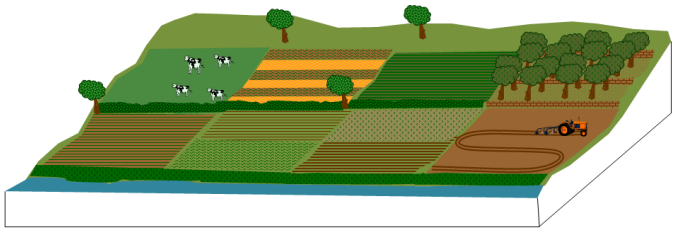
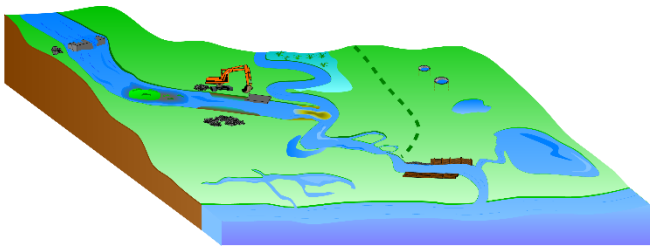
Disclaimer: This document has been prepared by the Natural Water Retention Measures (NWRM) Working Group which is co-chaired by the EPA and the OPW to inform the Programme of Measures for the 3rd Cycle River Basin Management plan. The information contained in this document has been sourced from other existing studies and research papers and references for same have been provided throughout. It is recommended that the reader should consult with these original reports/studies to obtain more detailed information. The methodology used to rank and score specific measures was informed by existing studies and based on the authors informed opinion and as such are open to interpretation and further refinement.

Natural Water Retention Measures (NWRM)

Overview and Recommendations for Use in Ireland





Working Group

September, 2020

Version no. 2

OPW
Oifig na nOibreacha Poiblí
Office of Public Works

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Table of Contents

1 Overview

1.1 Background

The Water Policy Advisory Committee (WPAC) requested that the National Technical Implementation Group (NTIG) develop a proposal for including Natural Water Retention Measures (NWRM) as part of a broader suite of mitigation measures that could contribute to the achievement of environmental objectives set out in the second River Basin Management Plan.

A NWRM Working Group was established to advise the NTIG on developing their proposal to the WPAC. The membership of the NWRM Working Group is detailed in Appendix 2.

The working group met three times in 2019 and this report and its recommendations reflect the discussions and learnings from these working group meetings.

This report also draws upon the outcomes of the European Commission DG Environment study *Atmospheric Precipitation - Protection and efficient use of Fresh Water: Integration of Natural Water Retention Measures in River basin management (2013-2014)* (EU NWRM, 2015) and brings their finding in to the Irish context.

1.2 Natural Water Retention Measures

1.2.1 What are they

NWRM are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes (EU, 2014).

The main functions of NWRM are to reduce flood risk, improve water quality, and create habitats. In carrying out these functions these measures can also provide multiple co-benefits such as climate regulation, climate change adaptation, improved soil management, and the creation of amenities.

NWRM are a broad range of measures in terms of physical scale, cost of implementation, and level of required intervention. The measures exist on a spectrum from those that restore natural processes to those that use ‘green-engineering’ to mimic a natural process to provide a desired function. It should be noted that there are many different terms used internationally to classify and describe the measures included here, including Nature Based Solutions, Working with Natural Processes, Natural Flood Management, and Engineering with Nature.

NWRM are not new; many measures that could be classified as NWRM already exist and are being implemented across different sectors plans and policies

1.2.2 How they work - theory

As the name suggests, these measures increase the retention time of water in catchments, for a period before it is passed downstream. These measures can retain water in soils, aquifers, and ecosystems and the retention time can vary from sub-hour to a permanent increase in a catchment’s water retention. By holding water in catchments for longer, these measures facilitate a number of beneficial ecological processes that can improve multiple environmental outcomes, such as creation of new habitat, increases in biodiversity, interception and attenuation of pollutants, improvements in water quality, and where the soils are carbon rich, reduction in greenhouse gas emissions. NWRM improve water quality by reducing pollutants before they become entrained in run-off and/or by intercepting pollutants once they are already entrained in run-off e.g. via wetlands.

NWRM can also play a role in flood risk management by reducing and delaying the onset of peak flow rates downstream, see They have been shown to be effective at reducing flooding in small catchments for frequent floods.

. They have been shown to be effective at reducing flooding in small catchments for frequent floods.

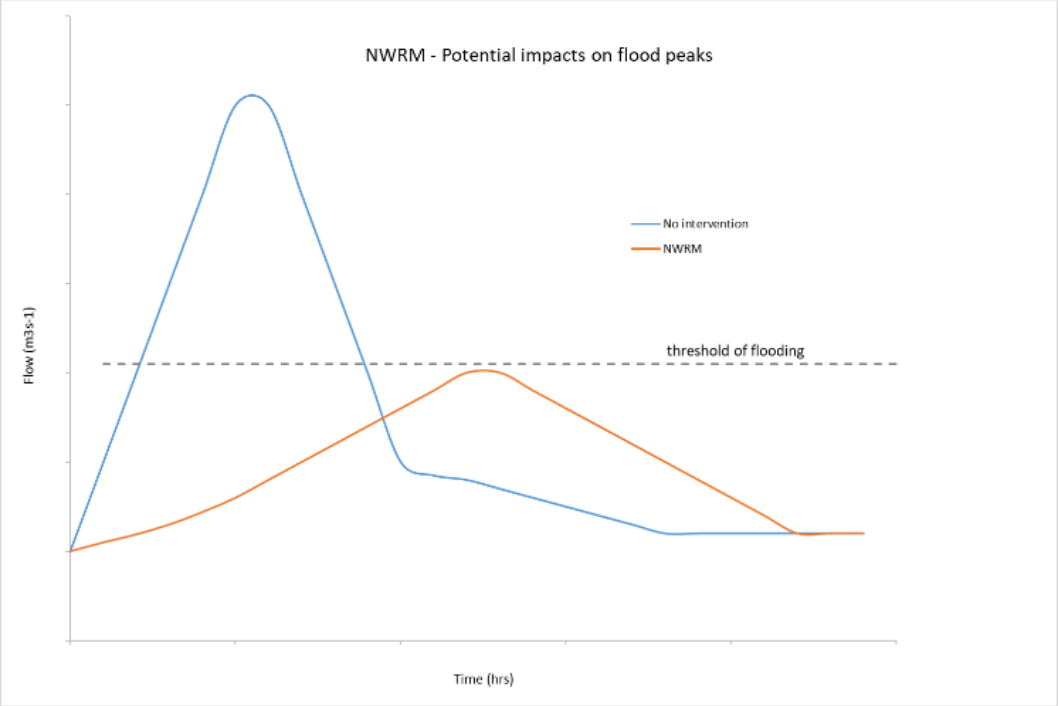


Figure 1-1 Theoretical impact of NWRM on flood peaks

NWRM can play a dual role with respect to climate change, providing both mitigation and adaptation functions. Several NWRM, and in particular restored peatlands, act as sinks for carbon dioxide, mitigating against climate change.

The predicted impacts of Climate Change scenarios for Ireland include more intense storms and rainfall events, drought, increased likelihood and magnitude of river and coastal flooding, adverse impacts on water quality, and changes in distribution of plant and animal species (Desmond M. et al 2017). NWRM can mitigate against these impacts by creating new habitats, reducing peak flows in our watercourses, and storing water in catchments to mitigate drought conditions. In this way, NWRM can assist us in adapting our catchments to this future.

NWRM can be broadly divided into five categories (see supplementary document "*NWRM Evidence and Opportunities for use in Ireland*") by separating common and appropriate measures by the sector or setting in which they are applicable. However, many measures overlap and cut across sectors or settings and are applicable across a broad range of applications, often to achieve very different end results. In addition, many NWRM are already in use but are not identified (are labelled) as such, for example establishing buffer strips and hedges along field margins and planting trees in urban areas are both considered to be NWRM and are already existing practice in Ireland – further detail is given in Section 2.3.

2 Opportunities for further use in Ireland

2.1 Overview

The means of implementing NWRM, and associated funding mechanisms, has been broken down into three levels to maximise associated take up (See Fig 2-1 below). The first approach (national and regional policy (including existing schemes)) offers a means for achieving widespread results in an organised manner. Existing plans, policies and guidance are already in place for many of the key sectors/settings which would simply require minor alterations/streamlining to achieve multiple benefits through the full integration of NWRM (see Section 3). The key benefit of this approach is that funding mechanisms through existing schemes are already in place and adaptation to include NWRM could achieve implementation over a very short period.

The second approach achieves implementation of NWRM at the project scale. A particular problem area is selected and measures are designed and then implemented to achieve a particular objective. An obvious example of such project-based solutions is flood alleviation schemes, however river restoration projects, urban regeneration schemes and rural bio-diversity projects all present opportunities for NWRM implementation with specific project-based funding on a case by case basis.

The third means of implementation is at the local scale where individuals or community groups implement NWRM through small scale private projects to achieve local benefits. Farmers, community river/wetlands groups, local fishing clubs etc. could all choose to identify, plan and execute NWRM projects and either fund them privately or through small scale grants such as the community water fund. Each of these three levels of implementation will require differing supports/actions to succeed but are all required if NWRM are to be implemented in a widespread manner. Figure 2-1 below illustrates the suggested approach for best implementation of NWRM in Ireland.

