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Our Ref: **LT10_JN5_GLS_Otter_D**
Date: **22nd January 2021**

Wildlife Licensing Unit,
National Parks and Wildlife Service,
Department of Arts, Heritage, Regional, Rural & Gaelteacht Affairs,
7 Ely Place,
Dublin 2,
D02TW98.

Re: Derogation license for otter (indirect holt disturbance) under section 54 of S.I. No. 477 of 2011 (Birds and Natural Habitats Regulations), Glashaboy River, Co. Cork.

Dear Sir /Madam,

There is a history of flooding in the Glashaboy River catchment and thus, the urban areas of Glanmire and Sallybrook have experienced flooding and considerable damage to residential and commercial properties. In more recent years there was a significant flood event in June 2012 and flooding also occurred during the winter of 2015/2016.

The Catchment Flood Risk Assessment and Management (CFRAM) Study for the Lee Catchment, which includes the Glashaboy River catchment, identified a preferred option for the alleviation of flood risk in the Glashaboy catchment. As a result, Cork Count Council, acting as Agents for the OPW has commissioned the development of the Glanmire/ Sallybrook Drainage Scheme. To progress the scheme in advance of the main contractor being appointed, advance tree felling works are required to facilitate construction within these areas.

Given likely unavoidable disturbance to the breeding and or resting places of otter in areas adjoining advanced works tree felling we wish to apply for a derogation license under Regulation 54 of S.I. No. 477 of 2011 (Birds and Natural Habitats Regulations). In accordance with the NPWS Guidance on '*the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland*' (NPWS, 2021), **Stage I** requires the examination of existing information to determine the probability of a protected species (i.e., otter) being present in the works area. Stage II requires an ecological survey be carried out by a competent ecologist. In accordance with Stage I and Stage 2 of the guidelines an otter survey was conducted by Triturus Ltd. during April 2021 to establish the recent distribution of otter breeding and resting areas in the vicinity of proposed works areas (Triturus 2021). This included the provision of detailed map locations of existing holt and or couch areas. **Stage 3** of the decision-making process requires the examination of impacts and satisfactory alternatives. The conclusion was that there was no alternative option but to fell trees in the vicinity of the identified holts (within the zone

of influence) (Arup pers. comm.). However, it was agreed that holt closure could be avoided in consultation with local NPWS staff and Arup consulting engineers as this decision minimised impacts that would otherwise arise from holt closure. However, indirect disturbance during tree felling would nonetheless be unavoidable. Therefore, it was deemed necessary to proceed to **Stage 4**, application for a Regulation 54 derogation license given no satisfactory alternative was available (refer to 'Advance Tree Felling works description and preconditions for derogation below).

The NPWS guidance also states that once the derogation decision has been arrived at it must conform with three pre-conditions set out in Regulation 54. These are as follows;

1. A reason listed in Regulation 54 (a)-(e)
2. No satisfactory alternatives exist
3. Derogation would not be detrimental to the maintenance of populations(s) at favourable conservation status.

Following examination of the three pre-conditions from part 1 above, it was determined a derogation was required on the basis of (C) '*being in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment'.*

In accordance with part 2 of the preconditions (above), as no satisfactory alternatives to the tree felling proposals were available (see scheme background and tree felling below), part 3 was arrived at.

It has been concluded based on careful consideration and knowledge of otter distribution and utilisation of the Glashaboy River catchment that the derogation for tree felling would not be detrimental to the maintenance of otter population(s) at 'favourable conservation status'. This was considered as there will be no direct removal of breeding and or resting areas with disturbance being temporary only (i.e., no holt closure required as part of advance works tree felling). Numerous holts have been identified on the system (Triturus Ltd. 2021) and there are large areas of undisturbed habitat available to otter which would reduce the negative effects associated with temporary disturbance. The provision of artificial holts (2 number) that form part of this derogation license application will also provide additional breeding and resting opportunities for otter. Furthermore, the most recent conservation evidence from Article 17 reporting highlights otter conservation status as 'favourable' (NPWS, 2019). Otters were considered to be previously 'Near Threatened' (Marnell, 2009) based on a 20-25% decline between 1980 and 2005 (Bailey & Rochford, 2006). However, the current conservation status is now of 'Least Concern' (Marnell et al., 2019) due to national observations of population expansions which agree with the findings of Triturus Environmental Ltd. based on our extensive otter survey experience. In conclusion is considered that the current derogation would not be detrimental to the maintenance of otter populations(s) at favourable conservation status.

Background on Advance Works Tree Felling

The advance tree felling is required to facilitate the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme which includes the construction of direct flood defences and conveyance improvement measures along the Glashaboy River and its tributaries. The direct defences proposed include flood walls and embankments with the conveyance improvements

consisting of localised channel widening and deepening and the introduction of, or replacement of, culverts. Due to existing residential and business property locations susceptible to flooding adjacent to the river there is a very limited scope to locate defences outside of the riparian corridor therefore in order to construct these defences existing trees along the banks of the river are required to be removed. The advance tree felling works are being carried out due to the various time constraints relating to environmental factors (for example in-stream works period etc.) so as not to adversely delay the main project schedule and are thus considered unavoidable. Please note that a separate derogation for otter will be sought for the scheme build (once the main contractor has been appointed. As such this derogation is for the advance tree felling phase only.

Breeding & Resting Areas subject to current derogation

Recent total channel walkover surveys otter surveys were conducted in April 2021 by Triturus Environmental Ltd. in April 2021 to record otter signs throughout the Glashaboy River covering the Flood Relief Scheme extents (see appended otter report). The surveys recorded both otter holts in the vicinity of the advance works tree felling areas (see Table 1 and Figures 1-3 below). Those holts situated on the scheme overlapping the proposed works areas (i.e. screened in if they are situated within 150m of the works areas) are presented on Table 1 below.

In total, 5 otter holts were recorded within the study area overlapping tree felling areas (Table 1). The holt locations were situated on the Glashaboy River riparian areas at **1.** Sallybrook (single holt N2), **2.** East of Glanmire GAA pitch (holt cluster N3, N4 & N5) and **3.** in the Circus Field north of Meadowbrook Bridge. Given the scope and nature of the proposed tree felling works in relation to the locations of the existing holts, disturbance is unavoidable. However, no permanent loss of the holts identified overlapping the tree felling areas is anticipated.

Table 1 – Summary of Otter Holts Screened in by virtue of distance from works (see also Figures 1, 2 & 3)

Holt Number	Holt Location (see also appended otter report Triturus 2021)	Distance from works (see Figures 1-3)	Rationale for monitoring	ITM (Coordinates)
1. Holt N2 (Sallybrook)	Adjoining proposed **tree felling** at Sallybrook	Adjacent to tree felling area	Indirect disturbance to holt (nearby tree felling)	572477, 576830
2. Holt N3, N4 & N5 (holt cluster)	Holts situated east of Glanmire GAA field on Millrace Channel Island. These are situated to the north of **proposed artificial holt area** at end of Millrace Channel Island.	25m to north of proposed artificial holt construction	Indirect disturbance to holt (construction of artificial holts – 2 number to south of holt cluster)	572676, 575837
3. Holt N6	Holt situated under root system of a large tree in the Circus Field north of Meadowbrook Bridge. Holt adjoining proposed **tree felling** area.	Adjacent to tree felling area	Indirect disturbance to holt (nearby tree felling)	572678, 575586

Mitigation during tree felling & compensatory holt construction

To compensate for the anticipated level of disturbance to otter holts on the main channel of the Glashaboy River (albeit no holts will be removed or closed during tree felling), two artificial holts are proposed for construction on the millrace island east of the Glanmire GAA pitches (Figure 3 below). The location been agreed with local NPWS staff and is based on maximising the likelihood of use by placing it near a known area used by otter. Despite the artificial holt area being within 25m of the nearest upstream location the construction period will last only one day and there is very dense scrub, trees and undergrowth separating the upstream holts from the artificial holt location. The location is also one of a few areas that can be accessed for such works away from human disturbance and thus based on extensive knowledge of the river is the best location for compensatory artificial otter holt construction.

It is understood that a course of monitoring is required in advance of the commencement of works to establish the relative occupancy of the identified holt structures inclusive of interim reporting. A section 9 & 23(b) license to film/ photograph otter has been obtained (License No. 3/2022) and each of the holt clusters is being monitored in advance of works. It is also proposed that holts will be monitored during and after works to monitor otter behaviour during tree felling. The field cameras have been monitoring in situ since the 19th of March 2022. Additionally, an Ecological Clerk of Works (otter specialist) will supervise the felling near otter holts to ensure that holts are not damaged during felling. Soft felling (i.e., felling of trees in section followed by gentle lowering to ground level) in areas adjoining the holts will be undertaken. Trees will be felled by lowering limbs away from riparian areas and his will be undertaken during daylight hours only.

In summary given that otter are afforded legal protection under the Wildlife Acts 1976-2021 and the European Communities (Birds and Natural Habitats) Regulations 2011-2021, Triturus Ltd. on behalf of Cork City Council wish to apply for a derogation license to conduct works that may disturb the breeding and or resting places of otter under Regulation 54 of S.I. No. 477 of 2011 (Birds and Natural Habitats Regulations). Specifically, this would include for the disturbance of otter holts screened in (i.e. within 150m of works – see Table 1 above & Figure 1-3 below).

We trust you have the information required to consider our derogation license application and please do not hesitate to contact us should you require any further clarifications. We would appreciate if you could expedite your response to this application at your earliest convenience as there it is hoped than tree felling can commence in mid-February 2022.

Yours faithfully,
For and on behalf of Triturus Environmental Ltd.,

Principal Ecologist & Fisheries Scientist

Triturus Environmental Services

C.C. Claire Deasy (NPWS Local Ranger)

Plate 1 – Example of otter holt (N2) on the Glashaboy River under root system with fresh spraint and well-worn slides to river

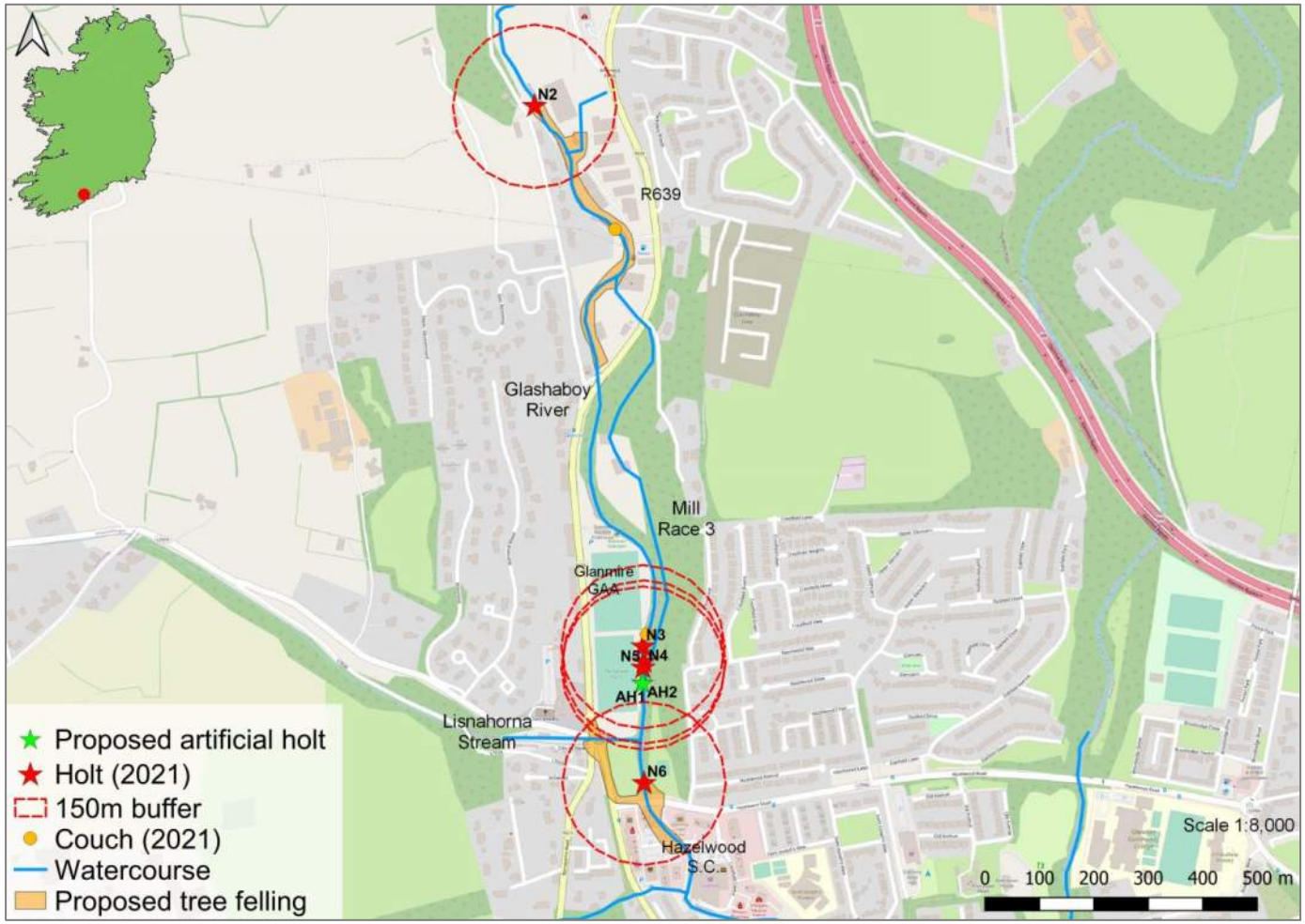

Figure 1 – Holt overview map in the vicinity of proposed tree felling areas & artificial holt construction

Figure 2 – Holt N2 in the vicinity of proposed tree felling area at Sallybrook

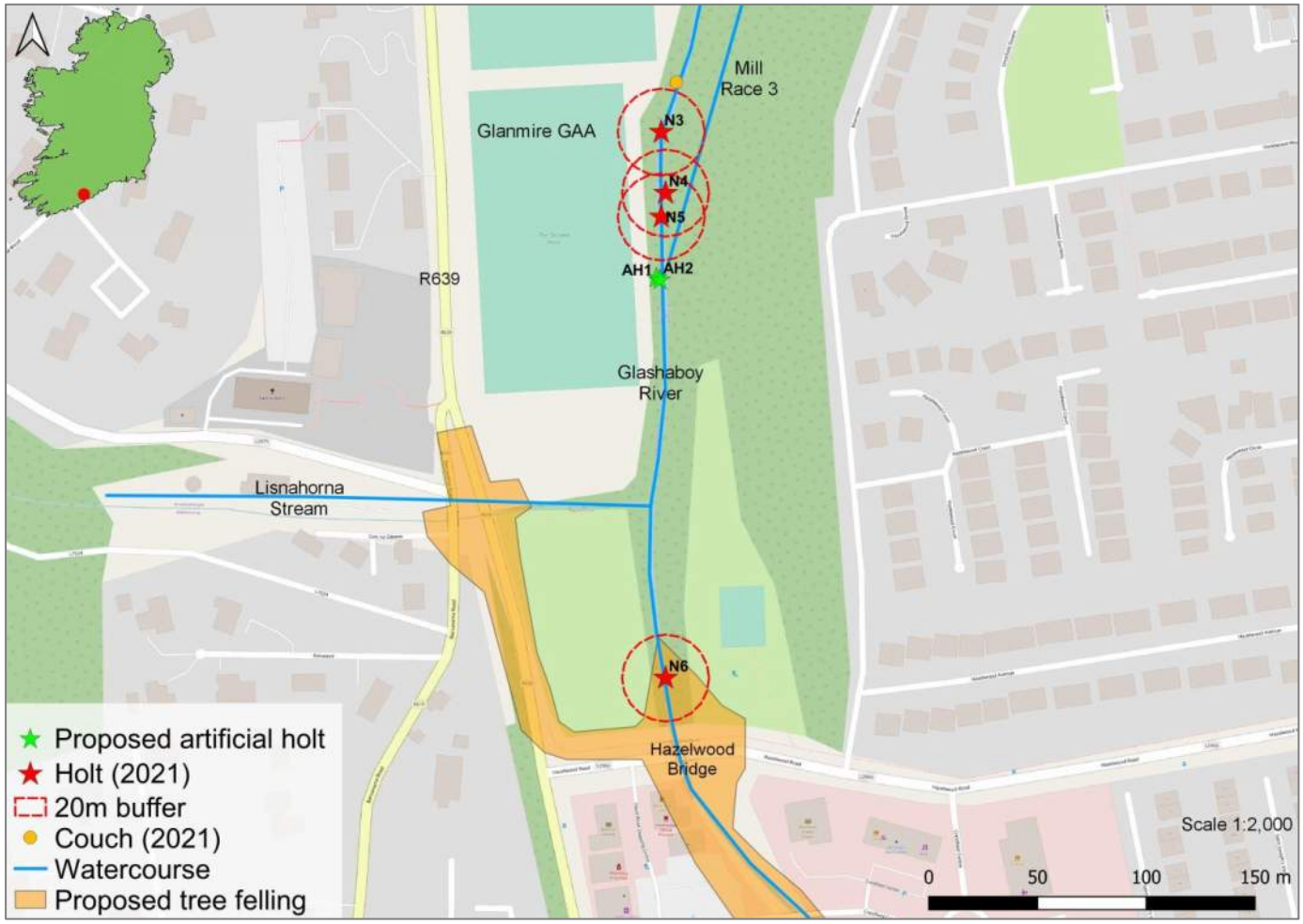

Figure 3 Holts (N3, N4 & N5) north of artificial holt areas AH1 and AH2. Holt N6 also shown in the vicinity of tree felling areas near Hazelwood Bridge

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NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 3: Specie Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill.

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Triturus (2021). Glashaboy Flood Relief Scheme otter survey 2021. Report prepared by Triturus Environmental Ltd. for ARUP. December 2021.

J.4 Glashaboy Flood Relief Scheme Otter Survey 2021, Triturus Environmental Ltd. for NPWS, December 2021

Glashaboy Flood Relief Scheme otter survey 2021

Prepared by Triturus Environmental Ltd. for ARUP

December 2021

Please cite as:

Triturus (2021). Glashaboy Flood Relief Scheme otter survey 2021. Report prepared by Triturus Environmental Ltd. for ARUP. December 2021.

Table of contents

1. Introduction

1.1 Project background

Triturus Environmental Ltd. were commissioned by ARUP to undertake a baseline otter (*Lutra lutra*) survey of the Glashaboy River and tributaries in the vicinity of Glanmire, Co. Cork as part of the Glashaboy Flood Relief Scheme (FRS). The survey area encompassed a total of 10.4km of riverine channel on the Glashaboy River and associated mill race channels, Upper Glanmire (Bleach Hill) Stream, Sallybrook Stream, Lisnahorna (Cois na Gleann) Stream, Rathcooney (Springmount) Stream, Butlerstown River and Lisheenroe (Glenmore) River which overlapped the proposed works areas and flood relief infrastructure. The survey was undertaken during April 2021 before heavy vegetation growth.

The Glashaboy FRS is being undertaken for the purpose of preventing or substantially reducing the periodical localised flooding of lands and properties in the area of this watercourse. The proposed scheme will include the construction of direct flood defences and conveyance improvement measures (including riparian vegetation removal) along the Glashaboy River and its tributaries. The direct defences proposed include flood walls and embankments with the conveyance improvements consisting of localised channel widening and deepening and the introduction of or replacement of culverts. The scheme will be designed to provide protection to properties from the 1 in 100 year fluvial and 1 in 200 year tidal flood events. Future maintenance of the scheme will also be carried out. Flood defences and conveyance improvements are proposed at a number of locations in the Glanmire/Sallybrook area.

This baseline otter survey helped to identify the presence of otters relative to the proposed works areas and map their distribution within the works footprint by identifying the occurrence of otter field signs (i.e. holts, spraints, couches, prints and other signs). The distribution of these signs acted as an indicator regarding areas of channel and aquatic habitat used by otters, inclusive of potential breeding areas (e.g. holts). The data collated will facilitate the recommendation of otter-specific mitigation measures for the proposed flood relief works.

1.2 Legislative protection

The Eurasian otter (*Lutra lutra*) is a species of conservation concern and high priority having suffered major declines in its range and population throughout Europe since the 1950s. It is classified as 'near threatened' by the IUCN Red List with a decreasing population trend and, as such, is listed in Appendix I of CITES, Appendix II of the Bern Convention (Council of Europe, 1979) and Annexes II and IV of the EC Habitats Directive (92/43/EEC).

Otters, along with their breeding and resting places, are also protected under provisions of the Irish Wildlife Acts 1976-2021. Otters have additional protection because of their inclusion in Annex II and Annex IV of the Habitats Directive 92/43/EEC, which is transposed into Irish law by the European Union (Birds and Natural Habitats) Regulations 2011-2021.

