River Basin Management Plans 2015 - 2021

Economic Analysis Paper

Programme of Measures for the River Basin Management Plans

December 2015

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1. Introduction and Background

In December 2009, the Department of the Environment (hereafter referred to as the Department or DOE) published the first River Basin Management Plans (RBMPs) as required by the Water Framework Directive (WFD). The RBMPs are being delivered by the Northern Ireland Environment Agency (NIEA) in conjunction with a number of Northern Ireland Departments: the DOE; the Department of Agriculture and Rural Development (DARD); the Department of Culture, Arts and Leisure (DCAL); and the Department for Regional Development (DRD).

The first RBMPs set out objectives for the improvement or the prevention of deterioration of rivers, lakes, marine environment and groundwaters for the three six-year WFD river basin planning cycles to 2015, 2021 and 2027.

A “Programme of Measures” was published as part of the first RBMPs, setting out actions required to meet the objectives to improve the status of all water bodies. An interim update on the measures was also published and provided to the European Commission in 2012.

This document relates to the assessment of costs and benefits of the additional measures identified for the second river basin planning cycle (2015-2021) in the draft RBMPs which were published at the end of 2014. The draft second cycle RBMPs can be found on NIEA’s website. Costs associated with some further measures, which may be taken forward following the consultation on the draft RBMPs, are also included.

The costs of the measures have been outlined along with an indication of the possible benefits which could accrue as a result of the measures being implemented. Options have then been developed which enables the optimal mix of measures to be selected based on funding and feasibility. Affordability has been a key consideration, given the current budgetary constraints facing the NI Executive and Departments.

2. Assessment of Need

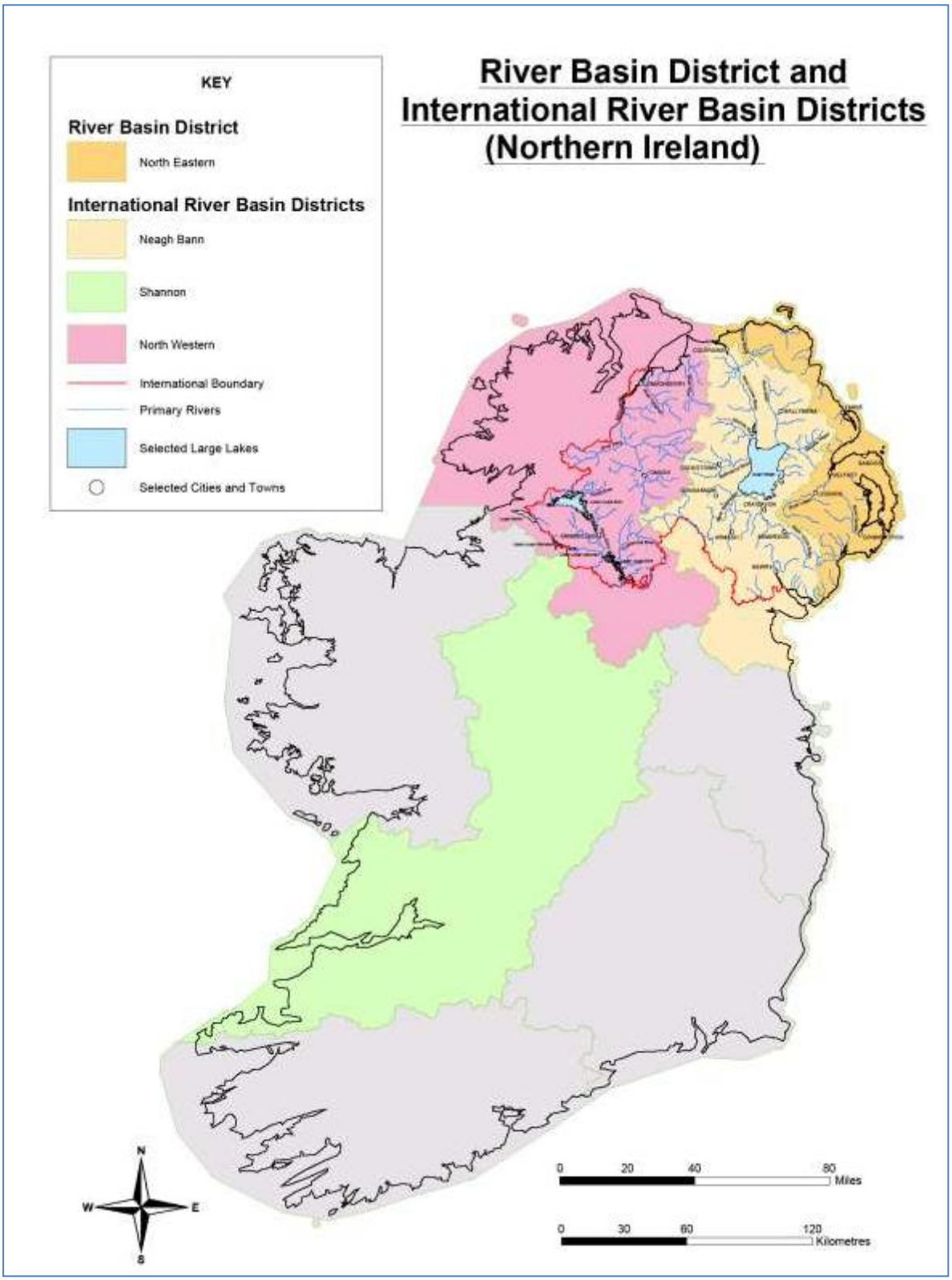
Draft second cycle RBMPs and supporting documents were produced for the North Eastern River Basin District and the two International RBDs, the Neagh Bann and the North Western IRBDs. As only a small portion of the Shannon International River Basin District lies within Northern Ireland, the drafting of the plan for that district is the responsibility of the authorities in Ireland given the majority of the district lies within Irish jurisdiction. All four RBDs are shown in Figure 2.1.

As part of the process of developing the second cycle RBMPs, work has been undertaken in each RBD to identify the pressures and impacts on the water environment. This work has provided an indication of whether such effects are likely to inhibit the accomplishment of good status which is the key objective under the WFD. The RBMPs set out a programme of measures aimed at maintaining and improving water quality in order to meet WFD objectives for individual water bodies. The programme of measures consists of policies and strategies, such as monitoring programmes and actions, which are intended to reduce the risk to water bodies and allow them to attain good status.

Existing measures such as the implementation of the current Nitrates Action Programme (referred to as “Basic Measures” within the Directive) and the wider investment in water and sewerage services to comply with requirements under other Directives will continue to contribute to significant improvements to the water environment. However, additional measures (also referred to as “Supplementary Measures” within the Directive), will also be needed to achieve further improvements in the second cycle.

It is these proposed additional or supplementary measures which are the subject of this assessment. By completing an economic assessment of the measures it will assist in identifying the potential costs, impacts and the benefits they might bring. To this end, the assessment will help the Northern Ireland Executive effectively plan and manage their implementation within the second and third river basin management planning cycles.

Figure 2.1: National and International River Basin Districts for Northern Ireland



Under the WFD, a programme of measures was implemented following publication of the 1st cycle RBMPs (2009-15) with the aim of achieving Good Ecological Status (GES) or Good Ecological Potential (GEP) where this was considered feasible in that timescale. It has not been possible to achieve GES or GEP in all water bodies for various reasons. In some cases the measures required to achieve this objective within the first WFD cycle were considered to be technically infeasible or in other cases it was considered that natural conditions would not allow for the timely improvement of certain water bodies within that timescale. The WFD also allows for extended deadlines to be set where completing the required improvements to a water body within the timescale would be considered disproportionately expensive. In these cases the Directive allowed the timetable to be extended by up to 12 years (two subsequent RBP cycles) by the setting of alternative objectives (extended deadlines). Likewise, for the second WFD cycle, it will not be possible to achieve GES or GEP for all water bodies. The deadline can be extended to 2027 if it is disproportionately expensive, technically infeasible or if natural conditions would not allow for water bodies to achieve Good Status by 2021. If it is still not possible to achieve Good Status by 2027 then it may be possible to set a Less Stringent Objective.

Tables 2.1, 2.2 and Figure 2.2 show the current status of waterbodies in NI.

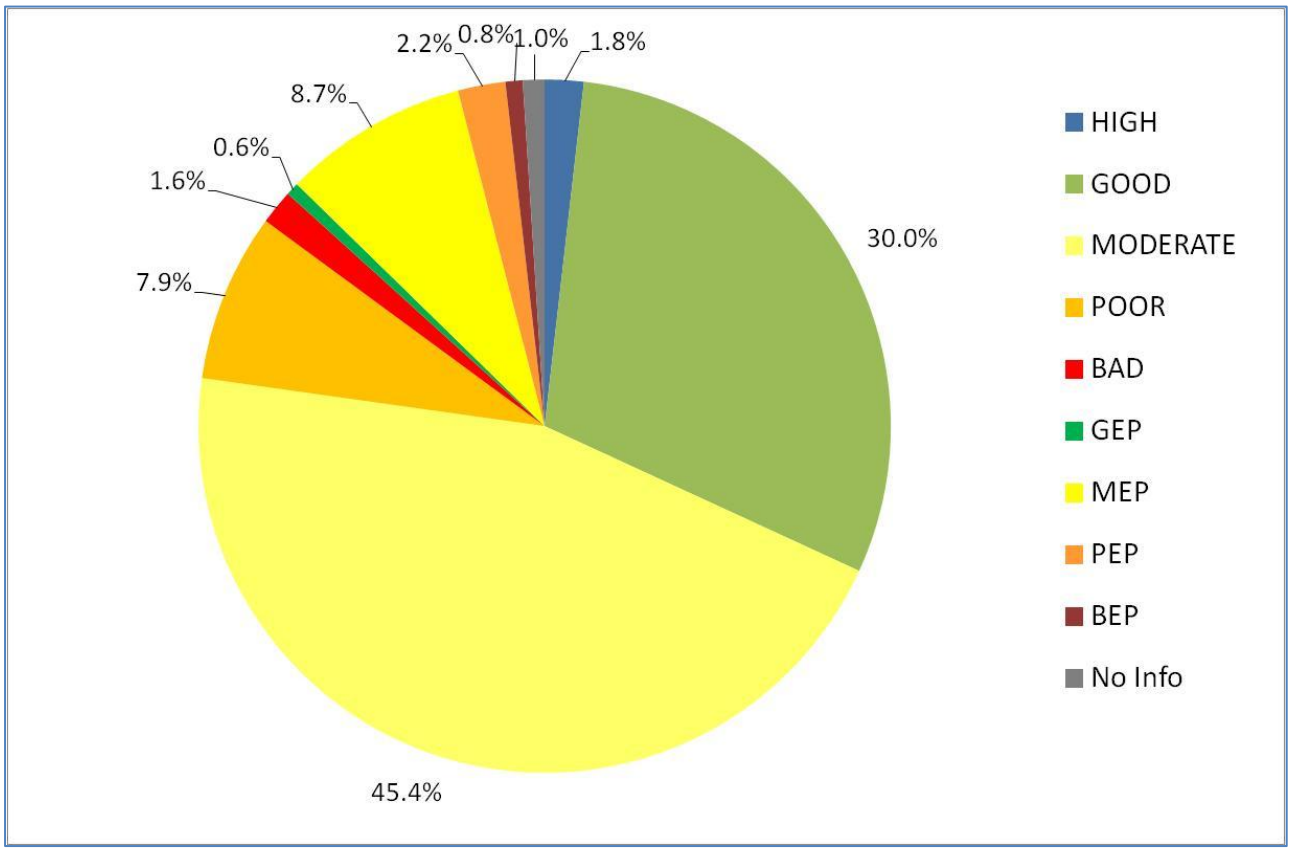
Table 2.1: 2015 Status of Surface Waterbodies

Status	Rivers		Lakes		Transitional and Coastal		TOTAL	
	No	%	No	%	No	%	No	%
HIGH	8	1.8	0	0.0	1	4.0	9	1.8
GOOD	139	30.9	2	9.5	8	32.0	149	30.0
MODERATE	212	47.1	4	19.0	9	36.0	225	45.4
POOR	38	8.4	1	4.8	0	0.0	39	7.9
BAD	5	1.1	3	14.3	0	0.0	8	1.6
GEP	0	0.0	3	14.3	0	0.0	3	0.6
MEP	33	7.3	5	23.8	5	20.0	43	8.7
PEP	7	1.6	2	9.5	2	8.0	11	2.2
BPP	3	0.7	1	4.8	0	0.0	4	0.8
No Info	5	1.1	0	0.0	0	0.0	5	1.0
Total	450	100.0	21	100.0	25	100.0	496	100.0

Table 2.2: 2015 Status of Groundwater

2015 Status	Number	Total %
Good	49	65.3
Poor	26	34.7
Total	**75**	**100.0**

Figure 2.2: 2015 Status of All Surface Waterbodies



As shown above, in regards to the current status of the surface waterbodies, 161 (32%) are considered to be at GES/GEP or better. Consequently, 68% of surface waterbodies are considered to be at less than GES/GEP status; although, as indicated above, it may not be possible to achieve GES or GEP in all water bodies even by 2027.

Nevertheless, this highlights the need for additional/supplementary measures to ensure the viable long-term river basin targets are achieved.

3. Methodology

This assessment has been based on input from the relevant Northern Ireland Departments along with their arm's-length bodies (ALBs) and non-departmental public bodies (NDPBs). Stakeholders were consulted on the content of the draft RBMPs and the details of the proposed measures described in this report. The sections below outline the general methodology for the economic analysis completed by departmental economists to assess the impacts of the programme of measures.

3.1 Cost Assessment

The second river basin planning cycle runs from 2015 to 2021. The analysis from Section 4 onwards focuses on costs of the supplementary/additional measures during this period. Therefore, any expenditure incurred before the cycle, where measures are already in place, is considered a sunk cost. Furthermore as the focus is on additional measures, any measures now considered as part of current operations (business as usual activities) are assumed to have no additional cost.

The costs have been estimated over the cycle (six years) and discounted using a standard discount rate of 3.5%, with a base year of 2015/16. They have been broken down to show if the costs are likely to be met by the public or private sector. Undiscounted costs have also been analysed in Section 19 to assess the financial impact and resource implications for departments and NDPBs.

Costs have been categorised by measure type as follows:-

- enabling – a measure to improve the regulator's understanding and knowledge of a pressure;
- regulatory – a measure designed to impose a form of regulation on a sector;
- working with third sector – a measure to facilitate and fund work being undertaken by not-for-profit organisations and local communities for improvements to the water environment; or

- voluntary – working with an industry to identify further measures to improve water status.

The type of measure is important in terms of trying to assess its impact. Enabling measures, which make up the majority of the proposed measures, will not in themselves impose any additional costs on the private or third sectors. They have been proposed to improve the level of understanding within NIEA or other Government organisations, and may in some cases be followed by regulatory measures.

All costs included in this assessment are estimates which are subject to change, and those measures that are not currently funded or where funding had not been secured at the time this assessment was undertaken will be the subject of bids for approval using the standard Government budgetary processes.

3.2 Benefits Assessment

In general, with regard to estimating benefits in the context of river basin planning, it is acknowledged that this is a more challenging exercise than the identification of costs for measures. Furthermore, given the data that is currently available, it has not been possible to show step changes in water status for each water body as a result of implementing individual measures. Consequently, isolating impacts and attributing benefits to measures was not feasible and, as a result, the approach taken for assessing the impacts was to use a mixture of quantitative analysis at a national level and qualitative information for each sector.

As regards the quantitative analysis, the methodology involved using the figures given in the National Water Environment Benefits Survey (NWEBS)[1] which has been developed by the environment agency in England to help place a monetary value on the environmental benefits of improving water bodies.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291464/LIT_8348_42b259.pdf

The average figures given in NWEBS have been applied to the relevant water bodies in Northern Ireland to estimate the possible benefits to the region if the status targets are achieved as outlined in the RBMPs. Therefore, it was necessary for NIEA to identify the gap between current water status and target status for 2021 and beyond.

This methodology has a number of limitations which have been outlined in Section 17. Nevertheless, the analysis provides a high level indication to highlight the magnitude of potential impacts as Northern Ireland moves towards good status.

3.3 Option Identification

In order to consider affordability and cost-effectiveness, it has been necessary to assess a range of options in regards to the programme of measures. To formulate options the measures have been grouped into categories as follows:-

- measures completed, covered by existing operations (business as usual activities) or currently ongoing;
- measures not yet introduced but where full funding has been secured;
- measures likely to be introduced but with full funding not yet secured; and
- measures not funded and unlikely to be introduced during this cycle.

Where possible, the cost of the measures has been estimated, as described in section 3.1 above, and the options assessed on the basis of affordability and viability.

This assessment was completed after a major data collection exercise involving all of the key stakeholders who will be responsible for delivering the measures.

The following sections (4–16) outline the costs related to the key sectors for which measures have been identified.

4. Key Sector: Agriculture
Pressure Type: Diffuse and Point Source Pollution

4.1 Background

Farming is a vital industry in Northern Ireland; however, it can have a major impact on water quality and can affect the quantity of water available. Intensive farming, including livestock and crop production, can lead to pollution. Animal manure can be washed from farm yards and fields, and cattle and sheep excretions can be deposited or run into streams and rivers where animals have direct access to rivers. Toxic substances, such as pesticides can enter the water system through the use or storage of chemicals beside waterways, spillages in farmyards, and the inappropriate disposal of toxic substances can lead to chemicals leaching into groundwater or flowing into surface waters.

Agricultural sources can also contribute to the sediment loading entering the water environment – this build up of sediment occurs through soil erosion caused by inappropriate cultivation, and the trampling of riverbanks by livestock. Excess sediment reduces the supply of oxygenated water to aquatic plants and animals, putting fish stocks at risk.

The introduction of measures under the Nitrates Action Programme and the Phosphorus (Use in Agriculture) Regulations has contributed significantly to reducing the concentration of nutrients in the water environment from agriculture. The Farm Nutrient Management Scheme has led to improved storage capacity for livestock manures. Improved nutrient efficiency has been encouraged through the provision of advice and nutrient management training for farmers and grant support through the Manure Efficiency Technology Scheme. Furthermore, agri-environment scheme participants must use Farm Nutrient and Waste Management Plans.

A voluntary agreement has also been made between DARD and the Northern Ireland Grain Trade Association to lower phosphorus levels in animal feedstuffs.

Farms are also selected for inspections under Cross Compliance using a combination of risk factors to protect water quality and ensure that farm practices do not put waterways at risk.

4.2 Measures and Costs

The table below outlines the cost of the supplementary measures for which agriculture is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 4.1: Agriculture Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
1	Measures to address the impact of pollution arising from farmyards, including farmyard audits and farmyard management practice with particular focus of farmyard drainage systems.	Farm Inspections.	NIEA	Regulatory	✓	✓	0.228	1.970	2.198
2	Develop modelling tools to help understand the natural dynamics and science of the catchments, including groundwater. This may include further development of the SCIMAP tool which examines diffuse pressures, determines flow pathways and flood risk areas within catchments so that measures can be targeted to manage problem areas.	Identification of agricultural and general diffuse critical risk areas using GIS and linking with hydrological significant pathways using SciMAP.	NIEA	Enabling	✘	✘	0.166	0	0.166
3	Measures to address nutrients including the Nitrates Action Programme (NAP); provision of training in Nutrient Management Planning; provision of online farm nutrient calculators and the facilitation of soil sampling and analysis.	NAP 2015-2018 CAFRE Training Programme. DARD online Services. Advice and support on land management under NI RDP.	DARD	Regulatory and Voluntary	✘	✓	3.856	0.497	4.353
4	The Environmental Farming Scheme (EFS) will include measures for riverbank fencing, riparian buffers and pasture pumps. These measures will help to address sediment input to rivers caused by livestock poaching and bank erosion by livestock.	EFS under the NI RDP.	DARD	Voluntary	✘	✓	20.661	0	20.661

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
5	Consider measures within Woodland and Environmental Farming schemes as part of Rural Development Programme such as riparian woodland.	Rural Development Programme.	DARD	Voluntary	✘	✓	2.755	0	2.755
6	Use the Water Catchment Partnership approach to work proactively together to promote and raise awareness of best practice when using pesticides on the farm.	Water Catchment Partnership.	WCP	Voluntary	✘	✓	0.016	0	0.016
7	Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of agriculture on fresh water pearl mussels.	Partnership working between Government and NGOs.	NIEA	Third Sector	✓	✓	0.026	0	0.026
8	Target areas identified under Nitrates Directive reporting with increasing nutrients for investigation and action.	As part of the catchment projects identified through annual reporting.	NIEA	Enabling	✘	✓	Costs not available at this time.		
9	Developing models and catchment based approach to protect these areas (Bathing and Shellfish Water Protected Areas). INTERREG VA project to develop prediction and discounting at bathing waters.	Partnership working between Government and NGOs.	MED	Enabling	✓	✓	0.063	0.667	0.730

4.3 Additional Information of Note

As shown in the table above, there are nine measures linked to agriculture to address diffuse and point source pollution, with both NIEA and DARD considered responsible for implementing these.

Funding has been secured for three of the measures and these are likely to proceed as planned. Funding has yet to be secured for the other five measures; however, it is expected that four of these will commence during the cycle.

In regards to measure number 1, a cost to the agricultural industry has been estimated of €0.5 million per annum. However, as this measure involves farm inspections, the actual cost will depend on the number of breaches detected and the severity of these. As explained in Section 4.1, NIEA carries out programmed inspections of farm businesses under Cross Compliance in its role as a designated Competent Control Authority.

Measure number 2 involves the possibility of enhancing GIS tools to include analysis of pesticides and other pollutants but it is yet to be funded and is unlikely to be taken forward in the second cycle.

DARD have estimated that funding from the Environmental Farming Scheme (a key element of the Rural Development Programme 2014-2020) linked to water quality ranges from £15 million-£30 million and, therefore, the mid-point of this was assumed. However, it is important to note that a large portion of this will be funded by the EU, estimated to be around 60%.

Funding of €1 million has been assigned for measure number 9 from Interreg VA. The project will be subject to confirmation of funding through an ‘open call’ in November 2015.

5. Key Sector: Sewage and Industry
Pressure Type: Diffuse and Point Source Pollution

5.1 Background

Northern Ireland Water (NIW) is the sole provider of water and sewerage services in Northern Ireland. When businesses, private housing developments or single dwellings are unable to connect to the sewerage infrastructure provided by NIW, private wastewater treatment systems are required to treat sewage. Pumping stations may also be required to pump sewage from new housing developments to the public sewerage system. When this is not possible, on-site systems (conventional septic tanks or treatment systems) with soil percolation areas are used.

Sewage discharges can contain a wide range of substances, such as nutrients, organic matter, ammonia, faecal pathogens, toxic substances (from industrial effluent, household chemicals and road run-off) and sewage-related debris.

Pollution can occur through:-

- direct discharges of sewage effluent to the water environment;
- combined sewer overflows (or storm overflows) may be a source of faecal contamination and sewage-related debris;
- misconnections in the sewerage system may lead to foul water being discharged to the storm sewer and then to a watercourse;
- poorly maintained and/or defective on-site treatment systems; and
- privately owned sewers, pumping stations and treatment systems may not be completed or maintained where developers have gone into receivership.

Point source discharges are regulated through the process of licensing consents under the Water Order (Northern Ireland) 1999, and all consents are currently being reviewed to ensure that the consent conditions are compliant with the objectives of the Water Framework Directive.

Waste water treatment works and sewerage networks are prioritised for investment based on their performance under the NIW Capital Investment Programme known as the Price Control Process. This process helps to identify and prioritise sewerage assets which are overloaded and discharges which are impacting or have the potential to impact on the status of a water body. The most significant polluting discharges are prioritised and remedial solutions identified and implemented to reduce the polluting effects on the water environment.

5.2 Measures and Costs

The table below outlines the cost of supplementary measures for which sewage and industry is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 5.1: Sewage and Industry Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
10	Review consents to discharge on a pilot catchment basis using the SIMCAT model.	Programme of priority catchments to be piloted.	NIEA	Regulatory	✘	✘	0.861	0	0.861
11	Introduce flow and priority pollutant monitoring as part of the compliance regulation regime.	Programme of compliance projects to be piloted.	NIEA	Regulatory	✓	✓	0.571	0	0.571
12	Further development and implementation of innovative and sustainable measures such as the use of willows to treat effluent from small waste water treatment works and then harvesting for fuel.	PC15.	NIW/ NIEA	Regulatory	✓	✓	0.117	0	0.117
13	Controlling sewage gross solids by using separation devices such as screens in unsatisfactory storm overflows.	PC15.	NIW/ NIEA	Regulatory	✓	✓	0.127	0	0.127
14	Inclusion of event monitoring on networks in the vicinity of bathing and shellfish waters.	Agreed programme of compliance projects funded as part of PC15.	NIEA	Enabling	✓	✓	1.908	0	1.908
15	Improve knowledge about the operation of storm overflows through more monitoring.	Agreed programme of monitoring funded as part of PC15.	NIEA	Enabling	✓	✓	0.026	0	0.026

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
16	Work with the water industry to develop and pilot recovering phosphorus from waste water treatment works and to pilot new technology to remove phosphorus to meet tighter discharge limits.	Engage with Water Industry on any projects on phosphorous recovery.	NIEA/ NIW	Voluntary	✓	✓	0 (BAU)	0	0
17	Increase awareness of need to install and maintain private sewerage systems correctly.	Continue to work with 'Supply, Install, Monitor, Maintain' (SIMM) group for Private waste water management.	NIEA	Voluntary	✓	✓	0.006	0	0.006
18	In land drained for agricultural purposes, research the impacts on streams of effluent from septic tank percolation areas	Engage with research community- possible research student project.	NIEA	Enabling	✘	✘	0.086	0	0.086
19	Introduce Environmental Permitting Regulations which will simplify permitting processes and allow for regulation under registrations and general environmental rules.	Environmental Permitting Team.	RNRPD	Regulatory	✘	✓	0.718	1.445	0.727
20	Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of sewage and industry on fresh water pearl mussels.	Partnership working between Government and NGOs.	NIEA	Regulatory	✓	✓	0.043	0	0.043

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
21	Work with other UK agencies and the water industry to scope and develop cost effective measures for reducing Phosphorus loads in WWTWs, septic tanks, human food, dishwasher detergents and use in water supply dosing.	Engage with UK agencies and water industries on relevant projects.	NIEA	Enabling	✘	✓	Costs unavailable at this time.		
22	Developing models and catchment based approach to protect these areas. INTERREG VA project to develop prediction and discounting at bathing waters.	Partnership working between Government and NGOs.	MED	Enabling	✓	✓	Already costed as part of measure #9.		

