

Natural Flood Management Review

Final Report

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This report describes work commissioned by Welsh Government, by an instruction dated Monday 28 February 2022. The Client's representative for the contract was Dickon Wells of Welsh Government. Mary Baldwin, Gwyn Jones, Tim Jones, and Eleanor Pearson of JBA Consulting carried out this work.

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This report includes contributions from Welsh Government, Natural Resources Wales, multiple local authorities, and key stakeholders (including the Project Advisory Group) and third-party organisations. JBA sincerely thank the stakeholders consulted for their contributions to the project.

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Abbreviations

CRW.....	Celebrating Rural Wales
GIS.....	Geographic Information System
NFM.....	Natural Flood Management
NRW.....	Natural Resources Wales
RMAs	Risk Management Authorities
WINS.....	Welsh Information for Nature Based Solutions
WFD.....	Water Framework Directive
WwNP	Working with Natural Processes

Definitions

Natural Flood Management (NFM) is a process whereby measures are put in place that work with the natural environment to store, slow and infiltrate flood waters to reduce flood risk (Environment Agency, 2018).

1 Project introduction

1.1 Background to natural flood management

Working with natural processes (WwNP) aims to protect, restore, and emulate the natural functions of catchments, floodplains, rivers and the coast (Environment Agency, 2018). Many different terms are used to describe WwNP, such as natural water retention measures, engineering with nature or catchment-based flood management. This report and project focusses on measures designed to store, slow and infiltrate flood waters to reduce flood risk, collectively defined by the term 'Natural Flood Management' (NFM).

NFM comprises of many different measures and can be implemented in urban and rural areas, and on rivers, estuaries, and coasts as depicted in Figure 1-1. When used appropriately, these measures not only have the potential to reduce flood risk, but also bring a wealth of wider environmental, biodiversity and societal benefits such as improved water quality, habitat creation, and health and wellbeing enhancements. However, the approach may also be limited due to a range of barriers, and there is uncertainty regarding the performance of NFM measures during extreme events (Environment Agency, 2017).

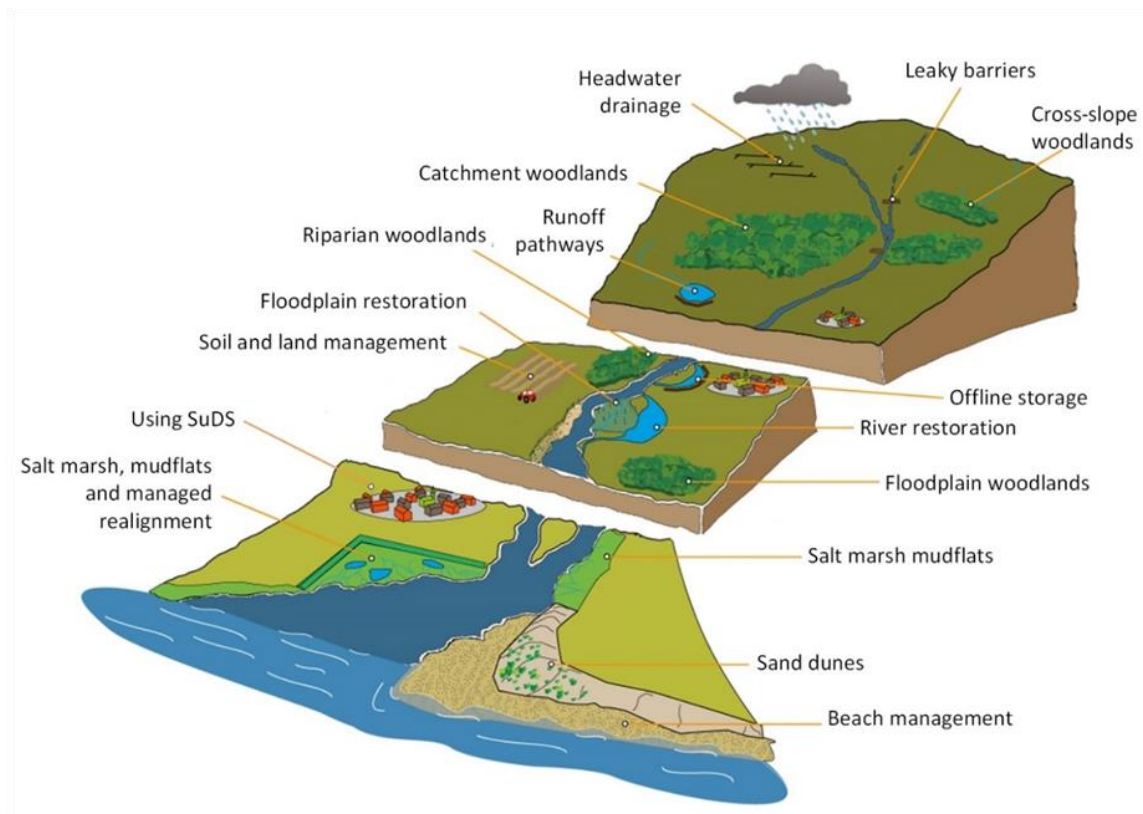


Figure 1-1 Working with Natural Processes - from source to sea (Source: Environment Agency, 2018)

1.2 Policy context

Natural resource management such as NFM is a key component of the Environment (Wales) Act (2016), the Wellbeing of Future Generations (Wales) Act (2015), as well as the flood and coastal risk management approach as set out by Welsh Government in the national Strategy for Flood and Coastal Erosion Risk Management (Welsh Government, 2020).

The published Programme for Government includes commitments to “deliver nature-based flood management in all major river catchments to expand wetland and woodland habitats” and “fund additional flood protection for more than 45,000 homes”. A further commitment to “establish a targeted scheme to support restoration of seagrass and saltmarsh habitats along our coastline” will also benefit from wider NFM work (Welsh Government, 2021a).

1.3 Role of the project

NFM is integral to building ecosystem resilience and ensuring protection of existing valuable natural resource assets in Wales. There has been substantial research and investment in NFM in recent years in Wales and across the rest of the UK; however, this has been conducted under multiple different programmes with different objectives. Consequently, there is now a need to collate, evaluate, and build on this information to create a coordinated national approach to NFM in Wales.

JBA Consulting (JBA) were commissioned by Welsh Government to undertake a review of NFM across Wales. This review project (‘the Project’) aims to help bring forward innovative catchment based NFM ideas which reduce flood risk as well as bring wider benefits for people and wildlife, helping to restore habitats, improve water quality and improving catchments’ resilience to the impacts of climate change.

1.4 Aims and objectives

The aim of this project was to evaluate, map, and prioritise catchments with NFM opportunities and recommend an approach to best deliver these opportunities.

The objectives to achieve this aim were to:

1. Prepare a catchment level NFM opportunities map to show a spatial prioritisation
2. Develop a roadmap for establishing a recommended delivery approach

1.5 Methodology

To achieve the above aims and objectives, the project was split into two parts: Part A and Part B.

- **Part A** focused on scoping catchments suitable for NFM.
- **Part B** sought to review potential methodologies for funding and delivering NFM across Wales and recommend an approach to best deliver the works identified in Part A and meet the programme for government commitments.

A more detailed overview of the methodologies can be found in Sections 2 and 3.

1.6 Purpose of this report

This overarching report seeks to summarise the findings, outputs and recommendations from this project, bringing together the two halves of the project to provide a picture of:

- NFM delivery in Wales to date
- Opportunities for NFM delivery going forward
- Recommendations of how best to deliver NFM

The report is structured as follows:

Project Introduction

Part A Summary

Introduction and approach

Status Report

Case Studies

Mapping NFM opportunity

Conclusion

Part B Summary

Introduction and approach

Stakeholder engagement approach

Summary of desk-based review findings

Delivery mechanism recommendations

Roadmap

Conclusion

Project Conclusions

2 Part A - Scoping NFM opportunities

To understand the baseline of current NFM delivery across Wales, a 'Status Report' was developed that sought to provide information regarding existing NFM projects (and wider environmental projects with NFM benefits) across Wales. Data to inform the Status Report was collected by undertaking a desk-based review and sending an information proforma to partners to complete.

The Status Report has been created in a Geographical Information System (GIS) format to allow for easy visualisation of the locations of NFM projects across the country. It is intended that this will be updated beyond the lifetime of this Project.

Using the information gathered for the Status Report, an analysis was undertaken to identify the following:

- Types of implemented and proposed NFM techniques
- Flooding types (e.g. coastal, pluvial, fluvial, groundwater)
- Approaches to quantifying flood alleviation and wider environmental benefits
- Monitoring and maintenance requirements
- Programme evaluation and funding mechanisms
- Key organisations and stakeholders
- Barriers and enablers to delivery
- Knowledge and information gaps

A summary report outlining the findings of the Status Report can be found in Appendix A. The GIS outputs are available from [DataMapWales](#).

To supplement the above, stakeholders were engaged in two workshops at the Celebrating Rural Wales (CRW) event between 9-10 June 2022. This event identified further information on the status of NFM projects in Wales, preference of NFM measures and key constraints. It is important to note the engagement conducted at the CRW event included a self-selected sample of around 25 people which is therefore likely to include some bias.

2.1 Summary of findings

This process identified 51 projects and 19 programmes as having been completed or ongoing in Wales since 2015. The Welsh Government's published Programme for Government includes commitments to "deliver nature-based flood management in all major river catchments to expand wetland and woodland habitats" - the spatial distribution of projects across the country is presented in Figure 2-1.