The protection of otters is outlined in Article 51(1) and (2):

Protection of fauna referred to in the First Schedule;

51.(1) *The Minister shall take the requisite measures to establish a system of strict protection for the fauna consisting of the species referred to in Part 1 of the First Schedule.*

51.(2) *Notwithstanding any consent, statutory or otherwise, given to a person by a public authority or held by a person, except in accordance with a license granted by the Minister under Regulation 54, a person who in respect of the species referred to in Part 1 of the First Schedule (listed below). Items (b) and (d) may be considered most relevant to developments.*

- ***(a)*** *deliberately captures or kills any specimen of these species in the wild,*
- ***(b)*** *deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,*
- ***(c)*** *deliberately takes or destroys eggs of those species from the wild,*
- ***(d)*** *damages or destroys a breeding site or resting place of such an animal, or*
- ***(e)*** *keeps, transports, sells, exchanges, offers for sale or offers for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive, shall be guilty of an offence.*

In an Irish context, according to the most recent Article 17 reporting (NPWS, 2019), otter conservation status has improved, with the species now evaluated as being of 'Favourable' conservation status. Otters were considered to be previously 'Near Threatened' (Marnell, 2009) based on a 20-25% decline between 1980 and 2005 (Bailey & Rochford, 2006). However, the current conservation status is now of 'Least Concern' (Marnell et al., 2019).

1.3 Study area description

Located in the Glashaboy [L.Mahon]_SC_010 sub-catchment, the Glashaboy River (EPA code: 19G01) rises at Bottlehill in north Cork and flows south-west adjoining Carrignavar and then through Sallybrook and Glanmire before entering Lough Mahon, west of the Dunkettle Interchange. The lowermost (estuarine) reaches of the Glashaboy form part of Cork Harbour SPA (004030) and Glanmire Wood pNHA (001054). The Glashaboy River catchment drains an area of approximately 141km^2. The Glashaboy is a spate river that flows predominantly over old red sandstone (GSI data). The river features extensive well-sorted gravel and cobble substrata which offer very good spawning for salmonids. It is also an important sea trout (*Salmo trutta*) system (McGinnity et al. 2003). The Glashaboy and tributaries are also known to support brown trout (*Salmo trutta*), Atlantic salmon (*Salmo salar*), *Lampetra* sp., European eel (*Anguilla anguilla*) and three-spined stickleback (*Gasterosteus aculeatus*) (Matson et al., 2019; ARUP, 2016).

In its lower reaches, the Glashaboy achieved **Q4-5** (high status) water quality at two stations in 2020 (i.e. RS19G010400 and RS19G010600). The Butlerstown Stream also achieved high status in 2020 at two monitoring stations (**Q5** at RS19B060500 and **Q4-5** at RS19B060800). Thus, these rivers are currently meeting the good status requirements (≥Q4) of the Water Framework Directive (2000/60/EC). Contemporary water quality data for the other survey watercourses was not available at the time of survey.

2. Methodology

2.1 Desktop review

A desktop review of published and unpublished data for the Glashaboy River and associated tributaries was undertaken in respect of otter. Data pertaining to otters held by the National Biodiversity Data Centre (NBDC) was also reviewed.

2.2 Otter sign surveys

Walkover otter surveys were undertaken in April 2021. The survey area reflected the extent of the proposed drainage works and comprised approx. 10.4km of riverine channel (including former mill race channels) (**Table 2.1**, **Figure 2.1**).

The site surveys were completed during dry, mild, bright and settled conditions, which ensured that a good representation of habitat marked by otter could be recorded in the field, including territorial marking or marking of feeding areas. The surveys also deliberately coincided with prolonged dry periods (≥3 days after significant rainfall) and base river flows to not only ensure safe site access but also that the extent of otter signs (spraint, smears etc.) washed away due to recent precipitation was minimised.

Each otter sign was logged by type, location (handheld GPS), condition and approximate age for later interpretation to distinguish differences in habitat use and activity. Spraints were subjectively assessed as either fresh (very recent), mixed-age (recent and older spraints typically indicative of a regular sprainting site) or old (spraint breaking down and not recently deposited). Furthermore, indicative counts of spraint (i.e. number of individual spraints) and the number of sprainting sites (often separate clusters in one area) were noted. This helped indicate the frequency of otter marking, which can clarify levels of activity in particular areas of river channel or other aquatic habitats.

Table 2.1 Watercourses surveyed as part of the Glashaboy FRS otter survey 2021. Primary nomenclature is according to the EPA

Watercourse	Alternative name (OS mapping)	EPA code	Length of channel surveyed (km)
Glashaboy River	n/a	19G01	4.65
Lisheenroe River	Glenmore River	19L40	2.00
Butlerstown River	n/a	19B06	0.88
Mill Race no. 3	n/a	n/a	0.82
Mill Race no. 2	n/a	n/a	0.58
Mill Race no. 1	n/a	n/a	0.42
Upper Glanmire Stream	Bleach Hill Stream	19U02	0.40
Rathcooney Stream	Springmount Stream	19R31	0.25
Lisnahorna Stream	Cois na Gleann Stream	19L45	0.25
Sallybrook Stream	n/a	n/a	0.16
		Total length	10.4

2.3 Total corridor otter survey (TCOS) methodology

The site visits broadly followed the best practice survey methodology for otter as recommended by Lenton et al. (1980), Chanin (2003) and Bailey & Rochford (2006). However, methodology differed in that the entire waterline was surveyed rather than the standard 500-600m sections from accessible points (e.g. bridges). The novel survey technique, known as a total corridor otter survey (TCOS) (Macklin et al., 2019), encompassed the entire riparian zone and in-channel surveys along both banks of the Glashaboy River and associated tributaries.

Total corridor survey methodology typically involves the use of two (or more) surveyors working independently (in tandem) along each respective bank of an individual watercourse (where practical). This also facilitates one to work from a more elevated position (e.g. bank top) with one surveying (with appropriate PPE such as a wet/dry suit or chest waders) from within the channel, thus greatly increasing the likelihood of otter sign detection. This is especially true of more cryptic signs such as holts, which can be located in undercut banks, under tree root systems etc., out of the view of traditional surveys. Surveyors can alternate between the river channel and each bank depending on surveyor knowledge and experience of preferential areas of habitat likely to be used by otter.

2.4 Biosecurity

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

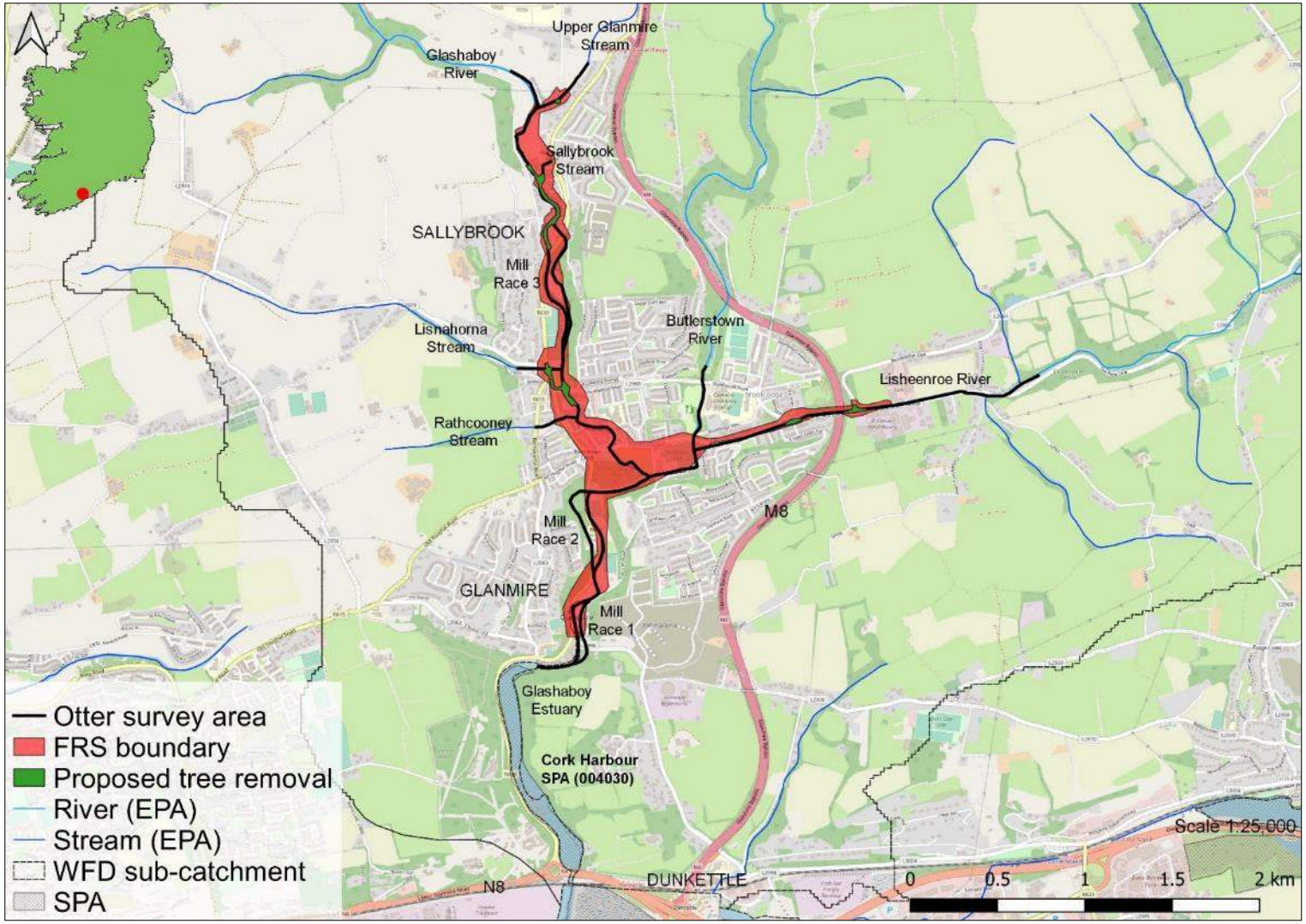

Figure 2.1 Overview of the Glashaboy FRS otter survey area, April 2021

3. Survey area descriptions

The following section briefly describes the hydro-morphology and habitats recorded along each survey watercourse in the wider context of otter. The watercourses were surveyed in April 2021. Individual watercourses are listed below in a north to south orientation and described following a downstream survey direction. Watercourse nomenclature is according to the EPA. Habitat codes, where provided, follow Fossitt (2000).

3.1 Glashaboy River and mill race channels

Within the survey area, the Glashaboy River (EPA code: 19G01) is a semi-natural, high-energy watercourse (prone to spate) that had been modified historically. Whilst some of these modifications were more extensive, locally (e.g. retaining walls and revetments near Grandon's Garage and Hazelwood), the river retained a good degree of naturalness, overall. The riparian zones are often mature and intact throughout the catchment, with the river flowing through heavily wooded areas in several locations within the survey area (e.g. near GAA pitch and John O'Callaghan Park). Downstream of the weir in John O'Callaghan Park, the river becomes tidal.

The Glashaboy River varied from 8-15m in width, on average, with good water quality and a high diversity of riffle, pool and glide habitats supporting a healthy fish population. The Glashaboy also features extensive well-sorted, mobile gravel and cobble substrata, which offer very good quality spawning habitat for Atlantic salmon, brown trout and sea trout (i.e. very good otter foraging opportunities).

A number of historical mill race channels adjoin the Glashaboy in Sallybrook (mill race no. 3) and downstream of John O'Callaghan Park (mill race no. 1 & 2). For much of the year, these 4-6m wide channels are shallow (<0.2m) and support low water flows, with abundant large woody debris (LWD) instream originating from the surrounding mature broad-leaved woodland. Whilst the fisheries value of these channels is relatively poor at basal water levels, their value increases significantly at higher flows (e.g. winter), with some areas providing good-quality salmonid holding habitat.

Plate 3.1 The Glashaboy River at Glanmire GAA showing large woody debris of high value to otter

Plate 3.2 The Glashaboy River at Hazelwood S.C. showing extensive bank modifications

Plate 3.3 The lower reaches of the Glashaboy River downstream of weir and John O' Callaghan Park

Plate 3.4 An example of a Glashaboy mill race channel (mill race no. 3)

Plate 3.5 Lower extent of study area in fully tidal waters of the lower Glashaboy River at Glanmire

3.2 Upper Glanmire (Bleach Hill) Stream

The Upper Glanmire Stream (19U02), also known locally as the Bleach Hill Stream, is a small, 4km-long upland eroding watercourse (FW1) that flows over a moderate gradient through an area dominated by agricultural pasture. The stream was typically shallow (<0.2m) and narrow (<2m) and featured shallow glide and riffle habitat with only very localised pool. Riparian shading from mature treelines and hedgerows is often very high along the watercourse and siltation of instream substrata is an issue. The stream adjoins the Glashaboy River near the L2973 road crossing, north of Riverstown. A culvert is present upstream of this road crossing and likely acts as a substantial barrier to upstream migration to salmonids. Nonetheless, the stream is known to support brown trout and European eel (ARUP, 2016) and has some suitability for otter.

Plate 3.5 Representative image of the Bleach Hill Stream near the L2973 road crossing

3.3 Sallybrook Stream

The Sallybrook Stream (no EPA code) is a small, unmapped upland eroding watercourse (FW1) which joins the Glashaboy River at Sallybrook Industrial Estate. The heavily modified stream was culverted underground apart from the lowermost 150m, where is flowed through dense scrub with mature adjoining treelines. At basal water levels, the stream averaged <1.5m in width and <0.05m in depth, with very low flows and is likely to be non-perennial (i.e. dries up, seasonally). The substrata were dominated by medium-coarse gravels and coarse sands but siltation was high. The stream was of very poor otter and fisheries value, but it may support spawning salmonids during high water levels.

3.4 Lisnahorna (Cois na Gleann) Stream

The Lisnahorna Stream (19L45), also known locally as the Cois na Gleann, is a small upland eroding watercourse (FW1) which flows for 3km over a moderate to steep gradient before joining the Glashaboy River at the Circus Field, Hazelwood. The semi-natural stream was heavily overgrown and shaded for much of its length, particularly in the lower reaches, where the high-energy stream averaged <1.2m wide and <0.1m deep. The substrata were dominated by cobble and coarse gravels with low siltation. Despite some suitability for smaller salmonids and European eel (at least in the lower gradient lower reaches), upstream fish passage was significantly impacted by a poorly-designed pipe culvert at the Glashaboy confluence. Otter suitability was very low overall given the poor fisheries value and small size of the channel.

Plate 3.6 Representative image of the Lisnahorna Stream at Cois na Gleann

3.5 Rathcooney (Springmount) Stream

The Rathcooney Stream (19R31), also known locally as the Springmount Stream, is a short, high-gradient, upland eroding watercourse (FW1) which adjoins the Glashaboy River near SuperValu Glanmire. The heavily-modified stream averaged <1.5m wide and <0.15m deep in its lower reaches, with poor connectivity to the Glashaboy main channel due to the presence of a small (but significant) weir on the lowermost reaches which was considered impassable to fish, apart from European eel. This was further compromised by the presence of several culverts, upstream. The small stream featured relatively clean substrata dominated by cobble and gravels and, thus, had some suitability as a salmonid spawning habitat. However, the small size of the stream and barriers present reduced the value considerably for both fish and otter.

Plate 3.7 Confluence of the Rathcooney (Springmount) Stream and the Glashaboy River (small weir impacting fish migration visible in background)

3.6 Butlerstown River

The Butlerstown Stream (19B06) is a major tributary of the Glashaboy River, which it joins at John Barleycorn Pool (John O'Callaghan Park) downstream of Glyntown Bridge. The 8-10m-wide lowland depositing watercourse (FW2) was largely natural in the upper survey reaches (upstream of the Hazelwood Road crossing), where it flowed through mature mixed broad-leaved woodland (WD1). Although modifications became more frequent downstream of Riverstown House (local straightening, bank modifications etc.), the river maintained some good semi-natural characteristics (particularly instream). The fisheries value was high overall, with a high diversity of habitats (riffle, glide and pool), including frequent good-quality holding habitat for migratory adult salmonids. Whilst good-quality otter foraging habitat was present, the historically modified (compacted) banks adjoining higher-disturbance areas in the lower survey reaches provided low suitability for otter breeding or resting areas.

Plate 3.8 Upper survey reaches of the Butlerstown River at Riverstown House

Plate 3.9 Lower reaches of the Butlerstown River upstream of Glyntown Bridge

3.7 Lisheenroe (Glenmore) River

The Lisheenroe River (19L40), also known locally as the Glenmore River, is a tributary of the Butlerstown River, to which is joins at Sarsfield GAA downstream of Copperalley Bridge. Whilst more semi-natural upstream of Glenmore Bridge (e.g. Carberrytown Woods), the medium-sized (4-6m wide) river had been extensively straightened throughout downstream of this point, with typically narrow, scrubby riparian zones adjoining agricultural and built-up areas. Despite this, some good instream recovery was evident with locally frequent large woody debris (an important habitat feature for otter) and channel poorly-accessible to humans. However, the fisheries habitat – and therefore, otter foraging opportunities – were compromised due to historical modifications, with siltation and compaction of the substrata reducing the value to spawning fish. This has resulted in fewer salmonids than the downstream-connecting Butlerstown or Glashaboy channels (ARUP, 2016). Overall, the river was of good value for foraging otter, particularly upstream of M8 motorway culvert.

Plate 3.10 Upper survey reaches of the Lisheenroe (Glenmore) River at Glenmore Bridge

Plate 3.11 Example of large woody debris (LWD) on the Lisheenroe (Glenmore) River, providing a valuable (and utilised) otter marking site

Plate 3.12 Lower survey reaches of the Lisheenroe (Glenmore) River (historically straightened section)

4. Results

4.1 Desktop review

A desktop review of NBDC data revealed a high number of available otter records for the study area, with long-term data available for the Glashaboy River, Butlerstown Stream and Glenmore Stream, both within and outside of the study area. A single record was available for the Upper Glanmire (Bleach Hill) Stream (2015). There were no NBDC records available for the other surveys watercourses.

Previous otter baseline surveys undertaken for the Glashaboy FRS in 2014 and again in 2016 identified a total of *n*=9 holts along the Glashaboy River (ARUP, 2016, supplementary data). These are clarified in **Table 5.1**.

4.2 Otter records (2021)

A total of *n*=52 otter signs were recorded within the study area during April 2021, comprising approx. 10.4km of the Glashaboy River and selected tributaries (**Table 3.1; Figures 3.1 & 3.2**). This equated to an average of 5.0 otter signs per kilometre of channel.

The majority of otter signs were recorded on the Glashaboy River (62%) and Glenmore River (29%), respectively (**Table 4.2**, **Figure 4.1**). A low number of signs were recorded on the Butlerstown Stream, Upper Glanmire (Bleach Hill) Stream and Glashaboy mill race channel no. 2 (**Table 4.2**, **Figures 4.1-4.3**). Spraints accounted for the majority of signs recorded (*n*=32). A total of *n*=10 holts (7 potentially active, the rest inactive) were identified in the survey area (**Figures 4.1-4.3; Table 5.1**). The majority of these were located along the Glashaboy River (*n*=8), with single holts recorded on the Butlerstown Stream and Glashaboy mill race no. 2, respectively. Prints (*n*=4) and couches (*n*=3) were only recorded along the Glashaboy River channel. A low number of latrines were recorded on the Glashaboy River and Butlerstown Stream.

