Comhairle Contae Lú
Louth County Council

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Louth Local Community Development Committee

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Coiste um Fhorbairt Pobail Áitiúil Mhuineachàin
Monaghan Local Community Development Committee

THE WILD TROUT TRUST
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Monaghan Integrated Development

The European Agricultural Fund for Rural Development:
Europe investing in rural areas

Walkover Assessment

River Fane

(and tributaries)

5th-7th/08/2019

Undertaken by the Wild Trout Trust

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&
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Rialtas na hÉireann
Government of Ireland
Tionscadal Éireann
Project Ireland
2040

Comhairle Contae Mhuineacháin
Monaghan County Council

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Key findings

- The Fane River supports long sections of high-quality habitat for salmonid fish species, with some particularly good areas in the section between Inniskeen and Knockbridge. Straight, uniform depth sections in the upper reaches limit the habitat quality somewhat, but generous buffer strips and healthy riparian zones help to mitigate the issue.
- The two large loughs at the head of the system have a huge influence on water quality and river hydraulics downstream. Long term management and monitoring plans should be in place to ensure the future protection and long-term stability of the river system.
- Numerous weirs and structures are present around the catchment and pose serious issues for habitat quality and connectivity.
- The water control structure on the Clarebane River d/s of Lough Muckno creates an obstruction for upstream and downstream migrating fish, increasing their susceptibility to stress, disease and predation.
- The fish counter and gauging weir at the downstream end of the river creates an obstacle to the free movement of fish (particularly sea trout) both in and out of the system. Delaying migration will result in increased mortality rates through stress and predation.
- The large public water supply intake located in the lower reaches of the river poses a serious threat of entrainment for both salmonids and eels.
- Channel modifications, particularly straightening of the main river and its tributaries, has resulted in reduced habitat diversity in many areas, limiting the size range and numbers of fish the river can support. This issue particularly degrades the natural pool:riffle sequence and availability of deeper pool habitat, therefore also degrading the fishery.
- Unlike many watercourses, livestock grazing (and associated poaching and bank erosion) are not considered to be a major issue on the Fane catchment; however, in localised areas it significantly degrades habitat. and livestock exclusion would be highly beneficial there.
- The encroachment of arable meadows without significant buffer zones is a major concern and will be responsible for diffuse pollution pressures.
- Significant occurrence of alder disease is a concern. A programme of planting using alternative native species that support low, scrubby cover such as willow, hazel and thorn is recommended.
- Most of the small tributaries observed (particularly entering the middle reaches of the river) have been straightened and/or drained and seriously physical diversity. Restoration of at least the lower 1km of all the tributaries would make a major contribution towards salmonid production, particularly sea trout, on this system.

1.0 Introduction

This report is the output of a c. 20km habitat assessment carried out on sections of the River Fane catchment in the counties of Monaghan and Louth, straddling the border between the Irish Republic and Northern Ireland.

The walkover survey was undertaken over three days between the 5th - 7th August 2019 to provide a habitat assessment for the local controlling angling clubs and in particular the Dundalk Salmon Anglers Association and the Dundalk and District Brown Trout and Salmon Anglers Association, to identify issues and habitat bottlenecks and highlight potential improvements and project opportunities that could benefit the brown trout, sea trout and salmon fisheries on the river.

The Wild Trout Trust has extensive knowledge and experience in carrying out habitat assessments of rivers and lakes in all corners of Britain & Ireland. For this report, we have utilised our standard methodology for walkover reporting, recording habitat quality, availability and access, as well as identifying key issues and habitat bottlenecks that are likely to be impacting on the ecological quality of the Fane River system.

Normal convention is applied throughout this report, with respect to bank identification, i.e. banks are designated left bank (LB) or right bank (RB) while looking downstream. Specific locations are identified using coordinates for latitude and longitude and reference to upstream and downstream is often abbreviated to u/s and d/s for convenience.

Long sections of the river were walked contiguously, supplemented by spot-checks in additional areas of particular interest from a fishery management perspective. Photographs taken during the walkover are geotagged to provide accurate locations.

Comments in this report are based on observations undertaken during the surveys and conversations with local club officials and in particular LW, RM and MC.

2.0 Catchment overview

The headwaters of the River Fane rise to the north west of Castleblaney, feeding Lough Muckno, from which the Clarebane River emerges and flows south east for a short distance before entering Lough Ross. The Fane River then drains Lough Ross, continuing in a south-easterly direction to enter the Irish Sea, to the south of Dundalk.

The bedrock geology of the catchment is primarily sandstone, mudstone and shale. The land use adjacent to the river is predominantly small pockets of pasture in the upper reaches and larger pasture and arable fields in the lower catchment. Old maps indicating the original course of the river(s) pre-channel modification are not easily available; the oldest found via an on-line search dating back to 1837. Major straightening of the main river Fane between Milltown and Haynestown had already occurred by that time, highlighting the capability and intent to undertake large-scale drainage and channel realignment projects.

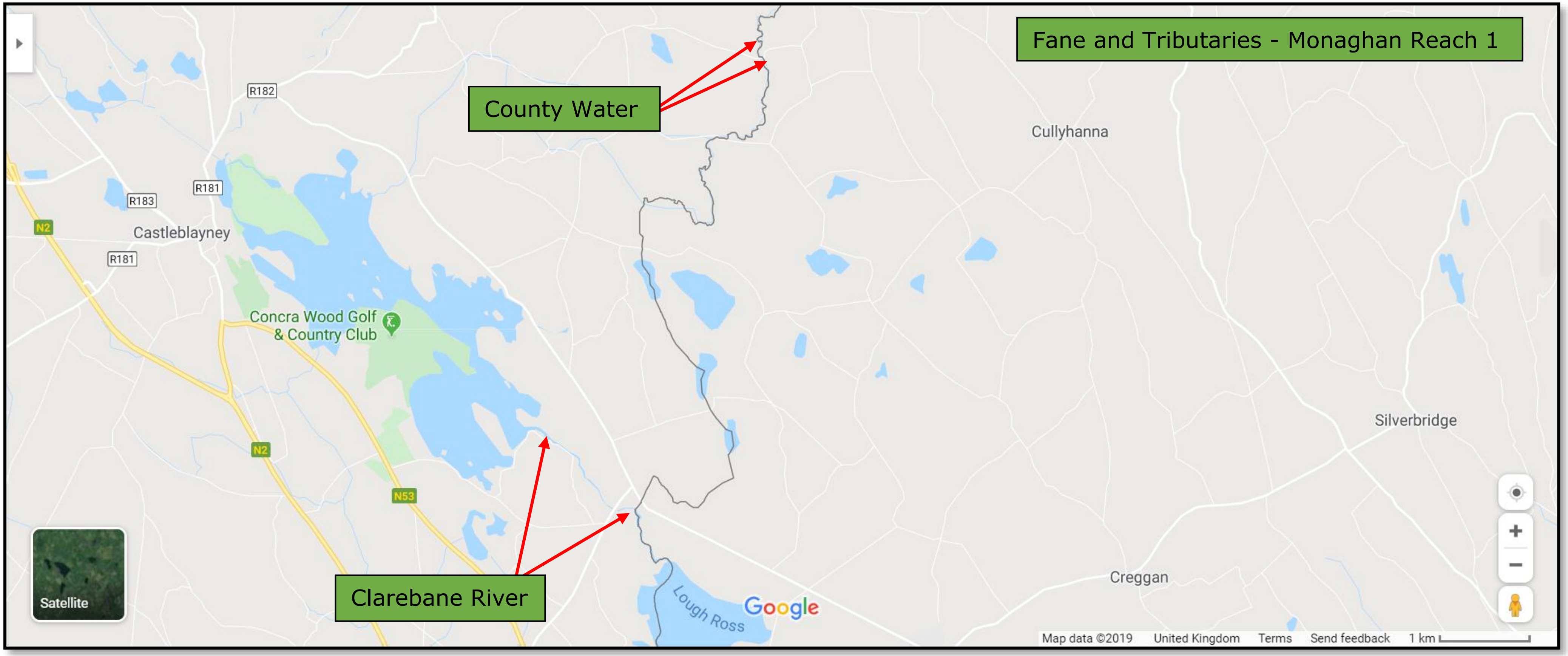
http://watermaps.wfdireland.ie/NsShare_Web contains Water Framework Directive information about the Fane catchment and suggests that ecological condition for all of the waterbodies visited are classified as *Poor* but not as *Heavily Modified*, despite the abstraction at Lough Muckno, which clearly impacts the hydrological regime and fish accessibility of the Muckno Water (and Fane catchment). The major channel re-sectioning and realignment observed could be interpreted as heavy modification.