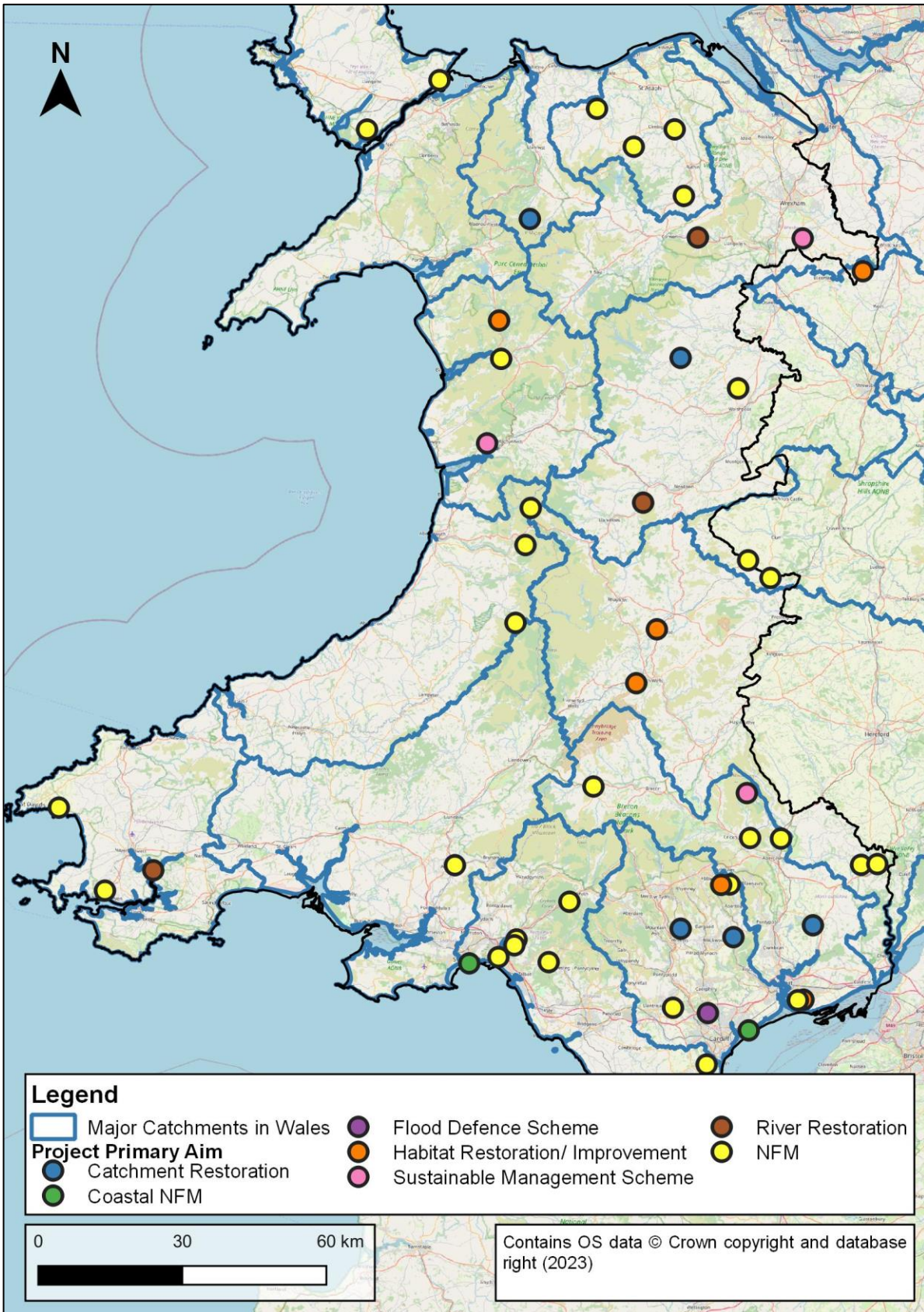


Figure 2-1 Locations and primary aims of NFM projects across Wales.

Project stage

The projects identified were found to be equally distributed across the different stages of project delivery. A greater number of projects, however, were identified as being ongoing and within the concept/feasibility or design/construction stage than the implemented/monitoring stage (Figure 2-2). This suggests NFM delivery to be recently increasing within Wales. To provide a well-rounded view of NFM in Wales, the assessment included projects within all stages on the project lifecycle, i.e. from those in the concept stage to those that have been fully implemented.

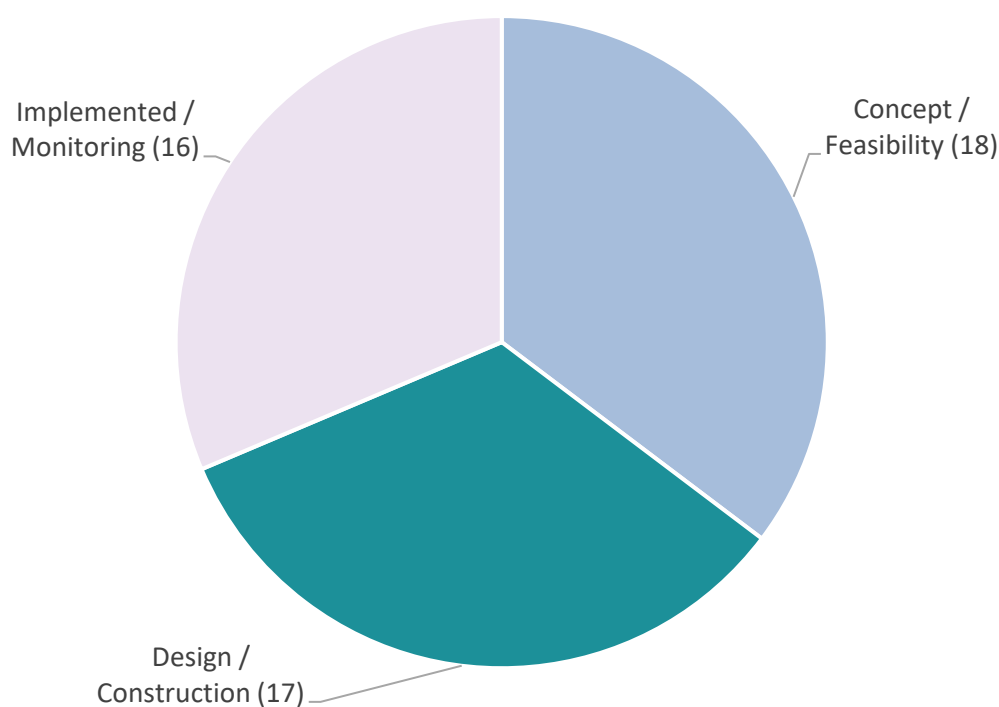


Figure 2-2 Summary of NFM projects within each project stage.

Implemented and proposed measures

A wide range of NFM measures have been used in Wales. Of these, leaky barriers and woodland/hedgerow planting were the measures implemented the most frequently (Figure 2-3). Tree and hedgerow planting were also popular techniques which bring multiple additional benefits, including considerable benefits to wildlife. Ponds and storage areas were cited in 11 of the projects but were not a popular choice amongst stakeholders at the CRW event, with some raising concerns over the need for impoundment licenses and concerns around removing high quality land from production. The engagement conducted at the CRW event indicated that soil and land management measures were the most preferred options amongst stakeholders and were viewed as being the 'least contentious' of NFM measures.

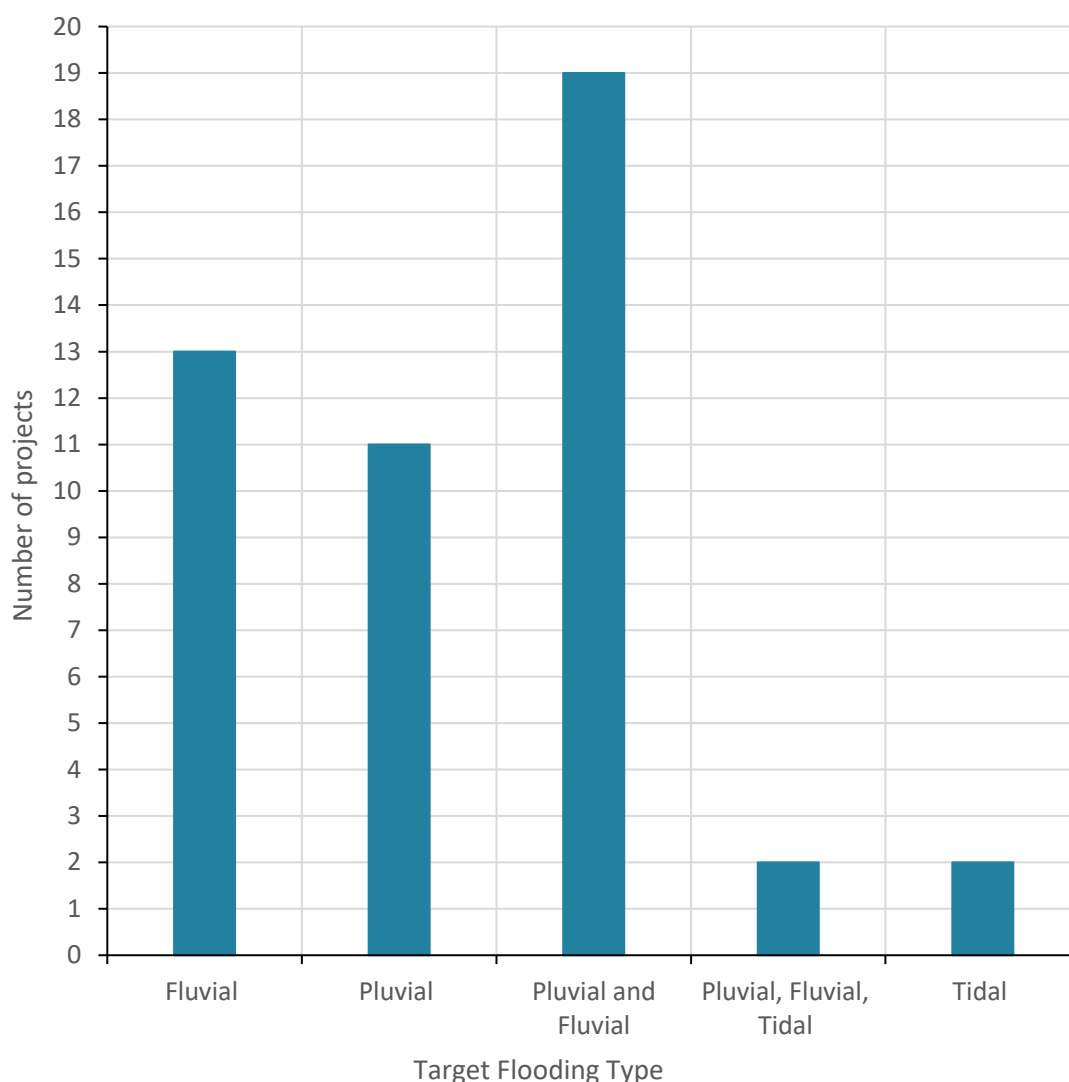


Figure 2-4 Target flooding type across all NFM projects discussed in Wales.