Table 4.1 Summary of the total number of otter signs recorded across all survey watercourses in April 2021 (ranked in order of total abundance)

Otter sign	No. signs
Spraint	32
Holt	10
Prints	4
Latrine	3
Couch	3
Total	**52**

Table 4.2 Summary of the total number of otter signs recorded per watercourse within the study area, 2021 (ranked in order of total abundance)

Watercourse	Alternative name	Spraint	Holt	Prints	Latrine	Couch	Total no. signs	% of total signs
Glashaboy River	n/a	15	8	4	2	3	32	60%
Lisheenroe River	Glenmore River	14	1	0	0	0	15	28%
Butlerstown River	n/a	2	1	0	1	0	4	8%
Mill Race no. 3	n/a	0	0	0	0	0	0	0%
Mill Race no. 2	n/a	0	1	0	0	0	1	2%
Mill Race no. 1	n/a	0	0	0	0	0	0	0%
Upper Glanmire Stream	Bleach Hill Stream	1	0	0	0	0	1	2%
Rathcooney Stream	Springmount Stream	0	0	0	0	0	0	0%
Lisnahorna Stream	Cois na Gleann Stream	0	0	0	0	0	0	0%
Sallybrook Stream	n/a	0	0	0	0	0	0	0%
Total no. of signs		**32**	**11**	**4**	**3**	**3**	**53**	**100%**

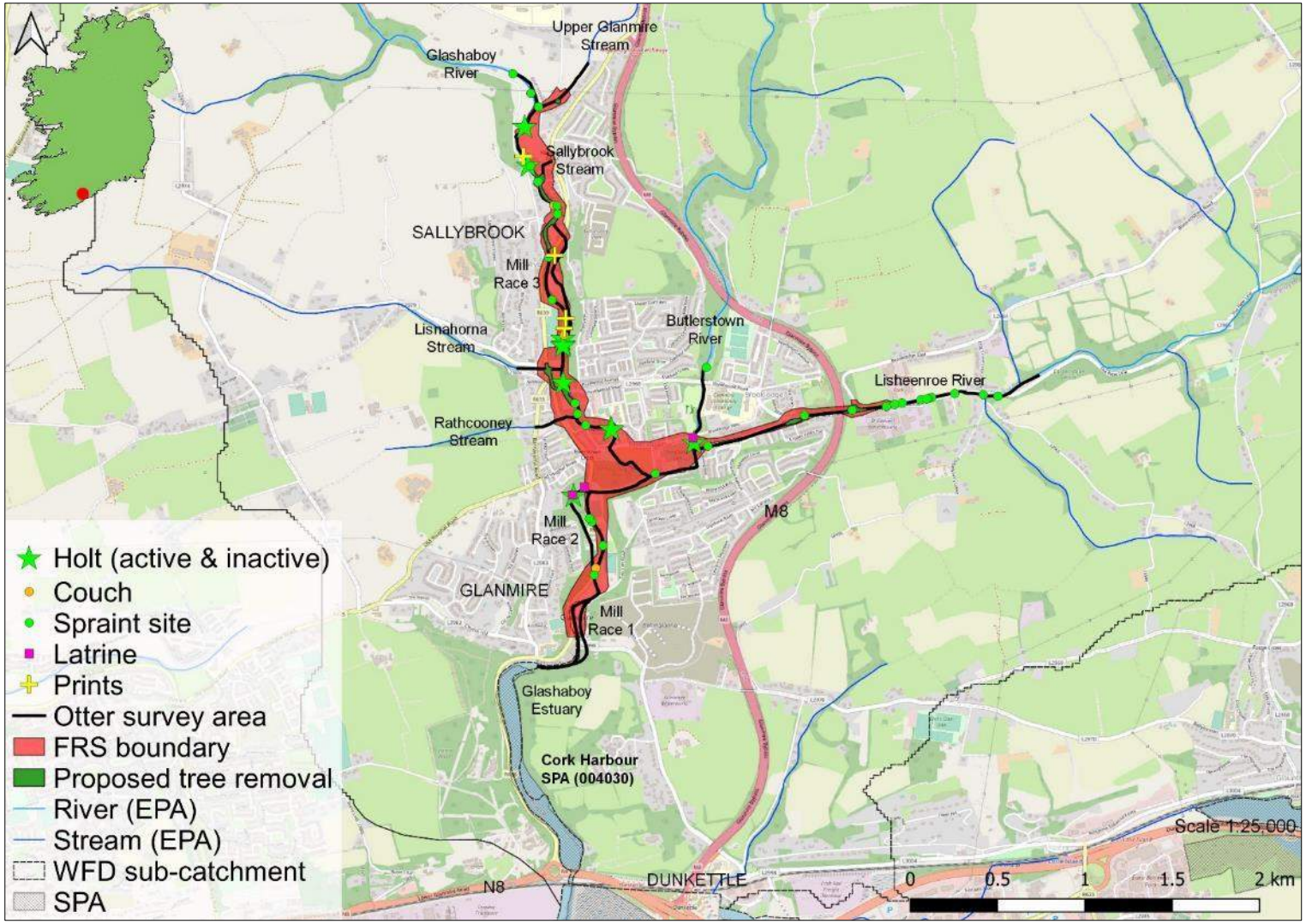

Figure 4.1 Overview of the otter signs recorded within the vicinity of the Glashaboy FRS survey area, April 2021

Figure 4.2 Otter signs recorded within the vicinity of the Glashaboy FRS survey area, April 2021 (upper extent)

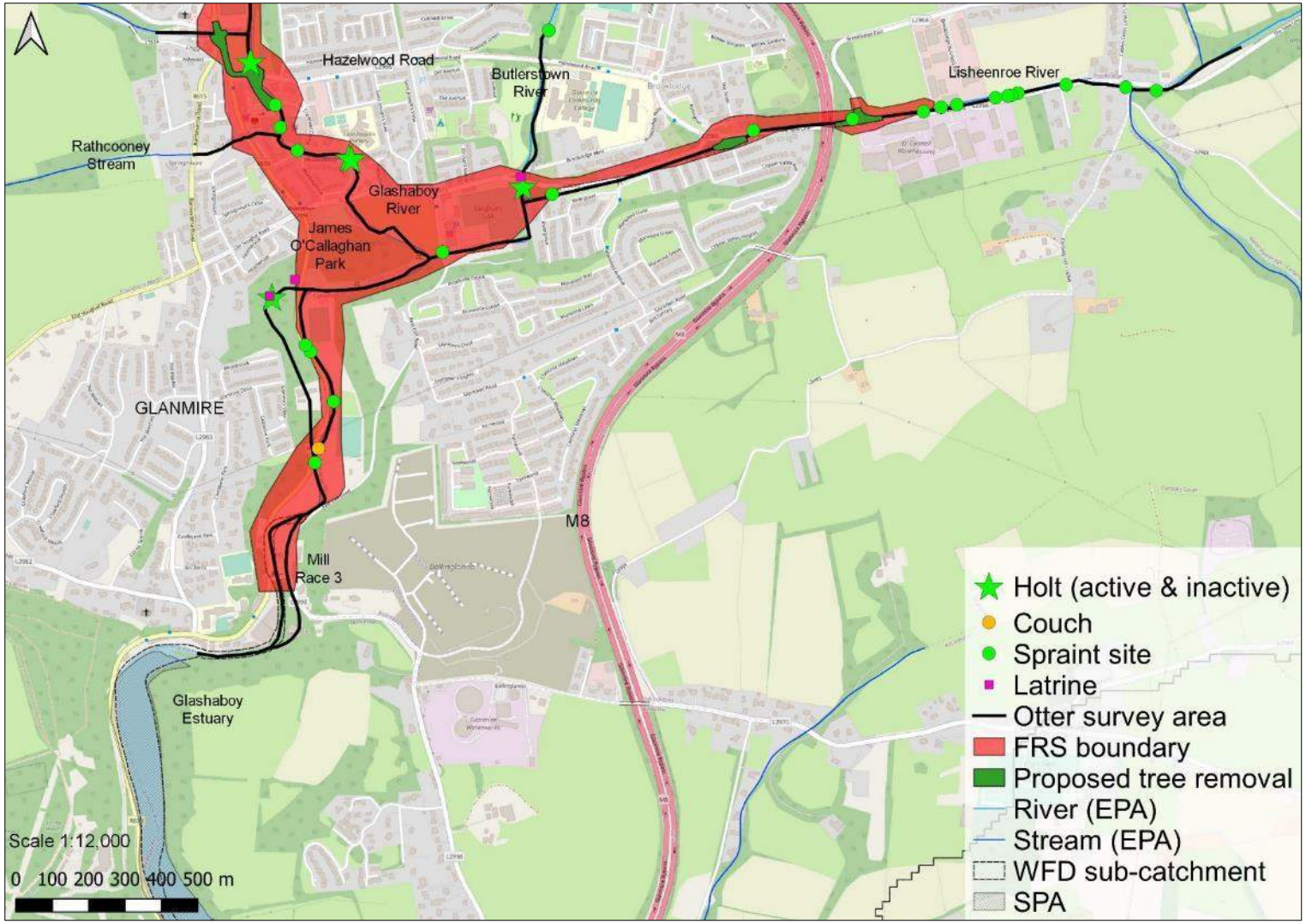

Figure 4.3 Otter signs recorded within the vicinity of the Glashaboy FRS survey area, April 2021 (lower extent)

5. Discussion

5.1 Otter sign distribution

A total of *n*=10 holts (7 potentially active, the rest inactive) were identified in the survey area during A total of *n*=52 otter signs were recorded within the study area during April 2021, comprising approx. 10.4km of the Glashaboy River and selected tributaries. The majority of otter signs were recorded on the Glashaboy River and its tributary the Lisheenroe (Glenmore) River (**Table 4.2**, **Figures 4.1-4.3**). No otter signs were recorded on the Rathcooney (Springmount) Stream, Lisnahorna (Cois na Gleann) Stream, Sallybrook Stream or Glashaboy mill race channels no. 1 and 3. These diminutive channels provided poor fisheries value and limited foraging opportunities for otter, in addition to a lack of optimal breeding and resting areas.

Given their higher value as migratory salmonid watercourses, otter foraging habitat was superior in the main Glashaboy River channel and larger tributaries such as the Butlerstown River and Lisheenroe River, compared with diminutive low fisheries value channels such as the Sallybrook Stream, Lisnahorna Stream and Rathcooney Stream. The occurrence of crab remains in spraint recorded in the lower reaches of the Glashaboy River indicates that otter also utilise the adjoining Glashaboy Estuary (and likely Lough Mahon) for foraging, i.e. a mobile population.

Evidently, most otter signs were located in areas of better-quality riverine habitat with lower relative levels of human-related disturbance. River hydromorphology and human disturbance levels are known to be key drivers of otter distribution and habitat utilisation, particularly in urban and modified watercourses (Scorpio et al., 2016). Furthermore, otter breeding (holts) and resting areas (couches) are especially sensitive to direct human disturbance (Mason & Macdonald, 2009) and there was a clear association between the location of these areas and disturbance levels (e.g. holts present in areas with little or no human access). This same local disturbance-related trend has been repeatedly observed in other urban and peri-urban watercourses across Ireland (e.g. Macklin et al., 2019; Brazier & Macklin, 2020; Triturus pers. obs.). Otter reproductive success is known to be higher in less disturbed habitats and demonstrates a preferential fidelity for low disturbance areas of channel (Loy et at., 2009; Ruiz-Olmo et al., 2011). Furthermore, well-developed and preserved riparian zones (such as those found on the Glashaboy and Butlerstown Rivers) can buffer anthropogenic impacts, and healthy ecological corridors with good connectivity are likely to play an increasingly important role in otter dispersion and commuting in light of climate change impacts (Cianfrani et al., 2018).

5.2 Otter breeding areas (historical and existing)

A total of *n*=10 holts (7 potentially active, the rest inactive) were identified in the survey area during April 2021 (**Figures 5.1-5.4** below). Four of these active holts (N4, N5, N6 & N7) had been recorded during previous surveys in the 2016-2017 period. Five holts identified during previous surveys were no longer present (i.e. X1, X2, X4 & X5). A previously identified holt (X3) located on the Glenmore River near the M8 road crossing was closed-off under a derogation licence (DER-Otter-2017-137) in November 2017.

The status of existing and historical holts are summarised in **Table 5.1** below.

Table 5.1 Summary of existing and historical otter holts and couches recorded in the vicinity of Glashaboy FRS survey area. Locations presented in north to south orientation, with identification numbers as per **Figures 5.2, 5.3 & 5.4** of this report

Holt ID	Watercourse	Bank (facing d/s)	Status	Details	ITM x	ITM y	Notes	Year first surveyed
N1	Glashaboy River	Right	**Active**	Holt tunnel system with spraint. 0.4x0.4m sized entrance, 1.3m above waterline	572427	577050		2021
N2	Glashaboy River	Right	**Active**	Holt site with two tunnels under sycamore, with 3 spraint sites near entrance and slide to river. Situated 0.9m above base flow with 2nd entrance 2.2m above base flow (0.3m*0.3m dimensions)	572477	576830		2021
X1	Glashaboy River	Left	No longer present	Historical holt adjacent to Grandon's Toyota	572578	576421	Holt no longer present, eroded from flood damage. Historical holt no. 1 from ARUP derogation map	2017
N3	Glashaboy River	Right	Inactive	Disused holt system with entrances partially infilled with cobwebs. Approx. 1.1m above waterline with 0.25x0.25m dia. burrow systems under sycamore	572676	575837		2021
N4	Glashaboy River	Left	**Active**	Holt in soft loamy bank. Entrance 0.6m above waterline (0.25x0.3m dia.) with two adjoining entrances. Slide to river also present	572678	575809	Same holt system as ARUP derogation no. 2/3 from 2017	2021
N5	Glashaboy River	Left	**Active**	Holt in soft loamy bank. Entrance 0.6m above waterline (0.3x0.35m dia.) with two adjoining entrances. Very well-used with two adjoining entrances on bank top and slide	572676	575798	Same holt system as ARUP derogation no. 2/3 from 2017	2021
H1	Glashaboy River	Left	Inactive	Approx. 25-30m upstream of Hazelwood Bridge. 2 entrances	572685	575599	Entrances partially filled-in	2017
N6	Glashaboy River	Left	**Active**	Holt under tree root system with regular spraint site at entrance	572678	575586	Same holt as historical holt no. 4 from ARUP derogation map	2021
X2	Glashaboy River	Left	No longer present	Holt near gabion wall at Meadowbrook	572849	575345	No longer present, filled in by floods. Historical holt no. 5 from ARUP derogation map	2016
H2	Glashaboy River	Left	Inactive	Holt under alder tree at Meadowbrook. Inactive with cobwebs at entrance	572918	575346	Inactive, scrubbed over Historical holt no. 6 from ARUP derogation map	2016
X4	Glashaboy River	Right	No longer present	3 entrances in soft loamy bank. Entrances all at same elevation.	572957	575335	No longer present. Part of historical holt (system) no. 8 from ARUP derogation map	2016
X5	Glashaboy River	Left	No longer present	Left hand bank near Meadowbrook	572951	575331	No longer present. Historical holt no. 8 from ARUP derogation map	2017

Holt ID	Watercourse	Bank (facing d/s)	Status	Details	ITM x	ITM y	Notes	Year first surveyed
H3	Glashaboy River	Right	Inactive	Historical holt with 3 entrances in area of Japanese knotweed infestation, near Meadowbrook	572945	575312	Entrance scrubbed over	2016
N7	Glashaboy River	Right	**Active**	System of holts with 3 entrances excavated in sandy muddy bank, 1m above waterline, under hawthorn treeline. No very recent activity but considered active	572949	575323	Part of same holt system as ARUP derogation no. 7 and same holt as recorded in 2016	2021
N8	Glashaboy River	Left	Inactive	Holt high up in scrubby bank, large tunnel 0.2x0.3m dia., with tracks/slide along bank. Historical holt, not recently active. 2.5m above waterline	572955	575318		2021
H4	Glashaboy River	Left	Inactive	Holt adjacent to John O'Callaghan Park	573027	575136	Inactive, partially filled in. Historical holt no. 9 from ARUP derogation map	2016
N10	Butlerstown River	Left	Inactive	Holt under grey willow tree, excavated into bank 0.3m above waterline. Tunnel extends into bank and upwards in root system (0.3x0.3m dia.). Situated 20m d/s L310 road bridge on right hand bank	573427	575243		2021
X3	Glenmore River	Left	Closed-off	Former holt closed-off in boulder revetment, left hand bank immediately d/s Brooklodge East Road culvert, u/s M8 crossing	574333	575432	Closed-off under derogation licence	2017
N9	Mill Race no. 2	Right	**Active**	Holt with 2 entrances on large scrubbed-over muddy bank, with slide to river. Entrances 0.3x0.25m dia., 1.2m above waterline	572737	574939		2021
Couch ID	**Watercourse**	**Bank (facing d/s)**	**Status**	**Details**	**ITM x**	**ITM y**	**Notes**	**Year first surveyed**
C1	Glashaboy River	Right	**Active**	Regular spraint site & couch on alder root system with well-worn muddy ledge & slide to river	572625	576604		2021
C2	Glashaboy River	Left	**Active**	Otter couch and spraint site under old shipping container at GAA pitch	572683	575860		2021
C3	Glashaboy River	Left	**Active**	Couch area with prints & spraint under dry culvert of millrace channel with large embankment of sand and deadwood	572865	574527		2021

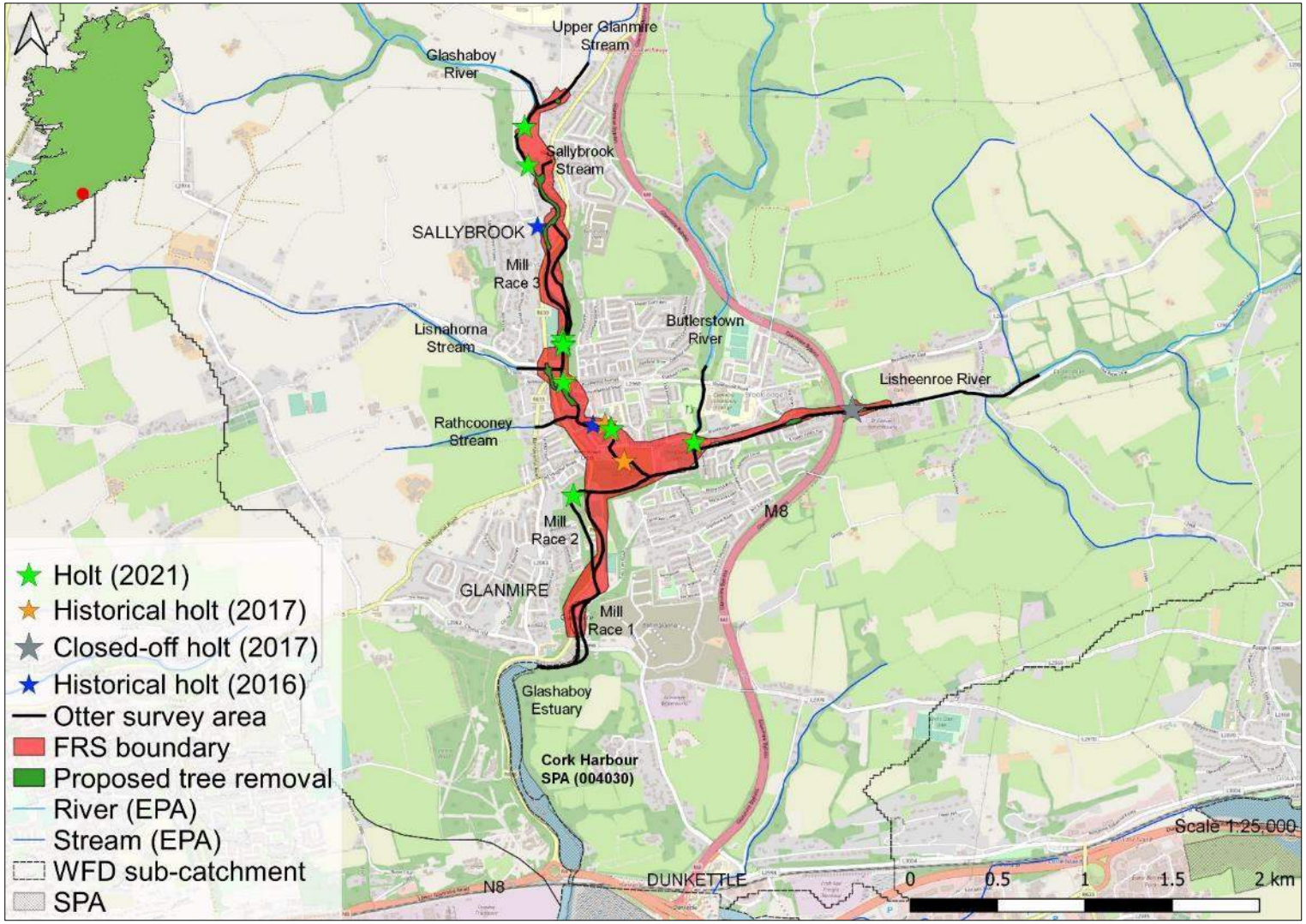

Figure 5.1 Overview of the historical and current otter holts recorded in the vicinity of the Glashaboy FRS

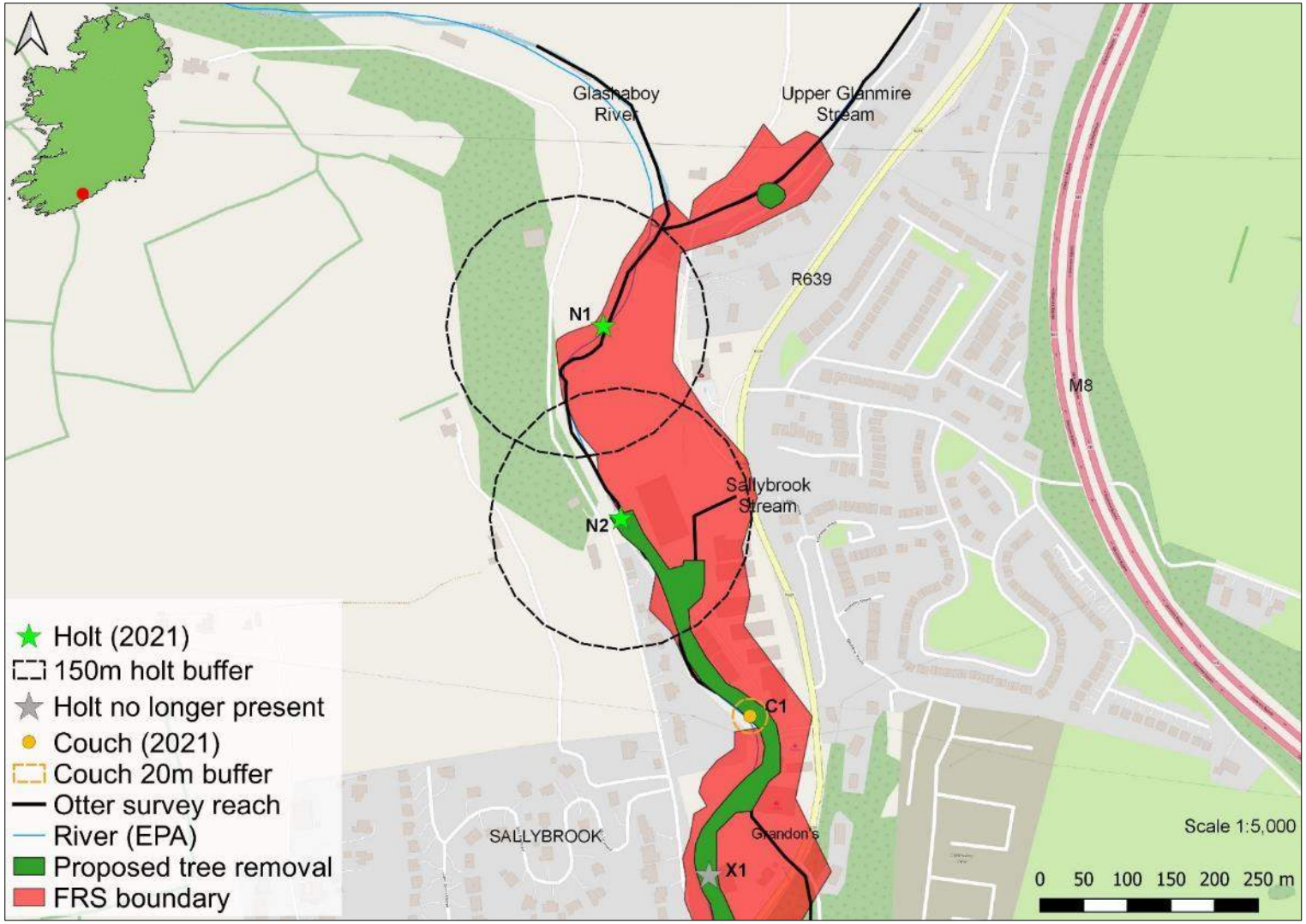

Figure 5.2 Historical and current otter breeding and resting areas recorded within the footprint of the Glashaboy FRS (upper survey reaches)

Figure 5.3 Historical and current otter breeding and resting areas recorded within the footprint of the Glashaboy FRS (middle survey reaches)

Figure 5.4 Historical and current otter breeding and resting areas recorded within the footprint of the Glashaboy FRS (lower survey reaches)

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Appendix K

Bat Eco Services (2022) Letter: Bat Duties

2022

LETTER: Bat Duties, Glanmire FRS, Glanmire, Co. Cork

Dr Tina Aughney

Bat Eco Services

Bat Eco Services, Ulex House, Drumheel, Lisduff, Virginia, Co. Cavan. A82 XW62.

