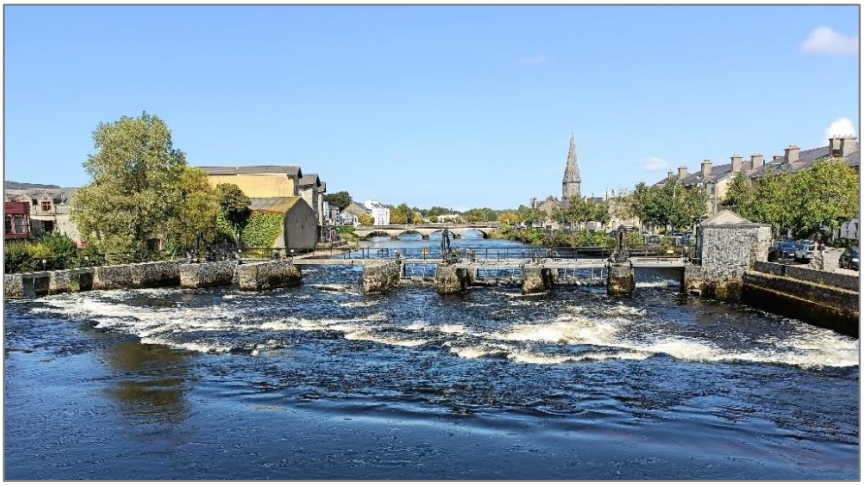
9.6 Ridge Pool Survey

Ballina Flood Relief Scheme



Appendix 9.6: Ridgepool Instream Survey

Construction Phase Temporary Works Areas

September 2024

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1 INTRODUCTION

1.1 Ridgepool Instream Works

As part of the proposed Ballina Flood Relief Scheme, temporary instream works are required along the margins of the 'Ridgepool', River Moy, Ballina, Co. Mayo. The construction phase works are required to repair and maintain integrity of existing Quay walls (which are in poor condition locally) and to install short sections of new flood defence walls to protect Ballina at the scheme design level.

The River Moy has the most abundant salmon population in Ireland, well exceeding its Conservation Limit for salmon annually (Millane et al., 2022). The Ridgepool is the premier salmon angling pool on the system, attracting domestic and international anglers who reserve well in advance the opportunity to fish this iconic beat.

Water levels in the lower River Moy are tidally influenced up as far as the Salmon Weir, noting that the Ridgepool itself forms the lower freshwater reach of the Moy_120 River Water Body (RWB code: IE_WE_34M021100) and is part of the River Moy Special Area of Conservation (SAC) (Site Code 002298). Sea lamprey (*Petromyzon marinus*) is an aquatic qualifying interest of the River Moy SAC. Just downstream of the Ridgepool (Cathedral Beat) is the upper, predominantly freshwater influenced reach of the Moy Estuary that forms part of the Killala Bay/Moy Estuary SAC (SAC 000458) where *P. marinus* is also a qualifying interest.

From a fisheries ecology perspective, Ridgepool is primarily a migration route (i.e., the freshwater river entry point) for salmon, sea trout and anadromous lampreys (*P. marinus, Lampetra fluviatilis*) into the vast upstream River Moy system where most of the catchment spawning and nursery habitat occurs. Sea lamprey have been observed by Inland Fisheries Ireland (IFI) staff within the Ridgepool and climbing the Salmon Weir. *P. marinus* has also been observed (at least from time-to-time) building spawning nests ("redds") in an area of the Ridgepool located about 30-40 m downstream of Salmon Weir, where a degree of suitable flow / depth is apparently maintained during both high and low tide.

Given such reports of potential sea lamprey recruitment in the Ridgepool, it was important to examine the potential for negative effects on sea lamprey spawning and nursery areas as a result of instream construction works at the river margins, and whether such effects (if any) could impact on Conservation Objectives for this species within the River Moy SAC and Killala Bay/Moy Estuary SAC.

1.2 Aim of this Report

The purpose of this report is to document whether there are any potentially suitable sea lamprey spawning and/or nursery locations in the Ridgepool, specifically within the footprints of proposed temporary instream construction works. The findings will be used to support the assessment of effects in **Chapter 9: Aquatic Biodiversity** of the Environmental Impact Assessment Report (EIAR) and the NIS.

1.3 Sea Lamprey Spawning and Lifecycle

Upstream migration of sea lamprey generally occurs in spring to early summer (April through May), although sea lampreys have been observed in the Ridgepool as early as February, likely owing to proximity to the estuary (Igoe et al., 2004). When sea lamprey encounter obstacles such as the Salmon Weir, they can spend considerable time making forays along the structure attempting to ascend.

In contrast to salmonids which regularly make stops and long residences in pools on their inward migration routes (Hawkins & Smith 1986), the evidence is that sea lampreys tend to move quite constantly upstream once in freshwater. Any migration delays correlate almost exclusively with obstacles and barriers such as dams and low-head weirs, even those with fish passes (Davis et al., 2022, Castro-Santos et al., 2017, Silva et al., 2019). Telemetry studies of sea lamprey movement have shown significant delays at such obstacles, with repeated failures of passage attempt (Davis et al, 2022, Castro-Santos et al., 2017, Silva et al., 2019), suggesting that delays are not natural to migrating lampreys as they seek to reach the spawning grounds. Telemetry studies of sea lamprey on the River Severn (western England) showed that, at one weir - of the 50 sea lamprey that passed, 16 (32%) passed within a day of the first approach (not considered a delay), while the remaining 34

(68%) passed during episodic high flow events 6 to 24 days later (Davies et al. 2022). Sea lamprey ascending the Moy likely require the right combination of elevated flow and high tide to pass the Salmon Weir.

Sea lamprey spawning typically occurs in mid-May to June (Kelly and King, 2001), and as late as mid-July (Igoe et al 2004). Spawning area water depth requirement is variable but is usually around 40–60 cm (Hardisty 1986, cited Maitland 2003) with current speeds over 0.4m/s (Curd, 2009) and up to 1.0-2.0 m/s (Maitland, 2003). Nests (redds) can be up to 2.0m in diameter and are constructed by wriggling against the substrate and moving stones around with the oral sucker. Coarse gravel and pebble are required; mainly gravel of 15–115 mm diameter (Mormon et al 1980 cited Maitland 2003) with coarse sand available to which eggs can adhere (Maitland 2003). Adults die quickly after spawning (Applegate 1950).

Sea lamprey eggs have very exacting temperature requirements for successful hatching, being 15–25ºC (Maitland, 2003). In this regard, EPA monitoring data shows that water temperature in the Ridgepool does not exceed 15ºC in April, and very occasionally reaches this threshold in May (**Figure 1-1**). This means sea lamprey spawning would typically not commence before early-May.

Sea lamprey eggs hatch after about 2 weeks and by day 20 the blind, worm-like larvae (ammocoetes), typically about 8-9mm in length (Applegate, 1950) emerge from nests and are swept downstream until they encounter an area of slack current where sheltered marginal sandy-silt deposits usually occur. They immediately dive to the bottom and burrow into the fine substrates where they remain, feeding on diatoms, blue-green algae and organic matter for about 5 years (Maitland 2003). They undergo metamorphosis in late summer (becoming “transformers”) then migrate downstream by night during autumn to spend around two years feeding at sea (Curd, 2009).