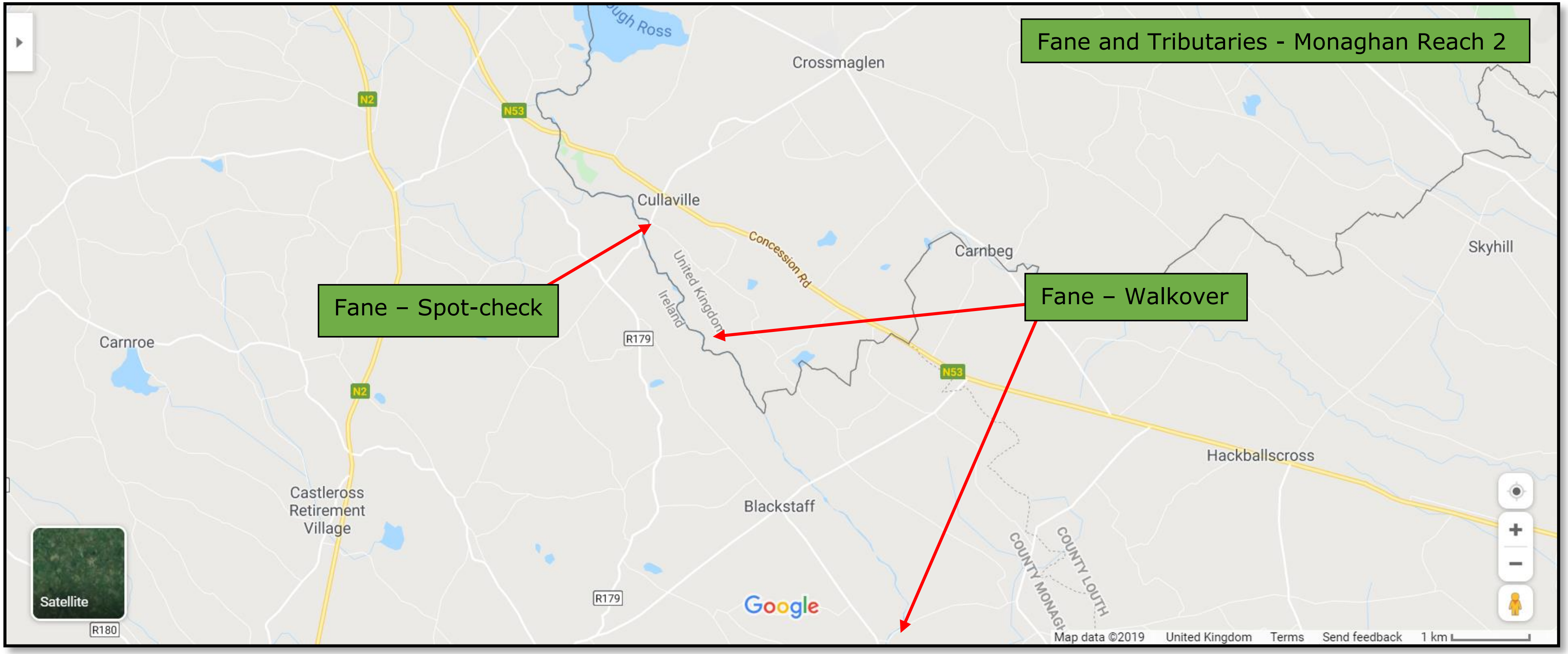
The hydrological and hydromorphological impacts associated with drainage and channel modification have been recognised in the Northern Ireland Environment Agency assessments of the cross-border waterbodies.

Status Report			
Water Management Unit:	**IE_NB_Fane**		
WaterBody Category:	**River Waterbody**		
WaterBody Name:	**County Water**	**Muckno, Trib of Fane**	**Fane River**
WaterBody Code:	IE_XB_06_11	IE_NB_06_256	IE_XB_06_8
Overall Status Result:	Poor	Poor	Poor
Heavily Modified:	No	No	No
Macroinvertebrate status	Poor	Poor	Poor
General physico-chemical status	Moderate	Good	Good
Freshwater Pearl Mussel / Macroinvertebrate status	N/A	N/A	N/A
Diatoms status	N/A	N/A	Poor
Hydromorphology status	N/A	N/A	N/A
Fish status	N/A	N/A	N/A
Specific Pollutants status (SP)	N/A	N/A	N/A
Overall ecological status	Poor	Poor	Poor
Overall chemical status (PAS)	n/a	n/a	n/a
Extrapolated status	N/A	N/A	N/A
Monitored water body	YES	YES	YES
Donor water bodies	N/A	N/A	N/A

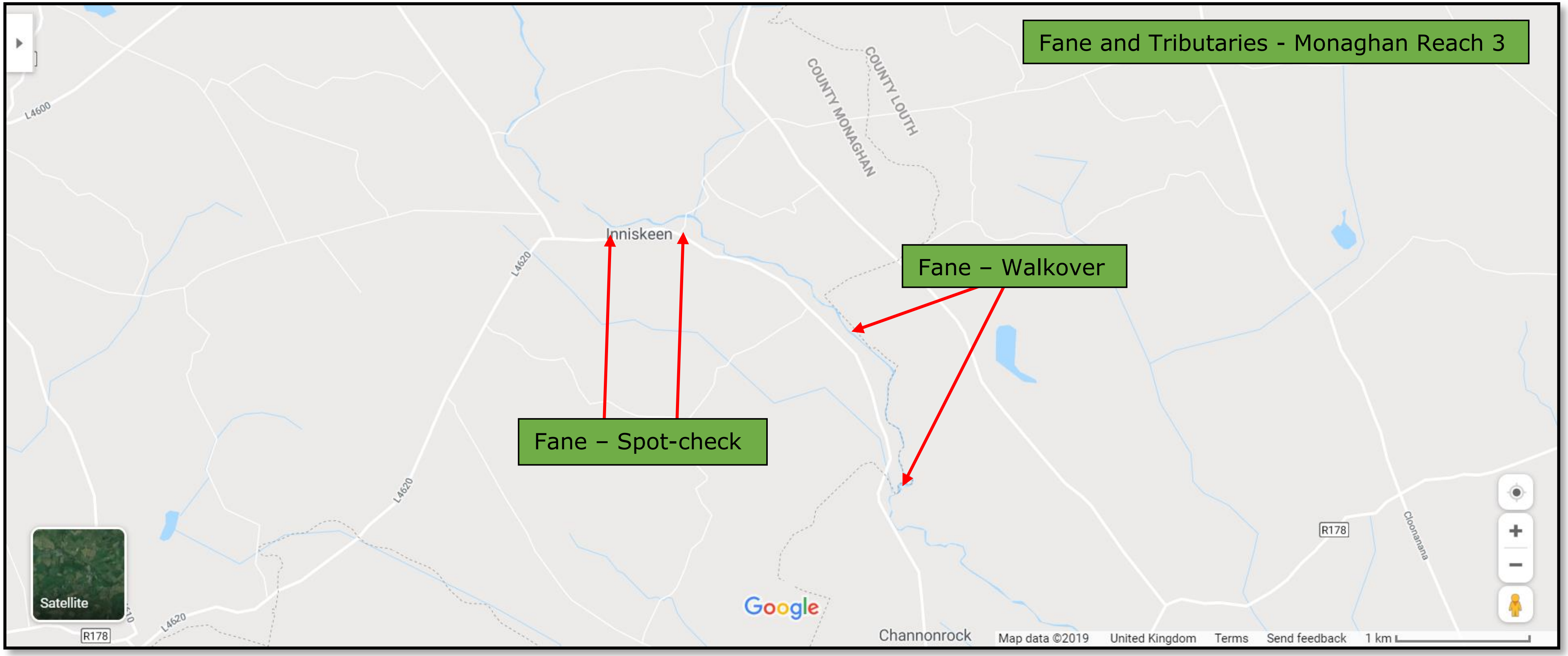
http://watermaps.wfdireland.ie/NsShare_Web/Viewer.aspx?Site=NsShare&ReloadKey=True

Overview Maps

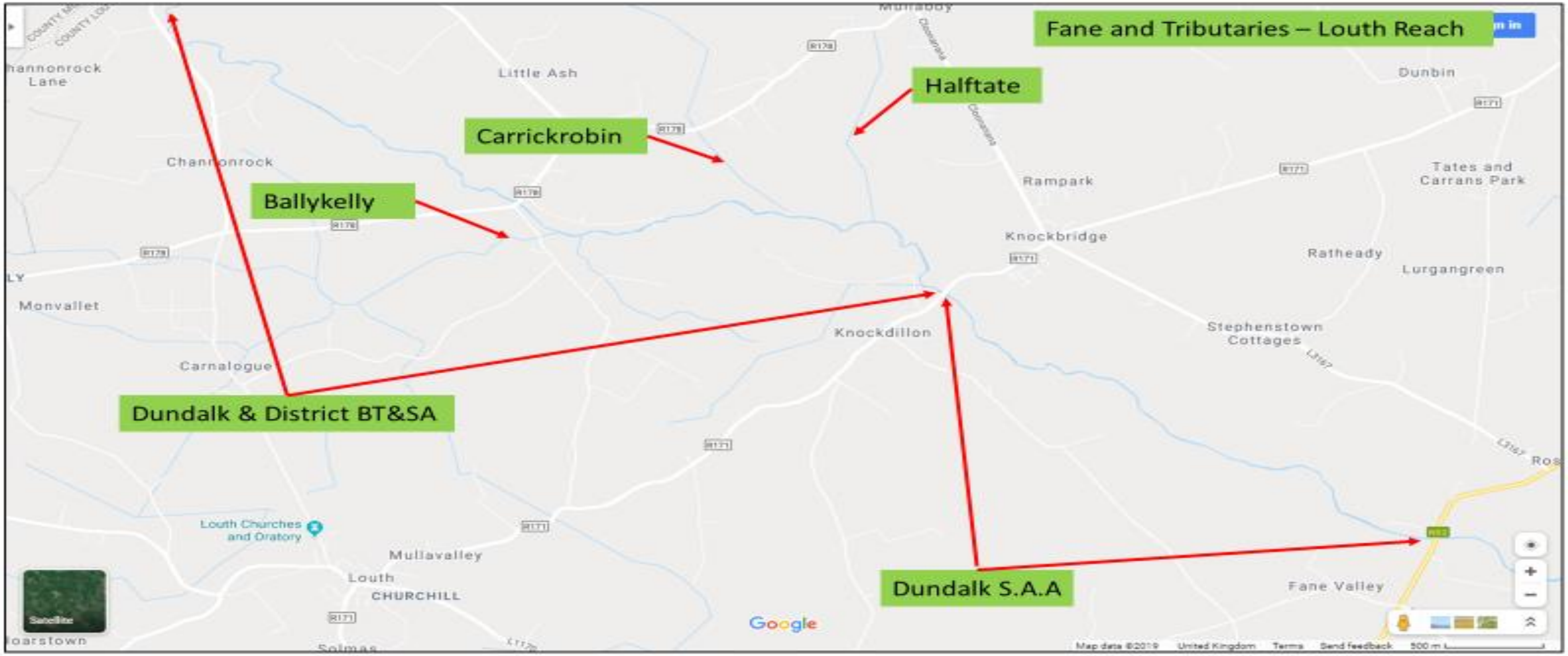




Fane and Tributaries - Monaghan Reach 2
Fane – Spot-check
Fane – Walkover
Crossmaglen
Cullaville
Concession Rd
Carnbeg
Skyhill
Carnroe
Hackballscross
Castleross Retirement Village
Blackstaff
United Kingdom
Ireland
COUNTY LOUTH
N2
N53
R179
R180
Satellite
Google
Map data ©2019 United Kingdom Terms Send feedback 1 km