Licenced Bat Specialist: Dr Tina Aughney (tina@batecoservices.com, 086 4049468)
NPWS licence C13/2020 (Licence to handle bats, expires 31st December 2022);
NPWS licence 08/2020 (Licence to photograph/film bats, expires 31st December 2022) ;
NPWS licence DER/BAT 2019-138 (Survey licence, expires 29th March 2022).

Statement of Authority: Dr Aughney has worked as a Bat Specialist since 2000 and has undertaken extensive survey work for all Irish bat species including large scale development projects, road schemes, residential developments, wind farm developments and smaller projects in relation to building renovation or habitat enhancement. She is a monitoring co-ordinator and trainer for Bat Conservation Ireland. She is a co-author of the 2014 publication *Irish Bats in the 21st Century*. This book received the 2015 CIEEM award for Information Sharing. Dr Aughney is a contributing author for the Atlas of Mammals in Ireland 2010-2015.

All analysis and reporting is completed by Dr Tina Aughney. Data collected and surveying is completed with the assistance of a trained field assistant.

Mr. Shaun Boyle (Field Assistant) NPWS licence DER/BAT 2021-19 (Survey licence, expires 15th March 2022).

9th March 2022

To whom it may concern:

The following duties were undertaken by Bat Eco Services in relation to tree felling works for the Glanmire Flood Relief Scheme:

1. 1/2/2022 Meeting with consultants in Glanmire, Co. Cork.
2. 1/2/2022 Erection of 6 bat boxes.
3. 9/2/2022 Dusk survey of trees in Hazelbrook area.
4. 15/2/2022 Dawn and Dusk Survey of trees in Sallybrook area and daytime inspection of trees.
5. 16/2/2022 Dawn and Dusk survey of trees in Sallybrook and Hazelbrook areas, respectively.
6. 17/2/2022 Dawn survey of trees in Sallybrook area.
7. 8/3/2022 Erection of 24 bat boxes.

Forty bat boxes are to be erected as part of the scheme. A total of 30 have been erected and these are located in three areas:

- John O'Callaghan Park (x12 boxes)
- Brooklodge (pedestrian path along river – x10 boxes)
- Hazelbrook (woodland tracks along river north of shopping centre – x8 boxes).

These details of the location of that bat boxes are presented in the table below. The remaining 10 bat boxes will be erected in the following two areas:

- Sallybrook
- North of Glanmire Bridge

In relation to Sallybrook, I inspected the area where tree felling was completed and there are no suitable trees to erect bat boxes. Therefore, I am enquiring if it is possible to get permission to enter private land west of the river in the areas marked on the aerial below.

I will erect the bat boxes for Glanmire at the same time as the Sallybrook, once a site is confirmed for the latter.

The bat box scheme will be registered on the Bat Conservation Ireland database.

If you require any more information, please do not hesitate to contact me.

Yours Sincerely,

Dr Tina Augyney

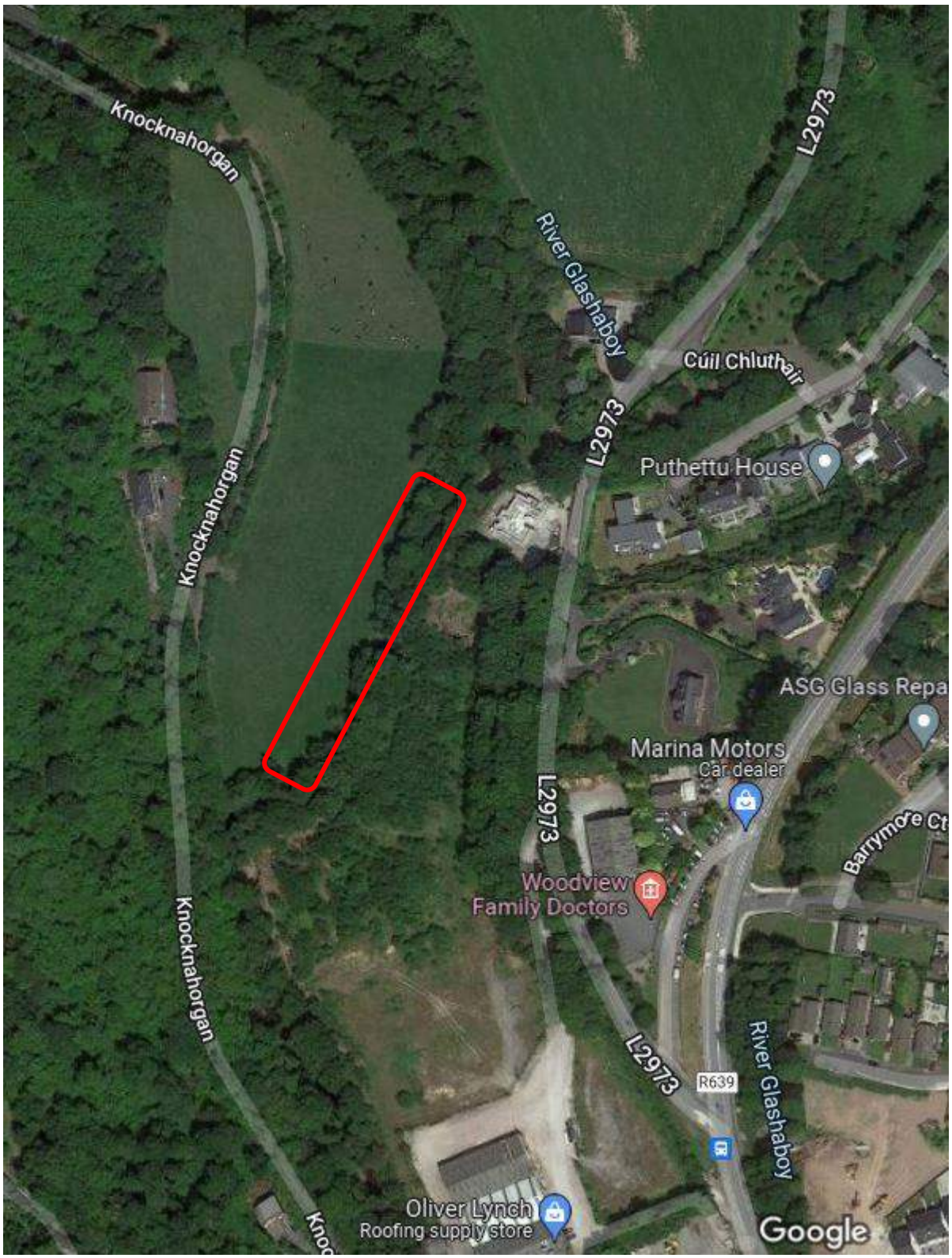

Figure 1: Ariel photograph of Sallybrook area – red box: potential area to erect bat boxes.

Bat Box Code	ITM Easting	ITM Northing	Irish Grid Reference	Site Name	County	Year	Type of Bat Box	Aspect	Height	No. on box	Tree	Location Details
2022CKJC1WS	572962	575159	W7300975121	Glanmire Flood Relief Scheme	Cork	2022	Harlech Woodstone	S	4m	1	Tree- 2 boxes	John O'Callaghan Park, adjacent to track/river
2022CKJC2WS	572962	575159	W7300975121	Glanmire Flood Relief Scheme	Cork	2022	Harlech Woodstone	S	4m	2	Tree- 2 boxes	John O'Callaghan Park, adjacent to track/river
2022CKJC3WS	572949	575151	W7299675112	Glanmire Flood Relief Scheme	Cork	2022	Harlech Woodstone	SW	4m	3	Tree - single box	John O'Callaghan Park, adjacent to track/ woodland close to play area
2022CKJC4WS	572935	575146	W7298275107	Glanmire Flood Relief Scheme	Cork	2022	Harlech Woodstone	E	4m	4	Tree - single box	John O'Callaghan Park, adjacent to track/ woodland close to play area
2022CKJC5WS	573079	575093	W7312775054	Glanmire Flood Relief Scheme	Cork	2022	Harlech Woodstone	E	4m	5	Beech - single box	John O'Callaghan Park, in woodland ridge in centre of park. On slope up ridge.
2022CKJC6WS	573070	575078	W7311775039	Glanmire Flood Relief Scheme	Cork	2022	Harlech Woodstone	E	4m	6	Beech - single box	John O'Callaghan Park, in woodland ridge in centre of park. On slope up ridge.
2022CKJC7WC	573026	575021	W7307074959	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	N	4m	7	Tree- 2 boxes	John O'Callaghan Park, in woodland ridge in centre of park. On top of ridge.
2022CKJC8WC	573026	575021	W7307074959	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	N	4m	8	Tree- 2 boxes	John O'Callaghan Park, in woodland ridge in centre of park. On top of ridge.
2022CKJC9WC	573033	575028	W7307274979	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	N	4m	9	Tree- 2 boxes	John O'Callaghan Park, in woodland ridge in centre of park. On top of ridge.
2022CKJC10WC	573033	575028	W7307274979	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	NE	4m	10	Tree- 2 boxes	John O'Callaghan Park, in woodland ridge in centre of park. On top of ridge.
2022CKJC11WC	572947	574982	W7299174920	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	SW	4m	11	Alder - single box	John O'Callaghan Park, adjacent to river (beside life jacket point)
2022CKJC12WC	573020	574993	W7306474933	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	SE	4m	12	Ash - single box	John O'Callaghan Park, adjacent to river (near 2nd life jacket point)
2022CKBL13WC	573486	575393	W7353075332	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	S	4m	13	Pine - 2 boxes	Pedestrian walkway beside schools in Brooklodge - beside school fence
2022CKBL14WC	573486	575393	W7353075332	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	S	4m	14	Pine - 2 boxes	Pedestrian walkway beside schools in Brooklodge - beside school fence
2022CKBL15WC	573478	575407	W7352275346	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	SW	4m	15	Pine - single box	Pedestrian walkway beside schools in Brooklodge - beside school fence
2022CKBL16WC	573474	575407	W7347375340	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	SW	4m	16	Pine - 2 boxes	Pedestrian walkway beside schools in Brooklodge - between river and track
2022CKBL17WC	573474	575407	W7347375340	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	SE	4m	17	Pine - 2 boxes	Pedestrian walkway beside schools in Brooklodge - between river and track
2022CKBL18WC	573472	575386	W7351575325	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FD	W	4m	18	Beech - single box	Pedestrian walkway beside schools in Brooklodge - beside river
2022CKBL19WC	573452	575321	W7349675259	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	N	4m	19	Beech - single box	Pedestrian walkway beside schools in Brooklodge - on slope to river
2022CKBL20WC	573453	575327	W7349775266	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	S	4m	20	Beech- 2 boxes	Pedestrian walkway beside schools in Brooklodge - beside river

2022CKBL21WC	573453	575327	W7349775266	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	SW	4m	21	Beech- 2 boxes	Pedestrian walkway beside schools in Brooklodge - beside river
2022CKBL22WC	573439	575322	W7348475242	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FF	E	4m	22	Pine - single box	Pedestrian walkway beside schools in Brooklodge - beside river
2022CKHB23WC	572704	575929	W7275275868	Glanmire Flood Relief Scheme	Cork	2022	ANS-5 (green tube)	S	4m	23	Beech- 2 boxes	Woodland ridge in Hazelbrook (passed the backetball court) - along river towards animal rescue
2022CKHB24WC	572704	575929	W7275275868	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1F	S	4m	24	Beech- 2 boxes	Woodland ridge in Hazelbrook (passed the backetball court) - along river towards animal rescue
2022CKHB25WC	572705	576039	W7274475969	Glanmire Flood Relief Scheme	Cork	2022	ANS-5 (green tube)	S	4m	25	Beech- 2 boxes	Woodland ridge in Hazelbrook (passed the backetball court) - along river towards animal rescue
2022CKHB26WC	572705	576039	W7274475969	Glanmire Flood Relief Scheme	Cork	2022	ANS-5 (green tube)	S	4m	26	Beech- 2 boxes	Woodland ridge in Hazelbrook (passed the backetball court) - along river towards animal rescue
2022CKHB27WC	572713	576019	W7275875958	Glanmire Flood Relief Scheme	Cork	2022	ANS-5 (green tube)	W	4m	27	Beech - single box	Woodland ridge in Hazelbrook (passed the backetball court) - up steep track used by bikes
2022CKHB28WC	572743	575980	W7277275911	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FF	NE	4m	28	Beech - single box	Woodland ridge in Hazelbrook (passed the backetball court) - upper track
2022CKHB29WC	572743	575928	W7278675866	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FF	N	4m	29	Beech - single box	Woodland ridge in Hazelbrook (passed the backetball court) - upper track
2022CKHB30WC	572719	575858	W7276575796	Glanmire Flood Relief Scheme	Cork	2022	Schwegler Woodcrete 1FF	E	4m	30	Beech - single box	Woodland ridge in Hazelbrook (passed the backetball court) - middle track

Bat Box Code explanation

2022 – Year of bat box scheme

CK – County = Cork

JC = John O'Callaghan Park, BL – Brooklodge, HB = Hazelbrook

1-30 – number of bat box

WS = Woodstone, WC = Woodcrete (i.e. type of bat box construction material)

Appendix L

Pre-Construction Fisheries Assessment (Triturus 2023)

Pre-construction fisheries assessment for the Glashaboy Flood Relief Scheme, Glanmire, Co. Cork

Prepared by Triturus Environmental Ltd. for ARUP

March 2023

Please cite as:

Triturus (2022). Pre-construction isheries assessment for the Glashaboy Flood Relief Scheme, Glanmire, Co. Cork. Report prepared by Triturus Environmental Ltd. for ARUP. March 2023.

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by ARUP to undertake a baseline fisheries assessment of numerous watercourses in the vicinity of the proposed Glashaboy Flood Relief Scheme (FRS) located near Glanmire, Co. Cork (**Figure 2.1**).

The survey was undertaken to establish a pre-construction baseline of the fish population status to compare with post-construction. This will help establish any potential changes in the fish population after the build of the flood relief scheme. To gain an accurate baseline of the fisheries status of the rivers in the vicinity of the proposed scheme, a catchment-wide electro-fishing survey across 11 no. sites was undertaken (**Table 2.1; Figure 2.1**). The survey updated previous data collated by Triturus for the scheme in September 2016 (ARUP, 2016). Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, lamprey species and European eel (*Anguilla anguilla*). Other fish species of lower conservation value were also recorded. The relative density of fish populations and an assessment of the condition of the associated supporting habitat would help inform a consolidated baseline for future comparison.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the proposed Glashaboy FRS. Permission was granted on the 23rd September 2022 and the survey was undertaken on Thursday 29th and Friday 30th September 2022.

1.2 Fisheries asset of the survey area

The Glashaboy River is a spate river that flows predominantly over old red sandstone (GSI data). The river features extensive well-sorted gravel and cobble substrata which offer very good spawning for salmonids. It is also an important sea trout (*Salmo trutta*) system (McGinnity et al., 2003). The Glashaboy is also known to support brown trout (*Salmo trutta*), Atlantic salmon (*Salmo salar*), lamprey (*Lampetra* sp.), European eel (*Anguilla anguilla*) and three-spined stickleback (*Gasterosteus aculeatus*) (Matson et al., 2019; ARUP, 2016; Kelly et al., 2012, 2010), with common transitional species such as grey mullet (*Chelon labrosus*) and flounder (*Platichthys flesus*) also present in the tidal reaches.

The Lisheenroe River, a major tributary of the Glashaboy (also known as the Glenmore River), is known to support Atlantic salmon, brown trout, European eel, *Lampetra* sp. and three-spined stickleback (Matson et al., 2019; ARUP, 2016).

Brown trout and European eel are known from the Upper Glanmire Stream (Bleach Hill Stream), with European eel present in the Rathcooney Stream (Springmount Stream) (ARUP, 2016). No fish were recorded from the Lisnahorna Stream (Cois na Gleann) during electro-fishing in September 2016 (ARUP, 2016).

Fisheries data for the other minor watercourses surveyed was not available at the time of survey.

2. Methodology

2.1 Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the proposed Glashaboy FRS (**Table 2.1, Figure 2.1**) on Thursday 29th and Friday 30th September 2022 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank.

Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel can be surveyed. This also facilitated greater coverage during the current pre-construction baseline assessment. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 50-75m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages. At certain, more minor watercourse sites or sites with limited access, it was more feasible to undertake electro-fishing for a 5-minute CPUE. Discrepancies in fishing effort (CPUE) between sites are accounted for in the subsequent results section (**Table 3.1**).

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate conductivity waters of the sites (draining sandstone geologies) a voltage of 250-290v, frequency of 35-40Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer

to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. The surface area of the targeted soft sediment patches was estimated and thereby an estimate of the density of emerging lamprey could be determined. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, approx. 10-15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

2.2 Fisheries habitat

A broad appraisal of the upstream and downstream habitat at each site was also undertaken to evaluate the wider contribution to salmonid and lamprey spawning and general fisheries habitat. River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (EA, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.).