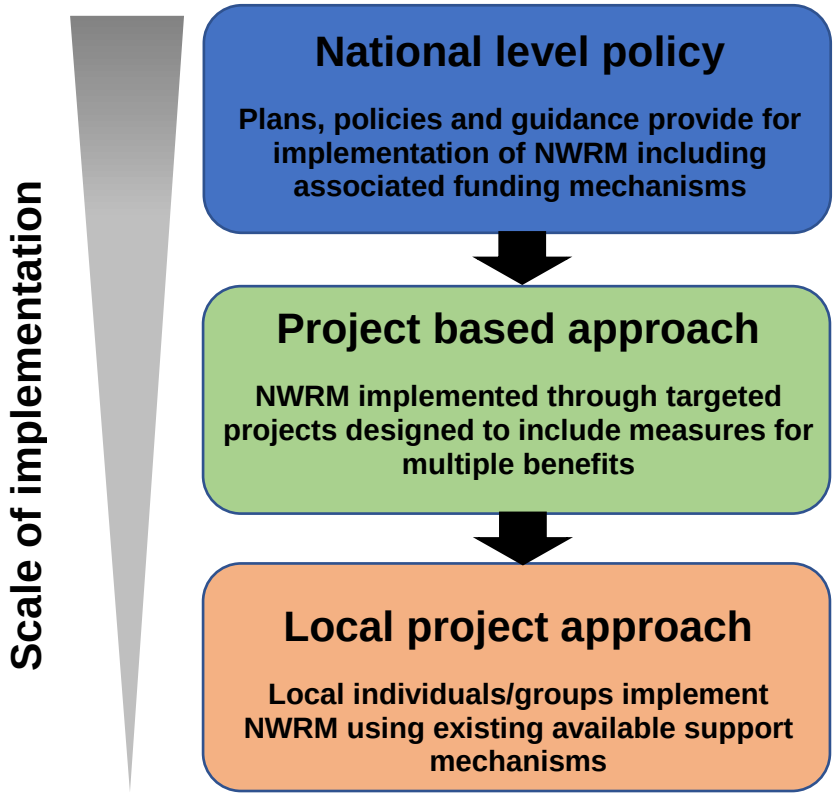


Figure 2-1 Graphic illustrating an approach to implementation of NWRM

2.2 NWRM Settings

The NWRM Workshop held in December 2019 identified that whilst there are many existing measures already being utilised in Ireland (although not labelled as NWRM) there is considerable opportunity for further implementation of these measures across all sectors in Ireland, particularly with a view to achieving multiple benefits (i.e. flood prevention and biodiversity etc.). In this regard, one of the key outcomes of the workshop, with which all participants agreed upon, was that in order to successfully implement NWRM, it would be key to 'main stream multiple benefits'.

The European NWRM study highlighted that all measures will achieve multiple benefits from implementation and given that these measures are typically aimed at re-naturalising the water environment, the benefits for habitats and biodiversity straddle all sectors and the vast majority of identified measures (EU NWRM, 2015). Flood prevention and alleviation is also a benefit common to many measures, although the general view at present is that these measures alone are not the sole solution for flooding in Ireland. However, it is recognised that such measures will play a vital role in integrating flood risk management with other catchment management functions.

The working group determined that the best approach was to categorise NWRM in Ireland into the following five categories:

- Agriculture;
- Forest;
- Urban;
- River Restoration; and,
- Peat.

The river restoration category is similar to the hydromorphology group referenced in the EU project, plus an additional category has been added to reflect the unique Irish conditions relating to peat.

2.3 Measures by Sector

The working group found that almost all NWRM, outlined in the supplementary document, could be applied in Ireland to achieve a range of environmental benefits. The measures that offer the greatest potential for implementation in Ireland were identified in order to examine these measures further and provide supplementary evidence.

The measures that offer the greatest potential are those that achieve high benefits whilst at the same time requiring the least effort in terms of capital expenditure, policy reform and scale of construction (including physical disturbance etc.). Matrices were developed to place each measure on a ‘Benefit’ and ‘Effort’ scale from low to high.

Each measure was scored based on corresponding ‘Benefit’ under the following key headings:

- Flood risk reduction
- Water quality improvement
- Habitat/biodiversity

The scoring process involved a low, medium or high score under each heading (represented numerically: 1 – 3) allowing an overall ‘Benefit’ score to be assigned.

The ‘Effort’ of implementation is a combination of the total economic cost and the difficulty of implementation. The total economic cost of a measure is the total economic cost to all

stakeholders, be they implementing bodies or landowners. The difficulty of implementation represents the difficulty in overcoming all other barriers to implement a specific measure

This allowed measures to be grouped and displayed graphically on a potential matrix. The criteria for grouping measures within the potential matrix utilised this scoring and the associated effort to place measures within four quadrants based on the various combinations observed.

The measures that have the greatest potential for widespread adoption are those that require a low effort of implementation while providing a high degree of benefits. It should be noted that measures that require a high effort of implementation also have potential for implementation where there is a structure to overcome the high effort, e.g. OPW Flood Relief Schemes, provided that the benefits can justify the level of effort.

The ranking of measures based on 'Benefit' and 'Effort' was informed by the experience of the working group and the literature reviewed. There is a need to develop a more objective methodology to assess measures against these criteria. This current ranking does not rule out any NWRM for future implementation

The combined potential matrix for all settings is shown in Figure 2-2 below, with the measures showing greatest potential falling within the bottom right quadrant (i.e. low effort & high benefit). Measures are colour co-coded by setting to differentiate the various areas that they are most suited.

It is clear from Figure 2-2 that a large number of measures fall within the low effort/high benefit quadrant and therefore a further stage of screening took place. The additional screening stage involved grouping all measures together and ranking their score within the cumulative list allowing the highest opportunity measures to be identified. This process resulted in 15 key measures being identified as having the highest opportunity for widespread uptake:

- Re-wetting drained organic lands
- Sediment capture ponds
- Basins and ponds
- Wetland restoration and management
- Floodplain restoration and management
- Re-meandering
- Wetland lakes
- Detention basins
- Retention ponds
- Infiltration basins
- Removal of dams and other longitudinal barriers
- Buffer strips & hedges
- Forest riparian buffers
- Artificial wetlands
- Engineered ditches

Many of these measures are similar in terms of their underlying principle or corresponding benefit and this list could therefore be further condensed within grouped headings. The final list of prioritised NWRM for Ireland is therefore as follows:

- Re-wetting drained organic lands
- Engineered basins, ponds & ditches
- Floodplain restoration
- River re-meandering

- Removal of dams and other longitudinal barriers
- Buffer strips & riparian margins
- Wetlands

Each of the grouped measures listed above has been reviewed in more detail to provide a sufficient evidence base for stakeholders to ascertain the key benefits that can be gained from their widespread implementation. This more detailed assessment considered associated benefits under two additional key headings: natural processes (restoration) and climate change. Summary details of each of these prioritised measures are given in **Error! Reference source not found.** below – see supplementary document "*NWRM Evidence & Opportunities for Use in Ireland*" for full details and evidence for each measure.

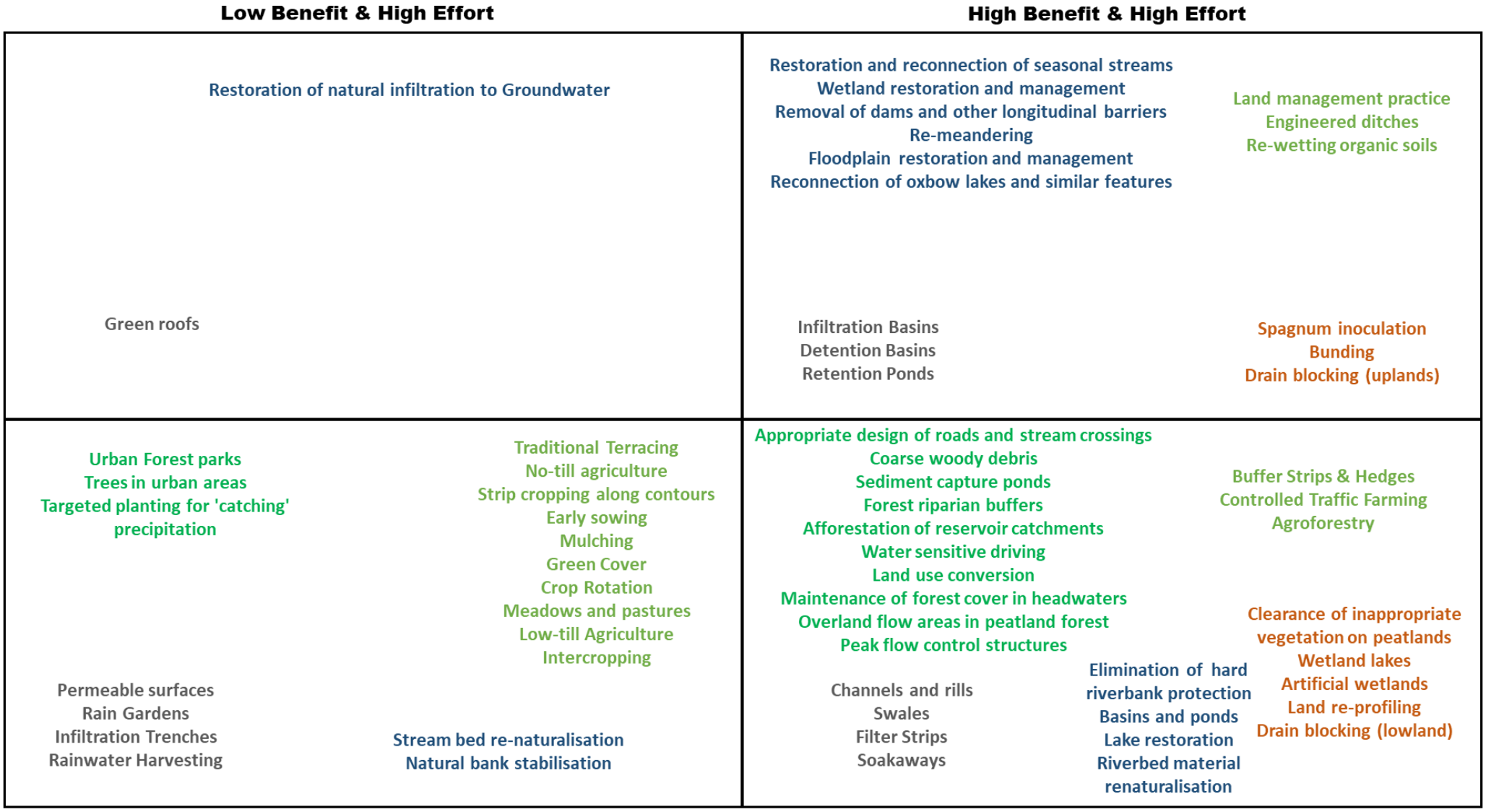
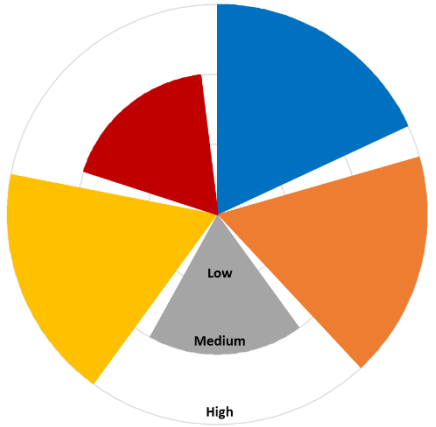
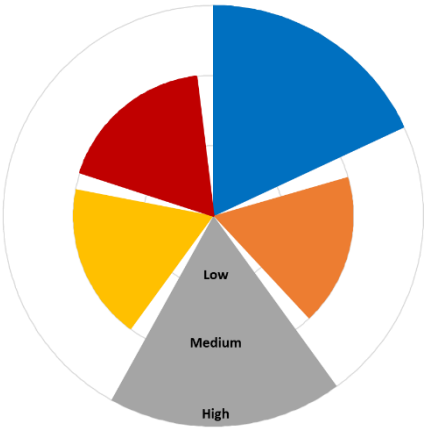


