IFI/2015/1-4291

Environmental River Enhancement Programme

Annual Report 2014

IASCACH INTÍRE ÉIREANN
INLAND FISHERIES IRELAND

EREP 2014 Annual Report

Inland Fisheries Ireland & the Office of Public Works

Environmental River Enhancement Programme

Iascach Intíre Éireann
Inland Fisheries Ireland

OPW
The Office of Public Works
Oifig na nOibreacha Poiblí

Acknowledgments

The assistance and support of OPW staff, of all grades, from each of the three Drainage Maintenance Regions is gratefully appreciated. The support provided by regional IFI officers, in respect of site inspections and follow up visits and assistance with electrofishing surveys is also acknowledged. Overland access was kindly provided by landowners in a range of channels and across a range of OPW drainage schemes.

Project Personnel

Members of the EREP team include:

Prof. Martin O'Grady

Dr. James King

Dr. Karen Delanty

Rossa O'Briain

Brian Coghlan

1 Introduction

Since the early 1990's the Office of Public Works (OPW) has been in engaged in scientific studies with Inland Fisheries Ireland, IFI (formerly the Central Fisheries Board). The aims of such studies were to identify the environmental impacts of drainage maintenance in OPW channels and to develop alternative strategies that would facilitate environmentally friendly maintenance programmes. In recent years a number of legislative and national polices, such as the EU Water Framework Directive (WFD), the EU Habitats Directive and the National Biodiversity Plan have increased the need for the OPW to consider the ecology of the environment in which they work in. As part fulfilment of these issues the OPW initiated the current five year research project with IFI - Environmental River Enhancement Programme (EREP).

The programme has two major strands – one dealing with river morphology enhancement and the second dealing with the robust implementation of OPW's own environmental protocols on channel maintenance. The effectiveness of these two strands will be assessed through monitoring the impacts of the necessary physical works on the river corridor biodiversity and hydromorphology.

The biodiversity element of the project includes monitoring fish, hydromorphology and riparian and instream vegetation using the river corridor in an exclusive manner as part of their ecology. Examination of physical habitat factors and how these may also be impacted both by channel enhancement works and by proactive maintenance is a significant component, complementing the biodiversity studies.

River enhancement programmes are a capital works initiative whereby IFI design enhancement plans while OPW fund and undertake the works identified using their own resources including field staff and machinery. Work on enhanced maintenance is focused on increasing environmental awareness and improving the implementation (and further development) of the 10 steps of environmental enhancement amongst machine drivers. OPW have committed to achieving 100km of work programmes annually through both strands of the programme.

The Environmental River Enhancement Programme (EREP) is now in its second year of its second cycle (2013 – 2017). Throughout the current year the project made good progress addressing the aims and objectives initially set out, which included the following;

- To identify 100km of OPW channels for EREP annually.
- To select a number of these channels for capital enhancement works and a number for enhanced maintenance works.
- To undertake a biological monitoring programme across a range of these channels, addressing the impacts of works on the river corridor biodiversity and hydromorphology.
- To provide support and advice throughout the implementation period.
- To carry out external audits of machine crews engaged in routine maintenance.

As part of the 2014 programme approximately 128km of channel were identified for works through either enhanced maintenance or capital works programmes of which 32km were carried over from 2013 and 96km were new for 2014. In total approximately 61km of EREP works were completed during the 2014 period. All channels were walked and a written enhancement report provided to OPW. Monitoring of the physical habitat and biological elements pre and post works at a number of these channels, across all OPW regions, is on-going with a number of experimental works also being undertaken. These scientific studies aim to assess the effectiveness of such works on the river corridor biodiversity and hydromorphology. While data is collected annually on fish communities, riparian and instream vegetation, crayfish and lamprey, it is often more appropriate to have several years data available before a full account of impacts is presented.

Throughout the programme IFI acted as an external auditor in relation to site assessment, implementation of the 10 Steps to environmentally friendly maintenance and the implementation of OPW's own standard operating procedures (SOP's) and environmental protocols (OPW, 2011). Approximately one third of all OPW's drivers are visited annually.

The EREP project continues to contribute annually to the WFD, Eel Management and Invasive Species databases within IFI. It also provides data and information to a number of non-fishery agencies, including National Parks and Wildlife, BirdWatch Ireland (BWI), the National Biodiversity Data Centre and the National Botanic Gardens. Likewise, datasets relevant to OPW, e.g. catchment-wide larval lamprey (*Lampetra sp.*) distributions in drained catchments, are made available by the EREP team to OPW.

2 EREP Programme 2014

2.1 Introduction

The EREP programme continues to develop its two major strands – a capital enhancement works programme dealing with enhancement of OPW drained channels and an enhanced maintenance element dealing with the robust implementation of OPW's environmental protocols for channel maintenance. The capital works programmes involve importation of stone and gravels, diggings and placement of materials to create instream physical diversity and bankfull fencing on completion of the instream works. This approach to enhancement works is more specific than that for enhanced maintenance which primarily focuses on the implementation of OPW's own environmental protocols and where suitable and possible instream development work are carried out using available on-site materials. As such capital enhancement work programmes require a greater investment of time and resources for both OPW and the EREP team.

All enhancement works were carried out using OPW staff and machinery, with IFI's staff working alongside OPW supervisory staff, with a geographic spread throughout the three arterial drainage maintenance regions. All materials required for the construction of enhancement structures were supplied by OPW.

The main focus of the EREP is to achieve enhancement and environmental methods of work to maximise the environmental quality of the Irish drained river corridor while balancing the channel's drainage outfall and flood conveyance capacity. It provides a tool for Ireland to comply with the WFD legislative obligations for hydromorphology.

2.2 EREP Overview 2014

Throughout 2014 a wide range of river enhancement programmes were carried out through either capital works or enhanced maintenance, each involving a site specific plan of instream development work and/ or vegetation management. In total 22 individual catchments and 31 individual rivers were identified for enhancement works (Tables 2.1 & 2.2). The distribution of these works is shown in figure 2.1. A number of EREP projects were not achieved this year and where possible these channels will be included in the programme of works for 2015.

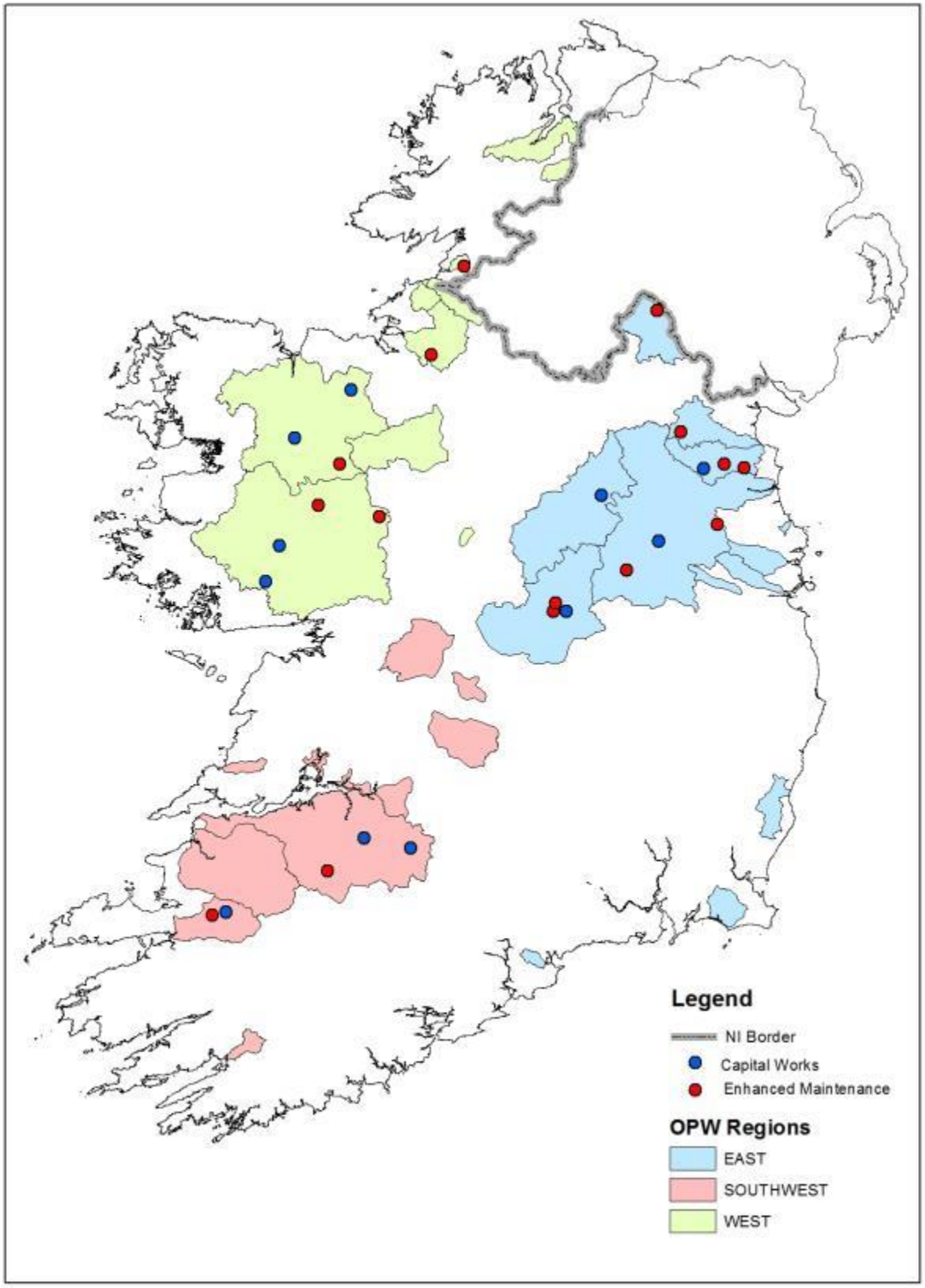


Figure 2.1. Location of Capital and Enhancement Works, 2014.

Table 2.1 EREP Capital Works for 2014

Region	Catchment	River Name	OPW Channel Code	Year of Plan	Work type	End of Year Status	Plan Length (m)
Southwest	Maigue	Camoge	C1/25	2014	CW	Complete	2000
Southwest	Nenagh	Ollatrim	C1/9	2013	CW	No	900
Southwest	Maine	Maine	C1	2014	CW/EM	Complete	800
Southwest	Feale	Galey	C1/18	2012	CW	No	200
Southwest	Feale	Shanow	C1/14	2012	CW	No	100
SouthWest Region Target 7km							**4000**
West	Moy	Moy MC upper	C1	2013	CW	Complete	2800
West	Moy	Straide	C1/23	2014	CW	Partial	2000
West	Corrib/Headford	Cross	CH8	2014	CW/EM	No	3500
West	Corrib/Headford	Cross	CH8/1/1	2013	CW/EM	Partial	2100
West	Corrib / Clare	Nanny	C3/18	2014	CW/EM	Complete	200
West	Abbey	Abbey lower mc	C1	2014	CW	No	1000
West Region Target 8km							**11600**
East	Boyne	Boyne MC	C1	2013	CW	Partial	4300
East	Boyne	Stonyford	C1/32	2013	CW	Complete	1300
East	Boyne	Kells Blackwater	C1/8	2014	CW	No	2700
East	Monaghan Blackwater	Monaghan Blackwater	C1/1/5	2014	CW	Complete	500
East	Inny	Glore	C50	2014	CW	Complete	2500
East	Dee/ Glyde	Dee	C2(1)	2014	CW	Partial	2800
East	Brosna	Brosna	C1(1)	2014	CW	Complete	300
East	Brosna	Tullamore Silver	C9(1)	2013	CW/EM	Complete	1000
East	Dodder	Dodder FRS	n/a	2013	CW	Partial	1000
East Region Target 10km							**16400**

Table 2.2 EREP Enhanced Maintenance for 2014

Region	Catchment	River Name	OPW Channel Code	Year of Plan	Work type	End of Year Status	Plan Length (m)
Southwest	Maine	Little Maine	C1/27	2014	EM	Partial	3000
Southwest	Magiue	Mahore	C1/25/23	2014	EM	No	2000
Southwest	Magiue	Clonshire trib	C1/17/11	2014	EM	No	4500
Southwest	Carrigahorig	Carrigahorig	C1	2014	EM	No	3000
Southwest	Deel	Deel trib	C18	2012	EM	Completed	3500
Southwest	Maigue	Gloshagh	C1/30	Repeat previous plan	EM	No	
Southwest	Feale	Douglas	C1/18/17	Repeat previous plan	EM	No	
SouthWest Region Target 21km							**16000**
West	Moy	Manulla trib	C1/21/1/5/18/3	2014	EM	Completed	600
West	Moy	Glore	C1/30	2014	EM	Completed	4000
West	Bonet	Bonet trib	C1/1	2014	EM	Partial	1400
West	Bonet	Bonet trib	C1/1/2	2014	EM	Partial	2000
West	Kilcoo	Kiltyclogher	C5	2014	EM	No	1700
West	Abbey	Abbey	C1	2013	EM	Completed	1000
West	Mask	Ballindine	CM4/34	2014	EM	Completed	1900
West	Duff	Duff MC -	C1	2014	EM	No	2000
West	Corrib Clare	Yellow	C3/35/11	2014	CW/EM	Completed	5000
West	Corrib Headford	Black	CH4	2014	EM	No	5600
West Region Target 24km							**25200**
East	Monaghan Blackwater	Monaghan Blackwater	C1/12	2014	EM	Completed	7000
East	Dee & Glyde	White R	C2(7)	2013	EM	Completed	3400
East	Dee & Glyde	White R trib	C2(7b)	2014	EM	Completed	2000
East	Dee & Glyde	Corkey R	C2(20)	2014	EM	Completed	3500
East	Glyde & Dee	Glyde trib	C44(3)	2014	EM	Completed	3000
East	Boyne	Skane trib	C1/12/1	2013	EM	Completed	2500
East	Boyne	Kinnegad	C1/44	2014	EM	Completed	5500
East	Boyne	Boycetown	C1/15	Repeat previous	EM	No	

				plan			
East	Boyne	Riverstown	C1/37/10	2013	EM	No	5000
East	Owenavorragh	Owenavorragh	C1	2013	EM	No	3600
East	Inny	Inny trib	C52	2014	EM	No	8000
East	Inny	Legan	C20	Repeat previous plan	EM	No	
East	Brosna	Brosna	C1(1)	2014	EM	Completed	5000
East	Brosna	Cloghatanny	C16/1	Repeat previous plan	EM	No	
East	Broadmeadow	Tributary	C1/6	2014	EM	No	6300
East Region Target 30km							**54800**

A summary of EREP targets and achievements is presented below in table 2.3.