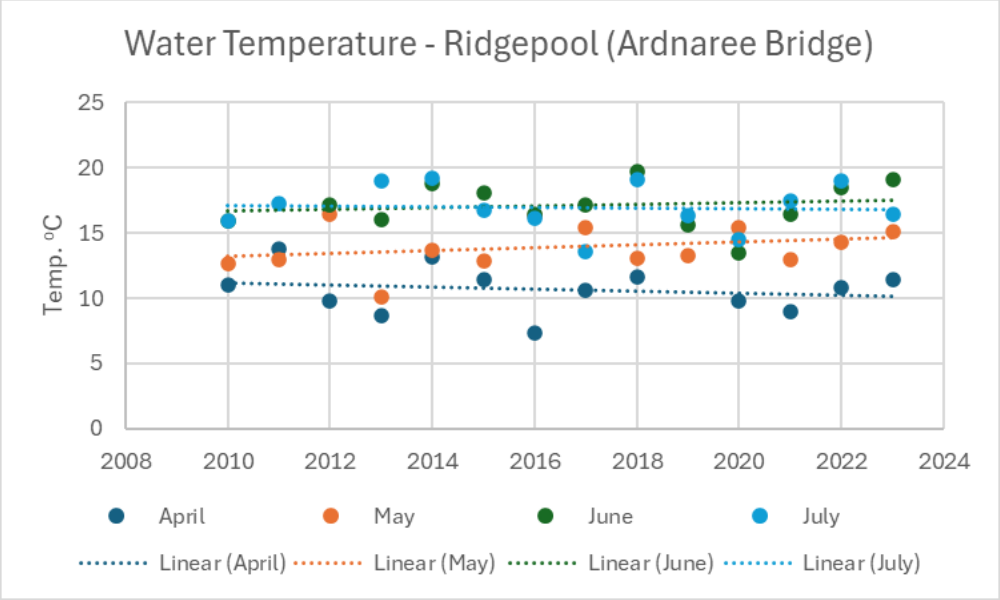


Figure 1-1 Water Temperature by month (spring/summer) – Ridgepool, River Moy (EPA data)

2 METHODOLOGY

2.1 Existing Data Review

The published scientific literature was reviewed to obtain reports and/or records of sea lamprey presence, particularly spawning (i.e., nest building activity) and nursery (i.e., larval lamprey presence) in the lower River Moy and specifically the Ridgepool.

OPW Hydrometric Data (https://waterlevel.ie/) was reviewed to determine water levels on 12th September, when instream surveys took place.

2.2 Consultation

An onsite meeting was held with IFI staff at the Ridgepool on 11th September 2023. The resident IFI ghillie who has over 20 years' experience and observations at the Ridgepool was present at the meeting, as were two IFI fisheries staff that have a regular presence at the Ridgepool. Permission was obtained from IFI staff to carry out instream survey of the Ridgepool on the following day (12th September 2023) as there were no fishing bookings meaning no disruption to the angling amenity.

Bryan Kennedy (EPA Castlebar), formerly of IFI Ballina, was consulted by email. He was mentioned in Igoe et al (2004) as providing personal observation of sea lamprey in the Ridgepool.

2.3 Field Survey

The field study sought to identify habitats within footprints of the proposed temporary work areas as to whether they constitute potential sea lamprey spawning or nursery habitats. Data used in this assessment was collected during field survey dates: 22nd July 2021 and 12th September 2023.

The focus was to support the determination of effects (if any) of temporary instream works on attributes and targets of the Conservation Objective for Sea lamprey in the River Moy SAC as set out in **Table 2-1**. Temporary work areas are proposed along both banks of the Ridgepool as shown in **Figure 2-1** and **Figure 2-2**.

Substrata and habitats were viewed using a combination of wading with a bathyscope (shallower zones) and snorkelling (deeper, more swift zones). During snorkelling, an IFI Fisheries Officer provided safety cover by following the surveyor from the bank with buoyancy aid and safety rope.

On 12 September 2023 the entire left-hand side (LHS) and right-hand side (RHS) (i.e., left and right banks respectively, viewed downstream) were subject to survey by wading or snorkelling back and forth along the river margin out to a distance of 10m from the LHS, and 5-8m on the RHS. The channel became swift and deep towards the mid-channel and was not safely accessible. However, there are no proposed works any further out than 7.5m into the channel on the LHS and 5m on the RHS, so this did not detract from the survey objectives.

The low velocity marginal habitat of the LHS in front of Ballina Manor was manually searched for presence/absence of larval lamprey. Patches of suitable, sheltered silty deposits were gently disturbed into a professional hand net and searched. Any juvenile lamprey captured were kept in a bucket of clean river water and were measured using a hand ruler.

On 22nd July 2021, the RHS along Ridgepool Road was waded during very low flow on low tide which provided an excellent view of instream marginal habitats at the base of the Quay wall. Constant stops were made to record habitat character and location using handheld GPS. Photographs were taken above and, where possible, below water to illustrate findings. Instream habitats were characterised according to flow (riffle, glide, run, pool), depth (at low tide), substrate types, instream vegetation and coverage. Habitats were recorded according to dominant features, with the focus on habitat characteristics that could support sea lamprey spawning and nursery.

Potential sea lamprey spawning habitat was defined as an area with the combination of suitable gravel, pebble and coarse sand substrates where a continuous flow regime would occur during the lowest flows and tides that generally coincide with sea lamprey spawning period, i.e., May-July inclusive. Continuous flow ensures constant oxygenation of any potential redd site, this being an important factor given the tidal influence on water level and instream velocity of the Ridgepool. Lamprey redds would not be expected to be successful in areas that dewater or form slack and/or backwater flow during high tide. The general area where lampreys have been observed nest building by IFI staff was largely inaccessible on 12th September 2023 because of swift flow.

Sea lamprey nursery habitat was defined as an area of sandy-silt deposit at river margins, mainly in association with instream emergent macrophytes, which tend to accumulate sediments and offer stable shelter to ammocoetes.

The instream survey on 12th September 2023 was conducted during the 3 hours around low tide. The pool was revisited later the same day during high tide to observe flow and water level, as relates to

potential spawning habitat. The day was clear and bright with good water clarity and no recent spate through the system, comprising ideal survey conditions.

Table 2-1 Conservation Objective for Sea Lamprey in River Moy SAC

Conservation Objective: To maintain the favourable conservation condition of Sea Lamprey in River Moy SAC, as defined by the following attributes and targets:	
Attribute	**Target**
Distribution: extent of anadromy	Greater than 75% of main stem length of rivers accessible from estuary
Population structure of juveniles	At least three age/size groups present
Juvenile density in fine sediment	Mean catchment juvenile density at least 1/m²
Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds
Availability of juvenile habitat	More than 50% of sample sites positive

