predominantly of **Buildings and artificial surfaces (BL3), Improved agricultural grassland (GA1), Dry calcareous and neutral grassland (GS1), Dry meadows and grassy verges (GS2), Wet grassland (GS4), Conifer plantation (WD4), Riparian woodland (WN5), Scrub (WS1), Treelines (WL2) and Stone walls and other stonework (BL1).**

Q-value scores calculated for the survey sites in the vicinity of the wind farm ranged from **Q2-3 – Poor** (WF 13) to **Q3-4 –Moderate** (WF 1, WF 5, WF 6, WF 7 / GC 1, WF 9 - WF 11), **Q4 –Good** (WF 3, WF 8, WF 12, WF 14) and **Q4-5 – High** (WF 16).

Survey locations WF 4, WF 6 and WF 13 exhibited limited fisheries potential as a result of a high degree of modification or ongoing disturbance due to surrounding land use pressures (forestry, agricultural and ford crossings). While survey sites such as WF 1 – WF 3 and WF 5 offered localised moderate fisheries habitat for juvenile salmonids in particular, the upland, at times bedrock-dominant nature of these watercourses, with step features throughout, may potentially limit the accessibility of these survey sites by fish species. Survey locations WF 8 – WF 11 (located along the Multeen River) and WF 16 provided the highest quality fisheries habitat, with channel substrate variability and associated flow pattern diversity providing a range of suitable instream habitats, from mobile, clean spawning gravels, to deep, well sheltered holding pools. Despite a high degree of existing habitat disturbance in the form of an absent riparian buffer and instream ford, survey location WF 12 (also located along the Multeen River) still provided suitable supporting fisheries habitat for salmonid fish. WF 15 represented a dry watercourse at the time of survey.

Varying degrees of bank and channel modification were identified along the surveyed watercourses, with the most highly altered watercourses at WF 6 and WF 12. WF 6 exhibited evidence of ongoing disturbance in the form of a ford crossing directly through the watercourse, with no distinct channel margins. Either side of the road, the watercourse at WF 6 dropped off into a more naturalised stretch of steep, step-pool-cascade sequence Eroding/Upland River (FW1) which was highly tunnelled. The surveyed stretch of the Multeen River along WF 12 represented a fast-flowing section of Eroding/Upland River (FW1) with largely natural channel substrates. However, modification was evident in the form of lack of any riparian buffer between the watercourse and pastural fields, active bank erosion and a artificial ford crossing built partially across the channel width. Undercut bank features were also present at WF 8.

Survey sites WF 5 and WF 7 exhibited evidence of ongoing livestock poaching, with a high degree of persistent siltation (opaque, brown water colouration) present across at least two days of survey (11th and 12th July 2024). Sites WF 9 and WF 16 also exhibited signs of historic livestock access, with bank reinforcement at both of these sites in the vicinity of bridge structures.

There were no positive results for freshwater pearl mussel or crayfish plague eDNA at any of the wind farm survey locations. Positive results for white-clawed crayfish eDNA were found at survey sites WF 8 (6/12 replicates) and WF 16 (3/12 replicates), indicating the presence of this species at or upstream of these survey locations.

No otter signs, otter holts or couches were identified at the survey sites in the vicinity of the Proposed Wind Farm, with many survey sites exhibiting limited potential otter habitat as a result of the upland, bedrock profile of some watercourse, and an existing high level of disturbance and/or modifications at others. Survey sites WF 8 – WF 11 and WF 16 provided good potential commuting and foraging habitat for otter in the form of good connectivity through the wider area and high fisheries potential. No kingfisher were observed utilising the watercourses in the vicinity of the Proposed Wind Farm survey sites, with no kingfisher burrows identified at any of the survey locations at the time of survey.

