

UPPER RIVER BLACKWATER SPECIAL
AREA OF CONSERVATION (SAC: 002170)
MANAGEMENT PLAN

IRD DuhallowLIFE+ Project

LIFE09 NAT/IE/000220 Blackwater SAMOK

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I.R.D. Duhallow Ltd.



River Blackwater Special Area of Conservation (SAC: 002170) Management Plan

IRD Duhallow LIFE Project (Blackwater SAM OK – *LIFE09 NAT/IE/000220*)

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Preface

Currently, there are no published conservation management plans for the Upper Blackwater Special Area of Conservation (SAC). Draft SAC conservation management plans, produced in 2010 by the National Parks and Wildlife Service, are available online for Freshwater Pearl Mussel (Anon, 2010a), but no final plans are available at the time of this publication.

This plan aims to provide the information necessary for the conservation management of the SAC. The plan was produced under Action A1 of the SAMOK LIFE Project (LIFE09 NAT/IE/000220).

Introduction:

Habitats Directive and National Legislation

The EU Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (*The Habitats Directive*) was adopted by Ireland in 1992. The Habitats Directive was set up to protect over 200 habitats and approximately 1,000 species which are listed in the Directive's Annexes. These are habitats and species that are deemed to be of European importance, following criteria set out in the Directive (European Commission, 2015).

The Directive led to the setting up of a network of Special Areas of Conservation (SACs) which, together with the existing Special Protection Areas (SPAs), form a network of protected sites across the European Union called the Natura 2000 Network (European Commission, 2015).

The Directive was transposed into Irish national law in 1997. The European Communities (Natural Habitats) Regulations, 1997 (SI 94/1997), represent an important change in policy and law for the conservation of Irish wildlife (NPWS, 2015). They were finally consolidated in the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477/2011).

River Blackwater Special Area of Conservation (Site Code: 002170)

The Munster Blackwater catchment is the largest Freshwater Pearl Mussel catchment in Ireland. It has an area of over 2,300km² and is situated in the South Western River Basin District (SWRBD). Rising in the Mullaghareirk Mountains, the Blackwater flows through counties Kerry, Cork and Waterford before discharging into Youghal Harbour. The entire length of the catchment forms part of the Blackwater River (Cork/Waterford) SAC (Natura 2000 code: 002170) selected for the following habitats and/or species listed on Annex I / II of the EU Habitats Directive (*See Table 1*):

Table 1 List of protected habitats and species in the Munster Blackwater Special Area of Conservation
(www.NPWS.ie)

Habitat	Code
Estuaries	1130
Mudflats and sandflats not covered by seawater at low tide	1140
Perennial vegetation of stony banks	1220
Salicornia and other annuals colonizing mud and sand	1310
Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)	1330
Mediterranean salt meadows (<i>Juncetalia maritimi</i>)	1410
Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation	3260

Old sessile oak woods with Ilex and Blechnum in British Isles	91A0
Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)	91E0
Taxus baccata woods of the British Isles	91J0
Species	Code
Freshwater pearl mussel (<i>Margaritifera margaritifera</i>)	1029
White-clawed crayfish (<i>Austropotamobius pallipes</i>)	1092
Sea lamprey (<i>Petromyzon marinus</i>)	1095
Brook lamprey (<i>Lampetra planeri</i>)	1096
River lamprey (<i>Lampetra fluviatilis</i>)	1099
Allis shad (<i>Alosa alosa</i>)	1102
Twaite shad (<i>Alosa fallax fallax</i>)	1103
Salmon (<i>Salmo salar</i>)	1106
Otter (<i>Lutra lutra</i>)	1355
Killarney fern (<i>Trichomanes speciosum</i>)	1421

Important tributaries include the rivers Allow, Awbeg, Owentaraglin, Glen, Finnow, Araglin, Bride and Licky. This plan concentrates on the River Blackwater from the source in Knockauncurragh (ITM 512292, 609080), to the confluence with the Glen River (ITM 539131, 598604). For this document, this section of river and catchment will be called the Upper Blackwater. The area of the Upper Blackwater catchment is 867km² and covers much of Northwest Cork and Southeast Kerry (*Figure 1*).

IRD DuhallowLIFE+ Project (Blackwater SAMOK LIFE09 NAT/IE/000220)

IRD Duhallow Ltd. is a rural development company based in Newmarket, Co. Cork. Established in 1989 to promote the tourism potential of the rivers in Duhallow, the company administers a range of EU and National programmes, including voluntary services. In 2010, IRD Duhallow, in partnership with Inland Fisheries Ireland, was awarded funding from the EU LIFE+ Programme targeting the Upper Blackwater. The total fund for the IRD DuhallowLIFE+ Project is €1,995,826 (46.88% of which is EC co-funding). The majority of the on-the-ground works, project innovations and demonstration of best practice entailed in the project are aimed at the River Allow catchment area.

The River Allow catchment forms part of the Munster Blackwater River SAC. The site is important for a number of species including the Kingfisher *Alcedo atthis*, Freshwater Pearl Mussel *Margaritifera margaritifera*, Atlantic Salmon *Salmo salar* and European Otter *Lutra lutra*. The conservation status of the site has increasingly come under pressure. Agricultural intensification, poor afforestation practices (historic), and inadequate water management over recent times have led to increased levels of nutrient enrichment, siltation and pollution. Significant threats to the site and its species have been exacerbated by years of degradation of the riparian environment. Examples of this include the spread of Himalayan Balsam (*Impatiens glandulifera*), and overgrown bank vegetation causing excessive shade for the river. These issues, if left unchecked, are likely to have serious repercussions for native vegetation, river bank stability, sedimentation of spawning beds and ultimately for the habitat and food sources of the Freshwater Pearl Mussel, Salmon, Otter and Kingfisher.

The conservation objectives of the IRD DuhallowLIFE+ Project targets five key species, four of which are Annex species under the Habitats Directive and Birds Directive. While this management plan is focussed mainly on these five species, other important species will benefit from the measures set out (see *Management Prescription for the Management and Monitoring of Other Important Species in the SAC - Page 29*).

Table 2 Protective Legislation for IRD DuhallowLIFE+ Project's target species

Species Name	Common Name	Key Legislation and Binding Instruments
<i>Margaritifera margaritifera</i>	Freshwater Pearl Mussel	<ul style="list-style-type: none"> • Habitats Directive (92/43/EEC) (Annex II and Annex V) • Bern Convention Appendix 3 • European Communities (Natural Habitats) Regulations, S.I. 94/1997, as amended by

		<p>S.I. 233/1998 and S.I. 378/2005</p> <ul style="list-style-type: none"> • Freshwater Pearl Mussel Regulations, S.I. 293/2009 • Wildlife Act 1976 and Wildlife (Amendment) Act 2000
<i>Salmo salar</i>	Atlantic Salmon	<ul style="list-style-type: none"> • EC Freshwater Fish Directive (2006/44/EC) • Habitats Directive (92/43/EEC) (Annex II and Annex V) • Bern Convention Appendix 3 • Wild Salmon and Sea Trout Tagging Scheme (Amendment) (No. 2) Regulations, 2014 • Inland Fisheries (Fixed Charge Notice) (No. 2) Regulations (SI No. 705 of 2011) • Special Tidal Waters (Special Local Licences) (Alteration of Duties) Order (SI No. 614 of 2011) • Salmon Rod Ordinary Licences (Alteration of Licence Duties) Order (SI No. 613 of 2011)
<i>Lutra lutra</i>	Eurasian Otter	<ul style="list-style-type: none"> • Habitats Directive (92/43/EEC) (Annex II and Annex IV) • Wildlife Act 1976 and Wildlife (Amendment) Act 2000
<i>Alcedo atthis</i>	European Kingfisher	<ul style="list-style-type: none"> • The EU Birds Directive (79/409/EEC) (Annex I) • European Communities (Natural Habitats) Regulations SI 94/1997, as amended SI 233/1998, and SI 378/2005 • Bern Convention Annex II • Wild birds protection act, 1930 (S.I. No. 259/1961)

<i>Cinclus cinclus hibernicus</i>	Dipper	<ul style="list-style-type: none"> • Wild birds protection act, 1930 (S.I. No. 259/1961)
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River Allow Catchment Management Group

To be most effective, catchment management should include all stakeholders from both public and private sectors, including volunteers and community groups. If all relevant groups actively engage in the conservation, research and regulation processes in a catchment area, the environmental benefits to that catchment can be achieved. For this reason, IRD Duhallow through its LIFE Project, and the South West Regional Authority through their INTERREG IVC funded TRAP (Territories of River Action Plans) Project, came together to establish the River Allow Catchment Management Group (RACMG). The Group has over twenty stakeholders and contributors (*see Appendix IV*), who meet on a regular basis to identify solutions to issues in the Allow Catchment Area.

Aims of this Management Plan:

Article 6.1 of the Habitats Directive defines the conservation measures that are required in SACs: *‘For Special Areas of Conservation, Member States shall establish the necessary conservation measures involving if need be, appropriate management plans specifically designed for the sites or integrated into other development plans and appropriate statutory, administrative or contractual measures which correspond to the ecological requirements of the natural habitat types in Annex I and the species in Annex II present on the site’* (Council Directive 92/43/EEC, 1992, p. No L 206 / 11).

The aim of this management plan is to provide a template for the protection and maintenance of the habitat features and species in the Special Area of Conservation in the Upper Blackwater and Allow River Sub-Catchments (*as illustrated in Figure 1*).

Objectives of this Management Plan:

The conservation objectives in this document outline the measures required to improve and protect the habitats and the species found in the Upper Blackwater SAC. The plan outputs are as follows:

1. Prescriptions for the management and monitoring of Freshwater Pearl Mussel (henceforth referred to as FPM) in the SAC.
2. Prescriptions for the management and monitoring of Atlantic salmon in the SAC.
3. Prescriptions for the management and monitoring of Otter in the SAC.

4. Prescriptions for the management and monitoring of Kingfisher and Dipper in the SAC.
5. Prescriptions for the management and monitoring of other important species within the SAC, including Brook Lamprey, River Lamprey, Sea Lamprey.
6. Prescriptions for the management of the riparian zone in the SAC. This sub-section includes management prescriptions for:
 - a) Invasive non-native riparian plants;
 - b) Excessive shading by trees (tunnelling);
 - c) Native tree planting;
 - d) Management of livestock near the river.

Prescriptions for the Management and Monitoring of Freshwater Pearl Mussel (*Margaritifera margaritifera*) in the SAC



The Munster Blackwater is ranked 24 out of the 27 for the status of its FPM SAC population in Ireland (see Figure 2). This rank is based on population status, habitat condition and current pressures, culminating in the Blackwater FPM population being classed in an “unfavourable” conservation status (Anon, 2010a). However, population density and distribution data gathered from ongoing FPM monitoring could alter the FPM status in the Upper Blackwater.