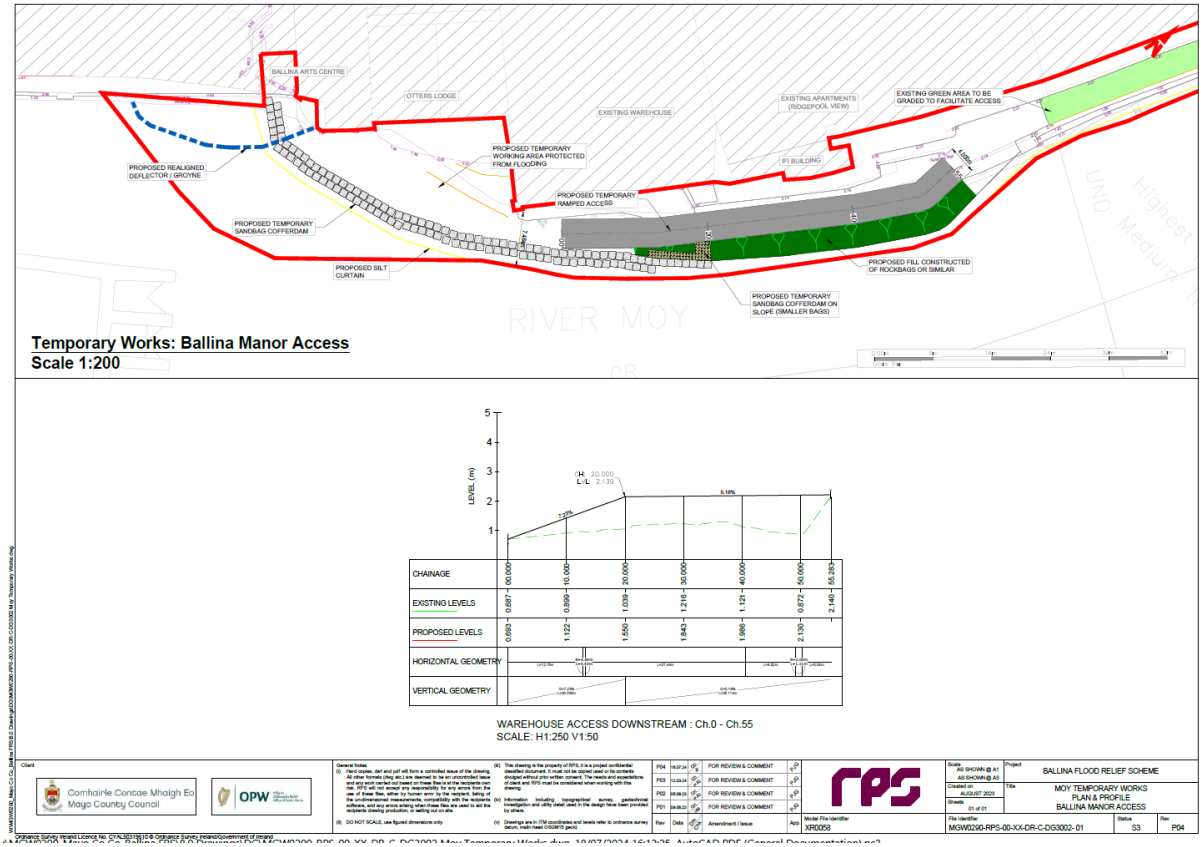


Figure 2-1 River Moy Temporary Instream Works (Ballina Manor Hotel/Apartments)

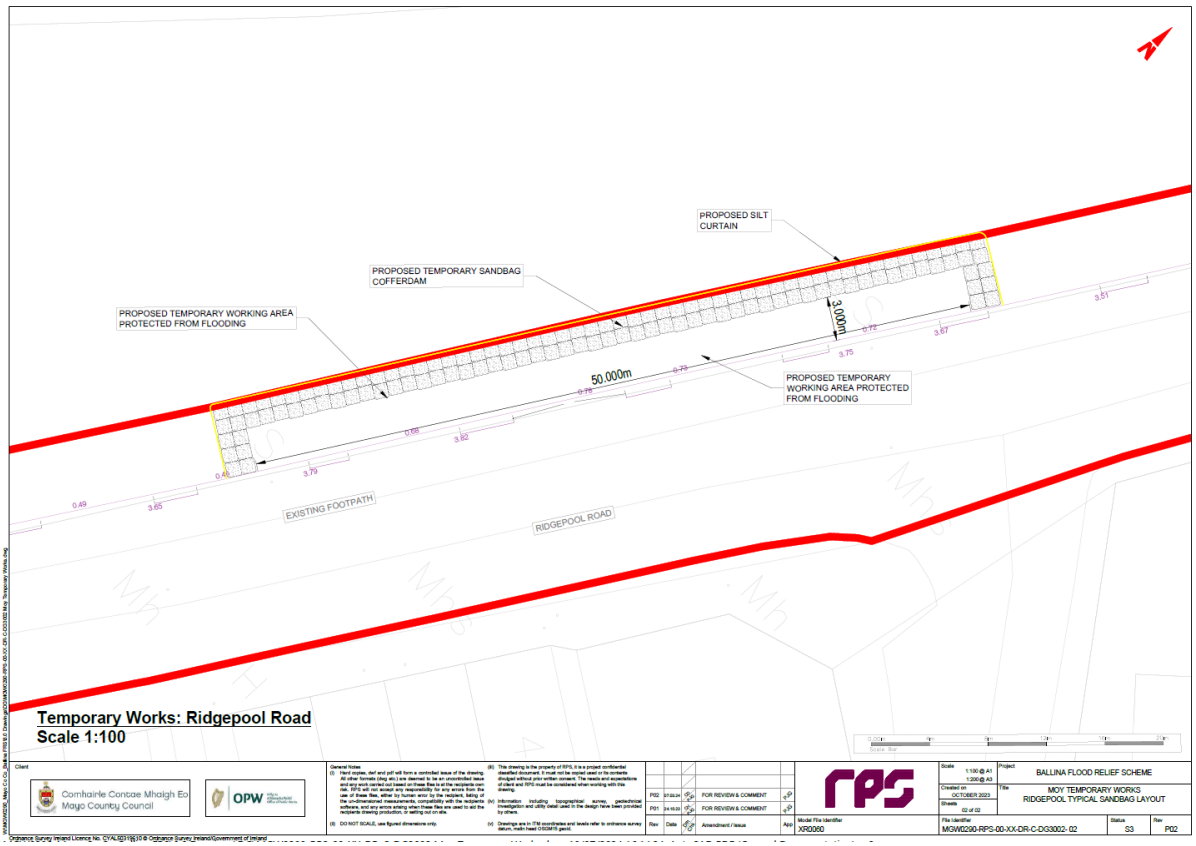


Figure 2-2 River Moy Temporary Works (Ridgepool Road)

2.4 Statement of Competence

Lauren Williams BSc PGDip MCIEEM is a qualified freshwater ecologist with over 22yrs professional consultancy experience working in New Zealand (2yrs) and Ireland (past 20yrs). Lauren holds a BSc in Zoology (University of Otago, NZ); a Certificate in Environmental Law (Open Polytechnic of NZ) and a Post Graduate Diploma with Distinction in Environmental Monitoring Assessment and Engineering from Trinity College Dublin. She has been a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) since 2015. Lauren specialises in water quality assessment, monitoring, aquatic ecological impact assessment and protected aquatic species and habitat surveys in relation to a wide range of infrastructural developments. She was contracted for several years to conduct instream phytobenthos and macroalgal surveys as part of the EPA national river monitoring programme. She is an accredited River Habitat Survey (RHS) operator: precursor to the Irish River Hydromorphology Assessment Technique (RHAT). Lauren has 22 years of experience in instream habitat and fisheries habitat assessment, backed up by a wide practical experience in technical assistance during drainage works on SAC rivers, electrofishing surveys and manual juvenile lamprey presence/absence surveys in various catchments around Ireland.

3 RESULTS

3.1 Existing Data Review

In relation to the spawning migration of sea lamprey, Igoe et al (2004) reported that "*adult sea lampreys were observed in the lower reaches of the River Moy at Ballina, Co. Mayo, during February 2001 (B. Kennedy, pers. comm.) and March 2002 and 2003 (S. Neylon, pers. comm.).*"

Juvenile lamprey surveys were conducted at 75 sites throughout the Moy catchment in July/August 2004 using electrical fishing methods (O'Connor, 2004). Results showed that sea lamprey

ammocoetes were generally confined to the Lower River Moy but were also present in some of the upstream tributaries (e.g., River Deel upstream of Lough Conn), the latter proving they can access at least parts of the upper catchment despite the presence of partial barriers such as weirs.