2.3 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation of pathogens and invasive species. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

Table 2.1 Location of *n*=11 fisheries survey sites in the vicinity of the Glashaboy FRS, Co. Cork

Site no.	Watercourse	Alternative name	EPA code	Location	X (ITM)	Y (ITM)
1	Glashaboy River	n/a	19G01	Upstream of Upper Glanmire Bridge (upstream control site)	571305	578459
2	Upper Glanmire Stream	Bleach Hill Stream	19U02	Sarsfield's Court	572647	577213
3	Glashaboy River	n/a	19G01	Sallybrook Industrial Estate	572477	576834
4	Glashaboy River	n/a	19G01	Grandon's Car Sales	572630	576532
5	Lisnahorna Stream	Cois na Gleann Stream	19L45	R639 culvert	572599	575665
6	Glashaboy River	n/a	19G01	Hazelwood SC bridge	572744	575479
7	Rathcooney Stream	Springmount Stream	19R31	Meadowbrook	572727	575390
8	Glashaboy River	n/a	19G01	Upstream of Riverstown Bridge	572963	575249
9	Lisheenroe River	Glenmore River	19L40	Brooklodge East	574386	575432
10	Lisheenroe River	Glenmore River	19L40	Bridge at Copper Valley Vue	573998	575368
11	Glashaboy River	n/a	19G01	Upstream of Glanmire Bridge	572741	574307

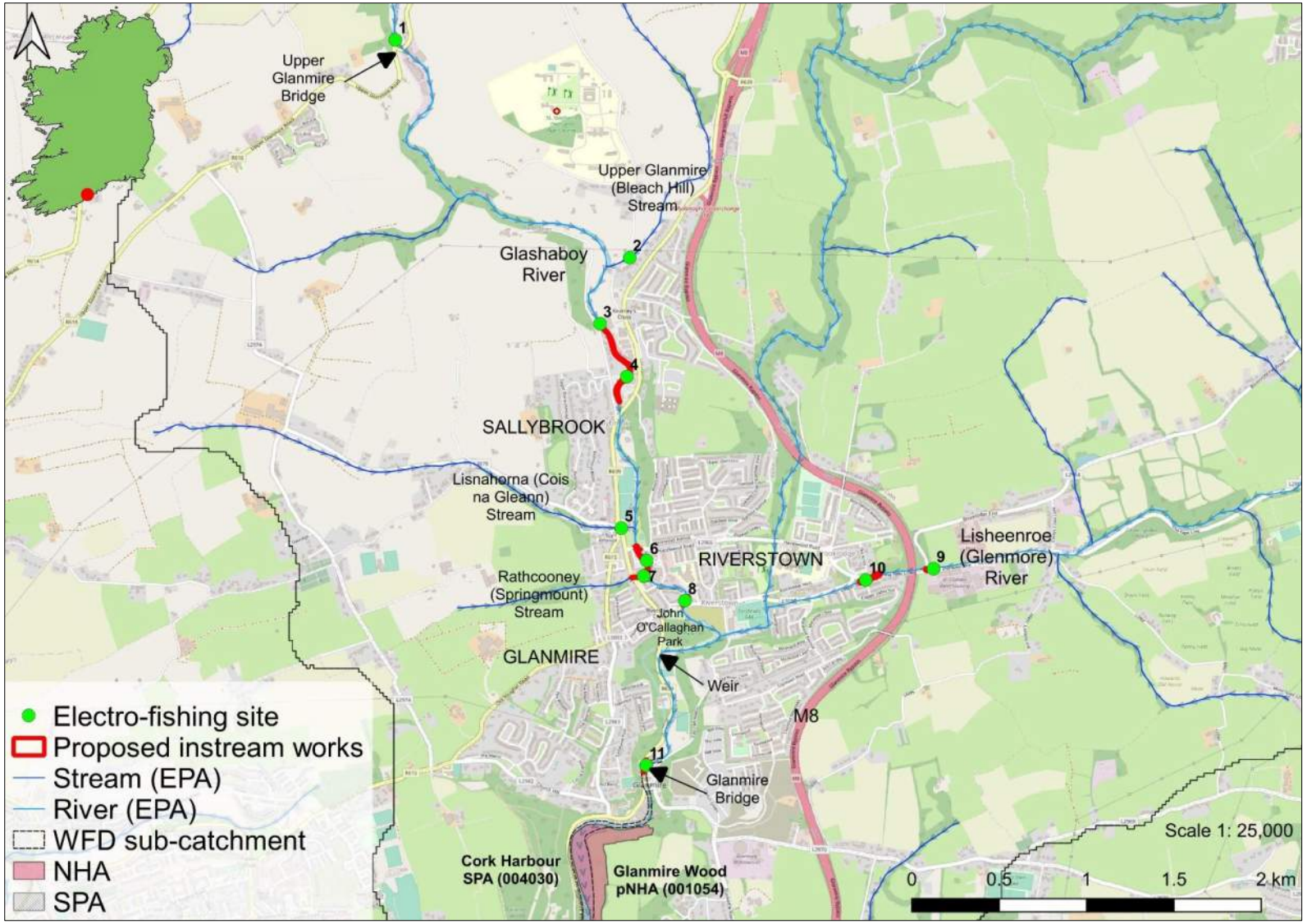

Figure 2.1 Overview of the *n*=11 electro-fishing survey site locations for the proposed Glashaboy FRS, Co. Cork

3. Results

A catchment-wide electro-fishing survey of *n*=11 sites in the vicinity of the proposed Glashaboy FRS was conducted on Thursday 29th and Friday 30th September 2022 following notification to Inland Fisheries Ireland. The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery and spawning habitat for salmonids, European eel and lamprey species. Scientific names are provided at first mention only.

3.1 Fisheries assessment & appraisal

3.1.1 Site 1 – Glashaboy River, Upper Glanmire Bridge

Site was located on the Glashaboy River (19G01) upstream of Upper Glanmire Bridge, 2.5km upstream of the nearest proposed works area (i.e. upstream control site). The large upland eroding spate river (FW1) was a fully natural river habitat at this location and flowed over a moderate gradient in an incised V-shaped valley with steep bank heights of up to 8m. The river averaged 7-8m wide and 0.2-0.5m deep, with locally deeper glide and pool to 1.1m. The profile comprised swift-flowing glide with occasional riffle and pool. The substrata of the high-energy site were dominated by boulder and cobble with abundant interstitial gravels and more occasional patches of sand. Beds of sand were also present along the channel margins (exposed at time of survey due to summer water levels). Soft sediment accumulations were absent and siltation was low overall (almost absent). Given the spate nature of the site and high riparian shading, macrophytes were not present. However, the site featured a relatively high coverage of aquatic bryophytes with abundant *Chiloscyphus polyanthos* and occasional *Brachythecium rivulare*. The liverwort *Pellia epiphylla* was locally frequent on exposed muddy sections of banks. The site was heavily shaded by mature woodland (WD1) and treelines supporting sycamore (*Acer psuedoplatanus*), beech (*Fagus sylvatica*), ash (*Fraxinus excelsior*) and hazel (*Corylus avellana*). The site was bordered by coniferous afforestation (WD3/WD4) and improved pasture (GA1) with well-developed riparian buffers.

Atlantic salmon (*Salmo salar*) (*n*=50) and brown trout (*Salmo trutta*) (*n*=41) were the only fish species recorded via electro-fishing at site 1 on the Glashaboy River (**Figure 3.1**). The high energy upland site was of very high value for salmonids, supporting abundant mixed-cohort Atlantic salmon and brown trout. The site was an excellent quality salmonid nursery with abundant instream cobble and boulder refugia in swift-flowing glide. The site was also of excellent value as a spawning habitat, with widespread clean cobble and mixed gravels suitable for both Atlantic salmon and brown trout, respectively. Localised pools (often associated with natural scours under tree root systems) provided good quality holding habitat, with localised deep glide present elsewhere in vicinity of the bridge. The upland eroding site was unsuitable for lamprey and none were recorded. Despite some good suitability, no European eel were recorded. No otter signs were recorded in vicinity of the site although suitability was high (low disturbance area with abundant prey resources).

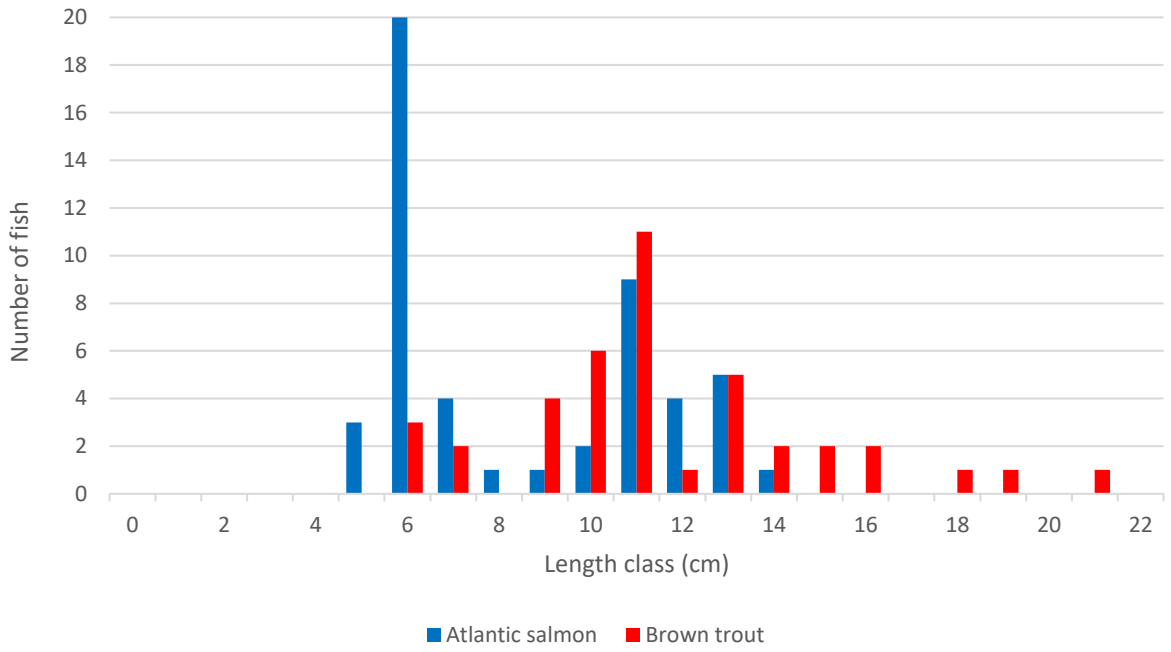

Figure 3.1 Length frequency distribution recorded via electro-fishing at site 1 on the Glashaboy River, September 2022

Plate 3.1 Mixed cohort salmonids recorded at site 1 on the Glashaboy River, September 2022

Plate 3.2 Representative image of site 1 on the Glashaboy River upstream of Upper Glanmire Bridge, September 2022

3.1.2 Site 2 – Upper Glanmire Stream, Sarsfield's Court

Site 2 was located on the lower reaches of the Upper Glanmire (Bleach Hill) Stream (19U02) at Sarsfield's Court, approximately 130m upstream of the Glashaboy River confluence. With the exception of the twin pipe culvert at the local road crossing, the small upland eroding stream (FW1) flowed in a natural channel form within an incised valley up to 6m in height. The spate stream averaged 2.5m wide (up to 4m channel width) and 0.1-0.2m deep at the time of survey. The profile was of abundant riffle with frequent shallow fast glide and very localised small, shallow pool (to 0.3m maximum depth). Given its high energy nature, the substrata were dominated by mobile, angular cobble and boulder with frequent interstitial mixed gravels. Sands were also present interstitially and along channel margins. Soft sediment accumulations were not present although siltation was moderate (plumes underfoot), with natural bank scouring frequent. Given high energy and high shading, macrophytes were limited to rare fool's watercress (*Apium nodiflorum*) in open areas. Aquatic bryophyte coverage was low with only occasional *Rhynchostegium riparioides*. The valley escarpments supported a well-developed bryophyte layer that included *Riccardia chamedryfolia* and *Hygrohypnum* sp. above the waterline. The stream was well shaded by mature holly (*Ilex aquifolium*), hazel, sycamore and ash with scattered bramble (*Rubus fruticosus* agg.) scrub. The site was bordered by mixed woodland (WD1) and residential properties (BL3) with ornamental cherry laurel (*Prunus laurocerasus*) hedging. Winter heliotrope (*Petasites fragrans*) and invasive giant knotweed (*Reynoutria sachalinensis*) were also present.

European eel (*Anguilla anguilla*) (*n*=1) was the only species recorded via electro-fishing at site 2. Despite some physical suitability in terms of nursery and spawning habitat, no salmonids were recorded. This was considered to reflect high natural gradients and instream barriers downstream (poor connectivity with the Glashaboy River) although a low density of brown trout was recorded in

July 2016 (ARUP, 2016; **Table 3.3**). Eel habitat was moderate given the shallow, spate nature of the stream at this location. The upland eroding site was unsuitable for lamprey.

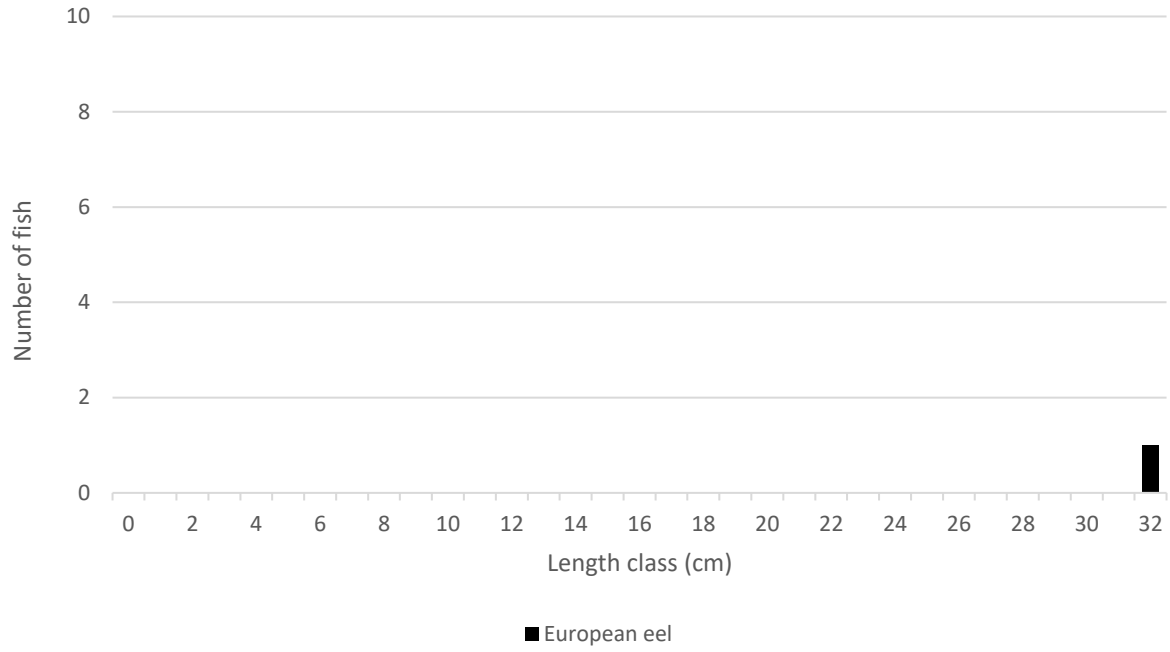

Figure 3.2 Length frequency distribution recorded via electro-fishing at site 2 on the Upper Glanmire Stream, September 2022

Plate 3.3 European eel recorded at site 2 on the Upper Glanmire Stream, September 2022

Plate 3.4 Representative image of site 2 on the Upper Glanmire Stream, September 2022

3.1.3 Site 3 – Glashaboy River, Sallybrook Industrial Estate

Site was located on the Glashaboy River (19G01) at ACR Crash Repairs at the upstream extent of a proposed works area, c.2.5km downstream of site 1. The upland eroding spate river (FW1) had been modified along the eastern bank (retaining walls, urbanisation) but retained a good degree of naturalness elsewhere. Steep banks to a height of up to 10m were present to the west. The high energy spate channel averaged 7-8m wide (up to 12m in some areas) and 0.2-0.5m deep with locally deeper glide and pool to 0.8m. The profile was dominated by fast-flowing glide with frequent riffle and occasional small pool along the western (more natural) bank. The substrata comprised abundant cobble and boulder with frequent mixed interstitial gravels. Finer mixed gravels and sand were also present locally, primarily along the eastern margins. Given the high energy nature of the site and high coverage (>50%) of filamentous algae (*Cladophora* sp.), macrophyte growth was limited to occasional hemlock water dropwort (*Oenanthe crocata*) with some localised fool's watercress and water pepper (*Persicaria hydropiper*) along channel margins. Exposed cobble bars supported these species in addition to watercress (*Nasturtium officinale*), great yellow cress (*Rorippa amphibia*) and water figwort (*Scrophularia umbrosa*). Aquatic bryophytes were sparse with only localised *Brachythecium rivulare* and *Hygroamblystegium* sp. The channel was lined by mature sycamore, alder (*Alnus glutinosa*) and elder (*Sambucus nigra*) with a bramble and fern understorey. The site was bordered by an industrial estate (BL3) and mixed broad-leaved woodland (WD1)

Atlantic salmon (*n*=35), brown trout (*n*=51), lamprey (*Lampetra* sp.) (*n*=19) and European eel (*n*=1) were recorded via electro-fishing at site 3 on the Glashaboy River. The site was of very high value for salmonids, supporting abundant mixed-cohort Atlantic salmon and brown trout. The site was an excellent quality salmonid nursery with abundant instream cobble and boulder refugia in fast-flowing glide. The site was also of excellent value as a spawning habitat, with widespread clean cobble and mixed gravels suitable for both Atlantic salmon and brown trout, respectively. Localised patches of

finer gravels and sands were also suitable for lamprey spawning. Localised pools (often associated with natural scours under tree root systems) provided good quality holding areas, despite the generally shallow depths (up to a maximum of 0.8m). Soft sediment areas suitable for larval lamprey were scarce but supported a high density of *Lampetra* sp. ammocoetes where present (>12 per m^2) for a spate river. A single *Lampetra* sp. transformer was also recorded (11.3cm TL). The site was of high suitability for European eel with abundant instream refugia, with a low density recorded.

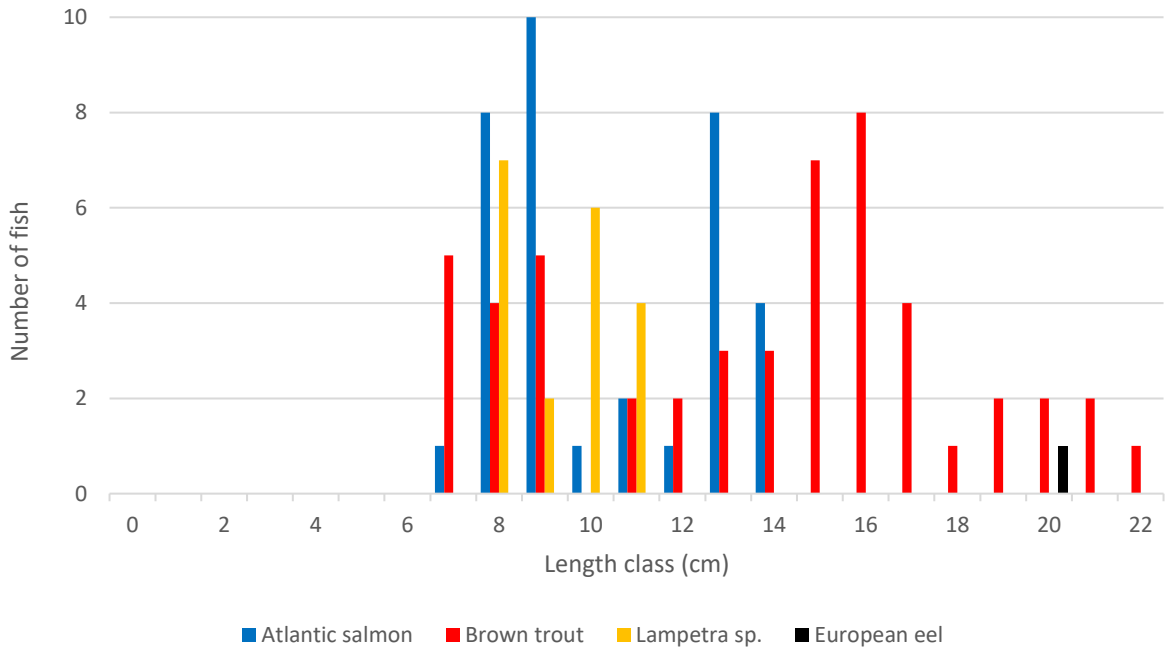

Figure 3.3 Length frequency distribution recorded via electro-fishing at site 3 on the Glashaboy River, September 2022

Plate 3.5 *Lampetra* sp. ammocoetes & transformer and juvenile European eel recorded at site 3, September 2022

Plate 3.6 Representative image of site 3 on the Glashaboy River, September 2022

3.1.4 Site 4 – Glashaboy River, Grandon's car sales

Site 4 was located on the Glashaboy River (19G01) at Grandon's car sales, within a proposed works area. The large upland eroding spate river (FW1) had been modified historically along the length of the eastern bank with boulder revetment, retaining walls, a mill race channel and an old weir present. The river averaged 8-10m wide (12m wide at weir) and 0.2-0.5m deep, with locally deeper areas of glide and pool to 1m. The profile comprised shallow open glide with only localised riffle and pool. The substrata were dominated by cobble and mixed gravels with scattered boulder and beds of sand in the margins and pool slacks. Boulder dominated downstream of the weir. Siltation was low overall. Macrophyte growth was sparse with occasional water crowfoot (*Ranunculus* sp.) and marginal beds of fool's watercress and brooklime (*Veronica beccabunga*) with rare watercress. Water pepper and hemlock water dropwort were also present locally on exposed marginal cobble bars and the weir face. Aquatic bryophyte cover was low with occasional *Fontinalis antipyretica* on larger instream substrata. *Brachythecium rivulare* and *Rhynchostegium riparioides* were present locally. Cover of floc[1] and filamentous algae was high (>50%), indicating significant enrichment. The west bank supported a mature riparian buffer of grey willow (*Salix cinerea*), ash, sycamore, osier (*Salix viminalis*), elder and alder with locally frequent great willowherb (*Epilobium hirsutum*), bramble and water figwort. The site was bordered by buildings and artificial surfaces (BL3).

[1] floc is defined as an aggregation of (mostly dead) organic material, mainly from algae and diatoms, but also with potential origins from decaying macrophytes and associated decomposers (bacteria and fungi). The floc can form a layer at the surface of the substrate, or infiltrate the substrate, generally where there is insufficient flow to keep the material in suspension (Moorkens & Killeen, 2020)

A total of 6 no. fish species were recorded via electro-fishing at site 4, namely Atlantic salmon (*n*=75), brown trout (*n*=24), *Lampetra* sp. (*n*=1), European eel (*n*=6), stone loach (*Barbatula barbatula*) (*n*=1) and three-spined stickleback (*Gasterosteus aculeatus*) (*n*=1) (**Figure 3.4**). This was the highest species diversity recorded during the survey. Site 4 was of very high value for salmonids, supporting abundant juvenile Atlantic salmon in addition to lower numbers of mixed-cohort brown trout. The site was an excellent quality nursery given abundant accessible cobble and boulder refugia upstream of the weir. Excellent quality spawning habitat was also present upstream of the weir (mobile cobble and mixed gravels), with suitability higher for salmon given the predominance of larger substrata. Holding habitat was limited given the predominance of glide and riffle habitat although a small pool at the weir provided valuable holding habitat. However, deep glide (to 1.3m) c.50m upstream provided excellent quality holding habitat. Suitable soft sediment areas for larval lamprey were absent given high flow rates although some localised spawning habitat was present. A single *Lampetra* sp. transformer was recorded.