Fane and Tributaries - Monaghan Reach 3
Fane – Walkover
Fane – Spot-check
Inniskeen
COUNTY MONAGHAN
COUNTY LOUTH
L4600
L4620
L4620
L4620
R178
R178
Cloonanana
Channonrock
Satellite
Google
Map data ©2019
United Kingdom
Terms
Send feedback
1 km


Fane and Tributaries – Louth Reach
Halftate
Carrickrobin
Ballykelly
Dundalk & District BT&SA
Dundalk S.A.A
Little Ash
Channonrock
Rampark
Knockbridge
Dunbin
Tates and
Carrans Park
Ratheady
Lurgangreen
Monvallet
Knockdillon
Stephenstown
Cottages
Carnalogue
Louth Churches
and Oratory
Mullavalley
Louth
CHURCHILL
Fane Valley
Google

3.0 Habitat Assessment

3.1 River Fane – Monaghan Reach

Photo 1. A spot-check was undertaken on the upper River Fane, visiting a collapsed weir (54.059055, -6.647277). The underlying bedrock creates a small natural obstruction but passability is made worse by the weir, and subsequent attempts to rebuild it. Ideally, the manmade part of this structure should be removed or allowed to fully disintegrate.

Photo 2. The section immediately u/s of the Corrasmore Road bridge at Cullaville is bedrock with good habitat for fry and parr and potential deeper pocket water for occasional larger adult fish. The deciduous tree-lined banks provide good shade and cover.

Photo 3. D/s of the bridge, the gravel bed facilitates a pool and riffle sequence with deeper adult fish holding water; again, complemented by low-level and trailing cover.

Photo 4. The next section visited (54.0444867, -6.6368217) consists of a short sinuous section of channel, where the increased flow diversity creates varied bed scour and the bends provide good, deeper adult fish-holding water; something that is scarce in many areas of the Fane.

Photo 5. A deeper pool d/s of the bend provides high quality habitat for adult salmonids. This feature is created and maintained by bed scour associated with the bend which naturally increases the water depth over that found in the straighter sections.

Photo 6. Although straight (suspected to have been straightened), the well vegetated channel margins provide good cover for salmonids, particularly fry and parr. The value of bankside buffer fencing in achieving this should not be overlooked and it is in the interest of anglers to report any breaches of the fence to the owner and/or tenant if they occur.

Photo 7. Bushy willows encroaching into the channel help focus flows and create bed scour that will help to develop valuable deeper areas.

Photo 8. Particularly in the more open, straighter sections, laying the occasional willow into the channel, or planting additional shrub willow species (goat willow or grey sallow) on alternating banks to encourage the flow to kick from one bankside to the other would be beneficial (around 54.039103, -6.626745 to 54.0352583, -6.6224367). From around this point, there is also potential for a more aspirational restoration scheme to reinstate a meandering form to the channel using the rough land adjacent to the RB.

Photo 9. A small LB tributary provides good potential salmonid spawning and juvenile habitat and should be regularly monitored to ensure protection from the impacts of livestock/agriculture (54.03651, -6.623628).

Photo 10. Use of the tributary for livestock watering is creating issues from poaching and siltation (54.0364133, -6.6234633). Excluding livestock and employing alternative watering options such as pasture pumps would be highly beneficial.

Photo 11. The generous buffer on the RB (right of shot) could be utilised for river restoration to re-meander the channel (54.0352583, -6.6224367).

Photo 12. A weir at (54.0339750, -6.6217200) impounds flow u/s and degrades local habitat. Unlike natural pools, the additional depth created upstream of the weir is at the expense of flow diversity, leading to a reduction in habitat quality for flow-loving salmonids. Weirs also trap sediment, resulting in the reach u/s becoming much shallower over time. Ideally, this weir would be removed, or a portion notched down to bed level on the RB side, to remove the impoundment, allow free sediment transport and encourage bed scour. Prioritising flow down the RB channel d/s would encourage the reinstatement of a bend. A pasture pump or other alternative watering option is likely to be required.

Photo 13. Potential salmonid spawning substrate (c. 5-40mm for trout c. 40-60mm for migratory salmonids) was observed d/s in areas with more natural sediment transport. For gravels to be of value for spawning they must be able to move within the channel during flood events, sorting the material and allowing fine sediment to be flushed away. This ensures that flow is able to percolate through the gravel to oxygenate incubating eggs.

Photo 14. Small, deflectors in the channel create flow diversity, but it is generally better to employ habitat techniques such as planting and woody material (54.0322583, -6.6199483). Note that the rock placed in the channel is inhibiting flow in an area that would otherwise be a valuable food-lane adjacent to the overhanging bush. A better course of action would be to lay that bush down into the wetted channel (see Recommendations).

Photo 15. Again, wherever the river's natural bends remain, valuable pools and deeper water habitat is usually available, providing adult trout holding areas. Larger fish will not spend all of their time in the deeper water but generally require a deeper bolthole not too far from their shallow water lies.

Photo 16. D/s the channel splits in two, with the main flow passing down what is suspected to be an artificially straightened section. Trees consolidate the RB and deflect scour downwards into the bed to create depth. The low cover they provide also improves the habitat. However, a more naturally sinuous channel would provide greater flow, depth and habitat diversity, and therefore improve the overall habitat quality.

Photo 17. At 54.0310733, -6.6191033, attempts have been made to block a more sinuous side-channel and it now only carries a small percentage of the flow. It would be better to encourage more flow through the side-channel to reinstate bends and increase channel sinuosity. As a minimum, the stones blocking the side channel could be removed to encourage more flow through and improve it as juvenile habitat. Livestock access along the side-channel impacts on the bankside vegetation (red circle).

Photo 18. The straight d/s to the next split/side-channel provides some reasonable habitat but could be improved with increased sinuosity/bends and a more varied bed profile. Laying a tree or creating a lodged flow deflector here would be beneficial in breaking up the long open stretch (see Recommendations).

Photo 19. Another side-channel d/s (54.0352583, -6.6224367) carries more flow and consequently supports better quality habitat. Again, there is potential to encourage more flow down this channel to reinstate bends to the river. This could be achieved over time by removing the stone that partially blocks the u/s and d/s end of the side-channel and installing more features within the current, straight main flow channel to divert flow into the side-channel.

Photo 20. There is good quality habitat in the current main channel (alongside the side-channel), but the overall habitat of the area would be improved by prioritising flow down the more varied, side-channel and reinstating a much-needed bend to the river.

Photo 21. Rocks have been used to reduce the flow passing down the side channel (red ellipse). The pool at the d/s (foreground) would change if the predominant flow came down the side-channel, but the overall habitat diversity and quality would be increased.

Photo 22. Habitat in the pool u/s of Magoney Bridge (54.028318, -6.614318) is greatly enhanced by the trailing ash branches. While these may prevent an angler from covering every area of the pool, the habitat improvement and increased fish-holding potential is a major benefit to angling.

Photo 23. D/s of Magoney Bridge (54.0283183, -6.6143183), the channel remains straight, with artificially armoured sections of bank. There may be more opportunities here to encourage the channel to move laterally into the low-grade agricultural land on the RB by removing the armouring, or even to undertake a more formal river restoration project.

Photo 24. Small weirs in the river inhibit its natural flow pathways and trap bed material upstream (54.027212, -6.612428). Removing 1-2 metres of the weir right down to bed level at the LB side (red circle) would encourage flow in that area to create and maintain depth through scour. Where required, partial width deflectors are always preferable to full-width weirs. However, the lack of depth the weirs are intended to address would be better tackled through restoration of a more varied and sinuous channel.

Photo 25. A weir a short distance d/s creates a similar issue (54.025323, -6.609878). Here, removing 1-2 metres of the weir down to bed level at the RB side (red circle) would encourage flow along the RB. When removing part of a weir (or installing deflectors), it is important to maintain the movement of the flow from one bank side to the other, to avoid effectively straightening the flow. It is therefore also important to consider which side of the channel the flow would naturally approach from u/s when choosing which side to notch.

Photo 26. In conjunction with removing a portion of the weir, some of the willow trees d/s could be laid into the channel to narrow the channel and increase flow velocities, as well as provide additional, low fish cover.

Photo 27. Again, removing all or a portion of the weir to maintain a bed depth channel without impoundment would be beneficial (54.025047, -6.609297).

Photo 28. Armouring of the LB could be removed to allow natural, lateral movement of the channel into the rough ground on the outside of the bend (54.024075, -6.606928).

Photo 29. The next section d/s is very straight and deep alongside the disused railway line, providing only limited habitat for salmonids, although some larger specimens and a few juvenile fish may reside there. It may well be that material was removed from the channel here to use in the construction of the railway/embankment.