5.3 Additional Information of Note

There are thirteen measures linked to sewage and industry which aim to address diffuse and point source pollution, as shown in Table 5.1 above. NIW and NIEA have ownership of the majority of these. Funding has been secured for eight of the measures but ten of them are expected to be introduced in the second cycle. Two of the measures (numbers 9 and 18) are unlikely to be introduced this cycle unless funding becomes available.

It should be noted that a number of the measures (numbers 12, 13, 14 and 15) may lead to subsequent investment from NIW, and as such the final cost of these are likely to be higher than estimated.

As regards measure number 14, the final direction of the project will be decided once data from a trial currently being carried out at Cloughey South WwPS is received. The trial will compare flow measured by a flow meter against that measured by an IPSM unit. The trial also includes collecting data from rain gauges in order to distinguish between storm events and overflows caused by blockages. The incorporation of data from the CSO Monitors back onto the Telemetry system is also being investigated. An estimation of costs has been made but the delivery programme and costs cannot be confirmed until the technical solution is confirmed.

Measure number 19 is a regulatory measure which is included in the Environmental Better Regulation Bill. This legislation has not yet been agreed by the Executive but an assumption has been made that it will be introduced. The Bill was introduced into the Assembly on 22 June 2015 and had its second stage reading on 30 June 2015. The Bill is on target to complete its passage through the Assembly by the end of the current Assembly mandate. The cost estimate for this was taken from the Regulatory Impact Assessment which estimated an annual saving for both the public and private sectors i.e. a benefit rather than a cost.

The cost of measure number 22 has already been included in other measures and, therefore, these are assumed to have zero cost to avoid double counting.

6. Key Sector: Forestry
Pressure Type: Diffuse and Point Source Pollution

6.1 Background

Forestry is a significant land use activity within Northern Ireland. The main forests are managed by DARD Forest Service and the aim is to contribute to the economic development of the entire forestry sector in Northern Ireland while promoting the sustainable management of forests for multiple uses and conserving and enhancing the rural environment.

Forests and their management can affect the quantity and quality of water moving through catchments. Although providing many positive benefits, forests have the potential to negatively impact on the environment. Impacts are largely related to poor management or to planting on unsuitable soils, and many of the current water problems associated with afforestation are a legacy of old practices, which have been subsequently amended.

The main potential water problems are related to:-

- nutrient enrichment: for example, when a forest is established, site cultivation and drainage may give rise to nutrient loss which can lead to problems such as algal growth;
- sedimentation: harvesting or other operations, such as establishment of forest roads, can cause erosion and sedimentation;
- flow pattern changes: the amount of water reaching the soil surface is reduced by evaporation of water intercepted by the canopy. Clear-felling of forests may lead to a change in flow patterns;
- pesticide contamination: incorrect application of pesticides may result in contamination of waters;
- phosphates within the soil may become mobile as a result of timber harvesting on peat soils and may enter nearby drains and watercourses; and

- acidification: forest canopies can capture sulphur and nitrogen compounds from the atmosphere. Rain becomes more acidic as it passes through the canopy to the ground below, and may alter the chemical balance of the receiving water.

The Forest Service continues to use the Forest and Water Guidelines to reduce and prevent diffuse pollution impacts from forestry on the water environment. Five new forestry measures were completed in the first river basin planning cycle. Forest Service Management Plans are now in place for all Forest Service Woodlands. These plans provide the basis for sustainable forest management, and cover the whole range of major forest operations including harvesting, planting, aerial fertilising and road making. Clear proposals for the management of riparian areas are an integral part of all the plans. The planting of private woodlands is being encouraged through forestry grant schemes. Maps have also been produced in co-operation with other agencies to indicate where forests should be developed while taking account of sensitive and protected areas.

6.2 Measures and Costs

The table below outlines the cost of supplementary measures for which forestry is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 6.1: Forestry Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
23	Consider the inclusion of new woodlands, wet woodlands and floodplain forests as part of catchment wide pilot projects to protect and improve water quality and quantity.	Partnership working with stakeholders, NGOs and other Government Agencies.	All partners and stake-holders	Enabling	✘	✓	0.012	0	0.012
24	Forest Service to provide woodland management advice and promote wider expansion of afforestation taking account of forestry best practice and sustainable forest management standards.	Approval processes compliant with UK Forestry Standard.	DARD Forest Service	Voluntary	✘	✓	0.165	0	0.165
25	Implement measures in the Forestry Commission Practice Guide 'Managing Forests in Acid Sensitive Water Catchments'.	Approval processes compliant with UK Forestry Standard.	DARD Forest Service	Enabling	✘	✓	0.003	0	0.003
26	Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of forests on fresh water pearl mussels.	Approval processes compliant with UK Forestry Standard.	DARD Forest Service	Regulatory	✘	✓	0.001	0	0.001

6.3 Additional Information of Note

As shown in the table above, four measures have been identified for the forestry sector which aim to mitigate diffuse and point source pollution. The Forest Service (DARD) are chiefly responsible for implementing these measures, for which funding has not yet been secured; however, it is likely that they will be funded and introduced during this river basin management cycle.

Measure number 23 entails public and private bodies working in partnership and Forest Service developing proposals to provide grant support for afforestation, including wet woodland.

Measure number 24 requires Forest Service to assess proposals for new first afforestation projects for compliance with the UK Forestry Standard for all woodland types, including those for wet woodland creation. Both measure number 23 and 24 fall under the Rural Development Plan 2014-2020 which was developed by DARD.

7. Key Sector: Sediment
Pressure Type: Diffuse and Point Source Pollution

7.1 Background

Sediment is an essential, integral and dynamic part of our water environment. However, where human activities interfere with sediment quantity or quality, sediment management becomes necessary.

Sediment is one of the less well defined pressures. There is no in-river Water Framework Directive sediment standard; sediment pressures are assessed by a link to biological element failures. Only limited data is available as there is no routine, monitoring of sediment run-off or in-river siltation. Sediment is also primarily a diffuse pressure, and river walk evidence has highlighted that this can make sources more difficult to identify.

Sediment impacts range from damage to the health of aquatic ecosystems, to poor water quality for abstraction in drinking water protected areas. The effects of siltation can impact Natura 2000 sites for example, through effects on salmon spawning sites, and may have a significant effect on room for water in the channel and consequently flood risk. Sediment can act as a source and transport contaminants that may be associated to sediment particles such as chemicals, nutrients and faecal indicator organisms.

Too much fine sediment causes a range of problems, from damaging wildlife to increasing the costs of treatment of drinking water, and increased risk of flooding from silted up drains. Sediment has direct impacts, carrying other pollutants like nutrients, chemicals and faecal contamination into the water environment. Tackling fine sediment not only tackles the direct effects of sediment, but also brings wider benefits, including reducing the risk of flooding. Fine sediment results from soil erosion, soil compaction (which increases run-off) and the erosion of riverbanks and road verges.

Diffuse pollution risk mapping tools, such as SCIMAP, are being developed to help determine where the most probable sources of diffuse source pollution are within a catchment and the associated risk that the sediment will get into the water environment. Through the programme of river walks carried out by Catchment Management Officers, locations where sediment is having an impact on water quality are being recorded. This information, in conjunction with model outputs, helps to inform measures targeted to address sediment issues.

The quantity of sediment reaching the water environment is controlled through regulation of industrial and sewage discharges. In rural areas, land erosion, run-off and sediment movement is reduced through controls contained in water pollution legislation, agri-environment schemes and requirements under cross-compliance.

7.2 Measures and Costs

The table below outlines the cost of supplementary measures for which sediment is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 7.1: Sediment Measures and Cost

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
27	Develop and enhance modelling tools to help understand the natural dynamics and science of the catchments, such as further development of the SCIMAP tool.	Working in partnership with other agencies, and research community.	NIEA	Enabling	✘	✘	Already costed as part of measure #2.		
28	Develop a pilot project in a catchment with sediment problems to consider alternative sustainable methods to dealing with issues.	Partnership working with stakeholders, NGOs and Government Agencies.	All partners and stake-holders	Enabling	✓	✓	0.029	0	0.029
29	The Environmental Farming Scheme (EFS) will include measures for riverbank fencing, riparian buffers and pasture pumps. These measures will help to address sediment input to rivers caused by livestock poaching and bank erosion by livestock.	Proposed EFS under the NI Rural Development Programme.	DARD	Voluntary	✘	✓	Already costed as part of measure #4.		
30	Assess the need and incorporate sediment management plans as part of NIW Abstraction Licences.	Abstraction and Impoundment Licensing regime.	NIEA	Regulatory	✓	✓	0.137	0	0.137
31	Develop expertise and knowledge to carry out catchment fluvial audits.	Training course provided by River Restoration Centre.	NIEA	Enabling	✘	✓	0.102	0	0.102
32	To develop and consult on appropriate sediment standards for UK.	Working with other UK Agencies through UKTAG and related groups.	NIEA	Enabling	✘	✓	0.030	0	0.030

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
33	Consider further research into the impacts of sediment in agricultural catchments, in conjunction with nutrients and biological quality.	Joint funded project and collaboration with DARD/AFBI or other external agencies.	NIEA	Enabling	✘	✘	0.170	0	0.170
34	Trial the use of new instrumentation and technology to better understand sediment issues and impacts.	In house investigations by NIEA in conjunction with external research projects.	NIEA	Enabling	✘	✓	0.155	0	0.155
35	Consider the findings of Interreg IVA Freshwater Pearl Mussel project and implement appropriate measures in designated FWPM sites with a focus on sediment issues, as part of a pilot project.	Partnership working between Government and NGOs.	NIEA	Regulatory	✓	✓	0.272	0	0.272
36	Produce guidance on best practice to minimise sediment disturbance during river works.	Guidance produced in-house.	NIEA	Regulatory	Almost complete – no additional cost.				

7.3 Additional Information of Note

As shown in the table above, there are ten measures identified in relation to sediment to mitigate diffuse and point source pollution. NIEA is responsible for the majority of these, and most are enabling measures which should improve NIEA's understanding and knowledge of the pressure.

Funding has been secured for three of the measures and one is close to completion. Of the six measures which have not yet received funding, four of these are still likely to be introduced during this cycle. If the other two measures are not introduced in this cycle, they will be considered to address the gap in water status during the next RBMP cycle.

Measure number 28 initially involves a desk study on the Moyola River for two years. There could be additional costs as a result but these cannot be estimated at this time because it will depend on the outcome of the study.

Measure number 30 will be captured as part of the NIW Abstraction and Impoundment Licence Review. Any requirement for additional investment identified during the review of the licences will be covered in the change protocol for the PC15 Investment Programme.

Measure number 32 will involve scientific review of available research. Northern Ireland will provide data and support in kind but the review will be led by UKTAG.

DARD will take the lead for measure number 33 which will involve new research. This is likely to involve one or two researchers, each working for three years. NIEA is to provide data and support in kind.

Measure number 35 is considered under the Habitats Regulation Assessment carried out for Planning and any other authorisations. Costs are captured in the standard Planning and Regulatory Costs.

8. Key Sector: Urban Catchment
Pressure Type: Diffuse and Point Source Pollution

8.1 Background

A large proportion of rainwater in urban areas falls on roads, footpaths, driveways, car parks and other impermeable surfaces. The majority of this water either runs off into local rivers and streams via the drainage network or finds its way to more permeable areas where it percolates into the ground.

Run-off can typically include pollutants such as grit, bacteria from animal faeces, engine oil, fuels, detergents and road salt, although the source and composition of these potential pollutants can vary depending on the range of activities that take place in these areas.

Water pollution can also result from ‘misconnections’. Misconnections is the term applied to situations where a foul water connection is made to a surface water system (for example a washing machine connected to the rainwater drains).

Sustainable drainage systems (SuDS) are a vital tool to reduce both pollution and the quantity of run-off. The Northern Ireland Storm Water Management Group has been set up with a mandate to improve storm water management across Northern Ireland. Progress has been made, for example, in the separation of storm water from combined storm water and sewage systems and increase of SuDS with discharge to ground where possible. A revised draft Planning Policy Statement (15) ‘’Planning and Flood Risk’’ was published in 2014 that promotes SuDS as the preferred drainage solution for new developments and provides guidance. This policy position is also strategically reflected in the Department's draft Strategic Planning Policy Statement for Northern Ireland (SPPS). The promotion of more sustainable drainage solutions is also a key element of the Long Term Water Strategy which is due to be published in the Autumn of 2015 and is being led by the Department for Regional Development.

8.2 Measures and Costs

The table below outlines the cost of supplementary measures for which urban catchment is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 8.1: Urban Catchment Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
37	Develop a prioritisation list of misconnections.	NIEA/NIW to review relevant information.	NIW	Regulatory	✓	✓	2.840	0	2.840
38	Increase awareness of WFD requirements and stormwater management within local planning processes, underpinned by Strategic Planning Policy Statement.	Capacity building within DOE Planning and the 11 new Council's Planning Departments.	NIEA	Regulatory	✓	✓	0.350	0	0.350
39	Co-ordinate Bathing Waters pollution reduction programmes with the misconnections prioritised list to minimise bathing water failures as a result of polluted storm water systems entering local rivers.	Source apportionment studies.	NIEA/ MED	Enabling	✓	✓	0.016	0	0.016
40	Draft a policy paper on Polluted Surface Water Outfalls, including responsibilities for dealing with misconnections.	Negotiations as part of PC15 spending round.	DRD/ NIEA/ NIW	Enabling	✓	✓	0.018	0	0.018
41	Continue with Environmental Liaison Groups as part of Transport NI consultation process for each major road scheme.	Environmental liaison group.	DRD TNI	Regulatory	✓	✓	0.008	0	0.008
42	To provide guidance and information to help communities protect and enhance local streams and rivers in their urban environment.	Inter-agency River Restoration and Continuity Group to work with existing rivers trusts, communities and angling clubs.	NIEA/ DCAL	Voluntary	✗	✗	0.005	0	0.005

8.3 Additional Information of Note

The table above show that six measures have been identified for the urban catchment sector to address diffuse and point source pollution. The majority of these fall under NIEA ownership but DRD and DCAL are also responsible for some of the measures. Funding has already been secured for five of the measures and these are likely to be implemented during the cycle. There are no private sector costs to consider for this sector.

As regards measure number 37, NIEA assists NIW in the investigation of the source/ location of misconnections. This measure includes a £3.05 million allowance to address misconnection of foul water discharges into storm water sewers and pollution from the storm water outfall. The direction of expenditure will be dictated by policy.

Implementation of measure number 38 will be done through responding to individual planning applications as well as development plans, working alongside Planning NI and councils who now have new planning powers.

Although not costed directly in measure number 39, there may be local implementation costs for NIW in maintaining sewerage network or in the management of local farm fertiliser application. Therefore, the cost of this could potentially be greater than reported here.

9. Key Sector: Quarries and Mines
Pressure Type: Diffuse and Point Source Pollution

9.1 Background

There are approximately 160 quarries and sand pits across Northern Ireland, supplying the construction industry with raw materials. Northern Ireland is an important source of high quality aggregates for use across the UK and Europe. The varied geology in Northern Ireland provides products such as sand and gravel, basalt, sandstone and limestone.

Pollution of surface waters can occur as a result of rainfall run-off from the land area around a quarry or mine, hydrocarbon or herbicide spills, excess herbicide or fertiliser applications and runoff from soil and spoil heaps which may contain toxic metals and phosphates. Pollution of surface waters can also occur indirectly due to pollutants being transported in groundwater.

Mineral extraction by its very nature poses risks to groundwater. Removal of the overlying land in the working area means that the vulnerability of the groundwater to pollution is increased as the natural protection is removed. Therefore, it is important that proper precautions are taken to ensure the risk of pollution is minimized. Pollutants may include oils, fuels and hydraulic fluids, metals (for example, Cadmium, Mercury), pesticides and flocculants used in settlement ponds and nutrients.

Unconventional gas exploration and extraction refers to the use of high volume hydraulic fracturing (fracking) of previously impermeable rock to permit the extraction of natural gas on a commercial scale from unconventional sources such as shale gas deposits, coal seams and tight sandstones. At present, there is no exploratory or commercial drilling underway in relation to this in Northern Ireland.

Legislation was introduced through the Planning Reform (Northern Ireland) Order 2006 which requires the initial review of old mineral permissions. Mineral mapping has been undertaken to highlight where specific reserves are located, what type they

are and what constraints exist in the form of environmental designations. Northern Ireland Government Departments, through the Shale Gas Forum, are in the process of identifying the regulatory framework applicable to onshore oil and gas exploratory activities in Northern Ireland, and the linkages between the existing regulatory regimes. Such activities may include high volume hydraulic fracturing. As part of the planning process, NIEA requests hydrological risk assessments for quarries, to assess risks from dewatering and how they can be mitigated. NIEA provides guidance notes for applicants.

9.2 Measures and Costs

The table below outlines the cost of supplementary measures for which quarries and mines are a key sectors as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 9.1: Quarries and Mines Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
43	Significant all-Ireland research project that will contribute to providing the evidence base for the regulation of fracking.	Research programme.	NIEA	Enabling	✓	Ongoing	0 (BAU)	0	0
44	Promoting and supporting greater environmental compliance and performance, product innovation, resource efficiency and adoption of best practice.	Partnership working.	QPA/ NIEA	Voluntary	✓	Ongoing	0 (BAU)	0	0
45	Address the challenge of environmental degradation across North West Europe by developing a framework for the restoration of minerals sites (quarries), to provide benefits for biodiversity, habitats and local people. The 'RESTORE' project is being co-ordinated by the RSPB.	INTERREG IV funded programme.	RSPB	Regulatory	✓	Complete	0 (BAU)	0	0
46	Potential for disused/abandoned quarries to be used as flood attenuation to aid with the management of volume in river systems during flood events.	Consideration under future reviews of the Flood Risk Management Plans.	DARD RA	Enabling	✓	✓	0.001	0	0.001

9.3 Additional Information of Note

Table 9.1 outlines the four measures in relation to quarries and mines to address diffuse and point source pollution. Three of these have already been introduced and are ongoing. Funding has been secured for the final measure and this is likely to be introduced during the current RBMP cycle.

There is considerable debate around the world as to the potential impacts upon the environment and human health of the practice of fracking to extract hydrocarbons; measure number 43 has been included to help inform this debate. The research may allow for hydrocarbon exploration to proceed in Northern Ireland which would have a direct economic benefit but objectors argue it may impact upon the environment and the tourism industry. The research is likely to cost £100,000 and half of this has been secured thus far.

Measure number 44 relates to partnership working with the quarrying industry. The Quarry Group was initiated in January 2015 between the Quarry Products Association Northern Ireland and Innovation Strategies Division. The work of the group is currently covering the following topics: Aggregates Levy Credit Scheme; training workshops; electronic data capture; databases; guidance; customer profiles; and, unified inspections.

In regards to the Restore Project (measure number 45), this has now been completed. All the funding for this was covered by Interreg IV.

10. Key Sector: Waste and Contaminated Land
Pressure Type: Diffuse and Point Source Pollution

10.1 Background

Pollution of groundwater and surface waters can occur when there is seepage from the residues or waste products contained in old waste disposal sites (including old un-lined landfills). Contamination of land and groundwater can also occur, through a wide range of circumstances, from diffuse or point sources. This can be an issue in urban development when potentially contaminated sites are redeveloped. For example, land and groundwater may be affected by contamination on former industrial sites such as factories and petrol filling stations where spillages of materials may have occurred over time.

The potentially harmful properties of landfill leachates result from the presence of high levels of ammonia and suspended solids, dissolved solids, toxic compounds, immiscible organic chemicals, high chemical or biochemical oxygen demand, nutrients or microbiological contaminants. Some components of leachates are of concern due to their toxicity, bioaccumulation and persistence. Landfilled waste decays over a period of decades and, therefore, the pollution from leachate and gas continues to be emitted over a long period of time.

In Northern Ireland, waste is regulated through primary legislation (e.g. the Waste and Contaminated Land Order 1997), secondary regulations (e.g. the Waste Management Licensing Regulations (Northern Ireland) 2003) and amendments. The Waste and Contaminated Land Order 1997 provides the basis for licensing controls and other provisions aimed at ensuring that waste handling disposal and recovery options do not harm the environment, such as waste management licensing, duty of care, registration of carriers, hazardous waste and producer responsibility.

The Pollution Prevention and Control Regulations (Northern Ireland) 2003 introduced a permitting regime whereby operators of certain installations or mobile plants must obtain a permit from NIEA and comply with the conditions in the permit.

Emissions from certain processes and activities carried out at industrial and commercial facilities have the potential to cause harm to the surrounding environment. The Pollution Prevention and Control (PPC) regime provides a robust integrated regulatory framework which reduces and controls the potential for impact of these emissions to air, water and land (Part A activities only). The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 prescribe that certain activities must operate under a permit issued by the relevant regulator. Operators of these activities must employ the Best Available Techniques (BAT) to control and manage the risk of pollution from their facility, whilst maintaining a balance between costs to the operator and environmental benefits.

The Landfill Regulations (Northern Ireland) 2003 aim to prevent, or to reduce as far as possible, the negative environmental effects of landfill. The Planning (Management of Waste from Extractive Industries) Regulations (Northern Ireland) 2010 transpose the EC Mining Waste Directive and is implemented through the Northern Ireland Planning System. The main requirement is the development of a site waste management plan.

10.2 Measures and Costs

The table below outlines the cost of supplementary measures for which waste and contaminated land is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 10.1: Waste and Contaminated Land Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
47	Improved collection, coordination and analysis of data in and around waste and the waste system.	Waste data flow project and LIFE SMART Waste Project.	NIEA	Regulatory	✘	✓	0.308	0	0.308
48	To advise on new waste management facilities and extensions for legacy landfills and remediation of contaminated land - advise planners and third parties on the risk management and remediation of contaminated land and groundwater sites.	Provision of advice to planners and landowners.	NIEA	Enabling	✓	✓	0 (BAU)	0	0
49	Develop partnership process with Local Councils to support their effective management of significant waste contracts.	Development of Stakeholder engagement structure.	NIEA	Voluntary	✓	✓	0.214	0	0.214
50	Update and develop an Northern Ireland Groundwater Protection Strategy to support land use planning.	Working with UK/ROI counterparts, GSNI Research community.	NIEA	Regulatory	✓	✓	0.033	0	0.033
51	Develop process for joint Waste/Water authorisations to include regulation DOE Regulatory Reform programme.	DOE Regulatory Reform programme.	DOE RNRPD	Regulatory	✓	✓	0.160	0	0.160
52	Develop a compliance assessment process for Waste Authorisations.	Measurement of compliance.	NIEA	Regulatory	✓	✓	0.864	0	0.864

10.3 Additional Information of Note

The table above shows that there are six measures being considered for waste and contaminated lands. Funding has been secured for all but one of these, although it is hoped that all six will be introduced during this cycle.

The majority of the measures are regulatory although no private sector costs have been identified at this time.

Measure numbers 49 and 50 involve partnership working and a number of the measures are being introduced to address waste crime in NI (including measure numbers 47, 49, 51 and 52).

11. Key Sector: Chemicals
Pressure Type: Diffuse and Point Source Pollution

11.1 Background

A vast range of chemicals are used every day, both at home and at work. These chemicals can enter the environment by many diverse routes, ranging from emissions from industry and sewage treatment works to run-off from roads or farms. Many of these chemicals come from using products in homes, hotels, restaurants and offices and get into the water environment via sewage treatment works. Other sources of chemicals include industry and agriculture.

For some substances, as well as current emissions from industry and sewage treatment works, there are significant legacy issues. Some substances are already widespread in the environment as a result of past use which has contaminated land and sediment. Some of these substances accumulate in the food chain and may adhere strongly to sediment. In addition, historic industrial activity such as mining has led to significant emissions of metals from underground in the water environment. Some chemicals can threaten the long-term sustainability of drinking water sources and lead to increased costs of treatment.

There are major challenges to achieving objectives for some designated chemicals under the Water Framework Directive. For example, brominated flame retardants were banned in 2006 but are still present in many home furnishings like sofas and still end up in the water environment. Some common persistent toxic substances can accumulate in the environment, and this may mean some waters are at risk of not meeting Environmental Quality Standards which are set to protect the environment.

Raising awareness on how to deal with chemicals is provided through a number of ways including advice to small and medium sized businesses regarding obligations for designated chemicals, promotion of best practice in environmental management and collaboration with other agencies on campaigns such as the safe use and disposal of pesticide containers.