The sites fished within Ballina (and within the proposed flood relief scheme footprint downstream of the Ridgepool) were positive only for larval sea lamprey, whilst further upstream between Ballina and Foxford, larvae of both sea lamprey and brook/river lamprey were present.

3.2 Consultation

The resident IFI ghillie and IFI staff confirmed the following:

- Sea lampreys have often been observed in the Ridgepool mainly in April-May, but also in June with nest (redd) building activity being observed at least on occasion.
- A quite specific area for observed nest building activity was pointed out by IFI staff, starting from c.30-35m downstream of the base of the Salmon Weir in the mid-channel flow where there is an obvious break in the water (i.e., standing wave-to-riffle formation) at low tide. This area continues to have suitable flow during high tide, whereas the outer river margins, central pool area and lower Ridgepool either dewaters at low tide and/or forms slack water at high tide which is unsuitable for lamprey spawning.
- Sea lampreys are observed annually (mainly April-June climbing the Salmon Weir from the Ridgepool, often being predated upon by otter, heron, cormorant and mink with discarded lamprey remains frequently being observed on the weir.
- Numbers of sea lamprey observed by IFI staff ascending the weir varied annually between 10s and 100s of individuals. For example, hundreds of sea lamprey were observed swarming up the weir "*about ten years ago*", i.e., circa 2013 (IFI ghillie, *pers. comm.)*.

Bryan Kennedy (EPA Castlebar, formerly IFI Fisheries Officer at Ridgepool) confirmed by email that lamprey spawning was observed and predated lamprey remains were a reasonably common occurrence on the bankside. The majority of the spawning activity was in the riffle below the salmon weir, which concurs with the above observations of the current, long-term resident IFI ghillie.

3.3 Field Survey Results

3.3.1 Survey Locations

Table 3-1 lists ITM site locations (X, Y) which are mapped in **Figure 3-1**. Habitat descriptions are presented in **Table 3-2**.

Table 3-1 Ridgepool Survey Points

Site	Easting (ITM)	Northing (ITM)
RP1	524518	818657
RP2	524531	818667
RP2A	524538	818660
RP3	818680	818680
RP4	524563	818710
RP5	524573	818743
RP6	524491	818549
RP7	524551	818601
RP8	524566	818616
RP8A	524578	818636
RP9	524577	818655
RP10	524596	818679
RP11	524615	818717

3.3.2 Survey Water Level Details

Figure 3-1 and **Figure 3-1** show water levels at OPW Hydrometric Station 34061: Ballina, located opposite Arbuckle Row on the tidal River Moy (downstream N59 Lower Bridge). Daily mean water level during field survey on 12th September 2023 was 0.75m (**Figure 3-2**), which equates to approximately 82 percentile daily mean water level for the tidal Moy, with low tide level of 0.552 representing 95 percentile (OPW data derived for the period 2007 to 2023). Field survey of 22nd July 2021 occurred during a daily mean water level of 0.65m equating to 95 percentile (**Figure 3-3**), with low tide level of 0.304 which was below 99 percentile of water levels on the tidal Moy.

Lower water levels tend to occur from May to July, coinciding with sea lamprey spawning season, the relevance being that sea lamprey require water of sufficient depth and velocity in which to spawn and marginal habitats need to remain submerged for juvenile survival. Areas of the Ridgepool that are prone to dewatering during low flow and low tide are entirely unsuitable for Sea lamprey recruitment.

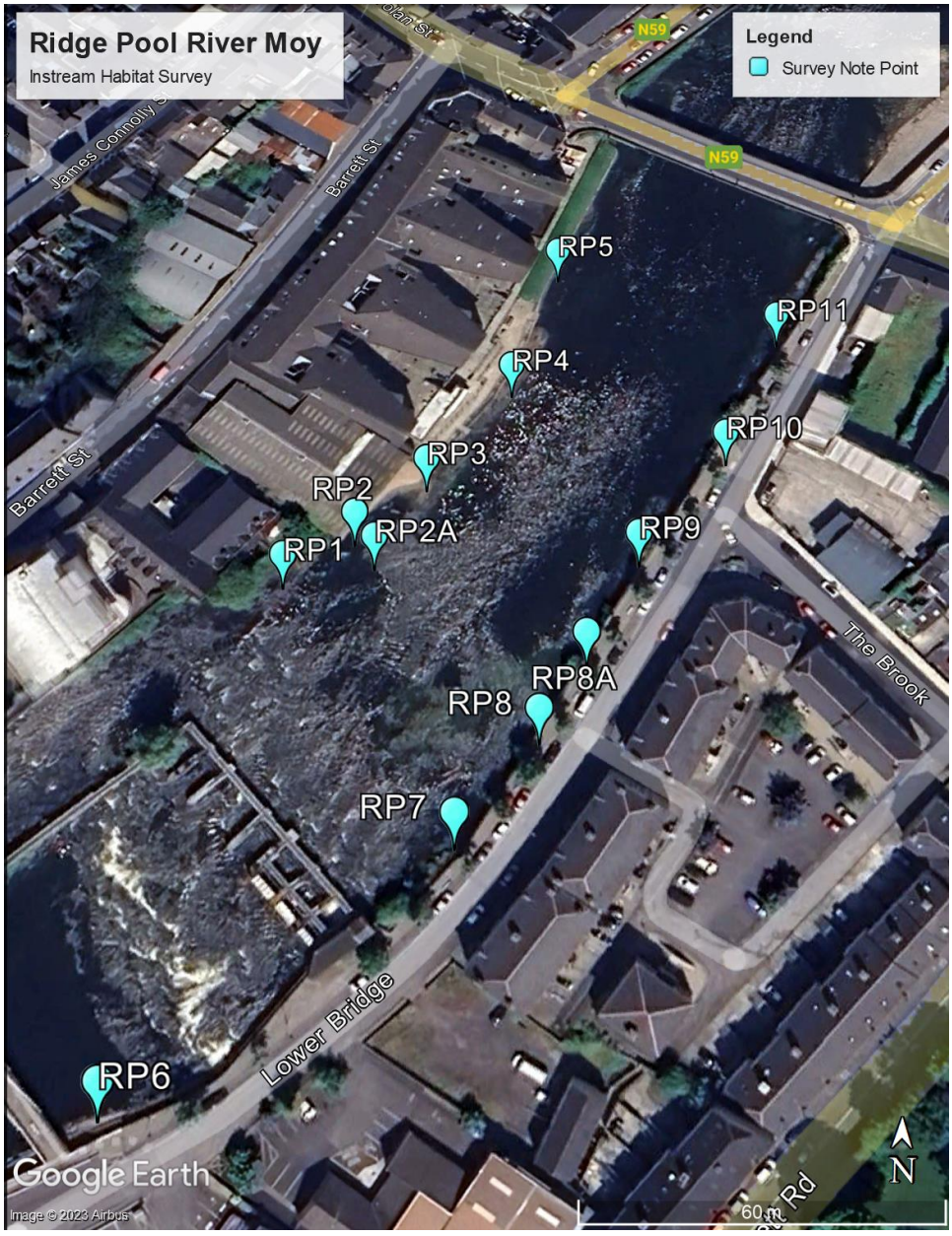


Figure 3-1 Ridgepool (RP) Survey Points (Google Earth)