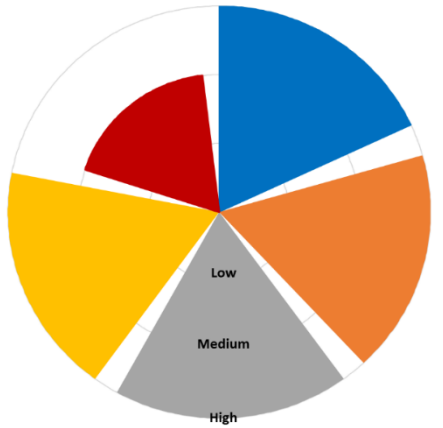
Figure 2-2 Potential matrix for all NWRM reviewed grouped by settings

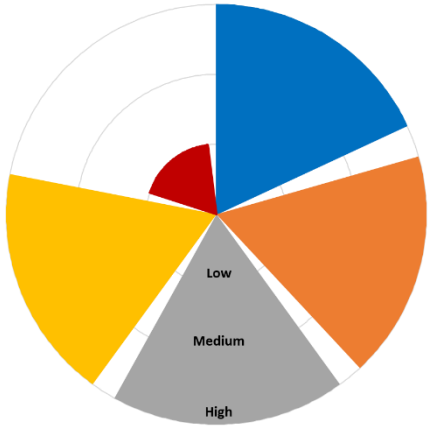
Forrest – Agriculture – Urban – River Restoration – Peat

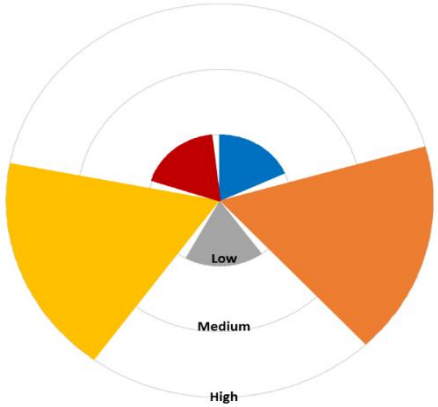
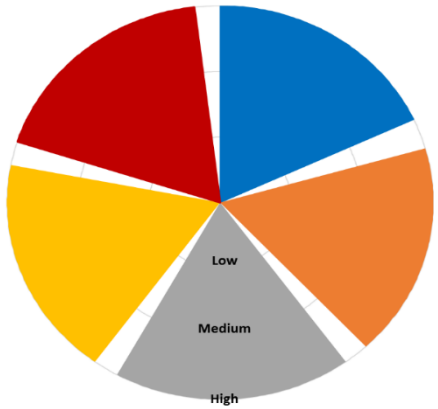
Table 2-1: Summary of key NWRM which have greatest potential for use in Ireland under existing plans/policies/guidance

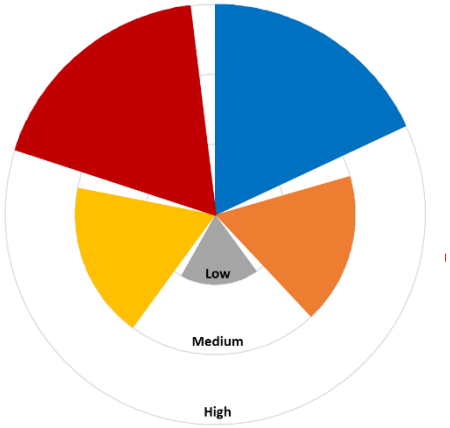
Measure Name	Short Description	Key Benefits & scoring under the assessment criteria
Buffer Strips & riparian margins	Forest riparian woodland involves planting native woodland within the riparian zone (i.e. lands immediately either side of a watercourse). Riparian woodland has the effect of slowing and holding back flood flows as well reducing sediment delivery and bankside erosion. Riparian buffers can include setbacks without trees in coniferous plantations. Buffer strips & hedges are areas of natural vegetation cover (grass, bushes or trees) at the margin of fields (pasture), arable land and watercourses (riparian zones). Vegetation within these buffer strips/zones can vary from simply grass to a combination of grass, trees, and shrubs. Buffers can be sited away from waterbodies including field margins, headlands or even within fields (i.e. hedges planted across long steep slopes); buffers also do not always contain trees and are not always linear (e.g. targeted areas of woodlands or plot).	– Slows runoff – Reduce erosion/sediment delivery – Filters nutrients – Increased biodiversity 
Engineered basins, ponds & ditches	Engineered basins and ponds are water bodies storing surface run-off temporality before discharging at a controlled rate to a receiving watercourse. Detention and infiltration basins differ from 'wet' ponds being free from water in dry weather flow conditions. Wet ponds (e.g. retention ponds, flood storage reservoirs, shallow impoundments, sediment capture ponds etc.) are designed to permanently contain water and have capacity to hold additional water during rainfall events. Engineered ditches are a variation on sediment capture ponds but are linear features. They are constructed by re-engineering traditional drainage ditches with dams/flow control structures to create a series of linear ponds. All of these NWRM are primarily focused at controlling the peak runoff from the areas draining to them whilst also allowing for the settlement of sediment and other pollutants.	– Store/Slows runoff – Water storage – Flood risk reduction – Intercept pollution pathways – Reduce erosion and/or sediment delivery – Increase infiltration and/or groundwater recharge 

Measure Name	Short Description	Key Benefits & scoring under the assessment criteria
Floodplain restoration	A floodplain is an area of land that borders and interacts with the river channel, playing a vital role in the health of river systems. Connected floodplains allow for the transfer and retention of water. They also allow for sediment and organic matter to be retained/deposited on the land which can aid river water quality but also supply nutrients to the land. Furthermore, floodplains provide habitat and refuge. Floodplains have been impacted and degraded by hydromorphological pressures, land use changes and flood defence. Quite often the lateral connectivity between the river channel and the floodplain has been cut off by, for example, embankments, flood walls, bank protection, drainage or, completely removed by urban development. Measures to restore floodplains can include: modification of the channel; removal of embankments or other structures impeding connectivity; removing legacy sediment; new/modification of agricultural practices; afforestation; plantation of native grasses, shrubs, trees and alluvial woodland; creation of grassy basins and swales; wetland creation; invasive species removal and; riparian buffer installation and development.	– Store/Slows runoff; – Store/slow river water; – Flood risk reduction; – Improve water quality; – Improve hydromorphological conditions; – Erosion/sediment control; – Improve soils; – Groundwater/aquifer recharge; – Create riparian/terrestrial habitats;
River re-meandering	River re-meandering involves re-naturalising the channel planform, or pattern, of a river. It involves creating a new meandering (or winding) course, if suitable for the system, or reconnecting cut-off meanders (due to man-made interventions rather than natural migration). This can lead to an increase in the length of the river channel, therefore slowing down the river flow and increasing storage capacity. The restored river channel creates new flow conditions and very often also has a positive impact on sedimentation and biodiversity, providing habitats for a wide range of aquatic and land species of plants and animals.	– Store/slow river water; – Flood risk reduction; – Prevent surface water status deterioration; – Erosion/sediment control; – Reduce erosion and/or sediment delivery; – Take adequate and co-ordinated measures to reduce flood risks; – Create aquatic/riparian habitats.





Measure Name	Short Description	Key Benefits & scoring under the assessment criteria	Water Quality Natural Processes (restoration) Flooding Biodiversity Climate Change
Removal of dams and other longitudinal barriers	Artificial barriers such as dams, weirs, culverts and sluices can impact the movement of water, sediment and biota along the channel. Removal of such barriers, along with restoring the slope and the longitudinal profile of the river, allows the re-establishment of fluvial dynamics, as well as sedimentary and ecological connectivity. With regard to flood mitigation, barriers have often been seen as a flood protection measure but there may be situations that barriers contribute to upstream flooding. Furthermore, if dams and weirs are not maintained or are compromised, removal can reduce potential flood risk.	– Improve hydromorphological conditions; – Improve fish migration and reproduction; – Create aquatic/riparian habitat; – Biodiversity preservation;	
Wetlands	Wetlands provide a transition zone between aquatic and terrestrial ecosystems and include peatland, marsh, swamp, reedbed, heath, wet woodland, wet grassland or fen type habitats. They are an important component of the catchment as they provide many functions including water (and nutrient) retention, water purification, habitat creation/maintenance and carbon sequestration. However, wetlands have been impacted by various pressures such as drainage, peat harvesting, land use changes and development. Restoration of these features can involve: re-establishment or creation of riparian and wetland habitats; removal of embankments or other structures impeding connectivity between the river and wetland; changes in land use practices; creation of artificial wetlands and/or wetland lakes. Artificial wetlands and lakes involve the construction of engineered ponds or low-lying areas that mimic naturally occurring wetlands. Artificial wetlands have the potential to provide suitable equivalent habitat and refuge to natural or restored wetlands. Wetland lakes also have the potential to be stocked with fish, promoting biodiversity and providing an amenity, such as angling, to the area. The key benefits of these types of measures lie in increased biodiversity, sediment removal, water quality improvement and flood prevention.	– Store/Reduce/Slows runoff; – Absorb and/or retain CO2; – Reduce erosion/sediment delivery; – Filters and retains nutrients; – Better protection for ecosystems and more use of Green Infrastructure; – Increased biodiversity; – Prevention of biodiversity loss; – Create aquatic/riparian habitat.	