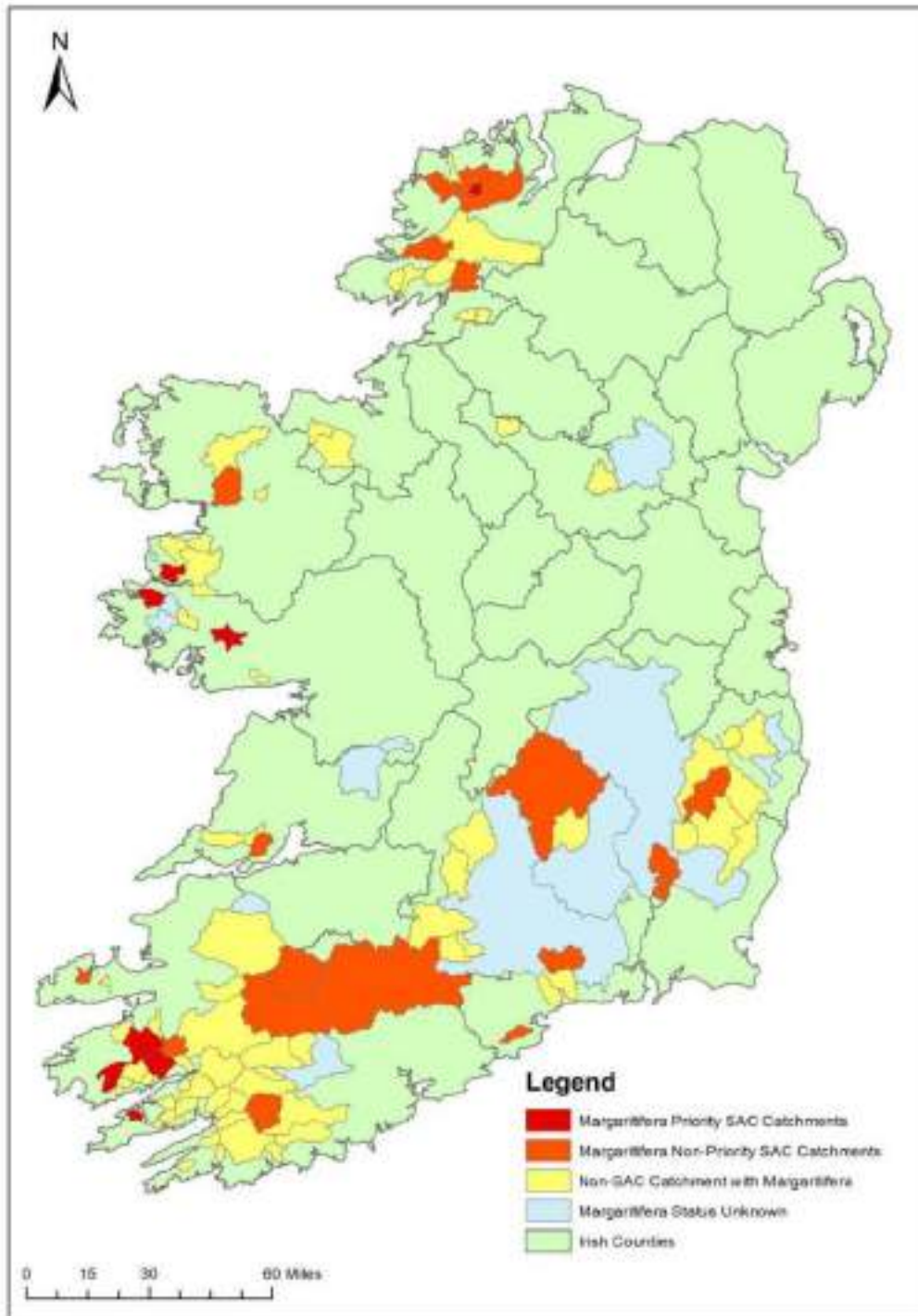


Figure 2 Locations and status of *Margaritifera margaritifera* SAC catchments in Ireland. SACs ranked in the top nine of the 27 FPM SAC catchments are deemed priority SACs due to the exclusion of the remaining 18 SACs from the proposed €70 million Locally Led Agri-environmental scheme

Although in better condition than the Blackwater, the FPM population in the Allow sub-catchment also has an unfavourable conservation status. It is currently ranked 12th out of the 27 FPM SAC (Figure 2) (Anon, 2010b). The population is reducing in size due to the decline in habitat quality (Anon, 2010b). This is due to the high levels of fine sediment (silt) being deposited on the riverbed, and extensive macrophyte growth which is exacerbated by the

change in substrate and elevated nutrient levels. The FPM demographic profile is poor due to a lack of juveniles to maintain a viable population in the future.

The Blackwater catchment fails to meet all five Environmental Quality Objectives (EQOs) as specified in Schedule 4 of the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations, S.I. 296 of 2009.

Table 3 Ecological Quality Objectives for Freshwater Pearl Mussel Habitat (S.I. No. 296 of 2009, p. 15)

Element	Objective	Notes
Macroinvertebrates	EQR 0.90	High status
Filamentous algae (Macroalgae)	Absent or Trace (<5%)	Any filamentous algae should be wispy and ephemeral and never form mats
Phytobenthos (Diatoms)	EQR 0.93	High status
Macrophytes - Rooted higher plants	Absent or Trace (<5%)	Rooted macrophytes should be absent or rare within the mussel habitat
Siltation	No artificially elevated levels of siltation	No plumes of silt when substratum is disturbed

The conservation of FPM is of national and European importance. In Ireland, the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S.I. No. 296), set out the requirements for a sub-basin management plan for surface waters classified “of less than good ecological status”. These sub-basin plans must include the following:

- (a) Specify objectives and targets, in accordance with Regulation 2, and the Third and Fourth Schedules to these Regulations, and deadlines for their achievement;*
- (b) Provide for the investigation of sources of pressures leading to the unfavourable conservation status of the freshwater pearl mussel;*
- (c) Establish a programme of measures, including a timeframe, for the reduction of pressures giving rise to unfavourable conservation status. The programme shall include pressure reduction targets and deadlines, either in relation to individual pollutants or to particular sectors or activities or both, which will be implemented within the sub-basin, or parts of the sub-basin as appropriate;*
- (d) Lay down a detailed programme of monitoring to be implemented within the sub-basin, or parts of the sub-basin as appropriate, in order to evaluate the effectiveness of measures and progress made towards restoring favourable conservation status.*

Conservation Objectives and Measures

Table 4: Key objectives for the future management of FPM in the Upper Blackwater SAC (Anon, 2010a) and key stakeholders identified to help deliver these objectives

	Objective	Key stakeholders who may help deliver the objective
1	Minimalisation of sediment losses arising from site clearance works for development, agriculture or other purposes	NPWS, Coillte, Forest Service, Local Authorities (Planning Dept.), Wind farms, Landowners and Farmers (GLAS)
2	Minimalisation of sediment and nutrient losses arising from land-use change (e.g. increased stocking-rates)	Landowners and Farmers (GLAS), Coillte, Forest Service, Private Forestry, NPWS, EPA
3	Prevention of nutrient and sediment losses from new on-site wastewater systems associated with one-off houses	Local Authorities (Planning Dept.), EPA, An Taisce, IFI, Homeowners
4	Control of hydro-morphological pressures, including drainage, drainage-maintenance, and bank stabilisation works etc.	Local Authorities, EPA, IFI, Landowners and Farmers (GLAS, Harvest 2020)
5	Control of municipal and industrial discharges to meet Environmental Quality Objectives set out in Schedule 4 of SI 296 of 2009	Local Authorities, Irish Water, EPA, NPWS
6	The key legal and policy measures required to mitigate impacts from on-going and future activities and to restore the Freshwater Pearl Mussel habitat are: <ol style="list-style-type: none"> 1. Freshwater Pearl Mussel-measures in Agri-environmental scheme 2. Catchment management plans for forestry 3. Proper licensing, upgrade and operation of Waste Water Treatment Plants and associated infrastructure 4. Proper licensing, mitigation and maintenance of other point-source discharges 	Local Authorities, NPWS, Coillte, Forest Service, EPA, IFI

The following are the NPWS conservation objectives for the Blackwater SAC concerning the FPM (NPWS, 2012):

Table 5: Conservation Objectives for FPM in the Munster Blackwater SAC (NPWS, 2012)

1	Maintain distribution at 161km
2	Restore population to 35,000 adult mussels
3	Restore population structure (recruitment) to at least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length
4	Adult mortality - No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution
5	Restore suitable habitat in more than 35km and any additional stretches necessary for salmonid spawning
6	Restore water quality - macroinvertebrates: ecological quality ratio greater than 0.90; phytobenthos: ecological quality ratio greater than 0.93
7	Restore substratum quality - filamentous algae: absent or trace (<5%)
8	Sediment - stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment
9	Redox Potential - Restore to no more than 20% decline from water column to 5cm depth in substrate*†
10	Maintain sufficient juvenile salmonids to host glochidial larvae
11	Flow Variability - Restore appropriate hydrological regimes

The draft Munster Blackwater and Allow Sub-Basin FPM Management Plans (2010) include a range of issues and risks that affect FPM in the Upper Blackwater sub-catchment. The plans also list measures to mitigate these risks. IRD Duhallow’s LIFE Project, through its walk over surveys of many of the tributaries of the Upper Blackwater, has identified a number of risks facing Freshwater Pearl Mussels. Through the LIFE project, and by working with stakeholders in the River Allow Catchment Management Group, management measures to address these threats have been identified.

*Freshwater Pearl Mussel sites in Ireland, that have juvenile recruitment, were found to have no detectable differences between the redox potential of the open water and the interstitial water at 5 or 10cm depth (North South Project 2, 2009)

† In natural ecosystems using redox potential is 'fraught with difficulties'. Results obtained should be used relative to other environmental parameters (Walsh, Neill, & Lucey, 2012). Walsh, Neil and Lucey (2012) also believe redox potential, with regard to oxygen, must be considered as a relative instead of an exact measurement.

Table 6: Risks, observed by the IRD DuhallowLIFE+ Project, affecting FPM and possible measures to mitigate these risks.

