Upper River Bandon Aquatic and Riparian Survey 2021

Prepared for Bandon Angling Association

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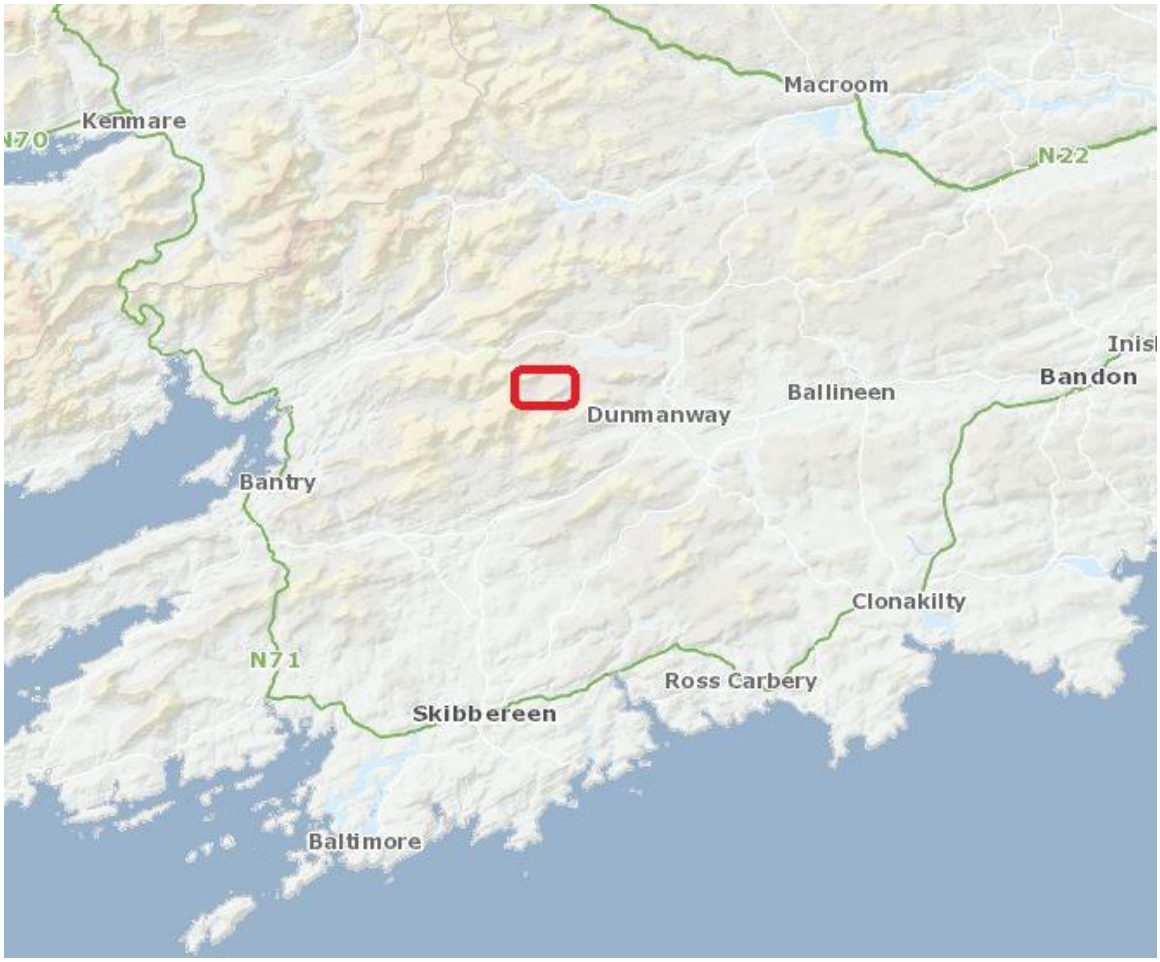
1. INTRODUCTION

1.1 OBJECTIVES

This report, prepared by Pascal Sweeney of Sweeney Consultancy, for Bandon Angling Association, with funding from Inland Fisheries Ireland, is a biological assessment of the upper catchment of the River Bandon (EPA Code 20B02), to the northwest of Dunmanway, Co. Cork, based on field-survey results (Location Map, Figure 1).

Figure 1. Location Map

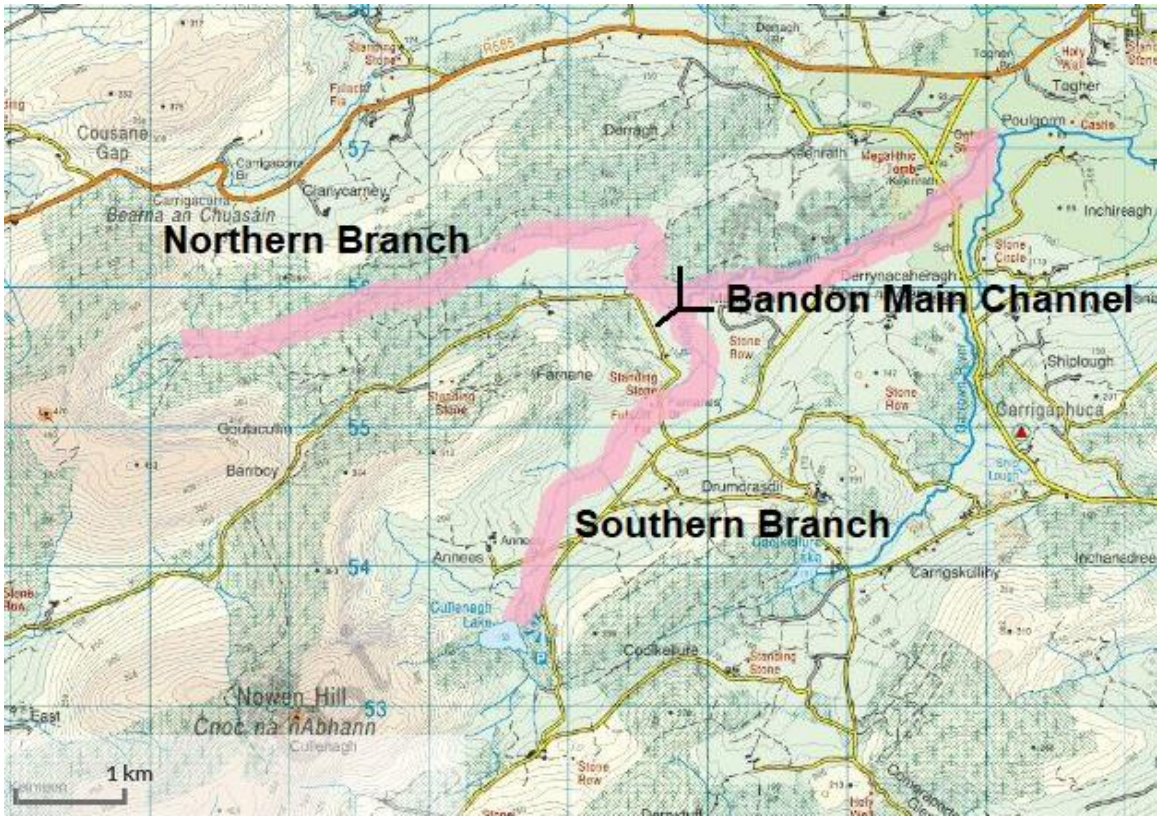


The purpose of the survey undertaken is to establish biological data on instream habitat types and quality (including salmonid spawning gravels and obstacles to fish migration), channel modifications, siltation, water quality, possible pollution sources, land use, bankside vegetation (including degree of shading/tunnelling and invasive plant species) and the presence of legally protected species.

1.2 STUDY AREA

The sections of watercourse included in this study are the northern branch downstream of the confluence of small headwaters at ITM 51328 55565, between the townlands of Glencarney and Goulacullin, the southern branch from the outflow of Cullenagh Lake at ITM 51557 55368 and the main channel from the confluence of the two branches at ITM 51682 55593 to the confluence with the Garrown River at ITM 51907 55716 (Figure 2).