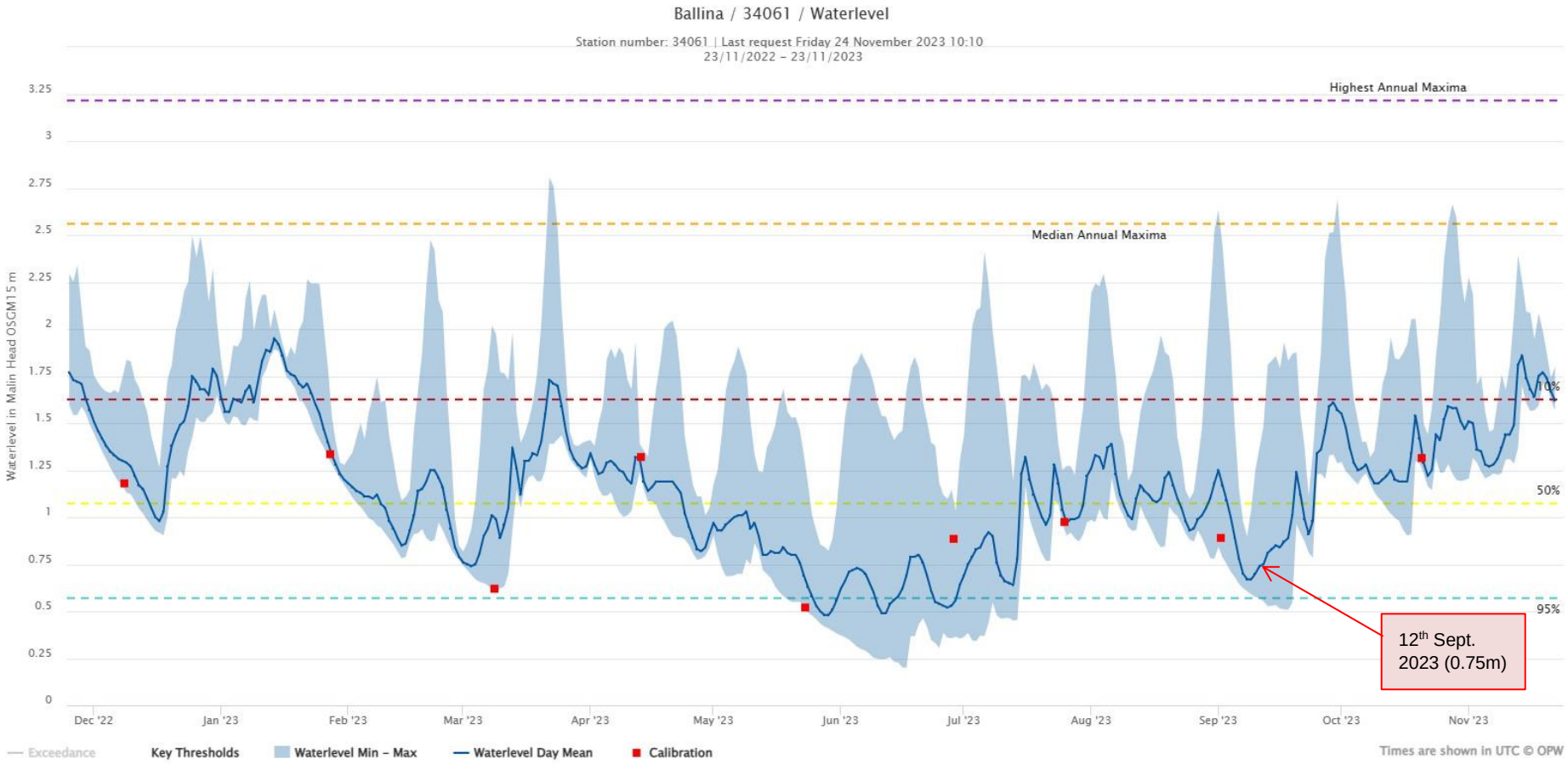


Figure 3-2 Water Level OPW Station: Ballina (34061) (Dec 2022 – Nov 2023)

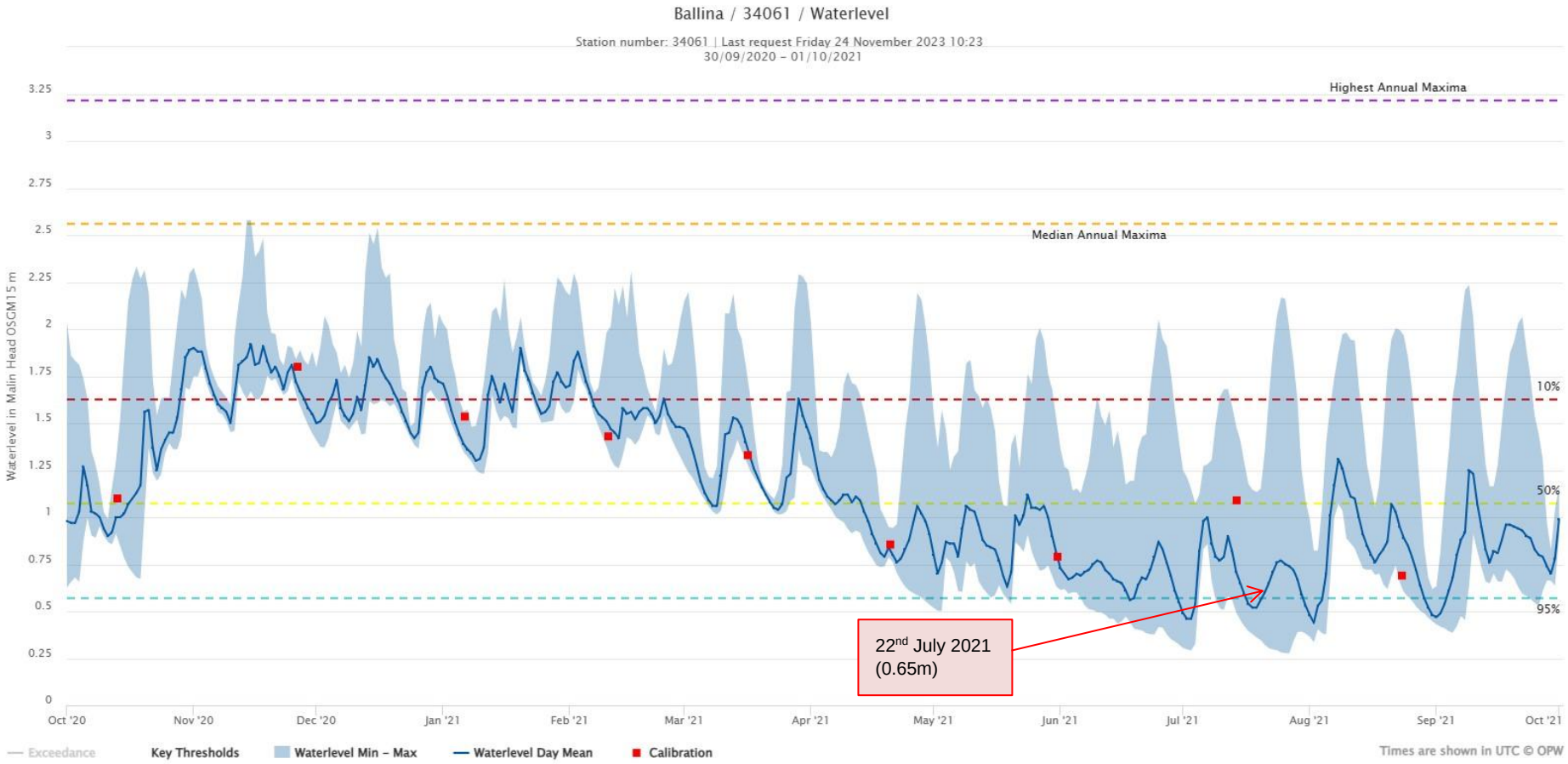
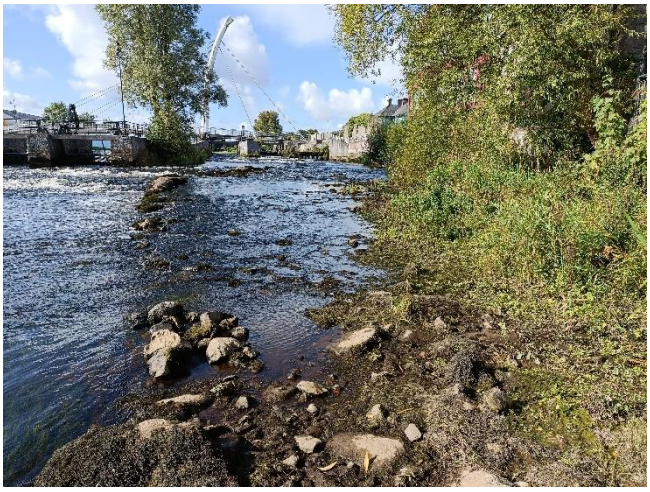