Additional Risks and Measures for Freshwater Pearl Mussel based on observations made by the LIFE Project (Blackwater SAMOK)	
Agriculture	<p>Risk – Over grazing, Cattle access, Land drainage</p> <p>Cattle grazing along unfenced riverbanks leads to poaching and unstable banks and consequently bank erosion.</p> <p>Livestock access to the river for drinking can lead to nutrient enrichment of the channel.</p> <p>Unregulated fertiliser and slurry spreading in close proximity to the river channel can lead to nutrient enrichment of the river.</p> <p>Newly opened drains along with deep and unvegetated drains risk adding fine materials to the main channel.</p> <p>Measures</p> <p>Cattle can reach up to 1m beyond a single strand fence regime; therefore, fencing 2m from the bank still allows vegetation to grow unimpeded along a 1m wide strip. This provides more bank stability and a riparian buffer against nutrient runoff. Where possible a wide buffer strip can be implemented. This depends on individual landowners.</p> <p>Alternative drinking strategies such as pasture pumps, solar powered pumps, or connecting troughs to main supply will exclude livestock from waterways.</p> <p>Installing and maintaining silt traps in drains will reduce the transport of fine sediment into the main channel.</p>
Forestry	<p>Risk – Clear felling, land drainage</p> <p>Exposed soil left behind after clear felling are at risk of erosion and transportation into water bodies.</p> <p>Drainage of peat soils and bog result in sediment and nutrient loss.</p> <p>Measures</p> <p>Settling ponds with complementary silt traps (that are regularly maintained) at the outflow, in upland forestry would reduce the amount of sediment and nutrient entering the main river channel. They would also decrease the rate of water flowing down the river, thus reducing the pressure on riverbanks.</p>
Wastewater Treatment Plants (WWTP)	<p>Risk – Discharge</p> <p>Discharge materials have been detected in the vicinity of WWTPs (<i>see appendix 2</i>).</p> <p>Measures</p> <p>Upgrading of treatment plants along with frequent, unannounced, inspections should be commonplace at all WWTPs. The general public should be encouraged to report discharge events to relevant authorities (i.e. Local Authority, EPA, IFI, NPWS, Irish Water etc.) and be reassured that any information given will be acted upon.</p>

Alien Invasive Species	<p>Risk – Alien Invasive Plants</p> <p>Invasive plants, such as Himalayan Balsam and Japanese Knotweed, die back in winter, leaving behind bare, unprotected soils which are vulnerable to erosion.</p> <p>Measures</p> <p>A programme of sustained invasive species control is the most effective eradication technique. Continuous monitoring is essential. The most effective measure for controlling Himalayan balsam is the labour intensive, pulling of the plant by hand. Other invasive plants like J. Knotweed require chemical treatment – See Prescriptions for the Management of the Riparian Zone in the SAC - Invasive Riparian Alien Plants in this document (Page 34).</p>
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Freshwater Pearl Mussel Survey information to date:

Table 7: Tributaries and main channel of the Upper Blackwater surveyed the presence and absence of FPM

River/Tributary	FPM Present	FPM presence not confirmed by survey
Upper Blackwater	✓	
Owentaraglin	✓	
Finnow		✓*
Rathcoole		✓*
Glen		✓*
Awanaskirtaun		✓*
Nadd		✓*
Aubane		✓*
Grinaloo		✓*
Corrigduff/Ivale		✓*
Allow		
Upper Allow	✓	
Lower Allow†		✓*
Dalua		✓***
Glenlara		✓*
Owenanare		✓*
Owenkeale		✓*
Brogeen		✓****
Glashawee		✓

* NPWS surveys (1997-2010 – Presence not confirmed).

**Glochidia found on fish caught by anglers.

***Post flood beached FPM specimen delivered to LIFE Project. Glochidia confirmed on fish caught by anglers.

†Lower Allow (i.e. downstream of Kanturk Town. Presence not confirmed)

Surveys were conducted by the National Parks and Wildlife Services between 1997 and 2005. In the majority of the tributaries in the Upper Blackwater, the presence of Freshwater Pearl Mussel was not confirmed. FPM shells were found, by the DuhallowLIFE+ Project, washed up on the banks of the Brogeen River, suggesting that a population exists in that river. In addition, angling surveys along the Brogeen and Dalua found glochidia (FPM larval stage) on the gills of the fish caught.

IRD DuhallowLIFE has conducted a large-scale baseline survey of the FPMs in the River Allow. Over 28.5km of riverbed was surveyed for FPM, with habitat features such as substrate, channel width and riparian vegetation also recorded.

Monitoring Programme

Two monitoring strategies will be employed to monitor the success of the measures outlined in this plan. The first is to monitor FPM recruitment. The second involves long-term monitoring of adult mussels. The former involves the establishment of fixed index sites with permanent transects. Following the methodology described in the Munster Blackwater Sub-Basin Management Plan (Anon, 2010a) these monitoring programmes should examine overall changes in the distribution and abundance of mussels, as well as monitoring the conservation status of the population in the Upper Blackwater and Allow sub-catchment. These sites will be monitored every year, completing a full cycle of transect monitoring once every three years (Anon, 2010a). These surveys will have to be conducted by trained and licensed individuals in accordance with the methods set out in the Irish Wildlife Manuals No. 12 (Anon, 2004).

Table 8: Index sites for permanent transects for monitoring recruitment, distribution, and abundance of FPM in the Allow River and Upper Blackwater Sub-Catchments (2010)

Site	Location (ITM)
Allow River	
Upstream of Raheen Bridge	536212, 615581
Downstream of Raheen Bridge	536611, 615719
Upstream of Johnsbridge	539428, 609903
Downstream of Coolageela Stream confluence	538748, 606247
Upper Blackwater	
Upstream of Lisheen Bridge	515854, 597646
Downstream of Lisheen Bridge	515973, 597395
Upstream of Nohaval Bridge	516958, 594240
Duncannon	518030, 593115
Ahane	522366, 594342
Charles Br	524846, 594441
Keale Bridge	529525, 693589
Colhurst Bridge	532899, 594602
Ballymaquirk	538337, 598797

Glen River confluence	539114, 598645
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To date, the final drafts of the Sub-Basin Management Plans for FPM have yet to be published. No locations for their monitoring programme have been published. Informing stakeholders, such as anglers and farmers, on the locations of FPM beds would increase awareness of the species and inform decisions on river and riparian management (e.g. managing and maintaining angling beats that avoid disturbing FPM habitats).

Prescriptions for the Management and Monitoring of Atlantic Salmon *Salmo salar* in the SAC

The Munster Blackwater is famous for being one of the best Salmon fishing rivers in Ireland (fishinginireland.info, n.d.). The Atlantic Salmon is listed under the Habitats Directive as an Annex II and Annex V species (Council Directive 92/43/EEC), making it a species of European importance. Once widely distributed, its range



has declined due to human activities that have degraded water quality, and the installation of weirs and other migratory barriers (Hendry & Cragg-Hine, 2003). In Ireland, Salmon angling is legally subject to tagging and rod regulations (e.g. Wild Salmon and Sea Trout Tagging Scheme (Amendment) (No. 2) Regulations, 2014; Salmon Rod Ordinary Licences (Alteration of Licence Duties) Order 2011 (SI No. 613 of 2011)).

Many of the pressures affecting the Freshwater Pearl Mussel also affect Salmon. Both species require well-oxygenated and clean gravel for spawning and the development of juveniles (Hendry & Cragg-Hine, 2003). The high levels of deposited silt recorded during FPM surveys (DuhallowLIFE Project) negatively impacts upon the quality of Salmon spawning redds by clogging interstitial spaces in the gravel, preventing oxygenated water from reaching the redds (Hendry & Cragg-Hine, 2003; Cowx & Fraser, 2003). Elevated silt and suspended solid levels also degrade Salmon habitat (Cowx & Fraser, 2003).

Conservation Objectives and Measures

The following are the NPWS (2012) conservation objectives for the Blackwater SAC with regards to Atlantic Salmon:

Table 9: Conservation Objectives for Atlantic Salmon in the Munster Blackwater SAC (NPWS, 2012)

1	Achieve distribution in 100% of river channels (incl. secondary)
2	Exceed conservation limit of adult spawning fish for each system
3	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min electrofishing sampling

4	Record no significant decline in out-migrating smolt abundance
5	Record no decline in number and distribution of spawning redds due to anthropogenic causes
6	Record at least EPA value Q4 at every site sampled by the EPA

Atlantic Salmon are affected by many of the stress factors that Freshwater Pearl Mussels endure. Point source pollution, abstraction, physical modification, agriculture, wastewater treatment plants, forestry and peat cutting (*Table 6*) all have the potential to stress Salmon and impact their habitat and spawning beds (Cowx & Fraser, 2003; Skinner, Young, & Hastie, 2003).

Table 10: Atlantic Salmon risks and measures based on observations by the IRD DuhallowLIFE+ Project

Risks and Measures for Atlantic Salmon based on observations made by the LIFE Project (Blackwater SAMOK)	
Agriculture	<p><i>Risk – Over grazing, Cattle access, Land drainage</i></p> <p>Cattle grazing along unfenced riverbanks leads to poaching and unstable banks and consequently bank erosion. Livestock access to the river for drinking can lead to nutrient enrichment of the channel. Fertiliser and slurry spreading in close proximity can cause nutrient loss to the river. Newly opened drains along with deep and unvegetated drains risk adding fine materials to the main channel.</p> <p><i>Measures</i></p> <p>Fencing at least 2m from top of bank will allow vegetation to grow unimpeded, thus providing bank stability and a riparian buffer against nutrient runoff. Alternative drinking strategies such as pasture pumps, solar powered pumps, or connecting troughs to main supply will exclude livestock from waterways. Installing and maintaining silt traps into drains will reduce the loss of fine materials into main channel.</p>

<p>Forestry</p>	<p><i>Risk – Clear felling, land drainage</i></p> <p>Exposed soils as a result of clear felling are vulnerable to erosion and transport into waterbodies, adding fine materials to the river bed.</p> <p>Drainage of peat soils and bog results in sediment and nutrient loss.</p> <p><i>Measures</i></p> <p>Settling ponds, with complementary silt traps (that are regularly maintained) at the outflow, in upland forestry would reduce the amount of sediment and nutrients entering the main river channel. They would also decrease the rate of water flowing down the river, thus reducing the pressure on riverbanks.</p>
<p>Wastewater Treatment Plants (WWPT)</p>	<p><i>Risk – Discharge</i></p> <p>Waterbodies in the vicinity of WWTPs have been observed having discharge materials present (<i>see appendix 2</i>).</p>
<p>Alien Invasive Species</p>	<p><i>Risk – Alien Invasive Plants, Mink</i></p> <p>Invasive plants, such as Himalayan Balsam and Japanese Knotweed (<i>Fallopia japonica</i>), which die back in winter, leave behind bare, unprotected soils that can enter the channel.</p> <p>While native predators such as Otters and Grey Herons (<i>Ardea cinerea</i>) consume Salmon, the added impact of the American Mink in an ecosystem can cause already low fish stocks to decline further (Scottish Mink Initiative).</p> <p><i>Measures</i></p> <p>A programme of sustained invasive species control is the most effective eradication technique. Continuous monitoring is essential. The most effective control measure for controlling Himalayan balsam is the labour intensive, pulling of the plant by hand. Other invasive species, like J. Knotweed, require chemical treatment – <i>See Prescriptions for the Management of the Riparian Zone in the SAC - Invasive Riparian Alien Plants in this document (page 34)</i>.</p> <p>Introduce licensed control measures for Mink. Mink hunting is often the guise for illegal Otter hunting. Trapping and shooting/drowning Mink should be the only method of eradication.</p>

Salmon Surveys to date:

IRD Duhallow’s project partner in the LIFE Project (LIFE09 NAT/IE/000220 Blackwater SAMOK), Inland Fisheries Ireland, undertook electrofishing surveys for Salmon in the Allow River sub-catchment for the project.

Limited fish stock surveys are also conducted as part of the programme of sampling fish for the Water Framework Directive (WFD). There are two locations in the Upper Blackwater. One site is near Novahal Bridge on the Upper Blackwater, and one site is on the Dalua River near the footbridge in Island Wood, outside Newmarket (Kelly, et al., 2014).