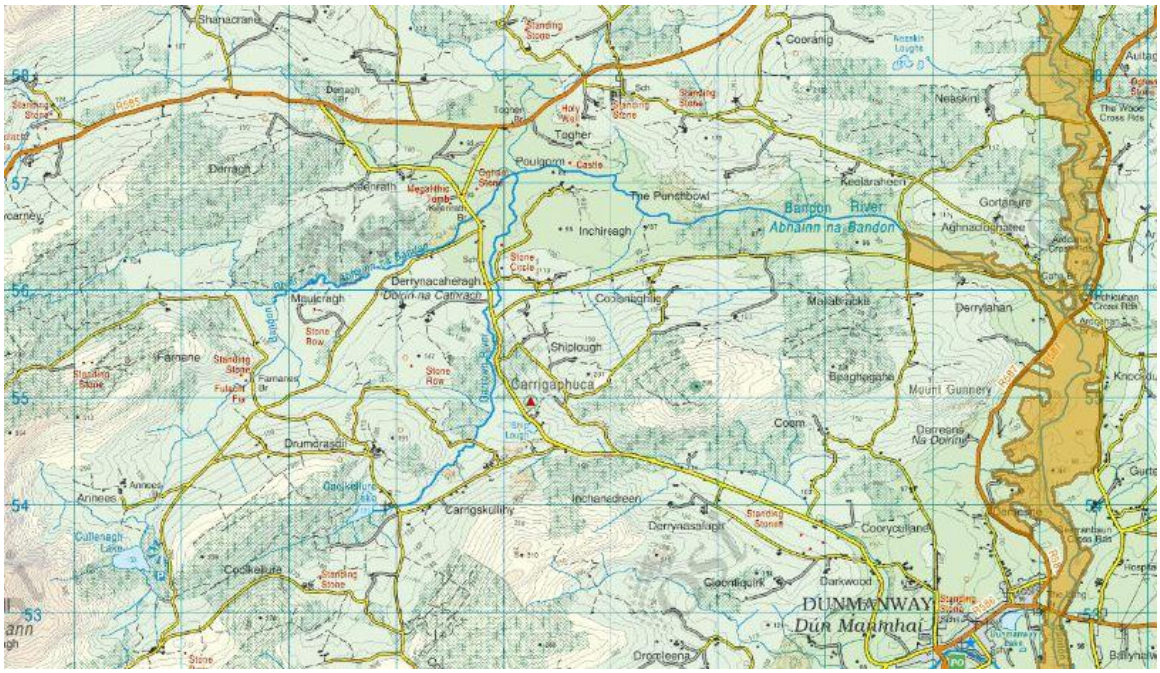
Figure 2. Watercourses Included in the Study



1.3 PROTECTED AREAS

The channels surveyed are not within any area designated for protection under the EU Habitats Directive. The Bandon River Special Area of Conservation (SAC Code 002171) starts approximately 4km downstream of the lower end of the study area (Figure 3).

Figure 3. Bandon River Special Area of Conservarion highlighted orange.



2. FIELD SURVEYS

2.1 DATES

Field surveys were carried out from March 4th to March 8th, 2021.

2.2 TERRESTRIAL AND AQUATIC HABITATS AND SPECIES

The channels were walked and direct observations made, with written notes, photographs and grid references taken, where appropriate. Photographs are presented in Appendix 1.

2.3 BIOLOGICAL WATER QUALITY

A change in the physical or chemical environment may change the composition and abundance of macroinvertebrate communities. Because macroinvertebrates are long-lived and of known sensitivity to pollution, they can provide an assessment of water quality based on a single sample in a manner not possible with a small number of chemical samples. Several biological indices have been developed worldwide, based on the composition of river benthic macroinvertebrate communities. In the Republic of Ireland, the main such index is the Q-value method, developed by the Environmental Protection Agency (EPA) and used in the River Biological Monitoring Programme, with sites throughout the country assessed on a three-year cycle. The rating scale scores sites from Q1 to Q5, with intermediary scores also assigned, as follows:

Q5 and Q4-5 =	High Ecological Quality
Q4 =	Good Ecological Quality
Q3-4 =	Moderate Ecological Quality
Q3 and Q2-3=	Poor Ecological Quality
Q2, Q1-2 and Q1=	Bad Ecological Quality

Sampling for biological water quality by the EPA Standard Operational Procedure (EPA 2020) was carried out at six sites throughout the study area (Figure 4), three on the norther tributary, two on the southern tributary and one on the main channel. Site location details are presented in Table 1. Photographs of the sampling sites are presented in Appendix 1.

Biosecurity measures were strictly adhered to, with all equipment in contact with river water washed down with Virkon Aquatic disinfectant between sites.

Figure 4. Sampling Site Locations

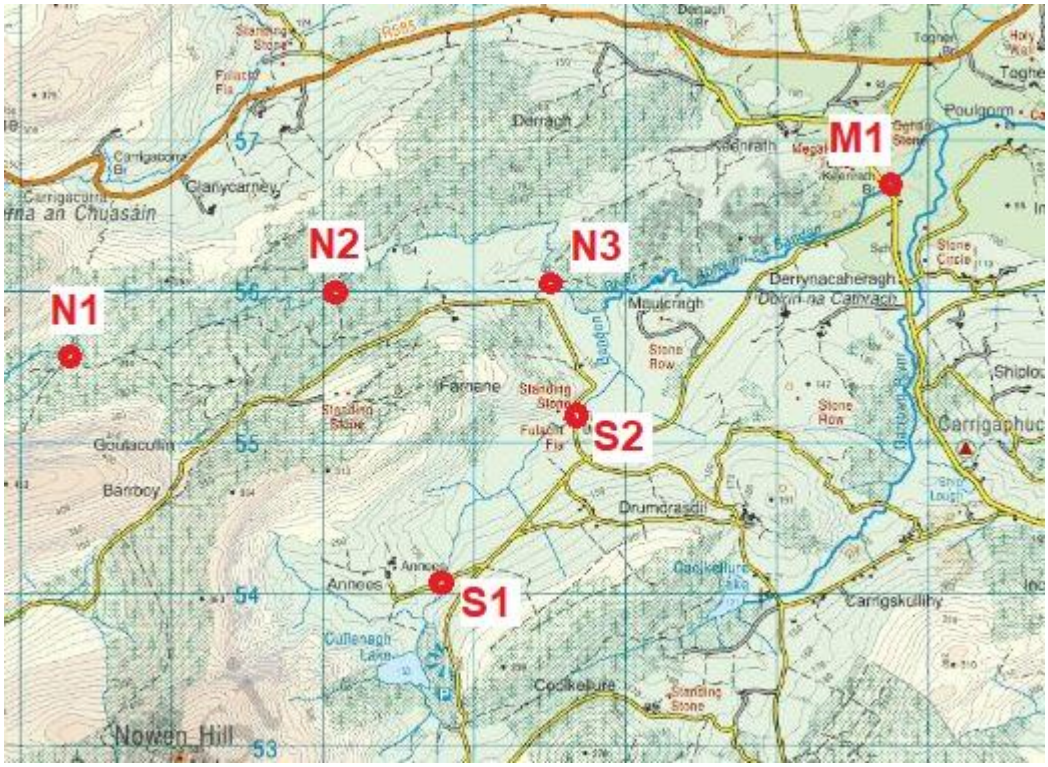


Table 1: Sampling Sites.

Watercourse	Site	Grid Ref (ITM)	Location Description	Photo
Northern Branch	N1	51329 55565	Just downstream of confluence of small tributaries	2
Northern Branch	N2	51503 55608	Ford on forestry road	4
Northern Branch	N3	51643 55610	Bridge on forestry road	12
Southern Branch	S1	51576 55446	Annees Bridge	16
Southern Branch	S2	51662 55524	Farnanes Bridge	22
Bandon Main Channel	M1	51869 55672	Keenrath Bridge	38