11.2 Measures and Costs

The table below outlines the cost of supplementary measures for which chemicals is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 11.1: Chemicals Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
53	Coordinate activities to reduce Dangerous Substances through an Expert Group.	Partnership working across government.	NIEA	Enabling	✓	✓	0.099	0	0.099
54	Pilot project looking at the regulation of priority and new substances of concern with more stringent standards for waste water treatment effluents.	Licence reviews under the Water (Northern Ireland) Order 1999.	NIEA	Regulatory	✓	✓	0.113	0	0.113
55	Investigate how existing and new technology and methods can apply to monitoring emerging chemicals of concern in the aquatic environment.	Collaboration with other agencies.	NIEA/ MED	Enabling	✘	✓	0.022	0	0.022
56	Investigate how passive sampling and associated analytical technology and methods can apply to monitoring emerging chemicals of concern in the marine environment.	Delivery of surveillance, operational and investigative monitoring programmes by NIEA/DAERA.	MED	Enabling	✘	✓	0.077	0	0.077
57	Pilot study of freshwater biota monitoring and use of passive sampling techniques during second cycle plans.	Biota monitoring managed through the NI Fish Monitoring Group and the Water Chemistry Group. Loughs Agency and AFBI collecting the fish samples.	NIEA	Enabling	✘	✓	0.237	0	0.237

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
58	To develop the analytical methodology required to facilitate the analysis of new substances added to Appendix X WFD.	Delivery of surveillance, operational and investigative monitoring programmes by NIEA.	NIEA	Enabling	✓	✓	0 (BAU)	0	0
59	Examine the feasibility of metals monitoring by passive techniques to allow the determination of time averaged concentrations of metals in rivers at locations of concern.	Pilot test of agreed methodology.	NIEA	Enabling	✗	✓	0.139	0	0.139
60	Potential introduction of pharmaceutical (Watch List) monitoring of waste water treatment works effluents e.g. Contraceptive pill.	Agreed UK Programme coordinated through UKCTT.	NIEA	Enabling	✗	✓	0.001	0	0.001
61	To develop methodology required to facilitate time averaged analysis and other analysis as it becomes available through UKTAG and as agreed by UKTAG working groups.	Pilot test of agreed methodology.	DOE EMD	Enabling	✗	✓	0.004	0	0.004
62	Encourage the adoption of Pesticide Minimisation Strategies, such as that adopted by Forest Service, across other sectors	Interdepartmental Forum/IWG.	NIEA	Enabling	✓	✓	0.017	0	0.017
63	Implementation of the Sustainable Use of Pesticides Directive.	The Plant Protection Products (Sustainable Use) Regulations 2012.	DARD	Regulatory	✓	✓	0 (BAU)	0	0

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
64	Further development of Drinking Water Protected Areas and establishment of safeguard zones to improve and maintain water quality within drinking water catchments.	Partnership working with NIW and DWI.	NIEA	Regulatory	✓	✓	0.003	0	0.003
65	Submit a project proposal through INTERREG V SCaMP to improve raw water quality in three cross border drinking water catchments.	Partnership working through INTERREG.	NIW/ IW	Regulatory	✘	✓	3.225	0	3.225
66	Use the Water Catchment Partnership approach to work proactively together to promote and raise awareness of best practice when using pesticides in the garden.	Water Catchment Partnership programme.	WCP	Voluntary	✘	✓	0.016	0	0.016
67	Promote no-pesticide usage by local authorities when managing green areas.	Engage with local Government via the interdepartmental Priority Subs Group.	NIEA	Enabling	✘	✓	Costs not available at this time		

11.3 Additional Information of Note

As shown in Table 11.1 above, fourteen supplementary measures have been identified in the chemicals sector to target diffuse and point source pollution. The majority of these are enabling measures and fall under the ownership of NIEA. Funding has already been secured for six of the measures but it is possible that all of them could be introduced during the second cycle.

One of the measures (number 63) is linked to legislation which was introduced to promote the sustainable use of pesticides and was calculated using information from a UK-wide regulatory impact assessment. However, it is arguably a basic measure and has, therefore, been classed as business as usual. As has measure number 58.

Measure number 65 involves EU funding of €5 million to improve drinking water quality in three cross-border drinking water catchments. A bid for funding is to be submitted in 2015/16.

12. Key Sector: Abstraction and Flow
Pressure Type: Water Quantity and Flow

12.1 Background

Abstraction is the removal of water, permanently or temporarily, from the water environment. Water is abstracted to meet a wide range of uses in Northern Ireland, including provision of water for public drinking water supply, industrial use, use in the food and drink industry, hydropower generation, agricultural and agri-industry use, recreational use and for use in fisheries.

The effect abstraction has on the environment depends on the amount and timing of the abstraction and the location and amount of water that may be returned after it has been used. Taking too much water from rivers and groundwater may result in lower flows and reduced water levels, which may not support a healthy ecology, affect wildlife and the look of a river, as well as impacting on other water users.

There are a number of reservoirs in Northern Ireland which impound water used for drinking water supply. Structures like this can impact rivers downstream by reducing or altering sediment movement and flows, or by preventing fish movement.

Where hydro power schemes are not designed or managed appropriately, adverse impacts on the local environment, and in particular, fish populations and other aspects of river ecology can occur. Fish can be harmed if they pass through a turbine and some hydropower schemes can lead to reduced flows in rivers, increase flood risk or adversely affect land drainage.

In 2006, the Water Abstraction and Impoundment (Licensing) Regulations were introduced to secure efficient and sustainable water use. Since 2010, NIW have produced and reviewed Drinking Water Safety Plans for Drinking Water Protected Areas which assess and mitigate against risks to drinking water quality. Similar regulatory assessments are also in place for private water supplies since 2009.

Water levels are managed by NIEA through controls on the quantity of water abstracted and the management of dams. NIW has developed targets to control water supply leakage levels, and its Water Resource Management Plan (2010-2035) promotes efficient water use by the industry and agriculture sectors through charging incentives. Further water efficiency measures have been developed to manage water demand through the Water Efficiency Plan. NIEA also controls abstractions from groundwater.

12.2 Measures and Costs

The table below outlines the cost of supplementary measures for which abstraction and flow is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 12.1: Abstraction and Flow Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
68	DRD Water Policy to prepare a Long-Term Water Strategy for Northern Ireland.	Publish Long-Term Water Strategy for Northern Ireland.	DRD Water Policy	Regulatory	✓	✓	0.028	0	0.028
69	NIW to prepare a Water Resource and Supply Resilience Plan by 2017.	NIW Water Resource and Supply Resilience Plan.	NIW	Regulatory	✓	✓	0.530	0	0.530
70	Implement a programme of water resource assessments and multi-disciplinary studies to provide evidence to inform abstraction and impoundment licence reviews.	Programme of investigations.	NIEA	Enabling	✗	✓	0.665	0	0.665
71	Increase awareness of importance of water efficiency and saving.	Joint stakeholder events and meetings.	NIW	Voluntary	✓	✓	0 (BAU)	0	0
72	Use burst water mains records to identify 'hotspots' and use to prioritise mains replacement to help reduce wastage in water supply.	PC15 programme of Water Mains Rehabilitation.	NIW	Regulatory	✗	✓	56.405	0	56.405
73	Implement catchment level assessments to inform NIW AIL licence reviews and monitoring requirements.	Project initiated in March 2014.	NIEA	Enabling	✓	✓	0.137	0	0.137
74	Consider whether groundwater licences can be issued as annual licences rather than the daily maximum volumes. This would reduce requirements for licence increase in some areas.	Regulatory position paper.	NIEA	Regulatory	Costs not available at this time.				

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
75	As part of implementation of the Floods Directive, develop and implement natural water retention measures and sustainable flood management options including role of bogs and wetlands.	UK and Ireland Working Group set up to consider outworkings of EU group on Floods/Diffuse Pollution/nature conservation.	DARD	Regulatory	✓	✓	0 (BAU)	0	0
76	Provide details of private drinking water supplies >10 cubic meters to inform WMU and GW designation and monitoring of DWPAs.	Through establishing a biannual information return.	DWI	Enabling	✓	✓	0.001	0	0.001
77	NIEA teams to have a reciprocal arrangement for transferring information to DWI on risks which could affect private water supplies either through monitoring programme or pollution incidents.	Electronic transfer of data.	NIEA	Enabling	✓	✓	0.002	0	0.002
78	Draft a guidance document for small scale hydro power scheme applicants to include advice on fish/lamprey passage.	Hydro power scheme interdepartmental working group.	NIEA/ DCAL/ Loughs Agency (LA)	Enabling	✓	✓	0.027	0	0
79	Co-ordination between DCAL and NIEA on the regulation of hydro power schemes, including pilot studies to examine the impact of hydro power schemes on fish stocks.	Hydro power scheme interdepartmental working group.	DCAL/ LA/ NIEA	Enabling	✓	✓	0.280	0	0.280

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
80	Clarify roles and responsibilities around fisheries and Abstraction and Impoundment Licensing legislation and enforcement.	Hydro power scheme interdepartmental working group.	DCAL/ LA/ NIEA	Enabling	✓	✓	Already costed as part of measures 78 and 79.		
81	Adopt a consistent UK methodology for assessing the passability of obstacles to fish migration and use the protocol at abstraction points to inform licence conditions and to inform the decision making process on weir design.	AIL Licensing process.	NIEA	Enabling	✓	✓	Already costed as part of measure 78 and 79.		
82	Integration of fuller ecological considerations into hydro power scheme licensing.	Ongoing research and networking and capturing best practice from the other fishery bodies and regulators within the UK. DCAL are initiating an inspection programme of fish screens and fish passes for both the adult and smolt runs.	DCAL/ AFBI/ NIEA	Enabling	Costs not available at this time.				
83	Research into recovery times for groundwater bodies to achieve good chemical status/travel times through the unsaturated zones.	Research community.	Research community e.g. Queens, UU, TCD	Enabling	Costs not available at this time.				

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
84	Consider CIS guidance on Ecological Flows during the next review of UKTAG Environmental Flow Standards.	UKTAG Water Resources Task team.	UKTAG members	Enabling	Costs not available at this time.				
85	Develop a programme of Reservoir surveys to assess the impact of impoundments on the aquatic environment.	Surveys to be completed by NIW.	NIW	Enabling	Costs not available at this time.				

12.3 Additional Information of Note

Table 12.1 shows that eighteen abstraction and flow measures have been identified to mitigate the issues connected to water quantity and flow. Ownership of the measures is spread around a number of stakeholders. Whilst the majority are enabling measures, there are a number of regulatory measures as well.

Two of the measures (numbers 71 and 75) are considered part of steady-state operations and have, therefore, been deemed business as usual. This means that they carry no additional costs for the second cycle.

Measure number 72 is one of the most costly measures expected to be implemented during the cycle (£56 million). This includes £42 million Captial Spend for the PC 15 Investment Programme and an additional £17.8 million identified for 2015-2016. Note that reducing wastage also is likely to accrue significant financial and environmental benefits.

Measure numbers 78, 79, 80 and 81 relate to an inter-departmental group and a guidance document which is under development. The development of the guidance will result in the co-ordinated approach to the regulation of hydro schemes, including how to regulate the legacy of poorly operated hydro schemes.

13. Key Sector: The Physical Condition of the Water Environment Pressure Type: Morphology

13.1 Background

Some of the water bodies in Northern Ireland have been modified to provide benefits such as the provision of drinking water, land drainage, reducing flood risk to communities, production of hydro electric power or improving transport networks.

Aquatic wildlife is affected not only by the quantity and quality of water but also the physical habitat of the water environment. Modifications such as straightening rivers, building weirs and reinforcing banks with concrete can constrain and stabilise the physical nature of water bodies, reducing the development and diversity of physical habitats. This can reduce the number and diversity of animals and plants present. In addition, the way land is managed can adversely affect habitats, for example by changing the amount of sediment that runs off both agricultural land and urban areas. These hydrological and morphological features are collectively known as the water body's hydromorphology.

An Inter Agency River Restoration and Continuity Group has been established to progress issues in respect of physical modifications. A guide, 'River Alterations - A Hydromorphology Handbook' was also produced in 2013. This is a user friendly guide for landowners and others who are considering making changes to watercourses. A number of habitat restoration projects have been carried out in Northern Ireland and many of these projects have been completed by DARD Rivers Agency and DCAL. The DOE Water Quality Improvement Grant has funded a number of projects to improve the hydromorphology across Northern Ireland. For example river restoration projects to improve hydromorphology by adding gravel and boulders to the river.

13.2 Measures and Costs

The table below outlines the cost of supplementary measures for which physical condition is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 13.1: Physical Condition Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
86	Develop the methodology for including river continuity in Water Framework Directive classification.	Inter-agency River Restoration and Continuity Group.	NIEA/ DCAL/LA	Enabling	✓	✓	0.002	0	0.002
87	Improve liaison with DRD Transport NI re potential road bridges inhibiting fish passage.	Liaison with DRD Transport NI through RR and C group or relevant sub group.	DRD TNI/ DCAL	Enabling	✓	✓	0 (BAU)	0	0
88	Inter-Agency River Restoration and Continuity Group to prioritise issues (e.g. potential barriers to fish movement) and co-ordinate river restoration and continuity work.	Inter-agency River Restoration and Continuity Group.	NIEA/ DCAL/ DARD RA/ LA	Enabling	✓	✓	0 (BAU)	0	0
89	Continue to support local stakeholder restoration projects through the Environmental Challenge Fund and Fisheries Habitat works.	NIEL Challenge fund and similar schemes.	NIEA/DCAL	Third Sector	✘	✓	0.641	0	0.641
90	Continue with Environmental Liaison Groups as part of Transport NI consultation process for each major road scheme.	Environmental liaison group.	DRD TNI	Enabling	✓	✓	0 (BAU)	0	0

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
91	Develop guidance on management of in-channel woody habitat debris.	Working in conjunction with Rivers Agency to take account of any flood risk issues as an extension/sub group of River Restoration and Continuity Group.	DARD RA/ DARD FS	Regulatory	✓	✓	0.001	0	0.001
92	Marine Environment Division to work with DRD Ports, DARD and NIEA to develop a Ports and Harbours Guidance document, outlining good environmental management within ports.	Initial discussions with DRD, DARD and MCA.	MED	Enabling	✓	✓	0.003	0	0.003
93	Ensure proper protection and compliance with gravel removal legislation.	Compliance with fisheries legislation.	DCAL/LA	Regulatory	✓	✓	0 (BAU)	0	0

13.3 Additional Information of Note

Eight measures have been identified in relation to physical condition as indicated in Table 13.1. Funding has been secured for all but one of these, although four have been deemed as business as usual and, therefore, should result in no additional costs during the second cycle.

Whilst two of the measures are regulatory, neither of these is deemed likely to impose an additional cost on the private sector over and above any costs which they would already face.

As regards measure number 89, there is uncertainty over the value of this as it is unknown how much of the funding available will be used for water based projects until the applications are accepted. Therefore, the figure presented is likely to underestimate the cost as it only includes funding related to fisheries, which was known.

14. Key Sector: All Sectors
Pressure Type: Invasive Alien Species

14.1 Background

Animals and plants that have been introduced to a place where they do not naturally occur are known as alien species. Many of these do not cause problems, but some can become invasive as they upset the balance of the ecosystem as they may be bigger, faster growing or more aggressive than the native species. They may also have fewer natural predators to control numbers. The native species are often unable to compete and the invasive species take over causing serious problems for biodiversity and the economy.

As well as the direct impacts described above, invasive alien species can also have indirect impacts in the wider environment. For example, in riparian areas, excessive growth of these species can result in increased shading. Winter die back of these invasive alien species can also result in river bank instability and erosion which can lead to increased sedimentation in rivers and consequent silting up of fish spawning grounds and smothering of freshwater pearl mussels.

Invasive alien species are not specifically mentioned in the Water Framework Directive. However, the Directive requires assessment of 'other significant anthropogenic impacts on the status of surface waters'. Invasive species such as Giant Hogweed, Japanese Knotweed and Himalayan Balsam can be found in a number of water bodies across Northern Ireland.

The Wildlife Order (Northern Ireland) 1985 now contains new provisions to strengthen the regulatory framework for controlling the introduction of invasive alien species. The DOE now has powers to introduce an order to prohibit the sale of high risk alien species. The Northern Ireland Countryside Management Scheme includes an option to control invasive species. Catchment scale eradication and control projects have taken place since 2007. For example, Controlling Priority Invasive Non-native Riparian Plants and Restoring Native Biodiversity (CIRB) is a partnership project lead by Queen's University, Belfast and supported by the DOE, will control,

and if possible eradicate, four invasive alien riverbank plants: Giant Hogweed, Japanese Knotweed, Himalayan Balsam and Rhododendron. These species will be controlled in river catchments in Ireland and Scotland. The project will run for four years (2011-2014) in order to manage and control effectively the regrowth that occurs from the soil seed bank and rhizomes.

Training programmes on identification and recording of alien species have been undertaken by NIEA and have also been funded through the Water Quality Improvement Grant. In partnership with the National Parks and Wildlife Service, NIEA has jointly funded the Invasive Species Ireland Project. A strategy to co-ordinate action on invasive species was published by the DOE in May 2013. The 'Be Plant Wise' and 'Check, Clean, Dry' awareness campaigns have also been launched in partnership with GB to raise awareness of aquatic invasive species.

14.2 Measures and Costs

The table below outlines the cost of supplementary measures for all sectors as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 14.1: Alien Species Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
94	Undertake appropriate actions to implement legislation.	EU Regulation 1143/2014 on the prevention and management of the introduction and spread of invasive alien species. The Wildlife (NI) Order 1985.	DOE NIEA	Regulatory	✘	✓	0.080	0	0.080
95	Consider research, in conjunction with DARD, to improve understanding of the effects of alien species in the aquatic environment.	Invasive Species Ireland Project (subject to funding).	NIEA/ DARD	Enabling	✘	✘	.020	0	0.020
96	Continue to implement the actions set out in the Invasive Alien Species Strategy for Northern Ireland.	Invasive Alien Species Strategy partners.	DOE RNRPD	Enabling	✘	✓	0.038	0	0.038
97	Develop process for assessing significant impact of species as listed in Ecoregion 17 lists for WFD classification.	UKTAG Aliens Species Group and Ecoregion 17 Group on Alien Species.	NIEA	Enabling	✘	✓	0.010	0	0.010
98	Develop new individual Invasive Alien Species Management Plans as required.	Invasive Alien Species Strategy partners.	NIEA	Enabling	✘	✓	0.020	0	0.020
99	Improve education re fish introductions and need for Section 14 authorisation for stocking and moving fish.	Implementation of current controls.	DCAL	Voluntary	✘	✘	0.028	0	0.028

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
100	Continue partnership approach between professionals and volunteers for invasive alien species monitoring to improve understanding of current distributions and spread.	Invasive Species Ireland Project, NGO projects and Challenge Fund.	NIEA	Third Sector	✘	✓	0.020	0	0.020

14.3 Additional Information of Note

As shown in Table 14.1 above, seven measures have been identified linked to mitigating the negative impact of invasive alien species. Funding has not yet been secured for any of the measures. However, it is possible that the majority of these could be introduced during this cycle with only two assessed as unlikely to be introduced; although this could change should funding become available.

As regards measure number 94, there is no requirement for this Regulation to be transposed into Northern Ireland law. However, DOE RNRPD has informed NIEA that this is likely to be transposed to some extent in the UK.

Measure number 95 requires NIEA (and DARD) to consider the development of methods to investigate the impacts of invasive alien species in the aquatic environment. There will have to be final agreement on what species will be covered, subject to funding.

Measure number 96 involves the continuation of working with partners to reduce the adverse impact of invasive alien species in the aquatic environment. As with measure number 95, there will have to be final agreement on what species will be subject to funding.

The subsequent measure, measure number 97, entails NIEA to consider the development of methods to investigate the impacts of invasive alien species in the aquatic environment. Again, there will have to be final agreement on what species will be subject to funding.

15. Key Sector: Fisheries
Pressure Type: All

15.1 Background

A range of inter-related factors that affect fish spawning grounds, rearing areas, food supplies and migration routes often combine to prevent fishery populations from maintaining their productive capacity. Poor water quality, inadequate or modified flows and morphological impacts that impede fish movements and degrade physical in-river habitats are particularly damaging, whilst predation and competition from invasive species can be locally significant. In sea loughs, poor water quality and other factors such as invasive species can affect the productive capacity of transitional fish and shellfish.

Fish and fisheries habitat are protected through the Fisheries Act (Northern Ireland) 1965. DCAL and Loughs Agency are responsible for the protection and restoration of Atlantic salmon which is achieved through compliance with NASCO1 principles for salmon management, and local projects are carried out to improve habitat quality, carrying capacity for native fish species, and to reintroduce salmon stock. A Management Strategy for Northern Ireland, Salmon Management Plans and National Eel Management Plans have been developed and implementation is on-going. Following pollution incidents, waters are reinstated under The Fisheries (Amendment) (Northern Ireland) Order 1991.

New conservation measures were announced by the DCAL Minister in December 2012 introducing:-

- legislation to impose a mandatory cessation of all commercial wild salmon fisheries to take effect from the 2014 season;
- legislation to impose mandatory catch and release in relation to recreational fishing for wild salmon across the DCAL jurisdiction with effect from the 2014 season; and
- a limit of one salmon carcass tag per angler in the 2013 season.

The Loughs Agency introduced carcass tagging and a logbook scheme in 2001 to improve adherence to regulations. A real time fishery management regime deals with the control of commercial and recreational fishing. Management action can include the suspension or extension of fishing and the introduction of catch and release angling.

Agri-Food and Biosciences Institute and Loughs Agency conduct a fish monitoring programme; NIEA uses this to inform classification of fish under Water Framework Directive. A Trout Stock Status report has been drafted and DCAL will consider recommendations to address issues related to trout status. Long term monitoring programmes in estuaries are being used to observe spatial and temporal trends in local marine fish populations and to assess impacts of climate change on fish distribution.

DCAL and Loughs Agency offer advice to stakeholders on fishery matters and provide education and guidance through visitor centres, outreach programmes and school based learning. Rivers Agency carry out work to alleviate the impacts of drainage maintenance works/flood alleviation measures and look for mitigatory measures and enhancement opportunities such as fishery rehabilitation where possible. DCAL provide advice to Rivers Agency on this work to protect and mitigate any impacts on fisheries.

15.2 Measures and Costs

The table below outlines the cost of supplementary measures for which fisheries is a key sector as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 15.1: Fisheries Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
101	Develop a coordinated rolling monitoring programme for large and small lakes prioritised according to protected area designations and local issues.	WMU Monitoring Review. AFBI SLAs with WMU and DCAL via Fish Monitoring Group.	NIEA/ DCAL	Enabling	✘	✓	0.281	0	0.281
102	Inclusion of fishery bodies within SCaMP (Sustainable Catchment Management Programme) stakeholder group.	SCAMP Stakeholder Group.	DCAL	Enabling	✓	✓	0 (BAU)	0	0
103	Further integration of river assessments and planned fishery habitat improvements, including targeted river restoration projects.	Inter-agency River Restoration and Continuity Group and Fish Group.	NIEA	Enabling	✓	✓	0 (BAU)	0	0
104	NIEA to work with DCAL Inland Fisheries Group in order to quantify, and seek through the courts, the costs in relation to fish kills.	Memorandum of Understanding between NIEA and DCAL Inland Fisheries Group.	NIEA/ DCAL/ LA	Regulatory	✓	Already Completed	0	0	0
105	Develop and monitor a demonstration project based on adapted channel maintenance, and through a partnership approach.	Inter-agency River Restoration and Continuity Group.	DARD RA/ NIEA/ DCAL/ LA	Enabling	✘	✓	0.020	0	0.020
106	Develop and implement Fisheries Management Plans for Lough Neagh and Lough Erne.	DCAL Fisheries strategic plan.	DCAL	Enabling	✘	✓	Already costed as part of measure #101.		

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
107	Continue to carry out large scale fish stock monitoring when the DOLMANT survey has been completed to inform Fisheries Management Plans.	AFBI SLAs with WMU and DCAL via Fish Monitoring Group.	DCAL	Enabling	✘	✓	Already costed as part of measure #101.		
108	Instigate a rolling programme of surveys for lamprey, European smelt, Sea trout and Brown trout.	Loughs Agency business plan.	LA	Regulatory	✓	✓	0.175	0	0.175
109	Consider regulatory options to protect stock of the European eel.	Introduction of regulations to provide eel passage through actions against possible obstructions and introduction of eel passes.	LA	Regulatory	✘	✓	Out for consultation – costs not yet estimated.		
110	Consider regulatory options for the conservation of Juvenile Coarse Fish.	Regulations to introduce new controls to prevent depletion and increase levels of protection of Juvenile Coarse Fish.	LA	Regulatory	✘	✓	Out for consultation – costs not yet estimated.		
111	Consider regulatory options for the protection of prescribed species.	Introduction of regulations to protect prescribed species.	LA	Regulatory	✘	✓	Out for consultation – costs not yet estimated.		

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
112	Increase awareness of fish passability issues for bridges and culverts to facilitate improved design and remediation.	Awareness Training and Surveys.	NIEA	Enabling	✓	✓	0.005	0	0.005
113	Introduction of a fishery management tool through the Fisheries Habitat Improvement Strategy.	Fisheries Habitat Improvement Strategy 2014.	LA	Enabling	Costs not yet available.				
114	Streamlining of aquaculture management. Strategic management of the resource.	DARD Fisheries Bill.	DARD	Regulatory	✘	✓	Out for consultation – costs not yet estimated.		

15.3 Additional Information of Note

As shown in the table above, fourteen possible measures have been identified in relation to fisheries to alleviate a range of pressures. The measures are split between enabling and regulatory, although no costs to the private sector have been identified at this time.

All of the measures could be initiated during this cycle although two of these are considered business as usual and another has already been completed. Funding has been secured for three of the measures, leaving eight still to be funded.

Measure numbers 109–111 fall under the ownership of the Loughs Agency. It is important to note that these are still out for consultation and the costs are currently unknown. There is a possibility that this will have a financial impact on both the public and private sectors.

DARD has ownership of measure number 114. This is linked to the Fisheries Bill which, as with the measures above, is currently out for consultation and the costs and benefits are currently unavailable.

16. Partnership Working

Pressure Type: All

16.1 Background

Progress has been made in implementing the programme of measures within the first cycle RBMPs within Northern Ireland and this is the result of the co-ordinated efforts of a wide range of responsible authorities and stakeholders.

NIEA has developed a number of initiatives to encourage partnership working. In support of this, Catchment Management Officers attend national and local events to raise awareness of the importance of the water environment and water quality issues. NIEA's Water Environment Community Awards funded eighteen projects across Northern Ireland (£18,000) which aim to improve awareness and understanding of the importance of the water environment. The Water Quality Improvement Grant scheme funds the wider community to help improve their local water quality, thereby helping to meet the objectives set out in the 2009 River Basin Management Plan.

NIEA supports the Rivers Trusts Northern Ireland through enhanced partnership and are also involved in supporting the set up of Riverfly Partnerships across Northern Ireland. A Riverfly Partnership is a community-led initiative to monitor river stretches to identify pollution.

Local District Councils have responsibility for implementing the two main pieces of legislation relating to litter (The Clean Neighbourhoods and Environment Act (Northern Ireland) 2011 and The Litter (Northern Ireland) Order 1994). Although NIEA has no statutory obligation to address litter in the water environment, it actively encourages the public to take more responsibility through good land management practices. To this end, the Department works in partnership in many areas for example in grant aiding the non-government organisation, Keep Northern Ireland Beautiful, and working on things such as the Beach NI website, beach cleans, coastal litter surveys. In addition to this, NIEA helps to organise a large number of local river events with local angling clubs and community groups in an effort to

encourage the general public to take ownership of their rivers. These events include voluntary litter cleanups, as well as educating attendees about the importance of the river both to themselves and the wider environment. Water Quality Improvement Grants have been used by local communities to assist river clean ups.

16.2 Measures and Costs

The table below outlines the cost of supplementary measures for partnership working as identified in the RBMPs. For a detailed description of the assumptions see Appendix A.