Table 2.3. Summary of EREP Targets and Achievements for Capital Works and Enhanced Maintenance, 2014.

Capital Works	Target	Set	Achieved	% achieved of plans	% achieved of target
East	10	16.4	7.1	43	71
West	8	11.6	3	26	38
Southwest	7	4	2.8	70	40
	25	32	12.9	40	52

Enhanced Maintenance	Target	Set	Achieved	% achieved of plans	% achieved of target
East	30	54.8	31.9	58	106
West	24	25.2	12.5	50	52
Southwest	21	16	4	25	19
	75	96	48.4	50	65

3 Bio-diversity and EREP Monitoring

The EREP biological monitoring programme aims to assess the impacts of capital works and of routine environmental maintenance on the river corridor bio-diversity. Fish, flora, lamprey and crayfish (*Austropotamobius pallipes)*, along with physical changes are being monitored across a number of sites.

3.1 River Corridor Bio-diversity

Our monitoring studies have shown that the temporal response exhibited by the various river corridor elements, that we sample, can differ (EREP Annual Reports 2008 to 2013). Our results also indicate that often the changes seen across the whole site can be interlinked. Enhancement of the physical regime can greatly improve the channel diversity, through restoration of the riffle / glide / pool sequence, addition of spawning gravels and bank protection. Such changes can improve the fish carrying capacity of these rivers. Fish dynamics will alter in response to the newly created habitat, with changes to population structure and abundance often noted. Species composition may also be effected.

As the physical aspect of the channel changes in response to an altered channel form, there will be corresponding changes in the floral communities. For example the reintroduction of a proper thalweg may increase the gravelly nature of bed material in scoured areas encouraging the growth of species like *Ranunculus*. In contrast, in sections with increased sediment deposition one may see an increase in emergent plant species like *Phalaris* or *Sparganium*.

Often changes in the aquatic, marginal and riparian vegetation will influence changes in the macro-invertebrate communities. Increased vegetation cover and diversity will often correspond to increased invertebrate diversity and abundance. Both vegetation and the invertebrate fauna are important to the fish communities present in any channel.

However flora and fauna respond to change at differing rates. Some of the improvements mentioned may occur immediately, others over a number of years. For example it is not surprising to record increases in fish spawning and for older fish to move into deeper waters/pool areas almost immediately post works. The benefits to the floral and macro-invertebrate communities often take longer to materialise.

3.2 Biodiversity Monitoring

3.2.1 Robe River (CM4)

Biodiversity monitoring at Sheepwash Bridge has been ongoing since 2008. Capital works were undertaken during the summer of 2009. Below, the results in relation to channel vegetation, crayfish and brown trout (*Salmo trutta*) are detailed.

3.2.1.1 Flora

Monitoring of the channel flora at Sheepwash bridge has been ongoing since 2008. The tall emergent vegetation is predominantly comprised of *Scirpus lacustris,* and *Sparganium ercetum* with some *Phalaris arundinacea*. Capital works in 2009 resulted in a 32% reduction of tall emergent vegetation one year post-works (Figure 3.1). The decrease can be attributed to the construction of a series of stone deflectors at sites where tall emergent vegetation was previously present. In recent years, these deflectors have been colonised by terrestrial plant species that are tolerant of damp conditions (Plate 3.1). Following capital works, tall emergent vegetation has continued to occupy approximately 25% of the channel area year on year (Figure 3.1).

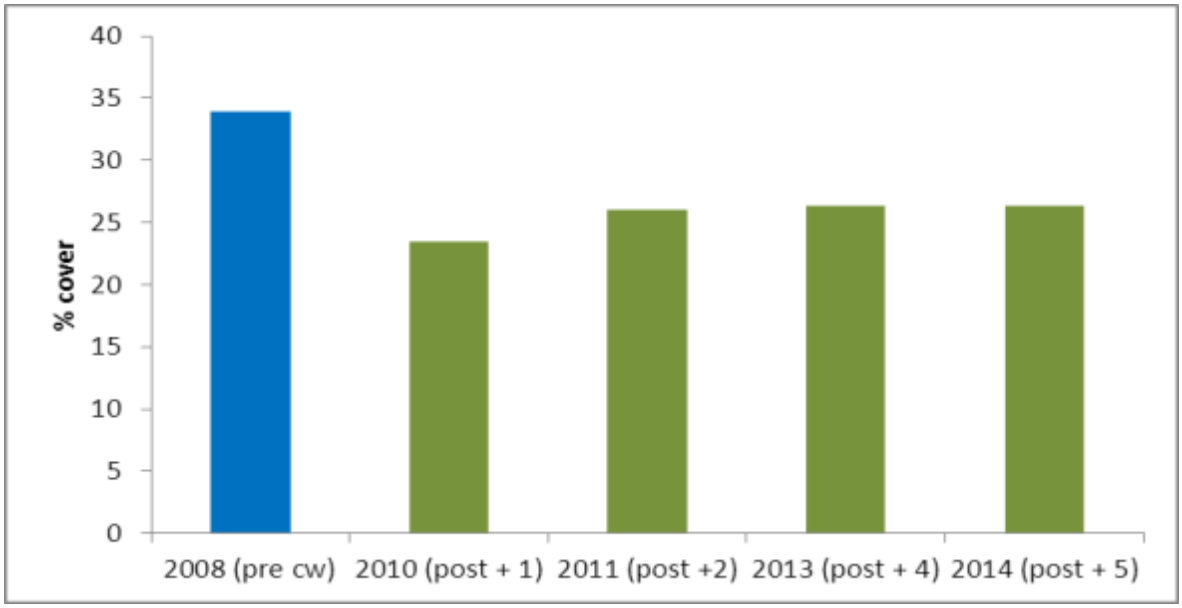


Figure 3.1: Tall emergent vegetation % cover pre and post works in the experimental site.

Plate 3.1: Deflector occupied by terrestrial grasses one year post works (2010).

Prior to 2013, tall emergent vegetation cover remained relatively unchanged in the control site (Figure 3.2). In 2013 maintenance work on the Robe main channel was carried out by an external contractor hired by OPW (as part of a benchmarking exercise) and as part of their drainage operations the control site downstream of Sheepwash Bridge was maintained. The extent of this maintenance work resulted in an 85% decrease in tall emergent vegetation (Plate 3.2). This reduction in tall emergent vegetation is not consistent with OPW's environmental protocol and has obvious adverse implications for other river biota including brown trout and crayfish. These are discussed below.

Figure 3.2: Tall emergent vegetation % cover pre and post works in the control site. Maintenance by the private contractor in 2013 occurred post the 2013 survey work. The experimental site was not maintained by the private contractor.

Plate 3.2: Robe control site pre works in 2013 (top) and post works in 2014 (bottom).

3.2.1.2 Robe Crayfish

Following capital works in 2009, crayfish numbers in the experimental site showed no significant change in any subsequent years (Table 3.1 and Figure 3.3). In contrast, the control site experienced a significant decline (Table 3.1) in crayfish numbers one year post capital works in 2009 and post maintenance works in 2014. It is not clear why crayfish numbers declined so severely in the control site after works carried out within the experimental site in 2009. One possibility is from additional silt deposits that might have occurred during the instream work phase carried out within the experimental site which was immediately upstream of the control site. Some literature suggests that excessive siltation can have a negative impact on crayfish populations (Holdich, 2003). The increased

siltation caused by excavation of pools and construction of deflectors upstream as part of the capital works programme may have impacted on crayfish downstream in the control site. One cannot rule out however the possibility that other land management activities or water quality issues may have contributed to the decline of crayfish within the control site between 2009 and 2014.

Excessive vegetation removal, carried out by the external contractor hired by OPW in 2013, is the most likely cause of the reduction in crayfish numbers in the control site in 2014 (Plates 3.1 and 3.2).This control site can now not be considered a 'control site' any longer. Tall emergent vegetation is an important component of crayfish habitat in Ireland and its wholescale removal represents severe habitat degradation from a crayfish perspective. Removal of vegetation upstream and downstream of the experimental will have caused crayfish throughout the channel to migrate to the experimental where refuges were still available (Peay, 2003) despite increased silt loads. 78% of crayfish captured in the experimental works site were in the fyke net closest to the control site (>200m) as evidenced by the very large standard deviation (Figure 3.3).

Table 3.1: Mann U-Whitney test comparing crayfish numbers pre and post works

Year	**Test**	**Experimental site**	**Control**
2009 v 2010	Pre V 1yr post works	not signif. (0>0.05)	*signif. (0>0.01)*
2010 v 2011	Pre V 2yr post works	not signif. (0>0.05)	not signif. (0>0.05)
2011 v 2012	Pre V 3yr post works	not signif. (0>0.05)	not signif. (0>0.05)
2012 v 2013	Pre V 4yr post works	not signif. (0>0.05)	not signif. (0>0.05)
2013 v 2014	Pre V 1-2months post works in the control	not signif. (0>0.05)	*signif. (0>0.01)*
2009 v 2014	5 years post capital works	not signif. (0>0.05)	*signif. (0>0.01)*

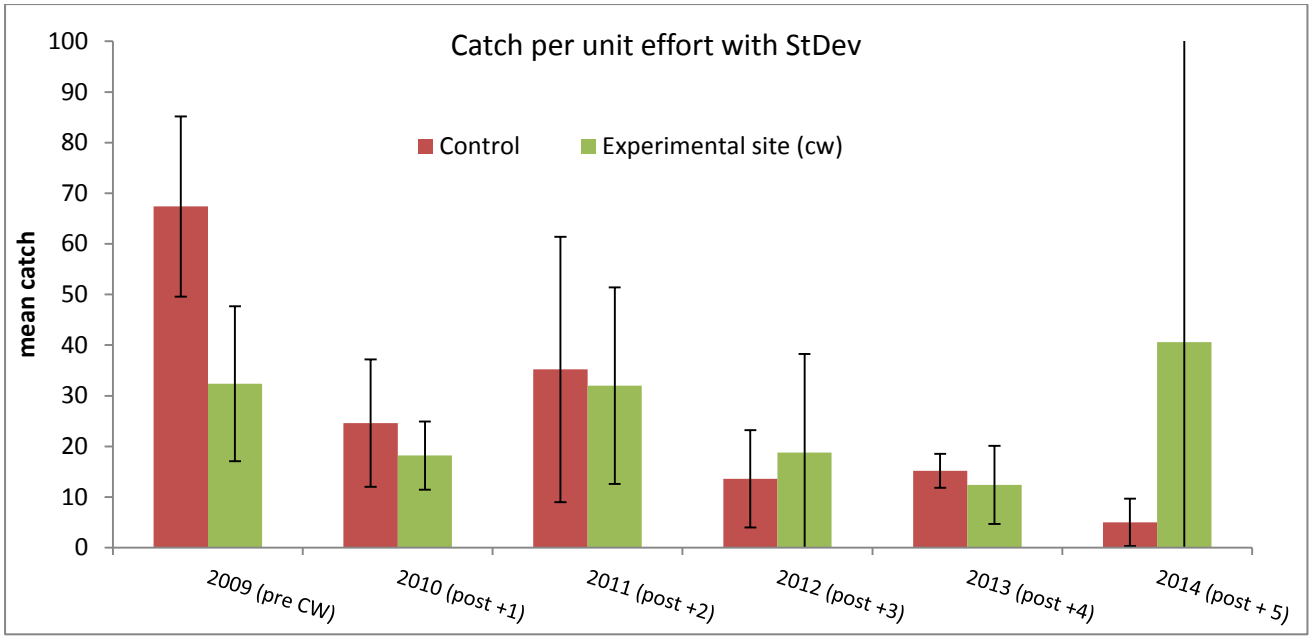


Figure 3.3: Mean crayfish catch per unit effort, 2009 -2014. Maintenance by the private contractor in 2013 occurred post the 2013 survey work. The experimental site was not maintained by the private contractor.