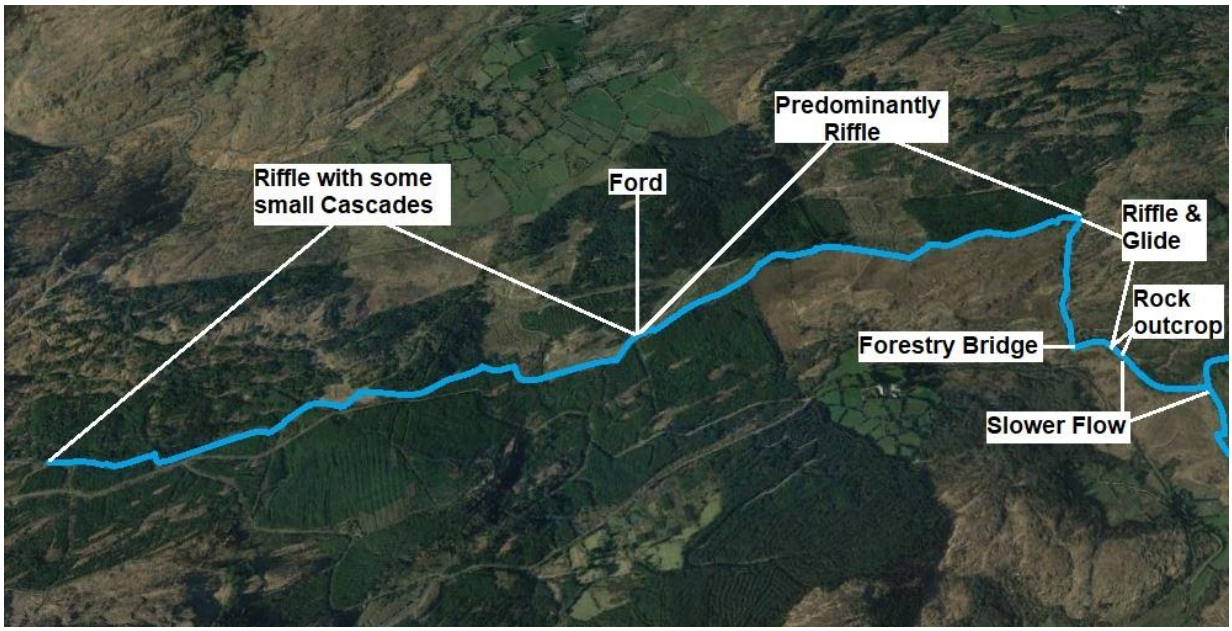
3. RESULTS

3.1 NORTHERN BRANCH

3.1.1 Physical Aquatic Habitat

At the confluence of headwaters at ITM 51328 55565, the nothern branch (Figure 5), flowing east, was small and shallow at the time of fieldwork (Photo 1), but the channel indicates large variations in flow (Photo 2). The substratum here is mostly flat gravels, but with occasional small cascades over boulders and outcropping bedrock (Photo 3). Downstream of a ford on the forestry road at ITM 51503 55608 (Photo 4), riffle over gravels is the dominant flow type (Photo 5). In the section downstream of the abrupt turn to the south at ITM 51652 55652, there is a mix of glide (Photo 6) and riffle (Photo 7) over gravels (Photo 8), with some faster flow over and between boulders and outcropping rock (Photo 9), before slowing down (Photo 10) as the watercourse passes through flatter terrain towards the confluence with the southern branch.

Figure 5. Northern Branch Instream Physical Habitat

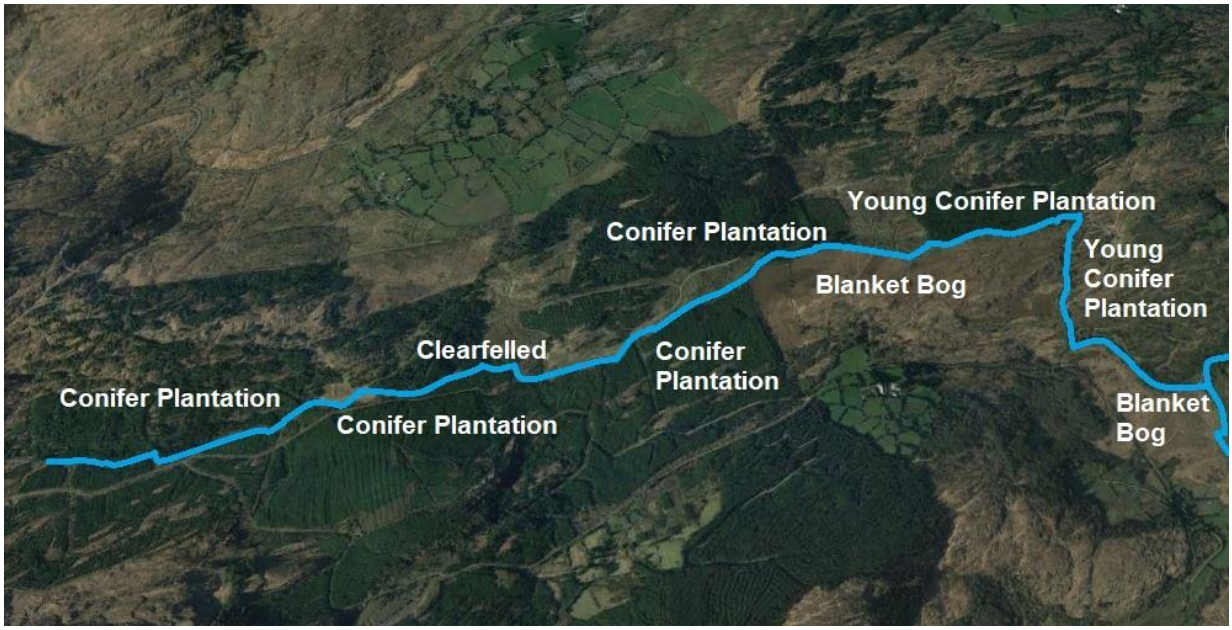


3.1.2 Riparian Terrestrial Habitat

Commercial conifer forestry plantations dominate the terrestrial habitats adjacent to the northern branch (Figure 6). The age of the conifer blocks varies. Older trees were planted closer to the channel. This is particularly noticable along the upper parts, where there are

mature conifers along the northern bank, but the semi-maure trees on the southern side are set well back (Photo 11). Blanket bog, too wet for planting, dominates the terrestrial habitat on the right-hand side of the lower end of the northern branch.

Figure 6. Terrestrial Habitats



3.1.3 Spawning Gravels

There are gravels throughout the northern branch, but low flows in the upper parts would limit their suitability for salmonids, while downstream of the ford on the forestry road, silt under the surface layer of gravels would be a problem.

3.1.4 Obstacles to Fish Migration

While the small cascades over boulders and outcropping bedrock in the upper part of this branch (Photo 3) would be slight obstacle for upstream migrating fish, the main man-made obstacle is a forestry bridge (Photo 12) at ITM 51643 55610, consisting of four cylindrical culverts and mass concrete. Adult salmon could find this difficult in upstream migration.

3.1.5 Channel Modification

There are no channel modifications on the northern branch.

3.1.6 Siltation

From downstream of the ford, deeper gravels are slightly silted, presumably from forestry activity and erosion of peat. There are forestry drains running though mature conifer plantations, but at present, these do not appear to be contributing significantly to silt imputs to the watercourse.

3.1.7 Shading/Tunnelling

Mature conifers that were planted too close to the bank are causing too much shade throughout the year (Photo 11). Downstream of the abrupt turn to the south at ITM 51652 55652, shade is mixed, with shaded and open sections.

3.1.8 Biological Water Quality

Site physical data and invertebrate data, with the relative abundances for each of the WFD Status Groups, are given Appendix 2. See Figure 4 for mapped site locations.

Q-values, based on the relative abundances for each of the WFD Status Groups, are:

Site N1: Q5

Site N2: Q4-5

Site N3: Q5

High Ecological Condition was recorded at all three sites on the northern branch, but with a slight dip in Q-value at Site N2.

3.1.9 Possible Pollution Sources

The slight dip in Q-value at the ford on the forestry road is likely to be attributable to some nutrient release from decomposing brash in the area that was clearfelled in 2020 (Google Earth Pro shows conifers in this block in September 2019). No evidence of machinery working close to the watercourse is evident and brash is kept well back from the stream (Photo 13). However, some leaching of nutrients from the brash is inevitable, as It has been demonstrated that, following clearfelling of conifers, plant nutrients, including phosphates and nitrates, leach from the brash (Titus and Malcolm, 1992; Cummins and Farrell, 2003; Davis, 2005) and in some circumstances this can result in increased export of these nutrients to streams (Likens *et al.*, 1970; Ahtiainen and Huttunen, 1999).

3.1.10 Protected Species

None recorded.

3.1.11 Invasive Species

A stand of Japanese knotweed (*Fallopia japonica*) is located beside the bridge on the forestry road at ITM 51643 55610. At the time of fieldwork, new shoots were beginning to emerge (Photo 14).