Figure 3-3 Water Level OPW Station: Ballina (34061) (Oct 2020 – Oct 2021)

3.3.3 Habitat Descriptions and Images

Table 3-2 Ridgepool Habitat Descriptions

Site	Image	Habitat Description
RP1	 **Image 3.3.1** View upstream from RP1 at low tide	A rock "groyne" (historical modification) extends directly upstream from the corner of the warehouse in line with the old mill race upstream. This area almost fully dewaters from time to time. It was 5-10cm depth on average at low tide (12 Sept. 2023, 95 percentile flow/tide) but can get even lower than this during sea lamrey spawning period. Habitat is riffle/run at low tide and slack glide at high tide over embedded cobble covered in bryophyte, mainly *Cinclidotus fontinaloides* and *Fontinalis antipyretica* and patches of *Ranunculus* spp. There were salmonid parr observed foraging at the top of the 'groyne' area where flows were more consistent (not affected by the temporary works). These are likely to have moved from elsewhere (upstream) as there is no suitable spawning habitat locally. No lamprey nursery or spawning habitat at all on this shallow, modified groyne area.
RP1	 **Image 3.3.2** View downstream from RP1 at low tide	Rock 'groyne' (historical modification) extends directly upstream from corner of old warehouse (next to IFI Building). The temporary access route would extend at most 7.5m into the channel at the corner of the warehouse then curve inwards towards the shallow, raised 'groyne' area (see Image 3.3.1 above). The bank margin below the proposed new flood wall (steel fence in Image 3.3.2) is 'dry' at this point dominated by *Phalaris arundinacea* and *Mentha aquatica* with small amounts of *Sparganium erectum* in more submerged bankside patches. No existing or potential lamprey nursery or spawning habitat in this reach either bankside of the groyne nor instream adjacent to the groyne owing to embedded cobble substrate (90%) (see RP2 instream habitat detail). The shallow groyne area is dewatered during low flow / low tide.

Site	Image	Habitat Description
RP2	 **Image 3.3.3** View downstream from RP2 at low tide	Concrete / stone apron at the channel margin extends 2-3m out into the channel from base of the warehouse, increasing to 6m downstream (at orange cone in image). Proposed access ramp utilises this apron, extending c.1.5m into the channel (yellow arrow). Instream habitat along the apron at RP2 was 30-50cm glide (low tide) but gradually shallows with downstream distance, largely dewatering under low flow / low tide. Embedded cobble dominates at RP2 with common bryophytes (as for RP1), *Cladophora* common, plus occasional *Ranunculus* and *Potamogeton* spp. and interstitial fine silt. No lamprey spawning or nursery habitat within 6m out into the channel from the edge of the apron at RP2. Salmon holding habitat in the deeper glide out from the u/s corner of the warehouse.
RP2A	 **Image 3.3.4** Underwater detail of substrates at RP2A	At a location 9-10m out into the channel perpendicularly in line with the upstream corner of the warehouse, substrates of pebble and gravel with some coarse interstitial sand are present, which, in the low flow wetted channel may be suitable for sea lamprey spawning, although gravels were scarce. This area was also not ideal because water backs up during high tide, increasing depth and reducing velocity. It was not an area that sea lamprey nest building has been observed by IFI staff. The area is being highlighted as a precaution owing to potential substrate suitability. The instream access ramp does not extend this far out into the channel.
RP3	 **Image 3.3.5** Detail of substrates at RP3	Very shallow at low tide in margin bordering existing concrete apron from the downstream corner of the warehouse extending all the way along in front of the IFI Building. Substrates comprise gravel and pebble with >50% *Cladophora* cover and interstitial fine silt. The area forms a trickling riffle/run then largely dewaters at low tide / low flow. It forms a slack backwater at high tide. There is absolutely no sea lamprey spawning or nursery habitat within the footprint of the proposed access ramp along this reach.

Site	Image	Habitat Description
RP4	 **Image 3.3.6** Marginal habitat at RP4	Very shallow river margin in front of and downstream of IFI Building (just upstream from angling access steps which will be left in-situ with no instream footprint further downstream of that point). This marginal area is comprised of silty gravel and pebble with silt covered *Ranunculus* spp., *Myriophyllum spicatum, Sparganium emersum and Alisma plantago-aquatica* and a high degree of wispy *Cladophora*. The margin almost fully dewaters at low flow / low tide, then forms slack backwaters under high tide where rooted macrophytes dominate. There is absolutely no sea lamprey spawning or nursery habitat within the proposed temporary works footprint at this point.
RP5	 **Image 3.3.7** Lamprey nursery habitat at RP5 (12/09/23)	Stand of Branched Burr Reed (*Sparganium erectum*) 40m upstream from the Upper Bridge with accumulations of marginal silt / mud containing various size classes of lamprey ammocoetes. Very slack flow at either low or high tide against this river margin. Patches of *Ranunculus* spp. and *Potamogeton* spp. were present in faster flows >2.5m out from the channel wall. The temporary instream works footprint does not affect this area as all works / access ramp will be landward of the existing river wall. Care will be required to prevent wash out of construction related materials to the river by use of robust silt protection measures.
RP5	 **Image 3.3.7** Lamprey ammocoetes at RP5 (12/09/23)	Two lamprey ammocoetes of different age classes (15cm, 4cm) were captured within 5min in pond sweeps of marginal silt accumulating around the above stand of *S. erectum*, 40m upstream from the Upper Bridge. Size class included young of the year, indicating spawning success in 2023. This was a very discrete area of nursery habitat. Manual searches for 30min outside of this stand of marginal vegetation revealed no juvenile lamprey. Species was not differentiated – but likely to be sea lamprey based on past juvenile lamprey surveys (O'Connor, 2004). The temporary instream works footprint does not directly affect this lamprey nursery area.