Measure Name	Short Description	Key Benefits & scoring under the assessment criteria	Water Quality Natural Processes (restoration) Flooding Biodiversity Climate Change
Re-wetting drained organic lands	Drain blocking and other measures (including bunding etc.) can be used to re-wet drained organic soils to restore the high water table necessary for natural wetland conditions to be rehabilitated. This measure is primarily aimed at marginal farm lands located on cutover peat. The key benefits of this measure lie in CO2 sequestration for climate change adaption and water quality improvements, however multiple other benefits also accrue including slowing and reducing runoff with associated flooding benefits and increased biodiversity.	– Absorb and/or retain CO2 – Store/slow runoff – Intercept pollution pathways – Reduce erosion and/or sediment delivery – Flood risk reduction – Prevention of biodiversity loss	

3 Need for policies and guidance

Whilst there is no one plan, policy or guidance document currently in place in Ireland for implementing NWRM, there are many existing guidance documents which either already include some form of measure (which are not specifically listed as such) or could be readily adapted to include applicable measures. During the workshop held in December 2019, the working group attempted to list these policies/plans with a view to identifying the most relevant areas to concentrate efforts for the implementation of NWRM in the short to medium term. Table 3-1 below has taken the full list identified during the workshop and extracted the most relevant and adaptable policies and guidance in relation to NWRM and has categorised these in relation to:

a) Setting to which the policy/guidance is most closely aligned;
b) Responsible body;
c) Relevant measures; and,
d) Indication whether measures are already included – traffic light colour coding applied where green highlights plans/policies where NWRM are already referenced.

Table 3-1 is not intended to be an exhaustive list and in this regard the full list identified during the workshop is included in Appendix 1. It is clear that there are few existing policies or guidance documents which specifically reference NWRM, but many do already include measures not specifically labelled as NWRM.

The cross-setting applicability of many of the policies and plans illustrates how measures included under these specific headings could provide a means for implementation of NWRM in Ireland through different policy instruments such as the River Basin Management Plan, Climate Change Adaptation planning, and restoration of peatlands and other Natura sites. It is noted that a specific guidance document for local groups relating to NWRM is currently not available.

It is clear from this list outlined below that NWRM have the potential to be present across all sectors of society and many measures will therefore naturally cut across multiple sectors in terms of their implementation. A targeted study to access the feasibility and practicality of wide-scale implementation would therefore be of great benefit to assist in streamlined implementation where multiple sectors and policies may be involved.

Table 3-1: Overview of relevant policies, plans & guidance for NWRM

Policies/Plans/Guidance	Agriculture	Forest	Urban	River Restoration	Peat	Responsible body	Measures included	NWRM incorporated into Policies/Plans/Guidance
Flood Risk Management Plans (Flood Directive)	✓	✓	✓	✓	✓	OPW	Varies	√ (NWRM considered at flood scheme design stage since January 2019)
River Basin Management Plan 2018-2021 (Water Framework Directive)	✓	✓	✓	✓	✓	DHPLG	NWRM noted as potential measures to be included in the Programme of Measures	√
Environmental River Enhancement Programme				✓		OPW/IFI	Bed re-naturalisation Riparian fencing	√ (measures exist but not categorised as NWRM)
National Barriers to Fish Migration Programme				✓		IFI	Removal of dams and other longitudinal barriers	√ (measures exist but not categorised as NWRM)
National Adaption Framework: Sectoral Planning Guidelines for Climate Change Adaptation 2018	✓	✓	✓	✓	✓	DCCAE	Varies - increase green space in urban areas to provide area for retention of floodwaters.	√ (Action 3.B)
National Adaption Framework: Climate Change Sectoral Adaptation Plans	✓	✓	✓	✓	✓	Varies	Varies	√ (measures exist but may not always be categorised as NWRM)

Policies/Plans/Guidance	Agriculture	Forest	Urban	River Restoration	Peat	Responsible body	Measures included	NWRM incorporated into Policies/Plans/Guidance
Local Authority Biodiversity Plans	✓	✓	✓	✓	✓	Local Authorities	Varies	√ (measures exist but may not always be categorised as NWRM)
Planning Guidelines (to consider River Basin Management Plans objectives)		✓	✓	✓	✓		Varies	√ (measures may exist but may not be categorised as NWRM)
National Development Plans	✓	✓	✓	✓	✓	OPW (Flood Risk management plans)	Measures for Flood Risk management plans implemented as part of the National Development Plan 2018-2027.	√ (NWRM considered at flood scheme design stage)
Development Plans (regional / county)	✓	✓	✓	✓	✓	Local Authorities	Varies	√ (measures exist but may not always be categorised as NWRM)
National peatlands strategy (2015)				✓	✓	DCHG (NPWS)	All measures identified in **Error! Reference source not found.** under peat	√ (measures exist but may not always be categorised as NWRM)
Land use / CAP / Harvest 2020	✓	✓			✓	DAFM	Varies	√

Policies/Plans/Guidance	Agriculture	Forest	Urban	River Restoration	Peat	Responsible body	Measures included	NWRM incorporated into Policies/Plans/Guidance
								(measures exist but may not always be categorised as NWRM)
Nitrates Action Programme	✓	✓				DHPLG	Buffer strips & Hedges	√ (measures exist but may not always be categorised as NWRM)
Afforestation Scheme (Native Woodland Scheme (Establishment)) (Funded under the Forestry Programme 2014 – 2020	✓	✓			✓	DAFM	Native woodland creation Riparian Buffers Buffer strips & Hedges	√ (measures exist but may not always be categorised as NWRM)
Afforestation Scheme (Native Woodland Scheme (Conservation)) (Funded under the Forestry Programme 2014 – 2020	✓	✓			✓	DAFM	Conversion of conifer commercial forest to native woodland Enhancement of native woodlands including the control of IAS Riparian Buffers Buffer strips & Hedges	√ (measures exist but may not always be categorised as NWRM)
Continuous Cover Forestry Scheme		✓				DAFM	Conversion of forests from clearfell sivicultural system to	√ (measures exist but may not always be categorised as NWRM)

Policies/Plans/Guidance	Agriculture	Forest	Urban	River Restoration	Peat	Responsible body	Measures included	NWRM incorporated into Policies/Plans/Guidance
							continuous cover forestry	
Woodland Environment Fund	✓					DAFM	Creation of native woodland with additional funding provided by the private sector	√ (measures exist but may not always be categorised as NWRM)
Woodland Creation on Public Lands Scheme	✓	✓	✓	✓	✓	DAFM	Native woodland creation on land in public ownership	√ (measures exist but may not always be categorised as NWRM)
Forest Roads Scheme (includes SCW grant)		✓				DAFM	Grant to construct roads to a certain specification and includes a grant for Special Construction Works (SCW) (e.g. appropriate bridges)	√ (measures exist but may not always be categorised as NWRM)
Low Pressure Tyre scheme		✓				DAFM	Grant for automated pressure reduction of tyres on haulage vehicles to reduce impact of driving on forest roads	√ (measures exist but may not always be categorised as NWRM)

Policies/Plans/Guidance	Agriculture	Forest	Urban	River Restoration	Peat	Responsible body	Measures included	NWRM incorporated into Policies/Plans/Guidance
Forestry Environmental Enhancement Scheme (in draft)		✓				DAFM	Includes grant aid for environmental measures including the creation of water setbacks where they may not have created at establishment	√ (measures exist but may not always be categorised as NWRM)
NeighbourWood Scheme		✓	✓			DAFM	Creation of public woodlands, including constructed paths, signage etc. Also includes grants for creating new woodland and removing IAS	√ (measures exist but may not always be categorised as NWRM)
Afforestation Scheme (Agroforestry) (Funded under the Forestry Programme 2014 – 2020)	✓	✓			✓	DAFM	Riparian Buffers Buffer strips & Hedges	√ (measures exist but may not always be categorised as NWRM)
Green, Low-Carbon, Agri-Environment Scheme (GLAS)	✓				✓	DAFM	Buffer strips & Hedges Meadows & pasture Cover crops Low till agriculture	√ (measures exist but may not always be categorised as NWRM)

Policies/Plans/Guidance	Agriculture	Forest	Urban	River Restoration	Peat	Responsible body	Measures included	NWRM incorporated into Policies/Plans/Guidance
Best practice in raised bog restoration in Ireland - Irish Wildlife Manuals No. 99 (2017)	✓				✓	DCHG (NPWS)	Most measures identified in **Error! Reference source not found.** under peat	√ (measures exist but may not always be categorised as NWRM)
National Biodiversity Action Plan 2017 - 2021	✓	✓	✓	✓	✓	DCHG	Varies	√ (measures exist but may not always be categorised as NWRM)

4 Funding of measures (existing & proposed)

There are many possible funding streams which could be utilised for the implementation of NWRM in Ireland; some of which are already in place and would only require reallocation through existing schemes. The working group has concluded that funding of these measures requires a concerted effort in joined up thinking across all sectors (including relevant policy) in order to leverage existing (and additional) funding for multiple benefits. Opportunities are likely to exist for further collaboration both within and between Departments, for development of measures, implementation and maintenance, and similarly within Local Authorities across various sections including planning, operations and environment.

Opportunities for NWRM also exist within Community led projects, although it is important that there is adequate support to ensure an integrated approach is adopted that will achieve the multiple benefits within a catchment.