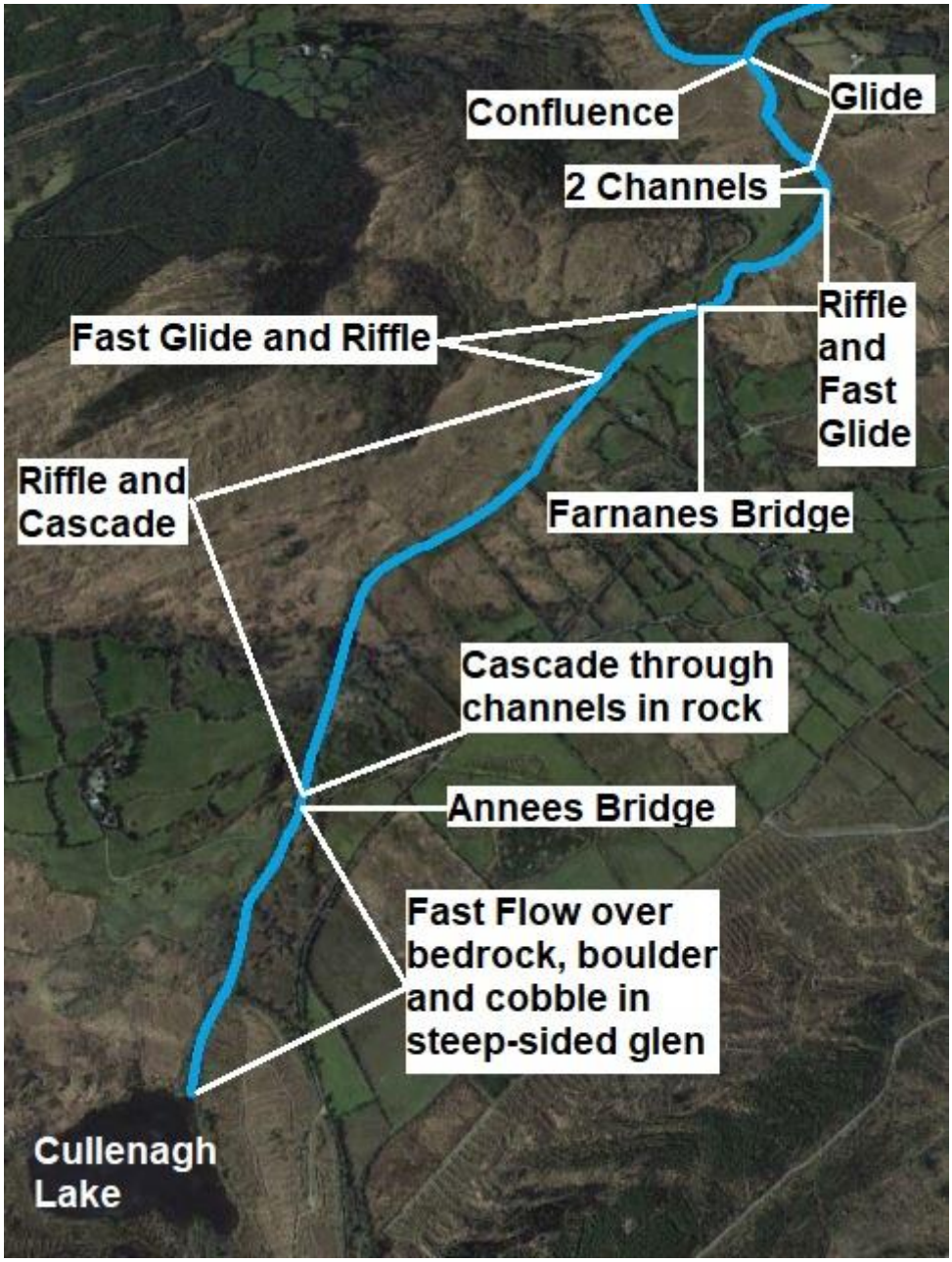
Small individual plants of rhododendron (*Rhododendron ponticum*) are scattered along open parts of the terrestrial habitat towards the lower end of the northern branch.

3.2 SOUTHERN BRANCH

3.2.1 Physical Aquatic Habitat

From the outflow of Lough Cullenagh at ITM 51557 55368 flows north to Annees Bridge at ITM 51576 55446 (Figure 7) in a mostly steep sided glen (Photo 15). Flow here is fast, over outcropping rock, boulder, cobble and gravel (Photo 16). Immediately downstream of Annees Bridge, there is a short section of very fast flow and cascade through channels in bedrock (Photo 17). After this, the gradient lessens slightly and, while flow is still fast, it is more riffle and less cascade (Photo 18) down to ITM 51640 55510 (Photo 19). From a short distance downstream of this point to Farnanes Bridge (ITM 51662 55524) the channel is very open, with fast glide and riffle over a mainly gravel substratum (Photo 20). Lack of shade has resulted in strong growth of water crowfoot (*Ranunculus sp.*) in places (Photo 21). Farnanes Bridge is due for repair and is currently supported by scaffolding poles (Photo 22), some of which have collapsed. For circa 470m downstream of Farnanes Bridge to ITM 51693 55559, there is riffle and fast glide (Photo 23). At this point, the channel splits into two smaller channels and the flow slows (Photo 24). These re-join at ITM 51685 55570, from where there is glide over gravel and peat, with dense instream growth of *Ranunculus* (Photo 25) down to the conflence with the northern branch.

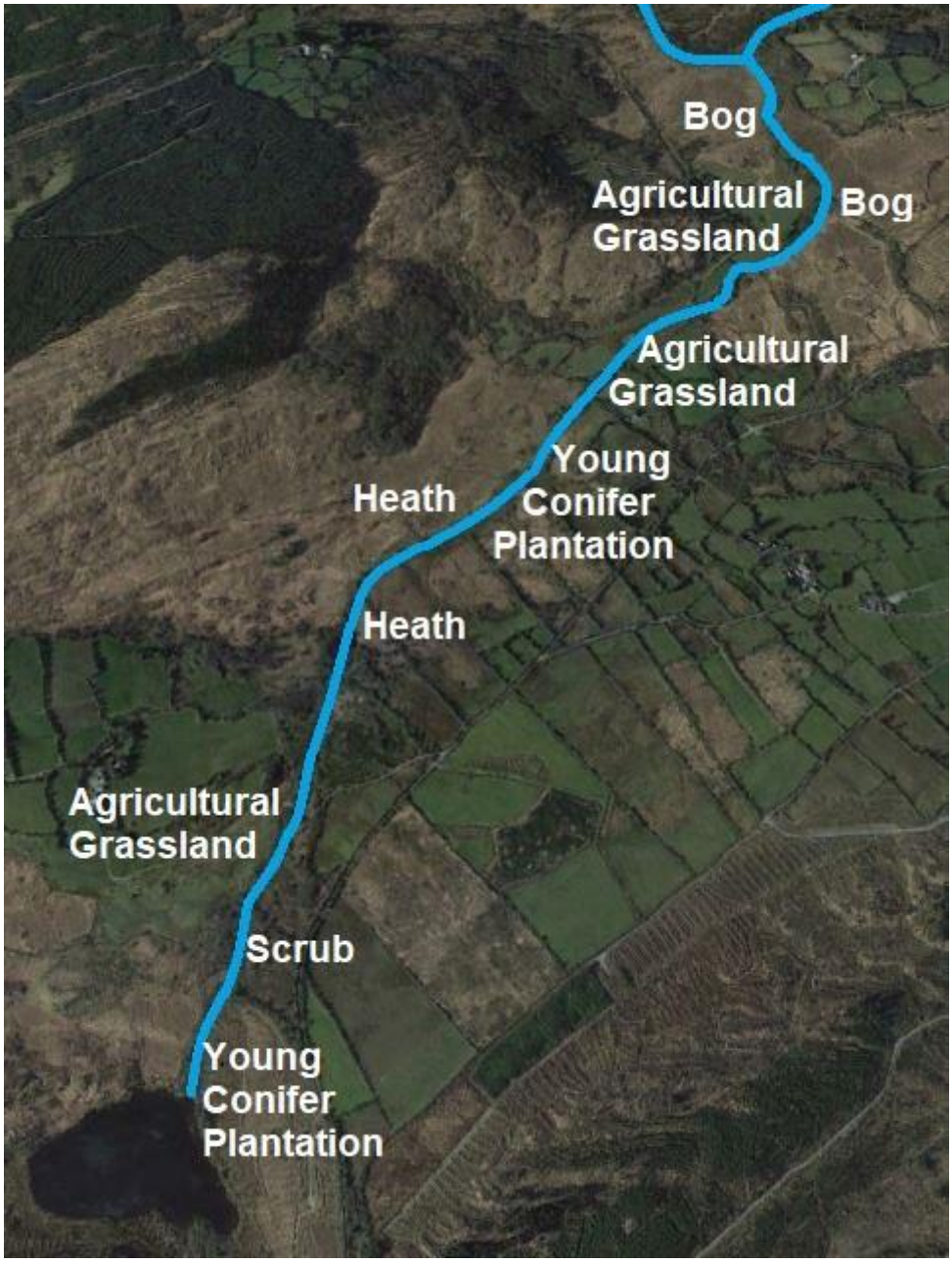
Figure 7. Southern Branch Instream Physical Habitat



3.2.2 Riparian Terrestrial Habitat

While a small proportion of the terrestrial habitat adjacent to the southern branch is in young plantation forestry, open heath, bog and agricultural grassland are more dominant (Figure 8). In the upper parts, close to Cullenagh Lake, scrub along the steep-sided glen separates the watercourse from agricultural grassland.