Site	Image	Habitat Description
RP6	 **Image 3.3.8** View downstream from RP6 (12/09/23)	Between the footbridge upstream of Salmon Weir (RP6) and the head of the Ridgepool the river is highly modified and constrained by existing walls. Fast rapids over bedrock and large boulder form the habitat type with very little instream vegetation owing to high water velocity. Pockets of coarse sand accumulate behind larger boulders, but with no clast sizes between boulder and sand. Habitat is completely unsuitable for lamprey spawning and nursery along this reach between RP6 and RP7. This margin of the river is also far less likely to be used by migrating lampreys as water velocity is concentrated and high. Salmon may be attracted to the strong flow but would pass the obstacle in lower velocity areas than the rapids at the river wall.
RP7	 **Image 3.3.9** View upstream at RP7 (22/07/21)	At the head of Ridgepool (RP7) on the RHS, strong flows over bedrock and boulder merge to a bouldery marginal reach with coarse sandy deposits. Boulders are covered in *Cinclidotis* mosses. A relatively 'dry' marginal berm has formed downstream of the weir control building, supporting a stand of relatively species poor fringing reeds, mainly *P. arundinacea* and tall herb (including Meadowsweet, Loosestrife). There is a stormwater pipe discharge at this point. No lamprey spawning or nursery habitat or potential at all within 5m (and more) of the Quay wall along this reach.
	 **Image 3.3.10** Overview of RHS margin from RP7 (22/07/21)	This image taken at 99 percentile low tide / low flow shows the Ridgepool Road side of the river, highlighting the areas of the channel that IFI staff report observations of potential sea lamprey nest building (yellow 'X'). These are the only areas that retain even remotely suitable flow and depth (at the top of riffles which is common for sea lamprey redd sites) that could potentially support sea lamprey spawning during the generally low flow months of May-July when sea lamprey spawning occurs. The marginal areas are generally unsuitable as they largely dewater or have slack flow of embedded cobble and or bedrock with silt and filamentous green algae.

Site	Image	Habitat Description
RP8	 **Image 3.3.11** View downstream from RP8 (22/07/21)	Slack and very shallow flow along the marginal reach upstream of the first riffle area (i.e., RHS riffle marked 'X' in **Image 3.3.10** above). Substrates were angular cobble, either embedded with interstitial fine silt and silt trapped on mats of Cladophora covered moss. Large areas of underlying bedrock also occur. The foot of the Quay wall is undermined in sections along this reach, becoming more eroded and collapsing further downstream towards RP8A and RP9 (see **Image 3.3.13** below).
RP8	 **Image 3.3.12** View upstream at RP8 / RP8A (22/07/21)	This image shows the base of the Quay walls along the RP8 reach viewed back upstream in the direction of RP7. Ivy and bramble coat the upper walls in places with occasional Buddleia, Alder and Sycamore bushes. The lower blocks of the Quay wall are eroded and slumping in places. Instream habitat in the 5m from the wall is as described above for RP8 (**Image 3.3.11**). No sea lamprey spawning or nursery habitat occurs within 5m from Quay wall at this point owing to dewatering and/or shallow slack flows at low tide.
RP8A to RP9	 **Image 3.3.13** Quay wall between RP8A and RP9 (22/07/21)	Marginal instream habitat alongside eroded and collapsing section of the Quay wall at RP8A. Partially dewatered at low flow and low tide. See detailed description of instream habitat accompanying Image 3.3.14, below. This area is subject to erosive forces arising from rapid flows in high water where the riffle marked in **Image 3.3.10** hits the Quay wall. No sea lamprey spawning or nursery habitat occurs within 5m from Quay wall, but because of the riffle habitat, the channel beyond 5m from the Quay wall is considered to have some potential sensitivity for sea lamprey spawning from May to mid-August of any year. The works footprint shall be narrowed as close as possible to the Quay wall at this point.

Site	Image	Habitat Description
RP8A to RP9	 **Image 3.3.14** Instream habitat detail RP8A / RP9 (22/07/21)	Marginal instream habitat detail between RP8A and RP9. Partially dewatered at low flow and low tide. Very slack, virtually stagnant water over heavy FGA (>50% cover) and moss-covered angular cobble, embedded in places and in other locations loose over bedrock. Cobbles covered in FGA and brown diatom encrusted mosses (*C. fontanaloides* with *S. rivulare* and *F. antipyretica* further out from walls). No sea lamprey spawning or nursery habitat occurs within 5m from Quay wall.
RP9 to RP10	 **Image 3.3.15** View downstream from RP9 (22/07/21)	The entire margin from RP9 downstream, for 5m (and more) out from the Quay wall, forms a shallow, slack glide at low flow/ low tide, with details of habitat as for **Image 3.3.14** (above). Heavy steel flap of stormwater culvert in distance at RP10. Lower walls are dominated by *Cinclidotus* moss. Ivy and bramble coat the upper walls in places with occasional alder and sycamore bushes). No sea lamprey spawning or nursery habitat occurs within 5m from Quay wall.
RP11	 **Image 3.3.16** Marginal berm at RP11 (12 /09/23)	RP11 is located just upstream of the Upper Bridge where a relatively 'dry' berm has formed on the inside edge upstream of the bridge. The berm occupies up to 2.5m of the river margin. Instream habitat within the band 5m from the Quay wall is dominated by glide flow over mainly pebble and gravel with coarse sandy deposits and occasional cobbles. Patches of *Ranunculus* spp., *Myriophyllum spicatum* and *Potamogeton* spp. (incl. *P. perfoliatus* and *P. x nitens*). A narrow marginal band of S. erectum occurs closer to the Upper Bridge. It was inaccessible for manual sampling but has potential to support larval lamprey.