3.2.1.3 Robe Fish

In common with crayfish in the control site, brown trout numbers were substantially reduced post maintenance works in 2014. This was also the case in the experimental site which experienced a more pronounced decrease (Figure 3.4). Similar to the crayfish results, habitat loss is the most likely explanation for the decrease in trout. The 2013 maintenance works consisted of maintaining 9km of the Robe main channel and 6km of a major tributary. Trout use aquatic vegetation for cover and as feeding areas. The removal of significant lengths of tall emergent vegetation over an extended area (approx. 16km) represents a severe degradation of riverine habitat and a very visible and serious departure from enhanced maintenance protocols.

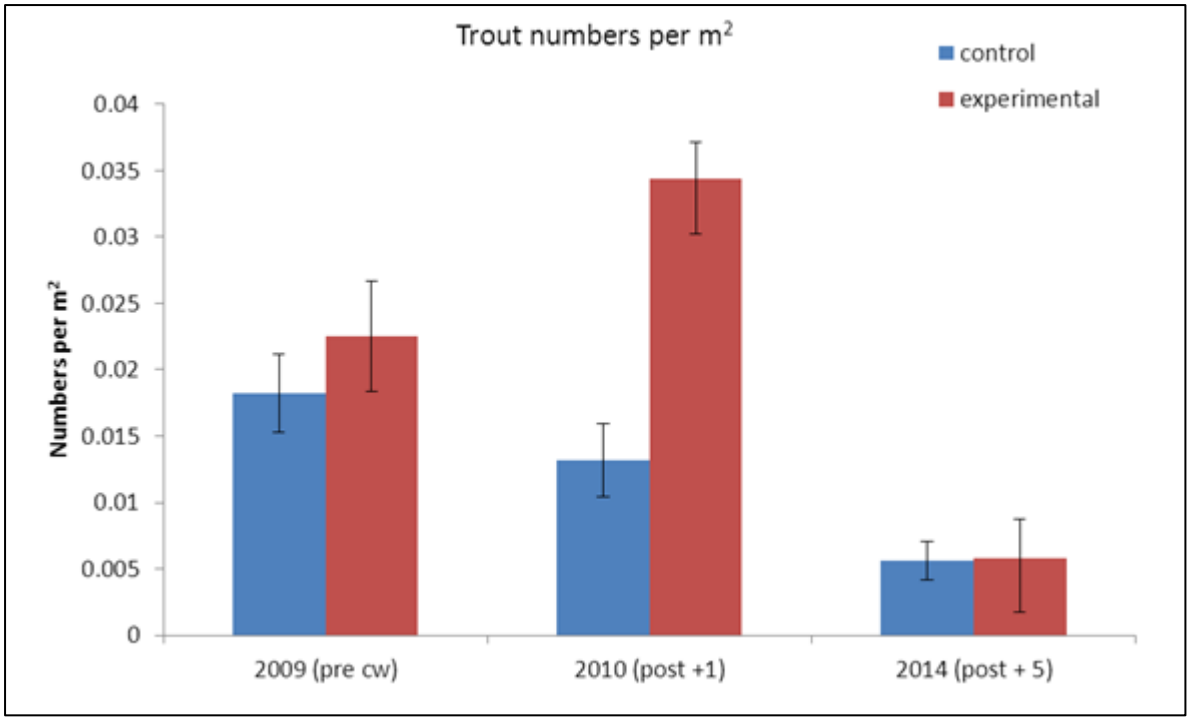


Figure 3.4. Brown trout numbers per m^2 in the Robe R. experimental and control sites in 2009, 2010 and 2014. Maintenance by the private contractor occurred in 2013. The experimental site was not maintained by the private contractor.

3.2.1.4 Conclusions

Maintenance works on the Robe main channel in 2013 were carried out by a private contractor on behalf of OPW as part of a bench marking exercise. Compliance with OPW's environmental protocols and procedures was part of the contractual requirements of the private contractor. While guidance on such protocols was provided to the contractor by OPW during maintenance operations it is apparent that compliance was quite poor and suggests that greater guidance and supervision, by OPW, is required when private contractors are used for such works.

In addition, the Robe main channel had not been maintained for a number of years and thus the level of maintenance required was greater than in those channels that would been maintained regularly. The impact of heavy duty maintenance can be quite extreme, both visually and environmentally, when significant amounts of vegetation need to be managed and large scale berm management is also required. Drainage maintenance on a more frequent basis would negate this high impact approach observed on the Robe main channel this year.

3.2.2 Fish Population Index Survey: Nenagh River

A fish population index (FPI) survey was carried out in the Nenagh River system (part of the Shannon catchment) in 2014.

The Nenagh River rises in the Silvermine Mountains in County Tipperary. It flows east of Nenagh town and into Lough Derg just north of Dromineer. The Nenagh catchment drains an area of 320km^2 with approximately 224km length of OPW drained channel. The river and its tributary the Ollatrim River are popular for both coarse and game angling. The Dolla and Ballintotty rivers are small tributaries of the Nenagh and Ollatrim rivers, both are important trout spawning streams.

60% of the EPA (Q-Value) water monitoring sites in the Nenagh catchment are meeting WFD requirements (Figure 3.5). There are no poor/bad Q-value sites in this catchment. The "moderate" sites recorded in this catchment are scoring Q3-4 which is still within the biological limits for salmonid enhancement. However, if this "moderate" water quality decreases from Q3-4 to Q3 water quality will threaten the salmon population. No salmon were recorded in the upper reaches of the Ollatrim River were water quality has only recently improved from a Q3 to a Q3-4.

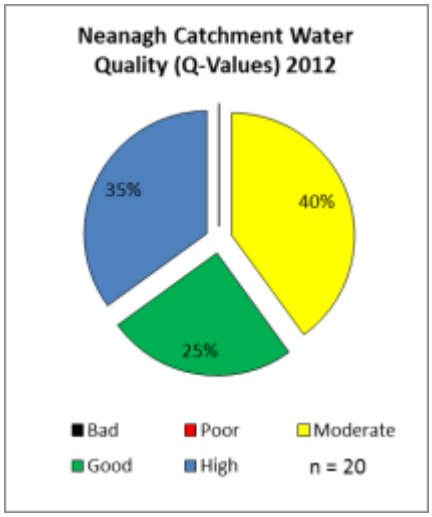


Figure 3.5. Results from EPA Q-Value macro-invertebrate monitoring sites in the Nenagh Catchment.

The fish community in the Nenagh catchment is dominated by trout (Figure 3.6). Trout were present at all sites surveyed (Figure 3.7). Salmon *(Salmo salar)* were only present in the Nenagh, Ollatrim and

Dolla rivers and not in large numbers (Figure 3.7). Total number of salmon captured in the FPI Nenagh Survey from both boat and bank was 96, compared to the trout total of 1235.

The trout stock in the lower reaches of the Nenagh River represents a valuable angling resource. Approximately 20% (125 Trout) of the trout captured here were ≥28cm in length and a further 5% (35 Trout were ≥35cm in length. Downstream of Annaghbeg Bridge there is a healthy coarse fishery with good numbers of perch, roach and pike. Bream are also present in this section.

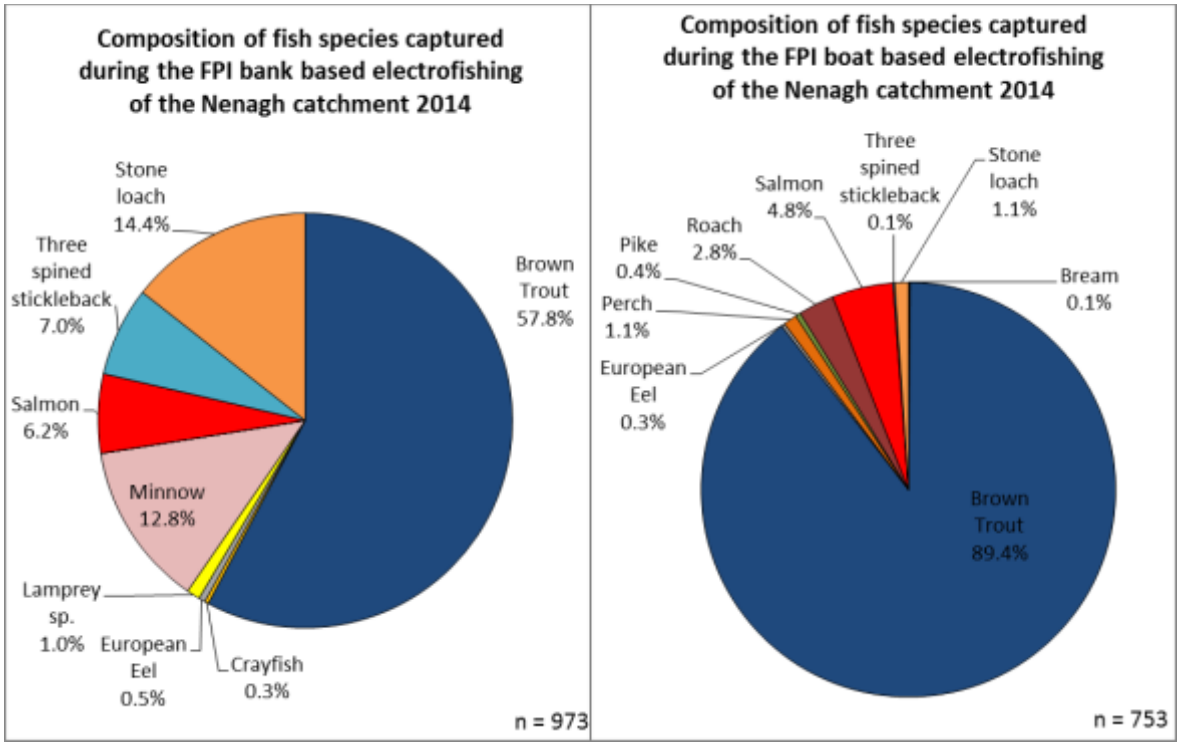


Figure 3.6. Composition of fish species captured in the Nenagh Catchment FPI survey using boat and bank electrofishing equipment.

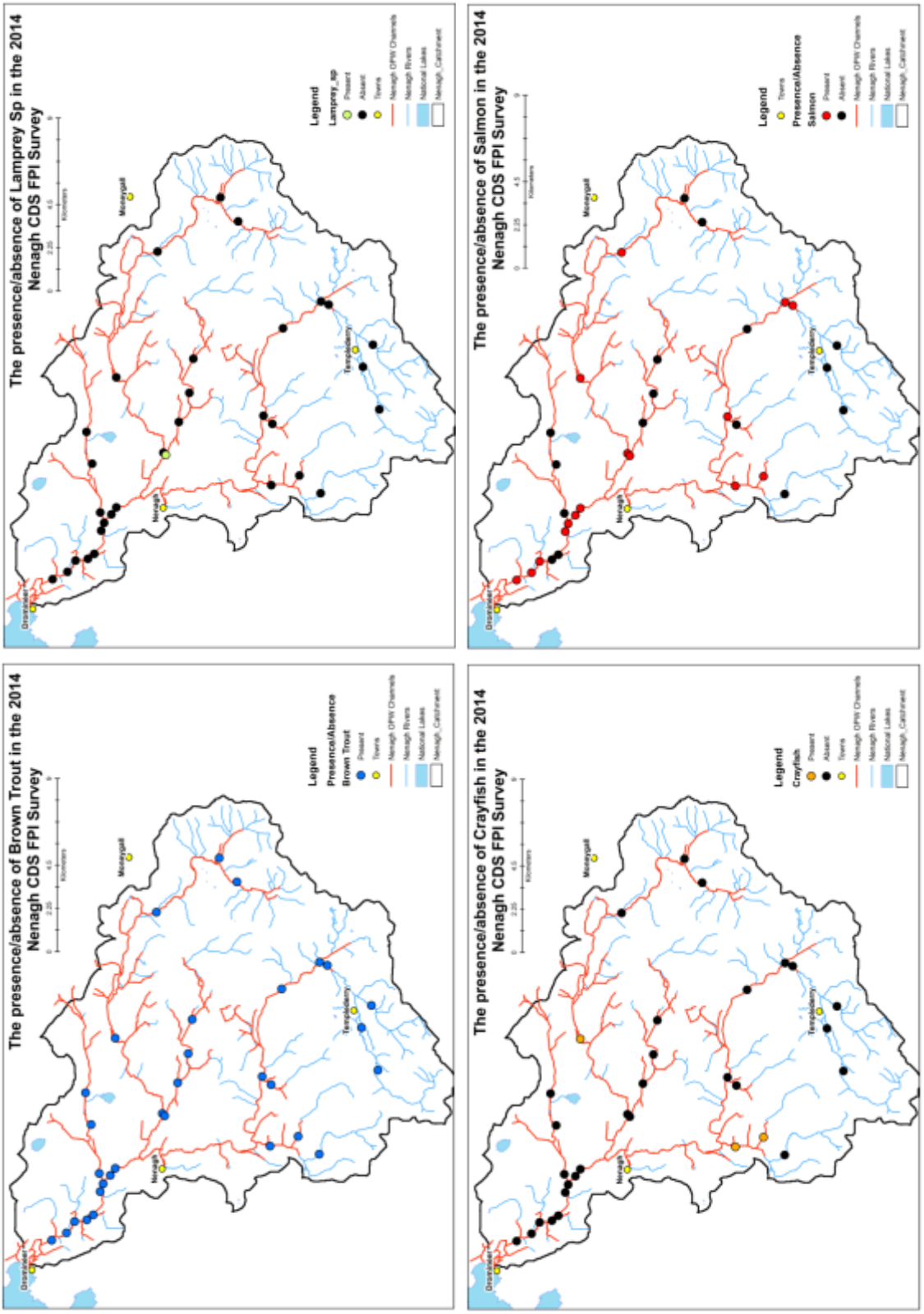


Figure 3.7. Presence / absence of brown trout, salmon, crayfish and lamprey sp. captured during the 2014 Nenagh FPI survey.