Figure 8. Terrestrial Habitats



3.2.3 Spawning Gravels

There is little gravel towards the upper end of the southern branch, where the gradient is generally too great. From downstream of the cascade at Annees Bridge to 470m downstream of Farnanes Bridge the point where the channel splits into two smaller channels at ITM 51693 55559, suitable salmonid spawning gravels are found, with the best of these in the vicinity of Farnanes Bridge. However, shading downstream of the bridge limits the potential of these gravels.

3.2.4 Obstacles to Fish Migration

The fast flow and cascades through channels in the bedrock just downstream of Annees Bridge (Photo 17) would be slight obstacle for upstream migrating fish. Also, where the watercourse is divided into two channels fownstream of Farnanes Bridge, a willow is growing across the left channel at ITM 51688 55564 (Photo 26), causing an obstruction that, from evidence of debris, results in overland flow in flood conditions.

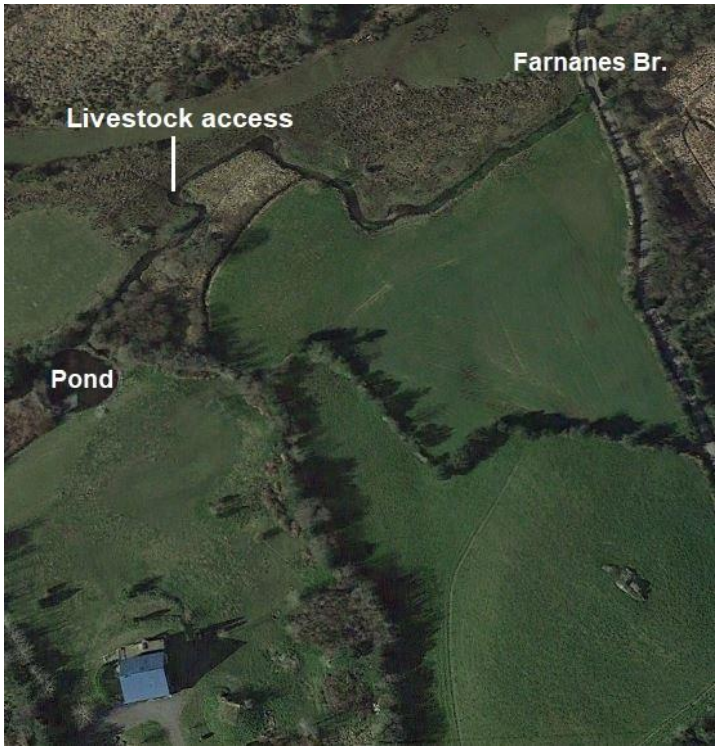
3.2.5 Channel Modification

A River Hydromorphology Assessment Technique (RHAT) survey at Farnanes Bridge reported in the Freshwater Pearl Mussel (Second Draft) Bandon Sub-Basin Management Plan (NPWS 2010) states "*The stretch was generally a glide which appeared to have been straightened at some point in the past*." This is clearly incorrect, as, on the 2020 aerial photograph on the Geohive website, the channel matches the alignment on the 1837-1842 six-inch map (Figure 9).

Figure 9. 2020 aerial photograph overlapping 1837-1842 six-inch map

At ITM 51642 55510, a pond has been created (Figure 10), separeted from the river channel by a line of boulders (Photo 27). This pond has evidently infilled somewhat since it was first created.

Figure 10. Pond and Livestock Access



3.2.6 Siltation

While there is a fenced drinking point where livestock access the river at ITM 51645 55517 on the left bank upstream of Farnanes Bridge (Figure 9), siltation did not appear to be an issue at the time of fieldwork.

Unmanaged land drains do not appear to be contributing significantly to silt imputs to the watercourse at present.

3.2.7 Shading/Tunnelling

The level of shade at the upstream end of the southern branch is not a serious problem as this part of the shannel is of limited usefulnees for salmonids. Downstream of Annees bridge, this shade continues where more gravels are present. There is also tunnelling downstream of Farnanes Bridge. Lack of shade upstream of Farnanes Bridge is resulting in excessive *Ranunculus* growth.

3.2.8 Biological Water Quality

Site physical data and invertebrate data, with the relative abundances for each of the WFD Status Groups, are given Appendix 2. See Figure 4 for mapped site locations.

Q-values, based on the relative abundances for each of the WFD Status Groups, are:

Site S1: Q4-5

Site S2: Q5

High Ecological Condition was recorded at both sites on the southern branch, with a slight improvement in Q-value at Site S2.

3.2.9 Possible Pollution Sources

The slightly lower Q-value at Annees Bridge could possibly be attributable to some slow release of nutrients from Cullinagh Lake, following enrichment of this lake from decomposing brash from felling on adjoining steep slopes.

The Freshwater Pearl Mussel (Second Draft) Bandon Sub-Basin Management Plan (NPWS 2010) refers to manure spreading, round feeders and wintering of cattle in the fields upstream

of Farnanes Bridge. No evidence of this was seen during the field visit for the present report and the fact that Q5 was recorded at Site S2 indicates that this is not the current practice.

3.2.10 Protected Species

There is a population of freshwater pearl mussel in the southern branch. In a licensed survey of the lower third of this watercourse, undertaken by the author of this report in 2018, a total of 134 mussels were found. While a few, checked again for the present survey, are located upstream of Farnanes Bridge (Photo 28), the majority are in the shaded section from Farnanes Bridge to the point where the channel divides.

3.2.11 Invasive Species

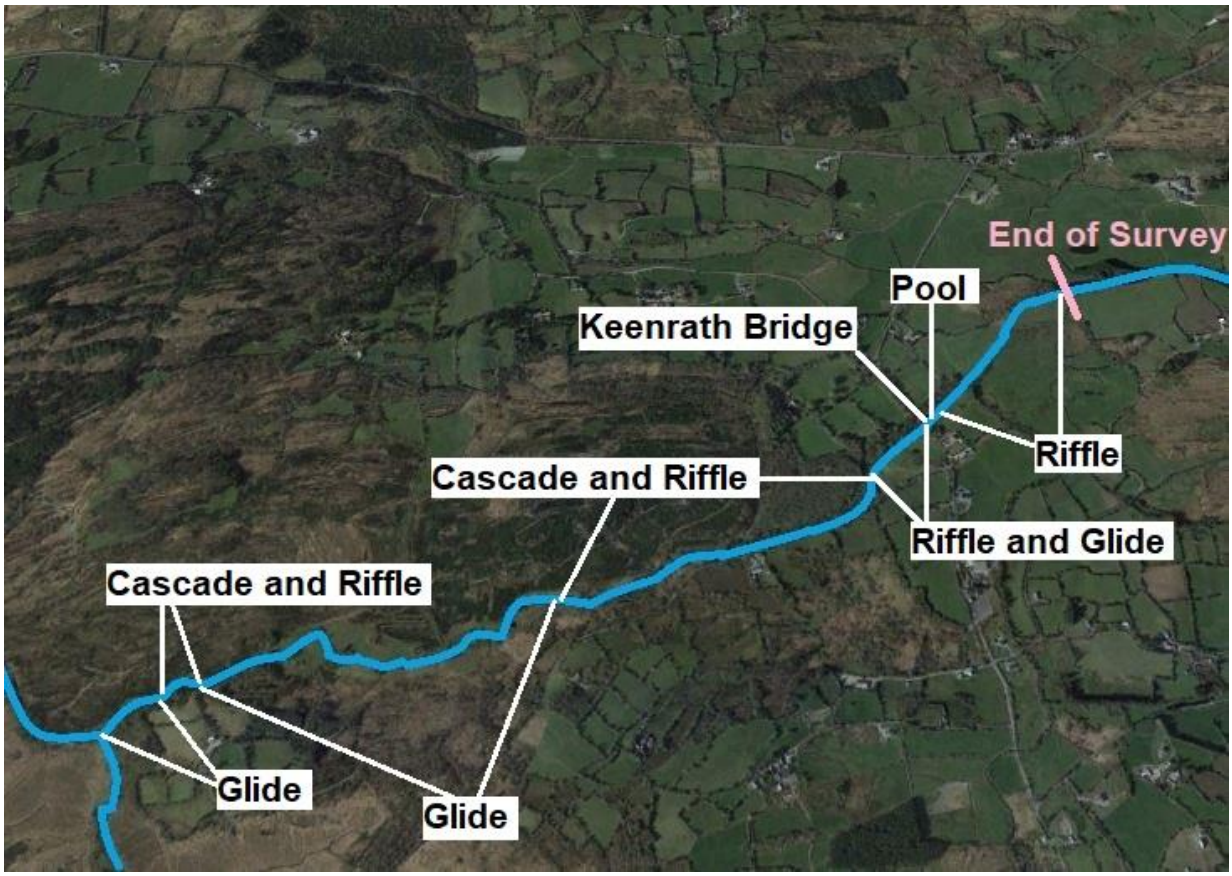
None recorded.