The role of research pilot projects and demonstration sites will be vital in both quantifying multiple benefits that are achievable through NWRM and in encouraging buy in from all relevant stakeholders. Further case studies in the Irish context, similar to those outlined in the supplementary document,, will be of benefit in driving the changes required for NWRM to be a success in Ireland. The following sections provides a brief summary of potential funding mechanisms for NWRM in Ireland. These can either be existing or proposed schemes which can be adapted to include NWRM or new revenue streams which can be attracted to either fund demonstration/research sites or for restoration schemes.

4.1 Forestry

The forest setting is readily adaptable for the incorporation of NWRM for all future afforestation schemes by tying their inclusion to the payment of grants. Existing schemes already in place which are utilising NWRM are described below. Given that funding for these schemes is already in place, the challenge appears to be increasing participation. Increased participation in existing schemes would allow for rapid rollout of NWRM, helping to achieve Government targets for afforestation and climate change. Opportunities for new measures are also discussed in the section following.

4.1.1 Existing measures, schemes and programmes

Forrest Riparian Buffers
Forest riparian buffers are required under the following DAFM grant aided schemes (and relevant accompanying guidance) and in this regard future updates of the various schemes under this heading could also acknowledge the likely benefits for natural water retention:

- Woodlands for Water measure.
https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2018/WoodlandWaterLoRes06June18270618.pdf

- DAFM Environmental Requirements for Afforestation 2016
https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2016/EnvironmentalRequirementsAfforestationDecember121216.pdf)

- DAFM Felling and Reforestation Policy 2017
https://www.agriculture.gov.ie/media/migration/forestry/treefelling/FellingReforestationPolicyMay2017250517.pdf

- Land Types for Afforestation

https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/schemecirculars/2018/LandTypesForAfforestationOct17030118.pdf

- Forestry Standards Manual

https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2015/ForestryStandManNov15050116.pdf

Overland flow areas in peatland forest

The Durrow alluvial forest restoration project was a LIFE project which commenced in 2009 and was run by Coillte which aimed to restore deterioration of priority habitat, due to planting of non-native conifers and drainage.

http://nwrm.eu/case-study/restoration-durrow-floodplain-alluvial-woodland-ireland

Urban forests

The NeighbourWood scheme is aimed at creating attractive close-to-home woodland amenities (or 'neighbourwoods') for public use and enjoyment. The scheme is available to both public and private landowners, working in partnership with local communities.

https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2015/NeighbourWoodScheme240717.pdf

Continuous Cover forestry

The Woodland Improvement Scheme – Continuous Cover Forestry is a grant aided scheme to provide funding for conversion of existing forests to Continuous Cover Forestry (CCF) over a 12 year transitional period. The main aim of the scheme is the avoidance of clearfelling of areas greater than 0.25 ha or more than two tree heights wide without the retention of some mature trees.

https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2019/WISCCFVer6120319.pdf

Land use conversion

The existing DAFM afforestation scheme is in essence a land use conversion NWRM with lands typically in agriculture or fallow planted to establish forestry cover.

https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2015/AfforestationSchemeEd2190315.pdf

Creation of Woodland on Public Lands

The strategic planting of native woodlands can improve water quality and help reduce the risk and severity of flooding. As set out in the DAFM document Woodland for Water, research and practice show that new native woodlands trap sediment and nutrients, stabilise banks, provide food, shading and cooling for aquatic life, aid riparian restoration, and help regulate floodwater. Used in this way, the [Woodland Creation on Public Lands] Scheme can be utilised by Public Bodies to contribute in a meaningful way to the achievement of objectives under the Water Framework Directive.

https://www.gov.ie/en/press-release/28b65-ministers-calleary-and-hackett-announces-new-scheme-for-creation-of-native-woodland-on-public-land/

4.1.2 Future opportunities

Existing schemes
The Forest Service could incorporate further NWRM into future afforestation schemes by tying their inclusion to the payment of grants. Scheme eligibility and payments for all schemes could be adapted to mandate the following measures:

- Coarse woody debris;
- Peak flow control structures;
- Overland flow areas in peatland forests;
- Appropriate design of roads and stream crossings (strengthen existing policy);
- Continuous cover forestry (for new planting in sensitive sites);
- Sediment capture ponds.

The opportunities for retrospectively introducing measures to existing plantations will be more limited, however the existing Woodland Improvement Scheme – the potential for Continuous Cover Forestry (CCF) to be mandated could be examined for all new licenced clear-fells in sensitive sites (e.g. close proximity to High Ecological Status objective water bodies) as an example. One option that could be considered is the introduction of this measure retrospectively within Blue Dot catchments or PAA's and if it resulted in noticeable improvements in water quality, it could be rolled out for sensitive sites across the country. If mandating CCF is not feasible, forests could be replanted with an appropriate mix of species post felling to establish future CCF management.

The existing Agricultural Sustainability Support and Advisory Programme (ASSAP) provided by Teagasc already offers advice to farmers in terms of forestry scheme participation however this service also provides a means by which forestry measures can be further encouraged. For example, in seeking further opportunities to further encourage uptake of the schemes in Areas for Action. This service could be adapted to target forestry measures amongst farmers with little or no change to existing services and with an immediate effect.

Other schemes
Sources of funding other than existing DAFM grants could include sensitive catchments within the Coillte Nature lands, research projects such as the LIFE programme, EPA Research Programme, DAFM stimulus Programme, and community-based projects funded though the LAWPRO Community Fund to Rivers Trusts. Community involvement through such schemes could be an ideal way to encourage connections between people and their local forest and river.

Another existing incentive involves corporate involvement combined with local policy planning (zoning) to maximise afforestation in desired greenbelt locations. Further promotion and incentivisation of this measure to supplement existing schemes may be successful in increasing uptake of this scheme. A potential adaption of this measure could involve double payments for native woodlands to achieve maximum multiple benefits. This type of approach has been implemented in other countries successfully and corporate funding represents a potentially viable way for big firms to offset carbon emissions whilst minimising their involvement at project scale levels.

4.2 Agriculture

Agriculture provides one of the greatest opportunities for affecting real change through NWRM due to it being the largest land use in Ireland. Given that the objective of the new Common Agricultural Policy is to increase the environmental ambition, in particular for climate and biodiversity, real opportunities for the implementation of NWRM exist. In addition, the majority

of measures outlined in **Error! Reference source not found.** are at the lower end of the cost spectrum and therefore could represent an affordable method for large-scale implementation. However, widespread implementation would be required to deliver significant benefits.

The challenge is to embed the natural water retention measures philosophies of 'slow the flow' and 'make room for the river' within the CAP strategic plan. With their multiple environmental benefit outcomes, these types of measures could be well suited to inclusion in eco-schemes and/or Pillar II agri-environmental schemes in the new CAP.

4.2.1 Existing measures, schemes and programmes

Common Agricultural Policy (CAP)
Under the Common Agricultural Policy (CAP) farmers can access payments through a mechanism called "Green Direct Payment" (Greening). Greening aims to support farming practices which support environmentally friendly production. Greening payment are accessed by carrying out three mandatory practices:

- Crop diversification;
- Maintaining Permanent Grassland;
- Allocating 5% of arable land to biodiversity.

There is potential to extend the greening practices listed above to further promote and encourage various NWRM measures including: Land Management practices, Buffers & hedges and Cover Crops.

Green, Low-Carbon, Agri-Environment Scheme – GLAS
The Green Low-Carbon Agri-Environment Scheme (GLAS) is an agri-environment scheme which forms part of the Rural Development Programme 2014-2020 and follows the Rural Environmental Protection Scheme (REPS) and the Agri Environmental Options Scheme (AEOS). GLAS aims to encourage farmers to promote biodiversity, protect water quality, and also to help combat climate change.

Activities under the scheme such as planting new hedgerows, arable margins, minimum tillage, catch crops and wild bird cover are equivalent to various NWRMs.

https://www.agriculture.gov.ie/farmerschemespayments/glas/

European Innovation Partnership (EIP)
There are various European Innovation Partnership (EIP) projects in progress that are implementing and evaluating NWRMs across the country. One example is outlined below.

The BRIDE (Biodiversity Regeneration in a Dairying Environment) Project is an innovative agri-environment project based in the River Bride catchment of north-east County Cork and west Waterford, Ireland. The project is co-funded by the European Union and the Department of Agriculture, Food and the Marine through the European Innovation Partnership (EIP) funding initiative and the project will operate through the period 2018-2023.

The Project aims to design and implement a results-based approach to conserve, enhance and restore habitats in lowland intensive farmland.

An innovative feature of the BRIDE Project is the landscape-scale approach to biodiversity whereby groups of farmers in a given area are being encouraged to implement a range of habitat improvement measures. This combined, community-based effort is an entirely new approach to environmental management compared to previous agri-environment schemes.

Another innovative aspect is the use of a results-based payment scheme where farmers have each habitat on their farm assessed and scored, with higher quality habitats gaining higher payments.

Many NWRM are included in the scope of the scheme including Buffer Strips, Hedges, Ponds, Wetlands and Riparian Woodland. This model could be a template for the establishment of a payment based system that has the scope to roll out NWRM on a catchment -wide basis nationwide.

https://www.thebrideproject.ie/

4.2.2 Future opportunities

CAP reform
The CAP reform process, which is currently in progress, aim to make the CAP scheme more responsive to current and future challenges such as climate change or generational renewal, while continuing to support European farmers for a sustainable and competitive agricultural sector.

Current proposals outlined by the European Commission set high ambitions on environmental and climate change. Mandatory requirements include:

- preserving carbon-rich soils through protection of wetlands and peatlands;
- obligatory nutrient management tool to improve water quality, reduce ammonia and nitrous oxide levels;
- crop rotation instead of crop diversification.

These three mandatory requirements present clear opportunities for linking the reformed CAP payments to various NWRM which fit these criteria. NWRM which could be considered for linkages with the reformed CAP include:

- Re-wetting organic soils
- Buffers & hedges
- Land management practices
- Wetlands & ponds
- Engineered ditches

There are also many other NWRM which could also be tied to the CAP payment. These efforts could be supplemented with complimentary agri-environmental schemes with bonus payments for high benefit measures (similar to GLAS).

https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en

Farming for Nature
Farming for Nature is an independent, not-for-profit initiative which was established in 2018 and aims to support high nature value farming in Ireland.