3.2.3 Vegetation Monitoring

3.2.3.1 Nanny River (C3/18/1)

Northeast of Tuam, the River Nanny intersects an area of wet grasslands with high biodiversity value. The Nanny itself supports brown trout and protected species including salmon, crayfish and lamprey. The adjacent area includes a range of wet grassland habitats and species that are listed under the European Habitats Directive. For example, fen habitat provides for a diverse plant and animal community including the protected marsh fritillary butterfly (*Euphydryas aurinia)* and its host plant devil's-bit scabious (*Succisa pratensis).*

Previously highlighted in the 2009 EREP annual report, the channel and its tributaries (C3/18/1/2 C3/18/1/2/1) play a fundamental role in the hydrology of the site and the continued viability of both its habitats and flora and fauna.

The 2012 botanical survey results indicated that the marginal and instream flora was recovering 3 years post maintenance (2009) (Figure 3.8) and channel flow/form was improving as a result. Vegetation removal and de-silting was undertaken again between 2013 and 2014. In 2014, a follow up survey of the channel flora demonstrated a substantial decline in plant diversity post works. Furthermore, survey results indicate that spoil spreading on the banktop is changing the plant assemblages from wet grassland species to dry grassland species, by raising the local topography along the machine access corridor at the top of the bank.

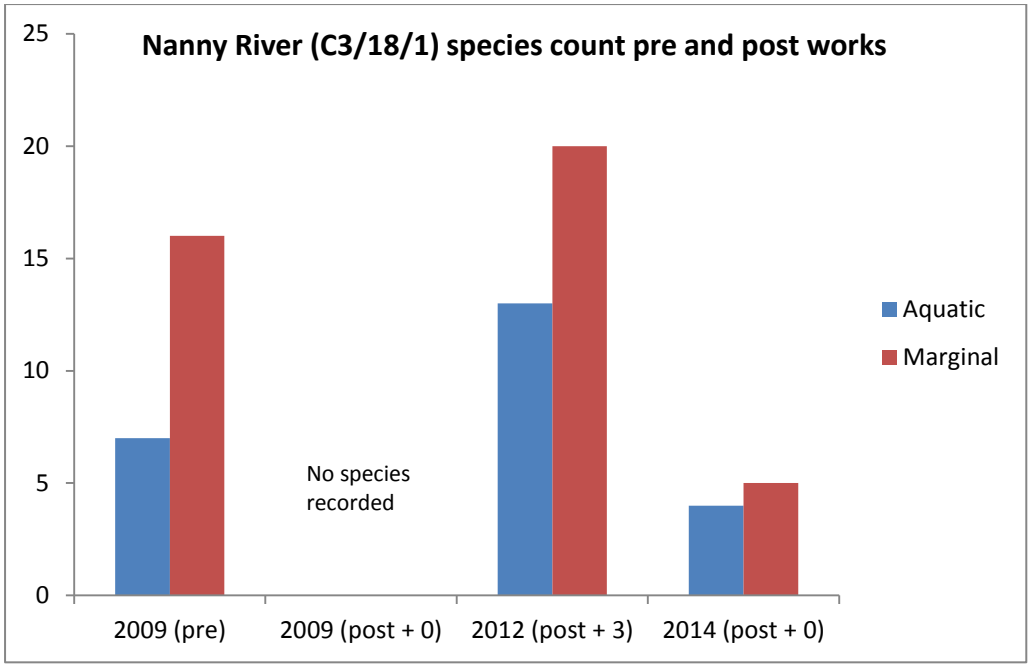


Figure 3.8: Channel species diversity pre and post works.

Future maintenance programmes for the Nanny and its tributaries should incorporate the following:

- Maintenance should be limited to a weed cutting boat between chainage 3 and 60 of the C3/18/1
- Cutting to be restricted to the channel centre to retain marginal vegetation in accordance with the 10 Steps approach and OPW's own SOP's and environmental protocols.
- Retain pockets of plant species along the reach so that they can recolonise more quickly after maintenance

4 EREP Audit Programme

4.1 Introduction

Environmentally sensitive maintenance is seen by OPW as the way forward for all routine maintenance operations. This standard approach to maintenance applies to all channels at all times of the year. One of the objectives of EREP requires that a number of machine crew audits be carried out annually. Such audits will inform OPW on the level of compliance with these environmental measures. Audits will be undertaken internally by the Environmental Unit of OPW and externally by the EREP team of IFI. External auditing covers a minimum of one third of all OPW drainage machine crews, annually. As drainage maintenance occurs throughout the whole year IFI auditing will also be spread out across the year. The majority of audits will, however, take place during the summer/autumn season or 'fishery open window', as this is the optimal time for implementing fishery instream works.

Machine crew auditing provides an opportunity for assessing the level of compliance with implementing OPW's environmental maintenance procedures. It also allows for further discussion and demonstration of certain maintenance options. It also provides OPW with up-to-date information on the level of compliance being achieved by their machine drivers and whether their staff are implementing as standard the environmental measures and protocols developed for routine drainage maintenance. Audit results are returned to OPW on a quarterly basis.

4.2 2014 Audit Results

In 2014, IFI carried out 25 external audits (Table 4.1), representing approximately 39% of all OPW maintenance crews. Audit outcomes are presented in figure 4.1. OPW has developed a rating system, based on the score obtained at each audit visit. This rating generates a series of broad categories for rapid assessment of outcomes (Table 4.2) and requires relatively high levels of compliance, i.e. 60% or greater, to be deemed acceptable.

Table 4.1. Number of audits carried out in each OPW Region, 2014 *(based on old form).*

		East	West	South West
Compliance Rating		**2014**	**2014**	**2014**
0-49	unacceptable	3	1	
50-59	poor	1	1	
60-70	acceptable		2	
71-84	good	2	1	1
85-100	very good	7	3	3
Total audits		**13**	**8**	**4**

Table 4.2. Summary of 2014 compliance ratings *(based on old form).*

OPW % Rating	Category	2014 over-all %	No. of Audits
0 - 49	unacceptable	16	4
50 - 59	poor	8	2
60 - 70	acceptable	8	2
71 - 84	good	16	4
85 - 100	very good	52	13

The 2014 IFI audits results show 6 audits were below the acceptable rating of 60% (within the category of unacceptable and poor). This represents 25% of all audits carried out (Table 4.1).

The overall mean compliance (audit score) for each OPW Region is provided in table 4.3.

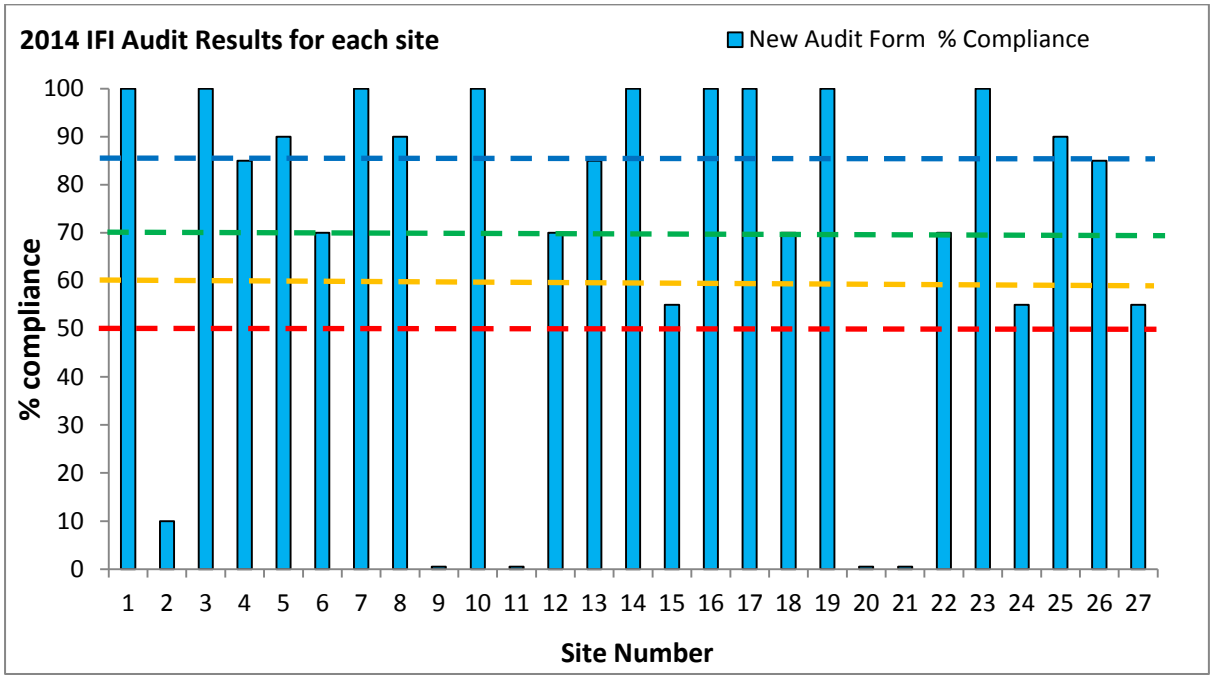
Table 4.3. Summary of 2014 over-all mean % compliance.

OPW Region	Mean Compliance %		No. Audits
	New Form	Old Form	
East	67	75	13
West	61	69	8
Southwest	89	90	4

4.2.1 New Audit Form

A new audit form was trialled in 2014. The new form is more detailed in measuring implementation of the 10 training steps for enhanced maintenance (Appendix I). The form entails a weighted marking system with negative marks for non-compliance with procedures. However there is also opportunities for drivers to improve their overall score by good tree management, skipping sections or by improving channel form e.g. pool creation. Where the overall score is negative the mark is rounded up to a zero score. In the case where a driver is not able to comply with a procedure due to a constraint such as a landowner requirement, the procedure will be negativley marked but the constraint is recorded and can be considered by OPW when deciding if there is follow up action required due to the audit result.

For comparison, both the new and old audit form were completed during each audit visit in 2014. The old and new form proved to be very comparable, with 76% and 68% of drivers falling into the acceptable /or higher scoring categories respectivelty (Tables 4.4 & 4.5 and Figure 4.1). Similarily, 24% and 32% of drivers failed to achieve a score of acceptable or higher based on the old and new form respectively (Tables 4.4 & 4.5 and Figure 4.1).



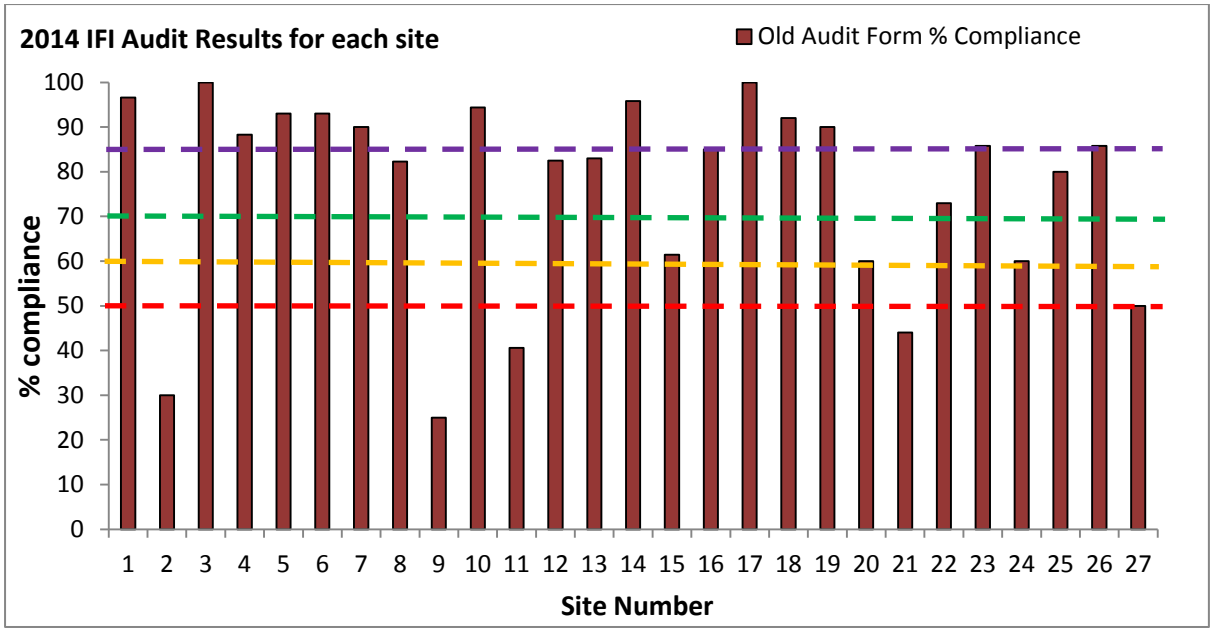


Figure 4.1. IFI 2014 Audit Results (based on both old form and new form).