Photo 30. Livestock are gaining access to the river from the LB and crossing over to the RB side, within the buffer (54.021845, -6.603547). This should be prevented to protect the riparian habitat.

Photo 31. A more formal weir backs up flow and creates similar but greater issues as those found u/s (54.020598, -6.60211). Removing stones from the RB side would accentuate the existing left-hand bend and help consolidate flow and habitat alongside the island downstream. Otter spraint were observed at this point.

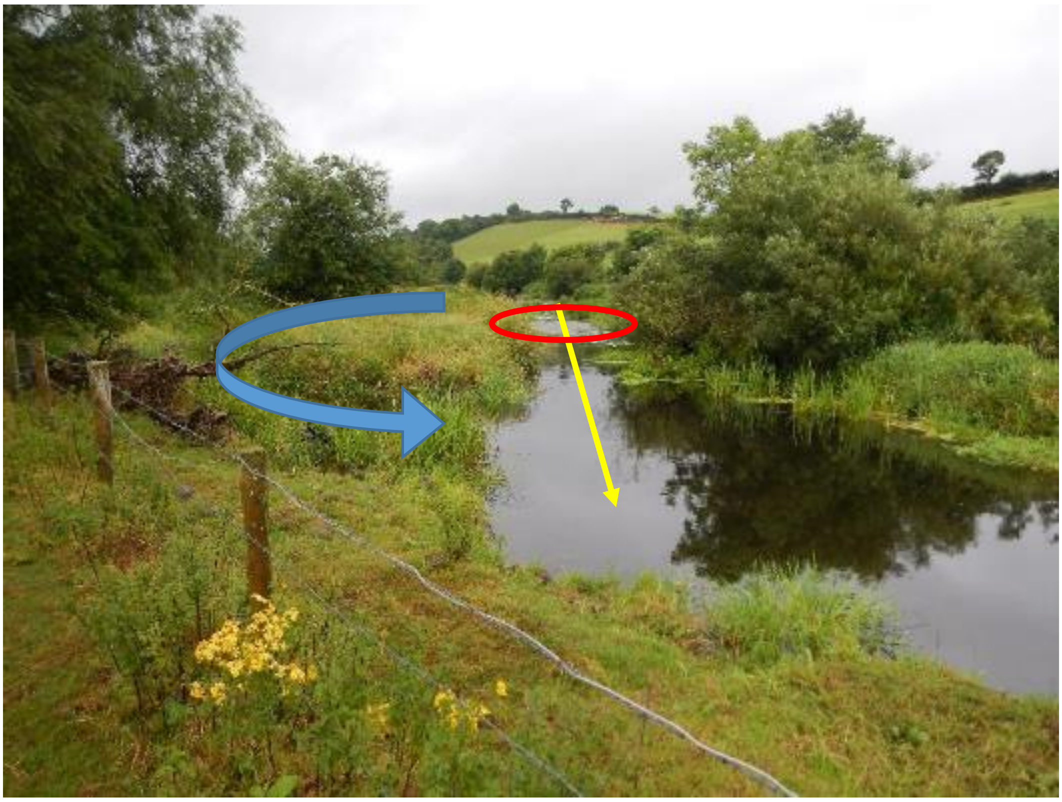


Photo 33. Looking u/s at the weir (red ellipse) and island. Encouraging flow down the RB channel could reintroduce a much-needed meander (blue arrow) to the long, straightened channel (yellow arrow).

Photo 34. The field on the RB is heavily grazed and the buffer fence has failed, leading to poaching and habitat degradation (54.019797, -6.601495).

Photo 35. Looking u/s at another island/straightened bend (54.019155, -6.600215): Prioritising flow down the RB channel could create/reinstate another meander. This location is a lower priority owing to the deep water and lack of bed features (likely resulting from past dredging) but reinstating the bend would assist with the natural channel/bed recovery.

Photo 36. The next field is electric buffer fenced (54.018498, -6.598745), but poaching around a drinking bay creates another negative impact.

Photo 37. Cattle are gaining access from the LB side and crossing the river at 54.016123, -6.597485. Note the much poorer riparian habitat quality resulting from the grazing.

Photo 38. Looking u/s (54.014055, -6.595): the bend u/s of the old railway viaduct beautifully demonstrates the kind of features lacking from much of the channel owing to the modifications. Note the scour and deeper water on the outside of the bend (right of shot) and deposition on the inside (left of shot), leading to a more varied cross-section. The trailing willow is also encouraging the deposition by slowing flow along the RB side (left of shot).

Photo 39. Another weir creates a small obstacle but is already breached, reducing the issue (54.01271, -6.595992). However, creating a notch to bed-depth in a section of the weir would still be beneficial.

Photo 40. In the heavily straightened section alongside the road, a similarly straightened and realigned tributary joins the Fane. Note how the sediment in the tributary has formed a steep, step riffle at the confluence. This is likely due to a combination of factors: the tributary now joins the Fane in an u/s direction, so the flows are opposing; this means that the flow and oversupply of sediment by the straightened tributary will be impounded at the confluence when the main channel is in flood, backing up the tributary so that it loses energy, causing it to deposit the coarse sediment.

Photo 41. The straightened section of the Fane d/s, alongside the road, is subject to uniform scour or deposition (depending upon the flow received) maintaining a uniform bed and lack of water depth (54.01083, -6.598303). It would be worth removing at least a portion of the weir to encourage bed scour that will naturally maintain deeper areas.

Photo 42. Spot checks were then undertaken around Inniskeen to look at some inappropriate in-channel work where weirs have been installed (54.004066, -6.582740). Dredging has also destabilised the bed and banks, leading to yet more bank work. It is not known what the purpose of the work was but is has certainly degraded the in-channel habitat for fish and interrupts vital sediment transport.

Photo 43. Another area dredged d/s of the weir. The issue of dredging and lowering of the bed is compounded by the interruption in the supply of sediment created by the weirs u/s. This is likely to result in further bank destabilisation and erosion in the nearby sections d/s.

Photo 44. The larger weirs in Inniskeen not only degrade the habitat u/s and d/s, they create an impediment to the u/s and d/s migration of fish, particularly in low flows. Juvenile fish dropping down the river are often deterred by such structures, delaying their progress d/s and making them an easy target for predators.

Photo 45. The weirs are also an unnecessary obstacle to u/s fish migration (54.004334, -6.578381). Contrary to common belief, migration doesn't just occur at high water. In the absence of obstacles, most fish (particularly sea trout) will move as and when they need to, on little or no increase in water. Creating unnecessary barriers can therefore greatly impact upon the distribution of fish through a system, delaying them from reaching their spawning areas and negatively impacting their populations.

Photo 46. D/s of Inniskeen, areas of main channel with potential for salmonid spawning were observed. Here, the extra width created by an old fording point has facilitated the retention of suitable substrate.

Photo 47. If any redd counting is undertaken on the river, this location would be a good spot to check (53.995873, -6.558588).

Photo 48. Increased deposition d/s of the old ford has also led to the development of a small, vegetated island which adds valuable diversity and focuses low flow down the LB side.

Photo 49. Note how the flow focussed down the LB side of the island maintains a deep pool through scour, without the need for an artificial impoundment. That increased depth will be naturally maintained long-term, unlike the short-term depth created u/s of a weir.

Photo 50. The heavily straightened, steepened and incised channel d/s, tight alongside the old railway line, has limited deeper water for adult salmonid habitat but provides some good niches for juvenile fish. The channel is slightly over-shaded by the tree canopy enveloping the lowered channel, but for such a short section it is not a major problem.

Photo 51. Away from the old railway line, the channel retains more natural meanders and a regular pool and riffle sequence, providing habitat for all salmonid life stages. Low and trailing branches provide valuable shade and cover.

Photo 52. Poorer quality habitat and increased erosion are associated with a drinking bay/fording point (53.993025, -6.555733). The crossing may be required to facilitate grazing at either side of the river, but livestock should be excluded when it is not in use (e.g. by simply grazing the fields independently, only opening the crossing to move stock from one to the other).

Photo 53. Sections of channel d/s appear to have also been straightened (possibly for agricultural purposes). Fortunately, in-channel habitat quality remains relatively good, with healthy bankside vegetation and trees. However, alder disease (*Phytophthora alni*) becomes increasingly apparent with progression d/s. This issue should be monitored, with dead trees being replaced with alternative species if areas suffer badly.

Photo 54. Where bends are present, the natural reduction in channel width creates depth through bed scour, producing high quality adult fish habitat. In this example, the only thing missing is low-level cover which could be provided by planting a willow shrub along the RB. In this instance, small, shrub species such as goat willow or grey willow would work best.

Photo 55. A track crossing and slatted farm bridge creates a small pollution issue but as the track is pretty much disconnected from the bridge, the issue is limited (53.986492, -6.554433). Small cross drains could be cut into (or raised across) the track on LB side to ensure that surface runoff from the hill drains to rough ground, not the watercourse.

3.2 Fane River - County Louth Reach – DBT&SAA Water

Photo 56. The top of the track leading to the slatted bridge (depicted in photo 55) at Fane Farm in the background. Track and field drainage (and associated sediments) could be intercepted and diverted into the ditch system in the foreground.

Photo 57. Deep, well covered pool habitat (53.983335, -6.551503) in the meandering reach above Fane Farm. A comparatively rare habitat for the Fane.

Photo 58. Good holding water for salmon and sea trout.

Photo 59. Maintaining lots of tree shading is particularly important over pool habitats.

Photo 60. A long, straight section of channel (53.983335, -6551503) lacking any significant pool habitat. Previous channel straightening, fallen tree removal and bank protection are usually the reasons why pool habitats fail to develop. Opportunities exist for tree hinging to promote a meandering thalweg at the very least.