3.3 BANDON MAIN CHANNEL

3.3.1 Physical Aquatic Habitat

From the confluence of the northern and southern branches at ITM 51682 55593 (Figure 11) to ITM 51694 55603, the glide habitat from the southern branch continues. *Ranunculus* growth is strong here in the unshaded channel (Photo 29). There is then a short section of fast flow, with cascade and riffle over bedrock, boulders and cobble (Photo 30). Then, for approximately 1km, there is glide (Photo 31), with strong *Ranunculus* growth in shallow areas (Photo 32). Flow speed increases from where the water cascades over bedrock at ITM 51823 55643 (Photo 33). This fast flow continues over boulder, cobble and some gravel for the next approximately 900m to ITM 51845 55649 (Photo 34). As the gradient decreases, the flow-type down to Keenrath Bridge is a mixture of riffle and glide (Photo 35). For a few metres immediately downstream of Keenrath Bridge the flow is between and through boulders, after which there is a pool, followed by riffle in a hazel-lined channel (Photo 36). Towards the lower end of the section of river surveyed, to the confluence with the Garrown River at ITM 51907 55716, the channel widens and gets shallower, with gravel dominating the bed (Photo 37).

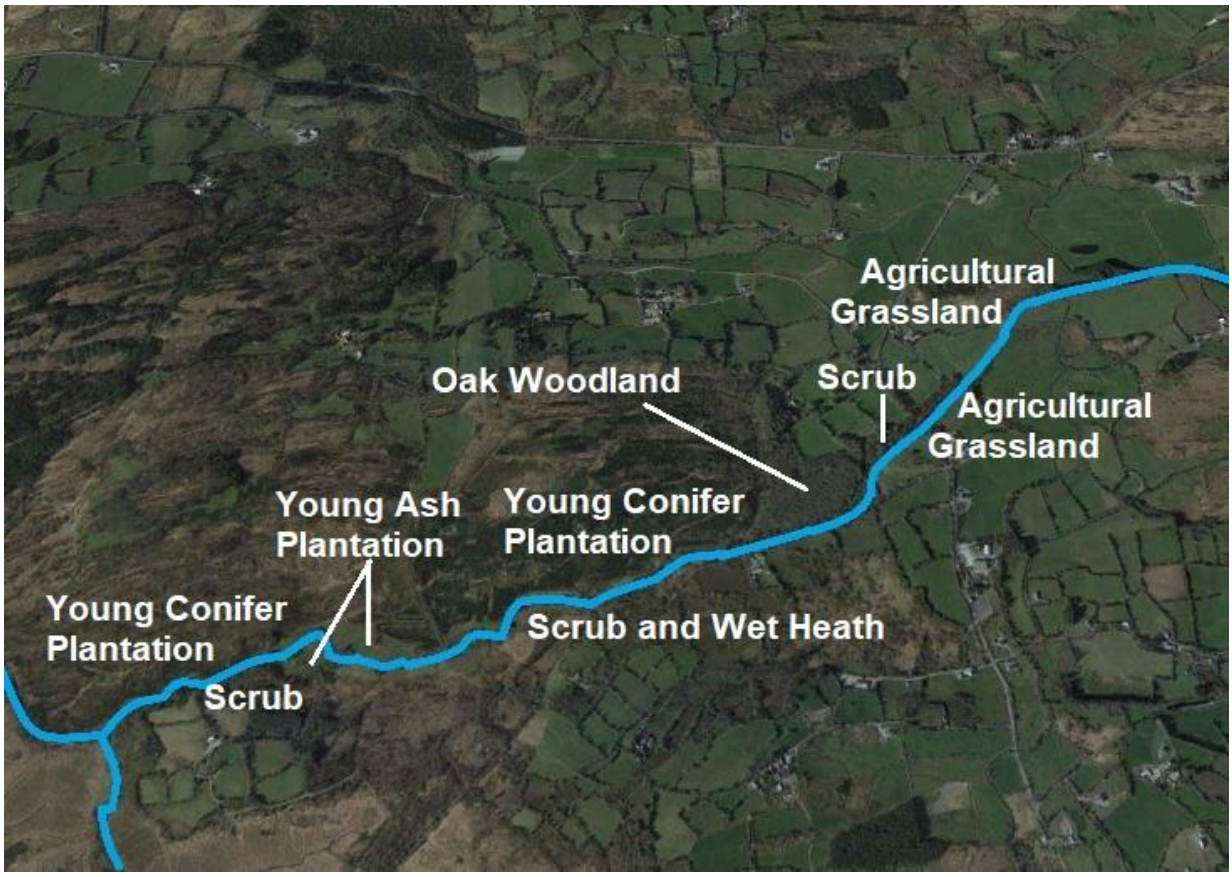
Figure 11. Bandon Main Branch Physical Habitat



3.3.2 Riparian Terrestrial Habitat

The terrestrial habitat (Figure 12) grades from peaty soil with willow/birch/gorse scrub and commercial forestry plantations (including a young ash plantation bounding both sides of one section of river) to drier more mineral soil with oak woodland, hazel scrub and improved agricultural grassland.

Figure 12. Terrestrial Habitats



3.3.3 Spawning Gravels

The best spawning gravels are from approximately 250m upstream of Keenrath Bridge to the end of the survey section. However, shading downstream of the bridge limits the potential of these gravels.

3.3.4 Obstacles to Fish Migration

While the cascades over outcropping bedrock (Photo 33) would be slight natural obstacle for upstream migrating fish, the main man-made obstacle is the bridge apron of Keenrath Bridge (Photo 38), where there is a vertical drop of c.40cm on the left side with most flow.

3.3.5 Channel Modification

Satellite images (Figure 13) show that woodland along the right (southern) bank of the river, immediately upstream of Keenrath Bridge was cleared some time between 2013 and 2019. Rock armouring is being put in place in an effort to stop the bank erosion resulting from these works (Photo 39). A hardcore yard constructed beside the riverbank (storing equipment and a few silage bales at the time of fieldwork) can also be seen in the 2019 satellite image. There is also some rock armouring of the right bank upstream of the confluence with the Garrown River at ITM 51907 55716 (Photo 37).

Figure 13. Satellite images showing woodland cleared upstream of Keenrath Bridge

Google Earth Pro: 2013 **Google Earth Pro: 2019**

3.3.6 Siltation

While siltation was not evident in the riverbed at the time of fieldwork, it is clear that some must have resulted from the bank erosion upstream of Keenrath Bridge.

3.2.7 Shading/Tunnelling

Downstream of Keenrath bridge, where gravels are present, there is tunnelling, which would cause quite dense shade when bankside hazels are in leaf. Lack of shade upstream of Keenrath Bridge is resulting in strong *Ranunculus* growth.

3.3.8 Biological Water Quality

Site physical data and invertebrate data, with the relative abundances for each of the WFD Status Groups, are given Appendix 2.

The Q-value, based on the relative abundances for each of the WFD Status Groups, is:
Site M1: Q4

While the Ecological Condition at Keenrath Bridge is still classified as Good, this is a decline from the High Ecological Condition recorded at all five sites on the upstream branches.

EPA records (Appendix 4) show the Q-value at Keenrath Bridge in 2018 dropping to Q4 for the first time since 1997.

3.3.9 Possible Pollution Sources

Land improvement and fertilisation to the riverbank upstream of Keenrath Bridge (Photo 41) is an obvious source of nutrient input to this section of river.

3.3.10 Protected Species

None recorded.

3.3.11 Invasive Species

Small individual plants of rhododendron (*Rhododendron ponticum*) are scattered along open parts of the terrestrial habitat towards the upper end of this section of river channel in peat habitats. However, it is thought that they are unlikely to become so prolific here to cause problems. In the woodland upstream of Keenrath Bridge, there are a few of these plants (Photo 42) where there is potential for them to take over the habitat and lower riparian biodiversity.

4. DISCUSSION

While there are some minor issues where improvements are possible and where precautions should be taken against possible future problems, the overall condition of the section of the upper Bandon catchment surveyed is good. The biological water quality of the two upper branches puts them as being of High Ecological Condition. To put this in context, , the EPA publication "*Water Quality in Ireland 2015-2018*" reports that, of the 2,355 sites assesssed throughout the state for the River Monitoring Programme in this period, only 196 (8.3% of the total) were assigned Q4-5 or Q5.

Even with a slight decline at Keenrath Bridge, the condition is still Good here.