Table 16.1: Partnership Measures and Costs

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
115	Support established rivers trusts through specific projects.	Established NI Rivers Trusts Rivers Trust Action Plans Community Engagement.	NIEA	Enabling	✓	✓	0.168	0	0.168
116	Work with Local Councils and wider stakeholders to increase awareness and support actions to address litter in the water environment.	Partnership working.	NIEA	Enabling	✓	✓	0.192	0	0.192
117	Develop and implement a programme of catchment scale pilot projects to protect and improve water status.	INTERREG V and other funding sources.	All	Enabling	✓	✓	0.113	0	0.113
118	Develop management measures for smaller lakes based on the outcomes from the DOLMANT project.	Set up an inter-agency Lakes Restoration working group.	NIEA/ DCAL	Enabling	✓	✓	0.047	0	0.047
119	Consider options for civil sanctions, such as on the spot fines, as part of the regulatory reform programme for environmental regulation.	DOE Regulatory Reform programme.	DOE RNRPD	Regulatory	✘	No decision taken yet	No costs available at this time.		
120	Develop and agree three prosperity agreements with local industry/ business.	Partnership working with businesses and interest groups.	NIEA	Voluntary	✓	✓	0.158	0	0.158
121	Consider increased utilisation of flood plain storage as part of Flood Risk Management Plans (FRMPs).	Partnership working on local projects and schemes.	DARD RA	Voluntary	✓	✓	0 (BAU)	0	0

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
122	Continue to work together to improve understanding of the wider public of the value and wider benefits of the water environment.	Partnership working and Catchment Stakeholder Groups.	NIEA	Enabling	✓	✓	0.069	0	0.069
123	Increase awareness of the role of groundwater in the management of the aquatic environment as part of catchment wide projects.	Working with others such as GSNI, Universities, Councils, NI Water, local stakeholder groups.	NIEA	Enabling	✘	✓	0.199	0	0.199
124	Review success of pilots with local councils to address fly tipping, including hazardous and fuel laundering waste.	Partnerships between NIEA and Local Councils.	NIEA	Regulatory	✓	✓	0.163	0	0.163
125	Development of an inter-departmental group to look at synergy between Directives, so that measures proposed have a synergistic effect and at least do not disbenefit progress elsewhere?	The interagency River Restoration and Continuity group.	All	Enabling	✓	✓	0 (BAU)	0	0
126	Consider alternative funding opportunities, for example, the INTERREG V programme, to deliver sustainable solutions that take account of economic and social needs as well as environmental objectives for various European Directives.	NIEA external funding group.	SEUPB	Enabling	✘	✓	0.153	0	0.153

#	Measure/Action	Delivery Mechanism	Owner	Type of Measure	Funding Secured	Likely to Proceed	Public Sector Cost (£m)	Private Sector Cost (£m)	Net Present Cost (£m)
127	Align, as far as possible, the objectives and standards for the Water Framework Directive and Natura 2000 Protected Areas.	Joint WMU and NED working group in place to take forward working approach to be trialled during finalisation of second cycle plans.	NIEA	Enabling	✓	✓	0.010	0	0.010
128	Submit a project proposal through INTERREG V SCaMP to improve raw water quality in three cross border drinking water catchments.	Partnership working through INTERREG.	NIW/ DWI	Regulatory	✘	✓	Already costed as part of measure #65.		
129	Complete Catchment Management Plans for 24 Drinking Water Catchments.	Catchment Plan studies undertaking by external contractor under NIW framework with support from NIW internal staff.	NIW	Regulatory	✘	✓	0.480	0	0.480
130	Details of pollution incidents to be made available on NIEA website.	NIEA website.	NIEA	Enabling	Costs not known at this time.				

16.3 Additional Information of Note

Sixteen measures have been identified to promote partnership working with the aim of mitigating a number of pressures. All except one of these measures could be introduced in this cycle.

Measure number 119 is a regulatory measure and there is uncertainty as regards its introduction. Civil sanctions are not included in the first Environmental Better Regulation Bill (see measure number 18), which has yet to be cleared by the Executive. They may be considered for inclusion in subsequent primary legislation. If introduced there is likely to be financial benefits for the private and public sectors.

Measure number 120 involves Prosperity Agreements. These are voluntary agreements through which the NIEA and an organisation can realise opportunities for reducing the environmental impacts of energy and material use in ways that create prosperity and well-being. Candidates for prosperity agreements are businesses with good compliance records that are looking to go beyond compliance to maximise environmental and economic benefits.

As regards measure number 126, the figures presented are only for the development and groundwork by NIEA staff. However, there is potentially funding of £15 million Interreg funding to be included for the restoration of waters. The call for funding is likely to be November 2015 and allocation of funds 2016.

Under measure umber129 Catchment Management Plans will be completed for all drinking water catchments using the UK Water Industry Research (UKWIR) approach. The plans will include a summary of land area, land use and risks to drinking water safety. The plans will produce a list of recommendations for catchment works to improve raw water quality and enhance ecosystems/habitat which will then be actioned on a priority basis during NIW's PC15 period.

17. Benefits Assessment

17.1 Introduction

A key element in the process of identifying an appropriate programme of measures to be included in the second cycle River Basin Management Plans is the assessment of the benefits that the measures may provide. Various approaches have been adopted at EU level with regard to the selection of cost effective measures; however, with regard to benefits assessment in the context of river basin planning, it is acknowledged that this is generally a more challenging exercise than the identification of costs for measures. In line with recommendations at a European level, the approach taken here has been to assess the benefits of the programme of measures at the River Basin District (RBD) and national level (in terms of improvements in water body status) as assessing the benefits from single or groups of measures can prove difficult, not least because a range of different measures can contribute to the same benefits. This approach should avoid the double counting of benefits. Further detail on the quantitative approach taken to assess benefits can be found in section 17.2 below.

As there is an inherent difficulty with quantifying the economic benefit of measures, a qualitative approach has also been adopted to describe the possible benefits of improving water status. A qualitative description can be based on the expected improvements in water quality and other characteristics of the water environment.

Qualitative information is important when considering the wider impacts of measures. Monetary valuations of benefits are often more difficult and, therefore, qualitative data and descriptions have been used in most cases for individual measures.

17.2 Quantitative Analysis of Improved Status Benefits

To estimate the high level benefits of the proposed measures a set of values was used from the National Water Environment Benefits Survey (NWEBS), which was carried out for the Environment Agency in England and Wales. The NWEBS was conducted by NERA and Accent in 2007 as part of the DEFRA-led Collaborative Research Programme (Project 4b/c).

The focus of the NWEBS was to obtain values for WFD improvement programmes for a national impact assessment, and for the regional impact assessments conducted for the first round of river basin management plans. The EA subsequently commissioned an update of these benefits estimates in 2012 for use in the second round of river basin management planning[2].

The NWEBS values were obtained with the specific objective of measuring the benefits of WFD improvements. The NWEBS provides values for recreation, amenity and non-use benefits from improving the water environment. It does this using stated preference methodology to derive willingness-to-pay (WTP) values to estimate the maximum amount an individual is willing to sacrifice to avoid undesirable impacts. This allows market values to be placed on otherwise unquantifiable impacts.

While it is acknowledged that the method used for the appraisal may give a conservative estimate for the overall benefits to industry etc, the updated NWEBS values provide the best and most practical way to use the currently available evidence on monetary values for non-market benefits for implementation of the Water Framework Directive.

To estimate impacts in Northern Ireland it was important to identify the gap between current status and future target status to show the benefits which could accrue if targets were achieved. This was broken down by water body type to allow the NWEBS figures to be applied. The table below shows current and 2021 target status (the gap) for all waterbodies excluding groundwater (see the bullet points below).

2 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291464/LIT_8348_42b259.pdf

Table 17.1: Current and Target Status - Surface Waterbodies

Status	Number of Waterbodies	
	2015 Status	2021 Objective
HIGH	9	9
GOOD	149	316
MODERATE	225	102
POOR	39	7
BAD	8	0
GEP	3	25
MEP	43	32
PEP	11	4
BEP	4	0
No Info	5	1
Total	496	496

Once this information was known, the average values in NWEBS were uplifted to 2015 prices[3] and applied to the rivers and lakes in Northern Ireland. However, it is important to note that figures are only to be used as an indication of possible benefits and this methodology has limitations, as outlined below:-

- NWEBS is based on English and Welsh rivers; however, residents of Northern Ireland are expected to have a different willingness-to-pay and, therefore, the values are likely to differ.
- The average values were used; however, as shown in NWEBS, all rivers have different levels of value. Therefore, taking an average has an impact on how robust the estimates are likely to be.
- To use NWEBS to derive monetary values[4] for the ecosystem service benefits, the WTP values are equally divided across six components[5] and applied per km of water body improved within a catchment. To do this in Northern Ireland a survey would need to be undertaken to allow experts to assess each water body to determine which of the components apply to

[3] Prices uplifted using HMT's GDP Deflator
[4] http://www.thames21.org.uk/wp-content/uploads/2013/12/NWEB-Briefing-Notes.pdf
[5] Fish, other animals such as invertebrates, plant communities, the clarity of water, the condition of the river channel and flow of water, and the safety of the water for recreational contact

the improvement of the water bodies in question. Given the time constraint, it has not been possible to do this within the timescale for completion of this document. However, it could be completed at a later date to ensure a more robust assessment of benefits. In the absence of such a survey it has been decided to apply two out of six components to the full size of each catchment in Northern Ireland per step change to allow benefits to be estimated. i.e. bad to poor represents improvement in two components, moderate to good is two components etc. Again, this results in a high level of uncertainty but is considered a reasonable estimate given the information available.

- It has not been possible to quantify groundwater impacts. The NWEBS values used for surface water cannot be used as they rely on being able to see the water body and use it for purposes other than consumption. Therefore, benefits are likely to be underestimated.

To allow for a comparison of the costs and benefits over the same timescale the benefits have been quantified over the six years of the cycle and are assumed to fully accrue by the end of the cycle. A proportionate growth of the benefits has been assumed over the six years i.e. benefits increase over the cycle to peak in year six.

Note the benefits of improving the water status are likely to continue accruing long into the future. However, additional resources may be required to maintain water bodies at the desired status and an assessment of this is outside the remit of this analysis. Therefore, to ensure a more robust analysis of possible benefits, only the six-year period of the cycle was assessed.

The results of the quantitative benefits assessment have been shown in Table 17.2 below.

Table 17.2: Results of Benefits Assessment

	Low	Central	High
Rivers	£61.5m	£74.8m	£88.3m
Lakes	£0.2m	£0.2m	£0.3m
Transitional and Coastal	£1.5m	£1.8m	£2.2m
Total Annual Benefits (if target status achieved)[6]	£63.2m	£76.9m	£90.8m
NPV over cycle	£197.6m	£240.2m	£283.7m

As shown in Table 17.2, achieving the 2021 objectives (as indicated in Table 17.1) could potentially lead to benefits estimated at £76.9 million per annum under the central estimate. Note that given uncertainties, NWEBS provides three scenarios which allow a range of benefits to be estimated reflecting low to high scenario sensitivity analysis (annual benefits are estimated to range from £63.2 million to £90.8 million).

The net present value of benefits over the six year cycle, accounting for a proportionate growth in benefit, ranges from £197.6 million to £283.7 million. As suggested above, the benefits of achieving good water status are likely to be long-term and lasting.

17.3 Key Groups or Sectors Affected by Benefits

All sections of society would benefit from the improvements to the water environment under options 2 to 5. The key benefits would include:-

- cleaner, healthier rivers and lakes would benefit anglers, walkers, boaters and wildlife interest groups;

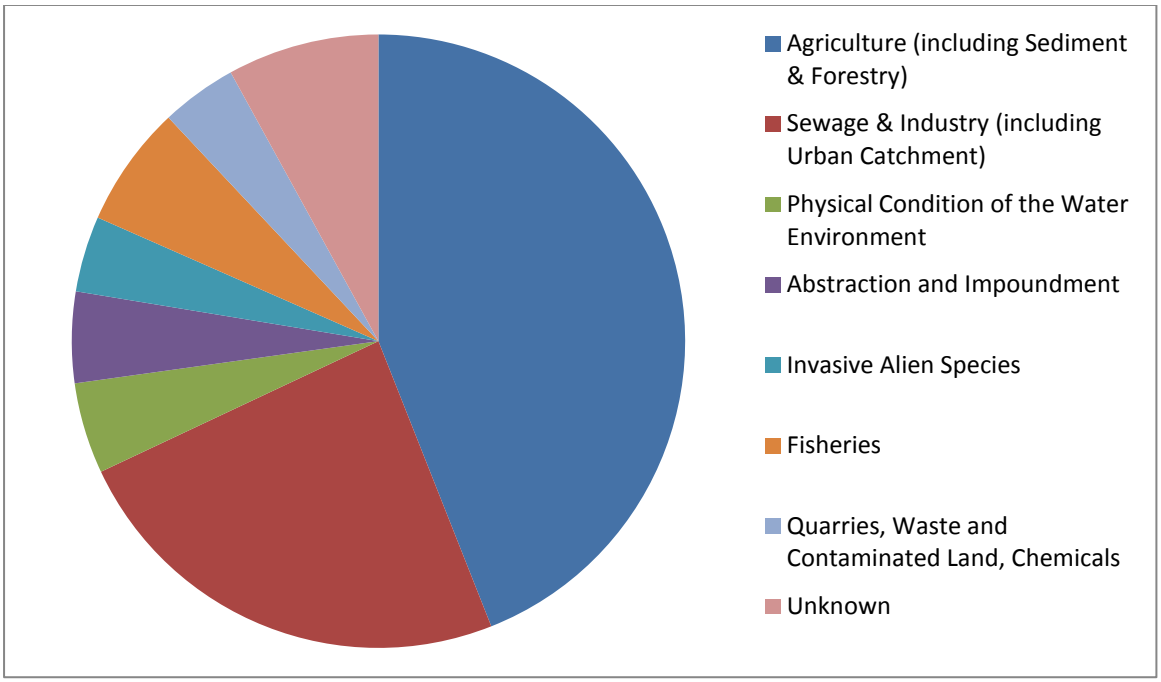
[6] Figures may not sum due to rounding.

- tourism and recreation businesses could develop and expand;
- improved quality and quantity of freshwater in the environment could result in savings to NIW (due to reduced treatment costs) and those who rely on access to clean drinking water supply; and
- public confidence and wellbeing would increase from knowing that the water environment is in a healthy state, irrespective of whether they use it.

In line with the analysis set out in the Significant Water Management Issues[7] reports published at the end of 2013, the draft and final second cycle RBMPs contain measures which address pressures across a range of specific sectors and issues. While all of these issues impact on the water environment to some extent, some have a greater impact on water quality and quantity and, therefore, the range of measures proposed and benefits that can be realised through prioritising resources to implement measures in these areas is likely to be greater. The main pressure impacting on the water environment in Northern Ireland is water pollution caused by diffuse and point sources. Diffuse and point source pollution can arise from a number of sectors including agriculture, sewage, urban development, forestry, industry and other businesses, and waste management. Based on an analysis of the reasons for water body failures, it is considered that the greatest benefits will be realised through implementing measures in respect of the agriculture and sewage and industry sectors to address some of the negative diffuse and point source impacts which can be caused by these sectors. It is no coincidence that the costs and benefits associated with the measures for these sectors are the most significant across the Programme of Measures. Based on which pressures are most commonly impacting on water bodies, Figure 17.1 below provides an indication of which groups of measures are likely to have the greatest benefits in terms of improved water quality.

[7] http://www.doeni.gov.uk/niea/water-home/rbp_water_framework_directive/2015-water-framework-directive/2015-wfd-related-consultations/swmi-2.htm

Figure 17.1: The Distribution of Benefits by Sector



Given the nature of the Water Framework Directive, the measures identified in each of the options being considered are very diverse and require input from a range of sectors and organisations. The benefits of the measures identified for the options being considered and the improvements in water quality that will be obtained as a result of the implementation of these measures will also affect a wide range of sectors. The main sectoral groups involved in river basin management planning who will contribute to and realise the benefits that will occur from the implementation of some of the key measures that will be included in the second cycle River Basin Management Plans include:-

- **Government** – benefits include better coordination and joined up working, better use of resources, improved understanding of pressures, achievement of WFD objectives, improvements in water quality helping to meet other key environmental and economic objectives, development of better approaches in relation to tackling water quality issues, a more informed public leading to improved behaviours.
- **Agriculture** – benefits include improved working practices, more sustainable growth, compliance with environmental legislation, more efficient use of natural resources and less reliance on chemical fertilisers.
- **Industry, services and infrastructure** – benefits include increased

business opportunities, increased tourism, increased production, more efficient and effective working relationships with government, more sustainable working models.

- **Water Industry** – benefits include improved efficiency, reduced operating costs, more sustainable working practices, increased public awareness on the importance of water, compliance with key legislation, better understanding of pressures on infrastructure, better targeting of resources.
- **Key stakeholders** (Voluntary Organisations, NGO's, angling groups, Community Groups etc) – benefits include these groups having more ownership of local water bodies, improved engagement and partnership working with government, taking pride in the local environment, achievement of targets, healthier water environment for recreational activities, improved biodiversity and habitat, increased transparency around allocation of Government resources.
- **General Public –** benefits for the general public include, reduced flooding risks, health and wellbeing benefits, access to a healthier water environment for recreational activities, increased awareness of the importance of the water environment, improved education on environmentally friendly practices and increased ecosystem services benefits.

17.4 Benefits of a Healthy Environment and Healthy Water Environment

The principle aim of the measures set out in the three Northern Ireland River Basin Management Plans is to meet the objectives of the Water Framework Directive by maintaining and improving the status and health of the water environment. In basic terms, this equates to increasing the number of water bodies meeting 'good status' as defined by the Directive. A number of elements are taken into consideration in the assessment of water body status under the Water Framework Directive, including the health of fish populations, plant communities, invertebrates, the clarity of water and the flow of water. There are a wide range of benefits that should result from a healthy water environment.

Northern Ireland's environment provides a powerful foundation for generating prosperity. The environment and economy are interdependent. A well managed and protected water environment helps to underpin prosperity and create opportunities for economic growth. Decisions on how to use and protect the wider environment and the water environment are inextricably linked to economic prosperity and well-being in Northern Ireland. It is widely acknowledged that there are economic and health gains to be realised when high environmental and heritage standards are attained. There can be opportunities to either generate wealth or save money through a better and more integrated approach to protecting and promoting the sustainable use of our environmental assets such as our water environment.

The range of assets and services that we use to support our way of life is often referred to as our Natural Capital. We rely on it for, amongst other things, our food, water and energy. It includes the water environment and also includes the less obvious processes which underpin and generate the services which the natural environment provides, for example, soil fertility processes and pollination. In addition, there is increasing evidence that experiencing nature has positive impacts on mental and physical health and wellbeing. The UK National Ecosystems Assessment of 2011 revealed that natural capital is worth billions of pounds to the UK economy. The report also highlights the value of nature to human health and wellbeing but notes that many of the ecosystems that make up our natural capital are degraded. Concerted action is required to reverse this degradation and secure enhanced economic, social and human health benefits.

Our environmental assets and services all have value. Any degradation of our natural capital entails not only the loss of precious habitats, wildlife, fish populations, landscapes, clean air and water but also the loss of economic value that we could have gained from sustainable use of our natural assets. There is a great inter-dependency within our natural resources and they should be managed in a holistic and integrated way. This is often referred to as taking an ecosystems approach.

In NI we have the capacity to make significant savings in the longer term – and avoid huge costs associated with pollution events and unsustainable use of resources through the River Basin Management Plans and local catchment area action plans.

For example, the right level of investment in managing floodplains and development around our rivers could save millions of pounds in water treatment, flood alleviation, and insurance costs. Conversely not taking account of the impact of consuming natural capital can lead to overconsumption and high risk situations that can destabilise our economic future.

17.5 A Healthy Water Environment

Water is essential for life. It allows the natural environment to flourish and businesses, agriculture and the economy to grow and prosper. The water environment provides many benefits to society, from supplying drinking water and supporting fisheries to providing an essential resource for business and agriculture, transport routes and a source of recreation that promotes wellbeing. It is also at the core of natural ecosystems and climate regulation. Society uses water to generate and sustain economic growth and prosperity, through activities such as farming, commercial fishing, energy production, manufacturing, transport and tourism.

Threats to water quality come from pollution, over-abstraction and hydromorphological changes due to industry, agriculture, urban developments, flood defences, power generation, navigation, recreation, wastewater discharge and more.

Protecting and improving the long term quality of the water environment is fundamental to securing high quality, safe drinking water supplies for households, business, industry and agriculture. A healthy water environment is critical. It is not just needed for drinking water but also supports recreational activities; biodiversity and the character of our countryside.

The need to protect and improve the water environment has been recognised for many years and the implementation of the first cycle River Basin Management Plans was a key step in working to achieve this goal. A healthy water environment will not only enhance the quality of the environment but will also enable development to proceed in a sustainable manner for the benefit of future generations. The Water Framework Directive, through the implementation of the River Basin Management Plans, is a key instrument for delivering long term sustainability in the water environment. The River Basin Management Plans set the framework for future

regulatory decisions within each river basin. They target pollution and a range of other pressures, based on an identification of the risks to water bodies, with the aim of enabling them to attain good status.

A wide range of people, stakeholders and organisations who make use of the water environment or whose activities can adversely impact its uses have been and will continue to be involved in the development and implementation of measures within each of the three River Basin Districts in order to work towards the targets and objectives set out in the river basin management plans.

17.6 Services Provided by Water

There are a wide range of benefits that can be achieved through a healthy environment based on an ecosystem services framework. The ecosystems services framework sets out the range of services that a healthy ecosystem would be expected to deliver. A number of these which are particularly relevant to water are summarised in the table below. This list is based on the UN Millennium Ecosystem Assessment[8] impacts and some will be more relevant than others.

Table 17.3: Range of Services Linked to Water

Provisioning services	**These are the products obtained from the ecosystem:-**
fresh water	People obtain freshwater from ecosystems and, therefore, the supply of freshwater can be considered a provisioning service. Because water is required for other life to exist, however, it could also be considered a supporting service.
food	Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems but marine and freshwater systems also provide food for human consumption.

[8] http://www.millenniumassessment.org

water for non-consumptive use	The use of water for economic activity that does not involve permanent abstraction, this includes water used for energy generation (hydroelectric, cooling for thermoelectric such as fossil fuel and nuclear plants), navigation and transport.
Regulating services	**These are the benefits obtained from the regulation of ecosystem processes, including:-**
water regulation	The timing and magnitude of run-off, flooding and aquifer recharge can be strongly influenced by changes in land cover, including, in particular, alterations that change the water-storage potential of the system such as the conversion of wetlands or the replacement of forests with farmland or farmland with urban areas.
natural hazard regulation	The presence of coastal ecosystems such as saltmarsh can reduce the damage caused by storms.
erosion regulation	Soil erosion is a naturally-occurring process involving the mobilisation of soil particles, mainly by water and air. Vegetative cover plays an important role in soil retention and the prevention of landslides.
water purification and waste treatment	Ecosystems can be a source of impurities (e.g. in fresh water). However, they can help in the filtering out and decomposition of organic wastes introduced into inland waters and coastal and marine ecosystems and can also assimilate and detoxify compounds through soil and sub-soil processes.
Cultural services	**These are the non-material benefits people obtain from ecosystems through cognitive development, reflection, recreation and aesthetic experiences, including:-**
cultural heritage	Many societies place high value on the maintenance of both historically important landscapes (‘cultural landscapes’) and other features.
recreation and ecotourism	The role that green space plays in maintaining mental and physical health is increasingly being recognised, despite difficulties of measurement. Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits.

aesthetic values	Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks and scenic drives and in the selection of housing locations.
Supporting services	**Supporting services are those that are necessary for the production of all other ecosystem services. They differ from provisioning, regulating and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people:-**
provision of habitat	Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.

17.7 Qualitative Benefits Assessment

The following sections provide an overview of the key benefits that could be realised from the measures identified in relation to each of the key sectors (as identified in the Significant Water Management Issues reports and the draft River Basin Management Plans).

In the majority of cases, the benefits realised from the implementation of the measures will apply across Northern Ireland although some of the measures will have specific benefits for specific targeted areas.

The tables also identify the key sectors benefitting from the measures. Note there are likely to be some secondary benefits of certain measures for other sector groups and benefits for the environment more generally; however, the table focuses on those sectors for which the more obvious benefits will be realised. Please also note that for the purposes of these tables, the *General Public* sector is considered to also incorporate the *Key Stakeholder* sector.

17.8 AGRICULTURE

The agriculture sector is a key sector in the Northern Ireland economy. Farming covers over 70% of the total land in Northern Ireland and there are over 26,000 farm businesses. Given its prominence in Northern Ireland, agriculture has a significant impact on water quality and quantity. Eutrophication, caused by agricultural activity, remains the most widespread threat to water quality in Northern Ireland. In 2012, farming also accounted for the largest proportion of substantiated incidences investigated by NIEA (32.3 %), followed by Domestic (18.2 %), Industry (16.9 %) and NIW (15.4 %). The two most significant sources of pressure preventing water bodies from achieving good status are diffuse pressures from agricultural sources and point source pressures from urban wastewater and development.

The NIEA estimate that around 13% of river water bodies in the North Western River Basin District, 22% in the Neagh Bann River Basin District and 16% in the North Eastern River Basin District have failures attributed to nutrient enrichment likely to be caused by agriculture and point sources such as waste water treatment works (WWTWs), industrial discharges and septic tanks. Similarly, 11% of river water bodies in the North Western River Basin District, 8% in the North Eastern River Basin District and 13% in the Neagh Bann River Basin District have failures in invertebrates, dissolved oxygen and ammonia elements likely to be caused by agriculture and point sources such as waste water treatment works (WWTWs), industrial discharges and septic tanks. 10% of water bodies in the North Western River Basin District, 43% in the North Eastern River Basin District and 25% in the Neagh Bann River Basin District have failures attributed to both nutrient enrichment and organics (invertebrates, dissolved oxygen and ammonia). Based on the objectives set for water bodies for the second WFD cycle, it is estimated that around 39% of water bodies in the North Western River Basin District, 37% in the Neagh Bann River District and 29% in the North Western River Basin District will move from moderate to good status. It is considered that the range of agriculture and sewage measures will contribute most significantly to this improvement and reduce the levels of failures highlighted above across the second WFD cycle.