This initiative stemmed from work carried out with farmers in the Burren, which is a particularly sensitive environment. The project sought to provide the resources and encouragement to enable farmers to act as active stewards of the environment and be recognised for their efforts.

The network has also developed guidance and holds farm walks and events, as well as promoting other initiatives and technical innovations taking place in Ireland today, for example the locally-led ‘European Innovation Partnerships’ and ‘Results-based’ Agri-environmental

programmes. Furthermore, the guidance includes information on NWRM such as hedges, buffer strips, wetlands, ponds and riparian planting. Similar initiatives could promote NWRMs, particularly as this project (in addition to projects such as Smart Farming (www.smartfarming.ie) and Digital Story Telling (https://www.carbery.com/digitalstorytelling/)) has demonstrated the value of peer networks in influencing behavioural change of farmers.

https://www.farmingfornature.ie/

Climate Action Fund
The Climate Action Fund was established under the National Development Plan 2018-2027 as part of Project Ireland 2040. The fund will support initiatives that contribute to the achievement of Ireland's climate and energy targets in a cost effective manner.

The Fund will also seek to facilitate projects that contribute to other Government policy priorities including:

- Supporting innovation and capacity building towards the development of climate change solutions capable of being scaled and delivering benefits beyond a once-off impact;
- Generating wider socio-economic benefits such as job creation, air quality improvements, reduction in fuel poverty, biodiversity and community resilience and development.

The Department of Communications, Climate Action and Environment has responsibility for implementing the fund, which will have an allocation of at least €500 million over the period to 2027.

https://www.dccae.gov.ie/en-ie/climate-action/topics/climate-action-fund/Pages/default.aspx

Carbon credits
Carbon credits are a way of allowing carbon producers to offset their emissions by purchasing carbon credits. This type of approach has not been implemented to date in the agricultural sector. There is potential to link such a scheme to NWRMs such as rewetting peatlands, organic soils, agroforestry, etc.

4.3 Urban

NWRM in urban settings in Ireland have typically been implemented as part of new development in the form of Sustainable Urban Drainage Systems (SuDS). The re-landscaping of green spaces and parks to incorporate NWRM and community based projects that seek to create amenity areas while also providing environmental benefit are another potential implementation route.

4.3.1 Existing measures, schemes and programmes

SuDS
In accordance with the Guidelines on the Planning System and Flood Risk Management (DECLG/OPW, 2009), planning authorities should seek to reduce the extent of hard surfacing and paving and require the use of sustainable drainage techniques to reduce the potential impact of development on flood risk downstream.

Flood Relief Schemes
Through the National Catchment Flood Risk Assessment and Management (CFRAM) programme, the OPW have 29 published river basin district scale Flood Risk Management Plans that have proposed the progression of 118 flood relief schemes. The Government has

committed almost €1bn for the implementation of these and other ongoing flood relief schemes as part of the National Development Plan 2018-2027.

The OPW are currently progressing over 90 flood relief schemes. The first in a five-stage process to deliver a flood relief scheme is to carry out scheme development and design, building upon the work already carried out in the CFRAM Programme. During this phase, the scheme designers are required to carry out a NWRM feasibility assessment. This assessment will look at the feasibility of NWRM to form part of the flood relief scheme and at the potential to achieve co-benefits.

The progression of these flood relief schemes is an opportunity for the implementation of NWRM to complement traditional engineering solutions.

Minor Flood Mitigation Works and Coastal Protection Scheme
The Minor Flood Mitigation Works and Coastal Protection Scheme (the 'Minor Works Scheme') is an administrative scheme introduced in 2009 and operated by the OPW under its general powers and functions to provide funding to local authorities to enable the local authorities, to address qualifying local flood problems with local solutions. Under the scheme, applications from local authorities are considered for projects that are estimated to cost up to €750,000 in each instance. Funding of up to 90% of the cost is available for approved projects, with the balance being funded by the local authority concerned. The Minor Works Scheme is available for funding flood relief projects that may include a NWRM function, provided they meet the prescribed Scheme criteria.

4.3.2 Future opportunities

SuDS
As detailed above the Guidelines on the Planning System and Flood Risk Management make it a requirement for planning authorities to seek to implement SuDS. Future local authority Development Plans offer the opportunity for these requirements to be strengthened. As per the Greater Dublin area, a policy could be introduced requiring that '*SuDS will be used, with the onus of responsibility with the developer to provide SuDS measures to the Councils' satisfaction, or to demonstrate that SuDS cannot be provided or is not applicable'*. Such a policy could be supported by the adoption of national guidelines on the implementation of SuDS.

4.4 River Restoration

The important role that hydromorphology, and in turn, river restoration play in catchment management is becoming increasingly acknowledged. NWRM can be seen as a subset of restoration measures. This subset can especially facilitate the recovery of natural hydromorphological processes, allow for a holistic catchment scale approach and provide multiple benefits – important attributes when restoring waterbodies. There is currently no national framework in place for river restoration. Any such works are mostly piecemeal and carried out on an ad-hoc basis. At present, river restoration or fisheries enhancement works are carried out through Inland Fisheries Ireland (IFI), local community groups, river trusts or angling groups, whereas funding is mainly sourced by IFI programmes and community funds.

After the success of the river trusts based in the UK, there has been a number of river trusts developed in Ireland (at present, 17 on the island of Ireland). One river trust in particular, the Inishowen Rivers Trust, has been working with the local community promoting NWRM. The trust is leading a pilot study, with the help of Trinity College Dublin, identifying opportunities for natural flood management in the area. The study ('*Natural Water Retention Measures in Inishowen – Community Engagement and Development of Strategic Plan*') is funded by an OPW grant. See https://www.catchments.ie/slow-the-flow-natural-flood-management-in-

inishowen/ for more information. The Inishowen Rivers Trust demonstrates how such measures, depending on the setting, can be considered by similar groups.

Existing programmes already in place which are utilising NWRM, either directly or indirectly, are described below. As funding structures are in place, there are opportunities to further promote the implementation of these measures, particularly given the multiple benefits that can be gained. Future opportunities for funding of NWRM through other programmes are also discussed in the section following.

4.4.1 Existing measures, schemes and programmes

Flood Relief Schemes
As highlighted in Section 4.3 with regards to urban flood protection schemes, there is an opportunity for the uptake of NWRM when implementing the flood relief schemes proposed for progression in the Flood Risk Management Plans. For recently commissioned Flood Relief Schemes; mapping is required to identify potential opportunities for NWRM implementation. As there is an existing budget within this programme to implement flood protection measures, an NWRM opportunity mapping requirement is already in place and with the multiple benefits for flooding and biodiversity that come with these measures, there is an opportunity for the uptake of NWRM (alongside hard engineering options when necessary) within these schemes.

Such NWRM that could be considered under the capital flood relief programme include:

- *Basin and ponds;*
- *Wetland restoration and management;*
- *Floodplain restoration and management;*
- *Re-meandering;*
- *Restoration and reconnection of seasonal streams;*
- *Reconnection of oxbow lakes and similar features;*
- *Removal of dams and other longitudinal barriers;*
- *Natural bank stabilisation;*
- *Elimination of riverbank protection.*

LAWPRO community fund
The Community Water Development Fund aims to support communities in progressing water related projects and initiatives, delivering benefits locally whilst also helping to meet the objectives of the River Basin Management Plan for Ireland and the wider EU Water Framework Directive. It is open to all community and voluntary groups in the Republic of Ireland to assist in the protection and management of water quality, both locally and in the wider catchment. The fund is administered by the Local Authority Waters Programme on behalf of the Department of Housing, Planning and Local Government (watersandcommunties.ie).

Capital projects can include restoration or NWRM. If appropriate for the setting, relevant stakeholders are engaged, and multiple benefits will be provided, NWRM should be encouraged and funded. Specific guidance in this area has been identified as a gap and now forms a recommendation of this report.

Environmental River Enhancement programme
The Environmental River Enhancement Programme (EREP) commenced in 2008 and is funded by the OPW and managed by IFI. The programme focuses on fisheries enhancement of drained rivers (*i.e*. within the arterial drained schemes), with an emphasis on multiple species with particular reference to rare and cryptic species such as lamprey and crayfish. The programme promotes measures which have the potential to provide multiple benefits and enhance biodiversity, with the aim being to effectively mitigate against the ecological and hydromorphological impacts caused by drainage. Typical construction details and good practice approach towards river enhancement are embodied in the OPW's Environmental

Guidance: Drainage Maintenance and Construction, supported by other publications to expand knowledge such as an OPW and IFI video on river enhancement. The EREP embodies a win-win scenario where the labour and machinery resource are maximised by utilising the resource in partnership with other environmental authorities to complete environmental improvements to river corridors where the works overlap with statutory arterial drainage maintenance. As more integrated catchment management projects are developed in the future, where these overlap with arterial drainage activities, there is potential to expand this win-win model by multiple authorities combining their resources and skill sets.

The focus of the OPW and IFI activities continues to evolve and more recently include evaluation of re-wetting cut off meanders through to hydromorphological improvements by re-evaluation of gravel trap structures, a number of which are present on arterial drainage channels. There could be an opportunity to further evolve this programme to support other environmental outcomes. In recent years, EREP have trialled measures such as natural bank stabilisation methods (pinning trees into the river bank to reduce erosion) and stream bed re-naturalisation (natural timber deflectors to assist stream bed recovery). A 2019 EREP report highlighted that a desk study has been completed on the feasibility of re-meandering in some OPW channels, with recommendations for future implementation.

National Barrier Programme
IFI are leading a programme that involves identifying and assessing the impact of barriers (e.g. weirs, bridge aprons, culverts), with a view to developing a national inventory of barriers. Barriers will be ranked according to the risk they pose to fish migration. The inventory will allow for a prioritised approach to be adopted when removing these barriers. A joint IFI and OPW project is piloting the development of generic barrier improvement designs for small barriers, with the objective of developing a simplified process for improvement of a large series of small barriers overlapping with arterially drainage channels nationally.