5.2 Proposed Grid Connection Aquatic Baseline Assessment

Watercourses surveyed along the Proposed Grid Connection consisted of stretches of both **Eroding/Upland River (FW1)** and **Depositing/Lowland River (FW2),** with varying degrees of modification. Several watercourses represented more naturalised stretches of watercourse, with natural, coarse channel substrates and flow diversity laterally and longitudinally along the survey stretches, including GC 3, GC 13 and GC 23 *(Eroding/Upland River, FW1)* and GC 22 and GC 28 *(Depositing/Lowland River, FW2).* These survey sites offered the highest quality potential fisheries habitat along the Proposed Grid Connection, as well as the best potential commuting and foraging habitat for otter.

Several watercourses represented narrow, laterally confined watercourses as a result of small under-road culverts or bankside reinforcement, with limited potential for migration of aquatic species through the watercourse at GC 2, GC 9, GC 15 and GC 25. Watercourses at survey sites GC 33 and GC 34 were visibly culverted under roads via concrete pipes.

Watercourses which exhibited the highest degree of modification included GC 10 which exhibited evidence of livestock poaching and historic bank alteration, including poaching and resectioning upstream of the bridge and stone wall reinforcement and channel narrowing downstream of the bridge. Survey location GC 11 represented the most highly modified watercourse along the Propsoed Grid Connection, with an impassable, collapsed pipe culvert, a high degree of channel and bank poaching, and silt dominant channel substrate, with little to no natural coarse channel substrate present. GC 17 exhibited a raised, likely impassable culvert, with a high degree of artificial channel bed substrate and channel straightening. GC 19 represented a watercourse with no natural channel bed substrates, evidence of channel straightening and a high degree of siltation, with opaque brown-grey water colouration at the time of survey.

Habitats surrounding the Proposed Grid Connection watercourse crossings consisted predominantly of **Buildings and artificial surfaces (BL3), Spoil and bare ground (ED2), Recolonising bare ground (ED3), Improved agricultural grassland (GA1), Amenity grassland (Improved (GA2), Dry calcareous and neutral grassland (GS1), Dry meadows and grassy verges (GS2), Wet grassland (GS4), Conifer plantation (WD4), Riparian woodland (WN5), Scrub (WS1), Treelines (WL2)** and **Stone walls and other stone work (BL1).**

Q-value scores calculated for the survey sites in the vicinity of the wind farm ranged from **Q2-3 – Poor** (GC 33), **Q3 – Poor** (GC 2, GC 5, GC 9, GC 10 – 12, GC 15, GC 17, GC 19, GC 22, GC 25 GC 26, GC 27 (both right-hand and left-hand channel branches), GC 29, GC 29 - GC 31, GC 32 GC 34 and GC 35) to **Q3-4 –Moderate** (GC 3, GC 6. GC 13, GC 23 and GC 28). Several watercourses represented entirely dry or negligibly wetted watercourses at the time of survey, often times heavily encroached with vegetation.

Due to the unwetted nature of these watercourse, kick-sampling could not be conducted at the following survey sites: GC 4, GC 7, GC 8, GC 14, GC 18, GC 20, GC 21 and GC 24. Survey location GC 16 could not be surveyed instream due to the presence of livestock.

Otter prints were identified at survey site GC 28. No other otter signs, holts or couches were identified along the Proposed Grid Connection at the time of survey.

BIBLIOGRAPHY

Armstrong J.D., Kemp P.S., Kennedy G.J.A., Ladle M., Milner N.J.., (2003). Habitat requirements of Atlantic salmon and brown trout in rivers and streams, Fisheries Research.

Bailey, M. and Rochford J. (2006). Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals, No. 23. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Barbour, M.T. and J.B. Stribling. (1991). Use of Habitat Assessment in Evaluating the Biological Integrity of Stream Communities. Biological Criteria: Research and Regulation: 25-38. EPA-440/5-91-005. Washington, DC: Office of Water, US EPA.

CEN (2003). Water Quality – Sampling of Fish with Electricity. CEN EN 14011 8. European Committee for Standardisation, Brussels 18 pp.

CFB (2008). Electric Fishing in Wadeable reaches. Unpublished report, Central Fisheries Board.

Conserving Natura 2000 Rivers Ecology Series No. 7. English Nature, Peterborough.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC (codified version of Directive 79/409/EEC as amended) (Birds Directive) – transposed into Irish law as European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477/2011).