Table 11: Locations of IFI electrofishing surveys in the Allow River Catchment (See Appendix - Maps)

River	Location (ITM)
Blackwater SAMOK LIFE Project	
Allow	538662, 614563
Allow	539379, 613687
Allow	539413, 613521
Allow	539408, 611909
Allow	539508, 611811
Allow	539326, 610582
Allow	539045, 606775
Dalua	537246, 604058
Dalua	534264, 604624
Brogeen	538112, 602079
Brogeen	538190, 602028
Brogeen	537317, 602396
Brogeen	537251, 602396
Rampart	532360, 606919
Water Framework Directive	
Upper Blackwater	517232, 594570
Dalua	532438, 604623

Monitoring Programme

Two types of monitoring strategies are sufficient to quantify the outcomes of the measures taken to achieve the objectives of this plan. The first is to monitor juvenile Salmon with the use of electrofishing. The electrofishing surveys will be continuations of the monitoring work already conducted by IFI in the Allow Catchment and Upper Blackwater (Kelly, et al., 2014) (Table 11). The second, long term monitoring programme is for Salmon adults. While electrofishing is adequate for monitoring juveniles, other additional methods are necessary for

observing adult Salmon migration (including return migration to spawning grounds), including the installation and maintenance of fish counters on the Upper Blackwater and its tributaries. This would provide data on adult Salmon movements. Redd counting as a method to estimate spawning adults is not a suitable method for estimating abundance as it is ‘*almost impossible*’ to see redds in the Upper Blackwater in recent years (Michael Faul, IFI Inspector, *pers. comm.*).

Prescription for the Management and Monitoring of Otter *Lutra lutra* in the SAC

The Otter is listed on Annex II and Annex IV of the EU Habitats Directive (Council Directive 92/43/EEC), thus making it a species of European importance. The Irish population is said to be one of the most important in Western Europe (Whilde, 1993) and is the most stable in Europe (Lundy, 2014). Despite this, the Otter is listed under the Red-data Book as vulnerable (Whilde, 1993) and is protected under the Wildlife Acts of 1976 and 2000 (Bailey & Rochford, 2006). The Munster Blackwater is one of 44 SACs designated for the Otter in Ireland (Bailey & Rochford, 2006). This includes the Allow sub-catchment.



Conservation Objectives and Measures

The following are conservation objectives for the Blackwater SAC with regards to the Otter:

Table 12: Conservation Objectives for Otter in the Munster Blackwater SAC (NPWS, 2012)

1	Record no significant decline in distribution
2	Record no significant decline in extent of terrestrial habitat
3	Record no significant decline in extent of freshwater habitat
4	Record no significant decline in couching sites and holts
5	Record no significant decline in fish biomass
6	Record no significant increase in barriers to connectivity

Table 13: List of risks and measures for Otters in the Upper Blackwater and Allow Sub-Catchments

Risks and Measures for Otter based on observations made by the LIFE Project (Blackwater SAMOK)	
Accidental Death	<p>Risk – Road kill</p> <p>Dead Otters have been found on roads in the catchment killed by cars.</p> <p>Measures</p> <p>Erect Otter crossing signage in known areas to raise public awareness.</p> <p>Road underpasses would greatly reduce otter road fatalities (Sleeman, <i>pers. comm.</i>, 2015).</p>

<p>Intentional Death</p>	<p>Risk – <i>Illegal hunting</i></p> <p>There is anecdotal evidence from game keepers of illegal Otter hunting in the Allow and Upper Blackwater catchments. This activity is usually under the guise of mink hunting and includes dogs.</p> <p>Measures</p> <p>Introduce licensed control measures for Mink. Mink hunting is often the guise for illegal Otter hunting. Trapping and shooting/drowning Mink should be the only method of eradication. Using dogs and other methods of flushing out mink should be legislated against.</p>
<p>Agriculture</p>	<p>Risk – <i>Scrub removal</i></p> <p>Many landowners in the catchment are removing scrub and reclaiming non-productive land under threat of a cut to their single farm payments.</p> <p>Measures</p> <p>Contact and reassure farmers that scrub and unproductive land in designated areas are exempt from single farm payment reductions. Provide guidance from the Department of Agriculture on appropriate management of rough pasture, hedgerows, and riparian areas for land in receipt of single farm payment. Discourage reclamation of high biodiversity areas.</p>

The Otter Threat Response Plan (NPWS, 2009) includes a list of potential threats to Otters at the national level. The plan identifies three principal risks: habitat destruction and degradation; water pollution; and accidental death and/or persecution.

Otter Survey Work to date

Seven locations in the Upper Blackwater were surveyed during the *Otter Survey of Ireland 2010/2012* (Reid, et al., 2013). Rapid assessment surveys were performed by IRD DuhallowLIFE+ in 2011 and 2012 with 45 bridges in the catchment surveyed in line with the technique set out by Chanin (2003). Walkover surveys of the Allow, Dalua and Brogeen were also conducted.

Table 14: Locations of Otter Bridge Survey of the Allow Catchment

Ref. no.	Location (ITM)	Ref. no.	Location (ITM)	Ref. no.	Location (ITM)
A1	538124, 699854	B1	538243, 601965	D1	538063, 603275
A2	538413, 698974	B2	537353, 602445	D2	537823, 603405
A3	538153, 603275	B3	536004, 602425	D3	533944, 604695
A4	538453, 606504	B4	532624, 602445	D4	532384, 604655
A5	539403, 609904	B5	532104, 602105	D5	530825, 607064
A6	539423, 611923	B6	532664, 602515	D6	530325, 607884
A7	539223, 613873	B7	528695, 602855	D7	529015, 610753
A8	536454, 615702	B8	525296, 602175	D8	528115, 612073
A9	534354, 615632	B9	525286, 603145	D9	528115, 613583
A10	531225, 616522	B10	525506, 604015	D10	527516, 614583
A11	530465, 615372			D11	527466, 614643
A12	529805, 616602			D12	529745, 604975
A13	529805, 615702			D13	527715, 607344
A14	530455, 617542			D14	525976, 609354
A15	533124, 616922			D15	525356, 609354
A16	532115, 616852			D16	525226, 609294
A17	531425, 617792				
A18	531005, 618202				
A19	530265, 618992				

Table 15: Locations of survey sites from the National Otter Survey of Ireland 2010-2012 (Reid, et al., 2013) and survey work conducted by Ferdia Marnell (NPWS) in 2012 (See Appendix - Maps)

Bridge Name (River)	Location (ITM)	Survey Name
Cullen Bridge (Owentaraglin)	523367, 596057	National Survey of Ireland 2010-2012
Glencam Bridge (Glencam)	542163, 587959	National Survey of Ireland 2010-2012
Long Bridge (Owenkeal)	529666, 604855	National Survey of Ireland 2010-2012
Priory Bridge (Owenanare)	534570, 608544	National Survey of Ireland 2010-2012
Lisheen Bridge (Blackwater)	515968, 597557	National Survey of Ireland 2010-2012
Cullavaw Bridge (Cullavaw)	513869, 592258	2012 survey work Ferdia Marnell
Wallis's Bridge (Blackwater)	528366, 592458	2012 survey work Ferdia Marnell

Monitoring Programme

The survey method outlined by Chanin (2003) ensures clearly defined sites for monitoring the progress and success of the measures outlined in this document. The best time of year to perform bridge surveys is between May and September. There should be a period of five days without heavy rain before surveying. For the first five years monitoring should be annual then every three years thereafter.

Prescriptions for the Management and Monitoring of Kingfishers (*Alcedo atthis*) and Dippers (*Cinclus cinclus hibernicus*) in the SAC

Despite the legal requirements to do so, no sites in Ireland have been designated for Kingfishers (Annex II Species) (Cummins et al., 2010). As well as the Birds Directive (79/409/EEC), Kingfishers are protected under the following laws: European Communities (Natural Habitats) Regulations (SI 94/1997, as amended SI 233/1998, and SI 378/2005); Berne Convention Annex



II; and the Wild Birds Protection Act, 1930 (S.I. No. 259/1961). Being a predator of small fish such as salmon parr (Vilches, et al. , 2013), Kingfishers are susceptible to many of the problems facing Atlantic Salmon and FPM.

Dippers normally occur in habitats of very clean, well oxygenated, fast flowing water (Sorace, et al., 2002). Acidification of water is an issue and Dippers do not do well in areas of low pH. The presence of an adequate supply of aquatic macro-invertebrates is important. If there is a low supply of larval stages then the Dipper will, in all likelihood, be absent (Ormerod, et al., 1991). Consequently, the dipper is one of the most sensitive birds to change in river ecology (Sorace, et al., 2002, Ormerod, et al., 1991).

Conservation Objectives and Measures

Table 16: Conservation Objectives for Kingfishers and Dippers in the Munster Blackwater SAC

Kingfisher	
1	Record no significant decline in distribution
2	Record no significant decline in fish biomass
3	Record no significant decline in habitat quality
4	Record no significant decline in nesting sites
Dipper	
1	Record no significant decline in distribution
2	Record no significant decline in water quality (macroinvertebrates)
3	Record no significant decline in habitat quality
4	Record no significant decline in nesting sites

Table 17: List of risk and possible mitigations for Kingfishers and Dippers in the Upper Blackwater Sub-Catchment based on observations from the IRD DuhallowLIFE+ Project (SAM OK)

Risks and Measures for Kingfishers based on observations made by the LIFE Project (Blackwater SAMOK)	
Transport	<p>Risk – Paths and Roads</p> <p>Pressures associated with transport such as paths/tracks, roads/motorways, bridges/viaducts and car parks appeared to be the most commonly encountered threats to the river systems (Cummins <i>et al.</i>, 2010). Maintenance of bridges may deny Dippers nesting opportunities.</p> <p>Measures</p> <p>Planning when building roads and pathways to avoid disturbance and compaction of soils. Adding ledges under bridges will provide dippers with nesting sites.</p>
Agriculture	<p>Risk – Grazing</p> <p>Cattle grazing along unfenced river banks causes disturbance to kingfisher nesting sites and compacts soil.</p> <p>Measures</p> <p>Fence at least 2m from top of bank.</p>
Hydro-morphology	<p>Risk – Erosion</p> <p>More rapid runoff has increased the level of erosion on many rivers in the Upper Blackwater catchment.</p> <p>Measures</p> <p>Water retention ponds and constructed wetlands will reduce the rates of water flowing into rivers; thus reducing the impact on vulnerable riverbanks.</p>

<p>Alien Invasive Species</p>	<p>Risk – Alien Invasive Plants, Mink</p> <p>Invasive plants, such as Himalayan Balsam and Japanese Knotweed, which die back in winter, leave behind bare, unprotected soils that can enter the channel.</p> <p>The Kingfisher has native predators such as the Otter but the added impact of the American Mink in an ecosystem can threaten already low Kingfisher numbers on the Blackwater (Crowe, 2010).</p> <p>Measures</p> <p>A programme of sustained invasive species control is the most effective eradication technique. Continuous monitoring is essential. The most effective control measure for controlling Himalayan balsam is the labour intensive, pulling of the plant by hand. Other invasive like J. Knotweed require chemical treatment – See Prescriptions for the Management of the Riparian Zone in the SAC - Invasive Riparian Alien Plants in this document (Page 34).</p> <p>Introduce licensed control measures for Mink.</p>
<p>Nest Disturbance</p>	<p>Risk – Habitat Removal/Nest destruction</p> <p>An active dipper nest was found to be removed and discarded when a branch, on which the nest was built, was removed by hand from a tree. The branch was removed outside the legislated timeline (see Appendix 2).</p> <p>Measures</p> <p>Raise awareness of breeding season among all agencies involved in bridge and river maintenance.</p>

Kingfisher and Dipper Survey to date

In 2010 the Blackwater was surveyed for kingfisher activity by BirdWatch Ireland (Cummins, et al, 2010). Walkovers surveys on the Allow and its tributaries were conducted by IRD DuhallowLIFE+ between 2011 and 2014. Based on the results of the survey, artificial nest boxes were installed at six locations in the catchment.