This new EREP audit form has been accepted as the version that will be used in 2015 by both the OPW for their internal audits and IFI for their EREP audits. Discussions on the effectiveness of this new audit form will be included in the 2015 EREP Annual Report.

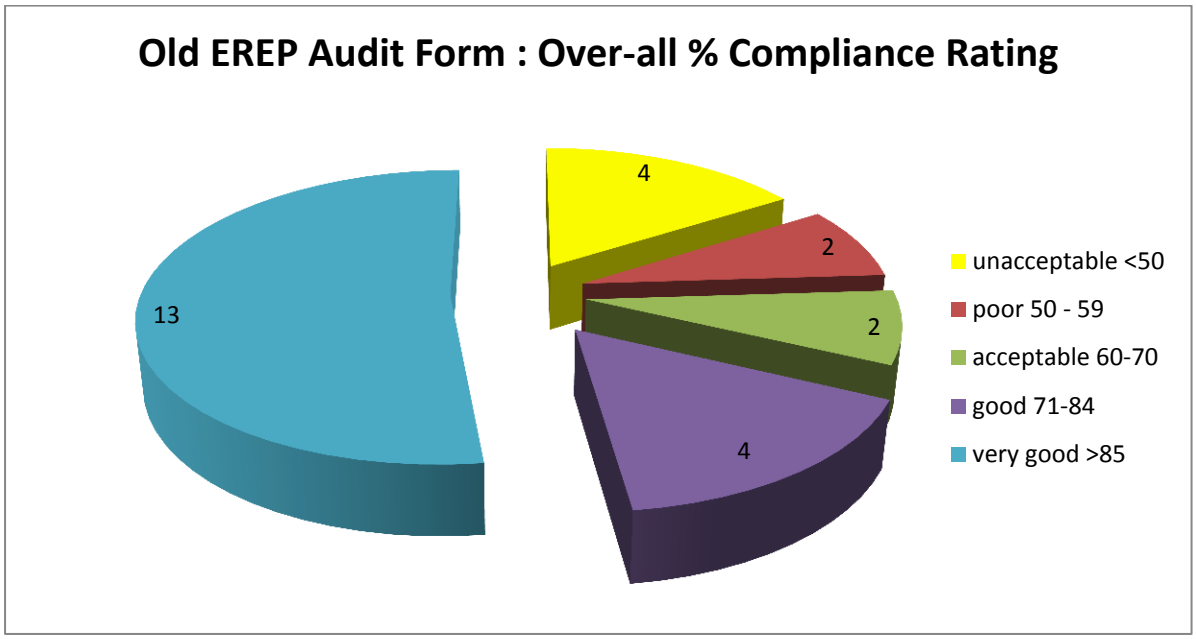
Table 4.4. Number of audits for each compliance rating, across each region, comparing new and old form.

		new form			**old form**		
		East	West	Southwest	East	West	Southwest
Compliance Rating		2014	2014	2014	2014	2014	2014
0 - 49	unacceptable	3	2		3	1	
50 - 59	poor	1	2		1	1	
60 - 70	acceptable	2		1		2	
71 - 84	good				2	1	1
85 - 100	very good	7	4	3	7	3	3
Total audits		**13**	**8**	**4**	**13**	**8**	**4**

Table 4.5. Over-all % of audits (all regions combined) within each compliance rating.

		new form		old form	
OPW % rating	Category	2014 over-all %	No of Audits	2014 over-all %	No of Audits
0 - 49	unacceptable	20	5	16	4
50 - 59	poor	12	3	8	2
60 - 70	acceptable	12	3	8	2
71 - 84	good			16	4
85 - 100	very good	56	14	52	13

A comparison of the over-all % compliance rating from all audits is presented below (Figure 4.2). These results indicate a good similarity between the two scoring system. However the new form elaborates out each of the 10 steps in more detail which provides more useful information back to OPW on the performance of their drivers to in relation to environmental maintenance. It should help identify areas for improvement as well as promote areas where OPW are doing well.



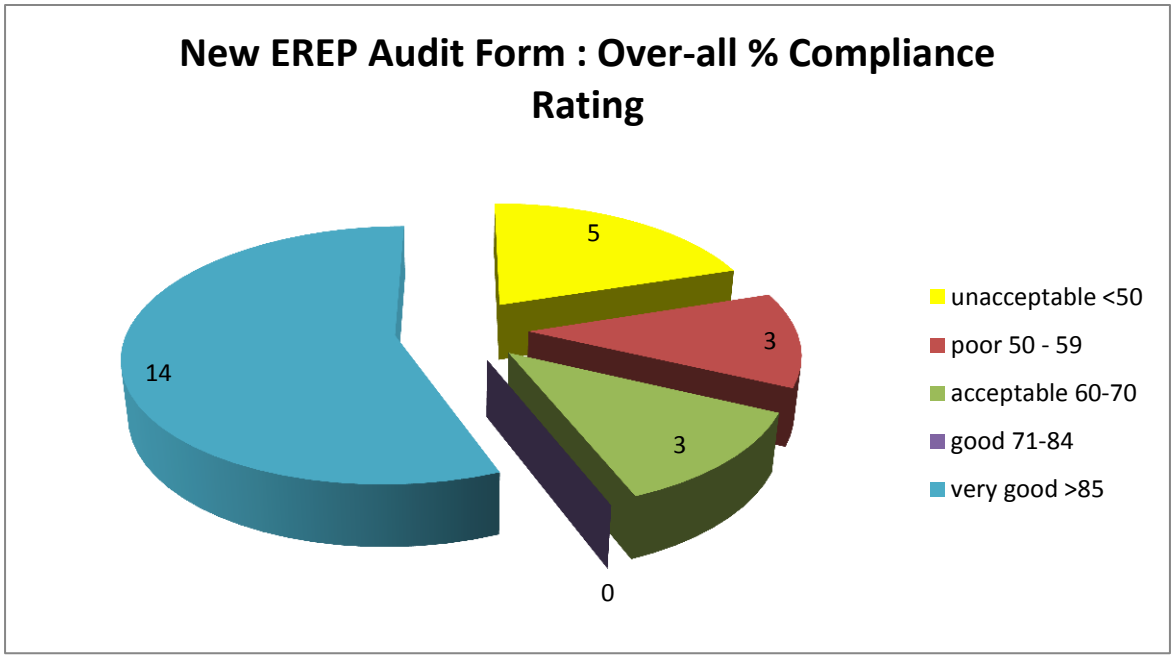


Figure 4.2. Comparison of EREP audit results based on the old and new form % compliance.

5 At Risk Catchments

Assess feasibility of WFD Hydromorphological Measures and identification of reaches for enhancement:

In accordance with the recommendations from the National Freshwater Morphology Programme of Measures (PoMs) Study and further review by the OPW, the following are the six waterbodies identified for Hydromorphology Programme of Measures applicable to OPW in 2012.

Table 5.1. OPW at risk waterbodies identified under the programme of measures study.

Water Body	Drainage Name	Responsible Authority	Channel Length (km)
WE_30_3370_1	Corrib ADS	OPW	35.9
WE_30_3370_2	Corrib ADS	OPW	49.4
SH_24_776	Maigue ADS	OPW	11.1
EA_07_1894_2	Boyne ADS	OPW	36.4
EA_07_1894_3	Boyne ADS	OPW	63.5
EA_07_990	Boyne ADS & Garr DD	OPW, Kildare & Offaly Co. Co.	72.7

Hydromorphology Enhancement Measures for OPW – Revised 2012

The National Freshwater Morphology PoMs Study concluded that circa 580 waterbodies were possibly 'At Risk' from channelisation and recommended that WFD monitoring includes these waterbodies so that the necessary data can be gathered to confirm status, particularly fish status. This will enable more waterbodies to be considered for enhancement works subject to the technical feasibility criteria.

IFI have considered the six waterbodies mentioned above in Table 5.1 and have concluded the following;

WE_30_3370_1 (Corrib ADS) – This sub-basin has some potential for capital works mainly on the main channel (CM4 Robe River). Many of the tributaries are too small and would be more suited to and benefit from enhanced maintenance. Some capital river enhancement works were completed under the Tourist Angling Measure (TAM) in the mid 90's and also under the current EREP project.

WE_30_3370_2 (Corrib ADS) – There is capital works potential in the lower sections of CM4/20, CM4/21, CM4/24, CM4/30 and CM4/31. However, these are small base width (<2m) channels and cover relatively short sections. There are extensive sections of this sub-basin that would be more suited to and benefit from enhanced maintenance works (Knockananeel upstream to Crossboyne Br). Again some capital works have been completed within this sub-basin through TAM and EREP.

SH_24_776 (Maigue ADS) - Possible Capital works locations are isolated and scattered throughout the Water body. Poor water quality would not give value for money in terms of capital works investment for salmon. This water body would be more suited to enhanced maintenance works.

EA_07_1894_2 (Boyne ADS) - Limited opportunities for capital works with exception of a few kilometres on the Boyne main channel upstream and downstream of Trim and the C1/17. Some capital works have been completed on the C1 Boyne main channel upstream of Trim through the current EREP.

EA_07_1894_3 (Boyne ADS) - Possible capital works locations are limited to the C1/6 and sections of C1 main channel. No water quality data is available for the C1/6, however, other water quality ratings at nearby site are good-moderate. Downstream of Navan was never drained and therefore cannot be considered at risk from channelization. This includes Armulchan, Castlefin lock and Slane. With the possible exception of the C1/6, this waterbody would be more suited to enhanced maintenance works.

EA_07_990 (Boyne ADS & Garr DD) - Potentially, there is considerable scope for capital works in the Boyne main channel (C1). From the C1/65 confluence to Coneyburrow Bridge, the criteria for capital works are met. Downstream of Coneyburrow Bridge there is over 8km of channel with sufficient gradient to meet the conditions of capital works. There are also a number of small side channels (wetted width 1.5-2.5m) that are potentially suitable for capital works.

Further details of all six waterbodies are provided in Appendix II.

6 References

Holdich D (2003). Ecology of the White-clawed Crayfish. Conserving Natura 2000 Rivers Ecology Series No. 1. English Nature, Peterborough.

Peay, S. 2003. Minimising loss of crayfish and habitat during works on watercourses. Bulletin Français de la Pêche et de la Pisciclture, 370-371: (CRAYNET Vol. 1): 193- 207.

I.F.I. (2009). Environmental River Enhancement Programme Annual Report, 2008. Inland Fisheries Ireland, Dublin, Ireland.

I.F.I. (2010). Environmental River Enhancement Programme Annual Report, 2009. Inland Fisheries Ireland, Dublin, Ireland.

I.F.I. (2011). Environmental River Enhancement Programme Annual Report, 2010. Inland Fisheries Ireland, Dublin, Ireland.

I.F.I. (2012). Environmental River Enhancement Programme Annual Report, 2011. Inland Fisheries Ireland, Dublin, Ireland.

I.F.I. (2013). Environmental River Enhancement Programme Annual Report, 2011. Inland Fisheries Ireland, Dublin, Ireland.

O.P.W. (2011). Environmental Management Protocols and Standard Operating Procedures, Arterial Drainage Maintenance Service, Office of Public Works.

OPW Site Audit Form V.1.1

OPW Region:		Scheme:	
Foreman:		Channel: (name & code)	
Driver(s)			
Auditor:		Section: (chg-chg)	
Site surveyed from:	LHB / RHB	Date & Time:	
GPS Ref:		Photographs:	
		Water level:	
		Machine number:	
		Red book	present ☐ absent ☐
		Spill kit	present ☐ absent ☐
Wetted/Base width (<1m, 1-3m, 3-6m, 6-10m, 10-15m, <15m)			
Velocity rating (slow, moderate, fast, flood)		Weather conditions:	
Bed type			

200m minimum **maintained** section walked?		If not, what distance walked?	
200m **unmaintained** section walked?		If not, what distance walked?	