While barrier removal may not change the flood risk, the presence of some structures can exacerbate flooding. Future consideration should be given as to how barriers can promote natural flood management when prioritising barrier removal.

4.4.2 Future opportunities

River restoration guidance and funding
Over the last few years, river restoration techniques have evolved as our understanding of the science has progressed. With that in mind, a best practice guidance for river restoration, including NWRM, is now required for the Irish setting. As highlighted above, there is no national framework for river restoration.

For a holistic, catchment-based, multi-stakeholder approach to be taken, that will allow for the implementation of measures and support multiple environmental objectives, such a framework needs to be developed. Adopting an approach, as outlined in Section 2.1, could allow for an integrated approach to funding, technical support, implementation and monitoring.

Research funds
Funding research, notably research targeting the use of demonstration sites, can provide further learnings as to what NWRM types are effective in different landscape settings, the magnitude and frequency of floods that can be mitigated and where they should be implemented.

Current Irish research focusing on NWRM includes, for example, the EPA SLOWATERS project (co-funded with OPW). Further research on NWRM could also be possible through the European Innovation Partnership Scheme (EIPS).

Corporate social responsibility

There could be an opportunity to develop a stewardship type scheme that allows the private sector to work with community groups and river trusts to deliver river restoration/NWRM projects. An example of such a scheme can be seen in the UK, the Catchment Based Approach Water Stewardship service (https://catchmentbasedapproach.org/learn/water-stewardship/). This service supports businesses to get involved in projects, contributing to the delivery of sustainable solutions for the water environment. In Ireland, there is the recently developed Corporate Water Stewardship Programme (https://www.central-solutions.com/sustainability-programmes/water-stewardship/).

National Lottery Good Cause fund
Grants for projects targeting the natural environment is available through this funding source (community type projects are part funded by the Department of Housing, Planning and Local Government). With regard to funding restoration/NWRM projects, this funding stream may be currently under-utilised.

4.5 Peat

Peatlands form an integral part of our landscape and healthy peatland ecosystems provide multiple benefits including water retention, maintaining important habitat with associated biodiversity, and carbon sequestration. The key role that peatlands have in tackling climate change has become increasingly prominent over recent years.

There is a long history of peatland drainage and extraction in Ireland but there are now several schemes planned or underway to rehabilitate and rewet these areas that are consistent with the concept of NWRM. These include rewetting of 40,000 ha per annum in the Climate Action Plan, rehabilitation of Bord na Mona peatlands to support a just transition in the midlands, and several LIFE funded projects. These projects all offer opportunities for strategic implementation of NWRM.

4.5.1 Existing measures, schemes and programmes

LAWPRO community fund
As outlined in Section 4.4 above the LAWPRO community fund provides a funding mechanism for river restoration including NWRM. Many rivers which are in need of restoration are located within peatland areas and could benefit from specific measures.

Flood Relief Schemes
NWRM have potential for incorporation into the overall solution for implementing flood protection. Opportunities for measures in peatlands may be limited due to the typically urban nature of the flood relief scheme projects, however the design process for projects, which requires opportunity mapping, may identify areas in peatlands whereby measures can be incorporated as part of the final proposals.

LIFE programme
The EU LIFE Programme provides funding opportunities for the support of Environment, Nature Conservation and Climate Action projects throughout the EU. The Living Bog – Raised Bog Restoration Project (LIFE14 NAT/IE/000032) is currently underway at 12 bogs across 7 counties under EU LIFE Nature & Biodiversity funding. The project is restoring Active Raised Bog in Ireland's SAC Network between 2016 – 2020. 'The Living Bog' project aims to improve over 2,600 hectares of important raised bog habitat restoring habitat for hundreds of plants and species. Funding for this project is due to end this year and as such many of the sites will need to transition to care and maintenance going forward with significantly reduced resources.

http://raisedbogs.ie/

4.5.2 Future opportunities

The flood relief schemes proposed in the Flood Risk Management Plans offer potential for NWRM implementation within peatlands which form part of the study area for schemes to form part of the overall solution for flood alleviation. This form of project-based implementation could significantly benefit from an example catchment to identify catchment-based solutions beyond the protection of life and property.

Climate adaptation fund

The Climate Action Plan (2019) has identified emissions reduction by way of re-wetting at least 40,000 ha of grasslands on drained organic soils, yielding up to an additional 0.44 Mt in sequestered CO_2 annually between 2021 and 2030 as a target. The plan states that this work will inform the development of agri-environment policies, including the new CAP. These measures are cross-cutting with the agricultural setting but are primarily aimed at peatland restoration. Even though the goal is for climate change benefits, this form of NWRM will also deliver multiple benefits particularly for water quality and biodiversity.

https://www.dccae.gov.ie/en-ie/climate-action/topics/climate-action-plan/Pages/climate-action.aspx

In addition, The Climate Action Fund has an allocation of €500 million over the period to 2027 (see Section 4.2 for details). NWRM in peatland areas can potentially access this funding again delivering multiple benefits beyond the targeted climate change targets.
https://www.dccae.gov.ie/en-ie/climate-action/topics/climate-action-fund/Pages/default.aspx

2020 national protected raised-bog restoration programme

The national protected raised bog restoration programme links directly to an action in the Climate Action Plan (2019) for the Department of Culture, Heritage and the Gaeltacht to restore/rewet approximately 22,107 hectares of protected raised bog. An allocation of €5m had been set aside in Budget 2020, from the Carbon Tax Fund, for this programme and Bord na Mona have recently been awarded the contract to project manage this work.

Bord Na Mona Bog enhanced rehabilitation plan

Bord na Mona are in the process of ceasing works at almost half of their peatland sites (33,000ha) and have plans to rehabilitate and restore these sites using an enhanced suite of measures. If successful, these works would be funded using supports for just transition in the midlands and the Climate Action Fund (subject to successful application). This enhanced rehabilitation will essentially take the form of NWRM and presents an opportunity for linkage with other plans (such as the Climate Action Plan) to achieve multiple benefits across multiple schemes to deliver broad results at the catchment scale. Bord na Mona are currently developing a Methodology Paper for Enhanced Decommission, Rehabilitation and Restoration on Bord na Móna peatlands and any specific measures for peatland rehabilitation (peat NWRM) will align with the final methodologies outlined within this paper.

5 Conclusion & Recommendations

NWRM provide a means to not only reduce flood risk and improve water quality but to address many other associated national challenges including tackling climate change, restoring habitat loss and increasing biodiversity, in an integrated way. The multiple benefits that can be accrued from the use of NWRM cuts across government policy and presents an opportunity to join up and integrate policy interventions at a range of scales.

Many existing schemes and policy documents already include implementation of NWRM either in part, or in full, and would only require minor revisions to provide for more targeted implementation, or to broaden the scope to incorporate the wider multiple benefits. For example, urban development in the Greater Dublin Region already includes for NWRM within new developments under the Greater Dublin Strategic Drainage Study.

The possible funding mechanisms and the means of implementing NWRM at the national level should consider opportunities to maximise the benefits from existing measures and schemes. Some examples include:

- The Government has committed to the rewetting of 40,000 ha of organic soils per annum under the Climate Action Plan. This is a natural water retention measure and it provides an opportunity for significant synergies for improving water quality, biodiversity and natural flood mitigation, as well as climate. A multi-sectoral approach should be adopted to identifying these areas for rewetting so that these multiple benefits can be achieved where possible and suitable taking account of other objectives.
- Teagasc have a drainage guidance manual for on farm drainage, and there is research ongoing into ditches and roads as pollutant transfer pathways. Opportunities should be sought to turn ditches into simple landscape mitigation features (e.g. by turning them into a series of linked settling ponds that can move high flows but retain sediment). This is a form of the peak flow control structures measure.
- The GLAS agri-environmental scheme currently has priority access for farmers who chose to install riparian buffer margins in high status waters. This is an example of a natural water retention measure. In the next iteration of the GLAS there is potential to target the scheme further to add additional NWRM benefits. For example, there could be potential to expand priority access for farmers to change their management practices in critical source areas for diffuse phosphorus loss. These areas are typically poorly draining and are also high risk for loss of sediment and runoff, so this would also be considered as a natural water retention measure achieving multiple benefits.
- The CAP strategic plan could provide a key mechanism for wide scale implementation of NWRM in agricultural settings through the eco-schemes and agri-environmental schemes. This approach maximises the added benefits accruing for climate change and emissions from NWRM.
- Continued investment in the Native Woodland Scheme (and other afforestation schemes) with NWRM incorporated into the eligibility requirements for funding will provide a means for achieving multiple benefits for habitats, biodiversity, water quality and flooding.
- Opportunities also under Urban Regeneration Development Fund as administered under Central Government.

Recommendation: At the national level, utilise and/or enhance existing policies and measures to achieve maximum multiple benefits from NWRM within existing funding mechanisms.

A targeted project-based catchment scale approach is another means whereby NWRM can be implemented. A particular problem area is identified, and measures are designed and then implemented to achieve a particular objective. This approach has the benefit of targeted actions, but there may be challenges in getting the right implementation process and budget in place. This approach may require coordination and discrete funding mechanisms which are specifically targeted for NWRM and their associated multiple benefits.

An integrated catchment approach looks beyond the scope of localised projects and seeks measures throughout the catchment to achieve the maximum benefit. A means of justifying such a fund to support the project-based approach could come through the development of a pilot project for the use of NWRM underpinned by the integrated catchment management approach. The pilot could be based on a well-studied catchment (such as the Suir) or could be selected to line up with existing requirements such as PAAs under the WFD or a proposed flood relief scheme. NIEA are also interested in this kind of an approach and there is potential to develop a joint application for cross border Peace Plus funding to implement a pilot catchment project. Such a pilot would provide the means to prove the multiple benefits that could accrue from such an approach. The following steps would be taken within the pilot catchment:

- Undertake opportunity mapping within a catchment to identify all potential areas where NWRM could be implemented to achieve multiple benefits Identifying existing projects within the catchment and link the pilot with these (e.g. PAAs or proposed flood relief scheme, Irish Water drinking water protection projects);
- Propose a suite of measures across the catchment (carry out hydromorphological assessments, including modelling, where appropriate, particularly for identifying river restoration type measures);
- Model/quantify what they would achieve in terms of benefits, and discuss mechanisms for implementation with all relevant stakeholders within the catchment;
- Develop a methodology to evaluate the benefits of NWRM to achieve each of their core objectives in water quality improvement, flood risk reduction, and habitat creation;
- Make recommendations for how such an approach might be implemented nationally including any additional funding streams that may be required for such widescale implementation;
- Make recommendations on the role that a multi-agency group under NTIG may have in co-ordinating efforts through local scale projects.