Quantifying flood and wider environmental benefits

Modelling is used most frequently in the early stages of the project, often to try to quantify the expected flood risk management benefits. There is, however, a general lack of quantified expected flood risk management benefits delivered by NFM, together with the associated detail regarding the modelling approaches used.

Reference to the use of local knowledge to understand the scale of flooding issues during project conceptualisation was often made, emphasising the importance of effective community and stakeholder engagement that draws on valuable local information to inform both the design and location of measures.

Amongst the projects studied, information regarding the wider environmental and societal benefits was often inferred from the known added benefits of the proposed NFM measures rather than calculated numerically. Almost half of the projects

reviewed did not provide detailed, quantified information regarding the proposed wider environmental benefits. The most cited wider environmental and societal benefits included biodiversity improvements and habitat creation.

Monitoring and maintenance requirements

Monitoring and maintenance are essential elements of NFM implementation and crucial in ensuring the continued success of any implemented NFM measures.

The proposal to monitor the requirement for maintenance after a significant rainfall or flood event was frequently included. The use of local stakeholders is also noted as a potential monitoring opportunity as public or landowners' reports, and anecdotal reports were commonly cited as opportunities to help monitor the continued success of implemented NFM techniques. Common monitoring methods included telemetry and river and/or rainfall gauging. The review highlighted that the responsibility of future monitoring is often unknown or not yet agreed. Legal liabilities were noted to add complexity to maintenance and monitoring programmes.

The review highlighted a lack of certainty regarding monitoring programmes and known quantified or reported flood risk management benefits. The benefits of including stakeholders, and in particular farmer-focused schemes, were consistently highlighted. Details of proposed monitoring were more evident within projects which had been implemented, suggesting that monitoring approaches are developed as projects progress rather than being outlined and agreed in the earlier stages. This can be on account of pre-scheme baseline data not being available and the lack of certainty around resources being available or guaranteed for post-scheme monitoring and maintenance for the likes of citizen science initiatives.

Natural flood management programmes

Programme objectives, drivers, and approach

The review identified 19 live and completed programmes. These programmes included those delivered by Welsh Government funding streams, NRW and non-governmental organisations.

Habitat restoration and creation was the most common primary objective (Figure 2-5) for the programmes. Many of the projects within them are expected to deliver flood risk management benefits in addition to habitat related benefits, on account of the types of measures delivered. There was, however, little information available to assess the extent of the flood risk management benefits and the effectiveness of different schemes and measures post implementation.

Policy and legislation act as key drivers to larger programmes, as seen by the Sustainable Management Scheme (SMS). The integration of NFM within the programmes varies significantly. A landscape scale approach was described in several of the programmes and extensive stakeholder engagement appears to be

another key characteristic of NFM programmes. There is a significant link between these two factors, as the scale of the programme increases, as does the number of stakeholders involved.

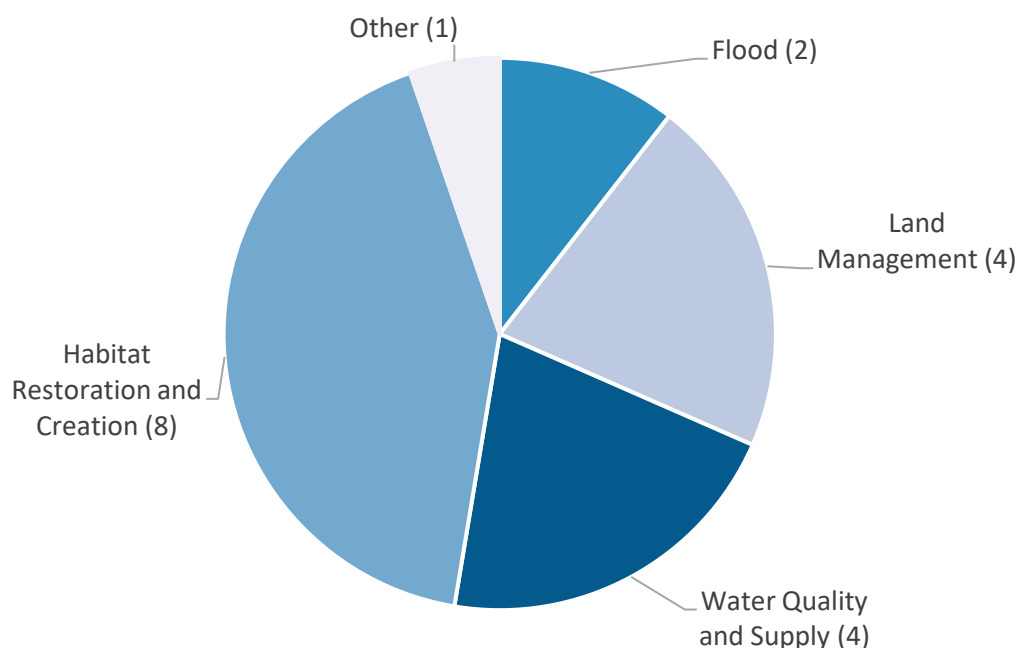


Figure 2-5 Summary of primary programme objectives.

Programme evaluation and funding mechanisms

Multiple methods of evaluating projects as part of programmes are used and are often closely linked to monitoring and maintenance requirements. Some methods highlighted include:

- 'Measure to Manage' approach (involving physical data collection which then feeds into an advice and discussion service to assist members of the programmes).
- Site inspections or assessments
- Existing assessment matrices or criteria (e.g. Water Framework Directive [WFD] status)
- Specific NFM assessment matrices which use a multi-criteria analysis considering multiple benefits, stakeholder engagement and flood risks benefits

Most funding mechanisms were administered by Welsh Government and NRW.

2.2 Case studies

The process of collating information for the Status Report also provided opportunity to create case studies of 4 key NFM projects in Wales as a means of disseminating lessons learned and best practice. Developed by the project delivery teams, they include:

- Brynau and Preswylfa
- Pennal 2050
- Upper Teme
- Winion Catchment

The case studies can be found in Appendix B and on the Welsh Government website.

2.3 Mapping NFM opportunities

Part A of the project sought to draw on the findings of the above review and prioritise Welsh catchments based on their suitability for NFM. New mapping based on the most recent science, spatial datasets, evidence and research was delivered to provide a dataset for organisations involved in delivering NFM to focus efforts in catchments where it is likely to be most effective in reducing flood risk.

NFM mapping in Wales, prior to this project, focused on the identification of potential opportunities for specific types of measures, such as woodland planting, runoff attenuation features and hedgerows. The two main sets of such maps were developed as part of the Working with Natural Processes Evidence Directory and the Welsh Information for nature-based solutions (WINS) System Cynorthwyo Cunllunio Adnoddau Naturiol (SCCAN) maps. The new prioritisation maps take the existing potential area maps and look to analyse the relative potential for NFM in catchments across Wales where there is thought to be a flood risk issue.

This section presents an overview of the outcomes and methodology used for prioritisation, from which more detail can be found on [DataMapWales](#) where the maps are published with an associated user guide.

2.3.1 Methodology

The efficacy of NFM measures is scale-dependent as supported by research from Dadson et al. (2017), which suggested different types of NFM can work at different scales (Figure 2-6). There is more empirical evidence for the effectiveness of NFM in small watersheds where NFM can encompass a large proportion by area (Dadson et al., 2017). Larger measures such as floodplain reconnection may help for larger floods, although significant design effort is needed to correctly store flood water and reduce the flood peak. There is also greater uncertainty for the efficacy of larger scale NFM types in larger catchments due to physical constraints reducing our ability to accurately monitor what is often a combination of types of NFM in a complex system. Modelling uncertainties are also often large in distributed NFM systems. Within the

modelling of NFM, there are different strengths of evidence for different processes and how they can be represented as a change to parameters such as infiltration rates and hydraulic roughness (see Hankin et al., 2017). Furthermore, while the efficacy of NFM in large catchments is more uncertain it was considered important to include this based on feedback from the CRW event.

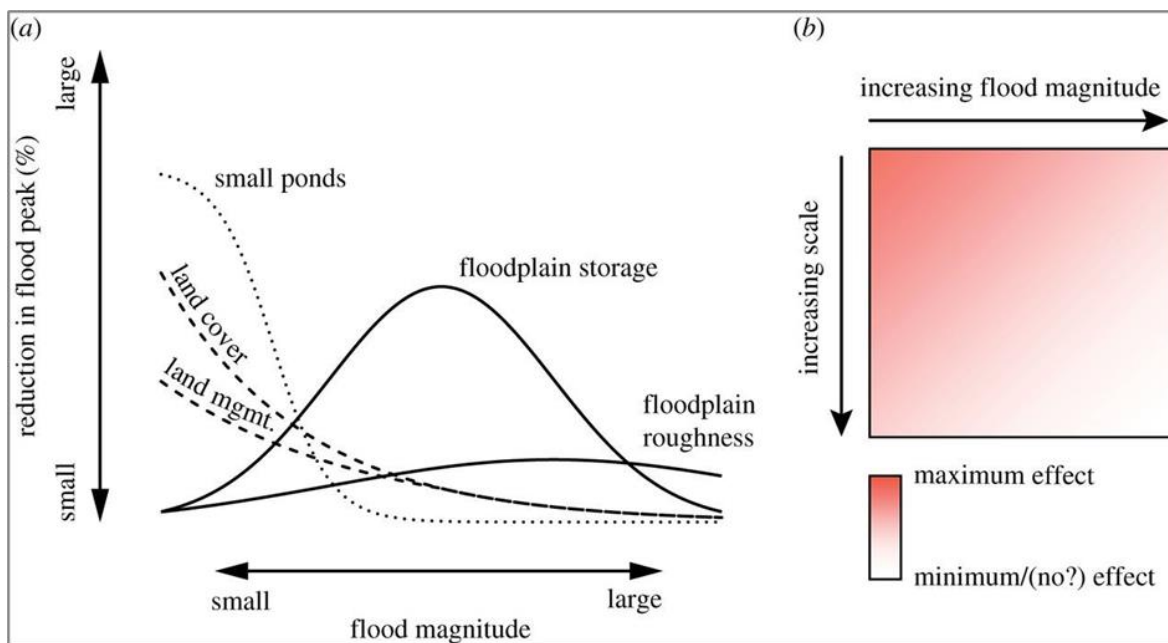


Figure 2-6- NFM, Flood Frequency, Risk. From Dadson et al. (2017)