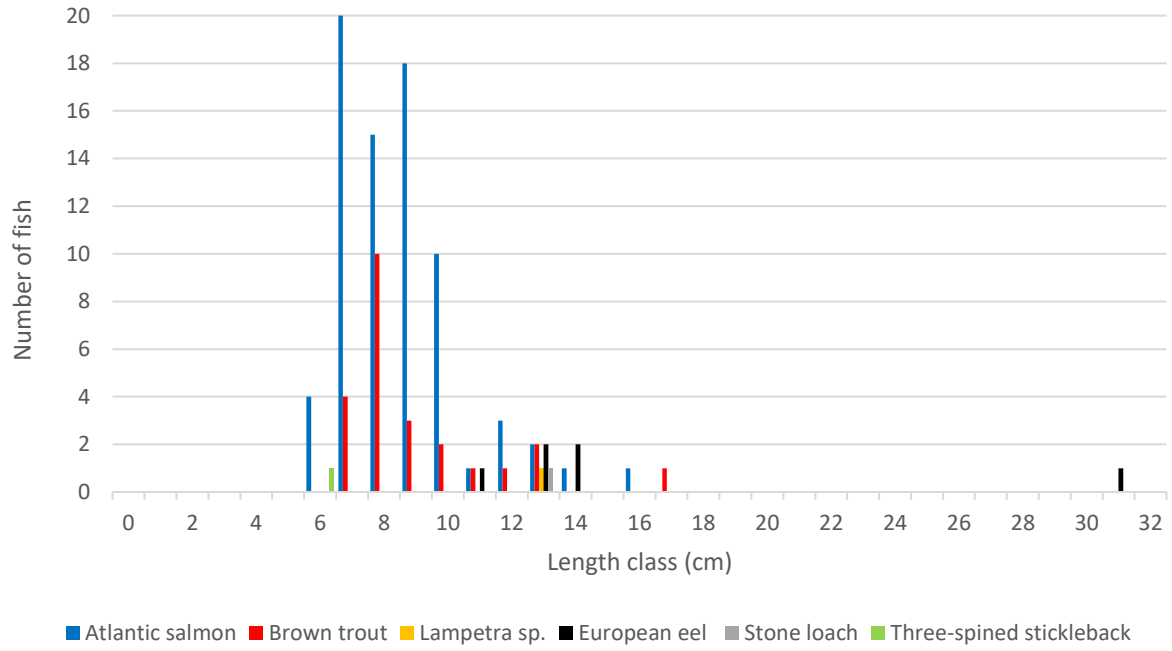

Figure 3.4 Length frequency distribution recorded via electro-fishing at site 4 on the Glashaboy River, September 2022

Plate 3.7 Juvenile Atlantic salmon recorded at site 4 on the Glashaboy River, September 2022

Plate 3.8 *Lampetra* sp. transformer recorded at site 4 on the Glashaboy River, September 2022

Plate 3.9 Representative image of site 4 on the Glashaboy River, September 2022 (facing upstream from small weir)

3.1.5 Site 5 – Lisnahorna Stream, R639 culvert

Site 5 was located on the lower reaches of the Lisnahorna (Cois na Gleann) Stream (19L45) downstream of the R639 road culvert. The small upland eroding watercourse (FW1) flowed over a high gradient upstream of the culvert before levelling out for the final 50m of its course and joining the Glashaboy River via a pipe culvert. This culvert featured a 0.6m fall which was impassable to fish at basal flows (**Plate 3.12**). The stream had been heavily modified in the vicinity of the road culvert (straightening and deepening with retaining walls upstream) but retained some semi-natural features. The stream averaged 1.5-2m wide and 0.05-0.15m deep, with very localised deeper areas to 0.2m. The small, shallow stream was dominated by riffle and very shallow glide habitat with a paucity of pool areas. The substrata were dominated by mobile angular cobble and coarse gravels, with localised finer gravels and sands. Boulder was present but rare and small, where present. Soft sediment accumulations were not present although siltation was moderate overall. Given a high degree of shading, macrophytes were limited to occasional watercress and fool's watercress and brooklime along channel margins. Aquatic bryophytes were limited to rare *Rhynchostegium riparioides* on larger substrata. The stream was shaded by a mature treeline of elder, grey willow and holly with a bramble-dominated understorey. The site was bordered by amenity grassland (GA2, Glanmire GAA) and dry meadow habitat (GS2).

Brown trout (*n*=2) and three-spined stickleback (*n*=4) were the only fish recorded via electro-fishing at site 5 (**Figure 3.5**). Site 5 was of moderate value only to salmonids, supporting a very low density of juvenile brown trout. The small, shallow stream provided some moderate quality salmonid nursery and spawning habitat at this location although the stream's poor connectivity with the downstream Glashaboy River reduced its value as a salmonid (and general fisheries) habitat. Despite some suitability as a spawning habitat for lamprey there was no suitable ammocoete habitat. European eel

habitat was of poor quality given connectivity issues and the shallow nature of the stream at this location.

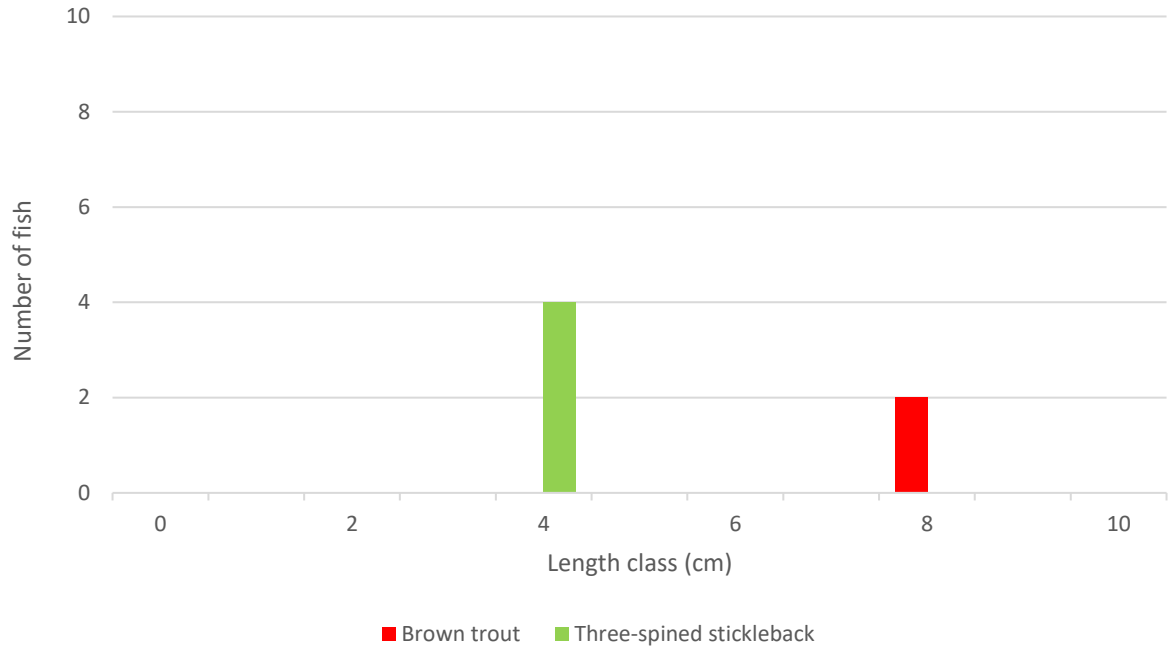

Figure 3.5 Length frequency distribution recorded via electro-fishing at site 5 on the Lisnahorna Stream, September 2022

Plate 3.10 Juvenile brown trout recorded at site 5 on the Lisnahorna Stream, September 2022

Plate 3.11 Representative image of site 5 on the Lisnahorna Stream, September 2022 (downstream of road culvert)

Plate 3.12 Confluence of the Lisnahorna Stream with the Glashaboy River via a perched pipe culvert (significant barrier to fish migration at base flows)

3.1.6 Site 6 – Glashaboy River, Hazelwood Bridge

Site 6 was located on the Glashaboy River (19G01) at Hazelwood Bridge within a proposed works area. The upland eroding spate river (FW1) had been modified extensively downstream of Hazelwood Bridge, with retaining walls and or boulder revetment along both banks, in addition to riparian tree

clearance. The high energy channel averaged 6-7m wide and 0.3-0.6m deep with locally deeper glide and pool to 1m. The profile was dominated by fast-flowing glide with frequent riffle and occasional small pool along the western (more natural) bank. The substrata comprised abundant cobble and boulder with frequent mixed interstitial gravels. Finer mixed gravels and sand were also present locally, primarily along the eastern margins. Exposed cobble bars were also present. Given the high energy nature of the site and high coverage (>50%) of filamentous algae (*Cladophora* sp.), macrophyte growth was limited to occasional hemlock water dropwort with some localised fool's watercress and water pepper along channel margins. Exposed cobble bars supported these species in addition to reed canary grass (*Phalaris arundinacea*), watercress and water figwort. Aquatic bryophytes were sparse with only localised *Brachythecium rivulare*, *Rhynchostegium riparioides* and *Hygroamblystegium* sp. The channel was lined by coppiced treeline of alder, grey willow and sycamore, with bramble scrub on the steep (often near vertical) banks. A small area of amenity grassland (GA2) adjoined the channel along the eastern bank. The site was bordered by buildings and artificial surfaces (BL3), with an area of dry meadow habitat (GS2) upstream of the bridge.

Atlantic salmon (*n*=24), brown trout (*n*=74), sea trout (*n*=1), European eel (*n*=2) and three-spined stickleback (*n*=1) were recorded via electro-fishing at site 6 (**Figure 3.6**). The site was of very high value for salmonids, supporting abundant mixed-cohort Atlantic salmon and brown trout in addition to a low density of sea trout. The site was an excellent quality salmonid nursery with abundant instream cobble and boulder refugia in fast-flowing glide. Spawning habitat was of good quality, with the value reduced given high filamentous algal cover and increased rates of siltation over upstream areas. Localised pools (often associated with natural scours under tree root systems but also under Hazelwood SC Bridge) provided good quality holding areas. Soft sediment areas for larval lamprey were absent given high flow rates (none recorded). The site was of high suitability for European eel with abundant instream refugia, with a low density recorded.

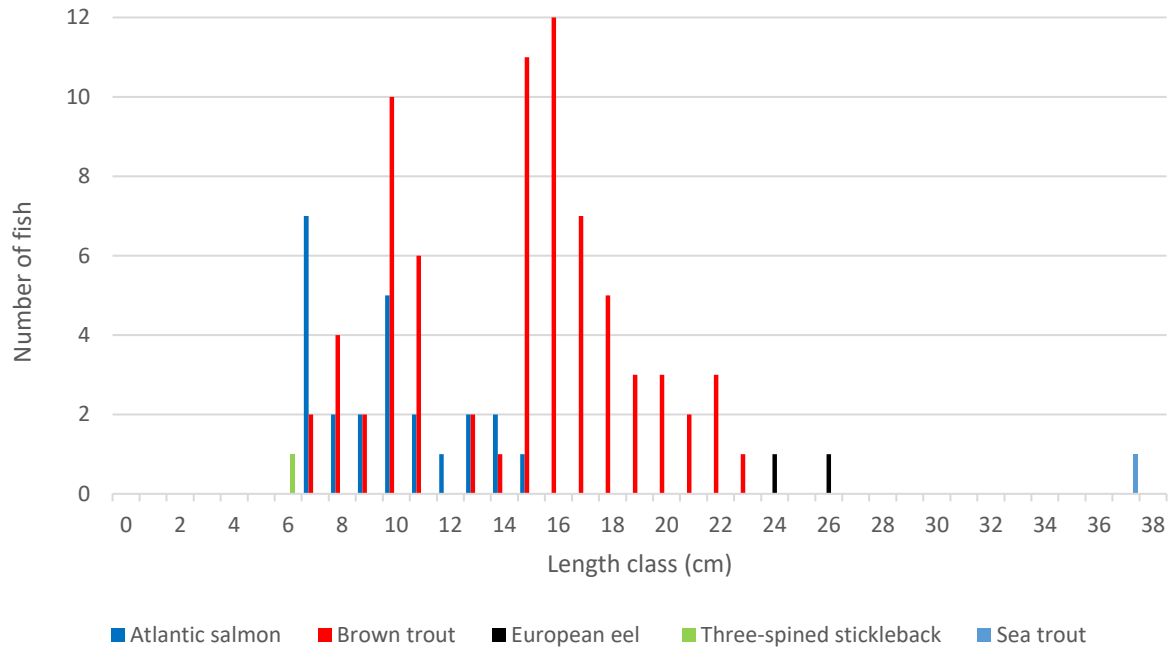

Figure 3.6 Length frequency distribution recorded via electro-fishing at site 6 on the Glashaboy River, September 2022

Plate 3.13 Adult sea trout recorded at site 6 on the Glashaboy River, September 2022

Plate 3.14 Representative image of site 6 on the Glashaboy River, September 2022 (facing upstream from bridge)

3.1.7 Site 7 – Rathcooney Stream, Meadowbrook

Site 7 was located on the lower reaches of the Rathcooney (Springmount) Stream (19R31) downstream of the R639 road culvert and immediately upstream of the Glashaboy River confluence. The small upland eroding stream (FW1) flowed under the road via a series of pipe culverts, with a 0.6m fall on the downstream side. The stream had been heavily modified in the vicinity of the road culvert,

with historical straightening, retaining walls and a locally-installed hydro-electric turbine installed on the lower reaches (**Plate 3.16**). The stream averaged 1.5-2m wide in an often trapezoidal channel. The depth averaged 0.05-0.1m with only very localised deeper areas. The profile comprised shallow glide and riffle with a paucity of pools. However, depositional glide (to 0.2m) was present upstream of the turbine and associated weir board. Whilst cobble and mixed gravels were present, these were exposed to very high rates of siltation. Very deep soft sediment deposits (>0.5m) were located upstream of the weir and were evidently contributing to the silt load of the downstream connecting Glashaboy River. Given heavy shading, macrophyte growth was limited to occasional fool's watercress and rare brooklime in more open areas of channel. Aquatic bryophytes were limited to very occasional *Rhynchostegium riparioides*. The stream was heavily shaded by dense growth of sycamore, cherry laurel, alder, elder and ash (WL2) with bramble scrub (WS1). The site was bordered by residential areas and buildings (BL3).

Three-spined stickleback (*n*=5) were the only fish recorded via electro-fishing at site 7 (**Figure 3.7**). With the exception of three-spined stickleback, the lower reaches of the stream were of poor fisheries value given multiple instream barriers, gross siltation and the shallow nature of the site. However, the lowermost reaches (cobble substrata) adjoining the Glashaboy (downstream of the weir) may serve as moderate quality spawning habitat at higher water levels (for salmonids in the adjoining Glashaboy River). Despite the presence of abundant soft sediment, poor flows precluded the presence of lamprey ammocoetes. A low density of European eel were recorded from the stream in July 2016 (ARUP 2016; **Table 3.3**).

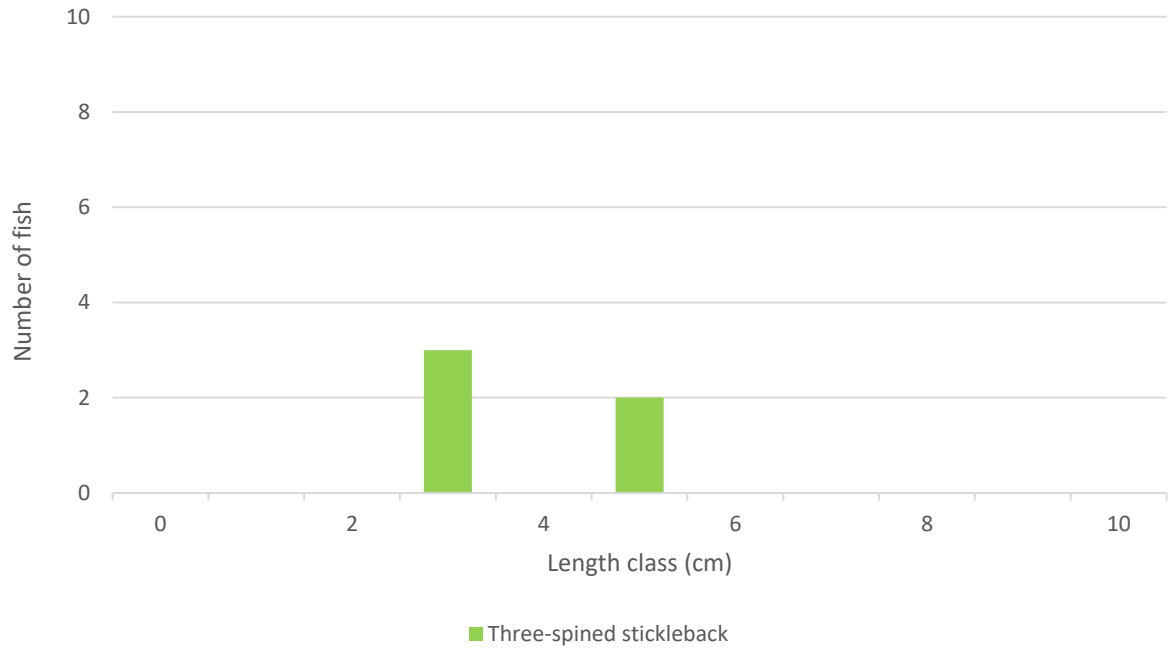

Figure 3.7 Length frequency distribution recorded via electro-fishing at site 7 on the Rathcooney Stream, September 2022

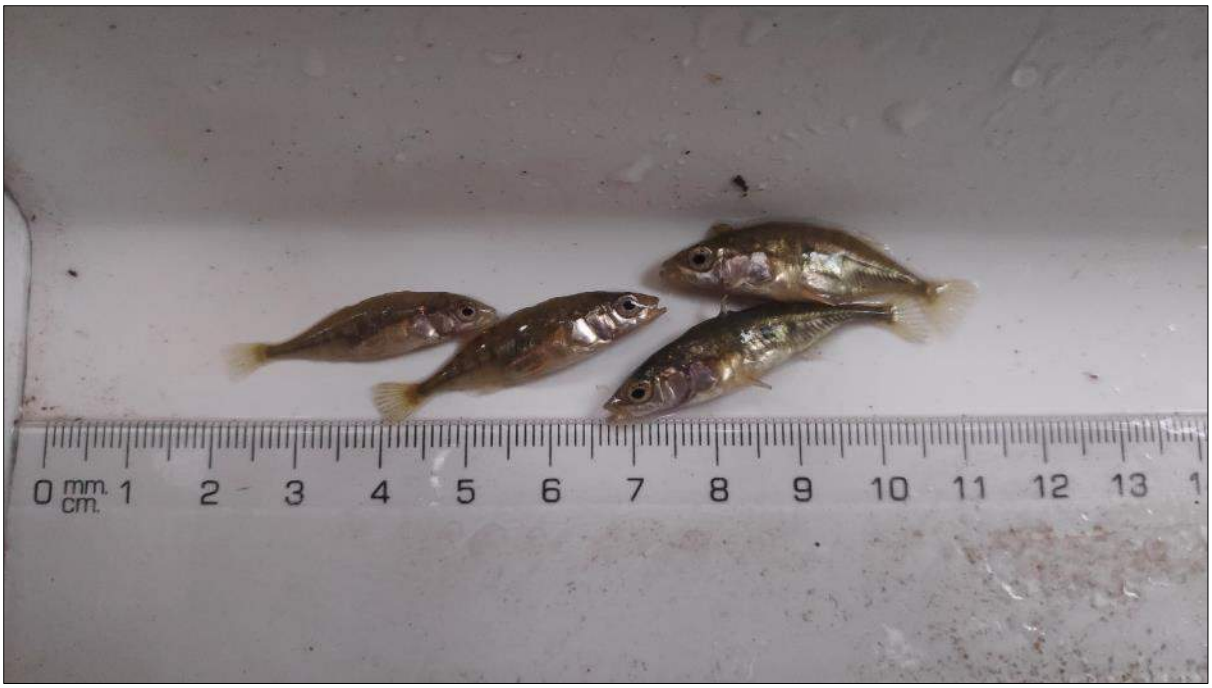

Plate 3.15 Three-spined stickleback recorded at site 7 on lower reaches of the Rathcooney Stream, September 2022

Plate 3.16 Representative image of site 7 on lower reaches of the Rathcooney Stream showing locally-installed hydro-electric turbine, September 2022 (significant barrier to fish migration)

3.1.8 Site 8 – Glashaboy River, Riverstown Bridge

Site 8 was located on the Glashaboy River (19G01) upstream of Riverstown Bridge at a proposed works area, approx. 0.4km downstream of site 6. The upland eroding spate river (FW1) had been modified historically with retaining walls and boulder revetment along both banks. However, the river

demonstrated good instream recovery. The river averaged 6-10m wide and 0.3-0.6m deep, with locally deeper pool. The profile comprised swift-glide with occasional riffle and localised scour pool. The substrata were dominated by relatively mobile cobble and mixed gravels with frequent small boulder. Soft sediment accumulations were flocculent, where present in marginal slacks (<0.02m deep). Siltation was low to moderate, locally. Macrophyte growth was sparse with occasional water crowfoot (*Ranunculus* sp.), fool's watercress, water pepper and rare hemlock water dropwort along channel margins and on exposed cobble bars (islands). The moss *Fontinalis antipyretica* was locally frequent on larger substrata with rare *Rhynchostegium riparioides*. Filamentous algae (*Cladophora* sp.) were present (10% cover), indicating significant enrichment. The site supported mature treelines of sycamore, hawthorn (*Crataegus monogyna*), ash, elder, beech and bramble scrub. The site was bordered by residential areas (BL3, GA2) and John O'Callaghan Park (WD5) downstream.