As part of the development of the first cycle River Basin Management Plans, the Defra 2007 WFD Impact Assessment calculated the present value (2006) benefits to

Northern Ireland from phosphorus reduction (to rivers and using non-use value only) as £6 million between 2015 and 2045 based upon 3,281 km of rivers failing to meet UKTAG standards at that time. While this estimate significantly understates the other direct and non-direct-use related benefits associated with reduced eutrophication and the status of some water bodies has improved during the first WFD cycle, it provides an indication of the benefits that can be realised through reduced eutrophication across Northern Ireland. The benefits to the environment and the economy would run into several £millions. Achieving reduced levels of eutrophication will only happen as a result of a wide range of measures, not simply those which affect the agricultural sector. However, it is considered that agricultural measures and actions will play a key role in this process.

Many other benefits will also be realised through reduced eutrophication and a reduction in the number of water bodies being polluted by agricultural sources. Action to tackle eutrophication will enhance biodiversity, restore fish habitats and improve the aesthetic standards of water bodies.

Good water quality is important because it provides clean drinking water, safe bathing water, healthy fisheries and contributes to an improved living environment. Good water quality is also essential for recreation and for supporting tourism which in turn encourages the use of the countryside and the viability of rural businesses.

Improved farming practices and reductions in pollution events and eutrophication caused by the agriculture sector will also have economic benefits for the sector in the long term. These include an improvement in compliance with relevant legislation, the development of more sustainable working models and more efficient nutrient management.

Table 17.4 summarises the benefits of the measures linked to agriculture.

Table 17.4: Agriculture Benefits

AGRICULTURE				
Action/Measure	**Key Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Measures to address the impact of pollution arising from farmyards, including farmyard audits and farmyard management practice with particular focus of farmyard drainage systems.	• Reduction in pollution incidents. • Improved farmyard practice. • Reduction in organic waste. • Reduction in nutrient enrichment.	• NI-wide.	• Agriculture. • General Public.	1
Develop modelling tools to help understand the natural dynamics and science of the catchments, including groundwater. This may include further development of the SCIMAP tool which examines diffuse pressures, determines flow pathways and flood risk areas within catchments so that measures can be targeted to manage problem areas.	• Reduced flooding potential • Reduction in organic waste • Improved understanding of pressures • Will assist in ensuring that government, water industry and stakeholder resources are targeted better.	• NI-wide.	• Government. *Following development and use of tools:-* • Water Industry. • Stakeholders. • Government.	3
Measures to address nutrients including Nitrates Action Programme (NAP); provision of training in Nutrient Management Planning; provision of online farm nutrient calculators and the facilitation of soil sampling and analysis.	• Reduction in nutrient levels. • Reduction in phosphorus levels. • Reduced Eutrophication which has multiple benefits for the Northern Ireland economy and environment, including: benefits of enhancing biodiversity and restoring fish habitat.	• NI-wide. • Over 26,000 farm businesses and over 70% of the land	• Agriculture. • General Public. • Water Industry.	2

AGRICULTURE				
Action/Measure	**Key Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
	• Human health benefits. • Biodiversity/Ecosystem health. • Improved use of manures and better practices in agriculture industry. • Decreased costs for water treatment. • Reduction in pollution incidents. • Tourism and recreation.	area are covered by NAP Regulations.		
The Environmental Farming Scheme (EFS) will include measures for riverbank fencing, riparian buffers and pasture pumps.	• Sediment and nutrients intercepted– reduced eutrophication in downstream lakes and ponds. • Reduction in pesticides. • Bank stabilisation – which can reduce or prevent erosion. • reduction in point source pollution by preventing livestock from entering watercourses. • Habitat benefits. • Increased biodiversity.	• NI-wide. • Likely to be thousands of farmers participating in the scheme so benefits should be widespread.	• Agriculture. • General Public.	2
Consider measures within Woodland and Environmental Farming schemes as part of Rural Development Programme such as riparian woodland.	Benefits of riparian woodland can include:- • The roots of bankside trees and associated vegetation help to strengthen stream banks. • Shading can reduce water temperature extremes. • Falling twigs, leaves and insects provide an	• Targeted areas.	• Agriculture. • General Public.	2

AGRICULTURE				
Action/Measure	**Key Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
	important source of food for freshwater life. • Trees, ground vegetation and surface roots can trap sediment and remove pollutants in water. • Reduction in pollution from agricultural land.			
Use the Water Catchment Partnership approach to work proactively together to promote and raise awareness of best practice when using pesticides on the farm.	• Increased awareness of best practice when using pesticides. • Protect people, wildlife, plants and the environment from adverse effects of pesticides. • Reduced possibility of pests becoming resistant though unnecessary use.	• NI-wide.	• Agriculture. • General Public.	2
Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of agriculture on fresh water pearl mussels.	• Protection of freshwater pearl mussels. • Improved water clarity.	• Targeted areas.		1
Target areas identified under Nitrates Directive reporting with increasing nutrients for investigation and action.	• Reduction in nutrient levels. • Reduced eutrophication. • Better targeting of resources. • Reduction in pollution incidents.	• Targeted areas.	• Agriculture. • Government.	

AGRICULTURE				
Action/Measure	**Key Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Develop models and a catchment based approach to protect bathing waters and shellfish waters. INTERREG VA project to develop prediction and discounting at bathing waters.	• Increased protection of bathing waters and shellfish waters. • Tourism benefits. • Economic benefits. • Better targeting of resources.	• Targeted areas.	• Agriculture. • General Public. • Water Industry. • Industry.	1

17.9 SEWAGE AND INDUSTRY

NIW is the sole provider of water and sewerage services in Northern Ireland. NIW collects and treats more than 300 million litres of wastewater every day from approximately 825,000 households and businesses. NIW operations have a significant impact on the water environment. In 2012, the proportion of pollution incidences investigated by NIEA related to NIW was 15.4%. Privately owned septic tanks and treatment works can be a source of localised pollution in rural areas.

The NIEA estimate that up to 13% of water bodies in the North Western River Basin District, 22% in the Neagh Bann River Basin District and 16% in the North Eastern River Basin District have failures attributed to nutrient enrichment likely to be caused by agriculture and point sources such as waste water treatment works (WWTWs), industrial discharges and septic tanks. Similarly, up to 11% of water bodies in the North Western River Basin District, 8% in the North Eastern River Basin District and 13% in the Neagh Bann River Basin District have failures in invertebrates, dissolved oxygen and ammonia elements likely to be caused by agriculture and point sources such as waste water treatment works (WWTWs), industrial discharges and septic tanks. 10% of water bodies in the North Western River Basin District, 43% in the North Eastern River Basin District and 25% in the Neagh Bann River Basin District have failures attributed to both nutrient enrichment and organics (invertebrates, dissolved oxygen and ammonia.

Based on the objectives set for water bodies for the second WFD cycle, it is estimated that around 39% of water bodies in the North Western River Basin District, 37% in the Neagh Bann River District and 29% in the North Western River Basin District will move from moderate to good. It is considered that the range of sewage and industry measures (along with the agricultural measures) will significantly contribute to this improvement and reduce the levels of failures highlighted above across the second WFD cycle.

NIW has planned investment from 2015 onwards (through PC15) to address some of the significant problems with old combined sewers which, during periods of heavy rainfall, overflow excessive amounts of storm waste water into rivers causing pollution and flooding. However, there may be additional problems associated with a

high density of septic tanks some of which may be defective or not maintained properly.

There are, therefore, multiple environmental benefits than can be realised by implementing measures which address water quality and quantity issues and pollution caused through sewage. There are economic benefits for NIW through the introduction of more sustainable environmental operating practices and having a more efficient sewage infrastructure network. NIW's current annual costs for providing water and sewerage services is around £380 million and its electricity consumption costs £30 million p.a. These electricity costs could rise to £40 million by 2020 given predicted increases in energy prices and without the introduction of 'greener' approaches to maintaining and upgrading the sewerage network. The potential savings and benefits for the taxpayer from implementing measures which provide a more sustainable and affordable model for wastewater treatment could be considerable. Measures which improve the quality of the water entering the NIW network reduce the amount of water being used by consumers and reduce the pressure on the overall NIW network will reduce operating costs and should deliver multiple benefits.

There are benefits to be realised through looking at innovative approaches to reducing the costs of treating wastewater for example by removing phosphorus at treatment works. For example, in 2013 Thames Water installed a £2 million reactor to remove Phosphorus from sewage and turn it into fertiliser at a plant in Slough, Berkshire. The nutrient-recovery facility takes waste water from the Slough Trading Estate and turns the phosphorus in it into crystalline fertiliser pellets. Before 2013, Thames Water estimated that it had spent £200,000 a year on chemical dosing to clear pipes of struvite (a nutrient compound containing ammonia and phosphorous) at the Slough treatment works. While this is an example of an innovative approach resulting in reduced treatment costs, reducing nutrient enrichment and other problems at source is still the most cost effective solution in the long term.

The key driver to creating a more sustainable water sector in Northern Ireland will be the effective implementation of the Department for Regional Development's Long Term Water Strategy (LTWS 2014-2039). There are strong synergies between the

measures identified in relation to the Sewage and Industry section in the RBMPs and those which are proposed under the LTWS.

Table 17.5 summarises the benefits of the measures linked to sewage and industry.

Table 17.5: Sewage and Industry Benefits

SEWAGE AND INDUSTRY				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Review consents to discharge on a pilot catchment basis using the SIMCAT model.	• Improved understanding of the impact of discharges on the local water environment in terms of flow and water quality. • Also facilitates the investigation of cumulative impacts of point source discharges at a catchment scale. • Ensure discharge consents are set which do not threaten the achievement of water quality targets. • Reduction in pollution from sewage.	• NI-wide.	• Government. • Water Industry.	3
Introduce flow and priority pollutant monitoring as part of the compliance regulation regime.	• Reduction in pollution from sewage.	• Targeted areas.	• Government. • Water Industry.	1
Consider Regulatory Reform to include single integrated permits, unified inspection powers for all environmental obligations, and enhanced enforcement powers.	• Improved efficiency in terms of the application of NIEA resources. • Less burden for compliant businesses. • Improved understanding of obligations for businesses. • Greater focus on high risk activities. • Reduction in pollution from industry.	• NI-wide.	• Government. • Industry. • Agriculture. • General Public.	2
Further development and implementation of innovative and	If implemented:-	• Targeted areas.	• Water Industry. • General Public.	1

SEWAGE AND INDUSTRY				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
sustainable measures such as the use of willows to treat effluent from small waste water treatment works and then harvesting for fuel.	• Protection of water quality through elimination of discharges to streams. • Economic benefits from yield. • Reduced emissions through less fossil fuel use. • Lower capital and operational costs for NIW using such systems. • Reduction in pollution from sewage.			
Controlling sewage gross solids by using separation devices such as screens in unsatisfactory storm overflows.	• Improved efficiency of NIW infrastructure. • Protection of watercourses. • Aesthetic benefits. • Increased protection of protected areas including bathing waters and shellfish waters. • Reduction in pollution from sewage.	• Targeted areas.	• Water Industry. • General Public.	1
Inclusion of event monitoring on networks in the vicinity of bathing and shellfish waters.	• Should assist in meeting protected area objectives. • Reduction in pollution from sewage.	• Targeted protected areas – 23 bathing waters and 10 shellfish waters.	• Water Industry. • General Public.	
Improve knowledge about the operation of storm overflows through more	• Potential to reduce flooding risk and pollution events should results of monitoring lead to improved practices which negate the negative	• Targeted areas.	• Water Industry. • General Public.	1

SEWAGE AND INDUSTRY				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
monitoring.	environmental impact of overflows. • Reduction in pollution from sewage.			
Introduce Environmental Permitting Regulations which will simplify permitting processes and allow for regulation under registrations and general environmental rules.	• Lighter form of regulatory control should provide protection for the water environment; and • Reduce the administrative burden on NIEA and operators.	• Targeted areas.	• Government. • Industry.	2
Work with the water industry to develop and pilot recovering phosphorus from waste water treatment works and to pilot new technology to remove phosphorus to meet tighter discharge limits.	• Has the potential to reduce eutrophication caused by high phosphorus levels. • Economic benefits through recovery and subsequent use of phosphorus as a resource. • Environmental land and soil benefits where phosphorus is recovered and re-used. • Reduction in pollution from sewage.	• Targeted areas.	• Water Industry. • Government.	SQ
Increase awareness of need to install and maintain private sewerage systems correctly.	• Increased knowledge among public on best practice in respect of private sewerage systems. • Reduction in pollution caused by poorly installed and maintained systems.	• NI-wide.	• Water Industry. • General Public. • Government.	1
In land drained for agricultural purposes, research the impacts on streams of effluent from septic tank percolation	• Improved understanding of water quality issues caused by septic tanks.	• Targeted areas.	• General Public. • Government.	3

SEWAGE AND INDUSTRY				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
areas.				
Implement measures through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures).	• Protection of freshwater pearl mussels. • Improved water clarity.	• Targeted areas.		1
Work with other UK agencies and the water industry to scope and develop cost effective measures for reducing Phosphorus loads in WWTWs, septic tanks, human food, dishwasher detergents and use in water supply dosing.	• Improved knowledge of best practice approaches to reducing Phosphorus loads. • Reduced treatment costs.	• NI Wide.	• Government. • Industry. • Water Industry.	
Develop models and a catchment based approach to protect bathing waters and shellfish waters. INTERREG VA project to develop prediction and discounting at bathing waters.	• Increased protection of bathing waters and shellfish waters. • Tourism benefits. • Economic benefits. • Better targeting of resources.	• Targeted areas.	• Agriculture. • General Public. • Water Industry. • Industry.	1

17.10 FORESTRY

Forests and their management can affect the quantity and quality of water moving through catchments. Although providing many positive benefits, forests have the potential to negatively impact on the environment. Some of the potential water problems that can be caused include nutrient enrichment, erosion and increased sedimentation, flow pattern changes, pesticide contamination and acidification.

There are, therefore, many benefits from implementing measures which improve the management of forests and reduce the risk of increased acidification, pollution, sedimentation and nutrient enrichment caused by forests.

Based on the analysis of the pressures impacting on waterbodies carried out as part of the significant water management issues exercise and the development of the draft RBMPs, it is not considered that forestry is a major contributor to failing water bodies across Northern Ireland. The measures identified are, therefore, in the main targeted at specific areas and the benefits will, therefore, be realised accordingly.

Table 17.6 summarises the benefits of the measures linked to forestry.

Table 17.6: Forestry Benefits

FORESTRY				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Consider the inclusion of new woodlands, wet woodlands and floodplain forests as part of catchment wide pilot projects to protect and improve water quality and quantity	Potential Benefits include:- • Reduced Flooding Risk. • Reduction in pressure on water resources.	• Targeted areas.		2
Forest Service to provide woodland management advice and promote wider expansion of afforestation taking account of forestry best practice and sustainable forest management standards.	• A number of hectares of new woodland established which comply with the UK Forestry Standard. • Better management of forests.	• Targeted areas.	• General Public. • Agriculture.	2
Implement measures in the Forestry Commission Practice Guide 'Managing Forests in Acid Sensitive Water Catchments'.	• Positive impact on water quality in catchments vulnerable to acidification. • Improved habitat conditions for fish.	• Targeted areas.		2
Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of forests on fresh water pearl mussels.	• Protection of freshwater pearl mussels.	• Targeted areas.		2

17.11 SEDIMENT

Too much fine sediment causes a range of problems, from damaging wildlife to increasing the costs of treating drinking water, and increased risk of flooding from silted up drains. Sediment has direct impacts, carrying other pollutants like nutrients, chemicals and faecal contamination into the water environment.

Tackling fine sediment not only tackles the direct effects of sediment, but also brings wider benefits, including reducing the risk of flooding. Fine sediment results from soil erosion, soil compaction (which increases run-off) and the erosion of riverbanks and road verges.

At the moment there is limited data available on sediment as there is no in-river WFD sediment standard and sediment run-off and in-river siltation is not routinely monitored. There are, therefore, benefits from implementing measures which increase understanding of where sediment is an issue.

Given the water quality issues that can be caused by sediment, further measures to reduce sediment will also help to reduce eutrophication and provide benefits for habitats and biodiversity. There are, therefore, multiple benefits of the proposed sediment measures.

The benefits of the measures in respect of sediment will also contribute to achieving the benefits identified in respect of the agriculture measures.

Table 17.7 summarises the benefits of the measures linked to sediment.

Table 17.7: Sediment Benefits

SEDIMENT				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Develop and enhance modelling tools to help understand the natural dynamics and science of the catchments, such as further development of the SCIMAP tool.	• Reduced potential of flooding. • Improved understanding of pressures. • Reduction in pollution from sediment. • Will assist in ensuring that government, water industry and stakeholder resources are targeted better.	• NI-wide.	• Government. Following development and use of tools:- • Water Industry. • Government.	3
Develop a pilot project in a catchment with diffuse pollution including sediment problems to consider alternative sustainable methods to dealing with issues.	Multiple benefits, including:- • Improved understanding of pressures causing sediment in catchment. • Efficient and targeted use of resources to tackle sediment issues in catchment. • Learning and experience which can be applied elsewhere going forward. • Reduction in pollution from sediment.	• Targeted Areas. Potentially, after the pilot project has been implemented, the benefits could be NI-wide.	• Government. • Agriculture. • General Public.	1
The Environmental Farming Scheme (EFS) will include measures for riverbank fencing, riparian buffers and pasture pumps.	• Sediment and nutrients intercepted – which can cause eutrophication in downstream lakes and ponds. • Reduction in Pesticides. • Bank stabilisation – which can reduce or prevent erosion and, therefore, reduce	• NI-wide, • Likely to be thousands of farmers participating in the scheme so	• Agriculture, • General Public,	2

SEDIMENT				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
	sedimentation and siltation of downstream lakes, ponds, and reservoirs. • Reduction in point source pollution by preventing livestock from entering watercourses. • Habitat benefits. • Increased biodiversity. • Reduction in pollution from sediment.	benefits should be widespread,		
Consider the findings of INTERREG IVA Freshwater Pearl Mussel project and implement appropriate measures in action plans for designated FWPM sites.	• Increased protection for freshwater pearl mussel population.	• Targeted Areas.	• Government.	1
Assess the need and incorporate sediment management plans as part of NIW Abstraction Licences.	• Potential reduction in pollution caused by sediment	• Targeted Areas.	• Water Industry. • Government.	1
Develop expertise and knowledge to carry out catchment fluvial audits.	• Should increase knowledge and ability to identify the inputs of sediment and the areas where it deposits in the water environment.	• Targeted Areas.	• Government.	2
To develop and consult on appropriate sediment standards for UK.	• Potential reduction in pollution caused by sediment	• NI-wide.	• Government.	2

SEDIMENT				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Consider further research into the impacts of sediment in agricultural catchments, in conjunction with nutrients and biological quality.	• Increased knowledge and improved understanding of pressures impacting on water quality. • Improved targeting of resources and measures.	• NI-wide.	• Government.	3
Trial the use of new instrumentation and technology to better understand sediment issues and impacts.	• Potential reduction in pollution caused by sediment. • Improved understanding of pressures which should enable better targeting of measures and resources in the long term.	• Targeted Areas.	• Government.	2
Produce guidance on best practice to minimise sediment disturbance during river works.	• Reduction in pollution caused by sediment.	• NI-wide.	• Government. • Industry. • Public.	SQ

17.12 URBAN CATCHMENTS

A large proportion of rainwater in urban areas falls on roads, footpaths, driveways, car parks and other impermeable surfaces. The majority of this water either runs off into local rivers and streams via the drainage network or finds its way to more permeable areas where it percolates into the ground. Water pollution can also result from 'misconnections' ie connecting domestic foul waste outputs to surface/ stormwater disposal systems.

There are significant benefits to be realised from implementing measures which reduce the impacts of misconnections and result in improvements to the management of stormwater. Planning decisions and future developments which include sustainable stormwater management systems will have long term benefits for water quality and the environment.

The measures which address pollution caused by urban catchments have potentially significant benefits in relation to reducing the risk of flooding and minimising pressure on NIW's infrastructure. In 2014 the Rivers Agency estimated that there were 46,000 properties in Northern Ireland at risk of flooding from rivers and the sea, and that around £60 million of public money is currently being spent every year protecting property against flooding. The damage caused by flooding events can run into £millions and this doesn't take into account the emotional distress experienced by people whose properties have been flooded.

Measures to address misconnections and encourage the wider use of SuDs will have long term benefits not only in reducing potential pollution and improving water quality but also in reducing the volume of water being treated by NIW which could result in significant savings in terms of operational costs.

The benefits of the measures in respect of urban catchments will also contribute to achieving the benefits identified in respect of the sewage and industry measures.

Table 17.8 summarises the benefits of the measures linked to urban catchments.

Table 17.8: Urban Catchments Benefits

URBAN CATCHMENTS				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Develop a prioritisation list of misconnections.	• Reduction in pollution and flood risk. • Targeting and prioritisation of resources to tackle key misconnection issues. • Improved amenity value and visual condition of waterbodies beside any areas where misconnection issues are addressed.	• Targeted Areas.	• Government. • Water Industry. • General Public. • Industry.	1
Increase awareness of WFD requirements and stormwater management within local planning processes, underpinned by Strategic Planning Policy Statement.	• May lead to wider use of SuDs and/or natural water retention measures and green infrastructure • Should result in relevant water quality and flooding issues being considered and incorporated in future developments. • Reduced flooding risk. • Reduced pressure on sewer network. • More sustainable development will result in less investment being required to treat wastewater.	• NI-wide.	• Government. • Water Industry. • General Public. • Industry.	1
Co-ordinate Bathing Waters pollution reduction programmes with the misconnections prioritised list to minimise bathing water failures as a result of polluted storm water systems entering local rivers.	• Positive impact in terms of bathing waters meeting relevant BWD standards. • Reduction in impact of diffuse and point sources of pollution. • Tourism benefits. • Effective targeting of resources.	• Targeted areas in the vicinity of Northern Ireland's 23 bathing waters.	• Government. • Water Industry. • General Public.	1

URBAN CATCHMENTS				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Draft a policy paper on Polluted Surface Water Outfalls, including responsibilities for dealing with misconnections.	• May lead to positive action which reduces the number of misconnections and thus pollution of watercourses caused by polluted surface water outfalls. • Will improve understanding of the issue and identify responsibilities. • Reduction in impact of diffuse and point sources of pollution. • Will help to introduce consistency in terms of how pollution associated with polluted surface water outfalls is tackled.	• Targeted Areas.	• Government. • Water Industry. • General Public.	1
Continue with Environmental Liaison Groups as part of Transport NI consultation process for each major road scheme.	• Reduction in pollution incidents - mostly suspended solids in nature. • Will ensure that environmental impacts continue to be a key consideration as part of the planning process for major road schemes.	• Targeted Areas.	• Government. • General Public.	1
To provide guidance and information to help communities protect and enhance local streams and rivers in their urban environment.	• Improved knowledge of environmental issues among local communities. • Improved engagement and partnership working. • Prevent further loss and degradation of urban river habitat. • Local communities take ownership of their local water environment.	• NI-wide.	• Government. • General Public.	3

17.13 QUARRIES AND MINES (INCLUDING OIL AND GAS EXPLORATION)

There are approximately 160 quarries and sand pits across Northern Ireland, supplying the construction industry with raw materials. Pollution of surface waters can occur as a result of run-off of rainfall from the land area around a quarry or mine. Pollution of surface waters can, however, also occur indirectly by pollutants being transported in groundwater.

Mineral extraction by its very nature poses risks to groundwater. Removal of the overlying land in the working area means that the vulnerability of the groundwater to pollution is increased as the natural protection is removed.

Unconventional gas exploration and extraction refers to the use of high volume hydraulic fracturing (fracking) of previously impermeable rock to permit the extraction of natural gas on a commercial scale from unconventional sources such as shale gas deposits, coal seams and tight sandstones. At present, there is no exploratory or commercial drilling underway in relation to this in Northern Ireland. There is the potential for this to change in the coming years and, therefore, it is important that the environmental impacts of the process are better understood.

The measures identified in relation to this pressure relating to encouraging best practice and environmental compliance through partnership working with industry will have water quality benefits through improved protection and prevention of pollution to the water environment.

Based on the analysis of the pressures impacting on waterbodies carried out as part of the significant water management issues exercise and the development of the draft RBMPs, it is not considered that quarries and mines are currently a major contributor to failing water bodies across Northern Ireland. The measures identified are, therefore, in the main targeted at specific areas and the benefits will, therefore, be realised accordingly.

Table 17.8 summarises the benefits of the measures linked to quarries and mines.

Table 17.8: Quarries and Mines Benefits

QUARRIES AND MINES, INCLUDING OIL AND GAS EXPLORATION				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Significant all-Ireland research project that will contribute to providing the evidence base for the regulation of fracking.	• Improved understanding of the environmental and health impacts of fracking. • Assist regulators in performing their statutory roles regarding fracking should any aspect of it be permitted.	• NI-wide.	• Government. • General Public.	SQ
Address the challenge of environmental degradation across North West Europe by developing a framework for the restoration of minerals sites (quarries), to provide benefits for biodiversity, habitats and local people. The 'RESTORE' project is being co-ordinated by the RSPB.	• Biodiversity benefits. • Habitat benefits. • Deliver green space for outdoor recreation and enjoyment of the natural world. • Benefit to local economies and public health.		• General Public.	SQ
Potential for disused/abandoned quarries to be used as flood attenuation to aid with the management of volume in river systems during flood events.	• Reduced flood risk. • Less pressure on the river environment.	• Targeted Areas.	• Water Industry.	1
Promoting and supporting greater environmental compliance and performance, product innovation, resource efficiency and adoption of best practice.	• Reduced pollution risk.	• NI-wide.	• Industry.	SQ

17.14 WASTE AND CONTAMINATED LAND

Pollution of groundwater and surface waters can occur when there is seepage from the residues or waste products contained in old waste disposal sites. Contamination of land and groundwater can also occur, through a wide range of circumstances, from diffuse or point sources.

Landfilled waste decays over a period of decades and, therefore, the pollution from leachate and gas continues to be emitted over a long period of time.

The benefits of the measures in respect of waste and contaminated land include reduced risk of pollution and the protection of groundwaters. The environmental and financial impacts of poorly controlled waste sites and illegally dumped waste can be hugely significant, as evidenced in the illegal waste dump at Campsie. An independent report published by the Department in December 2013 noted that 516,000 tonnes of illegally dumped waste was found at the Campsie site near the River Faughan. The estimated clean up costs of illegal waste could be as much as £250 million.