Issues needing consideration are: forestry, nutrient inputs, shading, bank erosion and stabilisation, obstructions to fish passage, invasive species and planned or possible instream/bankside works.

5. RECOMMENDATIONS

5.1 RECOMMENDATIONS BY TYPE

5.1 RECOMMENDATIONS BY TYPE & REASONS

5.1.1 Forestry

Forestry has a major influence along the northern branch. Recent activity here indicates an effort being made to reduce aquatic impacts, with machinery and brash being kept back from the banks, unplanted buffer strips and some planting of ash. Coillte should be contacted to ensure that these good practices continue and it could also be suggested to them that some areas, such as that felled on the northern bank in 2020, might be suitable for inclusion in the Native Woodland Scheme.

5.1.2 Nutrient Inputs

Some nutrient inputs from forestry are inevitable, as the current crop of mature conifers is felled. Best practice will reduce this.

Farmers should be contacted to make sure slurry and fertiliser spreading is kept back from riverbanks.

Silage bales should not be stored in the yard by the right bank upstream of Keenrath Bridge.

5.1.3 Shading

Over shading by conifers along the northern branch will be allieviated as the current crop is felled and new trees are planted farther from the banks.

Nothing can be done about the shading of the gravel section of the southern branch downstream of Farnanes bridge, due the the presence of a significant population of freshwater pearl mussels here.

Some coppicing of the trees causing excessive shading of the gravel section downstream of Keenrath Bridge might be possible. However, as this stretch is not far upstream of the Bandon River SAC, an Appropriate Assessment report would be needed and the National Parks and Wildlife Service would probably require a survey of freshwater pearl mussels.

Excessive *Ranunculus* growth is a problem at some gravels in unshaded sections. Some planting of trees upstream of Farnanes Bridge is recommended. Young birch trees have already been planted at intervals along the right bank upstream of Keenrath Bridge.

5.1.4 Bank Erosion and Stabilisation

Discussion should be had with the owner of the land upstream of Keenrath Bridge to ensure that bank protection works are properly carried out.

Best practice should reduce silt runoff when the current crop of mature conifers is felled.

5.1.5 Obstructions to Fish Passage

As the willow tree that is obstructing the left channel of the southern branch is downstream of the freshwater pearl mussel population here, it could be removed.

A small rock ramp at the downstream side of the apron of Keenrath Bridge would facilitate upstream fish migration.

5.1.6 Invasive Species

The patch of Japanese knotweed beside the forestry road bridge on the northern branch should be treated with herbicide until it is eradicated. Otherwise, this plant could spread and quickly get out of control in the upper catchment. Contact with Coillte would be necessary as it is on their property.

As rhododendron could take over the shrub layer in the oak woodland on the left bank upstream of Keenrath Bridge, a plan for its control is advisable.

5.1.7 Planned or Possible Works

The pond beside the southern branch is filling in. Contact should be made with the house owners to ensure that they will not dig it out, which could cause a significant silt insult to the adjacent river habitat.

It is known that repair works are planned for Farnanes Bridge, which is currently supported by scaffolding poles. Cork County Council should be contacted regarding the nature of these works and the need for an Ecological Clerk of Works to be on-site throughout the period when they are being carried out.

5.2 RECOMMENDATIONS FOR AN ACTION PLAN, RANKED BY PRIORITY AND MAPPED

Priority is assessed, based on a combination of importance and urgency. Locations of recommened actions are mapped by number in Appendix 5.

1. Contact Cork County Council regarding the nature of the works planned for Farnanes Bridge and the need for an Ecological Clerk of Works to be on-site throughout the period when they are being carried out.
2. Discussion bank protection works upstream of Keenrath Bridge with the landowner.
3. Put to landowner that silage bales should not be stored in the yard by the right bank upstream of Keenrath Bridge.
4. Contact Coillte re the following: Inclusion in the Native Woodland Scheme of the area felled on the northern bank in 2020 and ensuring that these good practices continue

with regards to nutrient and silt runoff and also to reduction in shade by planting farther back from the banks.

5. Eradication of Japanese knotweed beside the forestry road bridge on the northern branch.
6. Contact farmers to make sure slurry and fertiliser spreading is kept back from riverbanks.
7. Coppicing of the trees causing excessive shading of the gravel section downstream of Keenrath Bridge.
8. Removal of the willow tree that is obstructing the left channel of the southern branch at ITM 51688 55564.
9. Planting of trees upstream of Farnanes Bridge
10. Construction of a small rock ramp at the downstream side of the apron of Keenrath Bridge.
11. Contact house owners to ensure that they will not cause siltation by digging out the pond adjacent to the river at ITM 51642 55510.
12. Plan for the control of rhododendron from the shrub layer in the oak woodland on the left bank upstream of Keenrath Bridge.

APPENDIX 1
PHOTOGRAPHS

Photo 1: Northern Branch. Confluence of two headwater streams

Photo 2: Sampling Site N1

Photo 3: Small cascade over bedrock

Photo 4: Sampling Site N2, downstream of ford on forestry road

Photo 5: Downstream of ford

Photo 6: Glide in northern branch

Photo 7: Riffle in northern branch

Photo 8: Gravels, northern branch

Photo 9: Outcropping bedrock and boulders, northern branch

Photo 10: Slower flow towards confluence with southern branch

Photo 11: Shading by bankside conifers

Photo 12: Forestry road bridge at Sampling Site N3

Photo 13: 2020 Clearfelled area by northern branch

Photo 14: Japanese Knotweed by forestry road bridge

Photo 15: Upper Southern Branch in steep-sided glen

Photo 16: Southern Branch upstream of Annees Bridge. Sampling Site S1

Photo 17: Flow through channels in bedrock at Annees Bridge

Photo 18: Southern Branch downstream of Annees Bridge

Photo 19: Southern Branch at ITM 51640 55510

Photo 20: Fast glide over gravel upstream of Farnanes Bridge

Photo 21: Ranunculus growth upstream of Farnanes Bridge

Photo 22: Farnanes Bridge. Sampling Site S2

Photo 23: Southern Branch in shade downstream of Farnanes Bridge

Photo 24: Southern Branch, left channel, in open area

Photo 25: Excessive Ranunculus growth

Photo 26: Willow obstructing flow in left channel

Photo 27: Pond by river

Photo 28: Freshwater Pearl Mussel upstream of Farnanes Bridge

Photo 29: Glide with Ranunculus growth in main channel downstreamof the confluence of the two upper branches

Photo 30: Shorth section of cascade and riffle

Photo 31: Slower, deeper glide

Photo 32: Excessive Ranunculus growth in unshaded area

Photo 33: Cascades over bedrock

Photo 34: Fast flow over boulder and cobble

Photo 35: Riffle and glide upstream of Keenrath Bridge

Photo 36: Pool and riffle in shade downstream of Keenrath Bridge

Photo 37: Shallow riffle over gravel at downstream end of survey section

Photo 38: Bridge apron at Keenrath Bridge Sampling Site M1

Photo 39: Bank erosion and boulders upstream of Keenrath Bridge

Photo 40: Tunnelling downstream of Keenrath Bridge

Photo 41: Improved agricultural grassland to bank upstream of Keenrath Bridge

Photo 42: *Rhododendron ponticum* in oak woodland upstream of Keenrath Bridge

APPENDIX 2
MACROINVERTEBRATE SAMPLING SITE DETAILS

Watercourse	Bandon Northern Branch
Site Code	N1
Grid Reference (ING)	51329 55565
Photograph	2
Sampling depth (m)	0.02
Flow Type	Riffle 100%
Velocity	Fast
Substratum In order of occurrence	Gravel Cobble

Watercourse	Bandon Northern Branch
Site Code	N2
Grid Reference (ING)	51503 55608
Photograph	4
Sampling depth (m)	0.3
Flow Type	Riffle 100%
Velocity	Fast
Substratum In order of occurrence	Gravel Cobble

Watercourse	Bandon Northern Branch
Site Code	N3
Grid Reference (ING)	51643 55610
Photograph	12
Sampling depth (m)	0.2
Flow Type	Riffle 100%
Velocity	Fast
Substratum In order of occurrence	Cobble Gravel Peat Silt

Watercourse	Bandon Southern Branch
Site Code	S1
Grid Reference (ING)	51576 55446
Photograph	16
Sampling depth (m)	0.1
Flow Type	Riffle 100%
Velocity	Fast
Substratum In order of occurrence	Cobble Gravel Boulder

Watercourse	Bandon Southern Branch
Site Code	S2
Grid Reference (ING)	51662 55524
Photograph	22
Sampling depth (m)	0.1
Flow Type	Riffle 100%
Velocity	Fast
Substratum In order of occurrence	Gravel Cobble