3.3.4 Map of Potential Sensitivities

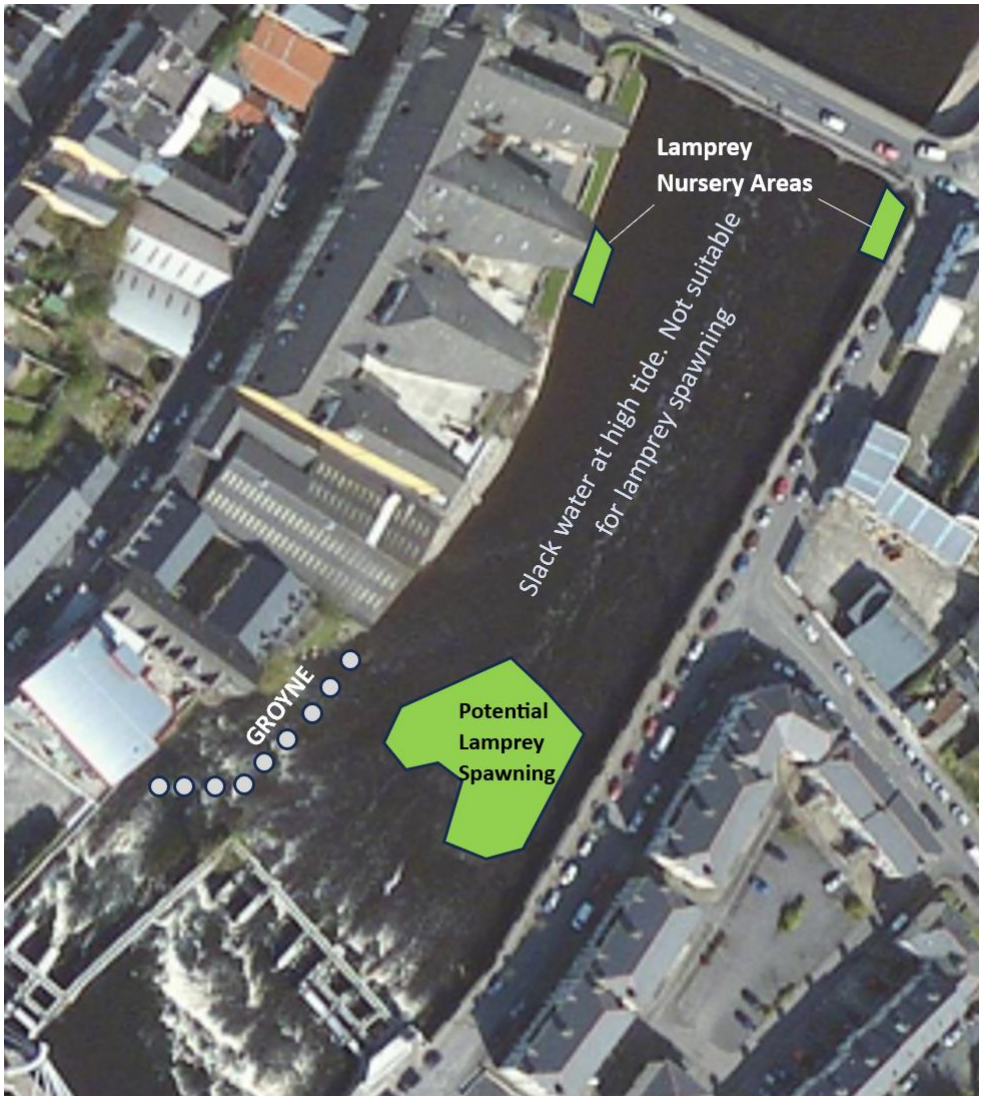


Figure 3-4 Ridgepool sea lamprey habitats: Identified sensitivities and features (*not to scale*)

4 DISCUSSION

Sea lampreys ought to be travelling further upstream than the Ridgepool in Ballina to spawn in the non-tidal habitats of the extensive inland Moy catchment. However, as reported from other large Irish rivers with fish passage barrier issues (e.g., River Mulkear at Annacotty Weir, River Lee at Salmon Weir) sea lampreys end up spawning immediately below obstacles (large weirs) when they fail to ascend them. This is not for lack of trying but rather because the obstacle is either partially impassable (related to flow conditions) or completely impassable (Igoe et al. 2004, Triturus 2016).

For example, sea lampreys are often observed in spring making ongoing forays along the Annacotty Weir face with frantic attempts to gain passage in advance of the spawning season. The majority fail and ending up spawning in relatively sub-optimal habitat downstream of the weir.

Existing sea lamprey records from well upstream of Ballina, i.e., juveniles in the River Deel; adults in Loughs Conn and Cullin (O'Connor, 2004) show that Ballina salmon weir is passable by *P. marinus*, at least on occasion. Sea lampreys that reach the Ridgepool as early as February on their upstream migration run from the estuary (as previously reported in Igoe et al (2004)) would be more likely to encountering combinations of high discharge and high tide that would be more likely to allow early season passage over Ballina Salmon Weir (see Figs 3-1 and 3-2 above). IFI staff surveyed the

Salmon Weir in 2023 as part of the National Barriers (IFI, 2024). On the day (and time) of the IFI survey (20th June 2023 during low tide and low flow), the weir itself was no barrier to adult and juvenile salmonids, juvenile eel, and cyprinids, but it was a high impact partial barrier to adult lamprey. 'High impact partial barrier' is defined as "*the structure represents a significant impediment to the target species/life-stage but some of the population (e.g. < one third) will pass eventually*". A few hours later, the weir was pounded out and passable by all fish species. The assessment concluded that the weir itself presents no barrier to any fish species for about 3 hours a day (high tide), but the rock outcropping upstream of the salmon weir (which wasn't assessed) has the potential to be a more significant passage issue for fish migration.

Sea lampreys very likely end up spawning in the Ridgepool when they fail to ascend the combination of the weir and upstream rock outcropping because of increasingly impassable flow/tide conditions closer to the spawning season (May to July). Such individuals are then driven to build redds in unreliable, tidally affected, and thus sub-optimal instream habitat of the Ridgepool. At that stage of the year, Ridgepool instream habitats are highly susceptible to combinations of low flow and low tide (Figs 3-1 and 3-2, above) that would limit potentially suitable wetted channel area for redd construction. For example, Igoe et al (2004) reported that sea lamprey redds were confined to the low flow-wetted channel of the Mulkear River below the Annacotty Weir from mid-May to Mid-July. The same would be true for the Ridgepool, where the low flow-wetted channel is additionally constrained by tidal cycles.

5 CONCLUSION

5.1 Direct effects

Instream habitat surveys conducted at Ridgepool in 2021 and 2023 showed that there will be no *direct* impact on potential sea lamprey spawning habitat in relation to the proposed temporary works footprints on either bank. Proposed in-channel work areas occur at channel margins that comprise unsuitable combinations of flow and substrate and, most notably, are subject to dewatering (based on tide and flow) during the redd building and egg incubation period.

There is potential for direct impact on juvenile lamprey habitat at one point (Site RP11) on the RHS (Ridgepool Road) just upstream of the Upper Bridge. Larval lampreys were not confirmed in this location, but the area must be treated as potential juvenile habitat as there is a reach of sluggish depositing backwater with silty substrate and patches of emergent *Sparganium erectum*.

5.2 Indirect effects - precautionary sea lamprey spawning areas

On a precautionary basis there are two discrete areas where potential for indirect effects on sea lamprey spawning must be considered (e.g., localised disturbance). These areas are located near the outer edge of the proposed temporary instream works areas on both banks. The areas comprise substrates with some limited, relatively sub-optimal potential to support sea lamprey spawning, subject to the actual low flow wetted channel width in this tidal reach during spawning season of any year. These specific areas are adjacent to RP8-RP8A on the RHS (Ridgepool Road) and the area adjacent to RP2A on the LHS (9m out from the warehouse corner upstream of the IFI Building). See also the sensitivities map (**Figure 3-3**).

It is recommended that works in the vicinity of these sensitive areas should be managed to avoid any possibility of *indirect* effects. The **EIAR Chapter 9, Aquatic Ecology - Mitigation: Section 9.5.1.3** details the precautions that shall be taken in relation to Sites **RP2A** and **RP8-RP8A**.

5.3 Larval lamprey nursery areas

There are also two distinct areas marked on **Figure 3-3** where both confirmed and potential lamprey nursery habitat occurs in the Ridgepool. The patch of *confirmed* larval lamprey habitat on the LHS in front of Ballina Manor (**Site RP5**) is not directly affected by the footprint of the proposed access ramp

in front of the IFI Building. There must be an exclusion zone clearly marked on the landward side of this area with no access to the river at any time and no disturbance or removal of the stand of fringing reeds that are a critical component of this juvenile lamprey habitat.

The patch of *potential* larval lamprey on the RHS on Ridgepool Road upstream of the Upper Bridge (**Site RP11**) is directly affected by the proposed 5m instream works area. If possible, it is recommended that works on Quay walls at this point are conducted from the road above, without an instream footprint. In the event this is not possible, mitigation will be required to remove lamprey ammocoetes prior to dewatering of the margins. It may be possible to achieve this using electrofishing techniques at low flow / low tide. Alternatively, marginal silt/mud can be excavated from the river margin within cofferdams at low flow / low tide and spread out at the bank to allow for removal of juvenile lamprey. Ammocoetes can be kept in a bucket of clean water and relocated to suitable habitat at the floating pontoon adjacent to Bachelors Walk, downstream of the N59 Lower Bridge. Juvenile lamprey will re-burrow very quickly following disturbance once they encounter suitable marginal habitat (Maitland 2003).

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