The Department is committed to introducing measures which improve NIEA's performance as the environmental regulator in this area and will protect the environment and water quality.

Table 17.9 summarises the benefits of the measures linked to waste and contaminated land.

Table 17.9: Waste and Contaminated Land Benefits

WASTE AND CONTAMINATED LAND				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Improved collection, coordination and analysis of data in and around waste and the waste system.	• Reduction in waste crime. • Reduction in pollution. • Improved waste management. • Should enable resources to be targeted more effectively.	• NI-wide.	• Government. • General Public. • Industry.	2
To advise on new waste management facilities and extensions for legacy landfills and remediation of contaminated land - advise planners and third parties on the risk management and remediation of contaminated land and groundwater sites.	• Protection of groundwater. • Reduction in pollution. • Effective management of contaminated land.	• NI-wide.	• Government. • General Public. • Industry.	1
Develop partnership process with Local Councils to manage significant waste contracts.	• Reduction in waste crime. • Effective engagement with local councils. • Reduction in pollution. • Efficient use of waste management resources.	• NI-wide.	• Government.	1
Update and develop a Northern Ireland Groundwater Protection Strategy to support landuse planning.	• Reduction in pollution. • Protection of groundwater. • Raises profile of the importance and role of groundwater.	• NI-wide.	• Government. • General Public.	1
Develop process for joint Waste/Water	• Reduction in waste crime.	• NI-wide	• Government	1

WASTE AND CONTAMINATED LAND				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
authorisations to include regulation DOE Regulatory Reform programme.	• Reduction in pollution. • Improved efficiency in use of NIEA resources. • Less burden on operators.		• Industry.	
Develop a compliance assessment process for Waste Authorisations.	• Reduction in waste crime. • Reduction in pollution.	• NI-wide.	• Government.	1

17.15 CHEMICALS

A vast range of chemicals are used every day, both at home and at work. These chemicals can enter the environment by many diverse routes, ranging from emissions from industry and sewage treatment works to run-off from roads and farms.

Some chemicals can threaten the long-term sustainability of drinking water sources and lead to increased costs of treatment. There are major challenges to achieving objectives for some designated chemicals under the Water Framework Directive There remains a risk of not meeting Environmental Quality Standards for some common persistent toxic substances that accumulate in the environment.

Various measures have been identified to improve monitoring and analytical methods in order to develop a better understanding of the extent of the presence of emerging substances and chemicals in our water environment. This will be important not only for complying with the relevant EU Directives but also for identifying where resources and measures may need to be targeted in future to minimise issues caused by particular chemicals.

Measures to control the impact of chemicals and the use of pesticides will bring multiple benefits to water quality, habitats and biodiversity. A key benefit to society of the proposed will be the protection of valuable drinking water sources.

Table 17.10 summarises the benefits of the measures linked to chemicals.

Table 17.10: Chemicals Benefits

CHEMICALS				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Coordinate activities to reduce Dangerous Substances through an Expert Group.	• Reduction in dangerous substances. • Potential health benefits.	• NI-wide.	• Government. • General Public. • Water Industry.	1
Pilot project looking at the regulation of priority and new substances of concern with more stringent standards for waste water treatment effluents.	• Reduction in dangerous substances. • Will assist in complying and meeting requirements of Directive 2013/39/EU.	• Targeted Areas.	• Government. • General Public. • Water Industry.	1
Investigate how existing and new technology and methods can apply to monitoring emerging chemicals of concern in the aquatic environment.	• Will help develop understanding of the extent of the presence of emerging pollutants. • Will assist in complying and meeting requirements of Directive 2013/39/EU.		• Government.	2
Investigate how passive sampling and associated analytical technology and methods can apply to monitoring emerging chemicals of concern in the marine environment.	• Potential increased understanding of the presence of emerging pollutants.		• Government.	2
Pilot study of freshwater biota monitoring and use of passive sampling techniques during RBMP2.	• Increased monitoring capabilities and understanding of different approaches.	• Targeted Areas.	• Government.	2

CHEMICALS				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
To develop the analytical methodology required to facilitate the analysis of new substances added to annex X WFD.	• Will assist in complying and meeting requirements of Directive 2013/39/EU.		• Government.	SQ
Examine the feasibility of metals monitoring by passive techniques to allow the determination of time averaged concentrations of metals in rivers at locations of concern.	• Increased monitoring capabilities and understanding of different approaches.	• Targeted Areas.	• Government.	2
Potential introduction of pharmaceutical (Watch List) monitoring of waste water treatment works effluents e.g. Contraceptive pill.	• Will assist in complying and meeting requirements of Directive 2013/39/EU. • Will provide data on levels of pharmaceuticals in water environment.	• Targeted Areas.	• Government. • General Public.	2
To develop methodology required to facilitate time averaged analysis and other analysis as it becomes available through UKTAG and as agreed by UKTAG working groups.	• Improved analysis capabilities.		• Government.	2
Encourage the adoption of Pesticide Minimisation Strategies, such as that adopted by Forest Service, across other sectors.	• Increased awareness of best practice when using pesticides. • Protect people, wildlife, plants etc from adverse effects of pesticides.	• Targeted Areas.	• Government. • General Public. • Agriculture .	1

CHEMICALS				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
	• Reduced possibility of pests becoming resistant though unnecessary use. • Minimise risks from pesticide residues in food. • Protect users and workers by minimising exposure to pesticides. • Reduce water pollution caused by pesticides.			
Implementation of the Sustainable Use of Pesticides.	• Compliance with Directive, which will have benefits for water quality.	• NI-wide.	• Government. • General Public. • Agriculture. • Water Industry.	SQ
Further development of DWPAs and establishment of safeguard zones to improve and maintain water quality with drinking water catchments.	• Protection of drinking water sources. • Health benefits.	• NI-wide.	• Government. • General Public. • Agriculture. • Water Industry. • Industry.	1
Use the Water Catchment Partnership approach to work proactively together to promote and raise awareness of best practice when using pesticides in the garden .	• Increased understanding of the risks of inappropriate pesticide use. • Potential reduction in pollution. • Potential health and environmental benefits.	• NI-wide.	• Agriculture.	2

CHEMICALS				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Submit a project proposal through INTERREG V SCaMP to improve raw water quality in three cross border drinking water catchments.	• Protection of drinking water sources. • Further facilitates engagement and coordination at a cross border level. • Potentially reduced costs for NIW.	• Targeted Areas.	• Government. • General public. • Water Industry.	2
Promote no-pesticide usage by local authorities when managing green areas.	• Potential reduction in pollution • Increased understanding of the risks of inappropriate pesticide use	• Targeted Areas.	• Government. • General Public.	2

17.16 ABSTRACTION AND FLOW REGULATION

The effect abstraction has on the environment depends on the amount and timing of the abstraction and the location and amount of water that may be returned after it has been used. Taking too much water from rivers and groundwater may result in lower flows and reduced water levels, which may not support a healthy ecology, affecting wildlife and impacting on other water users.

The key benefits of the proposed measures in respect of abstraction and flow regulation are the protection and promotion of sustainable use of Northern Ireland's water resources so as to reduce and minimise any impacts of abstraction on flow levels, and protect fisheries and habitats.

More than 10% of river water bodies in the North Western River Basin District and around 5% in the North Eastern and Neagh Bann River Basin Districts have failures in fish. Failures in fish can indicate a wide range of pressures such as from physical modifications and abstraction and flow regulation. It is predicted that the range of abstraction and flow measures could potentially, in combination with other measures in relation to fisheries and physical modifications, reduce these levels of failures across the second WFD cycle.

It is considered that there could be significant benefits from implementing measures which have a positive impact on fish habitat and passage. A report on the social and economic value of angling in Northern Ireland, published in July 2007, estimated that all forms of angling to be worth £40 million p.a. to the Northern Ireland economy. Measures which reduce failures in fish are likely to increase the overall value and benefit of the angling industry in Northern Ireland.

Table 17.11 summarises the benefits of the measures linked to abstraction and flow.

Table 17.11: Abstraction and Flow Benefits

ABSTRACTION AND FLOW REGULATION				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
DRD Water Policy to prepare a Long - Term Water Strategy for Northern Ireland.	• Implementation of measures and proposed actions set out in the Strategy could have significant long term water quality benefits.	• NI-wide.	• Government. • General Public. • Agriculture. • Water Industry. • Industry.	1
NIW to prepare a Water Resource and Supply Resilience Plan by 2017.	• Efficient and sustainable use of Northern Ireland's water resources. • Potential savings for NIW. • Mitigate against drought or water shortage issues. • Reduce the impact of climate change and user demand on water resources.	• NI-wide.	• Government. • General Public. • Agriculture. • Water Industry. • Industry.	1
Implement a programme of water resource assessments and multi-disciplinary studies to provide evidence to inform abstraction and impoundment licence reviews.	• Efficient and sustainable use of Northern Ireland's water resources. • Could lead to improvement in abstraction and impoundment licensing system.	• Targeted Areas.	• Government. • Agriculture. • Water Industry. • Industry.	2
Increase awareness of importance of water efficiency and saving.	• Improved understanding of the value of water as a resource. • Substantial financial savings in annual water bill for businesses. • Leaks detected and dealt with more quickly	• NI-wide.	• Government. • General Public. • Agriculture. • Water Industry.	SQ

ABSTRACTION AND FLOW REGULATION				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
	through regular monitoring. • Reduced water consumption through increased awareness. • Environmental benefits through water conservation.		• Industry.	
Use burst water mains records to identify 'hotspots' and use to prioritise mains replacement to help reduce wastage in water supply.	• Reduction in leakage. • Efficient and sustainable use of Northern Ireland's water resources. • Improved water infrastructure. • Reduced costs for NIW due to improved efficiency.	• Targeted Areas.	• General Public. • Agriculture. • Water Industry. • Industry.	2
Implement catchment level assessments to inform NIW AIL licence reviews and monitoring requirements.	• Efficient and sustainable use of Northern Ireland's water resources. • Reduce any negative impacts of current licenses on local catchment water quality. • Improved flows in rivers and lakes.	• NI-wide.	• Government. • Water Industry.	1
Consider whether groundwater licences can be issued as annual licences rather than the daily maximum volumes. This would reduce requirements for licence increase in some areas.	• Potential simplification of approach.	• NI-wide.	Government.	NA
As part of implementation of the Floods	• Reduction in flood risk.	• Targeted	• Government.	SQ

ABSTRACTION AND FLOW REGULATION				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Directive, develop and implement Natural water retention measures and sustainable flood management options including role of bogs and wetlands.	• Increased use of green infrastructure. • improved flows in rivers and levels in lakes. • Reduced soil erosion. • Habitat benefits. • Natural filtration of water.	Areas.	• General Public. • Agriculture. • Water Industry. • Industry.	
Provide details of private drinking water supplies >10 cubic meters to inform WMU and GW designation and monitoring of DWPAs.	• Protection of drinking water. • Protection of private water supplies. • Public health benefits. • Improved water quality.	• Targeted Areas.	• General Public.	1
NIEA teams to have a reciprocal arrangement for transferring information to DWI on risks which could affect private water supplies either through monitoring programme or pollution incidents.		• NI-wide.	• General Public.	1
Draft a guidance document for small scale hydro power scheme applicants to include advice on fish/lamprey passage.	• Reduction in negative impacts of such schemes on fish passage.	• NI-wide.	• General Public.	1
Co-ordination between DCAL and NIEA on the regulation of hydro power schemes, including pilot studies to examine the impact of hydro power schemes on fish	• Reduction in negative impacts of such schemes on fish passage. • Protection of fisheries.	• NI-wide.	• General Public.	1

ABSTRACTION AND FLOW REGULATION				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
stocks.				
Clarify roles and responsibilities around fisheries and Abstraction and Impoundment Licensing legislation and enforcement.	• Reduction in negative impacts of abstraction and impoundment licenses on fish passage. • Protection of fisheries.	• NI-wide.	• Government. • General Public.	1
Adopt a consistent UK methodology for assessing the passability of obstacles to fish migration and use the protocol at abstraction points to inform licence conditions and to inform the decision making process on weir design.	• Reduction in negative impacts of abstraction and impoundment licenses on fish passage. • Protection of fisheries.	• NI-wide.	• Government.	1
Integration of fuller ecological considerations into hydro power scheme licensing.	• Protection of habitat. • Protection of water environment. • Reduction in negative impact of such schemes on fish populations and river ecology.	• NI-wide.	• Government. • Industry.	NA
Research into recovery times for groundwater bodies to achieve good chemical status/travel times through the unsaturated zones.	• Better understanding of impact of chemicals on groundwater status.	• NI-wide.	• Government.	NA
Consider CIS guidance on Ecological Flows	• Protection of water environment.	• NI-wide.	• Government.	NA

ABSTRACTION AND FLOW REGULATION				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
during the next review of UKTAG Environmental Flow Standards.				
Develop a programme of Reservoir surveys to assess the impact of impoundments on the aquatic environment.	• Protection of water environment. • Better understanding of impact of impoundments.	• NI-wide.	• Government.	NA

17.17 PHYSICAL CONDITION OF THE WATER ENVIRONMENT

Some of the water bodies in Northern Ireland have been modified to provide benefits such as the provision of drinking water, land drainage, reducing flood risk to communities or improving transport networks. While some modifications undoubtedly have positive impacts and may aid compliance with other Directives and policies, they can also have a negative impact on the water environment.

Restoring water bodies to a more natural condition through the removal of physical structures and modifications which have altered their shape can have significant water quality benefits, particularly in relation to fish passage. Measures which protect and promote fish passage can have a positive impact both environmentally and economically. Research has often highlighted the value of fish and the fishing/angling industry in Northern Ireland. While it is difficult to estimate the exact impact of the proposed measures with regard to any increases in fish populations, it is considered that the benefits will be positive.

Previous studies have indicated that the benefit to cost ratio of certain projects to improve the physical condition of water bodies can be in the region of 6:1. River restoration measures can, therefore, have significant benefits. There can be benefits in terms of improved fish habitat in rivers in which measures have been taken to improve their physical condition. For example, the implementation of salmon rehabilitation schemes in drained river systems could result in an increase in salmon production and significant economic benefits and commercial opportunities.

More than 10% of river water bodies in the North Western River Basin District and around 5% in the North Eastern and Neagh Bann River Basin Districts have failures in fish. Failures in fish can indicate a wide range of pressures such as from physical modifications and abstraction and flow regulation. It is considered that the range of physical modifications measures will, in combination with other measures in relation to abstraction and flow and fisheries, reduce these levels of failures across the second WFD cycle.

Measures which improve the physical condition of the water environment will also improve ecology and enhance the value of water bodies for landowners, fishermen

and the general public. Improving the physical condition of the water environment will promote the sustainable management of the water environment, improve biodiversity, reduce flood risk and contribute to climate change adaptation and mitigation.

Table 17.12 summarises the benefits of the measures linked to the physical condition of the water environment.

Table 17.12: Physical Condition Benefits

PHYSICAL CONDITION OF THE WATER ENVIRONMENT				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Develop the methodology for including river continuity in Water Framework Directive classification.	• Improve the WFD classification process. • Improve evidence base to target actions. • Assist in controlling modifications to surface water bodies.	• NI-wide.	• Government.	1
Improve liaison with DRD Transport NI re potential road bridges inhibiting fish passage.	• Protection of fish passage.	• Targeted Areas.	• Government • General Public.	SQ
Inter-Agency River Restoration and Continuity Group to prioritise issues (e.g. potential barriers to fish movement) and co-ordinate river restoration and continuity work.	• Efficient and targeted use of resources • Reduction in impact of barriers and issues at prioritised sites • Restoration of some rivers and lakes • Repairing the damage to the physical condition of the water environment will improve ecology and enhance the value of the resource for others	• Targeted Areas.	• General Public • Government.	SQ
Continue to support local stakeholder restoration projects through the Environmental Challenge Fund and Fisheries Habitat works.	• Will encourage engagement at a local level. • Restoration of some rivers and lakes. • Will encourage local communities to take ownership of their local water environment.	• Targeted Areas.	• General Public.	2
Continue with Environmental Liaison	• Reduction in pollution incidents - mostly	• Targeted	• Government.	SQ

PHYSICAL CONDITION OF THE WATER ENVIRONMENT				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Groups as part of Transport NI consultation process for each major road scheme.	suspended solids in nature. • Will ensure that environmental impacts continue to be a key consideration as part of the planning process for major road schemes.	Areas.	• General Public.	
Develop guidance on management of in channel woody habitat debris through grants schemes.	• Increased understanding of management of woody habitat. • reduced impact of woody habitat debris on rivers and lakes.	• NI-wide.		1
Marine Environment Division to work with DRD Ports, DARD and NIEA to develop a Ports and Harbours Guidance document, outlining good environmental management within ports.	• Improved understanding of good environmental management within ports.	• Targeted Areas.	• Government. • Industry.	1
Ensure proper protection and compliance with gravel removal legislation.	• Protection of water bodies.	• Targeted Areas.	• Government. • Industry.	SQ

17.18 INVASIVE ALIEN SPECIES

Invasive alien species are not specifically mentioned in the Water Framework Directive. However, the Directive requires the Department to assess 'other significant anthropogenic impacts on the status of surface waters'.

The benefits of eradication of invasive alien species to the UK environment and the economy more widely could be very significant. For example, in Great Britain (GB) it is estimated that the removal of all invasive alien species could result in significant savings to the economy. The leisure and tourist industry is vulnerable to invasive alien species impacts from freshwater plants in particular. The potential savings to recreational boating in the UK has been estimated at £30.45 million, in the UK. There are significant savings to be realised through the early eradication of invasive alien species as well as significant habitat and biodiversity gains.

The measures set out in the draft programme of measures focus on managing, controlling and preventing the spread of invasive alien species in Northern Ireland. For example, implementing the actions set out in the Invasive Alien Species Strategy for Northern Ireland will improve the control and limit the spread of invasive alien species through raising awareness and involving key stakeholders in tackling issues caused by invasive alien species. The development and implementation of Invasive Alien Species Management Plans will also reduce the impacts of specific species on the water environment by targeting actions to control their introduction and spread.

While invasive alien species have the potential to significantly impact on water quality and habitats, based on the analysis of the pressures impacting on water bodies carried out as part of the significant water management issues exercise and the development of the draft RBMPs, it is not considered that invasive alien species are currently a major contributor to failing water bodies across Northern Ireland.

Table 17.13 summarises the benefits of the measures linked to invasive alien species.

Table 17.13: Invasive Alien Species Benefits

INVASIVE ALIEN SPECIES				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Undertake appropriate actions to implement legislation.	• Reduction of the adverse impact of invasive alien species to the Northern Ireland aquatic environment. • Environmental, economic, habitat and biodiversity benefits.	• NI-wide.	• Government. • General Public. • Agriculture. • Water Industry. • Industry.	2
Consider research, in conjunction with DARD, to improve understanding of the effects of alien species in the aquatic environment.	• Reduction of the adverse impact of invasive alien species to the Northern Ireland aquatic environment. • Potential water quality benefits. • Improved awareness of the impacts of invasive species on the ecosystems.		• Government.	3
Develop new individual Invasive Alien Species Management Plans as required.	• Reduction of the adverse impact of specific invasive alien species to the Northern Ireland aquatic environment. • Identification of and commitment to targeted actions.	• Targeted Areas.	• Government. • General Public.	2
Continue to implement the actions set out in the Invasive Alien Species Strategy for Northern Ireland.	• Improved control of invasive alien species. • Involvement of key stakeholders in tackling issues. • Meeting legislative commitments. • Developing knowledge and awareness. • Prevent introduction of invasive alien species.	• NI-wide.	• Government • General Public • Industry.	2

INVASIVE ALIEN SPECIES				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
	• Control spread of invasive alien species. • Raise awareness. • Ensure a co-ordinated, effective approach on invasive alien species.			
Develop process for assessing significant impact of species as listed in Ecoregion 17 lists for WFD classification.	• Improved control of invasive alien species.	• NI-wide.	• Government.	2
Continue partnership approach between professionals and volunteers for invasive alien species monitoring to improve understanding of current distributions and spread.	• Increased awareness of the spread of invasive alien species.	• Targeted Areas.	• Government. • General Public.	2
Improve education re fish introductions and need for Section 14 authorisation for stocking and moving fish.	• Increased awareness and understanding.	• NI-wide.	• Government. • General Public.	3

17.19 FISHERIES

The angling industry is an important industry in Northern Ireland. A Pricewaterhouse Coopers report on the social and economic value of angling in Northern Ireland, published in July 2007, estimated that all forms of angling in Northern Ireland support some 780 full time equivalent jobs, and are worth some £40 million p.a. to the Northern Ireland economy, mostly from game angling. Measures which reduce failures in fish are likely to increase the value and benefit of the angling industry in Northern Ireland. Good water quality and satisfactory fish stocks are key factors in maintaining the growth and success of the industry. The measures identified in terms of the fisheries sector and other measures in the programme of measures are, therefore, important from a water quality and economic perspective.

As well as the economic and tourism benefits, there are also other benefits for managing water quality provided by anglers' activities. For example, anglers regularly highlight areas of pollution and actively engage with schemes to develop their local aquatic environment.

There are benefits to be gained from monitoring fish stocks and taking targeted action to protect and restore those stocks to optimum levels. The development and implementation of formal Fisheries Management Plans for Lough Neagh and Lough Erne will have positive benefits for fisheries, biodiversity and habitats in these areas.

More than 10% of river water bodies in the North Western River Basin District and around 5% in the North Eastern and Neagh Bann River Basin Districts have failures in fish. Failures in fish can indicate a wide range of other pressures such as from physical modifications and abstraction and flow regulation. It is predicted that the range of Fisheries measures identified in the RBMPs will, in combination with other measures in relation to abstraction and flow and physical modifications, reduce these levels of failures across the second WFD cycle.

Table 17.14 summarises the benefits of the measures linked to fisheries.

Table 17.14: Fisheries Benefits

FISHERIES				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Further integration of river assessments and planned fishery habitat improvements, including targeted river restoration projects.	• Protection and restoration of fish populations.	• Targeted Areas.	• Government.	SQ
Develop and implement Fisheries Management Plans for Lough Neagh and Lough Erne.	• Protection and restoration of fish populations. • Other habitat and biodiversity benefits.	• Targeted Areas.	• Government. • General Public.	2
NIEA to work with DCAL Inland Fisheries Group in order to quantify, and seek through the courts, the costs in relation to fish kills.	• Restoration of fish populations.	• NI-wide.	• Government. • General Public.	SQ
Develop and monitor a demonstration project based on adapted channel maintenance, and through a partnership approach.	• Improved management of habitats.	• Targeted Area.	• Government. • General Public.	2
Instigate a rolling programme of surveys for lamprey, European smelt, Sea trout and Brown trout.	• Improved fish stock and species monitoring.	• Targeted Areas.	• Government.	1

FISHERIES				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Develop a coordinated rolling monitoring programme for large and small lakes prioritised according to protected area designations and local issues.	• Will improve understanding of issues affecting protected areas.	• Targeted Areas.	• Government.	2
Inclusion of fishery bodies within SCaMP (Sustainable Catchment Management Programme) stakeholder group.	• Increased protection of fisheries.	• Targeted areas.	• Government. • General Public.	SQ
Continue to carry out large scale fish stock monitoring when the DOLMANT survey has been completed to inform Fisheries Management Plans.	• Improved understanding of issues around stocking levels of fish.	• Targeted Areas.	• Government.	2
Streamlining of aquaculture management. Strategic management of the resource.	• Benefits for aquaculture with related water quality benefits. • Better integration and use of resources.	• NI-wide.	• Government.	2
Consider regulatory options to protect stock of the European eel.	• Increased protection of fisheries.	• NI-wide.	• Government.	2
Consider regulatory options for the conservation of Juvenile Coarse Fish.	• Increased protection of fisheries.	• Targeted Areas.	• Government. • General Public.	2

FISHERIES				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Streamlining of aquaculture management. Strategic management of the resource.	• Increased protection of fisheries.	• Targeted Areas.	• Government.	2
Consider regulatory options for the protection of prescribed species.	• Increased protection of fisheries.	• Targeted Areas.	• Government.	2
Increase awareness of fish passability issues for bridges and culverts to facilitate improved design and remediation.	• Increased protection of fisheries.	• Targeted Areas.	• Government.	2
Introduction of a fishery management tool through the Fisheries Habitat Improvement Strategy.	• Increased protection of fisheries.	• Targeted Areas.	• Government.	2

17.20 PARTNERSHIP WORKING

The best way to protect and improve the water environment is by everyone being actively involved, with government departments working in partnership with local stakeholders in catchments to tackle local water quality issues. The benefits that can be realised through genuine sustained partnership working can be significant, particularly in the current economic climate where government funding and resources are limited and reducing in many areas.

An important element of partnership working will be identifying areas and measures that require a joined up approach and can deliver synergies and a range of multiple benefits. Greater levels of cooperation and integration between Government agencies and stakeholders will yield more sustainable results and avoid duplication of effort. Seeking new sources of funding will also assist in building capacity and presenting opportunities to take new approaches. The individual benefits gained at project level will accumulate and will assist in meeting objectives for other EU Directives as well as the WFD.

Some of the measures identified in terms of partnership working relate to increasing awareness of the importance of the water environment and the environment more widely. Achieving increased awareness among the general public and businesses can have significant benefits in the long term though changing perceptions and increasing the perceived value of the environment to society and businesses. This would have significant benefits for water quality as the number of pollution incidents caused though carelessness or ignorance would be reduced as businesses and local stakeholders take greater interest and ownership of local water bodies. Measures which encourage and develop partnership working can help to make good water quality more achievable and sustainable in the short, medium and longer term.