Forty-five bridges in the Allow Catchment were surveyed for dipper nests. As a result of this, and as part of the LIFE+ Project, thirty bridges had nest boxes installed under them. The locations of these bridges correspond to *Table 14*. No such surveys have been conducted in the

tributaries of the Upper Blackwater. However, a nest box was installed in a footbridge that crosses the Owentaraglin near Kiskeam.

Monitoring Programme

Monitoring for Kingfishers should follow the methodology set out by Cummins et al. (2010). Three boat-based (e.g. kayak) survey visits between mid-March and late May are recommended (Cummins, et al, 2010). Rivers should be divided into 500m sections with surveys carried out between 08:00 and 18:00. There were two years between the surveys of Crowe et al. (2008) and Cummins et al. (2010). There have been no published surveys since. If adequate data of nesting sites and breeding is to be achieved, then more frequent surveys are required.

Dipper nests are commonly found under bridges. Nesting sites can be visited from March. Monitoring breeding success without disturbing adults, chicks, or juveniles can be done through observations of the site during nesting season (March to June). To maintain a fixed nesting site for annual monitoring, used nests can be removed. If the site remains suitable for foraging, the same ledge, nest box, crevice will be used again.

Prescriptions for the Management and Monitoring of other Species of European Importance in the SAC

Management prescriptions for other species under consideration in this plan are listed below.

Sea Lamprey *Petromyzon marinus*, Brook Lamprey *Lampetra planeri* and River Lamprey *Lampetra fluviatilis*

Table 18: Conservation Objectives for Sea Lamprey in the Munster Blackwater SAC (NPWS, 2012)

1	Target extent of anadromy is >75% of main stem lengths of rivers accessible from estuary
2	At least three age groups present
3	Juvenile density in fine sediment at least 1/m ²
4	No decline in the extent of distribution of spawning beds

Table 19: Conservation Objectives for Brook and River Lamprey in the Munster Blackwater SAC (NPWS, 2012)

1	Distribution in all water courses, down to first order streams
2	At least three age groups present
3	Juvenile density in fine sediment at least 2/m ²
4	No decline in the extent of distribution of spawning beds

Below are the risks facing all three Lamprey species and potential measures identified by the LIFE Project. Other risks and measures are consistent with those for the Freshwater Pearl Mussel (see *Table 6*).

Table 20: Risk and measures observed by the IRD DuhallowLIFE+ Project for the three Lamprey species found in the Upper Blackwater

Risks and Measures for Lamprey species based observed by the IRD DuhallowLIFE Project	
Water Quality	<p><i>Risk – Siltation of spawning gravels</i></p> <p>Significant site clearance and bankside vegetation removal associated with forestry operations (including roads) was recorded, and is a potential source area for fine sediment. Agricultural impacts, such as land drainage and poaching of riverbanks have also led to an increase of fine materials being deposited into the main channel.</p> <p><i>Measures</i></p> <p>Strategically sited and regularly maintained silt traps can greatly reduce levels of sediment runoff to rivers. Fencing of riverbanks at over 2m from the bank will allow for unimpeded growth of vegetation and stabilise the banks.</p>

Lamprey Survey to date

To date, data collected from survey work conducted in 2014 has yet to be published (Dr James King, IFI, pers comm., 2015). Survey locations from the previous study (King & Linnane, 2004) indicate that there were 29 survey sites.

Table 21: Rivers in the Upper Blackwater Sub-Catchment that were surveyed for juvenile lamprey (three species) in 2003 and 2004 (King & Linnane, 2004)

River	No of sites
Blackwater Main Channel	5
Owentaraglin	4
Glen	4
Allow	3
Dalua	2
Crooked	2
Brogeen	2
Owenkeale	1
Nad	1
Finnow	1
Awanaskirtaun	1
Owennagloor	1
Rathcoole	1
Glashawee	1

Monitoring Programme

Survey methods will follow that of King & Linnane (2004). Electro-fishing using a backpack unit, with an electrified net and trailing cathode, is recommended. A single-pass technique with a consistent effort of one-minute fishing, in pulses, per metre length of sediment should be applied. Also, the area fished should be measured to give a minimum density estimate (King & Linnane, 2004). Sites should be monitored every five years (Harvey & Cowx, 2003).

Prescriptions for the Management of the Riparian Zone in the SAC

Invasive Riparian Alien Plants



Himalayan Balsam *Impatiens glandulifera* outcompetes native vegetation in riparian areas by shading them out in spring and summer. In winter when the plant dies back, the soil becomes exposed to erosion. This results in increased levels of erosion and sedimentation into the river, which negatively alters the instream habitat of the river (*Figure 3*).

Japanese Knotweed *Fallopia japonica*, along with other *Fallopia spp*, can also do a lot of damage to riverbanks by increasing the risk of soil erosion in winter (Invasive Species Ireland, 2015). The Upper Blackwater and its tributaries have been surveyed for these invasive plants by IRD Duhallow staff (*Figure 4*).

Management of Himalayan Balsam

- The plant can be pulled by hand.
- Teams of two per bank need to be on hand to continuously walk riverbanks monitoring and removing plants along the way.

In dry conditions or in areas of dry ground plants that have been pulled can be left to desiccate and rot. However, if conditions are wet and humid, greater care is required as the newly removed plant can continue growing from nodes along the long stalk. For this reason, the plant needs to be broken up and the root removed.

Care must also be taken if the plant is in flower. Seed pods form from the flower heads. These spring-loaded pods can expel seeds up to 7m away.

By carefully placing a small plastic bag over the flower before removing it, the risk of reseeding the area is greatly reduced.

- All sites, treated and untreated, must be revisited to ensure there is no regrowth.

Management of Knotweed Species (Japanese, Bohemian, Himalayan, Giant)

- This plant needs to be sprayed, as removal by hand carries the risk of spreading the invasive.
- Applicators such as a knapsack sprayer are the best way to utilise herbicides (Glyphosate, 2,4 - D amine, Triclopyr, Picloram).
- Control is easier if dead winter stems are tidied over the winter months to assist with access before growth commences i.e. to prevent tripping on them or them interfering with the knapsack lance.
- It is advised to leave the cane *in situ* to reduce the risk of spread to other sites.
- Care must be taken to avoid spreading knotweed crowns when tidying dead canes.

Volunteers and angling clubs will be best suited to aid in the management and monitoring of these alien species.