Suitable habitat in reach? **YES** NO	**Crayfish (in spoil)**	Abundant ☐	Common ☐	Rare ☐
Annex spp./habitats	**Lamprey (in spoil)**	Abundant ☐	Common ☐	Rare ☐
(Recorded on site)	Abundant (>11 individuals), Common (5 - 10 individuals), Rare (1 - 4 individuals) per 5m² of bank top			
	Floating-leaved vegetation	Abundant ☐	Common ☐	Rare ☐
	Circle % cover in reach: Abundant (30-70% cover), Common (3-10% cover), Rare (< 3% cover)			

Invasive Species	Species Name:			
% cover in reach: Abundant (30-70% cover), Common (3-10% cover), Rare (< 3%	Abundant ☐	Common ☐	Rare ☐	
Exercising Due Diligence (Skipped Section) ☐				

Maintenance Constraints:	**Working Bank**	Woodland	Tillage	Fencing
	Non Working Bank	Woodland	Tillage	Fencing

Comments on Audit Findings:

Outstanding Issues:

Result:

		Compliant	Grade 1	Grade 2	Grade 3
1. PROTECTING BANK SLOPES	Applicable	✓	%	%	%
1.1: Has the non-working bank been disturbed? (slope and Bankfull)			10-15	15-30	30-100
1.2: Has the working bank slope been disturbed? (mechanically)			15-30	30-60	60-100
Re profiling ☐ Scraping ☐ Inappropriate bank protection ☐ Fine material ☐					
Other (list):					

2. CONFINING WORKS TO CHANNEL CENTRE	Applicable	✓	%	%	%
2.1: Is maintenance retaining 10-15% channel width vegetation on the working margins		See Section 4			
2.2: Is maintenance retaining 10-15% channel width vegetation on the non-working margins					
2.3: Is the quantity/type of spoil being removed appropriate?			10 - 20	20-30	>30
Gravel/cobble ☐ Marl/boulder clay ☐ Dragging gravel to margins ☐					
2.4: Is spoil is checked for lamprey/crayfish at least 3 times a day as per SOPs? Yes/No	See Section 4.4 - 4.5 for Tall Reeds/Flaggers		moderate	poor	none

3. Spoil Management	Applicable	✓	%	%	%
3.1 Is spoil being placed in the best location? Spoil heap/bank top ☐			70-50	50-30	<30
W/ bank slope ☐ NW/bank slope ☐ Inside fence ☐ Spoil spread on NW/bank slope the only option? Yes ☐ No ☐					
Is spoil visibly slipping back into channel? ☐ Restrictions:					
3.2: Is spoil spread thinly ?			moderate	poor	Bad
3.3: Is driver allowing water to drain from bucket? (*observe driver for 3 minutes; if possible*)			40-60	<40	

		Compliant	Grade 1	Grade 2	Grade 3
4. Vegetation Management Applicable		✓	%	%	%
Timing					
4.1 Outside coarse fish spawning season (April 1st to July 1st) If Relevant					
Tall Reeds/Flaggers Relevant					
4.2 Is vegetation management Interfering with nesting birds (March 1st to Aug 3 1st: Wildlife Act)		YES	NO		
4.3 Is maintenance opening the centre of the channel ONLY? (maximum open area is 75-80% of width)			80-70	70-50	<50
4.4: Where crayfish are present, are additional wider areas of vegetation being retained?(1/3 channel width retained)				20-15	<10
4.5: Where lamprey are present, are additional wider areas of vegetation being retained?(1/3 channel width retained)				20-15	<10
Floating-leaved vegetation (Annex habitat) Relevant					
Ranunculus sp. (% cover =) *Pondweed sp. (% cover =)*					
4.6: Is maintenance attempting to remove floating pondweed with the normal bucket?		NO	YES		
4.7: Is floating leave pondweed being skipped/retained? (Retain 50-33% of total reach)			33 - 25	25-15	<15
4.8: Is ranunculus being retained/skipped in the Channel? (Retain 50-33% of total reach)			33 - 25	25-15	<15
Water celery/cress: Relevant					
4.9: Is the driver skimming off water celery vegetation only?	100-60		60-40	<40	
4.10: Is there an avoidance of digging the channel bed?			60-41	<40	
4.11: Is the driver trying to retain water celery on margins?	100-60		60-40	<40	
4.12: The driver is implementing enhanced maintenance in a channel with <1m base width					
Weed-cutting boat/bucket Relevant					
4.13: Is it cutting the channel centre vegetation ONLY? (maximum open area is 75-80% of width)			70-50	50-30	<30
5. Skipping Sections (Where appropriate) Applicable					
5.1: Were appropriate sections skipped?	YES				
5.2: Reason for skipping: Power cables ☐ Good Gradient ■ Lamprey/Crayfish present ■					
Maintenance not required ■ Gravel section ■ Otter holt ☐ Mature tree line ■					
Kingfisher/ Swan nest ☐ Wetlands - Bogs, Fens & Turloughs ■ Freshwater Pearl Mussel ☐					
Swan & Duck Mussels ■ Invasive Plants Species ■ Channel not accessible ☐					
Other (list):					
6. Tree Management Applicable		✓	%	%	%
Timing					
6.1 Appropriate tree management is only permissible from September 1st toFebruary 28th under the Wildlife Act					
Tree cutting					
6.2 What is the purpose of the tree cutting?					
Conveyance ☐ habitat enhancement ☐ access ☐ Other (list)					
6.3 What equipment is being used?			Machine bucket		
Secateurs ☐ chain saw ☐ hand saw ☐ Tree shears ☐					
6.4 How much tree cover is being retained on the banks in the channel reach?			70-50	50-25	<25
removing fallen/low trees ☐ opening sections over riffles ☐ Selective tree cuttingpening limited sections for access ☐					
Other (list):					
6.5: Is tree cutting retaining the variety of trees present/diversity?					
6.6: Is tree cutting retaining a diversity of bankside vegetation? (trees/Scrub/Shrub)					
6.7: Manage scrub - Otter & Birds SOP			80-70	70-50	
6.8: Woody habitat placed in field / bank slope/top as wildlife refuges?					
6.9: Avoidance of damage to tree cover during the closed season					
7. Berm Management Applicable		✓	Infrastructure ☐		
7.1: Retain berms (no maintenance)					
7.2 Managed to the basic berm protocol?			80-70	70-50	<50
7.3 Berm re-sodding done where appropriate (berm width / sod character)					
Gravel Berm					
7.4: How gravel berm has been managed?			moderate	poor	bad
gravel drawn to bank toe ☐ gravel removed from channel ☐ Gravel used downstream in channel ☐					
Other (list):					
8. Replacing stone and boulders back in the channel Applicable		✓	%	%	%
8.1: Are materials being returned to the channel (boulders/cobble/gravel) from diggings?				70-50	<50
8.2: Is readily available and appropriately sized stone from adjoining locations being placed into the channel?			60-40	<40	
8.3: Is there a reason for not placing stone material into the channel, if stone available?			No		
If Yes (List):					
9. Gravel Bed Channels Applicable		✓	%	%	%
9.1: Is instream maintenance taking place between 1st July and 30th September, without consulation with IFI?					
9.2: Loosen or toss bed gravels to wash out fines			70-40	<40	
9.3: Are measures present to prevent sediment and silt flowing downstream between Autumn-Spring?					

		Compliant	Grade 1	Grade 2	Grade 3
10. New Excavations in the channel - *simple structures* Applicable		✓	%	%	%
10.1: Is the bed being excavated to form deeper pool areas and shallow riffles?			70-50	<50	
10.2: Is the channel being deepened on one side and spoil placed on the opposite side?			70-50	<50	
Opportunity to use existing spoil to form simple structures?		✓	%	%	%
10.3. Alternating/ paired deflectors			70-50	<50	
Rubble mat					
Simple weir					
Random boulder array					
Count No of Applicable Steps:					
Scoring for Applicable sections: Totals:					

< 4 Steps	Total Marks	Total score
1 Yellow = -15		
1 Orange = -30		
1 Red = -70		
Total Negative Mark		
1 Green = +15%		
Total Positive Mark		

Total Score

Compliance =

Between 5 - 7 Steps	Total Marks	Total score
1 Yellow = -10		
1 Orange = -25		
1 Red = -70		
Total Negative Mark		
1 Green = +10%		
Total Positive Mark		

Total Score

Compliance =

Between 8 - 10 Steps	Total Marks	Total score
1 Yellow = -10		
1 Orange = -20		
1 Red = -70		
Total Negative Mark		
1 Green = +10%		
Total Positive Mark		

Total Score

Compliance =

To Calculate Score: 100 - (Total Negative Mark +Total Positive Mark)

This score represents % compliance (a negative is possible)

Example: No of Sections: 6. Scores: 1 Orange, 2 yellow and 1 Green Mark

(1 orange =-25, 2 yellow = -20, 1 green = +10, ∴ Total = −35

100 - 35 = 65

Ratings

0 - 50 = Bad

51 - 59 = Poor

60 - 70 = Moderate

71 - 84 = Good

85- 100 = Very good

Additional Comments:

Appendix II

At-risk catchments: Hydromorphology Enhancement Measures for the OPW

Waterbody: SH_24_776

Scheme: Maigue, Upper Mahore River

Channels

Total Channels = 10,207m OPW Channels = 11,038m (Artificial Side drains = 850m)

Channels with Gradient > 0.002 and Stream Order 2 = 1,433m

OPW Channel ID	Location	Length (m)	Q-value	Fish Sp Present in 10 min Survey
C1/25/23	O'Carrolls Br to Ballynaveen	8052	Q3 (Poor)	See Below
C1/25/23/2	Oldtown	790	No data	No data
C1/25/23/3	Ballynaveen	840	No data	No data

Fish Species Present in 2012: 10 min Survey

C1/25/23 at O'Carrolls B: Fish Species In decreasing order of abundance: Stoneloach, Lamprey *Sp*., Crayfish and Brown trout. This fish species composition would indicate a population being effected by cultural eutrophication. The fish Population at O'Carrolls Bridge has been classified as Moderate using the WFD Ecological Quality Rating (EGR) model.

5 River Hydromorphology Assessment Technique (RHAT) scores were taken in SH_24_776 (Figure 1) all were classed as moderate.

Possible Capital works locations (Gradient > 0.002 and wetted width >1.5m) are isolated and scattered throughout the waterbody. Poor water quality would not give value for money in terms of capital works investment for salmon (Figure 2, EPA Q-Value Q3). This water body would be more suited to enhanced maintenance works.

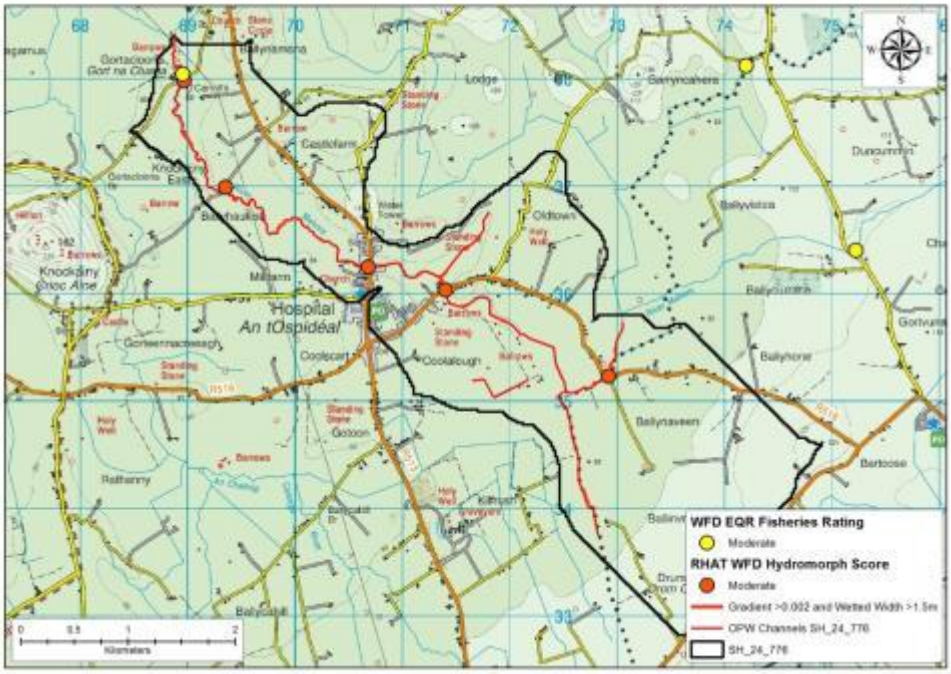


Figure 1. WFD EQR Fish rating and RHAT Scores for sub basin SH_24_776

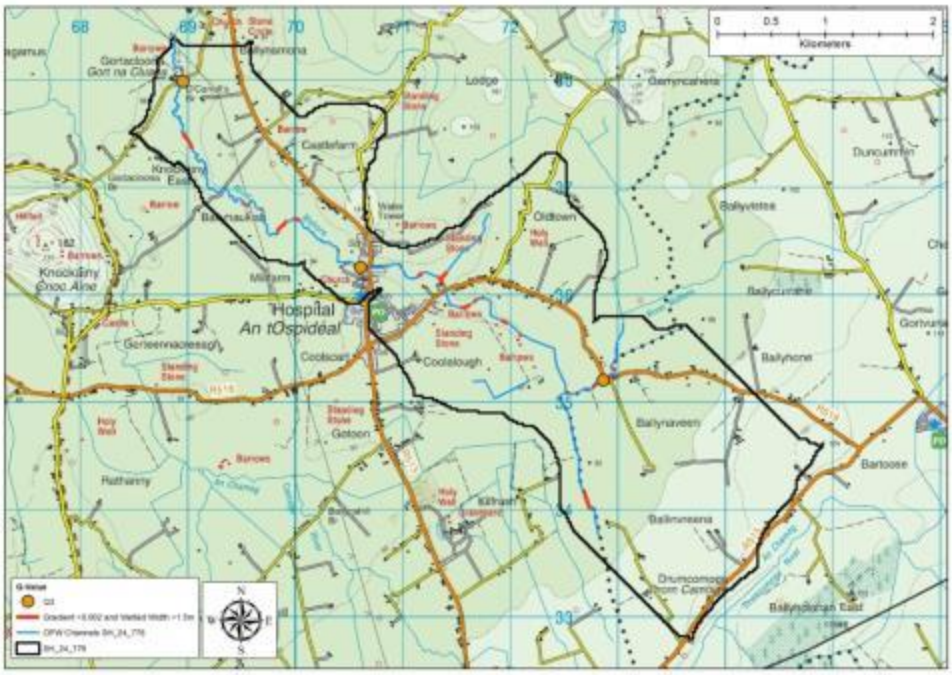


Figure 2. EPA Q-Values for sub basin SH_24_776

Waterbody: WE_30_3370_1

Scheme: Robe, Robe River

Robe River - CM4 Sect. G/E/F, CM4/35 to CM4/46

Channels

Total Channels = 34,357m OPW Channels = 33,640m

Channels with Gradient > 0.002 and Wetted Width >1.5m = 8078m

OPW Channel ID	Location	Length (m)	Q-value	Fish Sp Present in 10 min Survey
CM4 Sect. G/E/F	Christinas Br to Cloontooa	15640	Q 3-4 (Moderate) - Q4 (Good)	No data
CM4/37	Meelik More	2250	No data	No data

5 River Hydromorphology Assessment Technique (RHAT) scores were taken in WE_30_3370_1 (Figure 3) one was good, two were moderate and two were poor. The site classified as good had river enhancement works done under the Tourist Angling Measure (TAM) in the mid 90's.