Atlantic salmon (*n*=23), brown trout (*n*=49), European eel (*n*=6) and stone loach (*n*=1) were recorded via electro-fishing at site 8 (**Figure 3.8**). As per upstream, the site was of very high value for salmonids, supporting high numbers of mixed-cohort brown trout with lower numbers of Atlantic salmon parr. The site was a good quality salmonid nursery with abundant instream cobble refugia in fast-flowing glide. However, the open nature of the glide habitat reduced the value somewhat. The site also provided good quality salmonid spawning habitat, although the value was reduced given siltation pressures. Frequent, heavily shaded scour pools (along the east bank) provided excellent quality holding habitat for salmonids and also supported some very good European eel habitat. Suitable soft sediment areas for larval lamprey were absent given high flow rates.

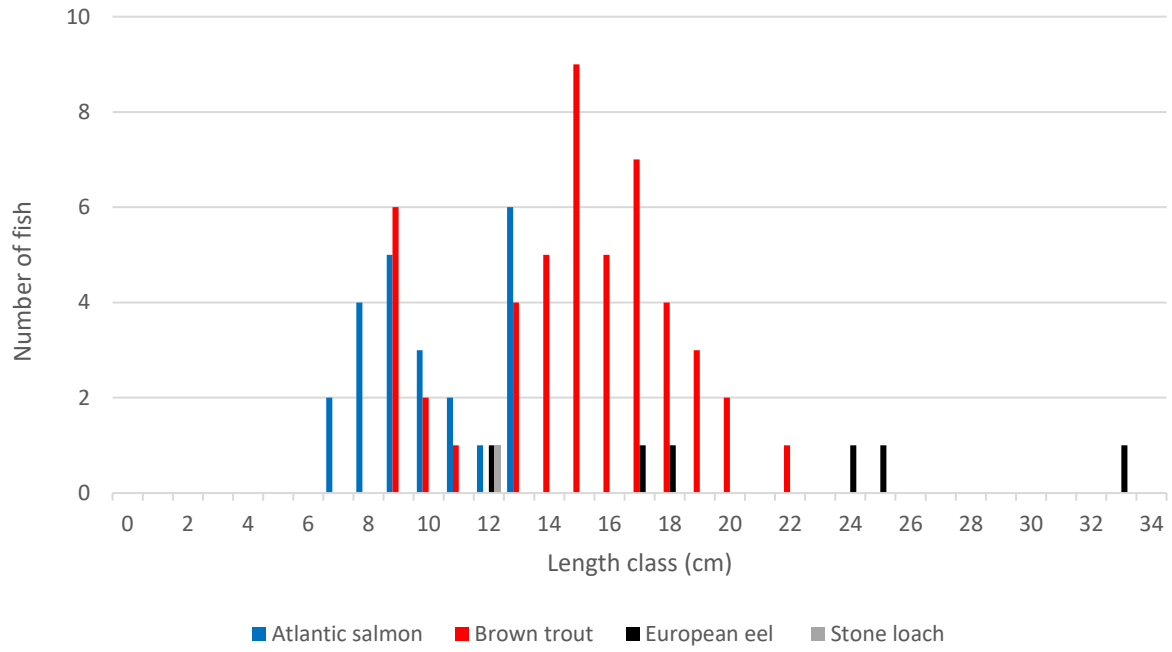

Figure 3.8 Length frequency distribution recorded via electro-fishing at site 8 on the Glashaboy River, September 2022

Plate 3.17 Mixed cohort brown trout recorded at site 8 on the Glashaboy River, September 2022

Plate 3.18 Representative image of site 8 on the Glashaboy River, September 2022 (upstream of Riverstown Bridge)

3.1.9 Site 9 – Lisheenroe Stream, Brooklodge East

Site 9 was located on the Lisheenroe (Glenmore) River (19L40) at a proposed works area near Brooklodge East, upstream of the L2964 road box culvert (a significant barrier; **Plate 3.21**). The upland eroding river (FW1) had been straightened and modified historically with retaining walls and revetment present upstream and downstream of the large box culvert. Despite this, the stream

retained some good semi-natural characteristics instream. The stream averaged 3-4m wide and 0.2-0.4m deep, with only localised deeper areas to 0.7m. The substrata were dominated by clean cobble and mixed gravels, with localised boulder. Soft sediment accumulations were shallow and flocculent where present. Siltation was low overall (locally moderate). Macrophyte growth was limited to occasional water crowfoot (*Ranunculus* sp.), fool's watercress and hemlock water dropwort. Cover of aquatic bryophytes was high with abundant *Chiloscyphus polyanthus* and occasional *Fontinalis antipyretica* and *Rhynchostegium riparioides*. Filamentous algae were present (<1%). The narrow channel was heavily shaded by maturing (previously coppiced) treelines dominated by sycamore, ash and grey willow with bramble scrub. The site was bordered by the L2966 road, industrial areas (BL3) and improved pasture (GA1).

Atlantic salmon (*n*=1), brown trout (*n*=31) and Lampetra sp. (*n*=7) were recorded via electro-fishing at site 9 (**Figure 3.9**). The site was of good value for salmonids, supporting a moderate density of mixed-cohort brown trout. Despite the presence of a poorly-passable sloping box culvert, a single Atlantic salmon parr was also recorded. The site provided good quality salmonid spawning habitat given abundant cobble and mixed gravels. The site was also of good value as a nursery although only a low density of juveniles was recorded. Whilst localised, deeper pool and glide upstream of the culvert provided some good quality holding areas for adult salmonids. Good quality lamprey spawning habitat was widespread (finer gravels) although the site was of poor value as lamprey nursery. Despite this, flocculent deposits associated with *Ranunculus* beds supported a low density of *Lampetra* sp. ammocoetes (3.5 per m^2). Despite some good suitability for European eel, none were recorded. This may have reflected fish passage difficulties due to the box culvert.

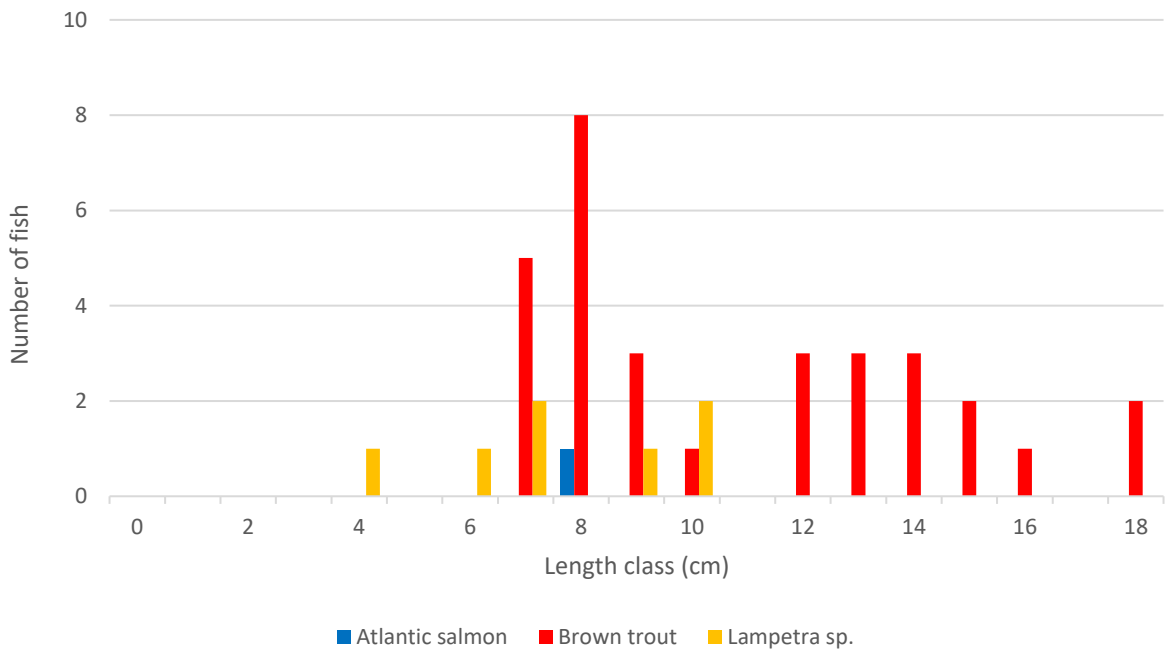

Figure 3.9 Length frequency distribution recorded via electro-fishing at site 9 on the Lisheenroe Stream, September 2022

Plate 3.19 *Lampetra* sp. ammocoetes recorded at site 9 on the Lisheenroe Stream, September 2022

Plate 3.20 Representative image of site 9 on the Lisheenroe Stream, September 2022 (facing downstream from box culvert)

Plate 3.21 Sloping box culvert present at site 9 on the Lisheenroe Stream (a significant barrier to fish migration)

3.1.10 Site 10 – Lisheenroe Stream, Copper Valley Vue

Site 10 was located on the Lisheenroe (Glenmore) River (19L40) at a proposed works area near Copper Valley Vue approx. 0.4km downstream of site 9. The upland eroding stream (FW1, with some depositing characteristics) had been historically straightened and modified, with retaining walls and culverts present. However, the stream retained some good semi-natural characteristics. The channel averaged 3-4m wide and 0.2-0.4m deep, with locally deeper areas to 1m. The profile was dominated by shallow glide and riffle with occasional pool. The substrata were dominated by cobble and boulder with frequent interstitial mixed gravels. These were relatively loose and exposed to moderate siltation. Soft sediment accumulations were shallow and flocculent where present (<0.02m deep). The swift-flowing site supported sparse macrophyte growth with occasional fool's watercress, watercress and water pepper along channel margins. Coverage of aquatic bryophytes was high with frequent *Chiloscyphus polyanthos* and *Rhynchostegium riparioides*, occasional *Leptodictyum riparium* and rare *Fontinalis antipyretica*. Filamentous algal (*Cladophora* sp.) and floc cover was high (40%), indicating significant enrichment. The riparian zone had been historically cleared and coppiced, with regenerating treelines of alder, grey willow, ash and sycamore in addition to bramble scrub. Downstream, more mature treelines of these species were present, providing valuable thermal refugia in the typically shallow stream. The site was bordered by residential and peri-urban areas (BL3).

Atlantic salmon (*n*=1), brown trout (*n*=77), lamprey (*Lampetra* sp.) (*n*=4) and European eel (*n*=1) were recorded via electro-fishing at site 10 (**Figure 3.10**). The site was of excellent value for salmonids, supporting a high density of mixed-cohort brown trout in addition to a very low density of Atlantic salmon parr (single fish recorded). The site provided excellent quality salmonid nursery habitat, with abundant cobble and boulder refugia in fast glide and riffle habitat. Whilst localised, excellent quality holding habitat was also present given occasional small scour pools in the vicinity of the bridge (the

majority of fish were confined to these areas). Good quality spawning habitat for both salmonids and lamprey was present although the value was reduced due to siltation pressures. Soft sediment areas were sub-optimal for larval lamprey due to their flocculent, shallow nature. However, a low density of *Lampetra* sp. ammocoetes (4 per m^2) were recorded c.5m upstream of the bridge. Suitability for European eel was high although only a low density were recorded.

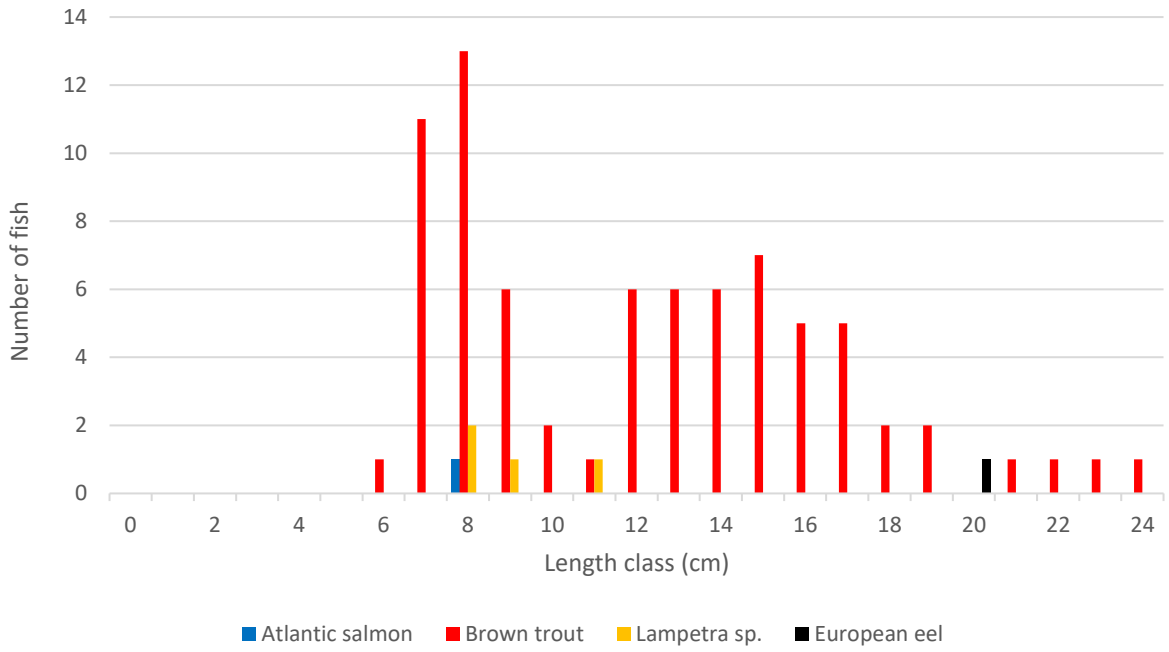

Figure 3.10 Length frequency distribution recorded via electro-fishing at site 10 on the Lisheenroe Stream, September 2022

Plate 3.22 Atlantic salmon parr recorded at site 10 on the Lisheenroe Stream, September 2022

Plate 3.23 Representative image of site 10 on the Lisheenroe Stream, September 2022 (facing upstream to road culvert)

3.1.11 Site 11 – Glashaboy River, upstream of Glanmire Bridge

Site 11 was located on the upper tidal reaches of the Glashaboy River approx. 130m upstream of Glanmire Bridge. The tidal channel (CW2) had been modified historically with a 4m-high retaining wall along the western (roadside) bank, and intermittent sections of revetment/retaining walls along the western bank. The channel (at low tide) averaged 8-12m wide and 0.4-0.8m deep, with frequent deeper areas to 1.6m. The profile (at low tide) was of tidal glide and riffle with localised pool. Deep glide and pool predominated downstream of the meander. The substrata were dominated by compacted cobble and boulder with interstitial gravels. Typical of a tidal channel, these were heavily silted. Aquatic vegetation was limited to *Ulva* sp. on littoral cobble with occasional *Rhynchostegium riparioides* on the upper littoral and retaining walls. *Fontinalis antipyretica* and *Cinclidotus fontinaloides* were present but rare. The site was heavily shaded by mature treeline (west bank) of ash, sycamore, alder and grey willow with occasional hazel. The non-native Traveller's joy (*Clematis vitalba*) was frequent along the road bank. The site was bordered by the R639 road to the west and rough pasture (GS2) on the eastern bank.

Atlantic salmon (*n*=3), brown trout (*n*=3), European eel (*n*=4), flounder (*Platichthys flesus*) (*n*=8) and sand goby (*Pomatoschistus minutus*) (*n*=4) were recorded via electro-fishing at site 11 (**Figure 3.11**). The tidal site was of good value for salmonids. Whilst only supporting a very low density of Atlantic salmon smolts and estuarine/slob brown trout at the time of survey, the abundant deep glide downstream of the site provided excellent holding habitat for migratory adults (in addition to European eel). The tidal site was not of value as a salmonid spawning habitat. The site was however of high value as a nursery for flounder and European eel given abundant boulder and cobble refugia.

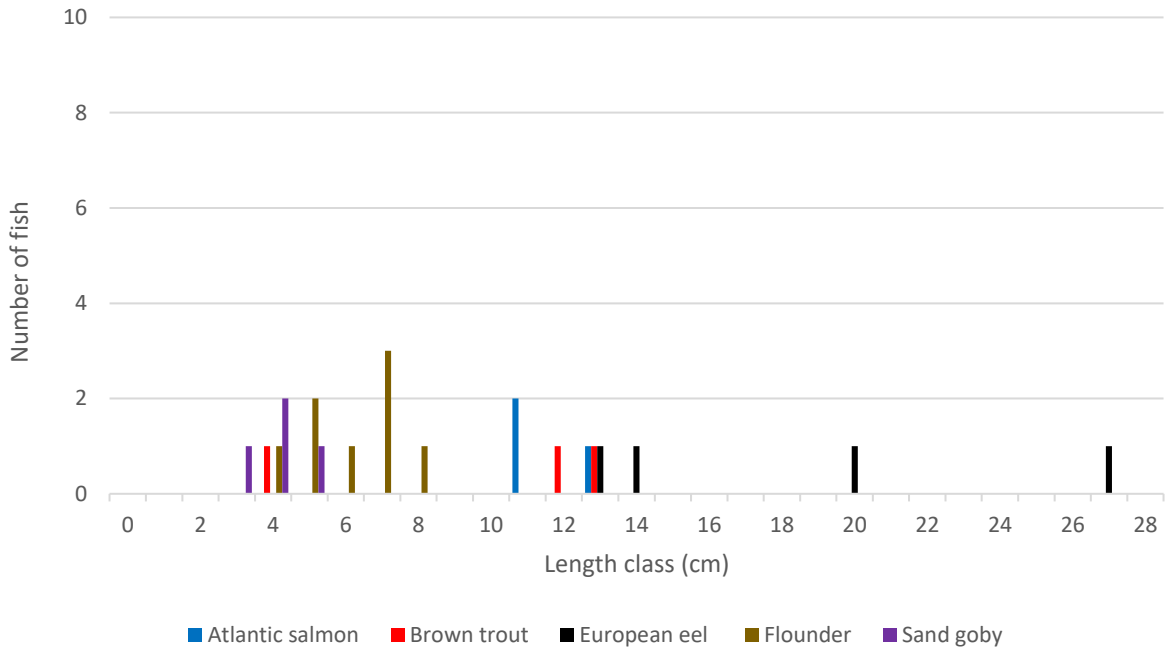

Figure 3.11 Length frequency distribution recorded via electro-fishing at site 11 on the tidal Glashaboy River, September 2022

Plate 3.24 Atlantic salmon smolt (top) and slob brown trout (bottom) recorded at site 11 on the Glashaboy River, September 2022

Plate 3.25 Juvenile flounder recorded at site 11 on the Glashaboy River, September 2022

Plate 3.26 Representative image of site 11 on the Glashaboy River, September 2022 (tidal channel)

Table 3.1 Fish species densities per m^2 recorded at sites in the vicinity of the proposed Glashaboy FRS via electro-fishing in September 2022 (values in **bold** represent the highest densities recorded for each species, respectively)

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Fish density (per m^2)								
				Atlantic salmon	Brown trout	Sea trout	*Lampetra* sp.	European eel	Three-spined stickleback	Stone loach	Flounder	Sand goby
1	Glashaboy River	10	280	0.179	0.146	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	Upper Glanmire Stream	10	200	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000
3	Glashaboy River	10	200	0.175	0.255	0.000	**12.6 per m^2**	0.005	0.000	0.000	0.000	0.000
4	Glashaboy River	10	200	**0.375**	0.120	0.000	0.005*	**0.030**	0.005	**0.005**	0.000	0.000
5	Lisnahorna Stream	5	80	0.000	0.025	0.000	0.000	0.000	0.050	0.000	0.000	0.000
6	Glashaboy River	10	270	0.089	0.274	**0.004**	0.000	0.007	0.004	0.000	0.000	0.000
7	Rathcooney Stream	5	90	0.000	0.000	0.000	0.000	0.000	**0.056**	0.000	0.000	0.000
8	Glashaboy River	10	280	0.082	0.175	0.000	0.000	0.021	0.000	0.004	0.000	0.000
9	Lisheenroe River	10	200	0.005	0.155	0.000	3.5 per m^2	0.000	0.000	0.000	0.000	0.000
10	Lisheenroe River	10	180	0.006	**0.428**	0.000	4 per m^2	0.006	0.000	0.000	0.000	0.000
11	Glashaboy River	10	350	0.009	0.009	0.000	0.000	0.011	0.000	0.000	**0.023**	**0.011**

* *Lampetra* sp. transformer, no ammocoetes recorded via targeted electro-fishing

Table 3.2 Summary of fish species of higher conservation value and relative abundances (low, medium, high & very high) recorded via **electro-fishing** per survey site in the vicinity of the proposed Glashaboy FRS, September 2022

Site	Watercourse	Atlantic salmon	Brown trout	Sea trout	*Lampetra* sp.	European eel	Other species
1	Glashaboy River	High	High				
2	Upper Glanmire Stream					Low	
3	Glashaboy River	Medium	High		High	Low	
4	Glashaboy River	Very high	Medium		Low	Medium	Three-spined stickleback, stone loach
5	Lisnahorna Stream		Low				Three-spined stickleback
6	Glashaboy River	Medium	Very high	Low		Low	Three-spined stickleback
7	Rathcooney Stream						Three-spined stickleback
8	Glashaboy River	Medium	High			Medium	Stone loach
9	Lisheenroe River	Low	Medium		Medium		
10	Lisheenroe River	Low	Very high		Low	Low	
11	Glashaboy River	Low	Low			Low	Flounder, sand goby

Conservation value: Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*) and river lamprey (*Lampetra fluviatilis*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Atlantic salmon and sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. With the exception of the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout and coarse fish species have no legal protection in Ireland.