Department of Agriculture (DOA-NI, 2005). Advisory leaflet on The evaluation of habitat for salmon and trout. EU Salmon Enhancement Programme.

Dobson, M., Pawley, S., Fletcher, M. and Powell, A., 2012. Guide to Freshwater Invertebrates, *Freshwater Biological Association,* The Ferry Landing, Cumbria, UK.

Environment Agency (2003) 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003. Updated and reprinted in April 2022.

European Communities (Conservation of Wild Birds) Regulations, 1985, SI 291/1985 & amendments – http://www.irishstatutebook.ie

European Communities (Natural Habitats) Regulations, SI 94/1997, SI 233/1998 & SI 378/2005 – http://www.irishstatutebook.ie

First Schedule of the European Union (Invasive Alien Species) Regulations 2024 (S.I. No. 374 of 2024).

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

Habitats Directive (92/43/EEC).

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

Hendry K & Cragg-Hine D (1997). Restoration of Riverine Salmon Habitats: A guidance manual. Fisheries Technical Manual 4.

Hendry K & Cragg-Hine D (2003). Ecology of the Atlantic Salmon.

IFI (2010). Biosecurity Protocol for Field Survey Work. Available online at: http://www.fisheriesireland.ie/InvasiveSpecies/biosecurity-protocol-for-field-survey-work.html

Inland Fisheries Ireland. Water Framework Directive Rivers Fish Ecological Status 2008-2022.

Kelly-Quinn, M. & Regan, E.C. (2012). Ireland Red List No. 7: Mayflies (Ephemeroptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Kelly, F.L., Matson, R., Connor, L., Feeney, R., Morrissey, E., Wogerbauer, C. and Rocks, K. (2013). Water Framework Directive Fish Stock Survey of Rivers in the Shannon International River Basin District. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland

Kelly, F.L., Harrison, A., Connor, L., Wightman, Glen., Matson, R., Hanna, G., Fenney, R., Morrisse, E., O'Callaghan, R., Wogerbauer, C., Rocks, K. (2009). Sampling Fish for the Water Framework Directive: Shannon International River Basin District. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland

Kennedy, G.J.A. (1984). Evaluation of techniques for classifying habitats for juvenile salmon (*Salmo salar L.*). *Proceedings of the Atlantic Salmon trust workshop on stock enhancement*. 23 pp

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

Matson, R., Delanty, K., Gordon, P., O'Briain, R., McCarthy, E., Cierpal, D., Connor, L., Corcoran, W., Coyne, J., McLoone, P., Morrisey-McCaffrey, E., Brett, T., Gavin, A and Kelly, F.L., (2019). Sampling Fish in Rivers 2018 - Suir, Factsheet No. 7. National Research Survey Programme. Inland Fisheries Ireland.

NPWS (2008). The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.0. Unpublished Report, National Parks and Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3, Version 1.0. Unpublished Report, National Parks and Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

NPWS Protected Site Synopses and maps available on http://www.npws.ie/en/ProtectedSites/

O'Connor, L. & Kennedy, R.J. (2002). A comparison of catchment-based salmon habitat survey techniques on three rivers in N. Ireland. *Fisheries Management and Ecology*, 9, 149-161.

O'Connor, W. (2004). A survey of juvenile lamprey populations in the Moy catchment. Irish Wildlife Manuals, No. 15. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland 6-85.

O'Connor, W. (2006). A survey of juvenile lamprey populations in the Boyne Catchment. Irish Wildlife Manuals, No. 24 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

O'Connor, W. (2007). A survey of juvenile lamprey populations in the Corrib and Suir catchments. Irish Wildlife Manuals No. 26. National Parks and Wildlife Service.

O'Grady, M.F. (2006). Channels & Challenges. Enhancing Salmonid Rivers. Irish Freshwater Fisheries Ecology & Management Series: No 4. Central Fisheries Board, Dublin, Ireland. https://www.fisheriesireland.ie/sites/default/files/migrated/docman/Channels%20%26%20challenges-enhancing%20salmonid%20rivers%2072secure.pdf

Stace, C. A. (1997). New Flora of the British Isles. Cambridge: Cambridge University Press.