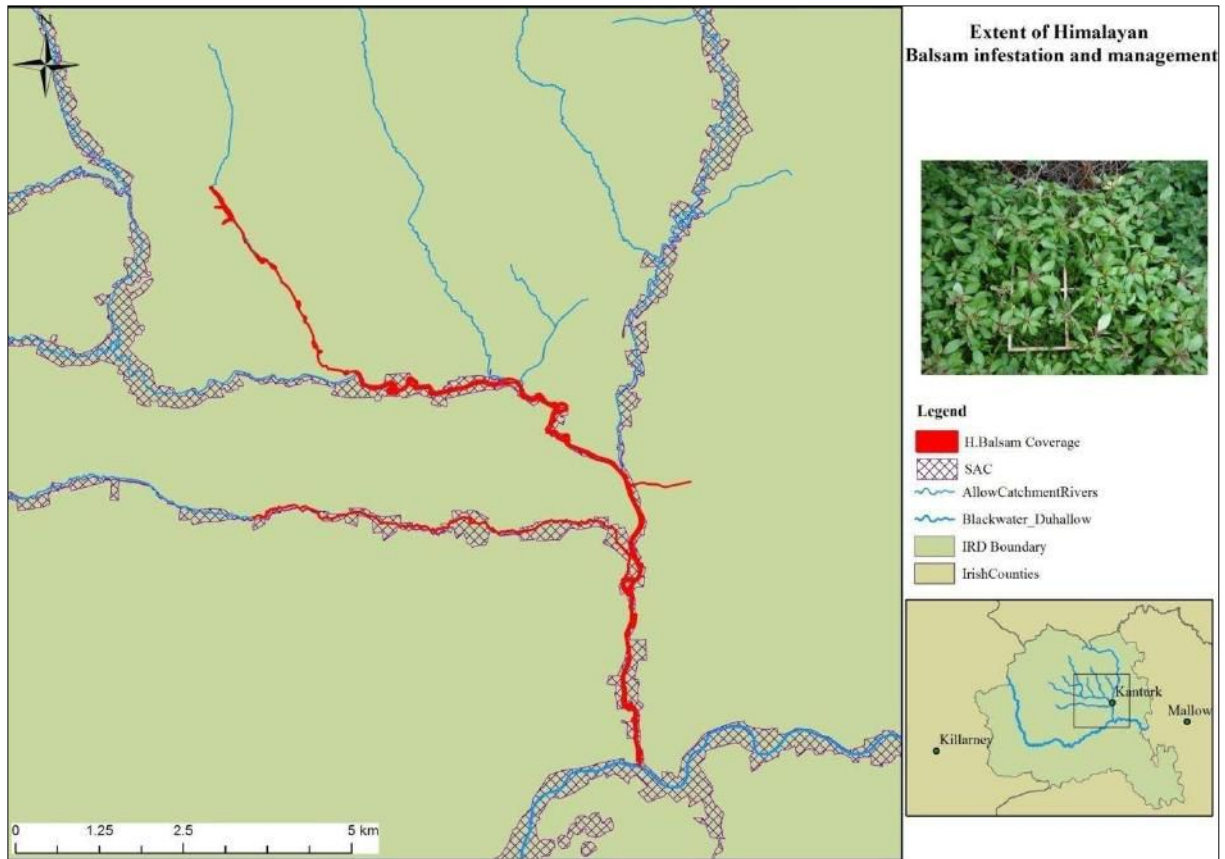


Figure 3 Extent of H. Balsam coverage in the Allow Catchment

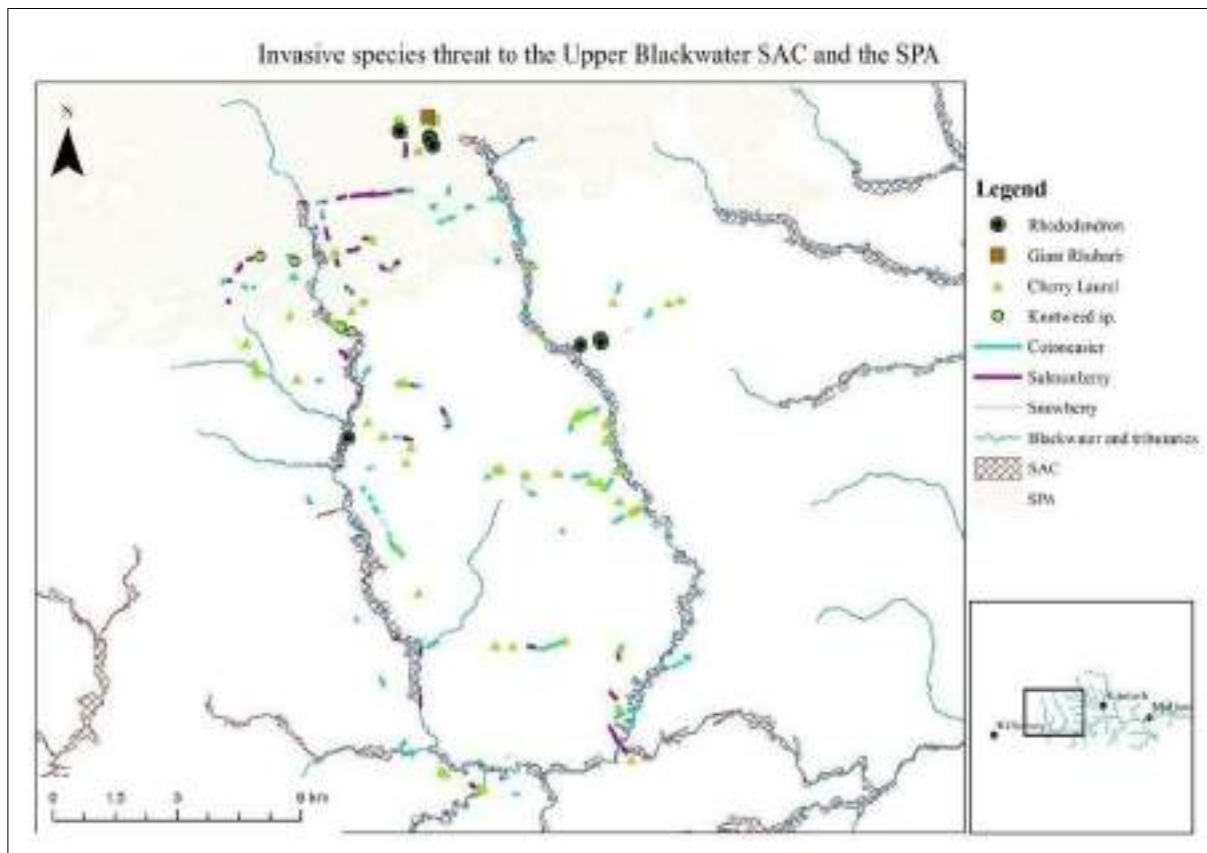


Figure 4 Extent of invasive species coverage in the Upper Blackwater Catchment

Excessive Shading (Tunnelling)



River sections affected by tunnelling (*Figure 5*) (i.e., excessively dense vegetation blocking out incident sunlight) have an impact on instream production, and ultimately salmon, resulting in an up to 70% reduction in juveniles (O’Grady, 1993).

Reducing excess shading of rivers
<ul style="list-style-type: none">• A dappled effect is the objective.• Trained and experienced personnel are required to operate chainsaws.• Under Section 37 of the Forestry Act, 1946, it is illegal to uproot any tree over ten years old or to cut down any tree, unless notice of the intention to do so has been given in accordance with the Act. A felling licence is required.• Management of such sites does not entail removing all of the trees that are blocking the light.• Removing a select number of limbs and lighter trees is sufficient to allow some light in.

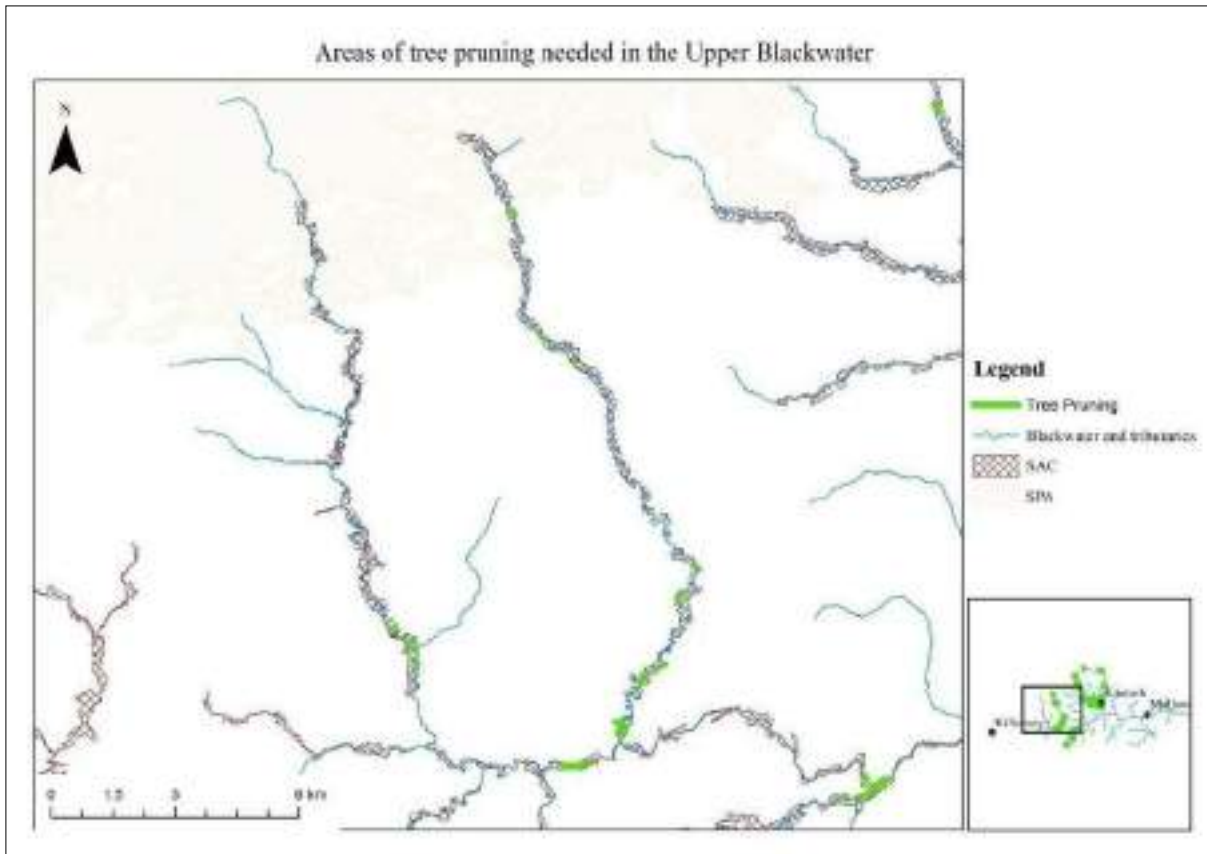


Figure 5 Extent of tree pruning required in the Upper Blackwater Catchment

Native Tree Planting



Trees and shrubs such as willow and gorse can form monoculture stands along reclaimed farmland riverbanks. While the planting of native trees is encouraged, a mixed selection will add to the biodiversity of the riparian area. Alder *Alnus glutinosa* and Ash *Fraxinus excelsior* can add stronger roots to riverbanks, providing more stability (Woodland Trust, 2013). Additionally, Alder is favoured by kingfishers for cover (Forestry Commission, 1994).

Riparian areas create important corridors that link a variety of ecosystems. They are the most diverse and complex biophysical habitats on the terrestrial portion of the Earth (Naiman *et al.*, 1993). Structurally diverse or ‘healthy’ riparian areas are said to retain much higher levels of natural biodiversity than ‘unhealthy’ riparian areas (The Alberta Riparian Habitat Management Society, 2012).

Planting native trees along riverbanks will help in developing a more interesting and biodiverse riparian zone. Planting trees with local provenance (i.e. eco-sourced) ensures that the trees planted are best adapted to the local climate, and have the genetics of the local area. Trees can be collected as saplings from local woodlands, or as donations from the public.

Management of Livestock in close proximity to the river



Cattle access to streams and rivers have a negative impact on waterbodies and lead to habitat degradation (Sheffield et al., 1997). Allowing livestock direct access to surface waters results in disturbance and increased turbidity (Henning & Segars, 1997). This has a devastating effect on Salmon spawning grounds and FPM sites (Anon, 2004). Also, live stock health problems arise from this practice (Price & Lovett, 2002) including mastitis, cryptosporidium and other water borne diseases (Sheffield 1997). By fencing water bodies and properly managing riparian areas the protective capability of riparian vegetation is enhanced. Stream bank fencing protects vegetation from grazing pressure (Collins et al., 2010).

Table 22: Management prescriptions for livestock and farming near SAC Rivers

Prescriptions for livestock management and farming near SAC rivers	
Fencing	<ul style="list-style-type: none"> • A fencing regime back at least 2m from the top of the riverbank will allow native vegetation to grow and stabilise the banks. • Drinking strategies such as pasture pumps and solar pumps will offer an alternative to allowing livestock access to the river directly. • Signed agreements to manage cattle crossing can be accessed through a number of schemes, namely GLAS and the Allow River Agri-environment Scheme.