The Environment Agency have recently completed an exercise which uses the efficacy of NFM at different scales to prioritise potential areas/opportunities for NFM. The following principles are applied:

- Land use and land management change have the largest impact on flood risk in smaller catchments. Catchment size is the main catchment characteristic commonly referred to in the literature as signalling an ability to reduce flood risk using NFM or land management change.
- Smaller catchments increase the probability that we can intervene in a sufficient proportion of high flows to reduce risk.
- Land use and land management change have the greatest potential benefit for reducing higher frequency, smaller flood events i.e. properties at high and medium risk of surface and fluvial flooding.
- Land use and land management change should be funded where it is likely to deliver the greatest public benefit in terms of flood risk management.
- Identification of smaller catchments with significant areas of upstream agricultural/rural land corresponding with areas with the largest numbers of people and property at high and medium risk of flooding.

This project takes the principles above and has sought to build and improve on them by focusing on catchments above communities at risk, based on their suitability for NFM. This has been done at two different catchment scales (see the methodology section for further explanation), namely:

1. Smaller-scale NFM interventions (e.g. runoff attenuation features, riparian planting, hedges) prioritised in smaller watersheds upstream of populations at greater risk from small watercourses and surface water flooding.
2. Larger-scale NFM interventions (e.g. significant floodplain reconnection or widescale soil infiltration improvements) are prioritised in the larger catchments with more urbanised receptors where populations are at risk from fluvial flooding

The final method used for NFM prioritisation to create the maps is summarised below:

1. Catchment identification - two scales of catchment were used for this stage: small catchments (<10km²) that are high risk for frequent surface water flooding, and show potential for smaller-scale NFM; and larger catchments where identification of urbanised areas at risk of fluvial flooding was the priority.
2. Prioritisation based on NFM potential - seven different NFM measures were considered, potentials areas of which were aggregated to produce an overall percentage of total catchment area with NFM potential for use in prioritisation. Additionally, a sensitivity analysis on NFM measures used in the prioritisation was undertaken at this stage to understand whether taking a subset of NFM measures would under-represent NFM potential in each catchment.
3. Weighting based on ecosystem services - This weighted prioritisation looks to identify catchments suitable for different NFM types based on their ability to provide potential ecosystem services. The total number of potential ecosystem benefits provided by each NFM type, as described in the Working with Natural Processes Evidence Directory (Burgess-Gamble et al., 2017) ranged between 2 and 14. Agricultural improvements have the least additional ecosystem service provision, and riparian planting the most.

2.3.2 Intended use

The intended use for these maps is to:

- Support and inform national level planning and decision making for the distribution of funding and support for NFM
- Support the selection and prioritisation of projects across a range of funding streams
- Provide additional information and evidence to support low cost and low risk projects that cannot justify specific modelling studies
- Add value to existing datasets (e.g. WWNP and SCCAN) by providing more clarity as to where the identified opportunities are likely to provide the greatest flood risk benefit

For example, managers of future grants may use the maps to prioritise expressions of interests or funding applications by those that fall in areas that the data suggests will deliver the greatest flood risk benefits.

The Sustainable Farming Scheme (SFS) (see Section 3.4.3), could use the two different scales of the NFM interventions identified in the mapping to prioritise measures delivered under either the Optional Action or Collaborative Action layers.

It is not intended that the mapping be used to exclude any areas for funding from any streams but should be used to inform how funds should be prioritised to deliver greatest likely benefit for flood risk and where to focus efforts and resources. It should also be noted that the catchments have been prioritised based on the potential for NFM to reduce flood risk, not on the level of flood risk currently in catchment. These maps should be combined with other datasets such as the outputs of the Flood Risk Assessment for Wales (FRAW) to allow for this comparison.

2.3.3 Limitations

The information provided within the prioritisation maps is based on a national scale mapping approach, taking into account largely modelled and open-source data. Therefore this mapping should be viewed as indicative rather than specific and be used as a decision support tool rather than decision making tool.

The maps represent a snapshot in time, with both the NFM potential area maps and the flood risk maps used within the development being subject to change. Locations identified may have more recent building or land use than available data indicates. Therefore the maps should always be viewed alongside an understanding of local knowledge, site visits and / or further analysis before a decision is made.

It is important to note that land ownership and change to flood risk have not been considered. The maps do not account for reduction in risk to individual assets, with further, more detailed analysis, including site visits, feasibility analysis and modelling required to attain this level of understanding. Individual asset risk reduction was not undertaken as it is highly uncertain and difficult to generalise the effect of NFM at a national scale.

2.3.4 Overview of outputs

At both spatial scales catchments were prioritised based on their potential for:

- Runoff Attenuation Features
- Floodplain reconnection features
- Riparian planting
- Hedgerows
- Larger floodplain reconnection
- Soil infiltration improvements / wider woodland

- Bog restoration
- Surface roughness
- Agricultural improvement

A second weighted prioritisation based on each NFM type's ability to provide additional ecosystem services was also created per spatial scale. This allows for a wider audience of the maps whose primary aim for delivering NFM measures may not be flood risk.

An example of a map is shown below in Figure 2-7.

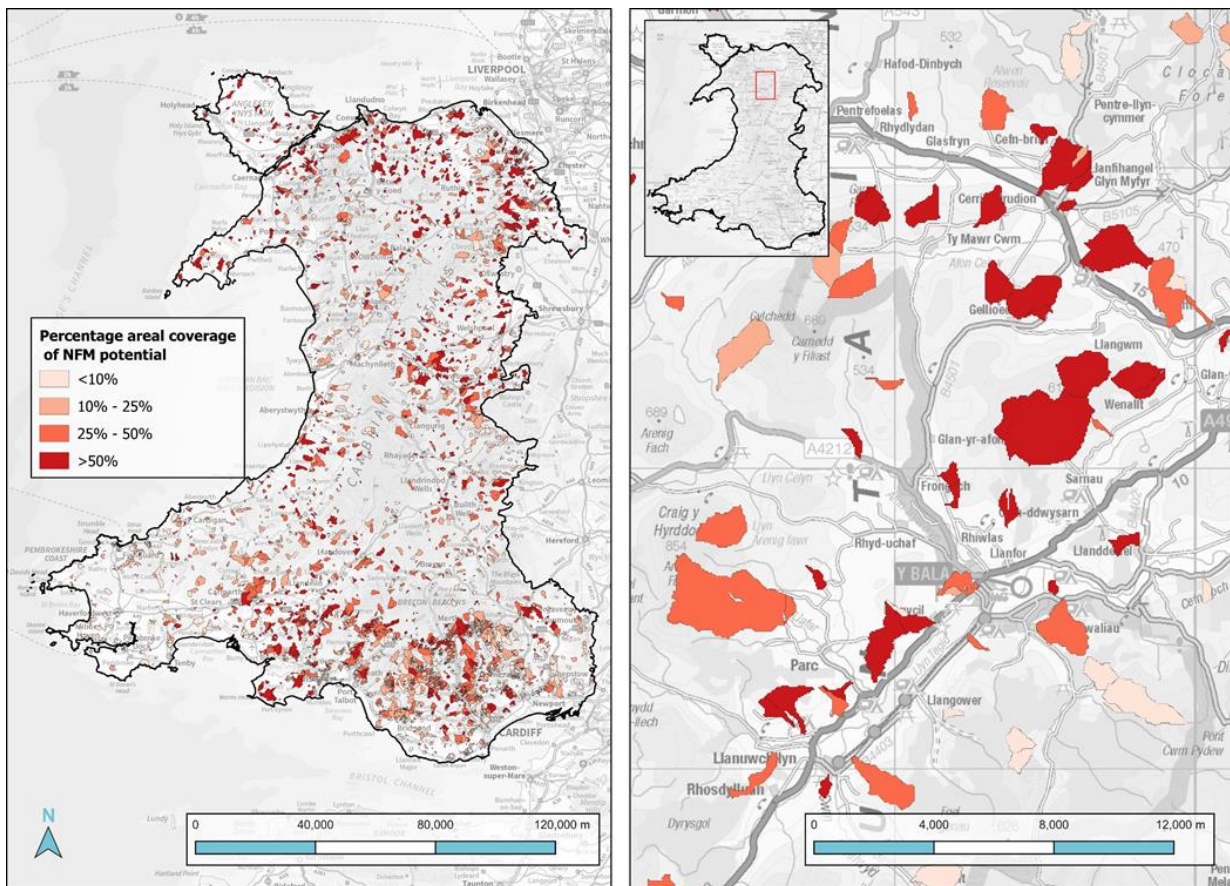


Figure 2-7 - Prioritisation of small catchments (<10km²) above communities at risk from frequent small watercourse and/or surface water flooding based on potential for NFM

2.4 Part A Conclusions

The creation of an NFM Status Report to understand the current delivery approaches and extent of NFM in Wales provides a valuable resource for policymakers and practitioners alike. Its continued use and updating beyond this project will allow for assessment of performance against government commitments whilst also helping to promote and share learning amongst projects and programmes across the country.