In situ River Enhancement

From Christinas Bridge (Chg. 38550) upstream to N17 Motorway (Chg 40650) =2,100m

Downstream of Brickeens Bridge (Chg 50220 to 49400) = 820m

Brickeens Bridge (Chg 50200) upstream to chg 51400 = 1,200m

Constraints:

Both the CM4/35 and CM4/36 are two small for Capital Works (wetted Width <1.5m)

Potential Capital Works:

Town Land Castlemagarret North (Chg 40750 to Chg 41800) = 1,050m

CM4/37 downstream of Meelick More (Chg 0 – 900) = 900m

There are 2 sections of possible capital works locations (moderate water quality, gradient > 0.002 and wetted width >1.5m) in this waterbody. Water quality and long potential enhancement zones would give good value for money in terms of capital works investment for trout. There are extensive

sections which would be more suited to and benefit from enhanced maintenance works (Garryduff North upstream to Kilnock Br).

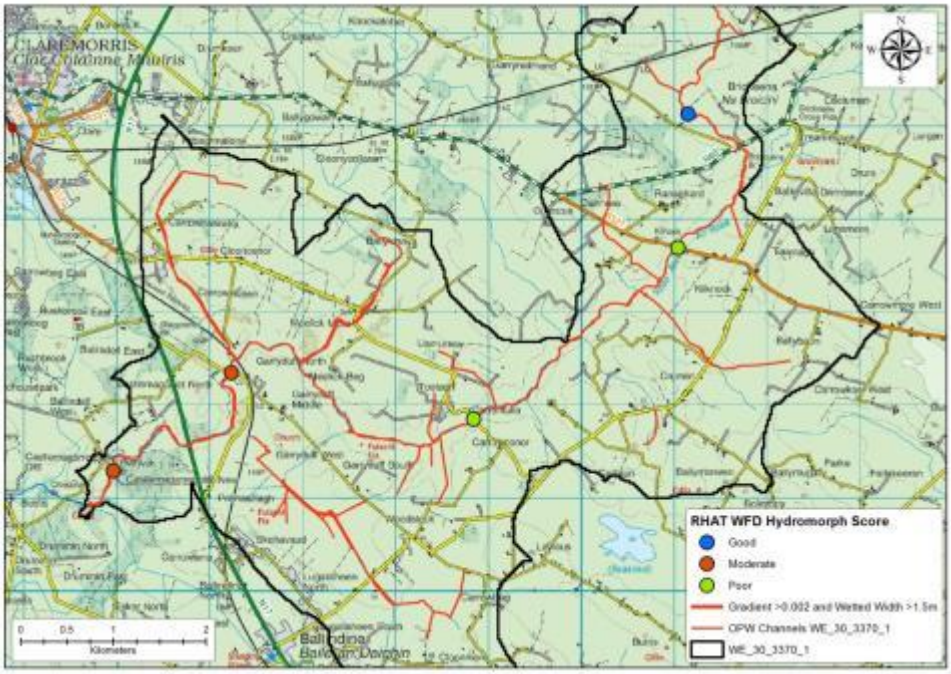


Figure3. RHAT Scores for sub basin WE_30_3370_1

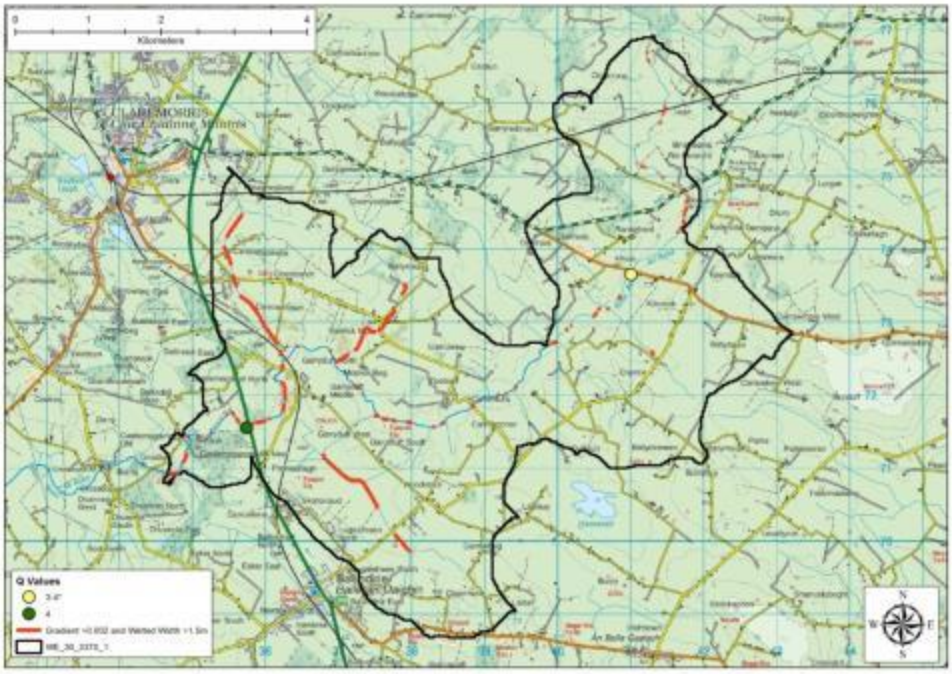


Figure 4. EPA Q-Value Ratings for sub basin WE_30_3370_1

Waterbody: WE_30_3370_2

Scheme: Robe, Robe River

Robe River - CM4 Sect. B/C/D and Channels CM4/20 to CM4/33

Channels

Total Channels = 45,030m OPW Channels = 47,984m (Artificial Side drains = 2,954m)

Channels with Gradient > 0.002 and Wetted Width >1.5m = 9,608m

OPW Channel ID	Location	Length (m)	Q-value	Fish Sp Present in 10 min Survey
CM4 Sect. B/C/D	Coolaghbaun to Christinas Br	19523	Q4 (Good) – Q 3-4 (Moderate)	No data
CM4/20	Clooneen	1857	No data	No data
CM4/21	Boleybeg	2651	No data	No data
CM4/24	Currantawy	2368	No data	No data
CM4/30	Crossboyne	300	No data	No data
CM4/31	Drummin West	1331	No data	No data

5 River Hydromorphology Assessment Technique (RHAT) scores were taken in WE_30_3370_2 (Figure 5) four were classed as moderate one as good. The site classified as good had river enhancement works done under TAM in the mid 90's and in 2014 had fresh gravels added.

In situ River Enhancement

Hollymount Bridge (Chg 22500) to Lehinch Demesne (Chg 24400) = 1900m

Pollaweela (Chg 26600) to Tagheen (Chg 29100) = 2500m

Crossboyne (Chg 37200) to Christinas Br (Chg 38200) = 1000m

Potential Capital Works:

CM4 Sect. B: Coolaghbaun: Chg 19500 to 20600 = 1100m

CM4 Sect. D: Tagheen: Chg 30200 to 31300 = 1100m

There is capital works potential in the bottom 300 to 500m of the channels CM4/20, CM4/21, CM4/24, CM4/30 and CM4/31. However, these are small base width (<2m) channels and are relatively short sections.

There are 2 sections of possible capital works locations (moderate water quality, gradient > 0.002 and wetted width >1.5m). Good water quality and long potential enhancement zones give good value for money in terms of capital works investment. There are extensive sections which would be more suited to and benefit from enhanced maintenance works (Knockananeel upstream to Crossboyne Br).

Figure 5. RHAT Scores for sub basin WE_30_3370_2

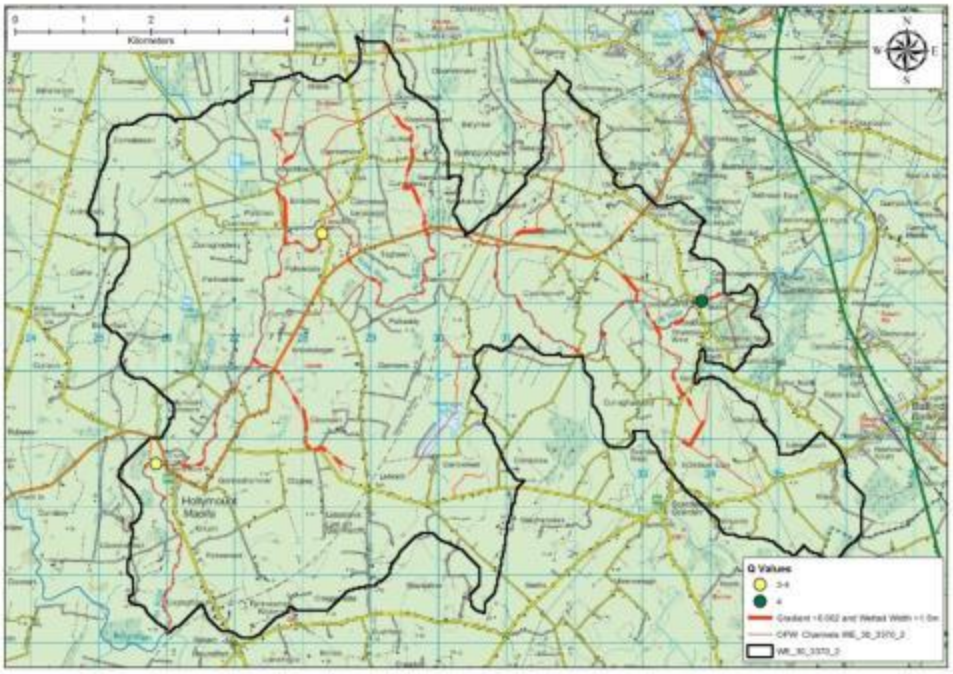


Figure 6. EPA Q-Value Ratings for sub basin WE_30_3370_2

Waterbody: EA_07_1894_3

Scheme: Boyne (Navan)

Channels with wetted width less than 1.5m or insufficient gradient: (C1/11, C1/9, C1/7, C1/6 tribs C1/5, C1/4, C1/2)

4 River Hydromorphology Assessment Technique (RHAT) scores were taken in EA_07_1894_3 (Figure 7) two were good, one was moderate and one was poor.

Channels potentially suitable for capital works (Channels with Gradient > 0.002 and Stream Order 2) = 7110m

OPW Channel ID	**Location**	**Length (m)**	**Q-value**	**Fish Sp Present in 10 min Survey**
C1/6 (excluding tributaries)	Brannanstown to main channel confluence	3895	unknown	No data
C1	Between Blackcastle and the C1/6	635	moderate	No data
C1	Ardmulchan motte	840	good	No data
C1	Castlefin Lock	340	good	No data
C1	Slane	1400	good	No data

Recommendation

Possible Capital works locations are limited to the C1/6 and sections of C1 main channel. No water quality data is available for the C1/6, however, other water quality ratings at nearby site are good-moderate. Downstream of Navan was never drained and therefore cannot be considered at risk from channelization. This includes Armulchan, Castlefin lock and Slane. With the possible exception of the C1/6, this waterbody would be more suited to enhanced maintenance works.