Nutrient Management	<ul style="list-style-type: none">• Current legislation prohibits the spreading of slurry within 30m of a Special Area of Conservation. Anecdotal evidence from across the Upper Blackwater Sub-Catchment suggests this restriction is not being adhered to as enforcement is seen to be non-existent. Through Agri-Environment schemes, landowners should be incentivised to limit spreading to outside the 30m buffer.• Works conducted outside SACs can affect habitats inside designated areas. Fertiliser and slurry spreading outside the SAC can still enrich designated rivers through land drains. Introducing vegetated buffer strips along SACs, and directing drains to flow through wetlands before discharging into the river can greatly reduce the impacts of excessive nutrients. Certain management actions should be incentivised through Agri-environment schemes.
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APPENDIX

Appendix I - Additional Information from other sources

Table 23: List of risks and mitigations for FPM in the Upper Blackwater and Allow Sub-Catchments (Anon, 2010)

Risks and Measures	
Point Sources	<p>Significant risks – impacts observed through survey/monitoring Munster Joinery, Cadbury (Mondelez - Rathmore) – IPPC, Newmarket Co-Op, Kanturk Creamery. All were observed causing significant impact on the associated river stretch through evidence of excessive macrophyte growth in the channel.</p> <p>Potential significant risks The Upper Blackwater catchment contains 10 WWTPs deemed to have a significant adverse effect on the pearl mussel or its habitat.</p> <p>Measures All discharge licences or authorisations must comply with the EQOs set out in SI 296 of 2009. All WWTP, IPPC and Section 4 and Section 16 discharge licences must be reviewed to assess compliance with EQOs and additional conditions imposed as required. WWTP improvements: Ballydesmond, Knocknagree, Rathmore, Kiskeam, Cullen, Millstreet, Rathcoole, Freemount, Kanturk, and Meelin WWTP were prioritised as these can impact two pearl mussel populations on both the Allow & Munster Blackwater. Newmarket MWWTP should also be investigated further in relation to its effects on the freshwater pearl mussel.</p>
Abstraction	<p>Significant risks – impacts observed through survey/monitoring The Allow Regional Supply at Freemount has been identified as posing a risk to the Freshwater Pearl Mussel population. It is located above the Allow pearl mussel population.</p> <p>Potential significant risks N/A</p> <p>Measures This abstraction needs to be investigated further and a possible alternative source identified due to its proximity directly above the pearl mussel population.</p>
Physical Modifications	<p>Significant risks – impacts observed through survey/monitoring Straightened, deepened, and widened channels were recorded on a number of river stretches throughout the catchment. Significant drainage and site clearance works together with numerous culverts and outfalls were found throughout the catchment largely associated with one-off housing. These contained high levels of silt, which was discharging into the river.</p> <p>Potential significant risks Any future flood alleviation schemes or physical modifications to the bank or channel in the vicinity of the freshwater pearl mussel.</p> <p>Measures Implement necessary legislative change to control morphological alterations of surface waters.</p>
Agriculture	<p>Significant risks – impacts observed through survey/monitoring Direct animal trampling and poaching on the riverbank was noted on a number of occasions throughout the catchment where inadequate fencing was provided. This has led to increased levels of siltation downstream.</p>

	<p>Machinery access, spreading of slurry and fertiliser close to the riverbank is causing loss of silt and nutrient into the river due to a lack of adequate buffer zones.</p> <p>Potential significant risks The lack of access to detailed agricultural land-use data precludes detailed risk assessment, but data from orthophotographs/NPWS Commonage Framework Plans, Livestock Unit Density maps and soil types indicates that a large percentage of the catchment is covered by relatively intensive pasture and silage with associated risks of nutrient/sediment losses. All agricultural activities that can lead to soil erosion (e.g. drainage, land reclamation, ploughing, poaching, overgrazing) and/or nutrient losses (e.g. slurry spreading, fertilisation) are potential significant risks within the Allow catchment.</p> <p>Measures Agricultural measures for Freshwater Pearl Mussels will be rolled-out in target areas within Freshwater Pearl Mussel SAC catchments under an agri-environmental scheme(s). Measures shall include detailed assessment of soil nutrient status, sediment and nutrient management plans, fencing to prevent erosion and trampling on mussels, etc. Guidance and training shall be provided in relation to risk assessment, and the implementation and inspection of required measures. Weightings shall be applied to increase GAP Regulation (S.I. 101 of 2009) and Cross-compliance inspections in these catchments.</p>
<p>On-site waste water treatment systems</p>	<p>Significant risks – impacts observed through survey/monitoring N/A</p> <p>Potential significant risks OSWWTS on high-risk potential settings pose potential significant risks in terms of nutrient loss. In particular, inappropriately designed and/or poorly maintained OSWWTS are a potential significant risk.</p> <p>Measures Inspection and appropriate remediation of all on-site waste water systems (OSWWS) which are adjacent to the river and with very high to extreme risk is a priority. The Department of the Environment, Heritage, and Local Government will be bringing forward legislation in the first half of 2010 that provides for the setting of standards for the performance and operation of all septic tanks and similar on-site wastewater treatment systems. The legislation will also provide for the monitoring and inspection of the performance of such treatment systems and will set out the responsibilities of households served by those systems (including requirements to carry out remedial actions where necessary).</p>
<p>Forestry</p>	<p>Significant risks – impacts observed through survey/monitoring Significant site clearance and bankside vegetation removal associated with forestry and forestry roads was noted and is a risk factor for siltation.</p> <p>Potential significant risks Forestry on drained peat and peaty soils is considered a potential significant risk owing to resultant hydrological changes, sediment losses from eroding drains and nutrient losses (particularly ammonia) from peatdecomposition. 1558 ha was planted before 1990 and is likely to have insufficient buffering. The following forest operations are also considered significant risks: fertilisation on peat and peaty soils (nutrient enrichment); drainage/other ground preparation, road-construction, thinning and clear felling on peat, peaty and other highly erodible soil types, particularly on steep slopes (sedimentation).</p> <p>Measures</p>

	A long-term, forestry catchment management plan shall be prepared with the aim of minimising hydrological, sediment, nutrient and other potential impacts from forests and all forest operations.
Peat Cutting	<p>Significant risks – impacts observed through survey/monitoring A large expanse of commercial peat cutting using difco (sausage-machine turf cutting) was observed in the upper reaches of the catchment. These could be significant sources of organic silt.</p> <p>Potential significant risks N/A</p> <p>Measures Investigation of the risk of siltation from peat cutting should be undertaken in the catchment (private or commercial and extent of cutting) and silt control measures should be installed where necessary.</p>
Ford	<p>Significant risks – impacts observed through survey/monitoring *Four significant vehicular and animal fords were observed. These caused significant direct sediment loading to the river from the vehicular/animal access and the access roads, leading to excessive siltation in the river.</p> <p>Potential significant risks N/A</p> <p>Measures Alternative access should be investigated immediately or site mitigation measures implemented.</p>
OTHER MEASURES	
Public Awareness	An education and awareness campaign shall include public meetings, talks (schools, etc.), clinics, and the distribution of leaflets. Topics covered will include the biology and ecology of pearl mussels and damage caused by e.g. pearl fishing, in-stream activities, sedimentation, and nutrient enrichment. The measures necessary for their conservation shall be explained.
Planning	Activities such as field drainage, land reclamation, site/land clearance are subject to planning control, i.e. no longer be exempted developments.
Habitats Directive Controls	Once the Activities Requiring Consent (or Notifiable Activities) has been reworded, these shall be formally notified to the relevant owners, occupiers, or users in the mussel SACs.

Appendix II - Photographs



Figure 6 Grey water and other discharged material metres main river channel



Figure 7 Discharge from DWTP in Allow Catchment



Figure 8 Dipper nest on branch over the Allow River (18-04-2011)



Figure 9 Branch that had a dipper nest was cut from tree (30-05-2011)