In particular, the catchment scale pilot projects could have significant benefits within the targeted catchments and across Northern Ireland more widely if the lessons identified through the projects are applied elsewhere. The completion of further Prosperity Agreements will encourage better practices among business and industry and strengthen the incentives for businesses to comply with relevant legislation. Table 17.15 summarises the benefits of the measures linked to partnership working**.**

Table 17.15: Partnership Working Benefits

PARTNERSHIP WORKING				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Support established river trusts through specific projects.	• Protection of rivers. • Engagement with local stakeholders.	• Targeted Areas.	• Government. • General Public.	1
Work with Local Councils and wider stakeholders to increase awareness and support actions to address litter in the water environment.	• Reduction impacts from waste disposal. • Reduced number of councils may lead to standardisation of approach across larger regions and sharing of best practice.	• NI-wide.	• Government. • General Public. • Water Industry. • Industry.	1
Develop and implement a programme catchment scale pilot projects to protect and improve water quality and quantity.	• Restoration of rivers and lakes.	• Targeted Areas.	• Government. • General Public. • Water Industry. • Industry. • Agriculture.	1
Consider options for civil sanctions, such as on the spot fines, as part of the regulatory reform programme for environmental regulation.	• Reduction in pollution. • Increased range of financial and legal deterrents for causing pollution.		• Government.	NA
Develop management measures for small lakes based on the outcomes from the DOLMANT project.	• Protection of lakes and control of diffuse and point sources of pollution.	• Targeted Areas.	• General Public.	1
Develop and agree three prosperity	• Reduction in pollution.	• Targeted Areas.	• Industry.	1

PARTNERSHIP WORKING				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
agreements with local industry/business.			• Government.	
Consider increased utilisation of flood plain storage as part of FRMPs.	• Reduction in pollution and flood risk.	• Targeted Areas.	• Water Industry. • General Public.	SQ
Continue to work together to improve understanding of the wider public of the value and wider benefits of the water environment.	• Improved awareness will enable the public to make better decisions. • Multiple environment and water environment benefits.	• NI-wide.	• Water Industry. • General Public. • Agriculture. • Industry. • Government.	1
Review success of pilots, with local councils, to address fly tipping, including hazardous and fuel laundering waste.	• Reduction in discharges/impacts from waste disposal.	• Targeted Areas.	• Government. • General public. • Industry.	1
Increase awareness of the role of groundwater in the management of the aquatic environment as part of catchment wide projects.	• Education and Awareness.	• Targeted Areas.	• Government. • General public. • Industry.	2
Development of an inter-departmental group to look at synergy between Directives, so that measures proposed have a synergistic effect and at least do not disbenefit any.	• Restoration of rivers and lakes.	• NI-wide.	• Government. • General public. • Agriculture. • Industry.	SQ

PARTNERSHIP WORKING				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
Align, as far as possible, the objectives and standards for the Water Framework Directive and Natura 2000 Protected Areas.	• Protection of rivers and lakes. • Protection of conservation sites. • Benefits for habitats and biodiversity.	• Targeted Areas.		1
Consider the findings of Interreg IVA Freshwater Pearl Mussel project and implement appropriate measures in designated FWPM sites.	• Protection of freshwater pearl mussel sites in Northern Ireland.	• Targeted Areas.		2
Submit a project proposal through INTERREG V SCaMP to improve raw water quality in three cross border drinking water catchments.	• Protection of drinking water sources. • Further facilitates engagement and coordination at a cross border level. • Reduced costs for NI Water.	• Targeted Areas.	• Government. • General public. • Water Industry.	2
Consider alternative funding opportunities, for example, the INTERREG V programme, to deliver sustainable solutions that take account of economic and social needs as well as environmental objectives of various European Directives.	Various potential benefits if funding can be obtained, including positive benefits for:- • Water quality. • Habitats. • Biodiversity.	• NI-wide.	• Government. • General public. • Agriculture. • Industry. • Water Industry.	2
Complete Catchment Management Plans for 24 Drinking Water Catchments.	• Protection of drinking water sources. • Water quality.	• Ni-wide.	• Government. • General Public.	2

PARTNERSHIP WORKING				
Action	**Benefits of Measure**	**Scale of Benefits**	**Key Sectors benefitting from Measure**	**Option Number**
	• Habitats. • Biodiversity.		• Water Industry.	
Details of pollution incidents to be made available on NIEA website.	• Tranparency around occurrence of pollution incidents.	• NI-wide.	• General Public.	

18. Consideration of Options and Cost-effectiveness

18.1 Options analysis

As explained in Section 3.3, options have been developed to enable measures to be appraised by separating the measures into groups based primarily on funding and affordability. This information was garnered from discussions and collecting data from those bodies responsible for implementing the measures.

The options being appraised have been outlined below:-

- Status Quo: measures identified which have already been completed, are covered by steady state operations (business as usual) or are currently ongoing.
- Option 1: Measures not yet introduced but where full funding has been secured (on top of the measures from the status quo).
- Option 2: Measures likely to be introduced but with full funding not yet secured (on top of the measures from Option 1 and the Status Quo).
- Option 3 (the aspirational option): Measures not funded and unlikely to be introduced during this cycle (all measures included).

Note that the cost analysis of the options is incremental. In other words, the status quo option is assumed to be the baseline, with zero additional costs, and only the costs and benefits over and above this are included for the alternative options. Furthermore costs are assumed to be layered whereby Option 2 includes the costs of Option 1, and Option 3 includes all the costs of Option 2. This allows Option 3 to reflect the cost of all measures being introduced, regardless of viability and available funding.

See Appendix A for an indication of which of the measures each option includes.

Costs were estimated over the six years of the cycle and discounted using a standard discount rate (3.5%), as set out in The Green Book[9]. The net present cost to the public sector and private sector was then calculated[10].

Table 18.1 below outlines the results of the net present calculation.

Table 18.1: NPC Results[11]

Option	Public Sector Cost	Private sector Cost	Total Cost
Status Quo	£0	£0	£0
Option 1	£11.0 m	£2.0 m	£13.0 m
Option 2	£104.1 m	£1.0 m	£105.1 m
Option 3	£105.4 m	£1.0 m	£106.4 m

Naturally the costs increase as the number of measures increase, as can be seen in Table 18.1. The cost of the status quo option is zero, bearing in mind work considered business as usual is assumed to have no additional costs. However, by only implementing the measures under the status quo, the objectives in relation to water status are unlikely to be achieved.

In relation to the other “do something” options, the level of expenditure for Option 1 is relatively small (£11.0 million). However, as funding has been secured it is clear that these measures are viable and affordable.

Option 2 includes all the measures under Option 1 and additional measures for which funding has not yet been secured but where those responsible for implementation are reasonably confident that funding could become available during the cycle. As the table shows, the public sector cost of this option is substantial (£104.1 million); however, it is likely that implementing these measures will help achievement of the water status objectives. Furthermore, whilst funding has not yet

[9] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

[10] http://www.dfpni.gov.uk/index/finance/eag/eag-step-by-step/eag-step-8/eag_net_present_values.htm

[11] Note some numbers may not add up due to rounding.

been secured, these measures are considered to be viable and affordable as indicated by those with ownership of them. In addition, as outlined in Section 19, a large portion of these costs consist of European funding and PC15 (NIW's agreed expenditure plan which is likely to be implemented regardless of RBMP commitments); therefore, the impact on departmental budgets is likely to be much lower.

The cost of Option 3 reflects what it would cost to implement all of the measures, including those measures which are not considered viable/affordable. Compared to Option 2, the additional funds required are relatively small, however, affordability was not necessarily the reason that these measures were not deemed as likely to proceed.

If affordability was not a concern then the preferred option would be Option 3. However, on the basis of affordability and viability, as indicated by those responsible for the measures, the preferred option is Option 2. This should enable the intended objectives to be achieved whilst also reflecting the current economic and budgetary pressures faced by departments, arms-length bodies and NDPBs.

18.2 Cost-Effectiveness

The WFD requires Member States to "make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures" [Annex II (b)]. Where there are a number of potential measures that could be implemented to achieve a WFD objective, the most cost-effective combination of measures is that which delivers the objective for the least overall cost.

The objective in this case is to achieve good status where possible (accounting for disproportionate cost). In Northern Ireland, work will be undertaken to identify specific measures targeted at individual water bodies to address 'the gap' between current status and the objective.

Given affordability constraints, these measures must form part of cost-effectiveness analysis to close the gap. This work is likely to form a large portion of the additional measures identified for the third cycle (2021-2027).

The regional level benefits outlined in Section 17 provided an indication of possible impact should the targets in the RBMPs be achieved. The range given was from £197.6 million to £283.7 million over the six years of the cycle, or annual benefits ranging from £63.2 million to £90.8 million. It is important to note that these benefits are likely to underestimate the actual impact as not all of the possible benefits have been quantified.

These benefits compare favourably to the cost of the additional measures required to achieve the targets (total cost of £105.1 million). However, whilst these costs only cover the additional measures, the benefits of achieving the targets are likely to include the impacts of the basic measures and, therefore, it is difficult to draw conclusions by comparing the two. Nevertheless, it does at least provide an indication that the costs of improving the water status to the desired level will likely be offset by the benefits to some degree and, therefore, at the regional level it is arguably cost effective to achieve the desired status as set out in the RBMPs.

19. Affordability and Funding

Whilst affordability has been highlighted as a key factor for selecting measures, the analysis has tended to focus on the discounted economic costs and benefits over the length of the cycle which has enabled the net present cost of the measures to be calculated accounting for the time value of money[12].

Although this allows for a comparison of options over time, it is unlikely to fully reflect the financial resources required. Therefore, to inform the Executive about possible resource implications, the undiscounted cost of measures under Option 2 has been presented in this section along with an indication of the impact on each department and if European funding is likely to ease the financial burden. Furthermore, measures which form part of PC15 have also been accounted for, as this expenditure is likely to be incurred regardless of the POMs.

The Table below outlines the results of the financial/funding analysis; the subsequent figures illustrate the departmental funding split.

Table 19.1: Financial Impact on Departments[13]

Dept/ Agency	Total Cost	EU Funding	PC15	Remaining Cost	Funding Secured	Funding Deficit
DARD	£29.8 m	£15.3 m	£0	£14.5 m	£0.02 m	£14.5 m
DCAL	£0.8 m	£0	£0	£0.8 m	£0.1 m	£0.6 m
DOE	£8.9 m	£0.7 m	£0.1 m	£8.1 m	£4.5 m	£3.6 m
DRD	£71.5 m	£3.6 m	£62.0 m	£5.9 m	£3.7 m	£2.2 m
LA	£0.3 m	£0	£0	£0.3 m	£0.3 m	£0.0 m
TOTAL	£111.3 m	£19.6 m	£62.2 m	£29.6 m	£8.7 m	£20.9 m

[12] http://www.dfpni.gov.uk/index/finance/eag/eag_resources/eag-basics-of-discounting.htm
[13] Figures may not add due to rounding

Figure 19.1: Financial Impact Split – Total Cost

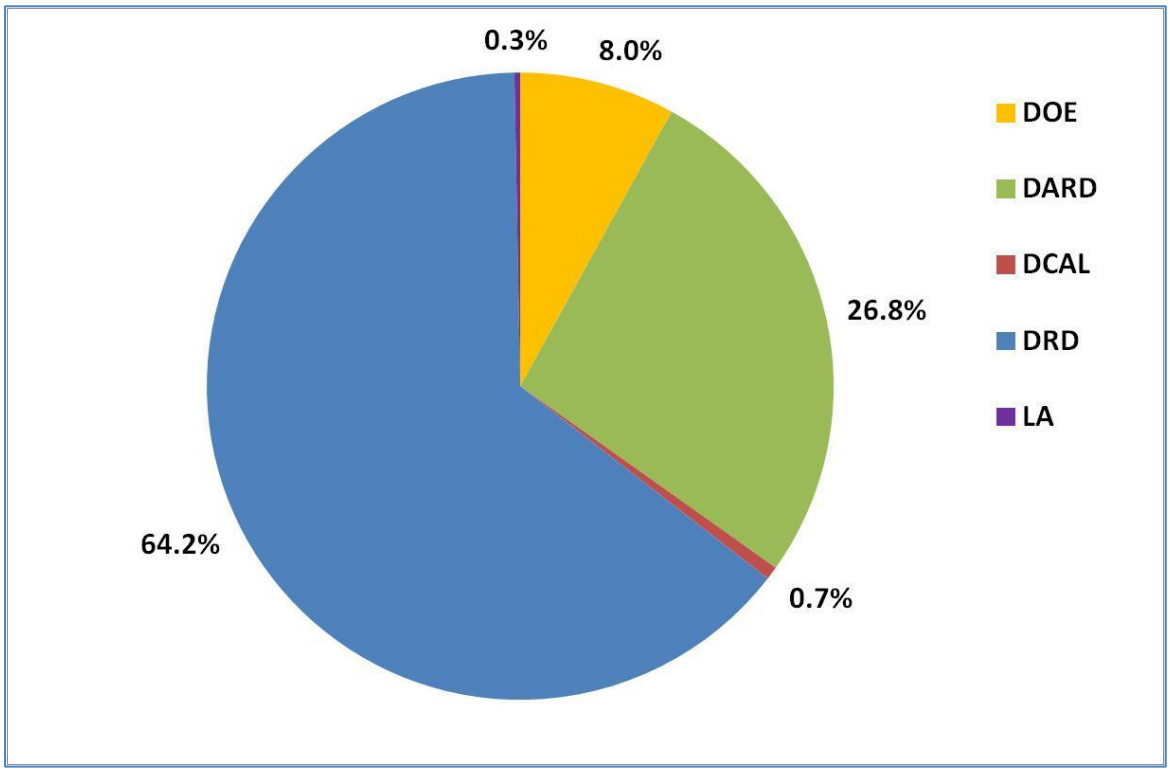
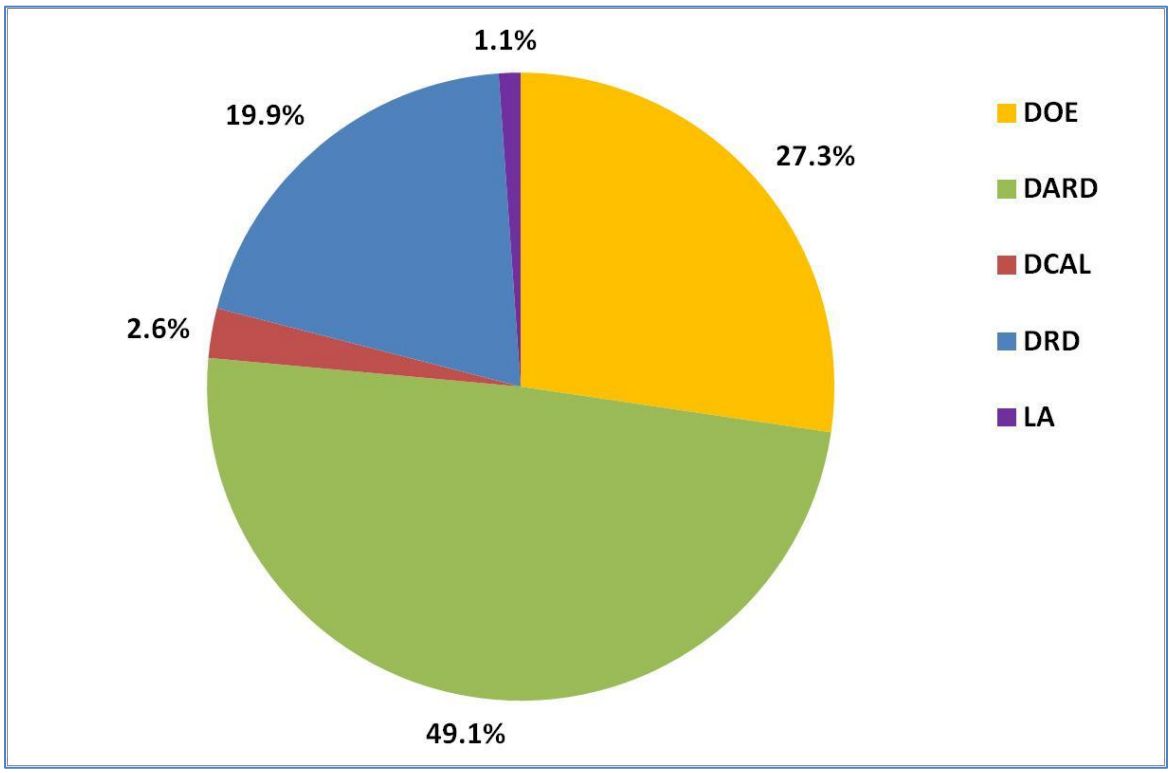


Figure 19.2: Financial Impact Split – Accounting for Euro Funding and PC15



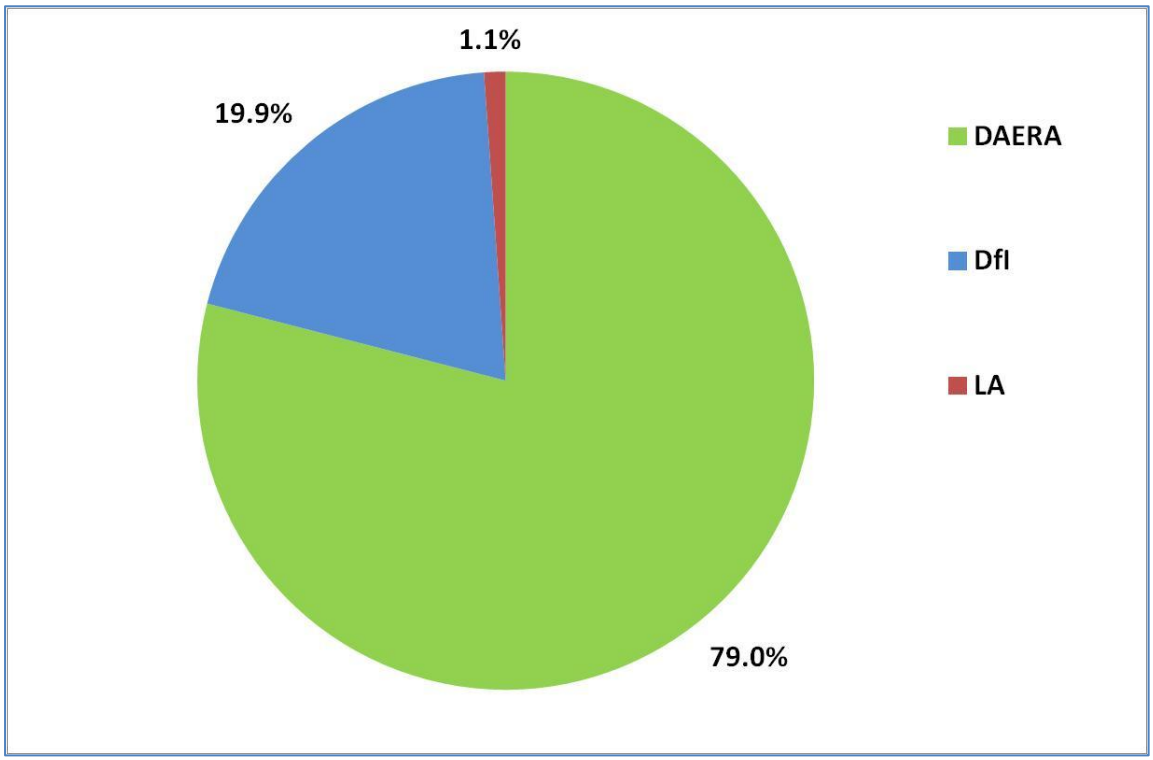
As can be seen in Table 19.1, the public sector cost of the measures which fall under Option 2 is estimated to be £111 million. Figure 19.1 shows that the majority of this cost (64.2%) will fall to DRD (£71.5 million). However, most of this cost is likely to be funded by PC15 or European funding, leaving a total cost of £29.6 million to be funded by the four Departments and the Loughs Agency.

After European funding and PC15 is accounted for, the majority of expenditure is likely to be incurred by DARD (£14.5 million which is 49.1%). Note that most of this expenditure (£10.2 million) falls under the Rural Development Programme (RDP).

Table 19.1 also shows that almost 30% (£8.7 million) of the required funding (£30 million) for the programme of measures has already been secured; thus leaving a funding deficit of £21 million over six years. Removing the RDP funding reduces this further to around £10 million required over six years.

One issue that may need further consideration is the impact on the Department of Agriculture, Environment and Rural Affairs (DAERA), which is due to be created. In 2016, a large portion of DARD, DOE and DCAL functions will transfer into the new department and, therefore, financial planning will need to consider the resource implications of the measures. Figure 19.3 below shows the Departmental split of the funding deficit (£21 million) based on the creation of the new departments in 2016.

Figure 19.3: Funding Deficit Split under New Departments



As shown in Figure 19.3, the majority of the funding deficit will be the responsibility of DAERA – in monetary terms this is £23.4 million. Again, it is important to note that just over £10 million of this fall under the RDP. Most of the remainder of the funding (£5.9 million) falls under the remit of the new Department for Infrastructure and is generally NIW expenditure.

Appendix A – Assumptions

The tables below outline the general assumptions used in the economic analysis to estimate the costs of the measures and possible benefits of achieving the targets as set out in the RBMPs.

Discount rate for Net Present Values

Year	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Discount Rate (3.5%)	1	0.9661836	0.9335107	0.9019427	0.8714422	0.8419732

Exchange Rate for Interreg Funding and other values given in Euros

ER as of 25/06/15	
£1	€1.40

Staff Costs – 2015/16 prices including overheads, pension and national insurance.

Grade	Annual Cost
Grade 5	£ 111,523
Grade 6	£ 88,621
Grade 7	£ 78,491
Deputy Principal	£ 57,490
Staff Officer	£ 46,555
Executive Officer 1	£ 39,627
Executive Officer 2	£ 34,133
Admin Officer	£ 29,042
Admin Assistant	£ 25,117
PPTO	£ 72,310
SPTO	£ 55,423
HPTO	£ 44,343
Grade 7 (Accountant)	£ 72,310
DP (Accountant)	£ 57,544
SO (Accountant)	£ 50,979
Sp Scientific Officer	£ 91,665
Principal Scientific Officer	£ 74,564
Senior Scientific Officer	£ 58,617
Higher Scientific Officer	£ 47,051
Scientific Officer	£ 39,187
Casual Scientific Officer	£ 34,114

NWEBS WTP values

Rivers (£/km)

Year	Bad to Poor			Poor to Moderate			Moderate to Good		
	Low	Med	High	Low	Med	High	Low	Med	High
2012	14300	17400	20500	16400	20000	23600	19100	23200	27400
2015	14946	18186	21426	17141	20903	24666	19963	24248	28638

Lakes, Coastal and Transitional (£/km^2)

Year	Bad to Poor			Poor to Moderate			Moderate to Good		
	Low	Med	High	Low	Med	High	Low	Med	High
2012	5200	6400	7500	6000	7400	8700	7000	8500	10100
2015	5435	6689	7839	6271	7734	9093	7316	8884	10556

Cost Assumptions for POMs

#	Measure	Option	Timescale	Assumptions
1	Measures to address the impact of pollution arising from farmyards, including farmyard audits and farmyard management practice with particular focus of farmyard drainage systems.	Opt 1	2015-2021	Field Staff Time 3,689 hours at £30.76 per hour. ScO Time 2,064 hours. HSO time 3,827 hours. SSO time 30.5 hours. Compliance cost of €0.5 million per annum (p.a.) (depends on number of breaches detected and severity).
2	Develop modelling tools to help understand the natural dynamics and science of the catchments, including groundwater. This may include further development of the SCIMAP tool which examines diffuse pressures, determines flow pathways and flood risk areas within catchments so that measures can be targeted to manage problem areas.	Opt 3	2015-2021	HSO to update/run models 0.5 FTE for 5 years. GIS Analyst (1 year) approx £60,000 p.a.
3	Measures to address nutrients including Nitrates Action Programme (NAP); provision of training in Nutrient Management Planning; provision of online farm nutrient calculators and the facilitation of soil sampling and analysis.	Opt 2	2015-2021	£2 million (2015-2018, AFBI research - 4 years), £210,000 ongoing (CAFRE training), £1,000 ongoing (CAFRE research), NAP (50,000 one-off and £0.21 million p.a. from 2017). Private Sector Compliance Cost - £0.14 million p.a. from 2017 (NAP).
4	The Environmental Farming Scheme (EFS) will include measures for riverbank fencing, riparian buffers and pasture pumps. These measures will help to address sediment input to rivers caused by livestock poaching and bank erosion by livestock.	Opt 2	2016-2020	EFS is £90 million in total. An estimated £15 million-£30 million spent on water 2016-2020. Mid-point assumed (£22.5 million).
5	Consider measures within Woodland and Environmental Farming schemes as part of Rural Development Programme such as riparian woodland.	Opt 2	2016-2020	Estimated to be £3 million.
6	Use the Water Catchment Partnership approach	Opt 2	2015-2021	1 x HSO 15 days p.a. and £210 p.a. on shows.

#	Measure	Option	Timescale	Assumptions
	to work proactively together to promote and raise awareness of best practice when using pesticides on the farm.			
7	Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of agriculture on fresh water pearl mussels.	Opt 1	2016-2021	For 30 farms inspections: 2 x HSO x 4 hrs per inspection. Annually from 16-17.
8	Target areas identified under Nitrates Directive reporting with increasing nutrients for investigation and action.			Costs not known at this time.
9	Developing models and catchment based approach to protect these areas. INTERREG VA project to develop prediction and discounting at bathing waters.	Opt 1	2016-2019	1 x SSO 55 days p.a. for 3 years; 1 x PSO x 20 days p.a. for 3 years. 1 x DP x 20 days p.a. for 3 years. €1 million assigned for this project from Interreg VA. The project will be subject to open call in November 2015. €1 million has been split over 3 years. Project Likely to start mid 2016.
10	Review consents to discharge on a pilot catchment basis using the SIMCAT model.	Opt 3	2015-2021	4 x SSO and 8 x HSOs. SSO 5 days p.a., HSO 20 days p.a. initially (year 1). If in place and operational 30% FTE as part of the application determination process for all consents (i.e. 30% FTE from 2016-2021).
11	Introduce flow and priority pollutant monitoring as part of the compliance regulation regime.	Opt 1	2015-2021	4 x HSOs and 4 x ScOs: 30% FTE.
12	Further development and implementation of innovative and sustainable measures such as the use of willows to treat effluent from small waste water treatment works and then harvesting for fuel.	Opt 1	2015-2021	4 x SSO and 4 x HSO. 5% FTE ongoing. Dependant on capital investment in technology by NIW, although the cost of this is unknown at this time.
13	Controlling sewage gross solids by using separation devices such as screens in unsatisfactory storm overflows.	Opt 1	2015-2021	4 x SSO and 4 x HSO and 1 x WQI. 5% FTE ongoing. Dependant on additional NIW investment, although the cost of this is unknown at this time.