Tesch, F.W. (2007). The Eel: Third Edition. 10.1002/9780470995389.

TII (2008). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (PE-ENV-01113). Transport Infrastructure Ireland, Dublin

TII (2020). The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (GE-ENV-01105) Transport Infrastructure Ireland, Dublin

Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477 of 2011).

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

Water status data available on http://www.epa.ie and http://www.wfdireland.ie

Wildlife Act 1976 and Wildlife (Amendment) Act 2000.

APPENDIX I

ELECTROFISHING SURVEY RESULTS AT PROPOSED WIND FARM SURVEY LOCATIONS

Appendix I: Electrofishing species records at Proposed Wind Farm Survey Locations					
Survey Location	Fish Species				
	Brown trout *(Salmo trutta)*	Atlantic salmon *(Salmo salar)*	Stone Loach *(Barbatula barbatula)*	Three-spined stickleback *(Gasterosteus aculeatus)*	Brook Lamprey (*Lampetra planeri*)
WF 1	–	–	–	–	–
WF 2	2	–	–	–	–
WF 3	21 (an additional 6 observed but not caught)	–	–	–	–
WF 4	–	–	–	–	–
WF 5	–	–	–	–	–
WF 6	–	–	–	–	–
WF 7	–	–	–	–	–
WF 8	18 (and additional 11 observed but not caught)	8	1	–	–
WF 9	–	8	–	–	–
WF 10	36	1	–	–	13
WF 11	37	13	–	–	8
WF 12	39	15	–	–	2
WF 13	–	8	–	–	–
WF 14	–	8	–	–	–
WF 15	Not fished due to dry and inaccessible channel				
WF 16	26	9			

APPENDIX II

Q-VALUE RESULTS AT PROPOSED WIND FARM AND PROPOSED GRID CONNECTION SURVEY LOCATIONS

Appendix II: Q-Values at all Survey Locations (Proposed Wind Farm and Proposed Grid Connection Underground Cable Route)	
Survey Location	Q-Value and WFD Status
Proposed Wind Farm	
WF 1	Q3–4 – Moderate
WF 2	Q3 – Poor
WF 3	Q4–Good
WF 4	Q3 – Poor
WF 5	Q3–4 – Moderate
WF 6	Q3 – Poor
WF 7 / GC 1	Q3–4 – Moderate
WF 8	Q4–Good
WF 9	Q3–4 – Moderate
WF 10	Q3–4 – Moderate
WF 11	Q3–4 – Moderate
WF 12	Q4–Good
WF 13	Q2–3–Poor
WF 14	Q4–Good
WF 15	Not kick-sampled due to dry and inaccessible channel
WF 16	Q4–5–High
Proposed Grid Route	
GC 2	Q3 – Poor
GC 3	Q3–4 – Moderate
GC 4	Not kick-sampled due to dry channel
GC 5	Q3 – Poor
GC 6	Q3–4 – Moderate
GC 7	Not kick-sampled due to dry channel
GC 8	Not kick-sampled due to negligibly wetted channel
GC 9	Q3 – Poor
GC 10	Q3 – Poor
GC 11	Q3 – Poor
GC 12	Q3 – Poor
GC 13	Q3–4 – Moderate
GC 14	Not kick-sampled due to dry channel
GC 15	Q3 – Poor
GC 16	Not kick-sampled due to inaccessible channel
GC 17	Q3 – Poor
GC 18	Not kick-sampled due to dry channel
GC 19	Q3 – Poor
GC 20	Not kick-sampled due to dry channel
GC 21	Not kick-sampled due to dry channel
GC 22	Q3 – Poor
GC 23	Q3–4 – Moderate
GC 24	Not kick-sampled due to dry channel
GC 25	Q3 – Poor
GC 26	Q3 – Poor
GC 27	Q3 – Poor (for both right- and left-hand channel branches)
GC 28	Q3–4 – Moderate
GC 29	Q3 – Poor
GC 30	Q3 – Poor
GC 31	Q3 – Poor
GC 32	Q3 – Poor