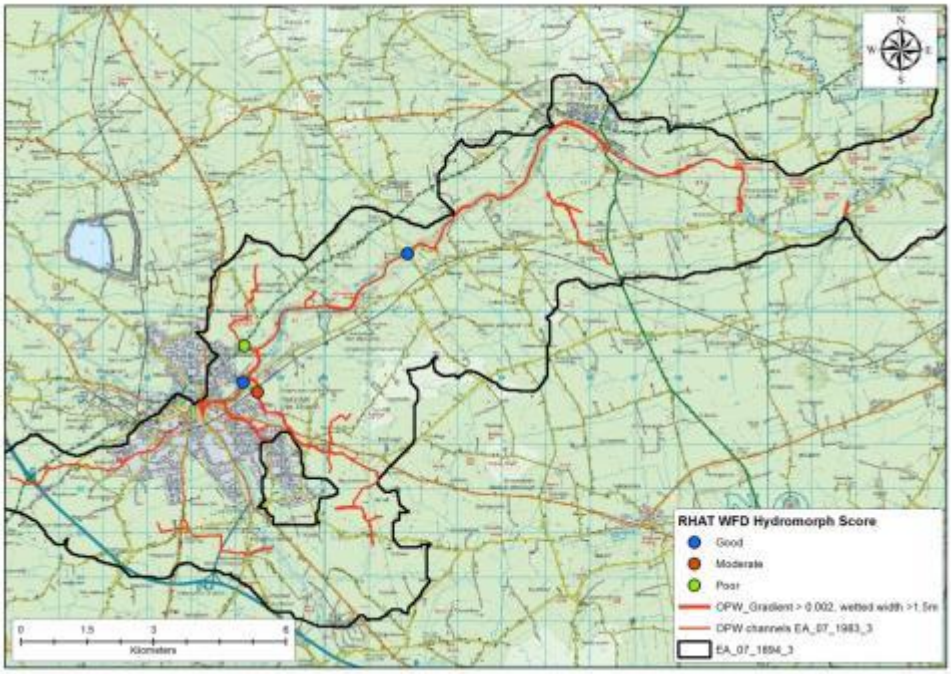


Figure 7. RHAT Scores for sub basin EA_07_1894_3

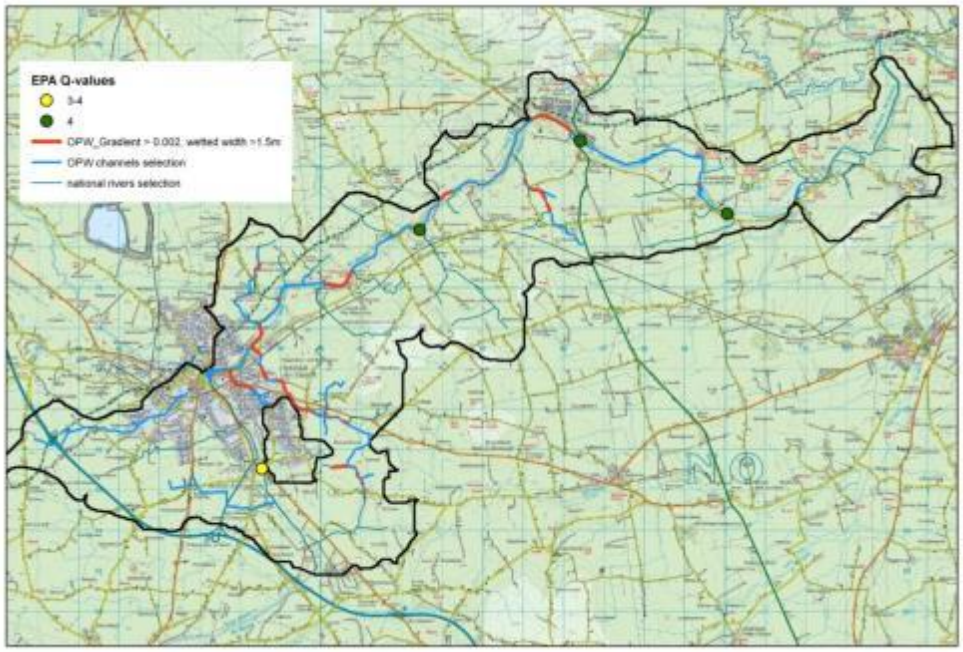


Figure 8. EPA Q-Value Ratings for sub basin EA_07_1894_3

Waterbody: EA_07_1894_2

6 River Hydromorphology Assessment Technique (RHAT) scores were taken in EA_07_1894_2 (Figure 9) four were moderate and two were poor.

Channels potentially suitable for capital works (Channels with Gradient > 0.002 and Order 2) = 3200m

OPW Channel ID	Location	Length (m)	Q-value	Fish Sp Present in 10 min Survey
C1/17 and C1/17/2	From the C1/17/3 downstream stream to the C1 confluence	2374	unknown	No data
C1	Below C1/19 confluence downstream to Loganstown	2600	moderate	No data

Recommendation

Limited opportunities for capital works with exception of a few kilometres on the Boyne main channel and the C1/17.

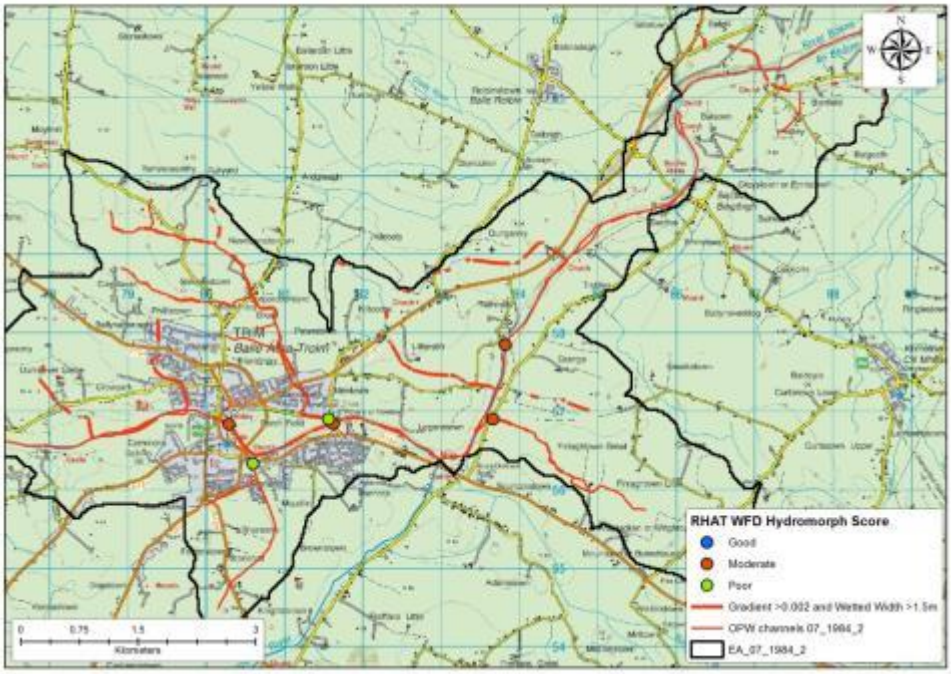


Figure 9. RHAT Scores for sub basin EA_07_1894_2

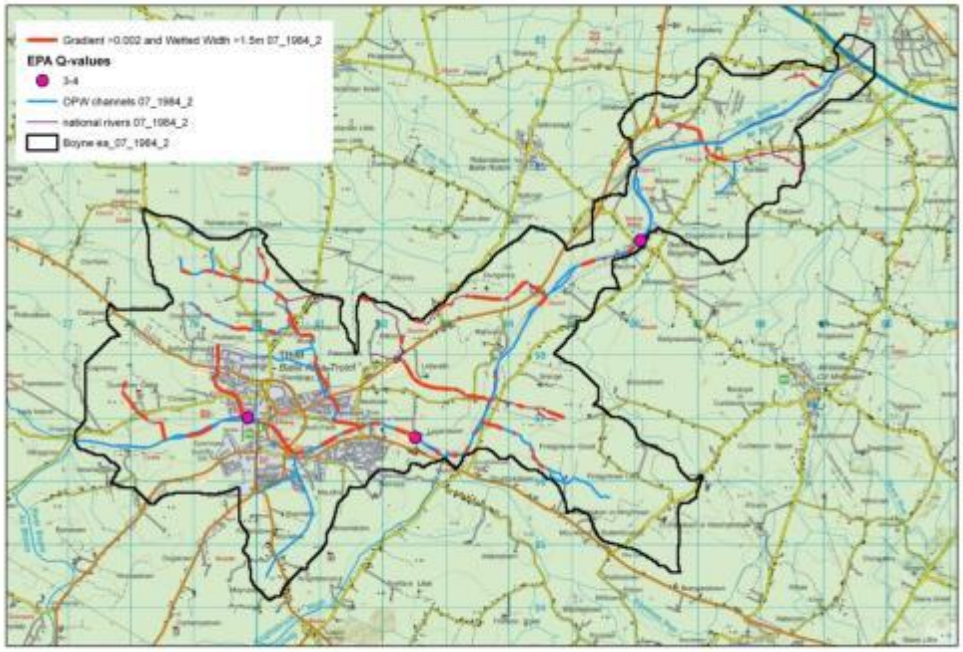


Figure 10. EPA Q-Value Ratings for sub basin EA_07_1894_2

Waterbody: EA_07_990

Scheme: Boyne (Edenderry)

5 River Hydromorphology Assessment Technique (RHAT) scores were taken in EA_07_990 (Figure 11) three were moderate and two were poor.

Channels potentially suitable for capital works (Channels with Gradient > 0.002 and Order 2) = 26541m

OPW Channel ID	Location	Length (m)	Q-value	Fish Sp Present in 10 min Survey
C1/72	Edenderry	1400	unknown	No data
C1/70	From C1 confluence upstream to R441 road	2150	moderate-good	No data
C1	C1/65 confluence to Coneyburrow bridge	5500	mod-good	No data
C1	River Bridge to dismantled railway line	8000	moderate-good	No data
C1/74	C1/74/1 confluence to C1 confluence	2280	unknown	No data
C1/73	Garr Bridge to C1 confluence	1770	unknown	No data
C1/81/2	Clonkeen cross roads to C1/74 confluence	1774	unknown	No data
C1/84	From C1 confluence 1.76km upstream	1767	unknown	No data
C1/81/1	From C1 confluence upstream to C1/80 confluence	1900	unknown	No data

Recommendation

Potentially, there is considerable scope for capital works in the Boyne main channel (C1). From the C1/65 confluence to Coneyburrow Bridge, the criteria for capital works are met. Downstream of Coneyburrow Bridge there is over 8km of channel with sufficient gradient to meet the conditions of capital works. There are also a number of small side channels (wetted width 1.5-2.5m) that are potentially suitable for capital works.

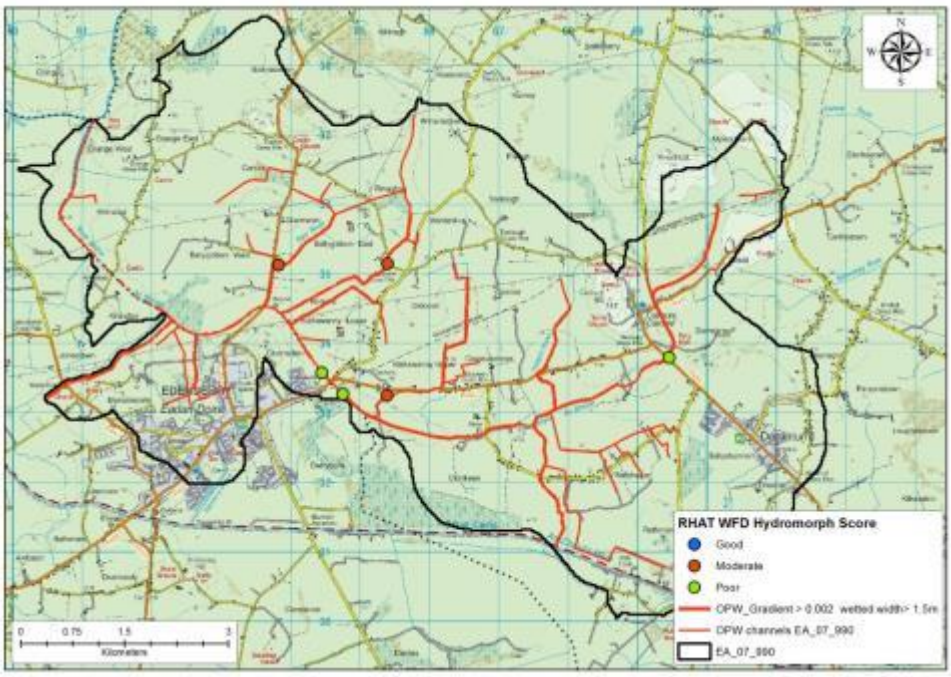


Figure 11. RHAT Scores for sub basin EA_07_990

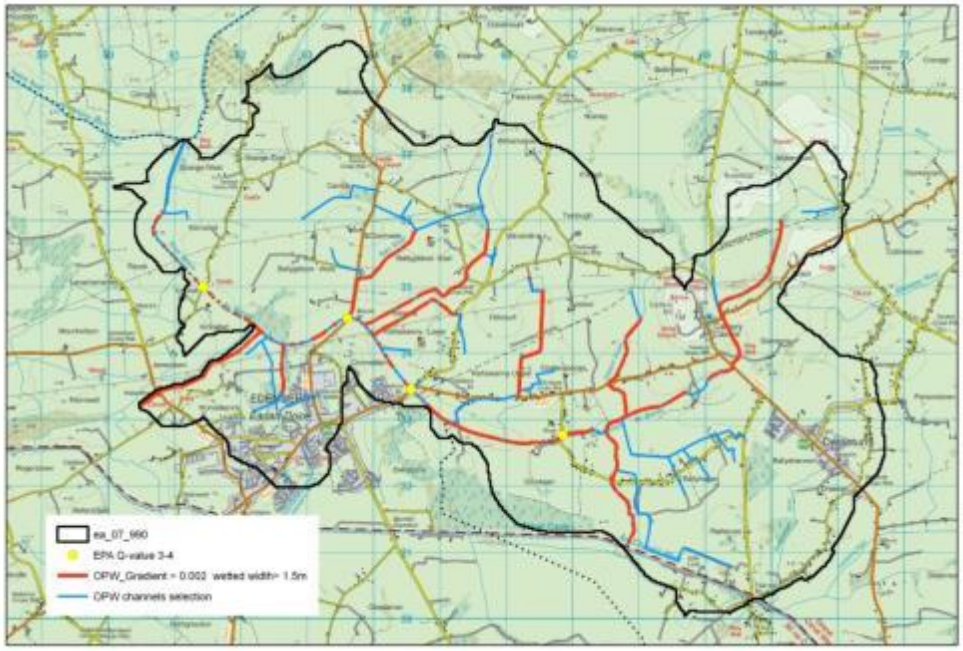


Figure 12. EPA Q-Value Ratings for sub basin EA_07_990