The NFM priority mapping brings together existing, high-quality data with cutting-edge science and research to create a resource that will allow a range of parties from government to farmers to identify where in Wales NFM is likely to deliver the greatest reduction in flood risk. It does not supersede existing datasets such as WWNP or WINS, but instead complements them and adds greater value to understand where action should be prioritised when budgets are constrained.

2.4.1 Current status of NFM in Wales

As part of this study, we have been made aware of 51 projects and 19 programmes across Wales. 61 out of 94 operational catchments did not have any NFM projects or programmes since 2015.

That majority can be considered to be well developed on account of two-thirds of projects being considered complete or in design/construction phase

Floodplain and cross slope woodland, headwater drainage management and runoff pathway management appeared to be the measures least implemented or proposed. It's not clear whether this is on account of a lack of understanding about the measures or the lack of feasible locations where the NFM projects and programmes were located.

The philosophy of NFM is to aim for a whole catchment approach, therefore the apparent absence of headwater drainage management needs to be addressed as it is considered to be the first port of call when beginning a catchment approach. Potentially missing a large area of crucial opportunity to slow the flow in the upper catchment. As ever, there is always need for monitoring and evidence from projects delivered on the ground to build upon the evidence based, learn and support future projects.

The prioritisation maps show 71% of small catchments and 97% of larger catchments have potential for greater than 10% coverage of NFM features. Of these, 28% of both small catchments and larger catchments have potential for greater than 50% coverage of NFM features.

The delivery of NFM whilst dependent on the physical characteristics and subsequent opportunity of a catchment is also highly dependent on suitable legislative, policy and fiscal support. An analysis of barriers and enablers has pointed several issues that can be addressed through the development of a series of delivery recommendations and associated roadmap for NFM delivery in Wales. These are presented in Part B (Section 3).

Despite the challenges in delivering NFM, progress is being made in Wales to deliver a variety of schemes and programmes. This project has identified several successful projects to share lessons learnt and best practice as case studies. They highlighted the value and importance of:

- Local knowledge of hydrological processes

- Careful study of previous projects and research documents to develop an appropriate and sustainable project
- Visiting demonstration or other project sites to inform new projects and engage landowners and farmers
- The need to build in funding flexibility for unforeseen issues
- Use of sensors to support inspection and maintenance for some measures
- Collaborative action between landowners, farmers, the public, and agencies

The case study projects also highlighted challenges to delivery such as the time and effort required for planning, consenting, tendering; meeting all legal and statutory requirements and the limited availability of experienced contractors to deliver NFM measures. These lessons learnt and best practice examples have been incorporated into the recommended delivery mechanisms and roadmap (Section 3.4 and Section 3.5). The detailed case studies can be found in Appendix C.

3 Part B: Recommendations for NFM delivery in Wales

3.1 Introduction and approach

Part B sought to review potential methodologies for funding and delivering NFM across Wales and recommend an approach to best deliver the works identified in Part A and meet the programme for government commitments. It considered all stages of the project delivery process including appraisal, design, implementation, on-going management, monitoring, and reporting. A co-design approach was adopted for Part B, working closely with a wide range of stakeholders to explore and develop the approach to deliver NFM across Wales that seeks to both reduce flood risk and deliver wider benefits.

The main steps undertaken to deliver Part B included:





- Stakeholder consultation to develop a delivery mechanism based on lessons learnt and informed by those involved in implementation.
- Development of recommended delivery mechanisms including considerations of:
 - Who is best to deliver NFM in the future
 - How best to deliver different types of NFM schemes
 - Who is best to oversee this work within Welsh Government
 - What resources are required
 - What information would be required to appraise these projects and allocate funding
- Production of a roadmap to establish the delivery approach (Section 3.5).

3.2 Stakeholder engagement

Stakeholder engagement was integral to the Project in helping to shape valuable and focused outputs. Input from stakeholders was embedded throughout the Project but was particularly crucial to Part B in developing the recommended delivery mechanisms.

The Project wanted to hear directly from those who have been involved with NFM delivery across Wales, from farmers to Risk Management Authorities (RMAs). This was done using the following engagement activities:

Table 3-1 Methods of stakeholder engagement used

Symbol	Method of Engagement
	<p>Roundtables</p> <p>A series of activities separated into multiple tables were used during the in-person CRW event. These gathered opinions of preferred NFM measures, barriers and enablers encountered, feedback on approaches to mapping.</p>
	<p>Project Advisory Group (PAG)</p> <p>The PAG was made up of a range of key stakeholders. The group met four times throughout the project to help guide and develop the following stages and engagement methods as well provide initial feedback on the draft Delivery Mechanism Recommendations and Roadmap.</p>
	<p>Online Workshops</p> <p>Five online workshops were conducted. These included two mixed sector groups, one NRW group, one Welsh Government group and one local authority group. The activities and questions discussed were consistent between the groups except for the Welsh Government Group, which focused on policy.</p>
	<p>Survey</p> <p>Following completion of the draft Delivery Mechanism Recommendations and Roadmap, an online survey was sent to key stakeholders to gather feedback. This feedback will then be incorporated into the final Delivery Mechanism Recommendations and Roadmap.</p>

Following engagement, the feedback and ideas from stakeholders were collated, analysed, and incorporated into the draft recommendations and roadmap.

After the creation of the initial draft Delivery Mechanisms Recommendations and Roadmap, the draft was circulated with the PAG, and initial feedback gathered. This feedback was then incorporated into the second draft which was circulated with wider stakeholders for further consultation. Stakeholder consultation was conducted to assess the acceptability of the proposals and identify any additional priority actions to help deliver NFM in the short-term (5-years) and begin initiating the proposed mechanisms.

Following receipt of comments from the stakeholder consultation, the PAG met for a final time to discuss the feedback. The project team incorporated the feedback into the final draft of recommendations.

3.3 Summary of desk-based review findings

3.3.1 Key organisations

A wide range of organisations were involved in the projects reviewed. Frequently this included Welsh Government or NRW, local authorities, non-governmental organisations as well as consultants and sometimes universities. Support from consultants was often sought to conduct feasibility assessments and determine the NFM measures to be used; however, some projects noted resource challenges within organisations as well as a lack of funding available to involve other organisations sometimes limited project delivery and outcomes. The use of local contractors was also highlighted to allow for direct community involvement with NFM and the utilisation of local knowledge.

3.3.2 Barriers and enablers

Extensive research has previously been conducted using a variety of research techniques to develop a greater understanding of the cultural, institutional, and social barriers and enablers to NFM. A wide-ranging list of enablers and barriers to NFM delivery across the project lifecycle was developed; from project concept to implementation as presented in Figure 3-1 (Ngai et al., 2020).

Key barriers identified include:

- Property rights - tenant/landowner relationship
- Changes to traditional farming practices
- Lack of effective communication and sharing of information between stakeholders
- Inappropriate evidence requirements for funding applications (e.g. modelling and mapping of NFM).
- Community buy-in for the perceived effectiveness of NFM solutions compared to hard engineering methods.

Key enablers identified include:

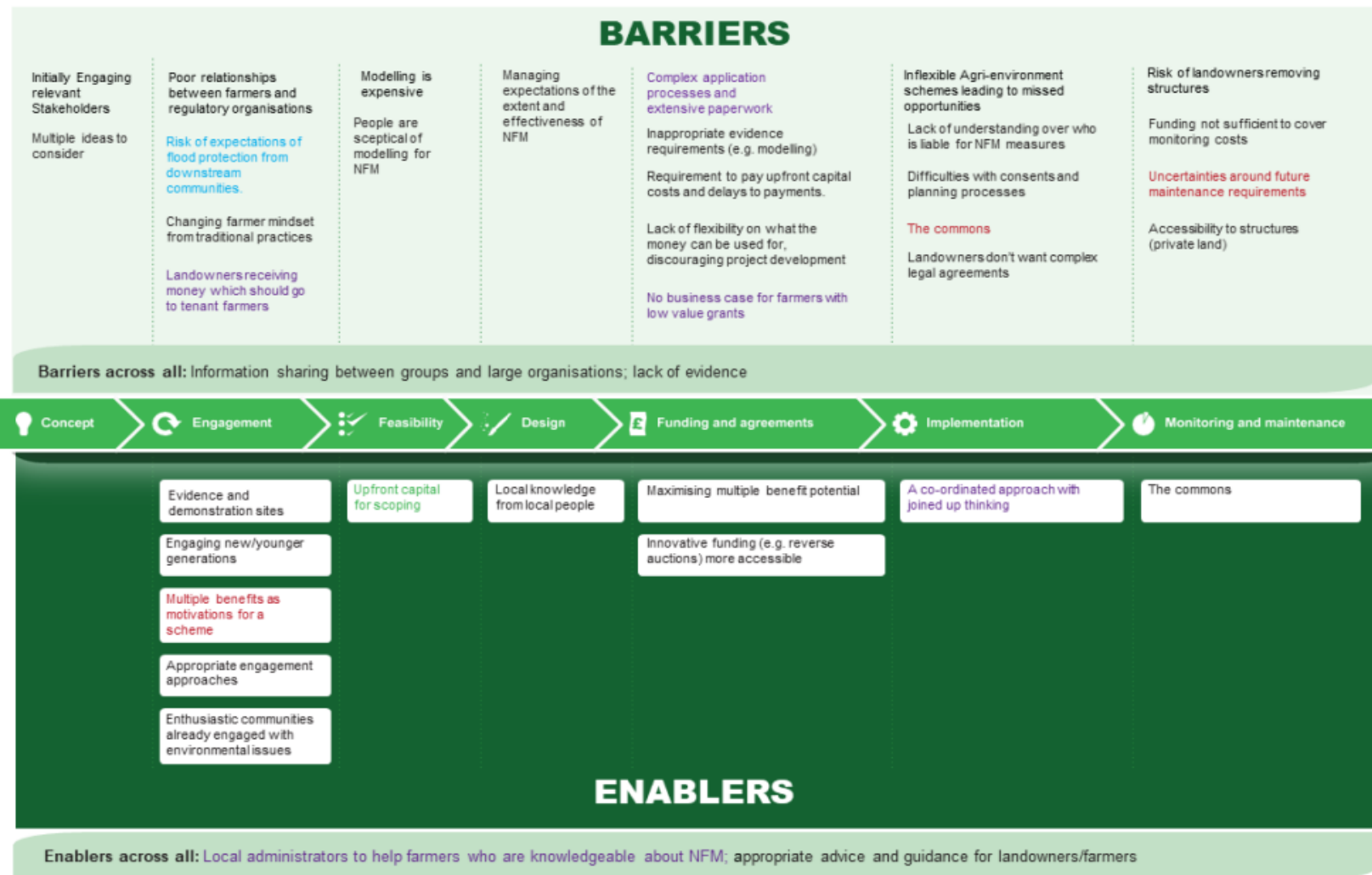
- Early, appropriate engagement with stakeholders.
- Innovative funding mechanisms to reduce barriers for landowners (e.g. farmers).
- Simplification of funding application processes.
- An improved and accessible evidence base with examples of successful partnerships and scheme implementation (an information hub).
- UK policy and legislation improvements and clarity to allow for easier NFM implementation.