Photo 61. Occasional inspection of the riverbed usually revealed evidence of a rich and prolific fauna of macroinvertebrates, cased caddis in this particular example.

Photo 62. Significant filamentous algal growth on bed rock indicates a high nutrient loading, possibly via agricultural diffuse pollution.

Photo 63. Another section of wide, featureless glide, lacking the cover and diverse flow patterns attractive to fish. Planting of the occasional shrub willow species in such areas would be beneficial.

Photo 64. By contrast, sections of channel in the reach running down towards Castlering support high class habitat, particularly for trout.

Photo 65. A long riffle habitat, with well-vegetated margins is likely to be a wonderful habitat for trout and salmon parr. Providing plenty of direct sunlight to shallow riffles and glides helps improve productivity but keeping long sections of tree shading is also important to maintain cool, adult fish-holding water.

Photo 66. Another example of high-quality habitat with luxurious beds of water crowfoot *Ranunculus* sp. in mid channel locations, with good holding water provided by over-hanging cover adjacent, along the LB.

Photo 67. A great example of valuable fallen tree cover helping to collect sediments (note emergent reed growth behind). A cover log for a trout and a large meal for grazing invertebrates - trees like this must be left untouched if optimal habitat quality is to be maintained.

Photo 68. Low, wet margins supporting luxurious beds of reed canary grass *Phalaris arundinacea*. Margins like this provide superb bank protection, cover for fish and, crucially, habitat for the adult stages of many species of river flies. Note how the naturally squeezed channel width also maintains flow energy, helping to sweep fine sediments from the gravel bed. A good example of high-quality habitat.

Photo 69. A large maize field located on a sloping meadow with a wholly inadequate buffer strip adjacent to RB just upstream of Castlering bridge (53.974340, -6.629830). Unless a cover crop is quickly planted post-harvest, this meadow will lose significant quantities of nutrient rich soil to the river over the winter period.

Photo 70. The same maize field a short distance above Castlering bridge, clearly showing the proximity of this crop to the river. An urgent dialogue is needed to encourage the farmer to give adequate protection to the river by leaving a much wider un-cultivated field margin.

Photo 71. Large willow across the full channel width just downstream of the Ballykelly confluence. Removing the top third of the fallen tree and leaving the rest in situ will create a lovely habitat feature.

Photo 72. One of several low stone weirs in the Castlering to Knockbridge reach. Notching out a 2m wide gap to bed level would reinstate sediment transport and create an attractive flume for fish holding. Ideally, the gap should be on the side of the river where the flow velocities are potentially the fastest (outside of any sweeping bend).

Photo 73. Habitat quality in the reach between Castlering and Knockbridge was generally very good. However, there were numerous opportunities to undertake some valuable tree hinging to create more in-channel habitat diversity and to open up one or two areas for increased light penetration.

Photo 74. The root plate of a large willow that has fallen away from the river. Great habitat and a favoured nesting site for kingfishers.

Photo 74. Beds of watercrowfoot were evident on the DBT&SFA water for the first time (e.g. none observed d/s). This plant is more prevalent in the reaches further upstream and is synonymous with high quality trout streams, providing cover fish and important habitats for specialised invertebrate species.

Photo 75. The section of river between Knockbridge and Castlering was extremely diverse and supported good examples of habitat suitable for all salmonid life stages. In this example, excellent parr habitat, with well-covered low natural margins and low overhanging willow likely to be valuable holding water for larger fish.

Photo 76. Where large crack or white willows fall into the river there are opportunities for further hinging to creating cover logs and natural flow deflectors.

Photo 77. The tail of smooth shallow glide with broken riffle below is likely to be a good spawning site. Retaining all the overhanging willow branches on the far margin is vital to provide cover for pre- and post-spawning adults.

Photo 78. Another low stone weir should be notched adjacent to the far LB to create an attractive run down under the far bank cover.

Photo 79. The far margin is defended with pitched stone. These should be removed to encourage bank and bed scour so that deeper pools can develop.

3.2 River Fane – Dundalk Salmon Anglers Association Water

Photo 80. Good spawning and nursery habitat for both salmon and trout at the very top end of the DSAA water, a short distance below Knockbridge. First class parr habitat made more valuable by the low trailing willow cover.

Photo 81. Lovely pool & run habitat within a sinuous planform – high quality habitat.

Photo 82. The next 250m of RB appears to be in single ownership and is blighted by poor management of the riparian zone (grazing and bank poaching pressures) with areas of the bank inappropriately defended with imported waste. The whole reach between 53.964985, -6.490593 and 53.963552, -6.485808 has examples of poor riparian management.

Photo 83. Discarded waste, stone and building materials presumably dumped in an ill-conceived attempt to reduce bank erosion pressures, initially caused by a lack of fencing and livestock access to the banks.

Photo 84. Further examples of inappropriate dumping of stone, presumably for ad hoc bank protection on a bank that doesn't really need protecting. It is possible these stones were removed from the riverbed.

Photo 85. A short distance downstream there was evidence of more substantial bank protection work using large pitched rocks for rip-rap adjacent to the LB. This would appear an excessive measure to reduce bank erosion when a simple stock fence and narrow buffer zone would have provided adequate protection - also cover and food for fish and invertebrates. Although it could be argued that pitched stone provides gaps and micro niches for small fish, it is a poor substitute for a naturally functioning “soft” margin and invariably leads to further erosion problems elsewhere.

Photo 93. A lovely deep holding pool for adult salmonids with valuable willow cover near the tail.

Photo 94. A great example of a partially fallen willow providing a brilliant marginal cover log. When these coincide with sufficient depth, they are hugely attractive to fish. Such features are often utilised by sea trout laying up during the day and can be a great means of increasing fish holding water, spreading fish throughout a river rather than restricting them to the few deeper pools/bends.

Photo 95. An old stone weir with the centre blown out: a much better outcome for the river. In such scenarios, it should be ensured that the foundations of the weir are also dislodged/removed to allow bed scour and depth creation.

Photo 96. Stock fencing and some tree planting (mainly hornbeam) has been undertaken adjacent to the RB. This is much more sustainable bank protection work and provides a fish-friendly river margin.

Photo 97. Yet more inappropriate bank protection, this time using waste concrete adjacent to the LB. It appears that the small meadow beyond has been raised and drained. Unfortunately, bank work like this will interfere with natural river processes. The reluctance to allow any lateral movement in this channel over the years has greatly degraded the river's natural morphological features, particularly deeper pool habitat, which are at a premium in this reach. This is a problem when the section is specially preserved for salmon fishing, where deeper fish-holding water is required.

Photo 98. Long sections of this lower river are remarkably straight. This is un-natural for the mature phase of a river where the bed gradient has reduced. The lack of a twisting, meandering planform has left the channel remarkably bereft of deeper pool habitat. Local information suggests the river has not been dredged or modified in recent memory, although it is highly likely that the river is artificially modified, perhaps back in the 1800s or earlier.

Photo 99. A better-sized buffer meadow between the riverbank and the start of the arable meadows on the valley sides. This would be considered good practice riparian management.

Photo 100. A dark avenue of dense shading around 53.958713, -6473519 is thought to be associated with ornamental planting in the grounds of the old derelict house, which sits back on the northern ridge. These horse chestnuts are an inappropriate riverside tree. The conkers themselves if crushed produce saponin, which is a highly toxic piscicide. Any horse chestnut that drops fruit on a farm access track for instance, where conkers might be prone to crushing, should be carefully assessed to ensure any run-off does not enter any nearby stream or river.

Photo 101. Another non-native legacy from the old estate, although not usually categorised as an "Invasive Non-Native Species": bamboo is nevertheless not native, highly invasive and undesirable as a riverside plant (53.957863.-6.470611).

Photo 102. However, banks lined with native willow are desirable and provide great opportunities for locally adapted native invertebrates (fish food) as well as fish cover and root systems that bind in bank soils.

Photo 103. Again, in some areas, essential buffer zones between sloping arable fields and the river were completely missing (53.958030, -6.470700). In this case, a large field running down below the derelict manor house.

Photo 104. Yet another low stone weir is present on this reach (53.957936, -6.467749). Creating a 2m wide notch to be level is recommended.

Photo 105. It was noted on this reach that alder trees in particular were suffering from disease (far right of picture). Consider coppicing trees with any early signs of *Phytophthora* (sooty marks on the bark) which is a fungal disease and particularly impacts river-side alders. Early coppicing can sometimes save the tree and its valuable root system.

Photo 106. The chamber to the public water supply abstraction near the bottom of the beat (53.954030, -6.460303). The author was surprised to find that there were only trash screens and appeared to be no fish barriers or behavioural screens installed. It is highly likely that this intake will be entraining smolts and eels on migration. Dialogue is required to establish if screens are fitted and if not, lobby for urgent mitigation.

Photo 107. The long concrete channel constructed at the downstream end of the abstraction appears set up for flow gauging. It would be worthwhile ascertaining whether the data are available to the club. Dialogue with the regulators and water company might also identify if the long section of sterile channel could be improved via box planters to provide shade and cover without interfering with the laminar flows within the gauging box.

Photo 108. The DSAA hatchery building: it is understood that the hatchery has not been used for several years. The WTT position on hatcheries and local broodstock schemes is unequivocal and based on sound science collected from numerous schemes operated around the world. The overwhelming evidence suggests that at best hatchery schemes don't help to improve runs of wild salmonids and at worst are just another negative impact upon the wild population. The WTT recommends that the club keeps the hatchery closed and redoubles efforts to improve river habitats as the best methods for supporting Fane salmon and sea trout runs.