To fully explore the multiple benefits of NWRM, the pilot study catchment should also include WFD PAAs and areas where biodiversity enhancements are sought. Given that the OPW Project Brief for all new flood relief schemes includes an assessment of the feasibility of NWRM as part of the optioneering stage including opportunity mapping, there may be an opportunity to develop the pilot in conjunction with or to inform an OPW flood relief scheme.

Recommendation: At the catchment level, conduct a pilot study to assess the feasibility and cost-benefit of implementing NWRM at the catchment scale and recommend strategies for their implementation. Use the learnings gained as a springboard to roll out implementation nationally.

Local scale projects implemented by private individuals and community groups would provide another means of implementation for NWRM in Ireland. These users/projects will require support and guidance on how best to plan, design and construct such features. This is

particularly relevant to ensure a common approach and to avoid poorly planned projects from having unintended consequences. Simple and easy to follow guidance could be developed to assist in the delivery of such local scale projects in particular settings.

The role that a multi-agency group under NTIG may have in co-ordinating efforts through local scale projects is to be informed by the recommendations of the recommended pilot study.

Recommendation: At the local level, prepare a simple best practice guidance document for Ireland to help community groups undertake local scale

There is a wide body of research that shows that slowing the flow moving through the landscape, through the introduction of natural water retention measures, provides multiple environmental benefits for water quality, biodiversity, flood mitigation, and reduction of climate emissions – see supplementary document "*NWRM Evidence and Opportunities for use in Ireland*". The overarching principals behind NWRM will be challenging to implement as there has been decades of historical practice in Ireland of draining lands to make them more productive for agricultural, forestry, urban or other human uses, and for the purposes of moving water more quickly away from certain lands, often to the detriment of other lands further downstream. This philosophy has not been without significant environmental cost – for example, the WFD 2nd cycle characterisation assessment estimated that c.24% of At Risk river water bodies nationally are in a degraded ecological condition due to channel maintenance and land drainage.

Given the need to balance both the maintenance of drainage for defending land and property, with positive environmental outcomes, the Joint Oireachtas Committee on Climate Action recently called for the development of a national land use strategy or plan. This could be a useful mechanism for considering how best to balance drainage with rewetting and managing lands for multiple environmental benefits. It is likely that a national land use strategy would have the integrated catchment management approach at its core.

One of the principles at the heart of this strategy should be the need to look for opportunities in the landscape where we can reduce or cease drainage activities, allow areas to naturally rewet and flood, and safely slow the flow. Rehabilitating and restoring rivers is in essence the reintroduction of NWRM to the landscape.

Recommendation: Consideration should be given to development of a land use strategy or plan for Ireland that takes account of the principles of slowing the flow to achieve multiple environmental benefits. Similarly, any national river restoration guidance for Ireland should include the findings of this studv.

The Department of Housing, Planning and Local Government have commissioned a review of the national legislation concerning drainage which is an important first step. Work from the proposed pilot project will feed into this current review of drainage, particularly given that NWRM can and should form an integral part of any national drainage policy or strategy.

Recommendation: Provide input to any future national drainage policy to incorporate NWRM as an integral part of the overall strategy.

There are several research and other projects currently underway in Ireland that are looking at the implementation of NWRM in agricultural and urban lands. These include SloWaters,

Camac River Flood Alleviation Scheme (and the separate longer-term Camac River Restoration Project) and the Inishowen Project.

In addition, the successful implementation of the above recommendations will require on-going co-ordination and guidance. It is recommended that there is a role for a multi-agency group under the NTIG on an on-going basis to support implementation of natural water retention principles across various policy domains, encourage and support implementation of research and project-based work, and develop and implement training resources for a range of users.

Recommendation: A multiagency group under the NTIG to continue a forum to co-ordinate efforts for implementation of NWRM.

The final recommendation of the Working Group relates to the future name and branding of this suite of measures. The Working Group collectively recommended that the term "Natural Water Retention Measures (NWRM)" does not accurately represent the full suite of measures and multiple benefits which arise from same. The group is therefore recommending changing the name of this suite of measures to "***Nature Based Catchment Management Solution***s". In addition, the following tag line is proposed: "***Nature Based Catchment Management Solutions – working with natural processes for water quality, climate resilience, biodiversity and flooding***".

Recommendation: Rebrand NWRM as: "*Nature Based Catchment Management Solutions*".

Appendix 1: Plans and policies identified at the workshop

- Policies, plans or guidelines that are directed or associated with NWRM as identified by the working group during the Workshop held on 02/12/2019

Agriculture

- River Basin Management Plans
- Common Agricultural Policy
- Green, Low-Carbon, Agri-Environment Scheme (GLAS)
- Nitrates Directive
- Blue Dot Programme
- Agroforestry (Afforestation Scheme, Funded under the Forestry Programme 2014 – 2020)
- Origin Green
- OPW Drainage Maintenance Programme
- Agricultural Sustainability Support and Advice Programme
- Flood Relief Schemes
- SAC / SPA
- High Nature Value Farming
- Agricultural college curriculum
- Contractor's guidelines
- Farm Roadways Specification
    - Nitrates Regulations
- Nitrates Action Programme
    - Cattle access
    - Soil management
    - Improve Riparian Zone
- GLAS
    - Buffer Strips
- European Innovation Partnerships
- Smart Buffer
- SLOWWATER
- Good Agricultural Practices (GAP)
- Climate Adaptation – Sectorial Plans
- Pilot drinking water source protection project
    - Source to tap project

Flood relief scheme projects underway as a possibility

Forestry

- Restoration of Blanket Bog measure
- EU Life 1,000 Ha – Bog restoration
- Restructuring commercial for regeneration
    - Coillte Nature
- Restructuring of commercial in Fresh Water Pearl Mussel catchments
- Climate Change – Sectorial Adaptation Plans
- Bio-forestry Plans – continuous forestry cover
- COFORD (Council for Forest Research and Development) – Guidance policies & procedures
- Forest Service - Guidance policies & procedures
- County Development Plans
- River Basin Management Plans
- Regional Economic Spatial Plans
- Drinking Water Safety Plans – National Federation of Group Water Schemes

- CAP – Grant
- Transport Ireland – forest beside motorway
- Flood Risk Management Plans
- WFD – include priority substances e.g. pesticides from forests
- Woodlands for water – Department Agriculture Food and Marine
- Forests and Water Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 - Department Agriculture Food and Marine
- Felling and Reforestation Policy - Department Agriculture Food and Marine
- Native Woodland Scheme
- Agroforestry grant scheme
- Environmental requirements for afforestation
- Neighbourhood woodland scheme

Urban

- Flood Risk Management Guidelines for LA Planners (DHPLG/OPW)
- LA development plans requirements for SUDS
- Transport Ireland road runoff guidelines
- GAP – Guidelines for what ordinary people can do
    - DCC / National Flood Forum engagement
- Dublin City Blue-Green infrastructure policy
- GAP – guidelines for LAs to protect/restore wetlands
    - Zoning in development plans
    - WFD – planning guidelines
- Building regulations
- GAP – National policy on SUDS
- IFI guidelines for development along urban waterways
- OPW – SuDS potential maps
- Greenways
- Climate Change Adaptation Plans
- Greater Dublin Strategic Drainage Study
- Drainage Area Plans (Irish Water)
- WFD – Bathing Water reductions in CSOS
- IW Capital Investment
- SUDS Manual
- Storm-water overflow policy DHPLG to be developed

Hydromorphology

- National peatlands strategy (best practice drain blocking guidelines)
- Climate adaptation Plan
- LA Biodiversity Plans
- Future physical modification regulations
- Flood relief scheme and WFD / Floods Planning Guidelines
- Abstraction (regs)
- Development Plans – national / regional / county / SEA
- Land use / CAP / Harvest 2020

Peat

- The National Raised Bog Special Areas of Conservation (SACs) Management Plan 2017 - 2022 (Department of Arts, Heritage and the Gaeltacht, 2017),
- The National Peatland Strategy (Department of Arts, Heritage and the Gaeltacht, 2015),
- The National Biodiversity Action Plan (National Parks and Wildlife Service 2017) and The
- National Climate Action Plan (Department of Communications, Climate Action and Environment 2019).
- Bord na Mona Enhanced Peatlands Rehabilitation Scheme
- 2020 Just Transition Fund
- Methodology Paper for the approval and allocation of works & interventions to deliver additional Enhanced Decommission, Rehabilitation and Restoration on Bord na Móna peatland

Appendix 2 - NWRM Working Group Membership

Public body	
DHPLG	Donal Grant
EPA Catchments	Jenny Deakin
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	Keiron Phillips
	Emma Quinlan
EPA EMAU	Shane O'Boyle
	Wayne Trodd
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OPW	Conor Galvin
	Fergal Kelly
	Nathy Gilligan
	Mark Adamson
	Wolfram Schluter
NPWS	Shane Regan
	Aine O'Connor
IFI	Ciara O'Leary
Local Authorities Water Programme	Carol McCarthy
	Fran Igoe
Local Authorities	Marian Healy (Offaly CoCo)
	Neil Higgins (DCC)
	Mary-Liz Walshe (DCC)
DAFM	Bernard Harris
	Claire Casey
Forest Service	Kevin Collins
	Ken Bucke
GSI	Taly Hunter-Williams
Coillte	Philip O'Dea
Bord na Mona	Enda McDonagh
Teagasc	Noel Meehan
Irish Water	Claire Coleman/Lorraine Gaston
	Angela Ryan/Mairead Conlon

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