Watercourse	Bandon Main Channel
Site Code	M1
Grid Reference (ING)	51869 55672
Photograph	38
Sampling depth (m)	0.3
Flow Type	Riffle 100%
Velocity	Fast
Substratum In order of occurrence	Gravel Cobble Sand

APPENDIX 3

Q-VALUE ASSESSMENT RESULTS

Relative abundance expressed as D: Dominant; N: Numerous; C: Common; F: Few; SS: Single Specimen

TAXON	SITE N1	SITE N2	SITE N3	SITE S1	SITE S2	SITE M1
Group A (Pollution Sensitive)						
Taenopterygidae	C	F	N	C		
Nemuridae	F	N	N		F	
Chloroperla sp.	N		F	N	C	F
Isoperla sp.	SS		C		C	
Perla sp.		SS				
Dinocras sp.	SS	F		F		
Ecdyonurus sp.	F			F	C	F
Rhithrogena sp.	F	F	F	F	C	N
Group B (Less Pollution Sensitive)						
Leuctra sp.	C	F		C	F	SS
Group C (Relatively Pollution Tolerant)						
Lumbriculidae			C	F		
Hydrachnidae	SS					
Baetis rhodani	F	N	N	N	N	N
Hydropsyche sp.			SS			
Philopotamidae						F
Rhyacophila sp.						F
Limnius sp.			F		F	F
Simuliidae	F	C		C	F	F
Chironomidae			F	F		F
Group D (Very Pollution Tolerant) None Recorded						
Group E (Most Pollution Tolerant) None Recorded						
Q-value	**Q5**	**Q4-5**	**Q5**	**Q4-5**	**Q5**	**Q4**

APPENDIX 4

EPA Q-VALUES

Date Report Generated: 15/03/2021

BANDON **20B02**

Date Surveyed (last survey year only): 16/07/18, 18/06/18, 18/07/18, 19/06/18, 26/06/18

Biological Quality Rating (Q Values)

Station Code	1971	1976	1978	1982	1986	1989	1994	1997	2000	2003	2006	2009	2012	2015	2018
RS20B020050						4-5	4-5	4	4-5	4-5	4-5			4-5	4
RS20B020100	5	4-5	4-5	4-5	4	3-4									
RS20B020150					4-5	4	4	4	4	4	4	4	4	4	4
RS20B020200			4-5	4-5	4-5	4									
RS20B020300	5	4-5	4-5	4	4	4	4	4	3-4	3-4	4	3-4	3-4	4	3-4
RS20B020400	5	4-5	4	4	4	3-4	4	3-4	3-4	3-4	4	4	4	4	4
RS20B020500		4-5	4	3-4	3-4	3-4									
RS20B020550						4	4-5	4	3-4	4	3-4	3-4	3-4	4	4
RS20B020600	5	5	5	3-4	3-4	4	4-5	4	4	4		3-4	3-4	4	4
RS20B020700	5	4-5	4	3-4	4	3-4	4-5	4	4	4	4	4	4	4	4
RS20B020780						3-4									
RS20B020800	5	3	2-3	3	4	3	3-4	3	3	3	4	4	4	4	3-4
RS20B020850						3-4									
RS20B020900	5	4-5	4	4	4	3-4	4	4	4	4	4	4	4	4	3-4

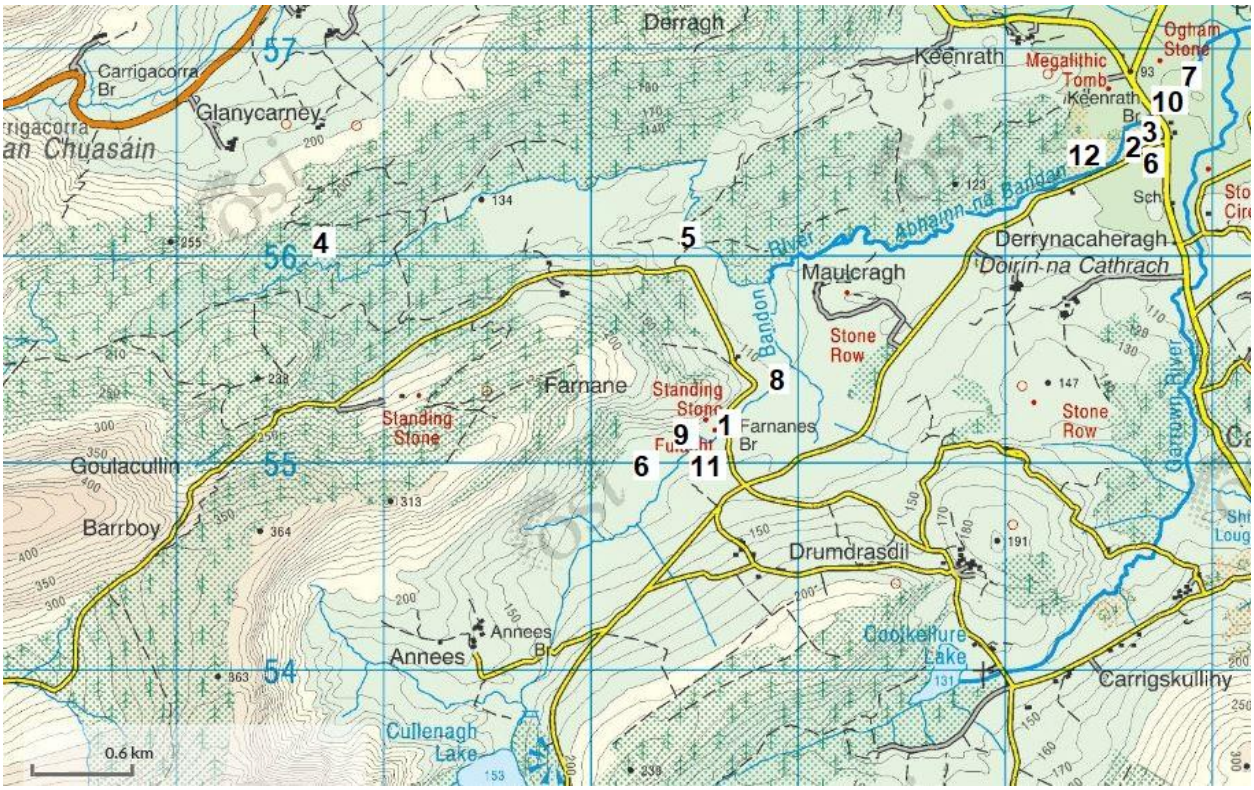
Largely satisfactory upstream of Bandon town with the six of the seven sites surveyed at Good ecological quality. The High ecological quality as witnessed at Keenrath bridge (0050) during the previous survey was not maintained and this site reverted to Good. The quality at Bealboy bridge (0300) downstream of Dunmanway, declined from Good to Moderate quality and there was very excessive weed growth at this location. Both stations downstream of Bandon town were extremely turbid and heavily silted and declined from Good to Moderate ecological quality as a result of the on-going instream works in Bandon town.

Station Details

Station Code	Station Location	WFD Waterbody Code	Easting	Northing	Local Authority
RS20B020050	BANDON - Br E of Keenrath Ho	IE_SW_20B020050	118718	56680	Cork County Council
RS20B020100	BANDON - Br u/s Ardcahan Br	IE_SW_20B020200	122739	56537	Cork County Council
RS20B020150	Ardcahan Br	IE_SW_20B020200	124242	55701	Cork County Council
RS20B020200	BANDON - Br near River View	IE_SW_20B020200	124173	53023	Cork County Council
RS20B020300	Bealboy Br	IE_SW_20B020300	125677	51284	Cork County Council
RS20B020400	Manch Br	IE_SW_20B020400	129281	52079	Cork County Council
RS20B020500	BANDON - Ballineen Br	IE_SW_20B020550	134349	53886	Cork County Council
RS20B020550	Enniskeen Br	IE_SW_20B020550	135701	54047	Cork County Council
RS20B020600	Br nr Desert Station	IE_SW_20B020600	138101	54112	Cork County Council
RS20B020700	Baxter's Br	IE_SW_20B020700	144122	54612	Cork County Council
RS20B020780	BANDON - Bandon Br	IE_SW_20B020780	149261	55060	Cork County Council
RS20B020800	1.5km d/s Bandon Br	IE_SW_20B020800	150362	55674	Cork County Council
RS20B020850	BANDON - French's Wood	IE_SW_20B020900	151648	56935	Cork County Council
RS20B020900	Inishannon Br	IE_SW_20B020900	154115	57086	Cork County Council

APPENDIX 5
RECOMMENDATIONS MAP

(Numbers refer to the points in Report Section 5.2)



APPENDIX 6
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