Photo 109. The crump weir/fish counter located a short distance downstream of the abstraction point (53.9536604, -6.4580669) raises a number of questions:

- Is the crump weir/impoundment an integral part of the licenced abstraction? If it isn't associated with the abstraction, then it begs the question of why the fish counter has to sit on such a high impoundment?
- It is possible the impoundment originates from the flow gauging installation (either at the crump weir itself, or possibly via electromagnetic/hydro-acoustic gauging equipment located upstream), either independently or as an intrinsic part of the pumped abstraction, which could be more problematic to address, but certainly not impossible. Even so, modern flow monitoring technologies can gauge flows without the requirement for such an intrusive structure.
- Are the data collected from the fish counter regularly shared and used for management action? And, could alternative methods of fish population assessment be employed which do not require a major barrier to fish migration and sediment transport? The answer is almost certainly yes.

Larger migratory salmonids will be able to negotiate the fish counter during higher flow conditions, when the water depth over the weir increases and elevated tail-water heights reduce the step over the weir. But prolonged periods of even normal flows from say mid-April through to September, will render this structure a massive challenge to fish passage, upstream migrating fish deterred and forced to simply drop back downstream. Any such delays potentially put migratory fish at increased risk from stress and predation and may prevent them from reaching their destination within the vital timing window. The high potential for increased predation on downstream migrating juvenile salmonids delayed upstream of the weir, within the long, impounded reach must also be considered.

WTT recognises the valuable contribution that robust counter data can make to the overall monitoring and management of a salmonid fishery; however, collection of those data must not be at the expense of natural, sustainable river habitat or the migration and dispersal of the very fish populations that are being monitored.

4.0 Clarebane River

Photo 110. The furthest u/s point on the Clarebane River inspected was from the d/s end of Lough Muckno (54.099832, -6.676972). Livestock are grazed on the LB but there is at least a small buffer strip.

Photo 111. The dam just d/s of Lough Muckno (54.099668, -6.67637) regulates flow in the Clarebane River. The overspill of the weir and narrow approach create an obstruction to fish movement u/s and the abrupt lift and flow constriction almost certainly inhibits d/s fish migration, particularly for smolts whose run-timing can be critical for successful seaward migration. Again, the delays also increase predation and disease risk.

Photo 112. The air behind the over-spilling water prevents fish from swimming up through in the water column, requiring a well-timed leap to ascend the structure. The heavily aerated water immediately d/s also reduces the amount of force fish can create within the water to make the jump (i.e. the high content of air bubbles means there is less resistance for the fish to drive forward from).

Photo 113. Looking at the d/s side of the structure: it appears some flow is also passing under the weir. This may provide some potential for fish passage, at certain times, but undershot structures are notoriously poor at facilitating d/s fish passage. Note the high turbidity of the water. Much of this is suspected to be algal/diatom growth, potentially indicating the enrichment/eutrophication recognised in the river system.

Photo 114. D/s of the weir, the artificial, straightened, uniform width and heavily incised channel offers poor habitat for flow-loving salmonids. Occasional overhanging trees provide some cover and refuge butt the area is better suited to course fish. Introducing more structure into the channel here could improve the flow characteristics and fish-holding potential.

Photo 115. Further d/s, just u/s of the L4400 road bridge (54.09279, -6.66574), habitat quality begins to improve, with a more varied channel width and depth, areas of shallower-water and increased flow diversity. Healthy riparian vegetation provides good marginal habitat.

Photo 116. D/s of the road bridge, the addition of more low-hanging trees creates ideal adult trout habitat, with several observed. While the low branches may make casting tricky, they greatly enhance the angling opportunities of the area which undoubtedly supports greater numbers and sizes of fish than it would without such cover.

Photo 117. Increased gradient and flow diversity create a range of pool and riffle habitat, with valuable pocket water among areas of bedrock.

4.1 County Water

Photo 118. A section of the County Water was walked d/s from around 54.140357, -6.640045. Here, gravel and cobble riffles create valuable potential spawning habitat, particularly for larger migratory salmonids. However, grazing is leading to a lack of riparian vegetation, erosion and poorer habitat than could be achieved through livestock exclusion.

Photo 119. An old meander in the river course (blue arrow) was observed in the field but is now disconnected from the watercourse and is highly suggestive that the channel has been straightened (54.1400448, -6.6409435). This kind of feature can be reinstated as part of a river restoration scheme, but that requires landowner buy-in to the scheme.

Photo 120. Active sediment transport is creating valuable bed erosion and deposition, facilitating a varied channel profile and niches for a range of fish ages, along with potential spawning riffles.

Photo 121. Un-natural bank erosion created by livestock access is not beneficial and is contributing to greatly increased fine sediment input that can clearly be seen smothering the bed (54.139115, -6.640402).

Photo 123. Around 54.139052, -6.640593, what appears to be a weir is actually the remains of failed bank protection, where the river has broken through from its previous course (blue arrow). Flow is now being directed into the bank by the failed revetment which acts as a flow deflector, which will be a particular issue at high flows. Consequently, the bank d/s is eroding at an accelerated rate.

Photo 124. D/s of the road bridge (54.13813, -6.639995), a drinking bay creates typical bank erosion issues. Interestingly, the erosion and widening at that point has subsequently led to deposition of fine material supplied from u/s (red circle), highlighting the over-supply of fine material resulting from erosion from u/s too. Note the very silty bed and smothered gravel.

4.2 Ballykelly Tributary

Photo125. The Ballykelly stream was inspected either side of the road bridge at 53.970310, -6.559003 and further downstream from 53.972160, -6.532505 to the Fane confluence (53.972061, -6.524963). The stream is heavily modified and straightened.

Photo 126. The section u/s of the bridge runs parallel with an open farm track. The heavy vegetation here covers a high quality, gravel bottomed nursery stream that will support juvenile trout. The nature of the plants observed indicates a neutral to slightly alkaline environment, possibly limestone-based, suggesting that this should be productive. The plants will die back very quickly come the first frost, so intervention is not needed.

Photo 127. The stream running down from the bridge is shaded but provides excellent in-channel cover for fry and parr.

Photo 128. An inspection of the bed highlighted the presence of a heathy invertebrate community, including fairly sensitive species such as olive nymphs (*Baetis* spp.).

Photo 129. The vast majority of the Ballykelly stream has been straightened and dredged but, on the positive side, most of it has been fenced and the extensive riparian cover provides protection for the offspring of fish that manage to run this stream for spawning. What is likely to be lacking is the diverse morphology associated with an unmodified stream. This is a common reason why this, and many other Fane tributaries, are not meeting their full potential as spawning and nursery streams.

Photo 130. A section of the lower Ballykelly with pitched stone revetment, a legacy of enthusiastic modification**.**

Photo 131. The confluence of the Ballykelly with the Fane: the bed of the stream here is considerably higher than the bed of the main river. All three of the tributaries inspected that join the Fane in the Castlering to Knockbridge reach were similar, suggesting that sediment transport is arrested when the main river is in flood, resulting in disposition of coarse bed sediments in the straightened, lower tributary reaches.

Photo 131. These small side streams and tributaries are critical to the overall productivity of the Fane system. Opportunities to restore them should be explored, with priority given to this stream, which appears to have the most reliable flow. In this case, any project to restore more natural morphology and river processes should begin at the d/s end to provide enhanced spawning and nursery opportunities for fish migrating into the system.

4.3 Carrickrobin Tributary

Photo 132. The Carrickrobin tributary has been horribly abused with inappropriate channel modifications and culverts.

Photo 133. 53.978724, -6.517539 is the point at which the Carrickrobin disappears from view into a >100m-long culvert. This is likely to be a behavioural barrier to fish on spawning migrations, even if the culvert is not also a physical barrier to migration.

Photo 134. The Carrickrobin flows beneath this meadow. An average grazing meadow and no justification for committing the stream to a subterranean existence.

Photo 135. The water in this particular stream was very clear and may be a limestone groundwater source. Like all the tributaries inspected, the Carrickrobin is gravel-rich and, like the Ballykelly, the confluence with the Fane discharges over a plug of coarse gravels, suggesting that the bottom section of the stream backups during local spate conditions.

4.4 Halftate Tributary

Photo 136. The Halftate was inspected at various locations in the meadows rising up above the Fane confluence at 53.972776, -6.500684. The stream has been dredged and straightened and is set well down in a deeply-incised channel, making inspection and assessment of habitat quality difficult.

Photo 137. Along much of its length, this stream is fenced off from livestock access although the example above clearly demonstrates what happens when cattle have access for drinking.

Photo 138. Another example where cattle have access to the stream, a short distance from the Fane confluence. Large densities of shrimp *Gammarus pulex* where found here, which often indicates enrichment, potentially even significant eutrophication**.**

Photo 139. Judging by the number of caddis found here there will be no local shortage of sedge hatches. A proliferation of caddis numbers relative to the numbers of mayfly species can also indicate enrichment. Taken with the high numbers of *Gammarus*, there is good cause for further investigation.

Photo 140. More evidence of the calcareous nature of these tributaries and the influence of local limestone geology was evident from tufa (calcium carbonate precipitation) on some of the gravels. This can be an issue for spawning success in certain scenarios where it occurs at a rapid rate and gravels can become naturally cemented, making redd cutting difficult. However, that is only evident in a small number of locations globally and mitigation is unlikely to be required in this case; it is simply a useful indication of elevated alkalinity.

5.0 Summary

The two large loughs situated at the head of the Fane system are likely to have a massive influence on the water quality and hydraulics of the entire system. In a changing climate, the ecology of anthropogenically modified loughs will have an increasing influence upon the health of the rivers below. It is therefore essential that measures are taken to reduce enrichment by influencing local catchment land use and pushing for higher standards of domestic water treatment.