Further barriers and enablers were drawn out during stakeholder engagement. The development of the Delivery Mechanisms Recommendations and Roadmap focused upon addressing these barriers and implementing enablers.

3.3.3 Knowledge and information gaps

A variety of knowledge and information gaps were highlighted throughout the review. Key themes highlighted include:

- Specific detail regarding modelling approaches
- Lack of certainty regarding monitoring programmes
- Exact maintenance requirements and liabilities
- Lack of quantified, known or reported flood risk management benefits.



Source of information: Interview findings Landowner deep-dive Legal analysis Case studies Focus groups

Figure 3-1 - The barriers and enablers to the delivery of NFM projects across the project lifecycle (Ngai et al., 2020)

3.4 Delivery mechanism recommendations

Through analysis of existing NFM schemes, barriers and enablers to delivery in Wales and the UK, best practice and case studies, and extensive discussions with stakeholders, four methods of facilitating NFM delivery were devised.

The delivery mechanisms are centred around funding on account of it being voted in the top three barriers throughout the stakeholder engagement process. Other barriers and enablers identified have been considered closely and addressed in each of the proposed delivery mechanisms, such as engaging landowners and partnership working.

The proposed delivery mechanisms are as follows:

1. Long-term grant programme
2. RMA hybrid fund
3. Sustainable farming scheme (SFS)
4. Catchment partnerships

The structure and linkages of the recommended NFM delivery mechanisms are shown in Figure 3-2. Catchment partnerships are recommended as the key enabler to NFM delivery in Wales and could overarch the three other recommended delivery mechanisms whilst also delivering wider projects beyond NFM, e.g. biodiversity enhancement.

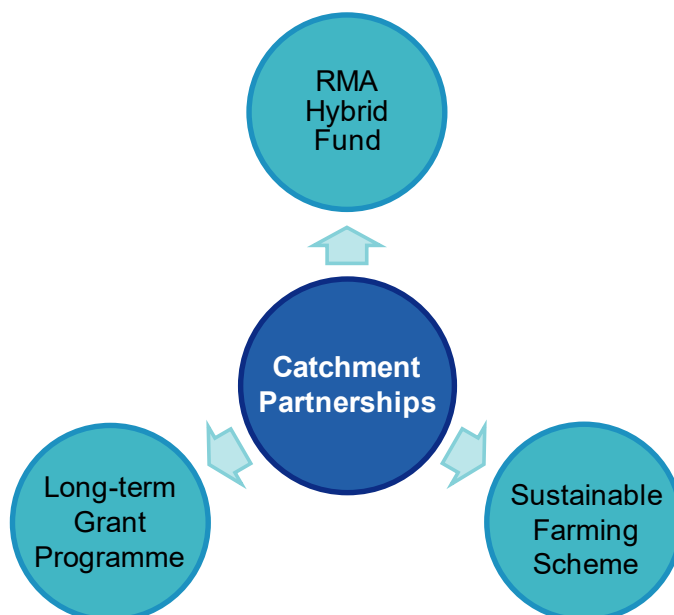


Figure 3-2 The overall structure of the recommended NFM delivery mechanisms.

The below sections provide a high-level overview of the delivery mechanisms recommended to Welsh Government to facilitate NFM implementation.

3.4.1 Long-term grant programme

Provision of a long-term grant programme would better enable NFM delivery in Wales by allowing organisations to access funding for all phases of the NFM lifecycle over a guaranteed long-term period. This will provide project teams with the opportunity to build trust and relationships with key landowners and use a co-development approach; ultimately leading to a higher quality and more successful scheme. Monitoring should also be funded as part of the delivery mechanism. Data should be made available to feed into the development of a Welsh NFM evidence base.

It is recommended that any future NFM grants should allow for a 6-to-12-month proposal phase, 6-to-12-month development phase and a 3-year delivery phase. Funding in the proposal phase will allow for initial co-design and engagement to begin which will continue throughout the project. Funding reviews are to occur between key phases.

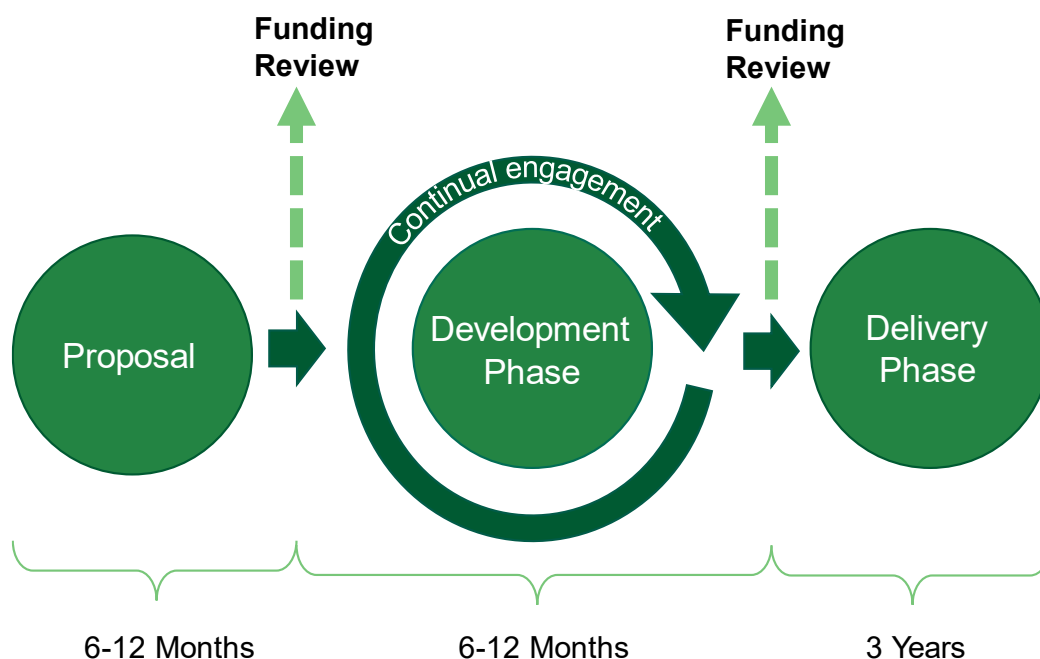


Figure 3-3 Process of key lifecycle phases within the long-term grant programme

The success of schemes should be judged on a combination of flood risk management benefits and other multiple benefits. This is further outlined in Section 3.5.1 and Section 3.5.2. Submission of reporting should be done by a simple digital application.

3.4.2 RMA hybrid fund

An RMA specific hybrid fund targeted at NRW and LLFAs is recommended. This features a new grant package to allow RMAs to extend their work beyond traditional FCERM measures and encourage greater uptake of NFM measures to deliver hybrid approaches.

Total funding could be linked to FCERM grant funding allocation and amount to 10-20% dependent upon the degree of opportunity in the area and the level of flood risk.

Catchment resilient metrics and targets to be set to allow wider benefits to drive project proposals.

It is proposed that with appropriate resourcing, NRW administer the fund and that any RMA can access it. An assessment of resource implications, skills gaps and necessary restructuring is needed. The suggested role of NRW is further outlined in Figure 3-4 as well as the aims of this delivery mechanism.

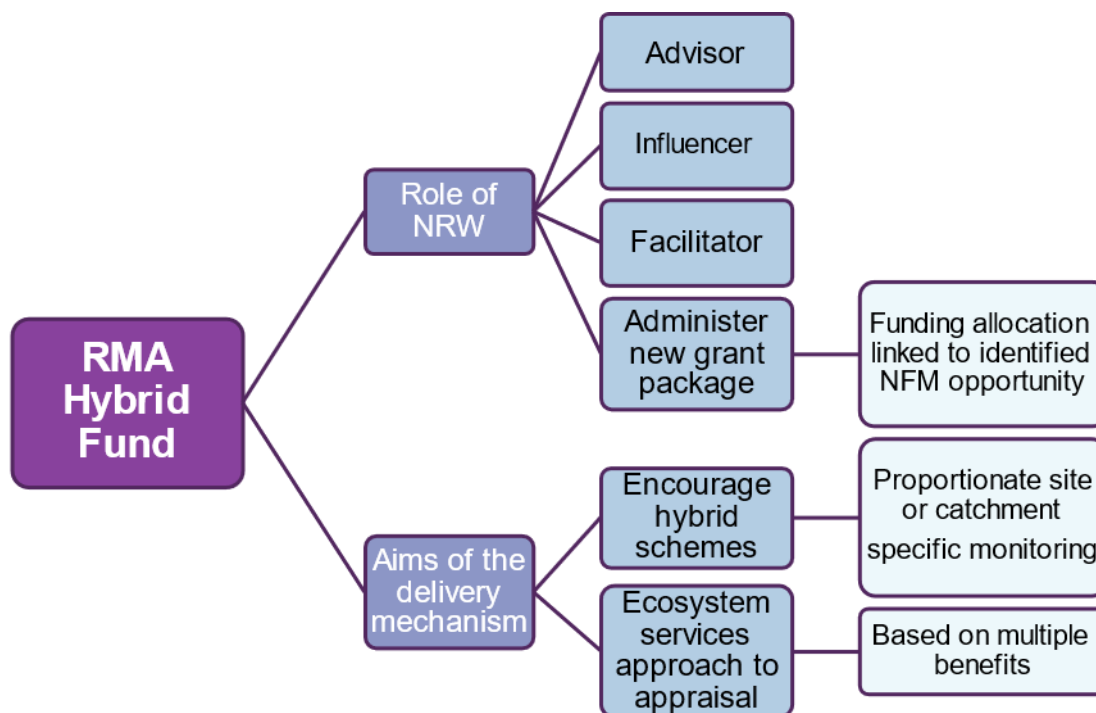


Figure 3-4 The key features of the proposed RMA hybrid funding mechanism

Post-completion maintenance and monitoring of a project should be factored into costings to optimise the life and efficacy of interventions as well as contribute to the evidence base for NFM and allow future projects to learn from the outcomes.