Appendix III - Maps

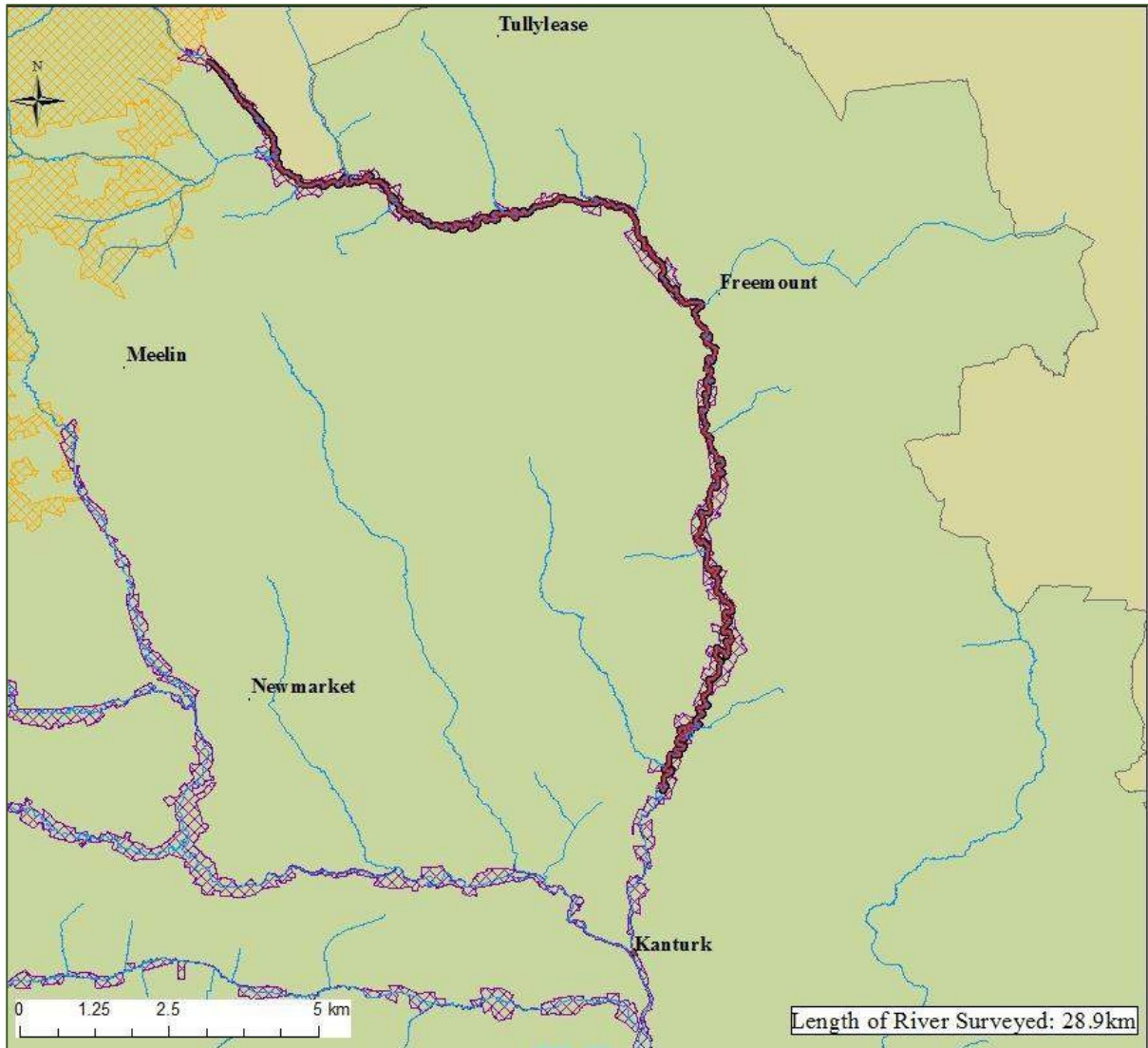


Figure 10 Extent of Allow River surveyed for FPM

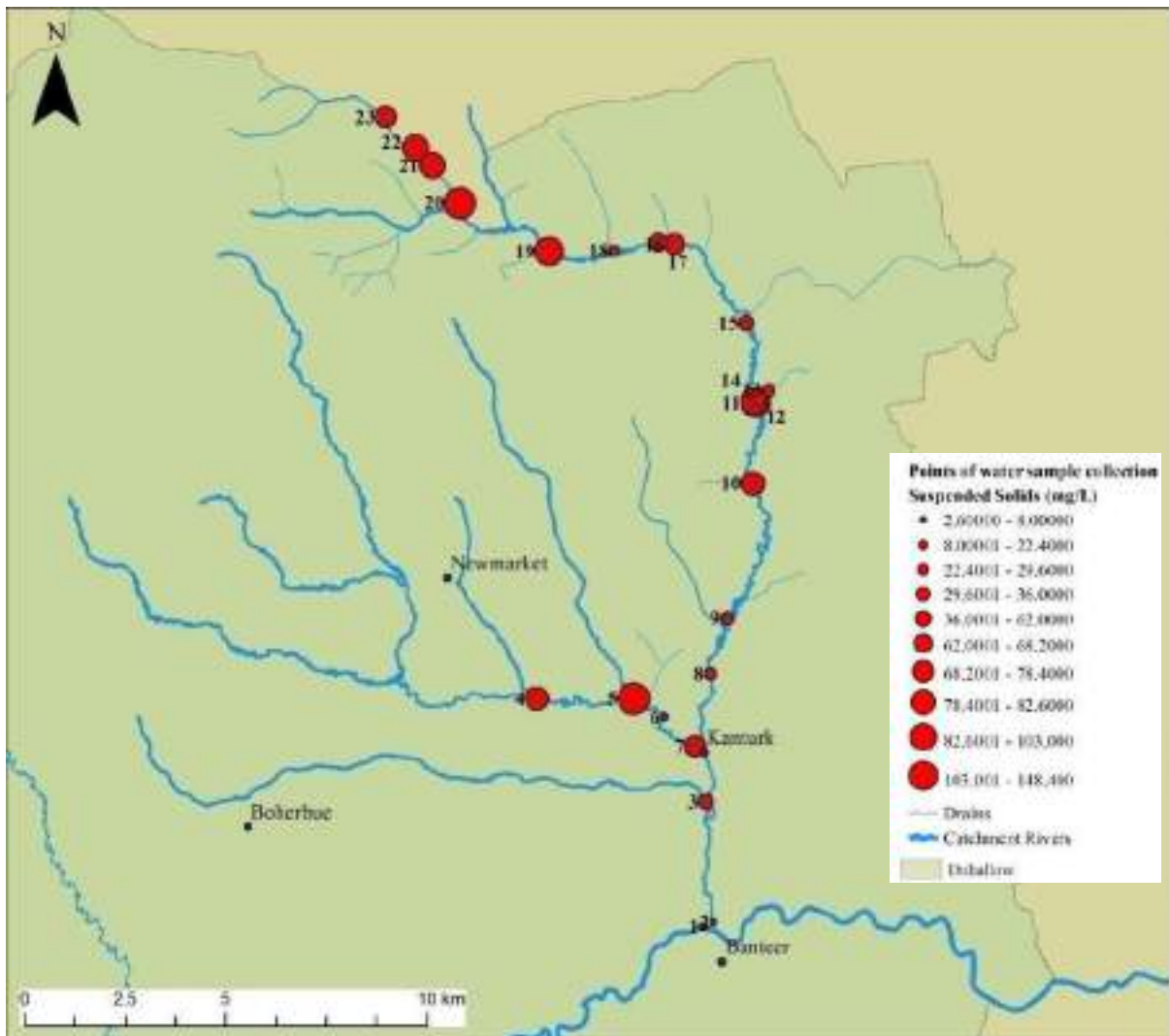


Figure 11 Levels of suspended solids from water samples taken, as grab samples, along the Allow River during a high water event in July 2013

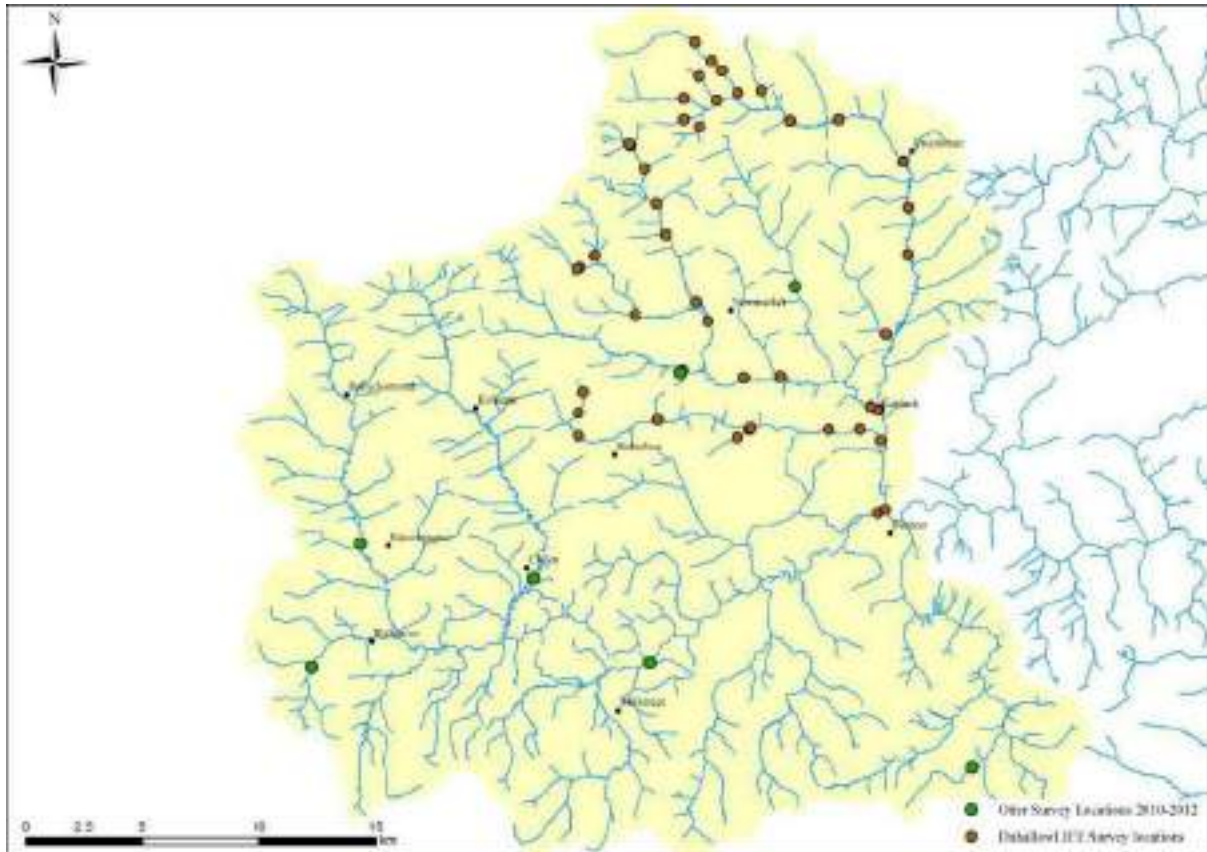


Figure 12 Locations of survey sites in the Upper Blackwater Sub-Catchment from the National Otter Survey of Ireland and DuhallowLIFE+ Project's Otter Survey

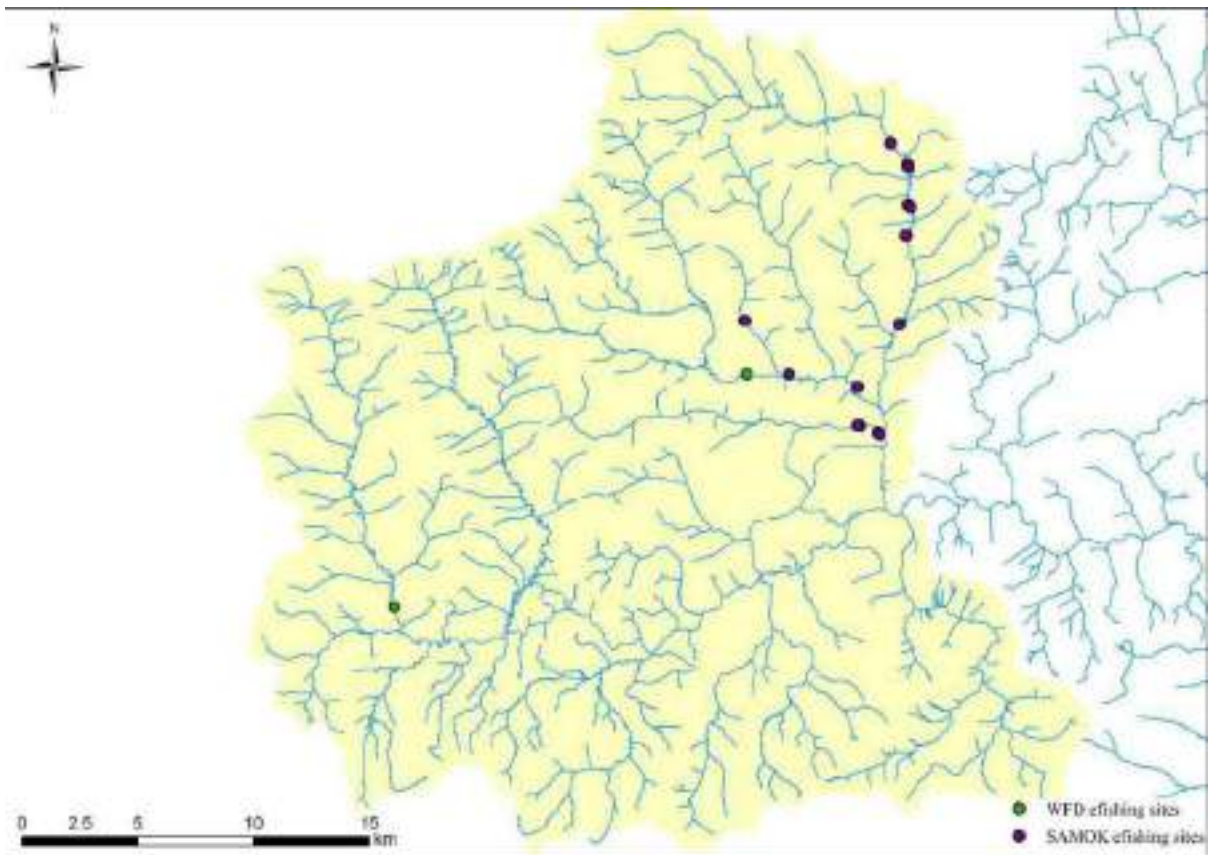


Figure 13 Locations of electro-fishing survey sites in the Upper Blackwater Sub-Catchment from the Water Framework Directive Report (IFI, 2010) and DuhallowLIFE Project's e-fishing surveys

Appendix IV - River Allow Catchment Management Group

- IRD Duhallow Ltd
- Cork County Council (Planning, Roads, Water Services, Environmental Enforcement)
- Landowners
- Environmental Protection Agency
- Irish Farmers Association
- Irish Creamery Milk Suppliers Association
- Teagasc
- Macra na Feirme
- Coillte
- Forestry Service
- Irish Water
- National Parks and Wildlife Service
- Inland Fisheries Ireland
- Kanturk & District Anglers
- Public
- Office of Public Works
- Duhallow Birdwatch Group
- Irish Wildlife Trust
- SWAN
- River Basin Districts
- IRD Duhallow Environmental Working Group