It is understood that the loughs are currently mixed fisheries: subtle changes to those fish communities could trigger huge changes in water quality. For example, an increase in zooplanktivores (like roach and many other coarse fish) could potentially lead to overgrazing of those invertebrates which themselves feed on phytoplankton (algae), reducing the natural nutrient cycling and potentially leading to increased algal blooms. Increased biomass of larger benthic feeding species such as bream can also result in the nutrients locked-up in the bed material being made more readily available, with similar long-term consequences. If triggered, algal blooms could have a significant impact upon water clarity and quality, particularly as those blooms die off and decompose within the lough (or river), with impacts throughout the system downstream.

The slow but insidious process of nutrient enrichment and increasing water temperatures could potentially lead to a tipping point in the fish community and these issues must be mitigated. Ensuring the highest possible quality of water entering the loughs will not only regulate the available nutrients (preventing enrichment) but also reduce the potential for proliferation of cyprinind fish species; instead favouring predatory, site feeding species like trout, pike and perch. The increase in water temperatures is a broader issue but can be mitigated somewhat by tree planting on open river sections and tributaries to improve the balance of light and, importantly, shade.

Lessons learnt from other large stillwater systems suggest that robust monitoring and early intervention can halt the slide into algal dominated environments. Clubs and landowners should therefore be asking the regulators and lough owners to set up robust monitoring and management regimes, specifically designed to reduce nutrient enrichment and initiate better recycling of nutrients on the Fane system, both naturally and through improved water treatment.

The habitat quality on long reaches of the Fane River is good. The underlying geology and catchment land use appears to be river-friendly (with a few notable exceptions), with healthy buffer strips providing valuable riparian habitat in many sections. The river system appears to be naturally productive, both in terms of its water quality/chemistry but also habitat availability and quality, aided by naturally available gravels that are ideal for salmonid spawning and provide high quality invertebrate habitat.

The sections of river that have largely escaped channel modifications are in the best condition; however, like so many other rivers in Ireland, long reaches have been re-aligned and bank protections put in place, with the nett effect of reducing morphological diversity and impacting on habitat quality and availability.

Attempts to create increased depth have previously been made by the construction of numerous low stone weirs and flow impoundments. These have often had the opposite effect, with long sections of deposition in the reaches immediately upstream of these various structures and sometimes increased bank erosion pressures downstream, often resulting in the construction of inappropriate bank defences. Invariably, these weirs should be removed, or at least notched to bed level, to allow sediments to pass through and bed scouring to create pool habitat downstream - as well as facilitating vitally important fish passage for all sizes of fish. More aspirational habitat improvement schemes to reinstate the natural bends back to the river, or to allow them to develop through erosion in areas of low-grade land would be an excellent way of naturally reinstating and maintaining pools and depth variation.

Long sections of river are now protected from grazing pressure via extensive stock fencing. In the areas where more generous buffer zones have been established, habitat quality has responded favourably. Where riverside meadows are being utilised as arable fields too close to the watercourse (or connected ditches), they will undoubtedly increase diffuse pollution pressures and nutrient enrichment, as well as risks associated with pesticide use. Urgent action is needed to open a dialogue with local farmers to identify sediment pathways and agree run-off interception measures (minimum-tillage and contour ploughing) plus much larger buffer zones to mitigate for the adjacent land use.

Overall, the river supports a good balance of both direct sunlight and shade, with in-channel weed growth responding well, particularly in the more open reaches upstream of Knockbridge. The more shaded areas are also highly valuable in regulating water temperatures to prevent excessive summer temperatures. Opportunities to utilise some of the marginal tree cover for hinging into the river margins coupled with the installation of large woody flow deflectors will promote increased channel sinuosity, as well as the development of new pool habitat. However, the work must be carefully managed to avoid a negative impact upon the existing areas of good shade and structure.

Habitat availability and quality in the smaller tributaries is often compromised by previous channel modifications. These streams still provide opportunities for juvenile fish but restoration projects to create a more sinuous planform and diverse bed topography would increase their contribution. Removing the numerous mana-made obstructions would also help.

Photo 141. Example of a live willow hinged into the channel which will promote diverse changes in the bed shape of the river and provide cover for fish.

There was evidence of significant tree disease, particularly of alder. Trees showing early signs of disease should be winter coppiced, which can in some cases preserve the trees valuable root systems. Trees in more advanced stages of disease, or already dead, should be left as they create valuable habitat for invertebrates and birds. A plan to plant new trees should start now, particularly in the more open areas, or where bank erosion is deemed an issue. A move towards planting local native species that are currently doing well is advisable and trees that provide low, bushy cover such as goat willow and hawthorn would be wise choices, especially when planted just above mean water levels in the face or toe of existing banks.

The bottom section of river controlled by the DSAA could be significantly enhanced to create improved opportunities for both salmon and sea trout. There appears to be no local knowledge of the river being dredged or modified, but the existing river channel is unnaturally uniform in many areas and there are clear indications of artificial straightening (and cut-off meander loops) visible on Google Maps (aerial photography), albeit likely to have occurred a long time ago. As a result, the reach lacks many of the deep, attractive pools with energetic throats, deep bellies and long tail glides, with well-covered margins it would have once possessed.

It is highly likely that the construction of the weir, now used for fish-counting at the bottom of the reach, has significantly impacted the lower half of this beat, reducing its ability to form diverse habitat. The drinking water abstraction, weir, flow gauge and fish counter are having a huge impact on this sensitive stretch of the river. The provision of secondary screening of the structure, in addition to simple trash screens, is essential and likely to be required by law. There is a chance that these screens are in place, or are planned; however, they were not evident during this walk-over survey. Rotating drum-style wedge-wire screens are the industry standard for abstraction points on rivers that support migratory salmonids and eels. It is therefore recommended that all angling clubs call for urgent improvements to screening.

Good quality data gathered from fish counters can be of enormous value to regulators and clubs. On the Fane, it is not apparent if such data are available and shared or, indeed, if the counter is fully functional. It is recommended that the clubs open a dialogue with the regulators to explore options for gathering fish population data and improving information sharing. Furthermore, the weir at the counter is a significant barrier to free fish migration and will significantly impact downstream sediment transport, over time creating siltation problems for the u/s reach. We suggest that the regulators be encouraged to consider alternative fish population monitoring options that do not require a significant step in the bed height and obstruction of the river.

Finally, the presence of the old fish hatchery was noted. The WTT strongly recommend that clubs resist any call to recommission the hatchery, this would be counterproductive to the development of a healthy wild salmonid fishery. Instead, improving wild salmonid populations through a programme of fish passage improvement and habitat restoration that will naturally boost smolt output is highly recommended. Further information on the pitfalls of fish stocking and hatchery schemes can be provide upon request from the Wild Trout Trust.

6.0 Recommendations

6.1 Issues and observations

6.1.1 River Fane

Observation	Photo (If required)	Priority (1-3)	Location	Proposed action
Weir – attempts to rebuild the structure	 Photo 1	1/2	54.059055, -6.647277	Ensure that the obstruction is not rebuilt.
Straight, uniform channel	 Photo 8	2	54.039103, -6.626745 to 54.0352583, -6.6224367	Planting and laying the occasional willow shrub. **From around this point, there is also potential for a more aspirational channel restoration scheme to reinstate some of the lacking meanders to the channel in the rough land to the RB.**
Poaching of a tributary (LB)	 Photo 10	1/2	54.0364133, -6.6234633	Replace the drinking bay with an alternative watering source (pasture pump, solar pump, ram pump etc).

Weir	 **Photo 12**	2	54.0339750, -6.6217200	Notch 1-2 metres of the weir down to bed level at the RB side, to create a flow deflector (rather than a weir). Alternative livestock watering is likely to be required.
Artificial structures interfering with the river's natural flow	 **Photo 14**	2/3	54.0322583, -6.6199483	Remove the structures and employ more natural techniques like tree laying.
Reduced flow side-channel (LB)	 **Photo 17**	2/3	54.0310733, -6.6191033	The obstructions at the u/s and d/s end of the side-channel could be reinstated, with flow prioritised there to create a more sinuous channel. As a bare minimum, excluding livestock from the side-channel would be beneficial.
Open section could be improved by increasing in-channel structure	 **Photo 18**	3	54.0310733, -6.6191033 to 54.029942, -6.616602	Following guidelines set in the habitat techniques section, identify suitable trees for hinging or coppicing to provide material for a lodged flow deflector.

Reduced flow side-channel	 **Photo 19**	2	54.0352583, -6.6224367	The obstructions at the u/s and d/s end of the side-channel could be reinstated, with flow prioritised there to create a more sinuous channel.
Small weir	 **Photo 24**	2	54.027212, -6.612428	Notch 1-2 metres of the weir down to bed level at the LB side, to create a flow deflector (rather than a weir).
Small weir	 **Photo 25**	2	54.025323, -6.609878	Notch 1-2 metres of the weir down to bed level at the RB side, to create a flow deflector (rather than a weir).
Potential for laying willow into channel	 **Photo 26**	3	54.025323, -6.609878	Lay some of the willow branches into the channel to act as a natural flow deflector.

Small weir	 **Photo 27**	2	54.025047, -6.609297	Notch a 1-2 metre portion of the weir down to bed level.
Bank revetment	 **Photo 28**	2	54.024075, -6.606928	Remove the bank armouring to allow natural channel migration.
Livestock access (LB and crossing to RB)	 **Photo 30**	2	54.021845, -6.603547	Exclude livestock. This will require discussion with the landowner.
Larger weir	 **Photo 31**	2	54.020598, -6.60211	Ideally the RB side of this weir should be removed to encourage flow along that side of the channel. This weir is more substantial, and the task is more difficult than with the previous weirs u/s, potentially requiring machinery or a long-term strategy of removing a bit at a time by hand.