Monitoring for schemes delivered through this mechanism, as in the others, should be judged on a combination of flood risk benefits and other multiple benefits in recognition of the wider catchment resilience benefits measures can deliver.

3.4.3 Sustainable farming scheme

The SFS aims to reward farmers for actions taken to respond to the climate and nature emergencies, alongside the sustainable production of food. Mitigating flood and drought risk is listed as a key outcome of the SFS. The SFS is currently under development by Welsh Government.

Whilst the SFS offers an excellent opportunity to facilitate NFM delivery, the detailed setup and structure of the SFS is outside of the control and influence of this NFM review project. The below points instead act as recommendations to Welsh Government to consider within the development of the SFS.

The scheme is separated into three layers: universal actions, optional actions, and collaborative actions. NFM should be embedded within all delivery layers as shown in Figure 3-5.

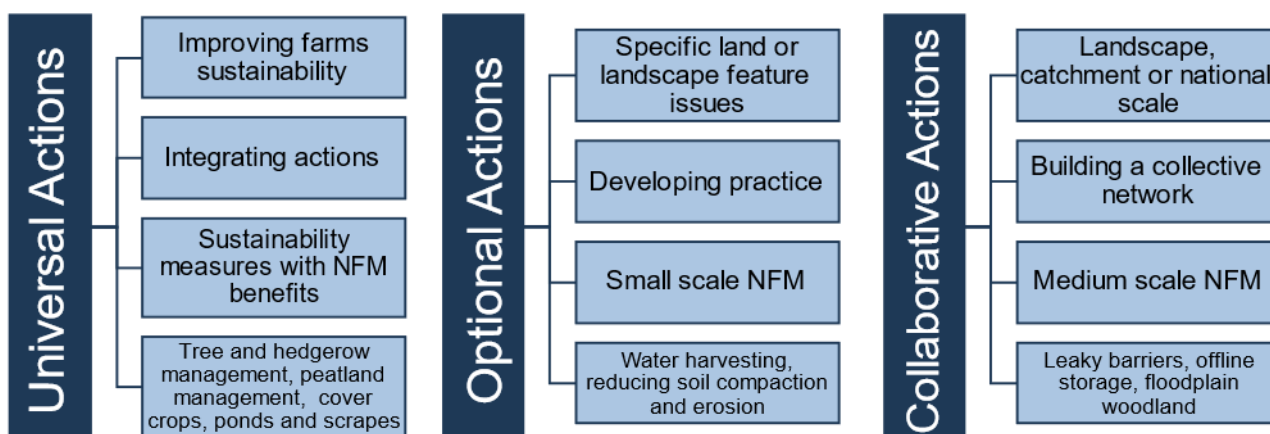


Figure 3-5 Overview of the three layers of SFS. Including the layer's focus and aim and potential NFM scale and some measures. Includes information from Welsh Government, 2022.

All farmers should be able to access the Scheme across Wales and therefore be able to access support for the delivery of NFM dependant on prioritisation of funding. The Scheme will help legitimise NFM as part of the work conducted by farmers and a public 'good' they produce.

Entrants who have previously undertaken NFM work have the potential to benefit.

Support and guide farmers through NFM delivery. Providing dedicated facilitators, practical guidance, tools, and resources. Establishing a knowledge sharing network and a set of exemplar projects.

The opportunity to help fund NFM maintenance as well as delivery.

The Farm Sustainability Review should be used to gather baseline data and outline key NFM objectives and success criteria. Performance against this baseline data should be measured as a key indicator of success.

It is vital for future NFM development that any such activity within the SFS is integrated at least at the monitoring level and ideally beyond with the other delivery mechanisms outlined in this report. This will enable comparative studies of the NFM and other multiple benefits planned and delivered through the SFS and other mechanisms.

3.4.4 Catchment partnerships

Catchment partnerships can broadly be defined as groups of organisations or individual landowners who collaborate to develop and deliver a vision and plan for their catchments. Such partnerships are recommended as the primary delivery mechanism for NFM and wider benefits in Wales and are central to achieving the principles of the Wellbeing of Future Generations (Wales) Act (2015) and the Environment (Wales) Act (2016). Crucially, once established catchment partnerships could deliver more than just NFM and contribute to overall catchment resilience through joined up approaches to improve water quality, drought management, and habitat connectivity

There is potential for catchment partnerships to join coastal, urban, river and upland NFM projects to create an integrated approach from source to sea. Catchment partnerships would be hosted by the most suitable organisation or group within a catchment. RMAs would then provide an advisory and facilitatory role to other organisations, allowing RMAs to focus on landscape-scale interventions and third sector organisations to deliver small-scale NFM projects across a catchment. An on-the-ground facilitator to engage with stakeholders and landowners, help build local relationships and knowledge exchange as well as manage a community NFM forum will be a crucial element of catchment partnerships. Long-term funding should be provided by Welsh Government with opportunities for catchment partnerships to complement public funding with private funding in the future, as per the approach in England. Undertaking a co-design process with stakeholders and partners would then help build trust and relationships, create a joint vision, and implement NFM to maximise wider benefits.

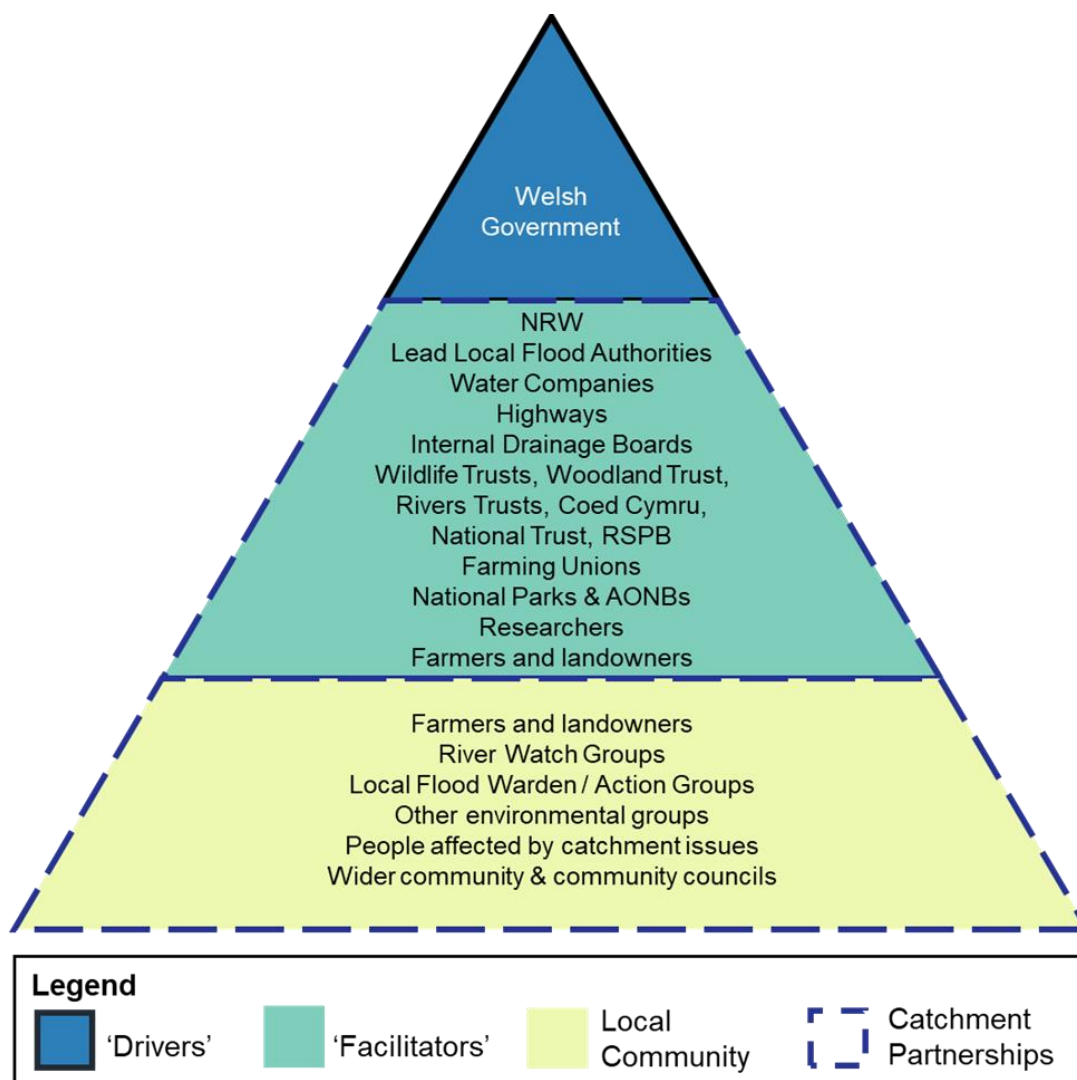


Figure 3-6 Example stakeholders involved in catchment partnerships in Wales (adapted from (Starkey and Parkin, 2015).

The creation of a National Catchment Partnership Hub would help share knowledge and best practice and streamline processes. Applying lessons learnt from the CaBA framework in England may help minimise implementation challenges in Wales.