Table 3.3 Comparison of fish species recorded by Triturus via electro-fishing in the vicinity of the Glashaboy FRS in July 2016 and September 2022

Site no. (2022)	Site no. (2016)	Watercourse	Species recorded (electro-fishing)	
			2022	2016
1	n/a	Glashaboy River	Atlantic salmon, brown trout	Site not surveyed in 2016
2	1B	Upper Glanmire Stream	European eel	Brown trout, European eel
3	3A	Glashaboy River	Atlantic salmon, brown trout, *Lampetra* sp., European eel	Atlantic salmon, brown trout, *Lampetra* sp., European eel, stone loach, three-spined stickleback
4	n/a	Glashaboy River	Atlantic salmon, brown trout, *Lampetra* sp., European eel, three-spined stickleback, stone loach	Site not surveyed in 2016
5	4B	Lisnahorna Stream	Brown trout, three-spined stickleback	No fish recorded
6	6A	Glashaboy River	Atlantic salmon, brown trout, sea trout, European eel, three-spined stickleback	Atlantic salmon, brown trout, European eel
7	7B	Rathcooney Stream	Three-spined stickleback	European eel
8	8B	Glashaboy River	Atlantic salmon, brown trout, European eel, stone loach	Atlantic salmon, brown trout, sea trout, *Lampetra* sp., European eel
9	n/a	Lisheenroe River	Atlantic salmon, brown trout, *Lampetra* sp.	Site not surveyed in 2016
10	n/a	Lisheenroe River	Atlantic salmon, brown trout, *Lampetra* sp., European eel	Site not surveyed in 2016
11	n/a	Glashaboy River	Atlantic salmon, brown trout, European eel, flounder, sand goby	Site not surveyed in 2016

4. Discussion

The watercourses in the vicinity of the proposed Glashaboy FRS are upland eroding, spate channels of varying size which have been subject to historical modifications such as local straightening, weirs and culverts in the vicinity of the urban centres of Glanmire, Riverstown and Sallybrook (i.e. the scheme footprint). Whilst hydromorphology was evidently a risk to fish populations in certain tributaries such as the Lisheenroe Stream and Lisnahorna Stream, the Glashaboy River retained many semi-natural instream characteristics and was of very high value for salmonids, including Atlantic salmon and sea trout. All 11 no. survey sites supported fish at the time of survey with Atlantic salmon and brown trout being the most widespread species. Sea trout, European eel and lamprey were recorded more locally. Other species of lower conservation value recorded included three-spined stickleback, stone loach, flounder and sand goby (**Table 3.2**). The larger watercourses in the vicinity of the scheme, namely the Glashaboy River and Lisheenroe (Glenmore) Stream, provided the highest quality fisheries habitat, further verifying previous surveys undertaken (refer to **Tables 3.1-3.3** of the results section).

4.1 Salmonids

Salmonids were present at 9 no. sites on the Glashaboy River (sites 1, 3, 4, 6, 8 & 11), Lisnahorna Stream (site 5) and Lisheenroe Stream (sites 9 & 10). With the exception of site 5 on the Lisnahorna Stream (which supported a very low density of brown trout only), Atlantic salmon were also recorded at these sites. Whilst sea trout (anadromous brown trout) were only recorded from a single site (6) during the survey[2], despite the Glashaboy River being a regionally important sea trout river (McGinnity et al., 2003). A healthy population of adult sea trout is known from the lower reaches of the river in the important holding habitat adjoining John O' Callaghan Park.

Only single examples of Atlantic salmon parr were recorded from sites 9 and 10 on the Lisheenroe (Glenmore) Stream and this was considered to reflect the reduced habitat suitability within the small stream due to hydromorphological modifications, instream barriers (**Plate 3.21**) and water quality (enrichment) pressures on the watercourse. Low densities of Atlantic salmon were also recorded elsewhere on the Lisheenroe Stream in July 2016 (ARUP, 2016). A very high density of mixed-cohort brown trout (the highest recorded during the survey; **Table 3.1**) was present on the lower reaches of the Lisheenroe Stream at site 10 and the watercourse is likely a significant contributor to the trout population of the downstream-connecting Glashaboy River.

High (often excellent) quality salmonid spawning and nursery habitat was widespread on the Glashaboy River with sites 4 (Grandon's) and 6 (Hazelwood Bridge) supporting particularly high densities of juvenile Atlantic salmon and brown trout, respectively (**Table 3.1**). The semi-natural river also provided frequent high quality holding habitat for migratory adult fish by way of deep pools, deep glide and undercut banks (scour pools) with sufficient riparian shading which reduces thermal stress (O'Briain et al., 2020, 2017). Upstream of the urban reaches of Glanmire, the Glashaboy River retains well-developed riparian buffers (including mixed woodland) and a high degree of naturalness (i.e. good hydromorphology) despite adjoining agricultural land use pressures. Much of the wider catchment was of good status in the 2016-2021 period with the river achieving Q4 (good status) or even Q4-5 (high status) biological water quality at all sampled locations in 2020, including within vicinity of the

[2] Sea trout are often confined to deep pools during daylight hours and thus are often difficult to capture with backpack electro-fishing methodologies

proposed scheme (EPA data). Thus, the Glashaboy provides highly suitable conditions for healthy salmonid populations, despite several pressures.

Instream barriers are a significant threat to both diadromous (Atlantic salmon, sea trout, European eel, river & sea lamprey) and potadromous (brown trout & brook lamprey) fish populations on the Glashaboy River with a total of 14 no. weirs mapped throughout the catchment (Atkinson et al., 2020). Several of these weirs are located within the survey area, in addition to widespread hydromorphological modifications, including culverts (**Figure 4.1**). Nevertheless, Atlantic salmon are known to penetrate into the upper Glashaboy catchment (Matson et al., 2019; Kelly et al., 2012, 2010). Historical modifications such as straightening and bank alterations damages instream habitats and hydromorphological heterogeneity, removes instream structure and refugia, encourages sediment deposition and invariably results in a reduction in fisheries potential, particularly for salmonids (O'Briain et al., 2019; O'Grady et al., 2017, O'Grady, 2006) but also European eel and lamprey species (see below).

4.2 Lamprey

Lamprey ammocoetes (*Lampetra* sp.) were recorded from a total of 3 no. sites via targeted electro-fishing during the survey, namely site 3 on the Glashaboy River and sites 9 and 10 on the Lisheenroe (Glenmore) Stream (**Tables 3.1 and 3.2**). An early stage *Lampetra* sp. transformer[3] was also recorded from cobble habitat at site 4 on the Glashaboy River (**Plate 3.8**). Ammocoetes were present in low densities at sites 9 and 10 (3.5 and 4.0 per m^2, respectively) but a relatively high density (12.6 per m^2) for a spate river was recorded at site 3 (**Table 3.1**). The restricted distribution of *Lampetra* sp. was also observed during electro-fishing surveys undertaken in 2016 (ARUP, 2016) and in the wider catchment in 2018 (Matson et al., 2019). Whilst suitable *Lampetra* sp. spawning habitat (clean, fine gravels; Dawson et al., 2015; Rooney et al., 2013; Lasne et al., 2010) was common throughout the survey area, there was a paucity of suitable nursery (soft sediment) habitat within the vicinity of the proposed scheme. This was considered to reflect the predominating higher-energy/spate nature of the surveyed watercourses which discourages the deposition of fine, organic-rich soft sediment ≥5cm in depth in which larvae burrow and mature, thus constraining population establishment and persistence and (Aronsuu & Virkkala, 2014; Goodwin et al., 2008; Gardiner, 2003).

Despite the close proximity to the sea (Lough Mahon/Cork Harbour), there are no known records of anadromous sea lamprey (*Petromyzon marinus*) or river lamprey (*Lampetra fluviatilis*) in the Glashaboy River or adjoining tributaries, likely due to unnavigable instream barriers.

4.3 European eel

European eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020). As observed in 2016 (ARUP, 2016), eel habitat was typically of good quality and the species was present throughout the survey area (7 no. sites) albeit in low to medium densities (**Table 3.1, 3.2**). Higher relative densities of eel were recorded from cobble and boulder-dominated areas of habitat present at sites 4 and 8 on the Glashaboy River. Such areas provided ample diurnal refugia required by the species, including boulders and deeper pool areas (Laffaille et al., 2003). In contrast to other diadromous species such as salmonids, European eel are better able to navigate

[3] All life stages from the start of transition to adult form (Gardiner, 2003)

and therefore less impacted by instream barriers, primarily given their remarkable climbing ability as juveniles (Tamario et al., 2019; Watz et al., 2019; Podgorniak et al., 2016).

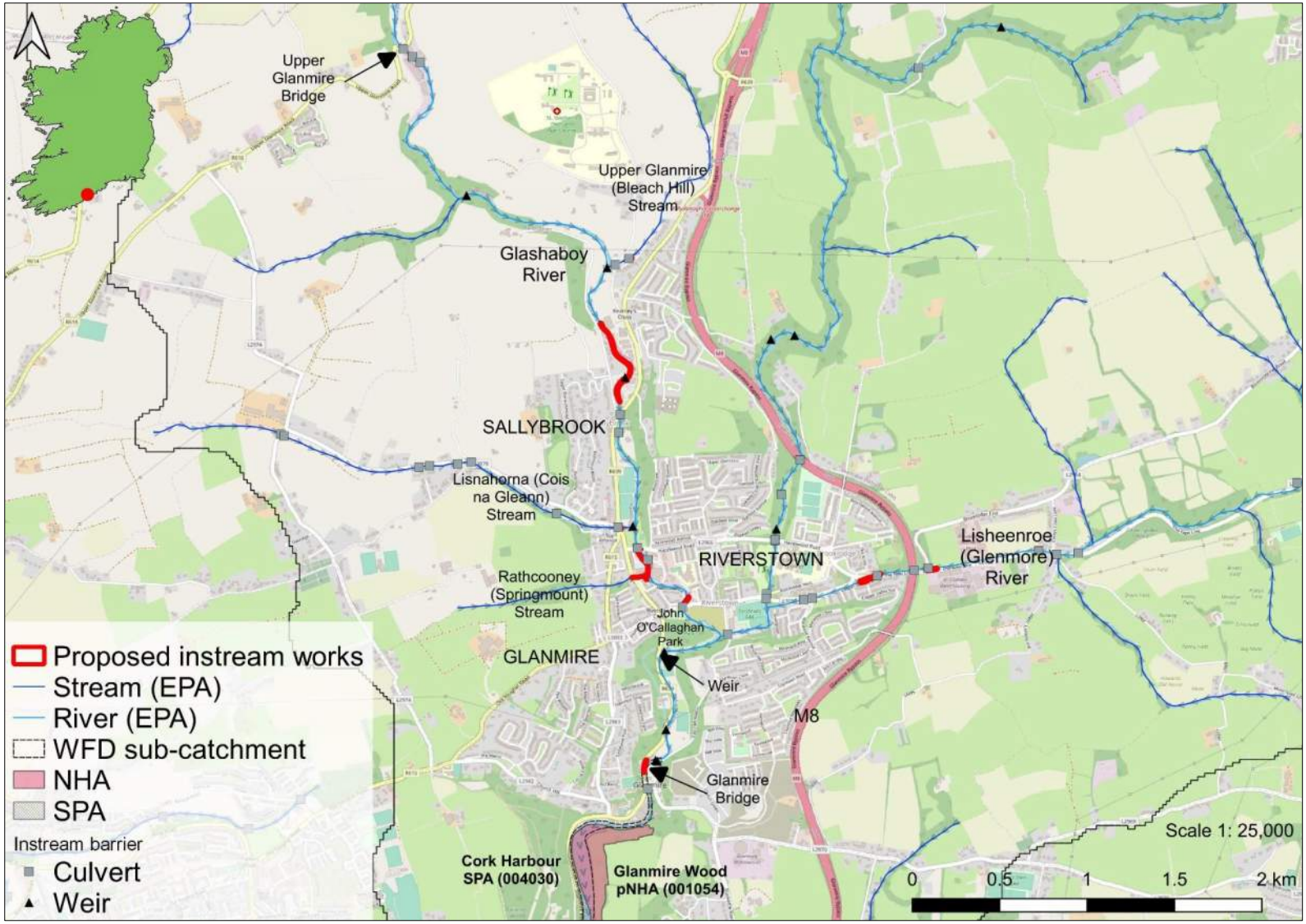

Figure 4.1 Overview of instream barriers in vicinity of the proposed Glashaboy FRS, Co. Cork (source: IFI's National Barriers Programme)

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Appendix M

Site Clearance Report and Checklist (Flynn Furney 2022)

FLYNN FURNEY
ENVIRONMENTAL CONSULTANTS

Glashaboy FRS - Site Clearance Report (February) 2022

For: Arup

FFEC Ecologists on Site: Usna Keating and Simon Furney

Written by Usna Keating, Flynn Furney Environmental Consultants

Date: 15/03/2022

Contents

1 Introduction

Background

This ecology report has been developed to provide information regarding the ecological supervision of clearance works during the initial phase of the Glashaboy Flood Relief Scheme. This report also summarises ecological site liaison, consultations and considerations during initial site clearance relating to tree felling, as part of the Glashaboy flood relief scheme. Felling commenced and was completed in February 2022, prior to the start of the bird nesting season in March.

2 Ecological Considerations and Liaison

2.1 Site Meetings and Ecological Considerations

An initial site meeting took place between the client, representatives from Flynn Furney Environmental Consultants (hereafter referred to as FFEC) (FFEC), Triturus Environmental Consultants (regarding Otter), and Bat Ecology Services (regarding bats). An additional on-site meeting was held between the client, FFEC, National Parks and Wildlife Service (NPWS), CE Tree Services, Bat Ecology Services, and Triturus Environmental Consultants to liaise directly regarding works, and for all parties to familiarise themselves and discuss ecological considerations at various works areas.

At these initial pre-works meetings, the site was inspected, proposed works were discussed and maps were assessed. Maps included the locations of Japanese Knotweed areas and locations of tree species of varying sizes, which were planned to be removed. The positions of other invasive species present were not mapped, but these are discussed below.

2.2 Arborist Works

The vehicles proposed to be used for site clearance were clarified with the arborist. These vehicles included two rubber tracked excavators armed with grabs (one of which was armed with a tree shears), as well as a tracked mulching machine (i.e. three vehicles). Other equipment included chainsaws.

2.3 Otter

The position of the two Otter holts in the immediate vicinity of proposed works was shown to all relevant parties. It was noted that a derogation licence was required for works adjacent to holts and

that this licence would need to be in place prior to commencement of works within 30m of the Otter holts.

The specific felling requirements adjacent to holts was also discussed. It was noted that felling could take place within the vicinity of the holt provided that a derogation was in place and it was noted that no trees on the western bank of the upstream holt would be felled. It was also agreed to retain some cover over and around the downstream holt (upstream of Sallybrook shopping centre). Therefore, no damage to this holt would occur as a result of proposed tree felling works during this phase. It was agreed that Triturus Environmental Consultants would be on site to supervise any works within 30m of the Otter holts.

2.4 Bats

Bat Ecology Services clarified that they would be pre-surveying areas for bats prior to felling and advising on specific felling requirements for specific trees that would be informed through their dawn and dusk survey findings. Bat Ecology Services would also be responsible for the installation of bat boxes as a compensation measure to provide suitable roost habitat for local bat species. NPWS were shown a selection of bat boxes that Flynn Furney Environmental Consultants had ordered for the project. A selection of these were supplied to Bat Ecology Services for installation on suitable trees along the Glashaboy River. It was noted by Bat Ecology Services that trees would be selected for bat box installation based on their suitability, with efforts being made to avoid ivy covered trees (where ivy may cover bat boxes), and mature trees were favoured, that would not be affected by future proposed flood relief works.

2.5 Consultations

2.5.1 Inland Fisheries Ireland Consultation

It was agreed that Inland Fisheries Ireland would be consulted to inform them of the works and also to assess whether it was possible for arborists to stand in the river if required, in order to remove selected trees. Inland Fisheries were successfully contacted by Flynn Furney Environmental Consultants and their environmental officer (overseeing the Glanmire area) was satisfied that felling by arborists could occur from within the river as required. It had been noted that no machines would enter the river for these proposed works. The methodology for tree removal was discussed and it was also noted that no trees would be felled into the river.

2.5.2 NPWS Consultation

NPWS local ranger was invited on site and shown the various planned works in the key works areas. NPWS were informed of the presence of Otter and had provided a derogation licence that permitted works within 30m of holts provided ecological supervision occurred during such works. This derogation licence was applied for through Triturus Environmental Consultants.

The scope of works and methodology of works was discussed with NPWS during the onsite meeting. NPWS were also informed of the presence of Japanese Knotweed and other invasive species on site. The local NPWS ranger was shown various locations of the site and shown how works were proposed to be undertaken. The ecological considerations associated with the works were also discussed, including timing of works (prior to bird nesting season, liaison with Inland Fisheries Ireland, and presence of and considerations to prevent the spread of invasive species).

2.6 Invasive Alien Plant Species

2.6.1 Japanese Knotweed

Japanese Knotweed was present on site and locations where Japanese Knotweed was once present had been marked on maps provided by Arup. These maps showed extensive areas of Japanese Knotweed coverage within areas where works were proposed. These areas were inspected and no active Japanese Knotweed growth was seen, however, viable rhizomes were possibly present within the soil, within these areas.

FFEC noted that no removal of soil should occur from any Japanese Knotweed (JKW) area and that no invasive species should be spread as a result of works. It was highlighted that soil on tracks could be transported to other areas and if viable roots had been present within this soil, that Japanese Knotweed or other invasive plants could be spread to other areas.

Given the high volume of brash and branch clearance, it was agreed for a layer of thick mulch to be sprayed over JKW areas and areas of other invasive plant species. Provided mulch was thick enough to support vehicle weight, and provided a full and adequate barrier of mulch cover over JKW areas was created, mulch was deemed to be an adequate barrier between track vehicles and JKW areas. It was agreed for works in all JKW areas to be supervised by FFEC.

2.6.2 Other Invasive Species.

FFEC surveyed the general works area and highlighted the presence of numerous invasive species present, that were not on maps. These species comprised Winter Heliotrope (*Petasites fragrans*), Buddleia (*Buddleia davidii*) and Old Man's Beard (*Clematis vitalba*). No other invasive plant species were identified. These species had a localised distribution, but Winter Heliotrope covered a significant extent along the river, and was present in both open grassy areas and under woodland cover. It was agreed not to spread these species, and therefore mulch was used, and tracks cleaned if required, while or after working in these areas. Trees with Old Man's beard cover could be removed from site if Old Man's beard was removed from them.

2.7 Arborist Method Statement

The arborist was required to develop a method statement in advance of works. FFEC liaised with all relevant ecological parties (i.e. Triturus and Bat Ecological Services) to provide ecological input to the arborist in relation to works requirements and a request was made that this advice be incorporated into the method statement. This was sent to Cork City Council (CCiC) who were responsible for liaising with CE Tree in this regard. These recommendations were incorporated into CE Tree method statement. These recommendations related to works around or in the vicinity of watercourses, otter holts, ivy covered trees or trees with bat roost potential and around invasive species avoidance and prevention of spread.

2.8 Site Visits and Supervision

FFEC were on site for the following days (Table I). During the supervision period, all works were monitored. Any ecological requirements identified by FFEC were discussed with CE Tree. All ecological requirements were adhered to by CE Tree. Liaison between Bat Ecology Services and Triturus Ecological Consulting was ongoing and any requirements identified by these consultancies were discussed directly with CE Tree. A checklist for ecological supervision requirements and recording was developed during the works process. This checklist was filled in daily following development to summarise and record key ecological requirements and communications from daily inspections.

Table I: Register of the various dates the site was visited and works were supervised by FFEC

February	
01/02/2022	site visit
07/02/2022	site visit
08/02/2022	site visit
09/02/2022	site visit
10/02/2022	site visit
11/02/2022	site visit
14/02/2022	site visit
15/02/2022	site visit
16/02/2022	site visit
17/02/2022	site visit
18/02/2022	Storm (no site visit)
21/02/2022	site visit

2.9 Conclusion

The clearance works have resulted in the removal of trees and scrub, which comprised suitable wildlife habitat within the works area. Communications and liaison occurred with the relevant state agencies regarding works (i.e. Inland Fisheries Ireland and National Parks and Wildlife Service). Further adverse impacts from works were prevented through regular maintained levels of ecological supervision, regular ecological communication with the arborists, and the implementation of ecological recommendations and best practice by the arborist teams. On site ecological supervision ensured that the clearance areas were appropriately marked (to ensure that no additional clearance occurred within the general area) and that further impacts to protected species were minimised within clearance areas. The ecological supervision also ensured that works were conducted in an appropriate manner, that prevented the further spread of any invasive plant species within the area.