Livestock access and degradation of the riparian vegetation (RB)	 **Photo 34**	1/2	54.019797, -6.601495	Reinstate the buffer fence.
Island / split channel	 **Photo 35**	3	54.019155, -6.600215	As with other similar features, there would be benefits to consolidating the flow down one bank side to accentuate the bend. However, owing to the heavily degraded nature of this section, this would be a lower priority.
Drinking bay (RB)	 **Photo 36**	2/3	54.018498, -6.598745	Provide alternative watering.
Livestock accessing both banks from the LB	 **Photo 37**	2	54.016123, -6.597485	Install buffer fencing.

Large, partially-breached weir	 **Photo 39**	2	54.01271, -6.595992	Notch at least a section of the weir to bed level.
Small weir	 **Photo 41**	2	54.01083, -6.598303	Remove a portion of the weir to bed level.
Large weir	 **Photo 42**	1/2	54.004066, -6.582740	The weir should be removed or at least notched down to bed level.
Large weir	 **Photo 45**	1	54.004334, -6.578381	The weir should be removed or at least notched down to bed level.

Crossing point / drinking bay	 **Photo 52**	2	53.993025, -6.555733	Use as crossing point only, with livestock excluded from the watercourse and banks when not in use.
Alder disease	 **Photo 53**	1	Throughout the river.	Monitor trees on the river and replace dying alders by planting with other species. Winter coppice selected trees if the disease is identified early.
Track crossing and run-off	 **Photo 55**	2	53.986492, -6.554433	Farm infrastructure improvements including diversion of surface run-off to rough ground.
Track crossing and run-off	 **Photo 56**	2	53.986179, -6.553918	Divert surface run-off into ditch and rough ground.

Straightened channel	 **Photo 60**	2	53.983335, -6551503	Undertake selective tree-hinging or lodged woody material installation.
Inadequately buffered maize field	 **Photo 69**	1/2	53.974427, -6.530000	Initiate dialogue with farmer. Monitor and report if/when the suspected fine sediment pollution occurs.
Weir – impoundment to flow and sediment transport	 **Photo 72**	1	Several low weirs	Notch out a 2m wide gap to bed level into all low stone weirs. Select areas where flow velocities would naturally be at their highest.
Over-shading	 **Photo 73**	2	Numerous locations	Undertake tree hinging to increase light penetration.

Stone bank revetment	 **Photo 79**	1/2	Numerous locations	These should be removed to encourage bank and bed scour so that deeper pools can develop.
Poor land management and inappropriate bank work	 **Photo 82**	1	53.964985, -6.490593 to 53.963552, -6.485808	Enter discussions with the landowner to seek buffer fencing and cessation of bank work with waste material. If no improvement is achieved, report to the relevant authority (e.g. EPA in RoI).
Extensive horse chestnut growth and shading along the riverbank	 **Photo 100**	1/2	53.958713, -6473519	It would be beneficial to thin-out the trees and replace with alternative species.
Bamboo – non-native and invasive species	 **Photo 101**	1	53.957863.-6.470611	Eradicate the plant from the wild (e.g. riverbank).

Inappropriate land use/lack of buffer	 **Photo 103**	1/2	53.958030, -6.470700	Initiate dialogue with farmer. Monitor and report if/when the suspected fine sediment pollution occurs.
Weir – impoundment	 **Photo 104**	1	53.957936, -6.467749	Create a 2m wide notch to be level.
Public water supply abstraction point - lack of screening	 **Photo 106**	1	53.954030, -6.460303	Dialogue is required to establish if screens are fitted and if not, lobby for urgent mitigation.
Long concrete channel – poor habitat quality	 **Photo 107**	2	U/s of 53.954030, -6.460303	Contact the water company and regulator to ascertain whether in-channel improvements could be achieved with planters, without compromising monitoring at the site.

Weir – obstruction to fish passage	 **Photo 109**	1	53.953660, -6.458066	Ideally, options should be explored to monitor fish populations without the requirement for a weir and certainly without the current obstruction to fish passage and sediment transport.

6.1.2 Clarebane River

Observation	**Photo** (If required)	**Priority (1-3)**	**Location**	**Proposed action**
Obstruction to fish movement	 **Photo 113**	1	54.099668, -6.67637	Without details of how this structure is operated, it is difficult to advise but improvements to both u/s and d/s passage are likely to be required.
Artificially uniform channel - poor habitat quality	 **Photo 114**	2	D/s of 54.099668, -6.67637	Install tree kickers of other large, lodged woody material to provide in-channel structure and diversify flow.

6.1.3 County Water

Observation	Photo (If required)	Priority (1-3)	Location	Proposed action
Straightened channel sections	 **Photo 119**	2	54.1400448, -6.6409435	Potential for channel restoration/re-meandering.
Cattle poaching/bank erosion	 **Photo 121**	1/2	54.139115, -6.640402	Buffer fence the field and provide alternative watering system (pasture pump, solar pump ram pump etc.).
Failed bank protection	 **Photo 123**	2/3	54.139052, -6.640593	Remove the block stone and buffer fence the field to reduce erosion to a naturally low level.

Erosion at drinking bay	 **Photo 124**	2	54.13813, -6.639995	Provide alternative watering system (pasture pump, solar pump ram pump etc.).

6.1.4 Ballykelly Tributary

Observation	**Photo** (If required)	**Priority (1-3)**	**Location**	**Proposed action**
Heavily straightened and incised tributary	 **Photo 131**	2	Throughout tributary, particularly the lower reaches, towards the Fane confluence.	The creation of a series of sinuous pool and run features will provide improved holding opportunities for pre and post spawning adult fish. The WTT can help with simple enhancement designs. Prioritise the reach in the lower two meadows.

6.1.5 Carrickrobin tributary

Observation	**Photo** (If required)	**Priority (1-3)**	**Location**	**Proposed action**
Obstruction	 **Photo 132**	2	53.980446, -6.516709	Inappropriate crossing points like this should be removed, particularly if now redundant. If necessary, they should be replaced with a single, much larger, partially sunken (below bed level) pipe.
Culvert/buried watercourse	 **Photo 133**	2	53.978724, -6.517539	This tributary could potentially be restored to a surface watercourse, massively improving habitat quality and fish passage.
Straightened and incised channel		1	Whole stream but prioritise the lower 500m	Ripe for wholesale restoration to include the creation of a sinuous planform with pool and run features. A combination of raising the bed with imported gravels and reprofiling with tracked excavator required.

6.1.6 Halftate tributary

Observation	**Photo** (If required)	**Priority (1-3)**	**Location**	**Proposed action**
Drinking bays and associated poaching / erosion	 **Photo 137**	1/2	Throughout the Halftate tributary.	Engage with the farmers to seek alternative livestock watering (mains water or pasture, solar or ram pumps).
Suspected enrichment	 **Photo 138**	1/2	Throughout the Halftate tributary.	Undertake further investigation of the potential pollution sources (e.g. septic tank discharges and farm run-off).
Heavily modified channel		1	The bottom 500m	Ripe for wholesale restoration to include the creation of a sinuous planform with pool and run features. A combination of raising the bed with imported gravels and reprofiling with tracked excavator required.

6.2 Simple improvement techniques

6.2.1 Tree work

6.2.1.1 Tree laying

Laying the occasional suitable tree species down into the channel, as described for the willow in Photo 141, would be beneficial. This technique can be applied to trees and shrubs elsewhere on the river too.

6.2.1.2 Low cover

In areas where numerous uniform height/age trees line the bank, coppicing one or two trees could reinvigorate low-level bushy regrowth and increase the availability of fish cover. This should be undertaken sparingly and within the dormant season to reduce the impact on the trees and to nesting birds.

6.2.1.3 In-channel structure

Where multiple stems of alder or other trees are present, one trunk can be cut (with no significant detriment to the overall canopy or other habitats) and lodged between two or more other stems (Photo 142). This would complement the recommended coppicing work, utilising the material won.

Photo 142. A lodged flow deflector – the technique can be used with a single trunk or branch (primarily to increase scour) or a multi-branched limb (to create greater flow dissipation and more in-channel structure). The elevated butt end (bank end) reduces the potential for detrimental bank scour (usually associated with d/s deflectors) as a through-flow is maintained along the bank.

An alternative, nature-like, lodged flow deflector method that could be applied is equally simple but involves hooking one branch of a multi-stemmed branch around an upright tree (Photo 143). The example below uses a medium-sized branch, but any size of branch or tree can be employed providing the anchor tree is stable and of sufficient size.

Photo 143. A medium-sized piece of lodged woody material which is securely anchored in place against an upright tree.

7.0 Making it Happen

This type of walkover assessment is designed to identify the range and location of issues impacting upon selected underperforming watercourses. The report highlights potential solutions to the issues encountered and potentially provides supporting evidence for future projects and funding bids.

Further to this report, the WTT can undertake specific Project Proposals for the more complex issues highlighted, detailing exactly what is required and how the work can be undertaken. Those Project Proposals then often form the supporting documentation for any consent applications that may be required. The WTT has extensive experience in medium and large-scale river restoration and are happy to advise on the feasibility, planning and development of such projects, which can often appear a daunting task at first but are usually relatively simple, if a little slow in progressing.

The WTT website library has a wide range of free materials in video and PDF format on habitat management and improvement:

www.wildtrout.org/content/wtt-publications

We have also produced a 70 minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody debris, enhancing fish stocks and managing invasive species.

8.0 Disclaimer

This report is produced for guidance; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting upon guidance made in this report.