3.5 Roadmap

The mechanisms outlined above have been presented as the "end goals" which will take several years to be developed. In the interim, a series of actions have been identified to initiate the process. Also identified are cross-cutting requirements related to wider support mechanisms that underpin the successful delivery of NFM such as knowledge sharing and staff capacity.

3.5.1 Cross-cutting requirements

It is recommended that the process to sign up and access funding should be kept as simple and consistent as possible across the delivery mechanisms. Integrating

mechanisms with existing funding application processes and support networks (such as Rural Payments Wales [RPW] Online) should be sought where possible.

The sharing of knowledge, best practice and research is crucial to increasing and mainstreaming NFM delivery. A Welsh NFM knowledge and best practice 'hub' should be developed, which would include case studies, guidance, and tools in one accessible place. The hub should encompass a website hosted by Welsh Government or sponsored body such as NRW. The hub must be supported by a wide based virtual team consisting of Welsh Government flooding specialists, NRW and RMA's who maintain, update and contribute to the Hub from emerging knowledge. Contribution from third sector organisations is also essential. Initially a contractor might set up the resource and populate the website with the necessary material before handing over to the virtual team to manage and maintain. Resources required to maintain this hub following establishment should be dedicated ICT/Communications to maintain the physical structure of the website as well as a coordinator role to maintain the virtual team and collate new material and update content.

The development of a clear, proportionate, and consistent approach to the consenting and planning process for all NFM types across Wales will be important to enabling NFM delivery. Standardising planning requirements for each NFM measure would be of benefit. It is recommended that Welsh Government facilitate the development of a standard agreement that can be used as a template between organisations and landowners delivering NFM.

NFM necessitates a range of skills and experiences due to the need to balance the needs of a range of stakeholders, land uses and policies (Waylen *et al.*, 2017; Challies *et al.*, 2016). Improving the availability of human resources with the correct range of skills is crucial to delivering Welsh Government's policy objectives, including those relevant to NFM. An assessment of skill gaps and revenue funding for staff resource in government bodies is recommended. The success of the recommendations is dependent upon suitable resourcing and structuring within organisations, especially NRW.

A clear set of metrics should be created to help measure the resilience of a catchment; considering (but not limited to): water resources, flood risk, biodiversity, water quality and social value.

3.5.2 Priority actions to unlock delivery mechanisms

The priority actions for each delivery mechanism are highlighted below (Figure 3-7).

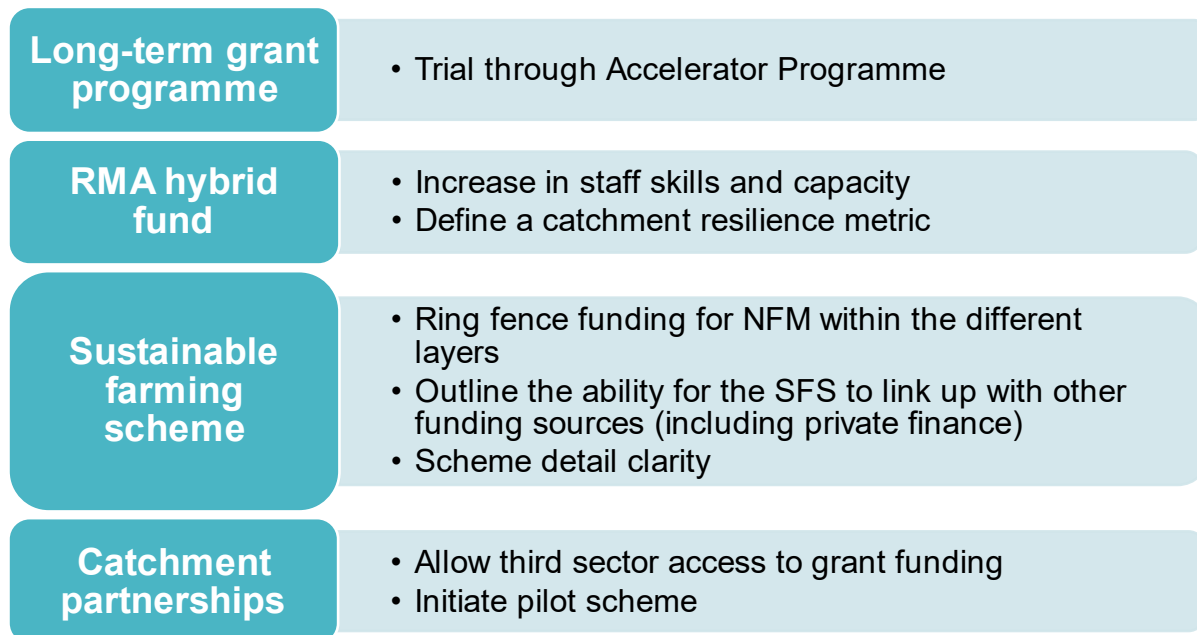


Figure 3-7 The priority actions for each recommended delivery mechanism to facilitate NFM delivery in the short term.

3.6 Part B: Conclusions

Part B of the Project aimed to develop potential methodologies (or 'delivery mechanisms') for funding, facilitating and delivering NFM across Wales. The NFM priority maps created in Part A (Section 2.3) may be used to supplement and inform project selection within these delivery mechanisms. However, the maps only intend to advise where NFM measures would result in maximum flood risk management benefit. There are often still considerable benefits to implementing NFM measures which are located outside of priority areas, such as wider environmental benefits including drought management and nutrient reduction.

The delivery mechanisms form the basis of the recommendations to Welsh Government for facilitating greater NFM implementation. A series of priority actions for each delivery mechanisms have also been identified to outline a roadmap for NFM delivery (Figure 3-7). To ensure a harmonious approach to NFM delivery throughout Wales, communication and interaction between the delivery mechanisms is vital.

Who is best to deliver NFM in the future?

Landowners and farmers are key to NFM delivery but need to be supported by a wider network of catchment partnerships. These partnerships should involve non-government organisations and charities such as (but not limited to) wildlife trusts, rivers trust, RSPB as well as RMAs such as LLFAs and NRW. It is clear that NFM measure can deliver a host of multiple benefits that ultimately contribute towards

overall catchment resilience (e.g. drought management, improved water quality) and so working with multiple organisations can help maximise benefits. Involving local communities in decision-making processes will help build and understanding of NFM. Welsh Government should act as the driver of these catchment partnerships. Within Welsh Government, this should be overseen by flood specialists. Coordination with the SFS policy team and RMAs across will facilitate delivery.

How best to deliver different types of NFM schemes?

NFM delivery should be focused on building catchment resilience to flood risk and other risks posed by the climate, as well as embedding multiple benefits. Larger, catchment scale schemes or those involving large-scale measures e.g. river or floodplain restoration may require greater input from RMAs such as NRW or LLFAs and funding from pots such as grant in aid. Uptake of smaller-scale NFM measures by landowners and farmers within mechanisms such as the SFS should not be undervalued or under-prioritised. Significant uptake across Wales with the support of catchment partnerships has the potential to provide substantial NFM benefits when delivered at scale.

What resources and information are required?

Long-term funding to support the planning, delivery, maintenance, and evaluation is vital. Within Welsh Government, a dedicated team that works across departments (e.g. flooding, farming), recognising the multiple benefits and potential for NFM, should aid delivery, policy coordination and strategic oversight of delivery by other mechanisms and bodies. The setup of a specific NRW team could benefit ownership of catchment resilience within the organisation and complement the resource requirement for NRW's expected role under the SFS. The identification and funding of a host organisation to lead and administer catchment partnerships is required. Communication and collaboration across the resources required for each delivery mechanism is crucial.

Within NFM implementation, there is a need to use evidence-based practices, monitor their effectiveness and adapt measures where necessary. The maps created within Part A of this project combined with additional data layers should be used to prioritise areas for NFM within Wales. Projects should be evaluated on a combination of flood risk benefits and other multiple benefits and information submitted via a simple digital application. A clear set of metrics should be created to help measure the resilience of a catchment. Stakeholders, local communities, and project teams should feed into this to increase the collection of data and build a sense of ownership of NFM solutions. This information can then feed into the proposed NFM Hub which will host information, case studies, and facilitate knowledge sharing in an accessible format. A proportionate, and standardised approach to the consenting and planning process for all NFM measures would be of benefit.

4 Project Conclusions

This project set out to evaluate, map, and prioritise catchments with NFM opportunities and recommend an approach to best deliver these opportunities across Wales.

The project has drawn on the following highly valuable resources to deliver a series of practical, Welsh-specific outputs that seek to enable and drive forward NFM delivery in Wales:

- Extensive experience and knowledge of NFM practitioners and policymakers in Wales and more widely across the UK
- Cutting-edge research and science from the Natural Environment Research Council's NFM Programme and other recent academic papers
- High-quality Welsh-specific datasets such as WWNP, WINS and the Flood Risk Assessment for Wales.

Part A has provided a 'Status Report' of NFM delivery in Wales which will continue to be updated and provide a useful tool to track progress against government commitments and allow greater interaction between projects and programmes through the sharing of best practice and lessons learned. The second output from Part A is the NFM Prioritisation mapping which has used existing opportunity mapping, flood risk data and cutting-edge NFM research to deliver a resource that will allow NFM delivery in Wales to be prioritised, focusing on catchments that are likely to deliver the greatest reduction in flood risk, as well as environmental benefits.

Part B, through its co-development approach, has built on the experiences, knowledge and needs of those involved in delivering NFM in Wales now and in the future, to create a series of recommended delivery mechanisms. These are:

- Long-term grant programme
- Catchment partnerships
- Sustainable farming scheme
- RMA hybrid fund

It has outlined a roadmap of key actions that will need to be undertaken to 'unlock' the mechanisms and NFM delivery generally, such as:

- Knowledge sharing, training, and guidance
- Planning, consents, and agreements
- Resource and capacity building
- Catchment resilience metrics

Appendices

A Prioritisation Maps (PDF outputs)

B Status Report

C Case Studies

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