GC 33	Q2-3 – Poor
GC 34	Q3 – Poor
GC 35	Q3 – Poor

APPENDIX III

PROPOSED WIND FARM SURVEY LOCATION eDNA RESULTS

Folio No: 3203-2024
Purchase Order: 231102
Contact: MKO
Issue Date: 02.08.2024
Received Date: 23.07.2024

eDNA Report

Technical Report

SureScreen Scientifics

Folio No: 3203-2024
Purchase Order: 231102
Contact: MKO
Issue Date: 02.08.2024
Received Date: 23.07.2024

SureScreen Scientifics

eDNA Analysis

Summary

When aquatic organisms inhabit a waterbody such as a pond, lake or river they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm the presence or absence of the target species within the waterbody.

Results

Lab ID	Site Name	OS Reference	Target Species	Sample Integrity Check	Result	Positive Replicates
FK1514	Carrow WF 8		Crayfish plague	Pass	Negative	0
			Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Positive	6
FK2200	Carrow WF 16		Crayfish plague	Pass	Negative	0
			Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Positive	3
FK2122	Carrow WF 7		Crayfish plague	Pass	Negative	0
			Freshwater pearl mussel	Pass	Negative	0
			White-clawed	Pass	Negative	0

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		crayfish			
FK2202	Carrow WF 12	Crayfish plague	Pass	Negative	0
		Freshwater pearl mussel	Pass	Negative	0
		White-clawed crayfish	Pass	Negative	0
FK2121	Carrow WF 3	Crayfish plague	Pass	Negative	0
		Freshwater pearl mussel	Pass	Negative	0
		White-clawed crayfish	Pass	Negative	0

Matters affecting result: none

Reported by:Chelsea Warner

Approved by: Lauryn Jewkes

Folio No:	3203-2024
Purchase Order:	231102
Contact:	MKO
Issue Date:	02.08.2024
Received Date:	23.07.2024

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Methodology

Samples have been analyzed for the presence of target species eDNA following readily available and scientifically published eDNA assays and protocols.

The analysis is conducted in two phases. The sample first goes through an extraction process where the filter is incubated in order to obtain any DNA within the sample. The extracted sample is then tested via real-time PCR (also called q-PCR) for each of the selected target species. This process uses species-specific molecular markers (known as primers) to amplify a select part of the DNA, allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines amplification and detection of target DNA into a single step. With qPCR, fluorescent dyes specific to the target sequence are used to label targeted PCR products during thermal cycling. The accumulation of fluorescent signals during this reaction is measured for fast and objective data analysis. The primers used in this process are specific to a part of mitochondrial DNA only found in each individual species. Separate primers are used for each of the species, ensuring no DNA from any other species present in the water is amplified. If target species DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If target DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent the risk of false positive and false negative results. True positive controls, negative controls, and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared. Stages of the analysis are also conducted in different buildings at our premises for added security. SureScreen Scientifics Ltd is ISO9001 accredited and participates in Natural England's proficiency testing scheme for GCN eDNA testing.

Interpretation of Results

Sample Integrity Check:

Laboratory Arrival:

When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results. Any samples which fail this test are rejected and eliminated before analysis.

Degradation and Inhibition check:

Analysis of the spiked DNA marker to see if there has been degradation or inhibition of the kit or sample, between the date it was made to the date of analysis. Degradation of the spiked DNA marker may indicate a risk of false negative results. If inhibition is detected, samples are purified and re-analyzed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result:

Presence of eDNA (Positive/Negative/Inconclusive)

Positive: DNA was identified within the sample, indicative of species presence within the sampling location at the time the sample was taken or within the recent past.

Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for species presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. Even a score as low as 1/12 is declared positive. 0/12 indicates negative species presence.

Negative: eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of species absence, however, does not exclude the potential for species presence below the limit of detection.

Inconclusive: Controls indicate inhibition or degradation of the sample, resulting in the inability to provide conclusive evidence for species presence or absence.