#	Measure	Option	Timescale	Assumptions
14	Inclusion of event monitoring on networks in the vicinity of bathing and shellfish waters	Opt 1	2015-2019	1 x Level 4 (SSO) and 1 x level 5 (HSO) 0.5 d/w for 4 years and £2 million 16-17 to 18-19. The project is profiled to spend approximately £2 million from 16-17 to 18-19 but the delivery programme and costs cannot be confirmed until the technical solution is confirmed.
15	Improve knowledge about the operation of storm overflows through more monitoring.	Opt 1	2015-2021	4 x SSO 2% FTE ongoing. Also dependant on NIW expenditure yet to be agreed and cost unknown.
16	Work with the water industry to develop and pilot recovering phosphorus from waste water treatment works and to pilot new technology to remove phosphorus to meet tighter discharge limits.	SQ	2015-2021	NI Water is not participating in the on-going P Trials. However, as a member of UK Water Industry Research (UKWIR) we will have access to the report detailing the findings of the trials. Hence there are no costs apportioned for staff time to this measure at this stage.
17	Increase awareness of need to install and maintain private sewerage systems correctly.	Opt 1	2015-2021	SSO 5 days p.a. - ongoing.
18	In land drained for agricultural purposes, research the impacts on streams of effluent from septic tank percolation areas.	Opt 3	2015-2018	SSO x 20 days, PHD Student @25,000 for 3 years.
19	Introduce Environmental Permitting Regulations which will simplify permitting processes and allow for regulation under registrations and general environmental rules.	Opt 2	2015-2021	£1.35 million admin cost for regs. At least £140,000 saving p.a. for public sector from 2016-17. £320,000 saving for private sector from 2016-17
20	Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of sewage and industry on fresh water pearl mussels.	Opt 1	2015-2021	3 x SSO, 4 x HSO, 1 x WQI. SSO 0.2 days/mth, HSO 0.5 days/mth, WQI 1 day/mth. Continuous ongoing. Dependant on number of sites and the level of risk presented by the operations.
21	Work with other UK agencies and the water industry to scope and develop cost effective measures for reducing Phosphorus loads in WWTWs, septic tanks, human food, dishwasher detergents and use in water supply dosing.			Costs not known at this time.
22	Developing models and catchment based	Opt 1		Already costed as part of measure #8.

#	Measure	Option	Timescale	Assumptions
	approach to protect these areas. INTERREG VA project to develop prediction and discounting at bathing waters.			
23	Consider the inclusion of new woodlands, wet woodlands and floodplain forests as part of catchment wide pilot projects to protect and improve water quality and quantity.	Opt 2	2015-2016	1 x FOI - 50 days for one year.
24	Forest Service to provide woodland management advice and promote wider expansion of afforestation taking account of forestry best practice and sustainable forest management standards.	Opt 2	2015-2020	Running 2014-2020 (2015–2020 years for purposes of analysis as any costs incurred before 2014 are sunk costs). 1 x FO1 (20 days one-off then 10 days p.a.), 1 x FO2 (10 one-off and 5 days p.a.), 3 x FO3 (30 one-off and 60 days p.a.)
25	Implement measures in the Forestry Commission Practice Guide 'Managing Forests in Acid Sensitive Water Catchments'.	Opt 2	2015-2016	One-off cost by 2017 (assumed expenditure incurred in first year for prudence purposes). Forest Officer 1-15 hrs Forest Officer 2-30 hrs Forest Officer 3-90 hrs.
26	Implement measures developed through the INTERREG IVA funded project (Practical Implementation of Freshwater Pearl Mussel Measures) to minimise the impact of forests on fresh water pearl mussels.	Opt 2	2015-2016	One-off cost by 2017 (assumed expenditure incurred in first year for prudence purposes). Forest Officer 1-5 hrs Forest Officer 2-10 hrs Forest Officer 3-20 hrs.
27	Develop and enhance modelling tools to help understand the natural dynamics and science of the catchments, such as further development of the SCIMAP tool.	Opt 3		Already costed as part of measure #2.
28	Develop a pilot project in a catchment with sediment problems to consider alternative sustainable methods to dealing with issues.	Opt 1	2015-2017	Rivers Agency - 1 x FTE HSO 1.5hrs/wk for 30 wks; Water Management Unit - 0.3 FTE HSO. Two year study so costs spread over 2 years.
29	The Environmental Farming Scheme (EFS) will include measures for riverbank fencing, riparian buffers and pasture pumps. These measures will help to address sediment input to rivers caused	Opt 2		Already costed as part of measure #4.

#	Measure	Option	Timescale	Assumptions
	by livestock poaching and bank erosion by livestock.			
30	Assess the need and incorporate sediment management plans as part of NIW Abstraction Licences.	Opt 1	2015-2021	1 x PSO, 4 x Reg SSO, 4 x Reg HSO. PSO 5 days p.a., SSO 10 days p.a., HSO 20 days p.a.. Ongoing, continuous.
31	Develop expertise and knowledge to carry out catchment fluvial audits.	Opt 2	2015-2021	10 HSOs x 10 days p.a. Also £1,000 per course (every 3 years).
32	To develop and consult on appropriate sediment standards for UK.	Opt 2	2016-2019	3 years 2016-19: SSO 10 days p.a; HSO 20 days p.a. Also funding of £5,000 p.a.
33	Consider further research into the impacts of sediment in agricultural catchments, in conjunction with nutrients and biological quality.	Opt 3	2015-2021	Will involve new research, likely to be 1 or 2 PhDs, each for 3 years. NIEA to provide data and support in kind. £25,000 per PHD. SSO 10 days, HSO 20 p.a.
34	Trial the use of new instrumentation and technology to better understand sediment issues and impacts.	Opt 2	2015-2018	0.5 HSO for 3 years. £30,000 per annum instrumentation.
35	Consider the findings of Interreg IVA Freshwater Pearl Mussel project and implement appropriate measures in designated FWPM sites with a focus on sediment issues, as part of a pilot project.	Opt 1	2015-2021	4 x SSO (5% FTE). 8 X HSO (10% FTE). Ongoing.
36	Produce guidance on best practice to minimise sediment disturbance during river works.	SQ	2015-2016	Nearly complete - no additional cost.
37	Develop a prioritisation list of misconnections.	Opt 1	2015-2021	1 x WQI (5% FTE) and 4 x SSO (2% FTE). Also a £3.05 million allowance linked to this.
38	Increase awareness of WFD requirements and stormwater management within local planning processes, underpinned by Strategic Planning Policy Statement.	Opt 1	2015-2021	1 x SSO (20%FTE), 1 x HSO (60%FTE), 1 x ScO (60%FTE) – ongoing.
39	Co-ordinate Bathing Waters pollution reduction programmes with the misconnections prioritised list to minimise bathing water failures as a result of polluted storm water systems entering local	Opt 1	2015-2021	ScO 12 days p.a. and HSO 6 days per annum. There could also be NIW costs which are currently unknown.

#	Measure	Option	Timescale	Assumptions
	rivers.			
40	Draft a policy paper on Polluted Surface Water Outfalls, including responsibilities for dealing with misconnections.	Opt 1	2015-2021	1 x PSO and 1 x SSO PSO 5 days p.a. SSO 8 days p.a.
41	Continue with Environmental Liaison Groups as part of Transport NI consultation process for each major road scheme.	Opt 1	2015-2021	ScO 70 hours.
42	To provide guidance and information to help communities protect and enhance local streams and rivers in their urban environment.	Opt 3	2015-2016	£5,000 one-off cost.
43	Significant all-Ireland research project that will contribute to providing the evidence base for the regulation of fracking.	SQ	2015-2016	1 year left – considered business as usual.
44	Promoting and supporting greater environmental compliance and performance, product innovation, resource efficiency and adoption of best practice.	SQ	2015 - 2021	Business as usual – ongoing.
45	Address the challenge of environmental degradation across North West Europe by developing a framework for the restoration of minerals sites (quarries), to provide benefits for biodiversity, habitats and local people. The 'RESTORE' project is being co-ordinated by the RSPB.	SQ		The restore project has been completed.
46	Potential for disused/abandoned quarries to be used as flood attenuation to aid with the management of volume in river systems during flood events.	Opt 1	2015-2016	SPTO 5 days one-off study.
47	Improved collection, coordination and analysis of data in and around waste and the waste system.	Opt 2	2015-2021	0.1 x G6 and 0.4 x SSO and 0.5 x HSO.
48	To advise on new waste management facilities	Opt 1	2015-2021	Considered business as usual.

#	Measure	Option	Timescale	Assumptions
	and extensions for legacy landfills and remediation of contaminated land -advise planners and third parties on the risk management and remediation of contaminated land and groundwater sites.			
49	Develop partnership process with Local Councils to support their effective management of significant waste contracts.	Opt 1	2015-2021	0.2 x G6 and 0.2 x SSO and 0.2 x HSO.
50	Update and develop a Northern Ireland Groundwater Protection Strategy to support land use planning.	Opt 1	2015-2016	3 months at SSO, 3 months at HSO and 1 month PSO.
51	Develop process for joint Waste/Water authorisations to include regulation DOE Regulatory Reform programme.	Opt 1	2015-2021	0.1 x G7, 0.2 x SSO and 0.2 x HSO.
52	Develop a compliance assessment process for Waste Authorisations.	Opt 1	2015-2021	0.2 x G7, 0.8 x SSO, 2.0 x HSO
53	Coordinate activities to reduce Dangerous Substances through an Expert Group.	Opt 1	2015-2021	2 x HSO, 4 x SSO and 2 x PSO. Per annum: HSO 4 days, SSO 12 days, PSO 10 days.
54	Pilot project looking at the regulation of priority and new substances of concern with more stringent standards for waste water treatment effluents.	Opt 1	2015-2021	1 x ScO, 1 x HSO and 1 x SSO. Per annum: ScO: 101 days, HSO: 27 days, SSO: 2 days.
55	Investigate how existing and new technology and methods can apply to monitoring emerging chemicals of concern in the aquatic environment.	Opt 2	2017-2018	2 x ScO, 2 x HSO, 1 x SSO. Per annum: ScO: 40 days, HSO: 30 days, SSO: 4 days. 2017 to 2018 (1 year).
56	Investigate how passive sampling and associated analytical technology and methods can apply to monitoring emerging chemicals of concern in the marine environment.	Opt 2	2017-2020	1 x HSO, 2 x ScO. 60 days x ScO and 20 days x HSO. 20 x £1,000 for sample analytical costs (one-off). 2017-2020 (3 years).
57	Pilot study of freshwater biota monitoring and use of passive sampling techniques during second	Opt 2	2017-2020	2 x ScO, 2 x HSO and 1 x SSO. Per annum: ScO: 155 days, HSO: 100 days, SSO: 20 days.

#	Measure	Option	Timescale	Assumptions
	cycle plans.			2017 to 2020 (3 years).
58	To develop the analytical methodology required to facilitate the analysis of new substances added to Appendix X WFD.	SQ	2015-2019	BAU as basic measure.
59	Examine the feasibility of metals monitoring by passive techniques to allow the determination of time averaged concentrations of metals in rivers at locations of concern .	Opt 2	2015-2021	2 x ScO, 2 x HSO, 1 x SSO. Per annum: ScO: 40 days, HSO: 30 days, SSO: 10 days.
60	Potential introduction of pharmaceutical (Watch List) monitoring of waste water treatment works effluents e.g. Contraceptive pill .	Opt 2	2015-2016	ScO 4 days. One year. 2015-16.
61	To develop methodology required to facilitate time averaged analysis and other analysis as it becomes available through UKTAG and as agreed by UKTAG working groups.	Opt 2	2017-2018	Per annum: HSO: 10 days, SSO: 10 days. 1 year (2018).
62	Encourage the adoption of Pesticide Minimisation Strategies, such as that adopted by Forest Service, across other sectors.	Opt 1	2016-2019	Per annum: SSO, 12days, PSO 12days. 3 years.
63	Implementation of the Sustainable Use of Pesticides.	SQ	2015-2021	BAU as basic measure.
64	Further development of Drinking Water Protected Areas and establishment of safeguard zones to improve and maintain water quality within drinking water catchments.	Opt 1	2015-2016	Per annum: PSO: 1 day, SSO: 9 days, HSO: 3 days. 1 year (2015).
65	Submit a project proposal through INTERREG V SCaMP to improve raw water quality in three cross border drinking water catchments.	Opt 2	2016-2021	IW and NIW are bidding for €5 million euro to improve drinking water quality in three cross border drinking water catchments. €5 million converted to pounds and split over 5 years (2016–2021). 1 Level 3s (PSO) - 1d/month. 9 Level 4s (SSO) - 13.5d/month. Assumed BA meant 13.5 d/month in total given they put total cost at £45,000.
66	Use the Water Catchment Partnership approach	Opt 2	2015-2021	HSO - 15 days per annum. Shows £210 p.a.

#	Measure	Option	Timescale	Assumptions
	to work proactively together to promote and raise awareness of best practice when using pesticides in the garden.			
67	Promote no-pesticide usage by local authorities when managing green areas.			Costs not known at this time.
68	DRD Water Policy to prepare a Long- Term Water Strategy for Northern Ireland.	Opt 1	2015-2016	6 months - DP 80%, 15% G7. Likely to be costs for actions after action plan agreed but cannot be estimated at this time.
69	NIW to prepare a Water Resource and Supply Resilience Plan by 2017.	Opt 1	2015-2021	Asset Management. 1 Level 3 (PSO) 0.5 days/week. 1 Level 4 (SSO) 1 d/w. 1 level 5 (HSO) 1 d/w. Other NIW Staff. Level 3s 0.25 d/m. Level 4s 1 d/m. Level 5s 2 d/m.. In addition to this the cost for external resources to support the delivery of the plan is c£400,000 every six years with a further c£25,000 annually.
70	Implement a programme of water resource assessments and multi-disciplinary studies to provide evidence to inform abstraction and impoundment licence reviews.	Opt 2	2015-2021	SSO 0.1 FTE, HSO 1.5 FTE, ScO 1FTE. Instrumentation £5,000 p.a. per study. 1 study per annum funded; two studies per annum preferred if resources available.
71	Increase awareness of importance of water efficiency and saving.	SQ	2015-2021	Business as usual through all types of stakeholder engagement.
72	Use burst water mains records to identify 'hotspots' and use to prioritise mains replacement to help reduce wastage in water supply.	Opt 2	2015-2021	£42 million capital spend for the PC 15 Investment Programme and an additional £17.8 million identified for 2015-2016. £42 million spread evenly over 6 years.
73	Implement catchment level assessments to inform NIW AIL licence reviews and monitoring requirements.	Opt 1	2015-2020	SSO 0.1 FTE; HSO 0.5 FTE. 5 years.

#	Measure	Option	Timescale	Assumptions
74	Consider whether groundwater licences can be issued as annual licences rather than the daily maximum volumes. This would reduce requirements for licence increase in some areas.			Costs not available at this time.
75	As part of implementation of the Floods Directive, develop and implement natural water retention measures and sustainable flood management options including role of bogs and wetlands.	SQ	2015-2021	Considered BAU as part of floods directive.
76	Provide details of private drinking water supplies >10 cubic meters to inform WMU and GW designation and monitoring of DWPAs.	Opt 1	2015-2021	HSO 1 day per annum.
77	NIEA teams to have a reciprocal arrangement for transferring information to DWI on risks which could affect private water supplies either through monitoring programme or pollution incidents.	Opt 1	2015-2016	One-off SSO 5 days. HSO 1 day per year for all of the 2nd cycle.
78	Draft a guidance document for small scale hydro power scheme applicants to include advice on fish/lamprey passage.	Opt 1	2015-2017	1 x PSO 4 x Reg SSO 4 x Reg HSO. Over two years PSO/40 days SSO/10 days HSO/10 days.
79	Co-ordination between DCAL and NIEA on the regulation of hydro power schemes, including pilot studies to examine the impact of hydro power schemes on fish stocks.	Opt 1	2015-2021	As part of working group. 1 x PSO, 4 x SSO, 4 x HSOs. PSO 2% FTE, SSO5% FTE, HSO 20% FTE. Ongoing.
80	Clarify roles and responsibilities around fisheries and Abstraction and Impoundment Licensing legislation and enforcement.	Opt 1	2015-2021	Costed above (measure number 78).
81	Adopt a consistent UK methodology for assessing the passability of obstacles to fish migration and use the protocol at abstraction points to inform licence conditions and to inform the decision making process on weir design.	Opt 1	2015-2021	Costed above (measure number 78).

#	Measure	Option	Timescale	Assumptions
82	Integration of fuller ecological considerations into hydro power scheme licensing.			Costs not available at this time.
83	Research into recovery times for groundwater bodies to achieve good chemical status/travel times through the unsaturated zones.			Costs not available at this time.
84	Consider CIS guidance on Ecological Flows during the next review of UKTAG Environmental Flow Standards.			Costs not available at this time.
85	Develop a programme of Reservoir surveys to assess the impact of impoundments on the aquatic environment.			Costs not available at this time.
86	Develop the methodology for including river continuity in Water Framework Directive classification.	Opt 1	2015-2016	HSO 10 days.
87	Improve liaison with DRD Transport NI re potential road bridges inhibiting fish passage.	SQ	2015-2021	Business as usual – negligible cost.
88	Inter-Agency River Restoration and Continuity Group to prioritise issues (e.g. potential barriers to fish movement) and co-ordinate river restoration and continuity work.	SQ	2015-2021	Business as usual – negligible cost.
89	Continue to support local stakeholder restoration projects through the Environmental Challenge Fund and Fisheries Habitat works.	Opt 2	2015-2021	9 x HSO for 10 days p.a. Ongoing. Also £100,000 p.a. for fisheries. Unknown how much NIEL fund will be used for water based projects until the applications are accepted. Total for 2015-2016 is £300,000 but covers a wide range of environmental projects. This figure will change on a yearly basis.
90	Continue with Environmental Liaison Groups as part of Transport NI consultation process for each major road scheme.	SQ	2015-2021	Business as usual – negligible cost.
91	Develop guidance on management of in-channel woody habitat debris.	Opt 1	2015-2016	One week of work for an SSO - one-off cost.
92	Marine Environment Division to work with DRD	Opt 1	2015-2016	HSO - 70 hours, PSO 10 hours, HSO x 6 x 3 hrs, SSO x 6 x 3 hrs.

#	Measure	Option	Timescale	Assumptions
	Ports, DARD and NIEA to develop a Ports and Harbours Guidance document, outlining good environmental management within ports.			
93	Ensure proper protection and compliance with gravel removal legislation.	SQ	2015-2021	Business as usual.
94	Undertake appropriate actions to implement legislation .	Opt 2	2015-2021	Per annum: SSO 5 days; HSO 40 days; ScO 40 days.
95	Consider research, in conjunction with DARD, to improve understanding of the effects of alien species in the aquatic environment.	Opt 3	2015-2021	Per annum: SSO 1 day; HSO 10 days; ScO 10 days.
96	Continue to implement the actions set out in the Invasive Alien Species Strategy for Northern Ireland.	Opt 2	2015-2021	Per annum: SSO 1 day; HSO 20 days; ScO 20 days.
97	Develop process for assessing significant impact of species as listed in Ecoregion 17 lists for WFD classification.	Opt 2	2015-2021	Per annum: SSO 1 day; HSO 5 days; ScO 5 days.
98	Develop new individual Invasive Alien Species Management Plans as required.	Opt 2	2015-2021	Per annum: SSO 1 days; HSO 10 days; ScO 10 days.
99	Improve education re fish introductions and need for Section 14 authorisation for stocking and moving fish.	Opt 3	2015-2021	£5,000 per annum.
100	Continue partnership approach between professionals and volunteers for invasive alien species monitoring to improve understanding of current distributions and spread.	Opt 2	2015-2021	Per annum: SSO 1 day; HSO 10 days; ScO 10 days.
101	Develop a coordinated rolling monitoring programme for large and small lakes prioritised according to protected area designations and local issues.	Opt 2	2015-2018	HSO - 0.9, SSO - 0.1, ScO - 0.2, ASO - 0.6 . NIEA contribution 0.5 HSO subject to funding Neagh one year, Erne next year, 3rd year other smaller lakes.
102	Inclusion of fishery bodies within SCaMP (Sustainable Catchment Management	SQ	2015-2021	Business as usual.

#	Measure	Option	Timescale	Assumptions
	Programme) stakeholder group.			
103	Further integration of river assessments and planned fishery habitat improvements, including targeted river restoration projects.	SQ	2015-2021	Business as usual.
104	NIEA to work with DCAL Inland Fisheries Group in order to quantify, and seek through the courts, the costs in relation to fish kills.	SQ	2015-2016	Already complete.
105	Develop and monitor a demonstration project based on adapted channel maintenance, and through a partnership approach.	Opt 2	2015-2021	HSO 20 days per annum.
106	Develop and implement Fisheries Management Plans for Lough Neagh and Lough Erne.	Opt 2	2015-2018	Already costed as part of measure #96.
107	Continue to carry out large scale fish stock monitoring when the DOLMANT survey has been completed to inform Fisheries Management Plans.	Opt 2	2015-2018	Already costed as part of measure #96.
108	Instigate a rolling programme of surveys for lamprey, European smelt, Sea trout and Brown trout.	Opt 1	2015-2021	Lamprey rolling programme = 1 X HSO and 2 X SO for approx. 5 weeks p.a. European smelt monitoring (weather dependant in any year given to narrow survey window = 1 x HSO and 2 X SO for approx 8 days p.a. Sea trout monitoring = based on 1 index site for pre spawning survey 1 x HSO and 2 x SO for approx 6 days p.a. This will increase depending on the number of index sites monitored. In addition combined spring sampling of Lamprey and Sea trout on R Faughan = 1 x HSO and 1 x SO for 3 hours per day for 7 weeks. Brown trout enhanced monitoring = 1 x HSO and 2 x SO for approx. 25 days p.a. This does not include LA annual semi quantitative electrofishing surveys which also monitor trout populations. This is all funded at present through core Loughs Agency funds.
109	Consider regulatory options to protect stock of	Opt 2	2015-2021	Out for consultation – costs not yet estimated.

#	Measure	Option	Timescale	Assumptions
	the European eel.			
110	Consider regulatory options for the conservation of Juvenile Coarse Fish.	Opt 2	2015-2021	Out for consultation – costs not yet estimated.
111	Consider regulatory options for the protection of prescribed species.	Opt 2	2015-2021	Out for consultation – costs not yet estimated.
112	Fish Passability and Transport NI measure?	Opt 1	2015-2021	5 days HSO p.a. for us for training and surveys.
113	Introduction of a fishery management tool through the Fisheries Habitat Improvement Strategy.			Costs not available at this time.
114	Streamlining of aquaculture management. Strategic management of the resource.	Opt 2	2015-2021	Out for consultation – costs not yet estimated.
115	Support established rivers trusts through specific projects.	Opt 1	2015-2021	7 HSOs, 2 days per month.
116	Work with local Councils and wider stakeholders to increase awareness and support actions to address litter in the water environment.	Opt 1	2015-2021	8 HSOs, 2 days per month.
117	Develop and implement a programme of catchment scale pilot projects to protect and improve water status.	Opt 1	2015-2018	Envisage 4 pilot projects, including Moyola, over next 6 years. To be costed by RBD managers. 4 HSOs and 4 SSOs, 2 days per month. This estimate is for the development of the programme. Implementation costs cannot be estimated until development is complete. There will be a review in 3 years to discuss the implementation going forward.
118	Develop management measures for smaller lakes based on the outcomes from the DOLMANT project.	Opt 1	2015-2018	NIEA - PSO 5 days; 2 x SSO 10 days; 3 x HSO 10 days. LA - 1 SSO 10 days, 1HSO 15 days.
119	Consider options for civil sanctions, such as on the spot fines, as part of the regulatory reform programme for environmental regulation.		NA	No decision taken yet on this policy. No costs available at this time.
120	Develop and agree three prosperity agreements with local industry/ business.	Opt 1	2015-2021	Programme team in ISD of: PSO, SO, EO2 plus project managers for each agreement at PSO/SSO level (3 staff in the first instance). Programme team spend approx 55 days p.a. Project Managers 22 days p.a. Will vary according to stage of agreement and progress of

#	Measure	Option	Timescale	Assumptions
				commitments.
121	Consider increased utilisation of flood plain storage as part of Flood Risk Management Plans (FRMPs).	SQ	2015-2021	Business as usual
122	Continue to work together to improve understanding of the wider public of the value and wider benefits of the water environment.	Opt 1	2015-2021	3 x PSO, 3 x SSO, 8 x HSO, 6 x SWQI. 3 days per annum. Conference room Hire 3 days p.a. @ £100 each.
123	Increase awareness of the role of groundwater in the management of the aquatic environment as part of catchment wide projects.	Opt 2	2015-2021	PSO, SSO and HSO x 0.2.
124	Review success of pilots with local councils to address fly tipping, including hazardous and fuel laundering waste.	Opt 1	2015-2017	0.75 FTE x SSO, 1.0 FTE x ScO - 2 years for both.
125	Development of an inter-departmental group to look at synergy between Directives, so that measures proposed have a synergistic effect and at least do not disbenefit any.	SQ	2015-2021	Business as usual.
126	Consider alternative funding opportunities, for example, the INTERREG V programme, to deliver sustainable solutions that take account of economic and social needs as well as environmental objectives for various European Directives.	Opt 2	2015-2021	NIEA external funding group - 1 x PSO and 1 X HSO (1 day per week) 1 x PSO (1 day per month). These figures are for the development and groundwork by NIEA staff. The call is likely to be November 2015 and allocation of funds 2016 - won't be operational until well beyond this. There will be a 3 year review to discuss implementation. Possible £15 million Interreg funding (although this has not been costed given uncertainty).
127	Align, as far as possible, the objectives and standards for the Water Framework Directive and Natura 2000 Protected Areas.	Opt 1	2015-16	PSO, HSO, SSO - 5 days, 20 days, 20 days.
128	Submit a project proposal through INTERREG V SCaMP to improve raw water quality in three cross border drinking water catchments.	Opt 2	2016-2021	Already costed as part of measure #64.
129	Complete Catchment Management Plans for 24	Opt 2	2015-2021	SSO - 5 days per study, 4 x HSO - 2 days per study, PSO - 1 day per

#	Measure	Option	Timescale	Assumptions
	Drinking Water Catchments.			study. And £20,000 per study cost. 4 studies a year assumed.
130	Details of pollution incidents to be made available on NIEA website.			Costs not available at this time.

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